Reyrolle Product Catalog

Protecting Grids With Confidence

Catalog Reyrolle · Edition 4.0

SIEMENS

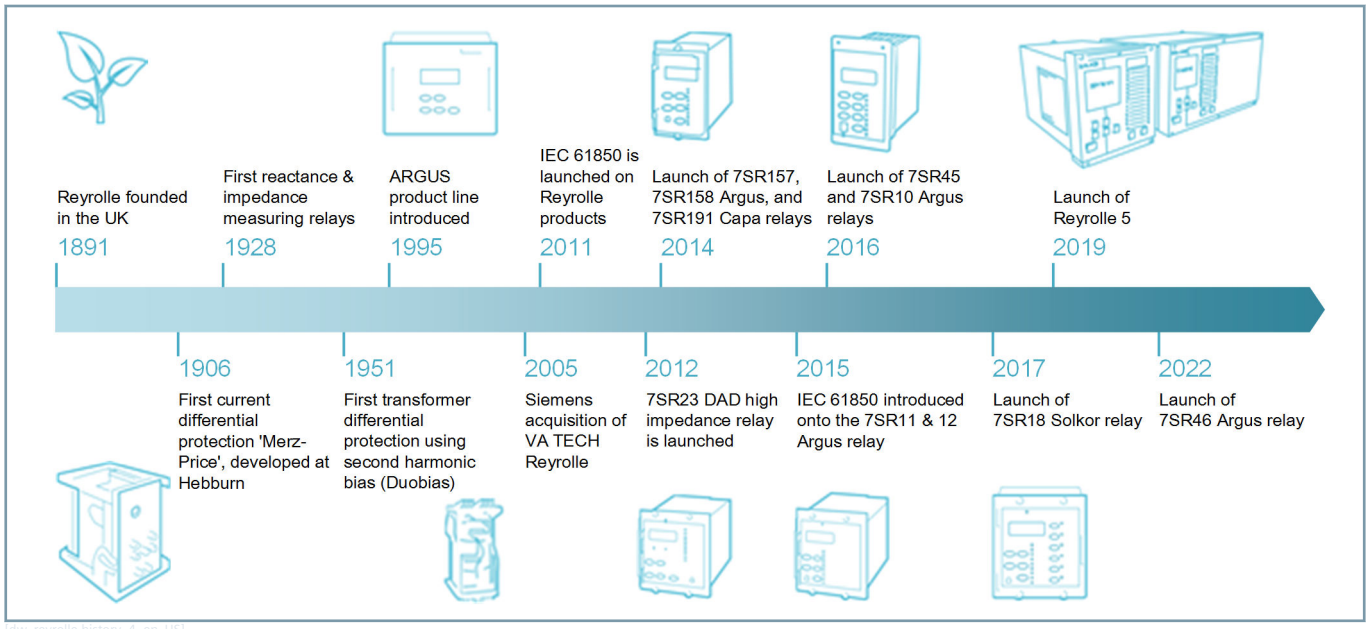
Reyrolle Product Catalog Protection and Auxiliary

Reyrolle Products - Catalog Edition 4.0

Editorial

1

Reyrolle – Solutions for Distribution Grids



[dw_reyrolle history, 4, en_US]

Reyrolle digital protection products have established a strong reputation over many years of installed service experience with a large variety of users.

The new Reyrolle 7SR5 devices provide comprehensive functionality and can be implemented in a wide range of applications – typically subtransmission networks, distribution networks, and industrial installations. In these areas the 7SR5 is an integral component and helps provide a secure interconnected power system and is an important part of distributed energy-supply and demand systems.

The 7SR5 is the new generation of 7SR devices providing an updated user interface linking to the latest hardware platform and software implementation. The hardware platform offers a flexible solution relevant to changing power grids and load flows. The 7SR5 builds on the proven performance of the existing 7SR1 and 7SR2 products, the function implementation and user interface are instantly recognizable to users of previous generation products but have also has been updated and enhanced. In-service experience and the need for future proofing has been incorporated by implementing flexible modular hardware architecture and modular software structure.

Many enhancements and additions to the 7SR product construction and functionality have been incorporated into the 7SR5, these include:

- Flexible hardware – minimized ordering options
- Full applications functionality is available in each device
- Large LCD facilitates device setting and display of network status from the front fascia
- 28 LEDs as standard
- Selectable binary input operating thresholds
- IP54 from front
- 3-winding transformer protection
- Additional standard front pushbuttons improve flexibility
- Standard IEC 61850 functionality supports system automation
- Cyber-security functionality
- User selectable languages: English, French, German, Portuguese, Spanish, Turkish

With the Reyrolle 5 you are able to install a product that will be upgradeable. As the power system grows to meet changing consumer requirements then the 7SR5 device will be reconfigurable without the need for replacement devices. The specific fit required for the application will be provided by the 7SR5 both at the time of installation and when future network and automation changes are required.

[sc_7SR5Family, 1, --_--]

Figure 1/1 Reyrolle 7SR5 Family

Device-Specific Overview of the Areas of Application

Main function	Device	Catalogue Number
Overcurrent and Feeder Protection		
Overcurrent Protection with control	7SR10 Argus	C53000-X7040-C021-1
	7SR11/12 Argus	EMEA-C10028-00-76GB
	7SR21/22 Argus	EMEA-C10030-00-76GB
	7SR51	C53000-X7040-C022-1
Self-powered Overcurrent Protection	7SR45 Argus	EMEA-C10020-00-76GB
Line Protection		
Line Differential Protection with control	7SR18 Solkor	EMDG-C10087-00-76GB
Transformer Differential Protection		
Transformer Differential Protection with control and monitoring	7SR242 Duobias	EMEA-C10035-00-76GB
	7SR54	C53000-X7040-C022-1
Motor Protection		
Motor Protection with control	7SR105 Rho	C53000-X7040-C021-1
	7SR17 Rho	EMEA-C10037-00-76GB
	7SR57	C53000-X7040-C022-1
Voltage and Frequency Protection		
Applicable for system decoupling, load shedding and load restoration	7SR158 Argus	EMEA-C10033-00-76GB
Synchronizing		
Synchronizing	7SR157 Argus	EMEA-C10032-00-76GB
Distribution Automation		
Protection and Automation for overhead lines	7SR224 Argus	EMEA-C10031-00-76GB
Capacitor-Bank Protection		
Capacitor-bank Protection	7SR191 Capa	EMEA- C10036-00-76GB
High-Impedance Protection		
High-impedance Protection	7SR23 DAD	EMEA-C10034-00-76GB

The Reyrolle product range offers a wide variety of protection devices. The table above lists all of the devices available and the main application with protection type.

2.1

Description

The Reyrolle 5 is designed for the electricity networks of the future with enhanced communications and cyber security while maintaining a user-friendly interface and easy product management.

The Reyrolle 7SR51 overcurrent device includes a wide range of protection functions and IEC 61850 Ethernet communications as standard. To further minimize the product variants the power supply and the binary inputs cover the full operating range with configurable binary input thresholds.

The large LCD, tactile pushbuttons and programmable LEDs provide a user-friendly product interface and the relay element is withdrawable for easy replacement.

Inputs and outputs	Current inputs – 4 or 5 Voltage inputs – 0 or 4 Binary inputs (max) – 39 Binary outputs (max) incl. healthy contact – 20 Arc flash detector inputs (AFD) – 0 or 3 High speed binary outputs (HSBO) – 0 or 3 Temperature sensor inputs (TSI) – 0 or 8
Communication	Standard front USB port (for configuration using Reydisp Manager 2, a PC based software tool) rear RS485, 2 x RJ45 electrical ports or optional optical Ethernet connections
Housing	Size 6, 8, or 12 with withdrawable design
Display	Backlit 128 x 128 LCD with text and graphical display capabilities suitable for single line mimic diagrams

Benefits

- Compact design and low product life-cycle cost
- Reliable operation due to powerful, proven protection algorithms
- IEC 61850 Edition 1 & 2 with HSR, PRP and RSTP operation for increased availability
- Simple product ordering
- Combined 1 A and 5 A current transformer inputs
- 28 programmable tri-color LEDs for clear indications
- User selectable languages: English, French, German, Portuguese, Spanish, Turkish
- Conformal coating ordering option

Functions

Standard Functionality

- 37/37G Undercurrent protection – phase/earth
- 46 Negative sequence overcurrent protection
- 46BC Broken conductor detection
- 49 Thermal overload protection

- 49TS Temperature sensor supervision [1]
- 50/50G/50N Instantaneous overcurrent/earth fault
- 50AFD Arc flash detection [2]
- 50BF Circuit-breaker failure protection – 3-pole
- 50GHS High speed earth fault – measured
- 50GI Intermittent earth fault
- 50GS Instantaneous sensitive earth fault – measured
- 50HS High speed overcurrent – phase
- 50SOTF Switch onto fault
- 51/51G/51N Time delayed overcurrent/earth fault
- 51CL Cold load overcurrent – phase
- 51GS Time-delayed sensitive earth fault – measured
- 52 Circuit-breaker control
- 60CTS CT supervision
- 74CC/74TC Close-circuit and trip-circuit supervision
- 79 Automatic reclosing
- 81HB2 Inrush current detection
- 86 Lockout
- 87GH Restricted earth fault protection – high-impedance
- 87NL Restricted earth fault protection - low-impedance

Additional Functionality – Devices with VT Inputs

- 21FL Fault locator
- 21LB Load blinder
- 25 Synchrocheck – synchronization function
- 27/27Vx Undervoltage protection
- 32 Power protection
- 47 Sequence overvoltage protection
- 51V Voltage-dependent overcurrent – phase
- 55 Power factor
- 59/59Vx Overvoltage protection
- 59N Neutral voltage displacement

1 An external interface unit is required where optional TSI module not fitted.

2 Requires external components

- 60VTS VT supervision
- 67/67G/67GI/67GS/67N Directional – phase/earth fault
- 78VS Voltage vector shift
- 81 Frequency protection – "f>" or "f<"
- 81R Frequency protection – "df/dt"

Monitoring Functions

- Primary, secondary, and phase sequence, current & voltage
- Frequency, power, energy and fault location
- Fault data, event and waveform records

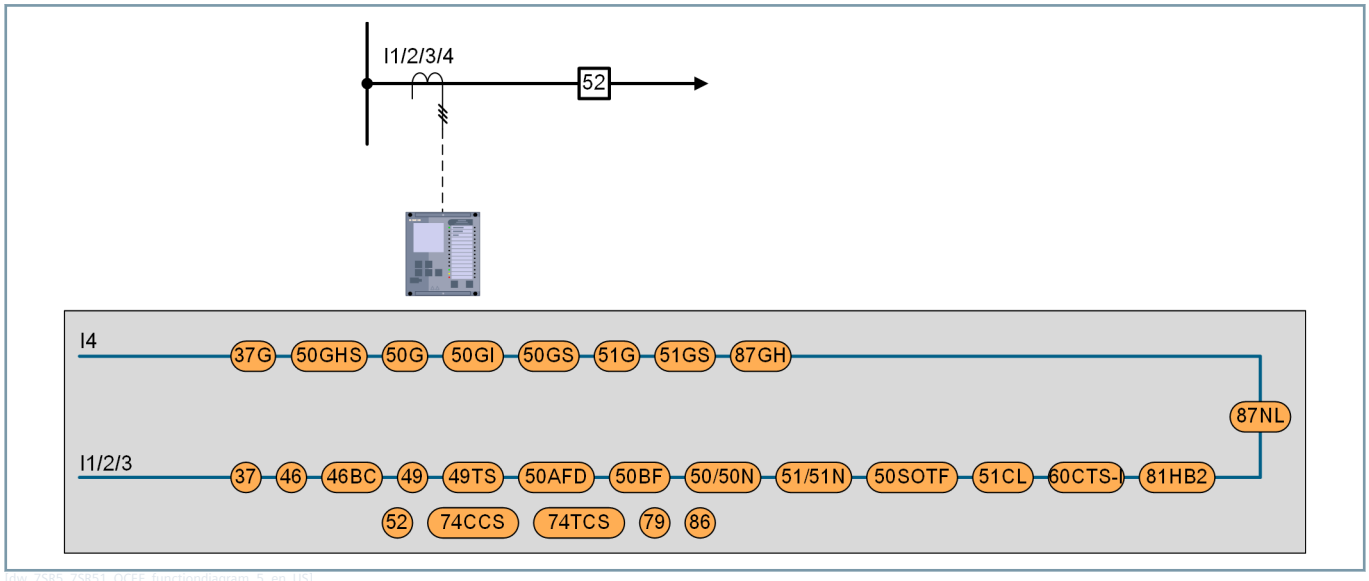
Applications

- Overcurrent and earth fault protection for medium voltage substations
- Backup protection for other main protection devices e.g. on lines, transformers, generators, motors, and busbars
- 5 CT model to provide measured standby earth fault for protection of transformer earthing resistors in addition to high-impedance earth fault protection
- Selectable directional overcurrent and earth fault elements for interconnected systems
- Measured and calculated earth fault protection elements provide a flexible solution when both earth fault and sensitive earth fault current detection is required
- Detection of earth faults in all networks including isolated and compensated networks
- High speed overcurrent elements for use with arc fault detectors to provide high speed fault detection and tripping
- Blocked overcurrent schemes using hardwiring or configurable IEC 61850 elements
- Configurable automatic reclosing to restore power flow after transient network faults

Communication

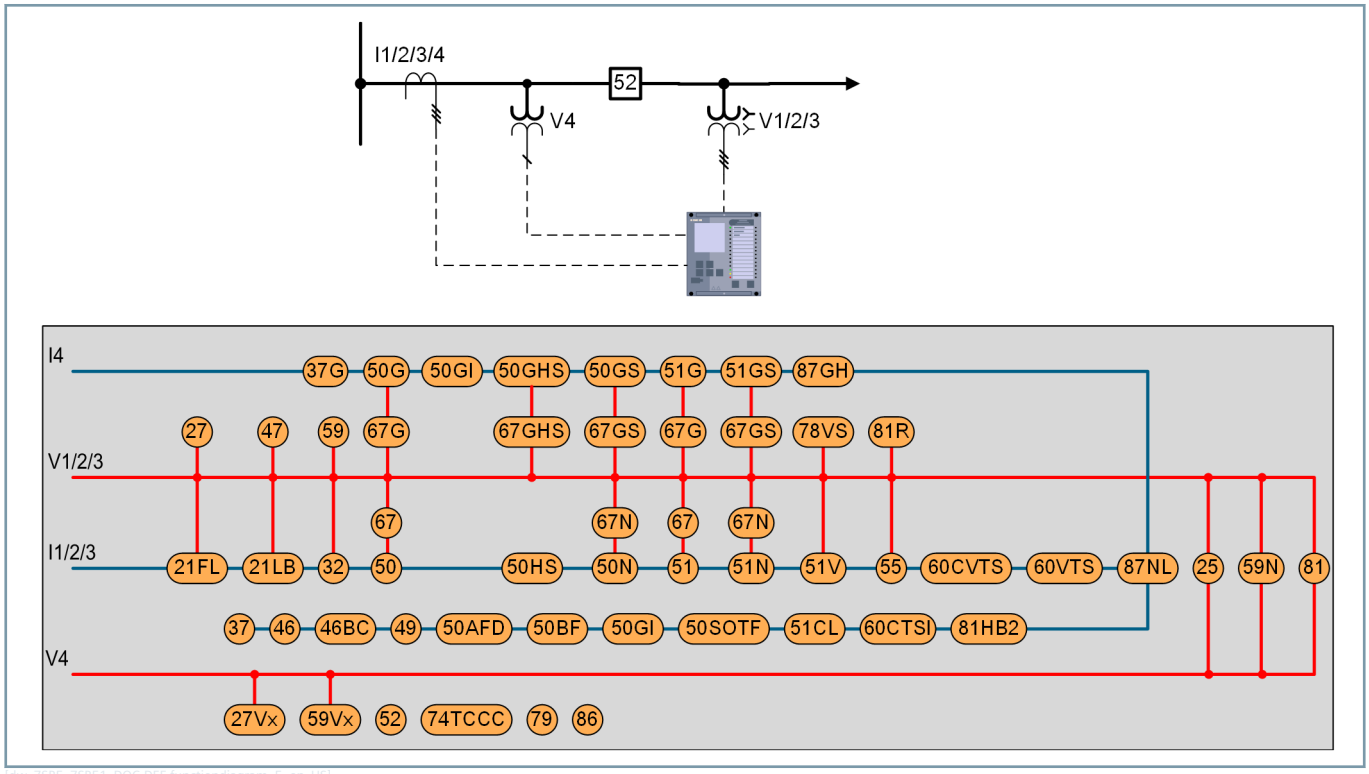
- IEC 60870-5-103, Modbus TCP, DNP3 TCP
  Modbus RTU, DNP3, IEC 61850

Application Templates



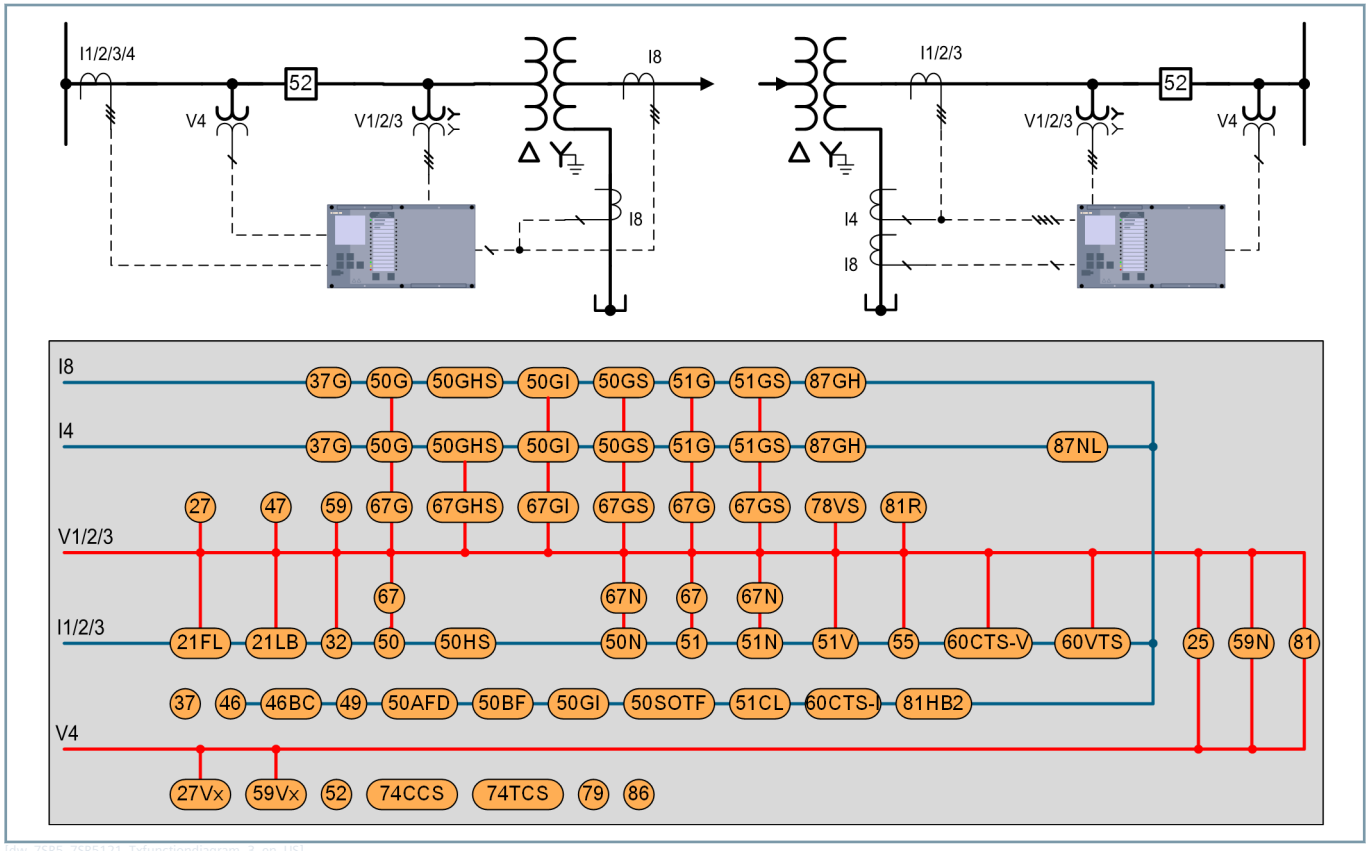
{dw_7SR5_7SR51_OCEF_functiondiagram; 5; en_US}

Figure 2.1/1 Function Diagram: 7SR5110 OCEF Protection



[dw_7SR5_7SR51_DOC-DEF functiondiagram, 5, en_US]

Figure 2.1/2 Function Diagram: 7SR5111 DOC/DEF Protection



[dw_7SR5_7SR5121_Txfunctiondiagram, 3, en_US]

Figure 2.1/3 Function Diagram: 7SR5121 DOC/DEF Protection

Functions, Application Templates

ANSI	Functions	7SR5110	7SR5111	7SR5121
21FL	Fault locator	–	■	■
21LB	Load blinder	–	■	■
25	Synchrocheck – synchronization function	–	■	■
27	Undervoltage protection – 3-phase	–	■	■
27Vx	Undervoltage protection – Vx	–	■	■
32	Power protection	–	■	■
37	Undercurrent protection – phase	■	■	■
37G	Undercurrent earth fault – measured	■	■	■
46	Negative sequence overcurrent protection	■	■	■
46BC	Broken conductor detection	■	■	■
47	Sequence overvoltage protection	–	■	■
49	Thermal overload protection	■	■	■
49TS	Temperature sensor supervision [3]	■	■	■
50	Instantaneous overcurrent – phase	■	■	■
50AFD	Arc flash detection [4]	■	■	■
50BF	Circuit-breaker failure protection – 3-pole	■	■	■
50G	Instantaneous earth fault – measured	■	■	■
50GHS	High speed earth fault – measured	■	■	■
50GI	Intermittent earth fault	■	■	■
50GS	Instantaneous sensitive earth fault – measured	■	■	■
50HS	High speed overcurrent – phase	■	■	■
50N	Instantaneous earth fault – calculated	■	■	■
50SOTF	Switch onto fault	■	■	■
51	Time-delayed overcurrent – phase	■	■	■
51CL	Cold load overcurrent – phase	■	■	■
51G	Time delayed earth fault – measured	■	■	■
51GS	Time-delayed sensitive earth fault – measured	■	■	■
51N	Time-delayed earth fault – calculated	■	■	■
51V	Voltage-dependent overcurrent – phase	–	■	■
52	Circuit-breaker control	■	■	■
55	Power factor	–	■	■
59	Overvoltage protection – 3-phase	–	■	■
59N	Neutral voltage displacement	–	■	■
59Vx	Overvoltage protection – Vx	–	■	■
60CTS-I	CT supervision – current reference	■	■	■
60CTS-V	CT supervision – voltage reference	–	■	■
60VTS	VT supervision	–	■	■
67	Directional overcurrent – phase	–	■	■
67G	Directional earth fault – measured	–	■	■
67GI	Directional Intermittent Earth Fault	–	■	■
67GS	Directional sensitive earth fault – measured	–	■	■
67N	Directional earth fault – calculated	–	■	■
74CC	Close-circuit supervision	■	■	■
74TC	Trip-circuit supervision	■	■	■
78VS	Voltage vector shift	–	■	■
79	Automatic reclosing	■	■	■
81	Frequency protection – "f>" or "f<"	–	■	■

3 An external interface unit is required where optional TSI module not fitted.

4 Requires external components

7SR5 Platform – Devices and Application

ANSI	Functions	7SR5110	7SR5111	7SR5121
81HB2	Inrush current detection	■	■	■
81R	Frequency protection – "df/dt"	–	■	■
86	Lockout	■	■	■
87GH	Restricted earth fault protection – high-impedance	■	■	■
87NL	Restricted earth fault protection - low-impedance	■	■	■
	Measured values	■	■	■
	Switching-statistic counters	■	■	■
	Circuit-breaker wear monitoring	■	■	■
	Logic editor	■	■	■
	External trip initiation	■	■	■
	Control	■	■	■
	Fault recording of analog and binary signals	■	■	■
	Sequence of events recorder	5000	5000	5000
	Security log	2048	2048	2048
	Monitoring and supervision	■	■	■
	Setting groups	4	4	4
	Changeover of setting group	■	■	■
	Binary inputs (max)	38	39	37
	Arc flash detector inputs (AFD)	0 or 3	0 or 3	0 or 3
	Temperature sensor inputs (TSI)	0 or 8	0 or 8	0 or 8
	Binary outputs (max) incl. healthy contact	18	20	18
	High speed binary outputs (HSBO)	0 or 3	0 or 3	0 or 3
	Current inputs	4	4	5
	Voltage inputs	0	4	4
	Size	6, 8, or 12	6, 8, or 12	8 or 12
	LCD resolution	128x128		
	Push buttons	7	7	7
	LEDs	28	28	28
	Power supply unit rated voltages	DC 24 to 250 V AC 100 to 230 V		
	Front user interface	■	■	■
	User selectable languages: English, French, German, Portuguese, Spanish, Turkish	■	■	■
	IEC 60870-5-103	■	■	■
	IEC 61850	■	■	■
	Modbus RTU	■	■	■
	Modbus TCP	■	■	■
	SNMP v3	■	■	■
	DNP3	■	■	■
	DNP3 TCP	■	■	■
	Time synchronization: Binary input, DNP3, Modbus RTU, DNP TCP, Modbus TCP, SNTP, IEEE 1588 PTP	■	■	■

Table 2.1/1 Reyrolle 7SR51 – Functions and Application Templates

NOTE

■ - Basic

Standard Variants

Standard Variants for 7SR511		
7SR5110-1AA	3/8, 8 BI, 6 BO, 4 I	
	Housing width 3/8 x 19" (size 6), housing height 4U 8 binary inputs 6 binary outputs (1 break, 2 changeover, 3 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5110-1AD	3/8, 8 BI, 9 BO (inc. 3 HSBO), 4 I, 3 AFD	
	Housing width 3/8 x 19" (size 6), housing height 4U 8 binary inputs 9 binary outputs (1 break, 2 changeover, 6 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5110-2AA	3/8, 13 BI, 8 BO, 4 I	
	Housing width 3/8 x 19" (size 6), housing height 4U 13 binary inputs 8 binary outputs (1 break, 2 changeover, 5 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5110-2AD	3/8, 13 BI, 11 BO (inc. 3 HSBO), 4 I, 3 AFD	
	Housing width 3/8 x 19" (size 6), housing height 4U 13 binary inputs 11 binary outputs (1 break, 2 changeover, 8 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5110-2AF	3/8, 13 BI, 8 BO, 4 I, 8 TSI	
	Housing width 3/8 x 19" (size 6), housing height 4U 13 binary inputs 8 binary outputs (1 break, 2 changeover, 5 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5110-3AA	1/2, 18 BI, 10 BO, 4 I	
	Housing width 1/2 x 19" (size 8), housing height 4U 18 binary inputs 10 binary outputs (1 break, 2 changeover, 7 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5110-3AD	1/2, 18 BI, 13 BO (inc. 3 HSBO), 4 I, 3 AFD	
	Housing width 1/2 x 19" (size 8), housing height 4U 18 binary inputs 13 binary outputs (1 break, 2 changeover, 10 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	

7SR5 Platform – Devices and Application

7SR5110-3AF	1/2, 18 BI, 10 BO, 4 I, 8 TSI	
	Housing width 1/2 x 19" (size 8), housing height 4U 18 binary inputs 10 binary outputs (1 break, 2 changeover, 7 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5110-4AA	1/2, 23 BI, 12 BO, 4 I	
	Housing width 1/2 x 19" (size 8), housing height 4U 23 binary inputs 12 binary outputs (1 break, 2 changeover, 9 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5110-4AA	3/4, 23 BI, 12 BO, 4 I	
	Housing width 3/4 x 19" (size 12), housing height 4U 23 binary inputs 12 binary outputs (1 break, 2 changeover, 9 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5110-4AD	1/2, 23 BI, 15 BO (inc. 3 HSBO), 4 I, 3 AFD	
	Housing width 1/2 x 19" (size 8), housing height 4U 23 binary inputs 15 binary outputs (1 break, 2 changeover, 12 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5110-4AF	1/2, 23 BI, 12 BO, 4 I, 8 TSI	
	Housing width 1/2 x 19" (size 8), housing height 4U 23 binary inputs 12 binary outputs (1 break, 2 changeover, 9 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5110-7AA	3/4, 38 BI, 18 BO, 4 I	
	Housing width 3/4 x 19" (size 12), housing height 4U 38 binary inputs 18 binary outputs (1 break, 2 changeover, 15 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5111-1AA	3/8, 9 BI, 8 BO, 4 I, 4 V	
	Housing width 3/8 x 19" (size 6), housing height 4U 9 binary inputs 8 binary outputs (1 break, 2 changeover, 5 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	

7SR5111-1AD	3/8, 9 BI, 11 BO (inc. 3 HSBO), 4 I, 4 V, 3 AFD	
	Housing width 3/8 x 19" (size 6), housing height 4U 9 binary inputs 11 binary outputs (1 break, 2 changeover, 8 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5111-1AF	3/8, 9 BI, 8 BO, 4 I, 4 V, 8 TSI	
	Housing width 3/8 x 19" (size 6), housing height 4U 9 binary inputs 8 binary outputs (1 break, 2 changeover, 5 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5111-2AA	1/2, 14 BI, 10 BO, 4 I, 4 V	
	Housing width 1/2 x 19" (size 8), housing height 4U 14 binary inputs 10 binary outputs (1 break, 2 changeover, 7 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5111-2AA	3/4, 14 BI, 10 BO, 4 I, 4 V	
	Housing width 3/4 x 19" (size 12), housing height 4U 14 binary inputs 10 binary outputs (1 break, 2 changeover, 7 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5111-3AA	1/2, 19 BI, 12 BO, 4 I, 4 V	
	Housing width 1/2 x 19" (size 8), housing height 4U 19 binary inputs 12 binary outputs (1 break, 2 changeover, 9 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5111-3AA	3/4, 19 BI, 12 BO, 4 I, 4 V	
	Housing width 3/4 x 19" (size 12), housing height 4U 19 binary inputs 12 binary outputs (1 break, 2 changeover, 9 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	

7SR5111-3AD	1/2, 19 BI, 15 BO (inc. 3 HSBO), 4 I, 4 V, 3 AFD	
	Housing width 1/2 x 19" (size 8), housing height 4U 19 binary inputs 15 binary outputs (1 break, 2 changeover, 12 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5111-3AD	3/4, 19 BI, 15 BO (inc. 3 HSBO), 4 I, 4 V, 3 AFD	
	Housing width 3/4 x 19" (size 12), housing height 4U 19 binary inputs 15 binary outputs (1 break, 2 changeover, 12 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5111-3AF	1/2, 19 BI, 12 BO, 4 I, 4 V, 8 TSI	
	Housing width 1/2 x 19" (size 8), housing height 4U 19 binary inputs 12 binary outputs (1 break, 2 changeover, 9 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5111-4AA	3/4, 24 BI, 14 BO, 4 I, 4 V	
	Housing width 3/4 x 19" (size 12), housing height 4U 24 binary inputs 14 binary outputs (1 break, 2 changeover, 11 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5111-4AD	3/4, 24 BI, 17 BO (inc. 3 HSBO), 4 I, 4 V, 3 AFD	
	Housing width 3/4 x 19" (size 12), housing height 4U 24 binary inputs 17 binary outputs (1 break, 2 changeover, 14 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5111-7AA	3/4, 39 BI, 20 BO, 4 I, 4 V	
	Housing width 3/4 x 19" (size 12), housing height 4U 39 binary inputs 20 binary outputs (1 break, 2 changeover, 17 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	

7SR5111-7AD	3/4, 39 BI, 23 BO (inc. 3 HSBO), 4 I, 4 V, 3 AFD	
	Housing width 3/4 x 19" (size 12), housing height 4U 39 binary inputs 23 binary outputs (1 break, 2 changeover, 20 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5111-7AF	3/4, 39 BI, 20 BO, 4 I, 4 V, 8 TSI	
	Housing width 3/4 x 19" (size 12), housing height 4U 39 binary inputs 20 binary outputs (1 break, 2 changeover, 17 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5121-2AA	1/2, 17 BI, 10 BO, 5 I, 4 V	
	Housing width 1/2 x 19" (size 8), housing height 4U 17 binary inputs 10 binary outputs (1 break, 2 changeover, 7 make) 5 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5121-2AA	3/4, 17 BI, 10 BO, 5 I, 4 V	
	Housing width 3/4 x 19" (size 12), housing height 4U 17 binary inputs 10 binary outputs (1 break, 2 changeover, 7 make) 5 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5121-3AA	3/4, 22 BI, 12 BO, 5 I, 4 V	
	Housing width 3/4 x 19" (size 12), housing height 4U 22 binary inputs 12 binary outputs (1 break, 2 changeover, 9 make) 5 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5121-3AD	3/4, 22 BI, 15 BO (inc. 3 HSBO), 5 I, 4 V, 3 AFD	
	Housing width 3/4 x 19" (size 12), housing height 4U 22 binary inputs 15 binary outputs (1 break, 2 changeover, 12 make) 5 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	

7SR5121-6AA	3/4, 37 BI, 18 BO, 5 I, 4 V	
	Housing width 3/4 x 19" (size 12), housing height 4U 37 binary inputs 18 binary outputs (1 break, 2 changeover, 15 make) 5 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5121-6AD	3/4, 37 BI, 21 BO (inc. 3 HSBO), 5 I, 4 V, 3 AFD	
	Housing width 3/4 x 19" (size 12), housing height 4U 37 binary inputs 21 binary outputs (1 break, 2 changeover, 18 make) 5 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5121-6AF	3/4, 37 BI, 18 BO, 5 I, 4 V, 8 TSI	
	Housing width 3/4 x 19" (size 12), housing height 4U 37 binary inputs 18 binary outputs (1 break, 2 changeover, 15 make) 5 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	

Table 2.1/2 Standard Variants for 7SR51

The technical data of the devices can be found in the hardware manual.

Description

The Reyrolle 5 is designed for the electricity networks of the future with enhanced communications and cyber security while maintaining a user-friendly interface and easy product management.

The Reyrolle 7SR54 provides protection, control and monitoring for 2- and 3-winding transformers. All transformer vector groups and earthing connections are supported.

The Reyrolle 7SR54 device includes a wide range of protection functions and IEC 61850 Ethernet communications as standard. To further minimize the product variants the power supply and the binary inputs cover the full operating range with configurable binary input thresholds.

The large LCD, tactile pushbuttons and programmable LEDs provide a user-friendly product interface and the relay element is withdrawable for easy replacement.

Inputs and outputs	Current inputs – 8 or 12 Voltage inputs – 0 or 4 Binary inputs (max) – 37 Binary outputs (max) incl. healthy contact – 18 Arc flash detector inputs (AFD) – 0 or 3 High speed binary outputs (HSBO) – 0 or 3 Temperature sensor inputs (TSI) – 0 or 8
Communication	Standard front USB port (for configuration using Reydisp Manager 2, a PC based software tool) rear RS485, 2 x RJ45 electrical ports or optional optical Ethernet connections
Housing	Size 8 or 12 with withdrawable design
Display	Backlit 128 x 128 LCD with text and graphical display capabilities suitable for single line mimic diagrams

Benefits

- Compact design and low product life-cycle cost
- Reliable operation due to powerful, proven protection algorithms
- IEC 61850 Edition 1 & 2 – with HSR, PRP and RSTP operation for increased availability
- Simple product ordering
- Combined 1 A and 5 A current transformer inputs
- 28 programmable tri-color LEDs for clear indications
- User selectable languages: English, French, German, Portuguese, Spanish, Turkish
- Conformal coating ordering option

Functions

Standard Functionality

- 37/37G Undercurrent protection – phase/earth
- 46 Negative sequence overcurrent protection

- 46BC Broken conductor detection
- 49 Thermal overload protection
- 49TS Temperature sensor supervision [5]
- 50/50G/50N Instantaneous overcurrent/earth fault
- 50AFD Arc flash detection [6]
- 50BF Circuit-breaker failure protection – 3-pole
- 51/51G/51N Time delayed overcurrent/earth fault
- 51CL Cold load overcurrent – phase
- 52 Circuit-breaker control
- 60CTS CT supervision
- 74CC/74TC Close-circuit and trip-circuit supervision
- 81HB2 Inrush current detection
- 81HB5 Overfluxing detection – 5th harmonic
- 86 Lockout
- 87GH Restricted earth fault protection – high-impedance
- 87NL Restricted earth fault protection - low-impedance
- 87T-BD Transformer differential protection – biased
- 87T-HS Transformer differential protection – highset

Additional Functionality – Devices with VT Inputs

- 21LB Load blinder (7SR5421)
- 24 Overexcitation protection
- 25 Synchrocheck – synchronization function
- 27/27Vx Undervoltage protection
- 32 Power protection
- 47 Sequence overvoltage protection
- 51V Voltage-dependent overcurrent – phase (7SR5421)
- 55 Power factor
- 59/59Vx Overvoltage protection
- 59N Neutral voltage displacement
- 60VTS VT supervision
- 67/67G/67N Directional – phase/earth fault (7SR5421)

5 An external interface unit is required where optional TSI module not fitted.

6 Requires external components

- 78VS Voltage vector shift
- 81 Frequency protection – "f>" or "f<"
- 81R Frequency protection – "df/dt"

2.1

Monitoring Functions

- Primary, secondary, and phase sequence, current & voltage
- Frequency, power
- Fault data, event and waveform records
- Event records (selectable events viewable on fascia)

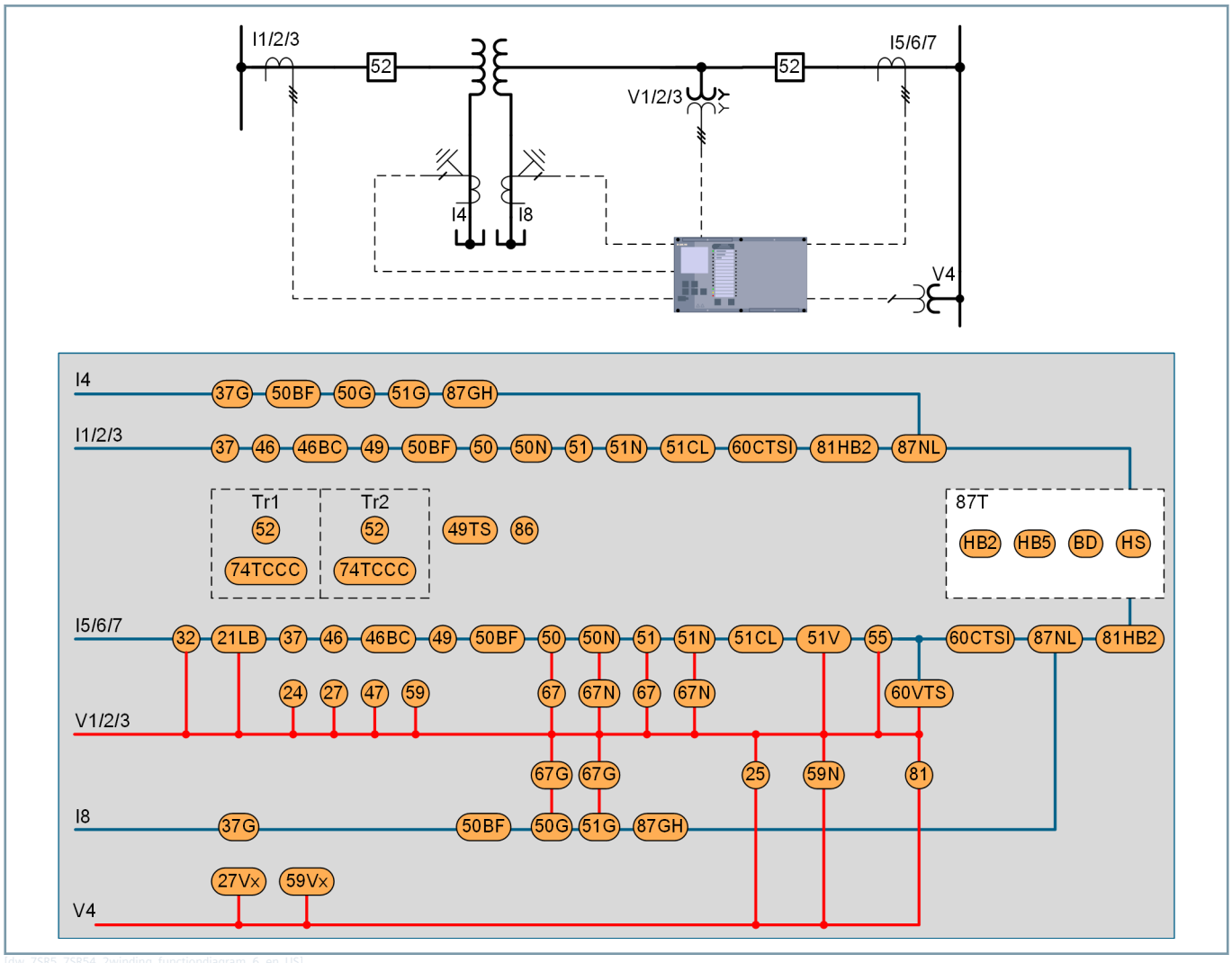
Applications

- Comprehensive protection for 2- or 3-winding transformers.
- Differential protection for auto-transformers, reactors and motors.

Communication

- IEC 60870-5-103, Modbus TCP, DNP3 TCP
  Modbus RTU, DNP3, IEC 61850

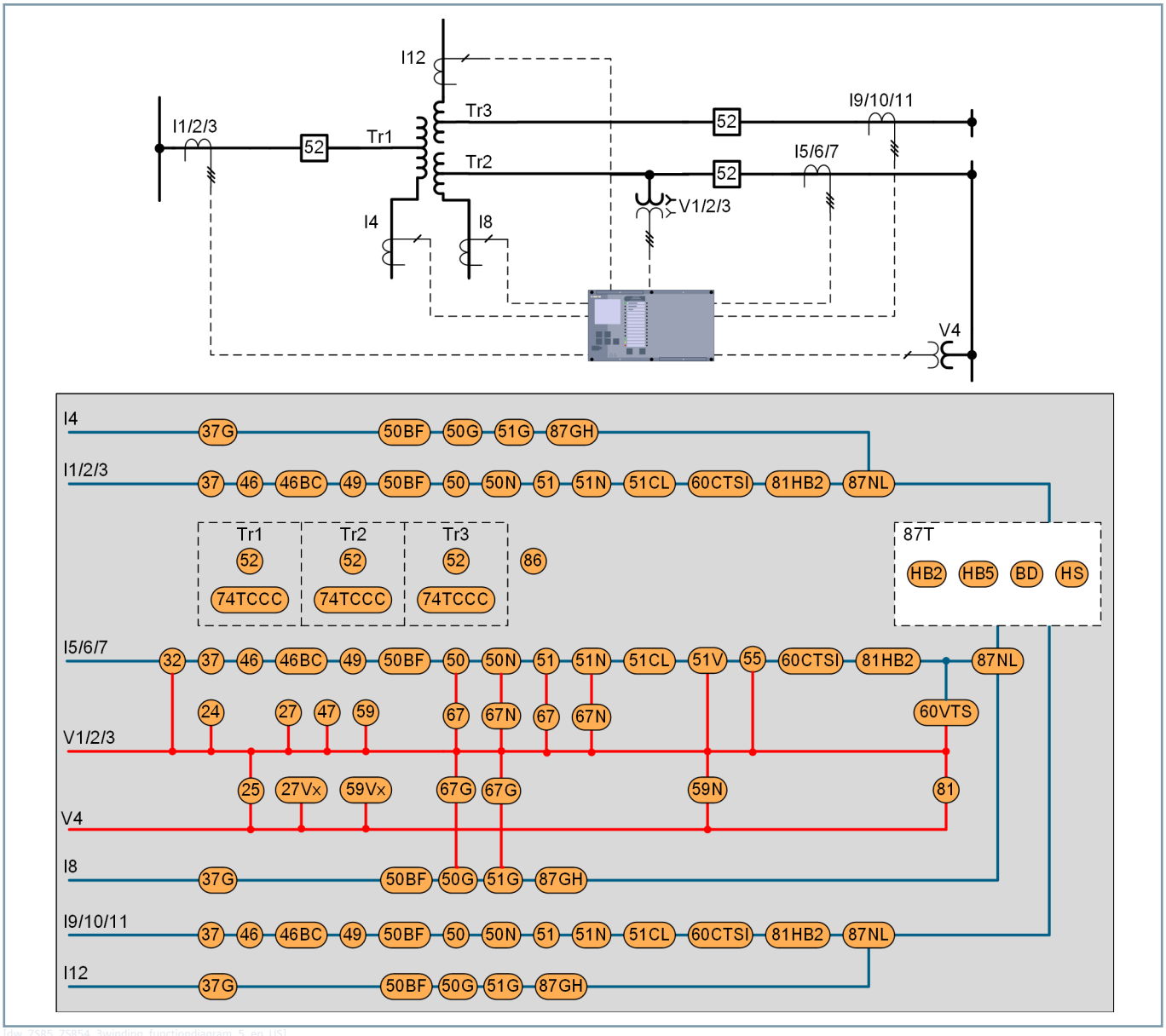
Application Templates



[dw_7SR5_7SR54_2winding_functiondiagram, 6, en_US]

Figure 2.1/4 7SR5421 2-Winding Transformer Protection Function Diagram

VT1,2,3 shown assigned to winding 2



[dw_7SR5_7SR54_3winding_functiondiagram, 5, en_US]

Figure 2.1/5 7SR5431 3-Winding Transformer Protection Function Diagram

VT1,2,3 shown assigned to winding 2

Functions, Application Templates

ANSI	Functions	7SR5420	7SR5421	7SR5430	7SR5431
21LB	Load blinder	–	■	–	■
24	Overexcitation protection	–	■	–	■
25	Synchrocheck – synchronization function	–	■	–	■
27	Undervoltage protection – 3-phase	–	■	–	■
27Vx	Undervoltage protection – Vx	–	■	–	■
32	Power protection	–	■	–	■
37	Undercurrent protection – phase	■	■	■	■
37G	Undercurrent earth fault – measured	■	■	■	■
46	Negative sequence overcurrent protection	■	■	■	■
46BC	Broken conductor detection	■	■	■	■
47	Sequence overvoltage protection	–	■	–	■
49	Thermal overload protection	■	■	■	■
49TS	Temperature sensor supervision [7]	■	■	■	■
50	Instantaneous overcurrent – phase	■	■	■	■
50AFD	Arc flash detection [8]	■	■	■	■
50BF	Circuit-breaker failure protection – 3-pole	■	■	■	■
50G	Instantaneous earth fault – measured	■	■	■	■
50N	Instantaneous earth fault – calculated	■	■	■	■
51	Time-delayed overcurrent – phase	■	■	■	■
51CL	Cold load overcurrent – phase	■	■	■	■
51G	Time delayed earth fault – measured	■	■	■	■
51N	Time-delayed earth fault – calculated	■	■	■	■
51V	Voltage-dependent overcurrent – phase	–	■	–	■
52	Circuit-breaker control	■	■	■	■
55	Power factor	–	■	–	■
59	Overvoltage protection – 3-phase	–	■	–	■
59N	Neutral voltage displacement	–	■	–	■
59Vx	Overvoltage protection – Vx	–	■	–	■
60CTS-I	CT supervision – current reference	■	■	■	■
60VTS	VT supervision	–	■	–	■
67	Directional overcurrent – phase	–	■	–	■
67G	Directional earth fault – measured	–	■	–	■
67N	Directional earth fault – calculated	–	■	–	■
74CC	Close-circuit supervision	■	■	■	■
74TC	Trip-circuit supervision	■	■	■	■
78VS	Voltage vector shift	–	■	–	■
81	Frequency protection – "f>" or "f<"	–	■	–	■
81HB2	Inrush current detection	■	■	■	■
81HB5	Overfluxing detection – 5th harmonic	■	■	■	■
81R	Frequency protection – "df/dt"	–	■	–	■
86	Lockout	■	■	■	■
87GH	Restricted earth fault protection – high-impedance	■	■	■	■
87NL	Restricted earth fault protection - low-impedance	■	■	■	■
87T-BD	Transformer differential protection – biased	■	■	■	■
87T-HS	Transformer differential protection – highset	■	■	■	■
	Measured values	■	■	■	■
	Switching-statistic counters	■	■	■	■

7 An external interface unit is required where optional TSI module not fitted.

8 Requires external components

ANSI	Functions	7SR5420	7SR5421	7SR5430	7SR5431
	Circuit-breaker wear monitoring	■	■	■	■
	Logic editor	■	■	■	■
	External trip initiation	■	■	■	■
	Control	■	■	■	■
	Fault recording of analog and binary signals	■	■	■	■
	Sequence of events recorder	5000	5000	5000	5000
	Security log	2048	2048	2048	2048
	Monitoring and supervision	■	■	■	■
	Setting groups	4	4	4	4
	Changeover of setting group	■	■	■	■
	Binary inputs (max)	21	37	24	35
	Arc flash detector inputs (AFD)	0 or 3	0 or 3	0 or 3	0 or 3
	Temperature sensor inputs (TSI)	0 or 8	0 or 8	0 or 8	0 or 8
	Binary outputs (max) incl. healthy contact	10	18	10	16
	High speed binary outputs (HSBO)	0 or 3	0 or 3	0 or 3	0 or 3
	Current inputs	8	8	12	12
	Voltage inputs	0	4	0	4
	Size	8 or 12	8 or 12	12	12
	LCD resolution	128x128			
	Push buttons	7	7	7	7
	LEDs	28	28	28	28
	Power supply unit rated voltages	DC 24 to 250 V AC 100 to 230 V			
	Front user interface	■	■	■	■
	User selectable languages: English, French, German, Portuguese, Spanish, Turkish	■	■	■	■
	IEC 60870-5-103	■	■	■	■
	IEC 61850	■	■	■	■
	Modbus RTU	■	■	■	■
	Modbus TCP	■	■	■	■
	SNMP v3	■	■	■	■
	DNP3	■	■	■	■
	DNP3 TCP	■	■	■	■
	Time synchronization: Binary input, DNP3, Modbus RTU, DNP TCP, Modbus TCP, SNTP, IEEE 1588 PTP	■	■	■	■

Table 2.1/3 Reyrolle 7SR54 – Functions and Application Templates

NOTE

■ - Basic

Standard Variants

2.1

Standard Variants for 7SR54		
7SR5420-2AA	1/2, 16 BI, 8 BO, 8 I	
	Housing width 1/2 x 19" (size 8), housing height 4U 16 binary inputs 8 binary outputs (1 break, 2 changeover, 5 make) 8 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5420-2AA	3/4, 16 BI, 8 BO, 8 I	
	Housing width 3/4 x 19" (size 12), housing height 4U 16 binary inputs 8 binary outputs (1 break, 2 changeover, 5 make) 8 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5420-3AA	1/2, 21 BI, 10 BO, 8 I	
	Housing width 1/2 x 19" (size 8), housing height 4U 21 binary inputs 10 binary outputs (1 break, 2 changeover, 7 make) 8 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5420-3AD	1/2, 21 BI, 13 BO (inc. 3 HSBO), 8 I, 3 AFD	
	Housing width 1/2 x 19" (size 8), housing height 4U 21 binary inputs 13 binary outputs (1 break, 2 changeover, 10 make) 8 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5420-3AD	3/4, 21 BI, 13 BO (inc. 3 HSBO), 8 I, 3 AFD	
	Housing width 3/4 x 19" (size 12), housing height 4U 21 binary inputs 13 binary outputs (1 break, 2 changeover, 10 make) 8 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5420-3AF	1/2, 21 BI, 10 BO, 8 I, 8 TSI	
	Housing width 1/2 x 19" (size 8), housing height 4U 21 binary inputs 10 binary outputs (1 break, 2 changeover, 7 make) 8 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5421-1AA	3/4, 12 BI, 8 BO, 8 I, 4 V	
	Housing width 3/4 x 19" (size 12), housing height 4U 12 binary inputs 8 binary outputs (1 break, 2 changeover, 5 make) 8 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	

7SR5421-2AA	1/2, 17 BI, 10 BO, 8 I, 4 V	
	Housing width 1/2 x 19" (size 8), housing height 4U 17 binary inputs 10 binary outputs (1 break, 2 changeover, 7 make) 8 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5421-2AD	1/2, 17 BI, 13 BO (inc. 3 HSBO), 8 I, 4 V, 3 AFD	
	Housing width 1/2 x 19" (size 8), housing height 4U 17 binary inputs 13 binary outputs (1 break, 2 changeover, 10 make) 8 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5421-2AD	3/4, 17 BI, 13 BO (inc. 3 HSBO), 8 I, 4 V, 3 AFD	
	Housing width 3/4 x 19" (size 12), housing height 4U 17 binary inputs 13 binary outputs (1 break, 2 changeover, 10 make) 8 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5421-2AF	1/2, 17 BI, 10 BO, 8 I, 4 V, 8 TSI	
	Housing width 1/2 x 19" (size 8), housing height 4U 17 binary inputs 10 binary outputs (1 break, 2 changeover, 7 make) 8 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5421-3AA	3/4, 22 BI, 12 BO, 8 I, 4 V	
	Housing width 3/4 x 19" (size 12), housing height 4U 22 binary inputs 12 binary outputs (1 break, 2 changeover, 9 make) 8 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5421-3AD	3/4, 22 BI, 15 BO (inc. 3 HSBO), 8 I, 4 V, 3 AFD	
	Housing width 3/4 x 19" (size 12), housing height 4U 22 binary inputs 15 binary outputs (1 break, 2 changeover, 12 make) 8 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	

7SR5421-3AF	3/4, 22 BI, 12 BO, 8 I, 4 V, 8 TSI	
	Housing width 3/4 x 19" (size 12), housing height 4U 22 binary inputs 12 binary outputs (1 break, 2 changeover, 9 make) 8 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5421-6AA	3/4, 37 BI, 18 BO, 8 I, 4 V	
	Housing width 3/4 x 19" (size 12), housing height 4U 37 binary inputs 18 binary outputs (1 break, 2 changeover, 15 make) 8 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5421-6AD	3/4, 37 BI, 21 BO (inc. 3 HSBO), 8 I, 4 V, 3 AFD	
	Housing width 3/4 x 19" (size 12), housing height 4U 37 binary inputs 21 binary outputs (1 break, 2 changeover, 18 make) 8 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5421-6AF	3/4, 37 BI, 18 BO, 8 I, 4 V, 8 TSI	
	Housing width 3/4 x 19" (size 12), housing height 4U 37 binary inputs 18 binary outputs (1 break, 2 changeover, 15 make) 8 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5430-3AA	3/4, 24 BI, 10 BO, 12 I	
	Housing width 3/4 x 19" (size 12), housing height 4U 24 binary inputs 10 binary outputs (1 break, 2 changeover, 7 make) 12 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5430-3AD	3/4, 24 BI, 13 BO (inc. 3 HSBO), 12 I, 3 AFD	
	Housing width 3/4 x 19" (size 12), housing height 4U 24 binary inputs 13 binary outputs (1 break, 2 changeover, 10 make) 12 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5430-3AF	3/4, 24 BI, 10 BO, 12 I, 8 TSI	
	Housing width 3/4 x 19" (size 12), housing height 4U 24 binary inputs 10 binary outputs (1 break, 2 changeover, 7 make) 12 current transformer inputs Communication: USB, RS485, 2 x Ethernet	

7SR5431-3AA	3/4, 25 BI, 12 BO, 12 I, 4 V	
	Housing width 3/4 x 19" (size 12), housing height 4U 25 binary inputs 12 binary outputs (1 break, 2 changeover, 9 make) 12 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5431-3AD	3/4, 25 BI, 15 BO (inc. 3 HSBO), 12 I, 4 V, 3 AFD	
	Housing width 3/4 x 19" (size 12), housing height 4U 25 binary inputs 15 binary outputs (1 break, 2 changeover, 12 make) 12 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5431-3AF	3/4, 25 BI, 12 BO, 12 I, 4 V, 8 TSI	
	Housing width 3/4 x 19" (size 12), housing height 4U 25 binary inputs 12 binary outputs (1 break, 2 changeover, 9 make) 12 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5431-5AA	3/4, 35 BI, 16 BO, 12 I, 4 V	
	Housing width 3/4 x 19" (size 12), housing height 4U 35 binary inputs 16 binary outputs (1 break, 2 changeover, 13 make) 12 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5431-5AD	3/4, 35 BI, 19 BO (inc. 3 HSBO), 12 I, 4 V, 3 AFD	
	Housing width 3/4 x 19" (size 12), housing height 4U 35 binary inputs 19 binary outputs (1 break, 2 changeover, 16 make) 12 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5431-5AF	3/4, 35 BI, 16 BO, 12 I, 4 V, 8 TSI	
	Housing width 3/4 x 19" (size 12), housing height 4U 35 binary inputs 16 binary outputs (1 break, 2 changeover, 13 make) 12 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	

Table 2.1/4 Standard Variants for 7SR54

The technical data of the devices can be found in the hardware manual.

7SR5 Platform – Devices and Application

Description

The Reyrolle 5 is designed for the electricity networks of the future with enhanced communications and cyber security while maintaining a user-friendly interface and easy product management.

The Reyrolle 7SR57 motor protection devices include a wide range of protection functions and IEC 61850 Ethernet communications as standard. To further minimize the product variants the power supply and the binary inputs cover the full operating range with configurable binary input thresholds.

The large LCD, tactile pushbuttons and programmable LEDs provide a user-friendly product interface and the relay element is withdrawable for easy replacement.

Input and outputs	Current inputs – 4 or 8 Voltage inputs – 0 or 4 Binary inputs (max) – 29 Binary outputs (max) incl. healthy contact – 16 Arc flash detector inputs (AFD) – 0 or 3 High speed binary outputs (HSBO) – 0 or 3 Temperature sensor inputs (TSI) – 0, 8, or 16
Communication	Standard front USB port (for configuration using Reydisp Manager 2, a PC based software tool) rear RS485, 2 x RJ45 electrical ports or optional optical Ethernet connections
Housing	Size 6, 8, or 12 with withdrawable design
Display	Backlit 128 x 128 LCD with text and graphical display capabilities suitable for single line mimic diagrams

Benefits

- Compact design and low product life-cycle cost
- Reliable operation due to powerful, proven protection algorithms
- IEC 61850 Edition 1 & 2 with HSR, PRP and RSTP operation for increased availability
- Simple product ordering
- Combined 1 A and 5 A current transformer inputs
- 28 programmable tri-color LEDs for clear indications.
- User selectable languages: English, French, German, Portuguese, Spanish, Turkish
- Conformal coating ordering option

Functions

Standard Functionality

- 14 Locked rotor protection
- 37/37G Undercurrent protection – phase/earth
- 46BC Broken conductor detection
- 46PR Phase-rotation reversal
- 46UB Phase unbalance

- 48 Starting-time supervision
- 49M Motor thermal overload protection
- 49TS Temperature sensor supervision [9]
- 50/50G/50N Instantaneous overcurrent/earth fault
- 50AFD Arc flash detection [10]
- 50BCL Break capacity limit
- 50BF Circuit-breaker failure protection – 3-pole
- 51/51G/51N Time delayed overcurrent/earth fault
- 52 Circuit-breaker control
- 60CTS CT supervision
- 66 Number of starts
- 74CC/74TC Close-circuit and trip-circuit supervision
- 81B Backspin monitor
- 81HB2 Inrush current detection
- 86 Lockout
- 87GH Restricted earth fault protection – high-impedance

Additional Functionality – Devices with VT Inputs

- 27/27Vx Undervoltage protection
- 32 Power protection
- 47 Sequence overvoltage protection
- 55 Power factor
- 59/59Vx Overvoltage protection
- 59N Neutral voltage displacement
- 60VTS VT supervision
- 67/67G/67N Directional – phase/earth fault
- 81 Frequency protection – "f>" or "f<"
- 81B-V Backspin monitor – voltage reference
- 87M Motor differential protection

Monitoring Functions

- Primary, secondary, phase sequence, current and voltage
- Frequency, power, and energy

9 An external interface unit is required where optional TSI module not fitted.

10 Requires external components

- Fault data, event and waveform records
- Motor start data log

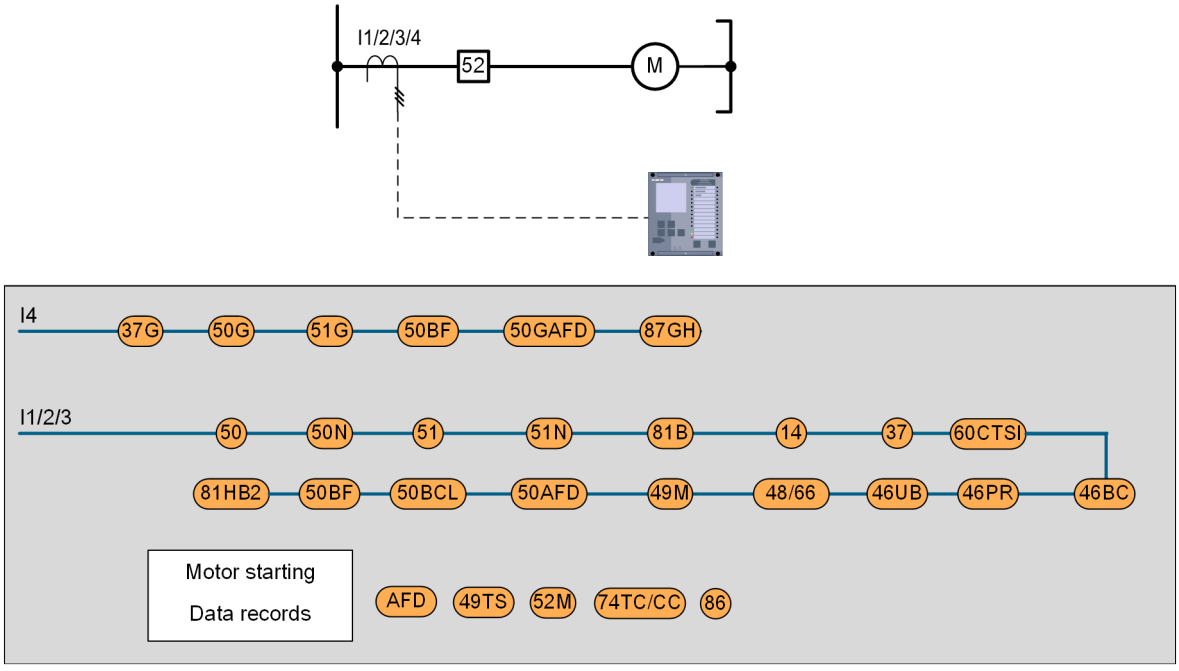
Applications

- Motor protection functions designed to protect during all motor starting and running sequences
- Thermal algorithm optimized to closely match the thermal characteristics of motors
- Thermal monitoring via plant temperature sensors supported

Application Templates

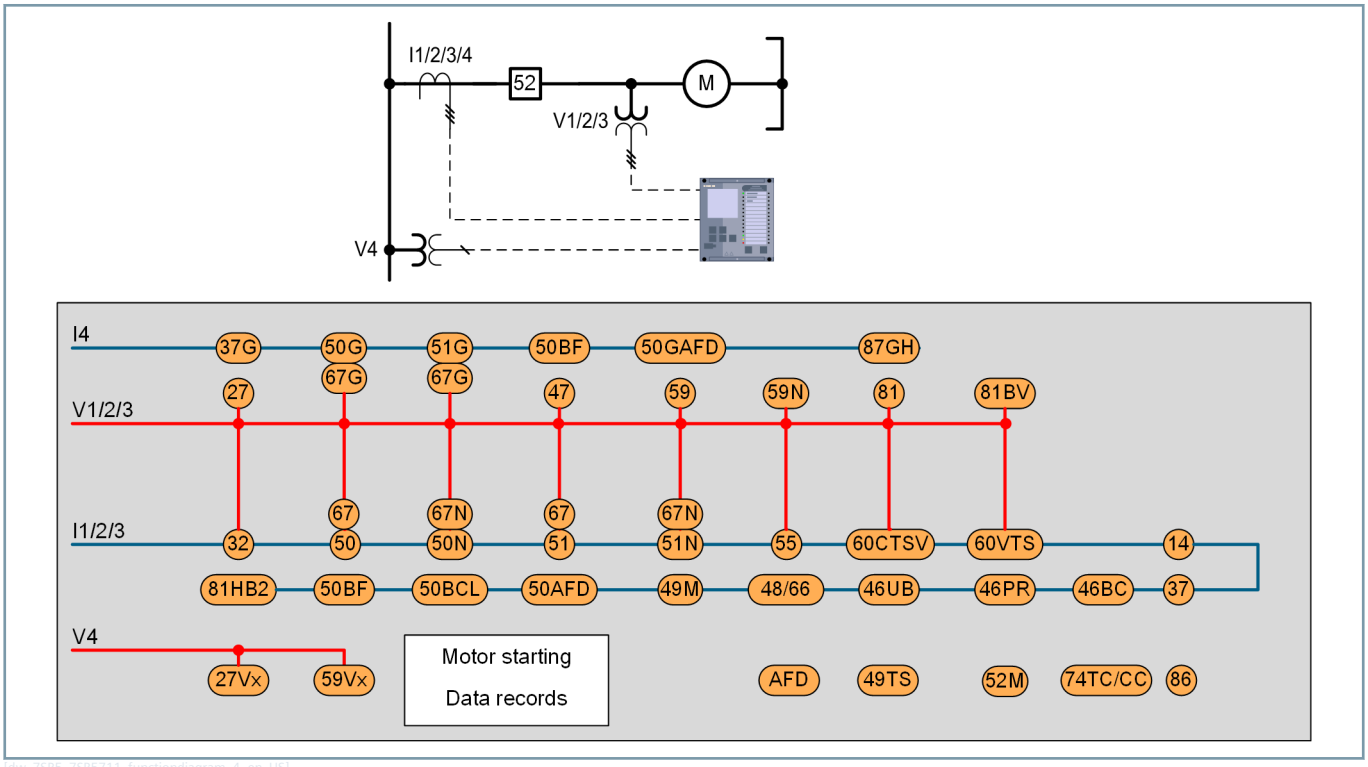
Communication

- IEC 60870-5-103, Modbus TCP, DNP3 TCP
  Modbus RTU, DNP3, IEC 61850, Modbus Client for connection to external RTD box



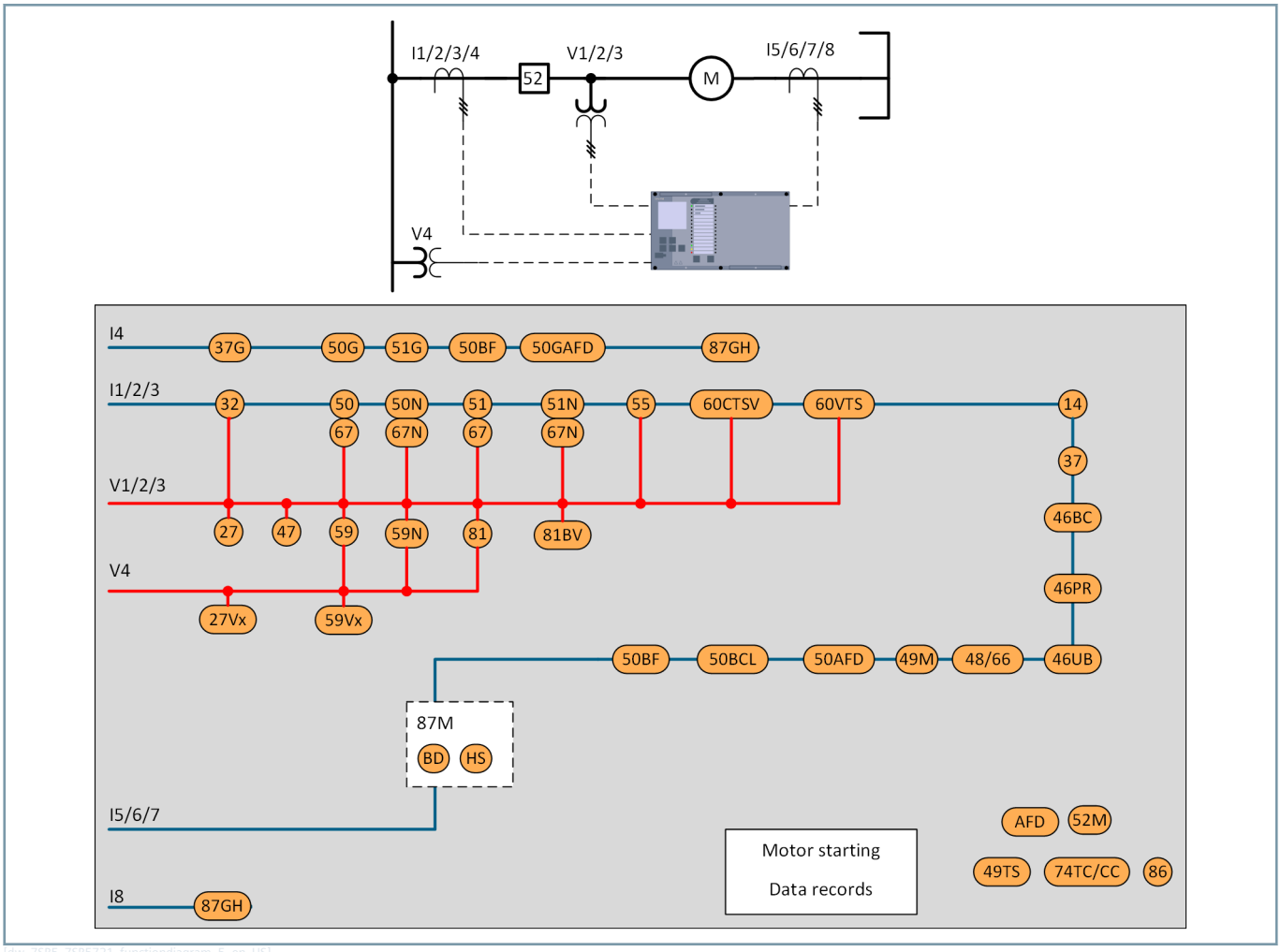
{dw_7SR5_7SR5710_functiondiagram, 4, en_US}

Figure 2.1/6 7SR5710 Motor Protection Function Diagram



{dw_7SR5_7SR5711_functiondiagram, 4, en_US}

Figure 2.1/7 7SR5711 Motor Protection Function Diagram



[dw_7SR5_7SR5721_functiondiagram_5_en_US]

Figure 2.1/8 7SR5721 Motor Protection Function Diagram

Functions, Application Templates

ANSI	Functions	7SR5710	7SR5711	7SR5721
14	Locked rotor protection	■	■	■
27	Undervoltage protection – 3-phase	–	■	■
27Vx	Undervoltage protection – Vx	–	■	■
32	Power protection	–	■	■
37	Undercurrent protection – phase	■	■	■
37G	Undercurrent earth fault – measured	■	■	■
46BC	Broken conductor detection	■	■	■
46PR	Phase-rotation reversal	■	■	■
46UB	Phase unbalance	■	■	■
47	Sequence overvoltage protection	–	■	■
48	Starting-time supervision	■	■	■
49M	Motor thermal overload protection	■	■	■
49TS	Temperature sensor supervision [11]	■	■	■
50	Instantaneous overcurrent – phase	■	■	■
50AFD	Arc flash detection [12]	■	■	■
50BCL	Break capacity limit	■	■	■
50BF	Circuit-breaker failure protection – 3-pole	■	■	■
50G	Instantaneous earth fault – measured	■	■	■
50N	Instantaneous earth fault – calculated	■	■	■
51	Time-delayed overcurrent – phase	■	■	■
51G	Time delayed earth fault – measured	■	■	■
51N	Time-delayed earth fault – calculated	■	■	■
52	Circuit-breaker control	■	■	■
55	Power factor	–	■	■
59	Overvoltage protection – 3-phase	–	■	■
59N	Neutral voltage displacement	–	■	■
59Vx	Overvoltage protection – Vx	–	■	■
60CTS-I	CT supervision – current reference	■	–	–
60CTS-V	CT supervision – voltage reference	–	■	■
60VTS	VT supervision	–	■	■
66	Number of starts	■	■	■
67	Directional overcurrent – phase	–	■	■
67G	Directional earth fault – measured	–	■	■
67N	Directional earth fault – calculated	–	■	■
74CC	Close-circuit supervision	■	■	■
74TC	Trip-circuit supervision	■	■	■
81	Frequency protection – "f>" or "f<"	–	■	■
81B	Backspin monitor	■	–	–
81B-V	Backspin monitor – voltage reference	–	■	■
81HB2	Inrush current detection	■	■	■
86	Lockout	■	■	■
87GH	Restricted earth fault protection – high-impedance	■	■	■
87M	Motor differential protection	–	–	■
	Measured values	■	■	■
	Switching-statistic counters	■	■	■
	Circuit-breaker wear monitoring	■	■	■
	Logic editor	■	■	■

11 An external interface unit is required where optional TSI module not fitted.

12 Requires external components

ANSI	Functions	7SR5710	7SR5711	7SR5721
	External trip initiation	■	■	■
	Control	■	■	■
	Fault recording of analog and binary signals	■	■	■
	Sequence of events recorder	5000	5000	5000
	Motor operating records	■	■	■
	Security log	2048	2048	2048
	Monitoring and supervision	■	■	■
	Setting groups	4	4	4
	Changeover of setting group	■	■	■
	Binary inputs (max)	23	29	27
	Arc flash detector inputs (AFD)	0 or 3	0 or 3	0 or 3
	Temperature sensor inputs (TSI)	0 or 8	0, 8, or 16	0, 8, or 16
	Binary outputs (max) incl. healthy contact	12	16	14
	High speed binary outputs (HSBO)	0 or 3	0 or 3	0 or 3
	Current inputs	4	4	8
	Voltage inputs	0	4	4
	Size	6, 8, or 12	6, 8, or 12	8 or 12
	LCD resolution		128x128	
	Push buttons	7	7	7
	LEDs	28	28	28
	Power supply unit rated voltages		DC 24 to 250 V AC 100 to 230 V	
	Front user interface	■	■	■
	User selectable languages: English, French, German, Portuguese, Spanish, Turkish	■	■	■
	IEC 60870-5-103	■	■	■
	IEC 61850	■	■	■
	Modbus RTU	■	■	■
	Modbus TCP	■	■	■
	SNMP v3	■	■	■
	DNP3	■	■	■
	DNP3 TCP	■	■	■
	Time synchronization: Binary input, DNP3, Modbus RTU, DNP TCP, Modbus TCP, SNTP, IEEE 1588 PTP	■	■	■

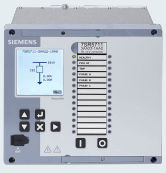
Table 2.1/5 Reyrolle 7SR57 – Functions and Application Templates

NOTE

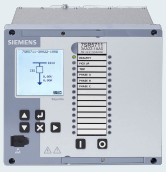
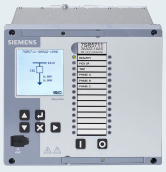
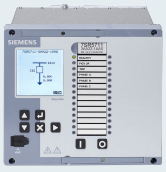
■ - Basic

Standard Variants

2.1

Standard Variants for 7SR57		
7SR5710-1AA	3/8, 8 BI, 6 BO, 4 I	
	Housing width 3/8 x 19" (size 6), housing height 4U 8 binary inputs 6 binary outputs (1 break, 2 changeover, 3 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5710-1AD	3/8, 8 BI, 9 BO (inc. 3 HSBO), 4 I, 3 AFD	
	Housing width 3/8 x 19" (size 6), housing height 4U 8 binary inputs 9 binary outputs (1 break, 2 changeover, 6 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5710-1AF	3/8, 8 BI, 6 BO, 4 I, 8 TSI	
	Housing width 3/8 x 19" (size 6), housing height 4U 8 binary inputs 6 binary outputs (1 break, 2 changeover, 3 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5710-2AA	3/8, 13 BI, 8 BO, 4 I	
	Housing width 3/8 x 19" (size 6), housing height 4U 13 binary inputs 8 binary outputs (1 break, 2 changeover, 5 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5710-2AD	3/8, 13 BI, 11 BO (inc. 3 HSBO), 4 I, 3 AFD	
	Housing width 3/8 x 19" (size 6), housing height 4U 13 binary inputs 11 binary outputs (1 break, 2 changeover, 8 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5710-2AF	3/8, 13 BI, 8 BO, 4 I, 8 TSI	
	Housing width 3/8 x 19" (size 6), housing height 4U 13 binary inputs 8 binary outputs (1 break, 2 changeover, 5 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5710-3AA	1/2, 18 BI, 10 BO, 4 I	
	Housing width 1/2 x 19" (size 8), housing height 4U 18 binary inputs 10 binary outputs (1 break, 2 changeover, 7 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	

7SR5710-3AD	1/2, 18 BI, 13 BO (inc. 3 HSBO), 4 I, 3 AFD	
	Housing width 1/2 x 19" (size 8), housing height 4U 18 binary inputs 13 binary outputs (1 break, 2 changeover, 10 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5710-3AF	1/2, 18 BI, 10 BO, 4 I, 8 TSI	
	Housing width 1/2 x 19" (size 8), housing height 4U 18 binary inputs 10 binary outputs (1 break, 2 changeover, 7 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5710-4AA	1/2, 23 BI, 12 BO, 4 I	
	Housing width 1/2 x 19" (size 8), housing height 4U 23 binary inputs 12 binary outputs (1 break, 2 changeover, 9 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5710-4AD	1/2, 23 BI, 15 BO (inc. 3 HSBO), 4 I, 3 AFD	
	Housing width 1/2 x 19" (size 8), housing height 4U 23 binary inputs 15 binary outputs (1 break, 2 changeover, 12 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5710-4AF	1/2, 23 BI, 12 BO, 4 I, 8 TSI	
	Housing width 1/2 x 19" (size 8), housing height 4U 23 binary inputs 12 binary outputs (1 break, 2 changeover, 9 make) 4 current transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5711-1AA	3/8, 9 BI, 8 BO, 4 I, 4 V	
	Housing width 3/8 x 19" (size 6), housing height 4U 9 binary inputs 8 binary outputs (1 break, 2 changeover, 5 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5711-1AD	3/8, 9 BI, 11 BO (inc. 3 HSBO), 4 I, 4 V, 3 AFD	
	Housing width 3/8 x 19" (size 6), housing height 4U 9 binary inputs 11 binary outputs (1 break, 2 changeover, 8 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	

7SR5711-1AF	3/8, 9 BI, 8 BO, 4 I, 4 V, 8 TSI	
	Housing width 3/8 x 19" (size 6), housing height 4U 9 binary inputs 8 binary outputs (1 break, 2 changeover, 5 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5711-3AA	1/2, 19 BI, 12 BO, 4 I, 4 V	
	Housing width 1/2 x 19" (size 8), housing height 4U 19 binary inputs 12 binary outputs (1 break, 2 changeover, 9 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5711-3AA	3/4, 19 BI, 12 BO, 4 I, 4 V	
	Housing width 3/4 x 19" (size 12), housing height 4U 19 binary inputs 12 binary outputs (1 break, 2 changeover, 9 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5711-3AD	1/2, 19 BI, 15 BO (inc. 3 HSBO), 4 I, 4 V, 3 AFD	
	Housing width 1/2 x 19" (size 8), housing height 4U 19 binary inputs 15 binary outputs (1 break, 2 changeover, 12 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5711-3AD	3/4, 19 BI, 15 BO (inc. 3 HSBO), 4 I, 4 V, 3 AFD	
	Housing width 3/4 x 19" (size 12), housing height 4U 19 binary inputs 15 binary outputs (1 break, 2 changeover, 12 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5711-3AF	1/2, 19 BI, 12 BO, 4 I, 4 V, 8 TSI	
	Housing width 1/2 x 19" (size 8), housing height 4U 19 binary inputs 12 binary outputs (1 break, 2 changeover, 9 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	

7SR5711-5DD	3/4, 29 BI, 19 BO (inc. 3 HSBO), 4 I, 4 V, 3 AFD, 16 TSI	
	Housing width 3/4 x 19" (size 12), housing height 4U 29 binary inputs 19 binary outputs (1 break, 2 changeover, 16 make) 4 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5721-2AA	1/2, 17 BI, 10 BO, 8 I, 4 V	
	Housing width 1/2 x 19" (size 8), housing height 4U 17 binary inputs 10 binary outputs (1 break, 2 changeover, 7 make) 8 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5721-2AD	1/2, 17 BI, 13 BO (inc. 3 HSBO), 8 I, 4 V, 3 AFD	
	Housing width 1/2 x 19" (size 8), housing height 4U 17 binary inputs 13 binary outputs (1 break, 2 changeover, 10 make) 8 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5721-2AF	1/2, 17 BI, 10 BO, 8 I, 4 V, 8 TSI	
	Housing width 1/2 x 19" (size 8), housing height 4U 17 binary inputs 10 binary outputs (1 break, 2 changeover, 7 make) 8 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	
7SR5721-4DD	3/4, 27 BI, 17 BO (inc. 3 HSBO), 8 I, 4 V, 3 AFD, 16 TSI	
	Housing width 3/4 x 19" (size 12), housing height 4U 27 binary inputs 17 binary outputs (1 break, 2 changeover, 14 make) 8 current transformer inputs 4 voltage transformer inputs Communication: USB, RS485, 2 x Ethernet	

Table 2.1/6 Standard Variants for 7SR57

The technical data of the devices can be found in the hardware manual.

Protection

2.1

NOTE

For devices that have more than one current input group the source of the operating current for each element can be configured.

14 Locked Rotor Protection

Each function element has a single definite time overcurrent characteristic with settings for pickup level and Definite Time Lag (DTL) delays.

Operation can be controlled from motor stopped or running conditions.

21FL Fault Locator

The relay provides a basic 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.

21LB Load Blinder

Load blinders block directional overcurrent tripping during periods of high reverse load currents that can occur due to increased contribution from distributed generation in the network. The blinder is operated during user defined load conditions. The application of appropriate settings can be derived by analysis of the data logger stored records.

24 Overexcitation Protection

Excess flux density causes stray flux to flow into transformer components external to the core, causing eddy currents and over-heating. Damage can be caused to transformer insulation.

In DTL mode 2 elements are provided each having an independent definite time lag (DTL) characteristic.

In 'User Defined' mode a user defined pick-up/time characteristic is implemented. Operation occurs where the measured Voltage : Frequency ratio is above setting for a time in excess of the time delayed operation.

25 Synchrocheck – Synchronization Function

Voltage, phase and frequency differences on opposing sides of the open circuit-breaker are checked before manual close and autoreclose circuit-breaker operations to ensure that the circuit-breaker is not closed in abnormal system conditions.

27 Undervoltage Protection – 3-Phase

Each element has settings for voltage pickup, drop-off (hysteresis) and definite time lag (DTL) operate delay. Operation occurs where the voltage falls below setting for the duration of the DTL setting.

27Vx Undervoltage Protection – Vx

This single phase element has settings as per 27 undervoltage protection – 3 phase.

32 Power Protection

Directional power elements are used to detect reverse load flow or loss of load.

Each element can be set to measure real, apparent or reactive power. Settings for pickup level and definite time lag (DTL) delayed operation are available for each element.

37 Undercurrent Protection

Undercurrent elements are used to detect loss of load or current flow. In some transformer applications an undercurrent check is used as a primary plant switching inter-lock/check.

Each element has settings for pickup level and definite time lag (DTL) delay – operating where the current falls below setting for a time exceeding the DTL setting.

46 Negative-Sequence Overcurrent Protection

NPS current elements can be used to detect unbalances on the system or remote earth faults when a delta-star transformer is in circuit.

2 elements, one DTL and one IDMT, with user settings for pickup level and delays, will operate if NPS current exceeds setting and delay.

46BC Broken Conductor Detection

Elements are used to detect transformer OLTC mechanism failures or broken phase conductors.

Each phase unbalance element has settings for pickup level and DTL delay – operating where 1 or 2 of the measured currents fall below the pick-up setting for a time exceeding the DTL setting.

46PR Phase-rotation reversal

Detects rotation of the current vectors and is used to avoid reverse rotation of the motor.

46UB Phase Unbalance

Unbalance current has a significant heating effect on the motor.

2 phase unbalance measurement modes are available. Either NPS current or the difference between maximum and minimum phase currents can be used as a measurement of the unbalance level. Inverse or definite time operation can be selected.

47 Sequence Overvoltage Protection

Phase sequence voltage elements operate where the selected sequence voltage (V1, V2 or V0) exceeds setting for a period in excess of the operate time.

Each element has settings for pickup level and definite time lag (DTL) delays. Operation occurs where the voltage exceeds setting for the duration of the DTL setting.

48 Starting-Time Supervision

Motor start up time is monitored by this function.

An output is raised if the start time exceeds the setting.

49 Thermal Overload Protection

The thermal algorithm calculates the circuit thermal state from the measured currents. 2 elements provide different heating time constants for natural and forced cooling operation.

Outputs are available for thermal overload and thermal capacity.

49M Motor Thermal Overload Protection

The enhanced thermal algorithm provides compliance with IEC 60255-8 (Thermal Electrical Relays).

The operating curves take into account the effects of present loading, prior loading, and unbalanced currents on the motor operating temperature.

A user definable thermal curve is selectable to allow matching of the relay thermal characteristic to all motor and cooling system types.

"Starting" and "cooling" constants modify the thermal characteristic during motor run-up and stopped conditions.

49TS Temperature Sensor Supervision

Resistance temperature detectors (RTDs) and thermistors can be monitored when the optional temperature sensor input (TSI) module is specified.

Resistance temperature detectors (RTDs) can also be connected via an optional external Temperature Monitoring Interface. Up to 12 Pt100 sensors can be monitored. The interface is connected to the RS485 serial communications port.

50 Instantaneous Overcurrent – Phase

The 3 phase currents are measured to provide instantaneous overcurrent protection.

Settings for pickup current operation are available for each independent time (50) element.

An operate time delay can also be applied.

50AFD Arc Flash Detection

All 7SR5 devices can be used with the 7XG31 ReyArc range of arc flash detection devices.

Optionally, 7SR5 devices can be ordered with 3 x light sensing AFD inputs which can be connected to P1X series arc sensors.

Arc detection is employed for the fast clearance of arcing faults on busbars, within metal clad switchgear and associated cable boxes. The arc is detected using an optical sensor and the signal input to the relay which also monitors the load current on the system.

50BCL Breaking-Capacity Limit

Operation of the tripping outputs can be blocked if the measured current exceeds this setting. This function is used to prevent the interrupting capacity of the primary switching device being exceeded.

50BF Circuit-Breaker Failure Protection – 3-Pole

Where a CB fails to open and current continues to flow then an alternative means of interrupting the current flow must be implemented. A CB fail output can be used to re-trip the CB (e.g. second trip coil) or to trip adjacent CBs. 2 DTLs are provided to facilitate 2 stage operation if required.

The circuit-breaker fail function can be initiated from an internal trip signal or from a binary input.

Line currents are monitored following trip initiation and outputs issued if any current is still flowing after elapse of a user selectable time delay.

50G Instantaneous Earth Fault – Measured

Earth current is directly measured from an independent CT or the residual connection of the 3 line CTs.

Settings for pickup current operation are available for each independent time (50G) element.

50GHS High Speed Earth Fault – Measured

High speed measured earth fault element for faster clearance of high current faults.

50GI Intermittent Earth Fault

For identification of intermittent, self clearing earth faults by counting fault occurrences and integration of fault current pulse duration for use on compensated networks and cable systems.

50GS Instantaneous Sensitive Earth Fault – Measured

Earth current is directly measured from an independent CT or the residual connection of the 3 line CTs.

Settings for pickup current and time delayed operation are available for each independent time (50G) element.

50HS High Speed Overcurrent – Phase

High speed overcurrent element for faster clearance of high current faults.

50N Instantaneous Earth Fault – Calculated

Earth current is calculated from the sum of the 3 phase CT inputs.

Settings for pickup current operation are available for each independent time (50N) element.

50SOTF Switch onto Fault

SOTF functionality provides high speed tripping if a fault is still present on the feeder after the reclosure of the circuit-breaker (Close-on-to-Fault) or if earthing clamps are left connected after maintenance.

51 Time-Delayed Overcurrent – Phase

The 3 phase currents are measured to provide time delayed overcurrent protection.

Settings for time delayed operation are available for each dependent time (51) element.

Dependent time elements (51) also have selectable IEC/ANSI operate and reset characteristics.

Minimum operating time and additional Follower DTL can also be configured for increased flexibility.

51CL Cold Load Overcurrent – Phase

If a circuit-breaker is closed onto load that has not been powered for a prolonged period a higher than normal load-current can flow until the load stabilizes. To allow optimum setting levels to be applied during this period the cold load pickup feature applies alternative overcurrent settings for a limited time.

The overcurrent function reverts to normal in service settings when either the circuit-breaker has been closed for a defined period, or the current has fallen below a set level for a defined period.

51G Time-Delayed Earth Fault – Measured

Earth current is directly measured from an independent CT or the residual connection of the 3 line CTs.

Settings for time-delayed operation are available for each dependent time (51G) element.

Dependent time elements (51G) also have selectable IEC/ANSI operate and reset characteristics.

51GS Time-Delayed Sensitive Earth Fault – Measured

Earth current is directly measured from an independent CT or the residual connection of the 3 line CTs.

Settings for time-delayed operation are available for each dependent time (51G) element.

Dependent time elements (51G) also have selectable IEC/ANSI operate and reset characteristics.

51N Time-Delayed Earth Fault – Calculated

Earth current is calculated from the sum of the 3 phase CT inputs.

Settings for time-delayed operation are available for each dependent time (51N) element.

Dependent time elements (51N) also have selectable IEC/ANSI operate and reset characteristics.

51V Voltage-Dependent Overcurrent – Phase

In 'Restrained' mode this element increases the sensitivity of the overcurrent protection proportionally with the decrease in the system voltage.

In 'Control' mode the element modifies the time multiplier applied to the 51/67 phase fault elements when the system voltage falls below setting.

55 Power Factor

This feature is used to monitor the system power factor, it is used for system monitoring and/or in conjunction with load flow optimization schemes.

Each element has independent settings for pickup level and definite time lag (DTL) delayed operation.

59 Overvoltage Protection – 3 Phase

Each element has settings for voltage pickup, drop-off (hysteresis) and definite time lag (DTL) operate delay. Operation occurs where the voltage exceeds setting for the duration of the DTL setting.

59N Neutral Voltage Displacement

2 elements, 1 DTL and 1 IDMTL, have user settings for pickup level and delays. These will operate if the neutral voltage exceeds the setting for duration of delay. Neutral overvoltage can be used to detect earth faults in high-impedance earthed or isolated systems.

60CTS-I CT Supervision – Current Reference

Open or short circuited CTs will not allow correct fault detection or stability measurement. Open circuited CTs may cause damaging over-voltages.

Protections can be blocked or an alarm raised, each element has settings for pickup level and DTL delay – operating where 1 or 2 of the line currents fall below the pick-up setting for a time exceeding the DTL setting.

60CTS-V CT Supervision – Voltage Reference

Each element has settings for V_{nps} and I_{nps} pickup levels and DTL delay – operating where V_{nps} is below setting and I_{nps} is above setting for a time exceeding the DTL setting. The CT supervision function typically provides an alarm output.

60VTS VT Supervision

The VT supervision uses a combination of negative phase sequence voltage and negative phase sequence current to detect a VT fuse failure. This condition may be alarmed or used to inhibit voltage dependent functions. Element has user operate and delay settings.

66 Number of Starts

The feature provides settings to control both the number of times a motor can be started within a specified time period and the minimum time between starts. Motor starting can be inhibited when this limit is reached.

67 Directional Overcurrent – Phase

Each element can be user set for forward, reverse, or non-directional operation.

Directional overcurrent elements are polarized from 3 phase quadrature voltage.

67G Directional Earth Fault – Measured

Each element can be user set for forward, reverse, or non-directional operation.

On 7SR5121 models with 2 measured earth current inputs, the source of the 67G current can be selected. Overcurrent elements using that measured current input can provide the directional option.

Earth fault elements are polarized using a residual voltage reference Vo.

67GI Directional Intermittent Earth Fault

Settings are provided for directional polarizing which are independent of the other earth fault elements.

On 7SR5121 models with 2 measured earth current inputs, the source of the 67GI current can be selected. Overcurrent elements using that measured current input can provide the directional option.

Elements are polarized using the residual voltage reference V0. Each element can be set for forward, reverse, or non-directional operation.

67GS Directional Sensitive Earth Fault – Measured

Each element can be user set for forward, reverse, or non-directional operation.

On 7SR5121 models with 2 measured earth current inputs, the source of the 67GS current can be selected. Overcurrent

elements using that measured current input can provide the directional option.

Sensitive earth fault elements are polarized using a residual voltage reference Vo.

67N Directional Earth Fault – Calculated

Each element can be user set for forward, reverse, or non-directional operation.

Where a suitable Vo reference is not available then calculated earth fault element (N) can also operate in 'NPS Voltage Polarising' mode.

74CC Close-Circuit Supervision

The close-circuit supervision can be monitored via binary inputs connected in basic, intermediate or comprehensive schemes. Close-circuit failure raises an HMI alarm and output(s).

74TC Trip-Circuit Supervision

The trip-circuit supervision can be monitored via binary inputs connected in basic, intermediate or comprehensive schemes. Trip-circuit failure raises an HMI alarm and output(s).

78VS Voltage Vector Shift

The voltage vectors of each phase are monitored and an output initiated when an abrupt phase shift above setting is detected simultaneously in all 3 phases. This indicates a sudden change in the system generation/load balance.

The function is applied to detect 'islanding' or loss of connection between a generator and the main utility supply.

79 Automatic Reclosing

Flexible, independent automatic reclosing sequences for phase and earth fault protection operations are provided.

Up to 5 trips + 4 reclose operations can be attempted.

Automatic reclosing sequences can be user set to any configuration of 'Instantaneous' or 'Delayed' protection trips, with independent reclose (Dead) times. Instantaneous/Delayed elements are user defined from the dependent and independent time elements available.

Limits can be set for the number of 'Delayed' trips to lockout and 'High set' trips to lockout.

The automatic reclosing feature can also be initiated by external protection devices e.g. from a separate line protection relay. External trips can be blocked to allowing the implementation of grading by overcurrent protections.

81 Frequency Protection – "f>" or "f<"

Frequency protection is used to initiate load shedding or generator start up. Over-frequency detectors can be used for generation shedding or within a load restoration permissible logic scheme.

Each element has settings for frequency pickup, drop-off (hysteresis) and definite time lag (DTL) operate delay. Operation occurs where the frequency exceeds setting for the duration of the DTL setting.

81B Backspin Monitor

To inhibit attempted restarting of the motor until after the rotor has completely stopped backspin protection is applied. Starting is inhibited until the 81B time delay has elapsed.

81HB2 Inrush Current Detection

A high content of second harmonic current is an indication of transformer energization inrush current.

Harmonic detectors are provided for both line and differential currents.

Where the measured second harmonic level is above the setting operation of the transformer differential and the overcurrent protection is blocked by 81HB2.

81HB5 Overfluxing Detection – 5th Harmonic

A high content of fifth harmonic current can indicate transformer over-fluxing conditions.

Harmonic detectors measure the fifth harmonic level in the transformer differential current and when above setting operation of the biased differential element (87T-BD) protection can be blocked.

81R Frequency Protection – "df/dt"

Each element has settings for pickup level and definite time lag (DTL) delay. Operates when the df/dt gradient exceeds setting for duration of delay.

The function is typically applied in load shedding schemes or to detect 'islanding' or loss of connection between a generator and the main utility supply.

86 Lockout

Output relays can be configured to self reset, pulsed or hand reset operation.

Output relays can be used to directly trip the circuit-breaker. The operate 'break' duty of output relays is limited so the circuit-breaker trip coil must be open circuited by a suitably rated contact, typically a circuit-breaker auxiliary switch.

87GH Restricted Earth-Fault Protection – High-Impedance

Restricted earth fault protection provides high sensitivity and high operating speed for internal earth faults as it is associated with only one transformer winding and so does not require harmonic stabilization.

To implement the high impedance restricted earth fault protection scheme the secondary windings of the line and neutral CTs are wired in parallel and connected to the measured earth current input. Class PX CTs with identical ratios must be used.

An external series stabilizing resistor and a voltage limiting (non-linear) resistor are required to complete the scheme.

87M Motor Differential Protection

87M-BD provides biased low impedance differential protection for phase and earth faults. 87M-HS provides fast protection for high internal fault currents e.g. terminal faults.

87NL Restricted Earth-Fault Protection – Low-Impedance

The line and neutral CTs provide inputs to a low-impedance restricted earth fault scheme.

For 7SR5121 models with 2 earth current inputs, CT4 is used.

A percentage biased algorithm is implemented.

Internal current multpiliers allow the use of line and neutral CTs with different ratios.

87T-BD Transformer Differential Protection – Biased

The differential characteristic incorporates an initial setting and two bias stages – the first stage for steady state errors i.e. tap position and CT ratios the second stage for transient errors i.e. CT saturation.

87T-HS Transformer Differential Protection – Highset

Unrestrained differential elements provide a fast protection for high internal fault currents e.g. terminal faults.

Programmable User Logic

The user can map binary inputs and protection operated outputs to function inhibits, logic inputs, LEDs and/or binary outputs. In addition to graphical user logic that is configured in the PC tool the user can map binary inputs and protection operated outputs to fuction inhibits, logic inputs, LEDs, and/or binary outputs using simple text based equations that can be viewed and edited at the device fascia. The user can also enter up to 16 equations defining scheme logic using standard functions e.g. timers, AND/OR gates, inverters and counters. Each protection element output can be used for alarm & indication and/or tripping.

Circuit-Breaker Maintenance

Up to 3 sets of circuit-breaker operations counters are provided. For each set:

- The maintenance counters record the overall number of operations.
- The delta counter records the number of operations since the last reset.
- The I^2t summation counter provides a measure of the contact wear indicating the total energy interrupted by the circuit-breaker contacts.

Each counter has a user set target operations count which, when reached, can be mapped to raise alarms/binary outputs. These counters assist with maintenance scheduling.

Plant Maintenance

2 circuit-breaker operations counters are provided. The maintenance counters record the overall number of operations and the delta counter the number of operations since the last reset.

An I^2t summation counter provides a measure of the contact wear indicating the total energy interrupted by the circuit-breaker contacts.

Each counter has a user set target operations count which, when reached, can be mapped to raise alarms/binary outputs. These counters assist with maintenance scheduling.

Plant Control

Plant control can be provided from the relay fascia or via the data comms channel(s).

The fascia mimic screen can be configured to provide a visual representation of the primary plant configuration and operate state.

Monitoring

Can include

Instruments and Meters

- Current:
  - Primary phases and earth
  - Secondary phases and earth
  - Relay operate and restraint
  - Phase sequence (PPS, NPS, ZPS)
  - Differential operate and restraint
- Voltage:
  - Primary
  - Secondary
  - Phase sequence (PPS, NPS, ZPS)
- Frequency & fluxing
- Power
- Energy
- Fault location
- Temperature (when temperature sensors are connected)
- Binary input/output and virtual I/O status
- Time and date
- Fault data records
- Event records (selectable events viewable on fascia)
- Waveform records
- Motor start records

Plant Data

- CB trip counters
- CB trip current counters
- CB I^2t summation (wear) counters
- Plant parameters
- Data logging (demand history)

Energy Metering

The imported and exported energy values are stored. Data is available for both active (Wh) and reactive (VArh) energy quantities.

Data Storage

Fault Data Records

The last 100 fault records are displayed on the HMI, with time and date of trip, measured quantities and type of fault.

Waveform Records

The waveform recorder stores analogue data for all inputs, protection function states, binary inputs/outputs and LEDs.

A waveform record can be triggered from protection function, binary input or via data communications.

The latest 20 waveform records can be stored. Waveform records are of 1, 2, 5 or 10 s duration. The ratio of pre-fault to post-fault storage is user selectable.

Waveforms are available for all relay functions and analogue inputs – the displayed waveforms are user selectable.

Motor Start Records (7SR57 Devices)

The records for motor starts include the following information:

- Start date
- Start time
- Number of starts
- Motor start duration
- Thermal capacity used for last start
- Total thermal capacity used
- Maximum starting current
- Minimum start voltage (requires voltage inputs)

Event Records

Up to 5000 events are stored and time tagged to 1ms resolution.

Selectable events can be displayed on the relay fascia or in the event recorder readout.

Data Log

The average values of current, voltage, power, and power factor (where applicable) are recorded at a user selectable interval e.g. every 15 min covers the preceding 7 days.

This stored data log facilitates load flow analysis. In conjunction with data communications and control this information can be used to optimize network power flows, for example in dynamic grids.

Real-Time Clock

The time and date can be set and are maintained while the relay is de-energized by a back up storage capacitor. The time can be synchronized from a binary input pulse, the serial or data communication port using a selected protocol or the Ethernet interface using DNP3 TCP, Modbus TCP, SNTP, or IEEE 1588 PTP. The real-time clock supports selectable main and backup clock signal source from binary input, serial port, or Ethernet interface as well as dual SNTP clock support.

Communication

Communications

Reyrolle 7SR5 devices are equipped with high performance integrated communication interfaces as standard. All devices include:

- Front USB port for local connection configuration
- Rear RS485 serial communication for SCADA interface

In addition 2 rear Ethernet interface ports are provided as standard. Ordering options provide the selection for: The Ethernet port types are specified when ordered as

- 2 x RJ45 Electrical Ethernet interfaces/connections **OR**
- 2 x duplex LC 1300-nm optical Ethernet interfaces/connections

The electrical Ethernet interface can be configured with or without an integrated switch. The maximum electrically recommended distance via CAT 5/CAT 6 patch cables is 20 m.

The optical Ethernet interface can be configured with or without an integrated switch. The maximum optically permitted distance via 50/125 µm or 62.5/125 µm multimode optical fibers is 2 km.

Serial Protocols (RS485 Port)

The RS485 port is intended for connection to a system interface and can be selected to **Off** or to use any one of the serial protocols, IEC 60870-5-103, Modbus RTU or DNP3. The implementation is compatible with existing Reyrolle 7SR solutions. The serial protocol mapping information can be viewed and configured in Reydisp Manager, this enables adaptation to existing solutions and the interchangeability of devices without changes in the systems control.

IEC 60870-5-103

In addition to indications, measured values, and fault records, metered values, and customer-specific defined indications of systems control are also available in protocol extensions. Control commands for switching devices can also be transmitted via the protocol.

DNP3

DNP3 information about a device and the fault records of the device can be routed and transmitted using the DNP3 protocol. Switching commands can be executed in control direction.

Modbus RTU

Modbus can be used to transmit messages (single-point and double-point indications), measured values, and metered values to 1 master. In command direction, switching of switching objects is possible via the protocol.

Ethernet Protocols

Ethernet modules are used for Ethernet-based protocol applications, for example, IEC 61850, Modbus TCP, time synchronization via SNTP, and network management via SNMP etc. Several applications can run in parallel, unused applications can be switched off for security reasons. The rear Ethernet interfaces are not configured with an IP address by default and must be configured prior to use.

IEC 61850-8-1 Client-Server Communication is always provided on the 7SR5 Ethernet interface and it supports 6 client-server associations with reporting function and GOOSE messages. Messages, measured values, and fault records can be read from an IEC 61850 client and the time of the device can be set via an SNTP server. Measured and metered values can be transmitted via the client-server communication in static and dynamic reports to a maximum of 6 clients (substation controllers). Dynamic reports are created and read by the client without configuring the parameters of the device. The static reports are created via the IEC 61850 system configurator and are permanently saved in the device as indication lists. Fault records can also be retrieved in COMTRADE format. Extensive control functions are available from the client, such as for the safe switching of a circuit breaker.

IEC 61850-8-1 GOOSE

GOOSE has been established as a worldwide standard for the exchange of messages between devices. The exchange itself occurs via high-performance IP network connections or Ethernet network connections. GOOSE messages can be used to exchange time-critical information that must be transmitted in a few milliseconds e.g. to replace protection signals between contacts and binary inputs. GOOSE applications are generated in the system configurator for this purpose.

Modbus TCP

Modbus TCP communication protocol utilises the electrical or optical Ethernet interface and can be used alongside the IEC 61850. Only Modbus TCP or DNP3 TCP can be used or configured at any time. Modbus TCP uses TCP packets for data transmission and is similar in operation to the Modbus RTU protocol. Modbus TCP can be used to transmit messages (single-point and double-point indications), measured values, metered values to 1 or 2 (redundant) masters. In the command direction, control operation of switching objects is possible via the protocol. Time synchronization can take place via the Modbus TCP protocol but should not be used when the SNTP time synchronizing is used.

Time synchronization can take place via the Modbus TCP protocol but should be disabled when the SNTP or IEEE 1588 PTP time synchronizing is used.

Further Ethernet-based Protocols and Services in addition to the actual protocol application, can be run in parallel on an Ethernet interface.

DNP3 TCP

DNP3 TCP communication protocol utilizes the electrical or optical ethernet interface and can be used alongside the IEC 61850. Only Modbus TCP or DNP3 TCP can be used or configured at any time.

The device reports event data in one of 3 class buffers, Class 1,2, or 3. Class 0 is supported as the current state condition. Where applicable the event data class can be modified in the Reydisp Manager 2 configuration file. Up to 2 masters can also be configured for unsolicited events.

Time synchronization can take place via the DNP3 TCP protocol but should be disabled when the SNTP or IEEE 1588 PTP time synchronizing is used.

Redundancy

2.1

Ethernet redundancy is supported on both the electrical and optical Ethernet allowing the building of redundant ring structures. They are independent of the substation automation protocol or the selected additional services.

With an integrated switch, electrical or optical rings with a maximum of 40 devices can be established using RSTP (Rapid Spanning Tree Protocol).

Seamless Redundancy with a reduced time for the reconfiguration of communication networks in the event of interruptions is supported with:

- PRP = Parallel Redundancy Protocol
- HSR = High Availability Seamless Redundancy

Time Synchronization via SNTP

Time Synchronization with SNTP Protocol is supported. The device can poll the absolute time from 1 or 2 time servers via an SNTP server. In redundant operation, both servers are read and the time of the 1st server is used for setting the device clock. If this server fails, the time is synchronized by the 2nd server.

IEEE 1588 Precision Time Protocol

Time synchronization by this protocol is supported in Line mode, RSTP, PRP, and HSR modes. **`Ordinary Clock Slave Only`** is provided, Domain Address 0, for all modes. IEC 61850-9-3:2016 profile is supported.

Network Monitoring via SNMP

The device can be integrated in network monitoring or power management systems via the SNMP protocol V3. SNMPV3 supports security features with authentication and privacy features. Monitoring variables, for example the state of the Ethernet interfaces, their data throughput etc. can be made known to the monitoring system via MIB (Management Information Base) files. No values can be changed in the device via SNMP. It serves exclusively as a diagnosis interface.

Cyber Security

With the increasing integration of bay devices in Ethernet-based communication networks, communication must be secured against internal disturbances and attacks from outside. Standards and directives contain requirements for the secure operation of devices in a critical communications infrastructure environment, and must be addressed by both manufacturers and operators.

By default only the front USB is enabled in the device to allow local connection. The rear Ethernet ports are not configured by default in the device and can be enabled and configured with Reydisp Manager.

Secure authentication takes place between the device and the communication partner (Reydisp Manager or web interface). This prevents an unauthorized program accessing the devices and reading or writing data there. The use of the transmission protocol secured by Datagram Transport Layer Security (DTLS) or Hypertext Transfer Protocol Secure (HTTPS) ensures the integrity and confidentiality of the transmitted data.

To ensure the Integrity of firmware and configuration of the 7SR5 device, files are digitally signed. In this way, corruption from outside by viruses or trojans, for example by manipulated firmware files, is reliably prevented.

The 7SR5 device provides user authentication using a connection password and maintenance password.

The user has read and write access to the device only after the connection has been established by entering the predefined password.

The maintenance password is configured to restrict access for firmware upgrades, security log access and resetting of the connection password.

The passwords conform to the cybersecurity requirements for assigning passwords defined in NERC CIP. Passwords must have between 8 and 30 characters and must include upper-case and lower-case letters, digits, and special characters.

Operational security (safety) by means of confirmation ID for local access to the control operations and parameter changes from the fascia is also provided. These confirmation IDs can be configured by the user in Reydisp Manager and may be different for different fields of application. After entering the confirmation ID's the user has access until timed out.

Logging of events relevant to cybersecurity, such as login attempts or device restarts, are recorded and optionally transmitted to a central server via the standardized Syslog UDP protocol. The device-internal log entries are secured to prevent deletion and protected against unauthorised access with the Security ID for fascia access and the Maintenance Password for browser access.

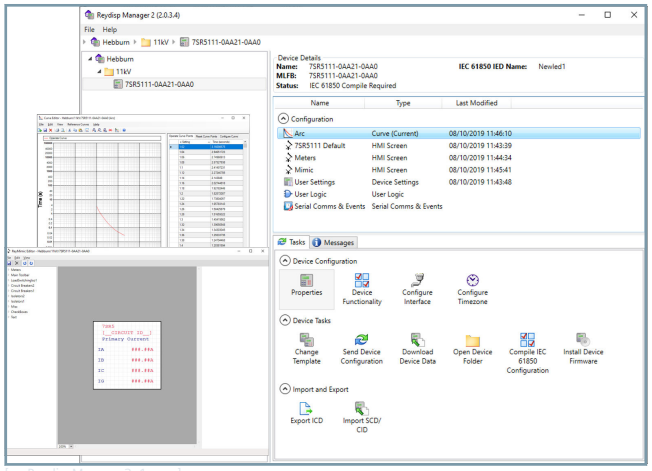
Reydisp Manager 2

Reydisp Manager 2 (RM2) is a PC based engineering tool used for the setting and configuration of all Reyrolle 5 devices. Available to download free of charge from our web site this easy to use software ensures an efficient work flow.

A connection can be made to the relay via the high speed USB port or over an Ethernet network.

RM2 provides a modern interface allowing the user to apply and interrogate settings, create logic, retrieve event records, disturbance records and waveform records and project management of multiple devices.

For system configuration engineering of IEC 61850 projects an IEC 61850 system configuration tool will be required. Either the Siemens IEC 61850 System Configurator, as used by DIGSI, or a 3rd party IEC 61850 system configurator tool.



[sc_ReydispManager2, 1, _ _]

Figure 2.1/9 Typical Reydisp Manager 2 screenshot

Overview of Functions

- Protection setting parameterization both offline and online
- Device configuration
- Viewing of device instrumentation
- Logic editing
- Creation of user curves
- Serial protocol point editing
- HMI screen design and configuration
- Real time indications on all records allowing direct correlation between all relay records e.g. between waveform and event records
- Indication of all element operate states
- User triggering of protection, control and supervision functions from Reydisp
- Relay BI/BO matrix display
- Reports can be produced and exported
- Comtrade files
- Communications Editor
- Curve Editor
- Mimic Creator
  - Mimic Control: Primary plant can be controlled by the mimic interface
  - Mimic Display: The mimic can display primary plant positions/status

2.1

Hardware Construction

The product platform includes the following:

- Backlit 128x128 LCD with text and graphical display capabilities
- 7 x menu navigation buttons – including 2 x I/O buttons
- 28 Programmable tri-colour LEDs
- Multi-language support capability

The device is housed in a draw-out case designed for panel mounting.

The rear connection comprises of screw type, fixed terminals.

The device fascia displays the MLFB order code, serial number, and device identification reference.

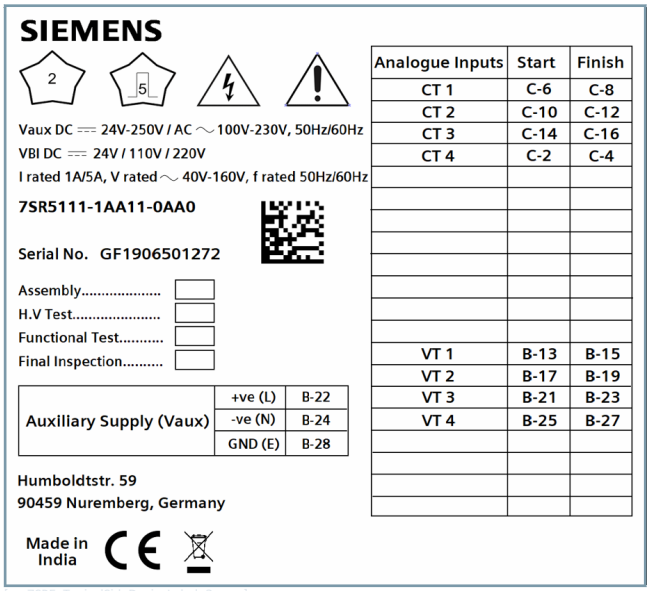
[sc_7SR5_size6_front angle, 3, --_--]

Figure 2.1/10 Size 6

[sc_7SR5_size12_FrontViewFullyWithdrawn, 3, --_--]

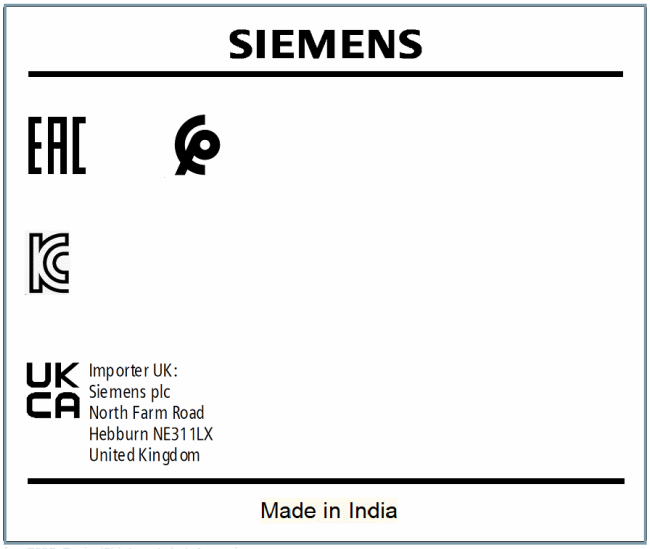
Figure 2.1/11 Size 12 Device Withdrawn

The device terminal labels display the MLFB code, serial number, relay description, terminal contact details, and safety symbols.



[sc_7SR5_TypicalSideDeviceLabel, 3, --_--]

Figure 2.1/12 Example Device Label



[sc_7SR5_TypicalSideLogoLabel, 1, --_--]

Figure 2.1/13 Example Logo Label

	QR code that can be scanned using a QR code reader application. This allows the device serial number to be quickly identified.
2	AC 2 kV insulation test of reset coil, trip coil, and output contacts
5	5 kV impulse voltage test (type test) in compliance with Class III
	Electrical Hazard

	European CE marking
	Refer to device documentation
	Waste Electrical and Electronic Equipment Directive (WEEE)
	Guideline for the Eurasian Market
	Mandatory Conformity Mark for Electronics and Electrotechnical Products in Morocco
	South Korea KC Certification for Electrical and Electronic Products
	United Kingdom (UK) conformity-assessed marking
	USB port to connect to other devices e.g. laptop
	Electrostatic Sensitive Devices warning

Function LED's

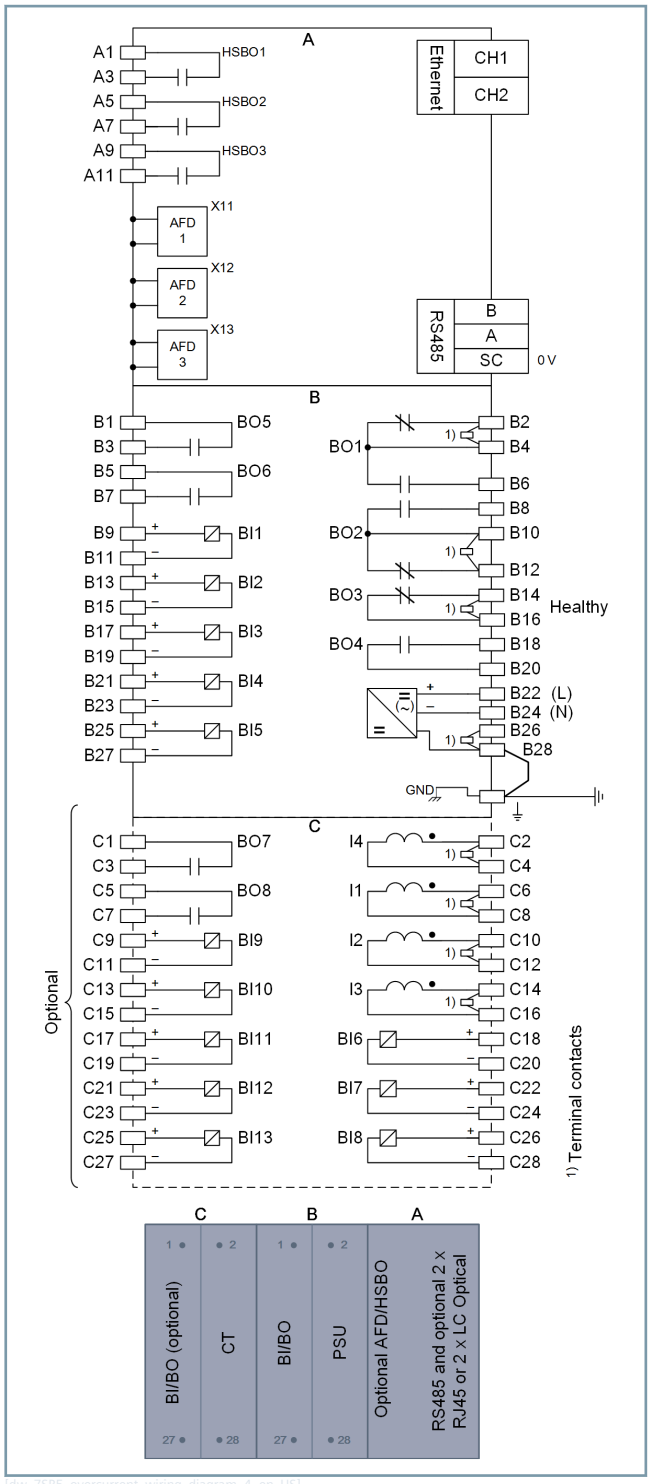
28-user programmable tri-colour LEDs are provided, each can be configured to illuminate red, green or yellow allowing for indication of the associated function's state.

An LED label can be inserted behind the transparent hinged cover on the relay fascia.

The relay settings include a menu allowing the user to input further explanatory text for LED functionality. This is displayed in the LCD.

2.1

Connection Diagrams and Dimension Drawings



[dw_7SR5_overcurrent_wiring_diagram, 4, en_US]

Figure 2.1/14 7SR5110 Overcurrent Relay Wiring Diagram

AFD Arc flash detector input

BI Binary input

BO Binary output relay

COM Data communications

GND Ground/earth

HSBO High speed binary output

I Current transformer connection

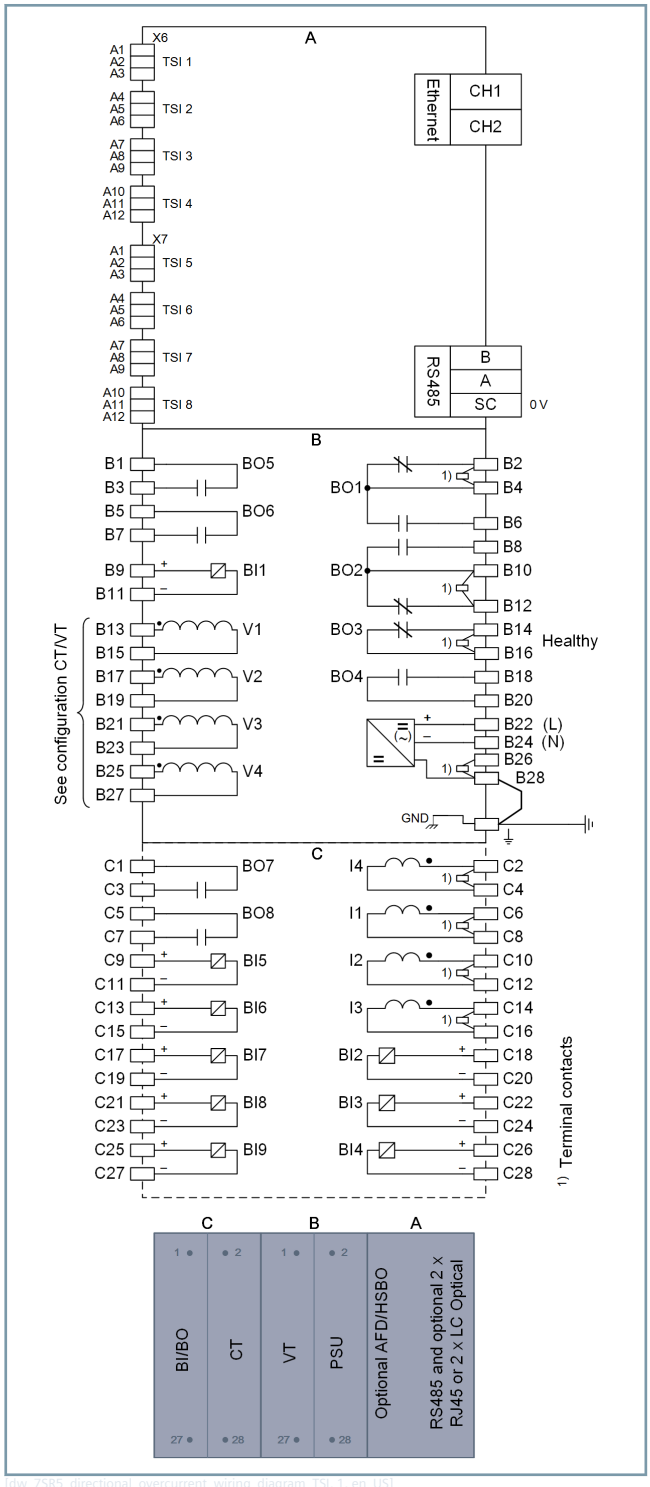
PSU Power supply unit

Module 'A' is shown with optional AFD/HSBO fitted.

The case earth stud should be solidly earthed to the panel earth. Terminal B28 (power supply unit) should be connected to the case earth stud. A minimum wire size of 2.5 mm^2 is recommended.

Terminal contacts internal to the relay case assembly close when the relay element is withdrawn from the case.

Hardware Configurations: The wiring diagram shows a size 6 case. Where the size 8 or 12 case is used, additional BI/BO modules can be specified at extra cost – see ordering information sheet.



[dw_7SR5_directional_overcurrent_wiring_diagram_TSI, 1, en_US]

Figure 2.1/15 7SR5111 Directional Overcurrent Relay Wiring Diagram inc TSI Inputs

AFD Arc flash detector input

BI Binary input

BO Binary output relay

COM Data communications

GND Ground/earth

HSBO High speed binary output

I Current transformer connection

PSU Power supply unit

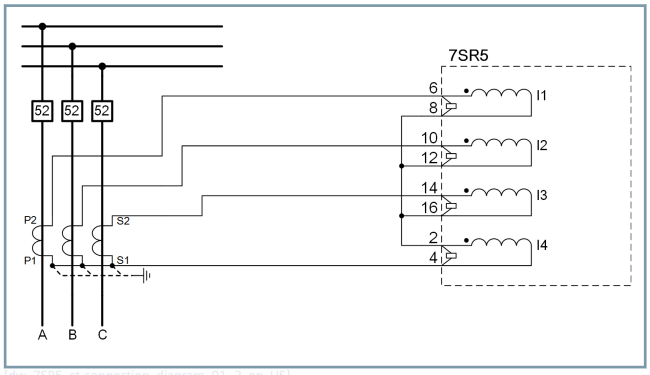
V Voltage transformer connection

Module 'A' is shown with optional TSI fitted.

The case earth stud should be solidly earthed to the panel earth. Terminal B28 (power supply unit) should be connected to the case earth stud. A minimum wire size of 2.5 mm^2 is recommended.

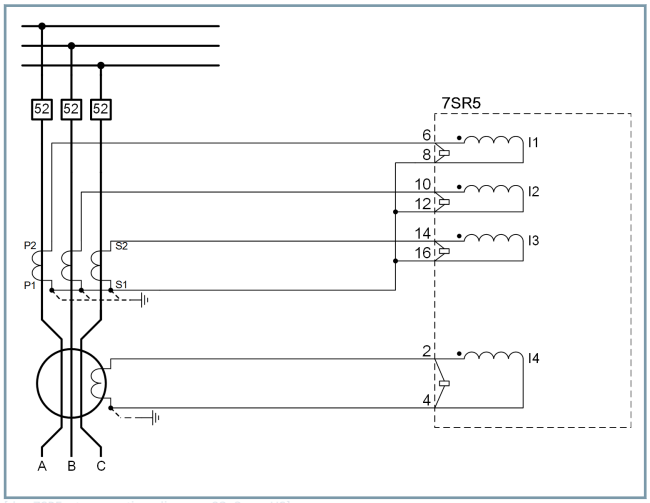
Terminal contacts internal to the relay case assembly close when the relay element is withdrawn from the case.

Hardware Configurations: The wiring diagram shows a size 6 case. Where the size 8 or 12 case is used, additional BI/BO modules can be specified at extra cost – see ordering information sheet.



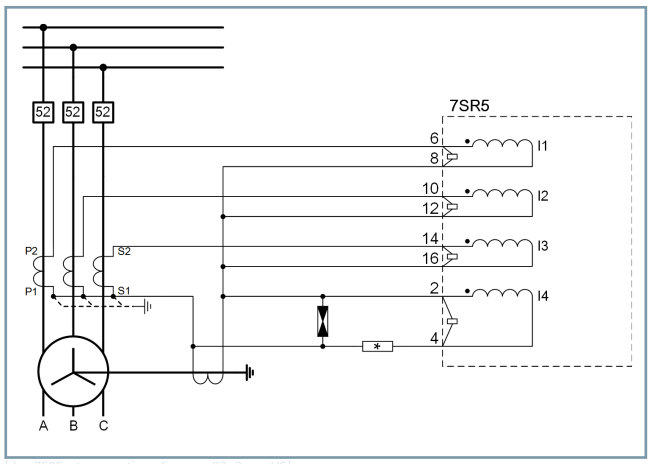
[dw_7SR5_ct-connection_diagram_01, 2, en_US]

Figure 2.1/16 CT Connections: 3 Phase and Earth Current Measurement using 'Holmgreen' Connected CTs



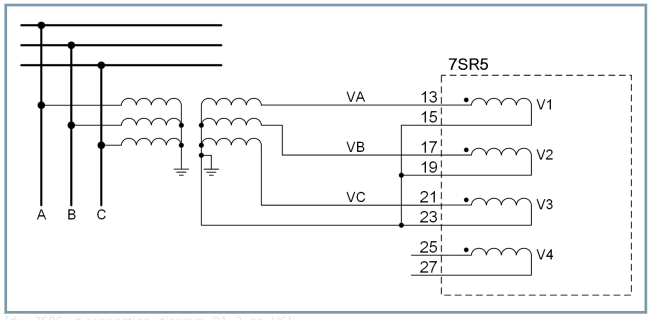
[dw_7SR5_ct-connection_diagram_02, 3, en_US]

Figure 2.1/17 CT Connections: 3 Phase Current Measurement. Earth Current Measurement using Ring Core CT



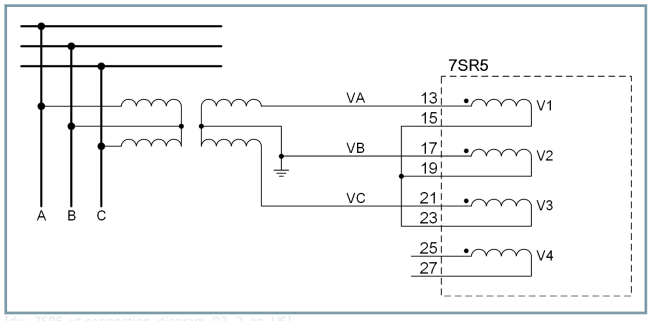
[dw_7SR5_ct-connection_diagram_03, 2, en_US]

Figure 2.1/18 CT Connections: 3 Phase Current Measurement. High Impedance Restricted Earth Fault Protection



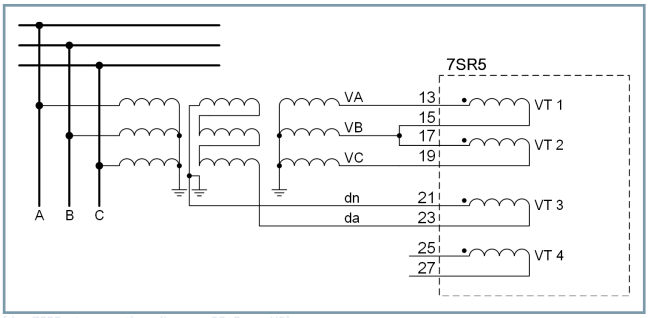
[dw_7SR5_vt-connection_diagram_01, 3, en_US]

Figure 2.1/19 Configuration CTs/VTs > VT 1/2/3 Config = Van, Vbn, Vcn



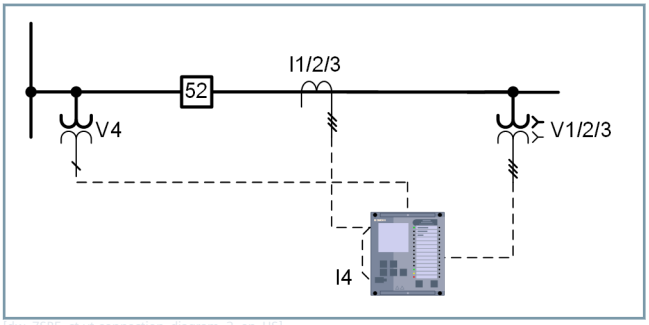
[dw_7SR5_vt-connection_diagram_02, 2, en_US]

Figure 2.1/20 Configuration CTs/VTs > VT 1/2/3 Config = Va, Vb, Vc



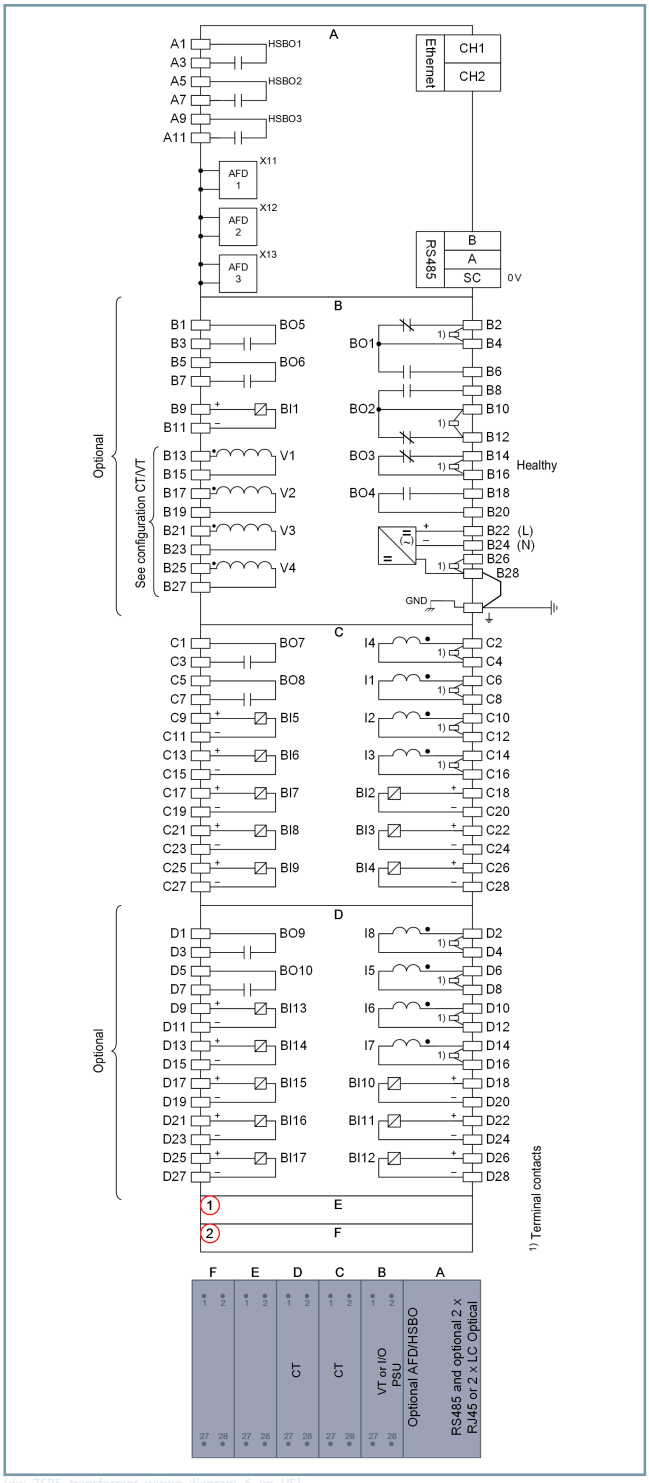
[dw_7SR5_vt-connection_diagram_03, 2, en_US]

Figure 2.1/21 Configuration CTs/VTs > VT 1/2/3 Config = Vab, Vbc, 3V0



[dw_7SR5_ct-vt-connection_diagram, 2, en_US]

Figure 2.1/22 Typical 4 CT, 4 VT Device Overall CT/VT Arrangement



[dw_7SR5_transformer_wiring_diagram, 6, en_US]

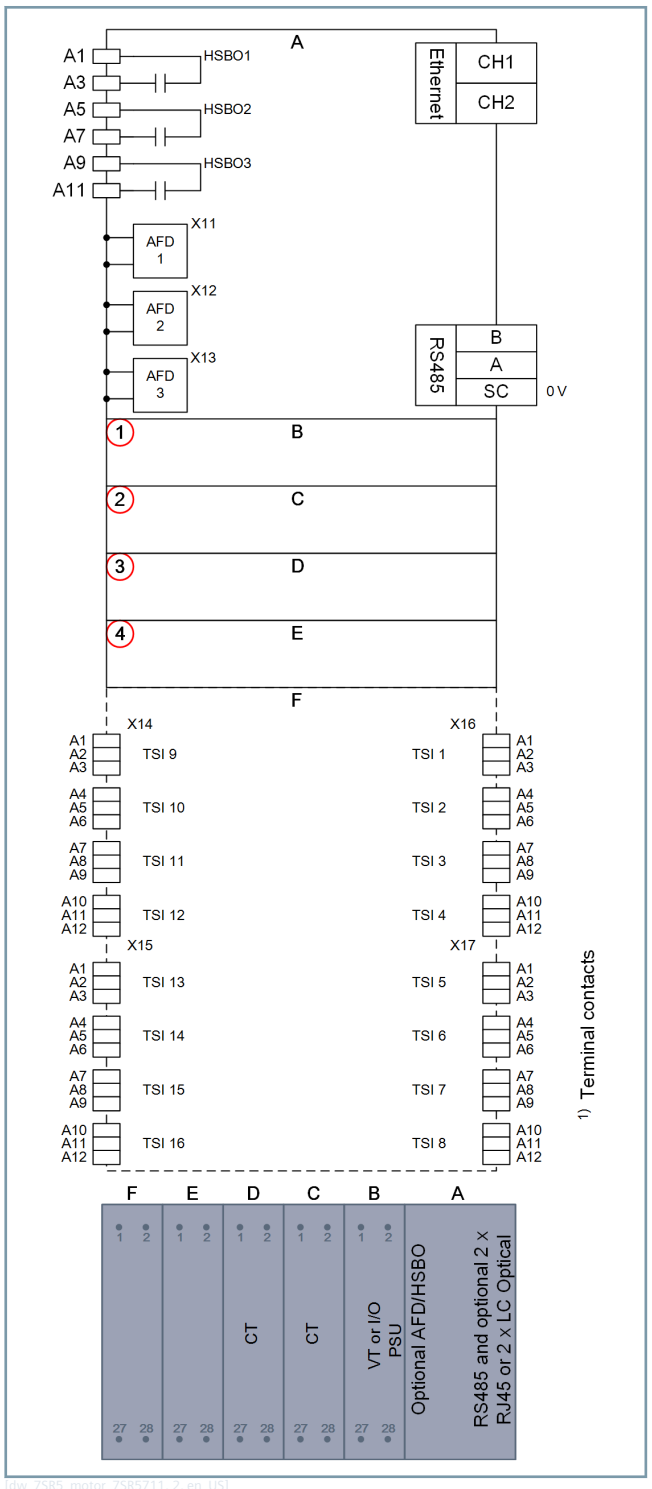
Figure 2.1/23 7SR5421 Transformer Relay Wiring Diagram

Module 'A' is shown with optional AFD/HSBO fitted.

The case earth stud should be solidly earthed to the panel earth. Terminal B28 (power supply unit) should be connected to the case earth stud. A minimum wire size of 2.5 mm^2 is recommended.

Terminal contacts internal to the relay case assembly close when the relay element is withdrawn from the case.

Hardware Configurations: The wiring diagram shows a size 8 case. Where the size 12 case is used, additional BI/BO modules can be specified at extra cost – see ordering information sheet.



[dw_7SR5_motor_7SR5711; 2; en_US]

Figure 2.1/24 7SR5711 Motor Relay Wiring Diagram

1	Dependent on device MLFB
2	Dependent on device MLFB
3	Dependent on device MLFB
4	Dependent on device MLFB
AFD	Arc flash detector input
BI	Binary input
BO	Binary output relay
COM	Data communications
GND	Ground/earth
HSBO	High speed binary output
I	Current transformer connection
PSU	Power supply unit
V	Voltage transformer connection

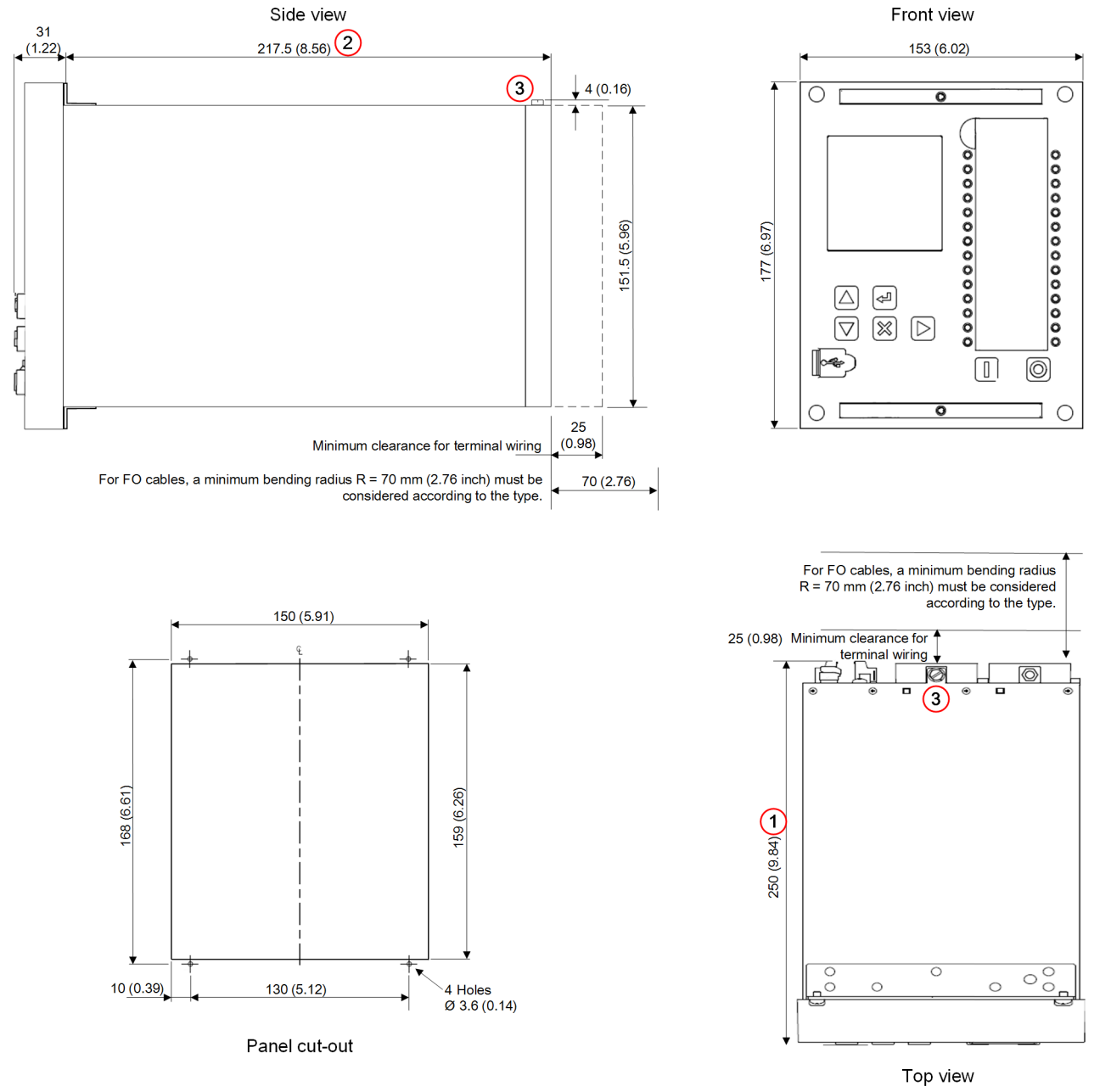
Module 'A' is shown with optional AFD/HSBO fitted.

Module 'F' is shown with optional TSI module fitted.

The case earth stud should be solidly earthed to the panel earth. Terminal B28 (power supply unit) should be connected to the case earth stud. A minimum wire size of 2.5 mm^2 is recommended.

Terminal contacts internal to the relay case assembly close when the relay element is withdrawn from the case.

Hardware Configurations: The wiring diagram shows a size 12 case for a 2-winding transformer protection relay. Additional BI/BO modules can be specified at extra cost – see ordering information sheet.



[dw_7SR5_E6_dimensions, 5, en_US]

Figure 2.1/25 Size 6 Case: Dimensions and Panel Drilling Details

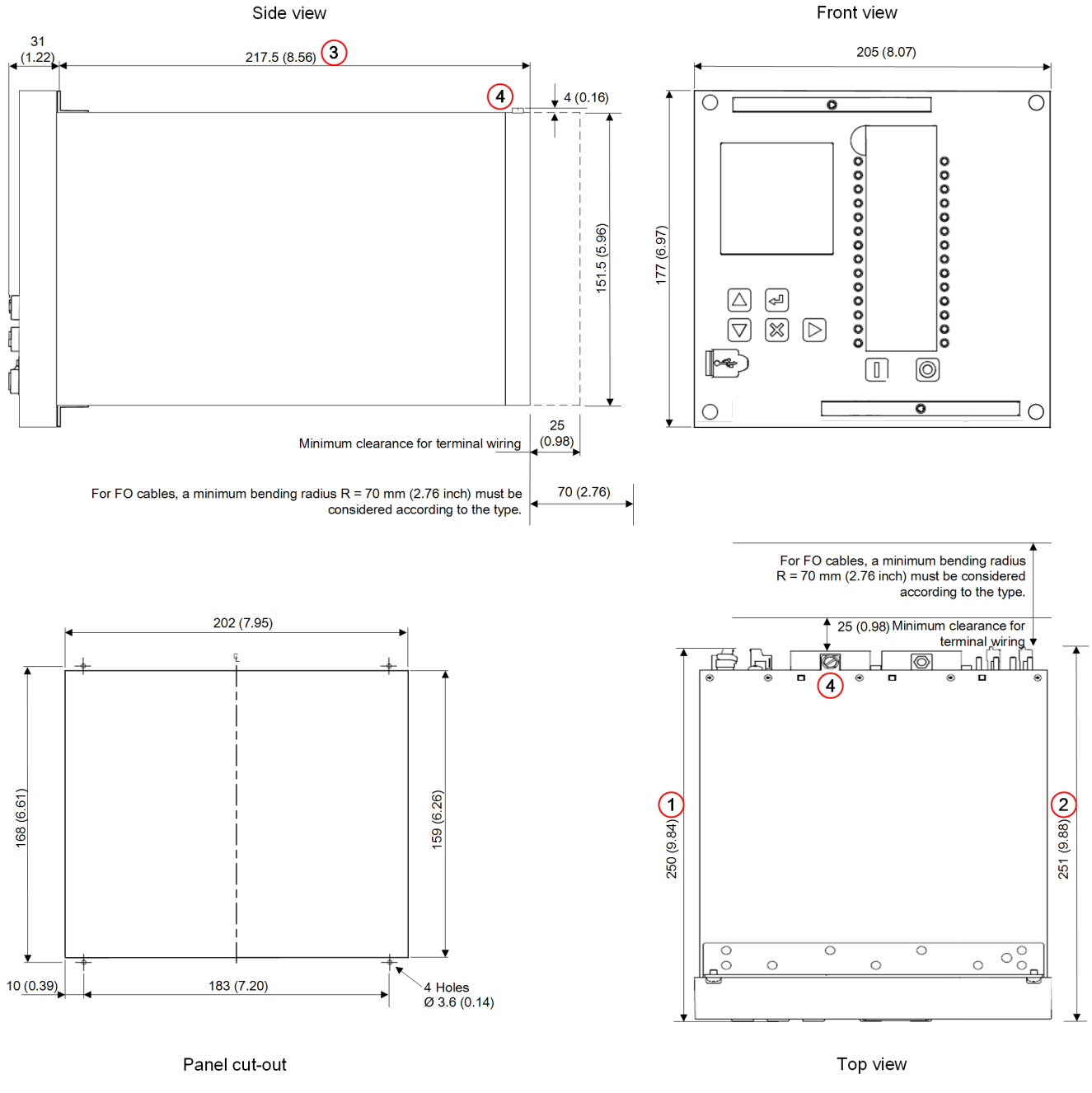
(1) Overall length with AFD/RS485 plugs

(2) Overall length to standard terminal blocks

(3) Earth screw

NOTE

3.6 mm holes are suitable for M4 thread-forming screws supplied with the device for typical panel thickness.



[dw_7SR5_E8_dimensions, 2, en_US]

Figure 2.1/26 Size 8 Case: Dimensions and Panel Drilling Details

(1) Overall length with AFD/RS485 plugs

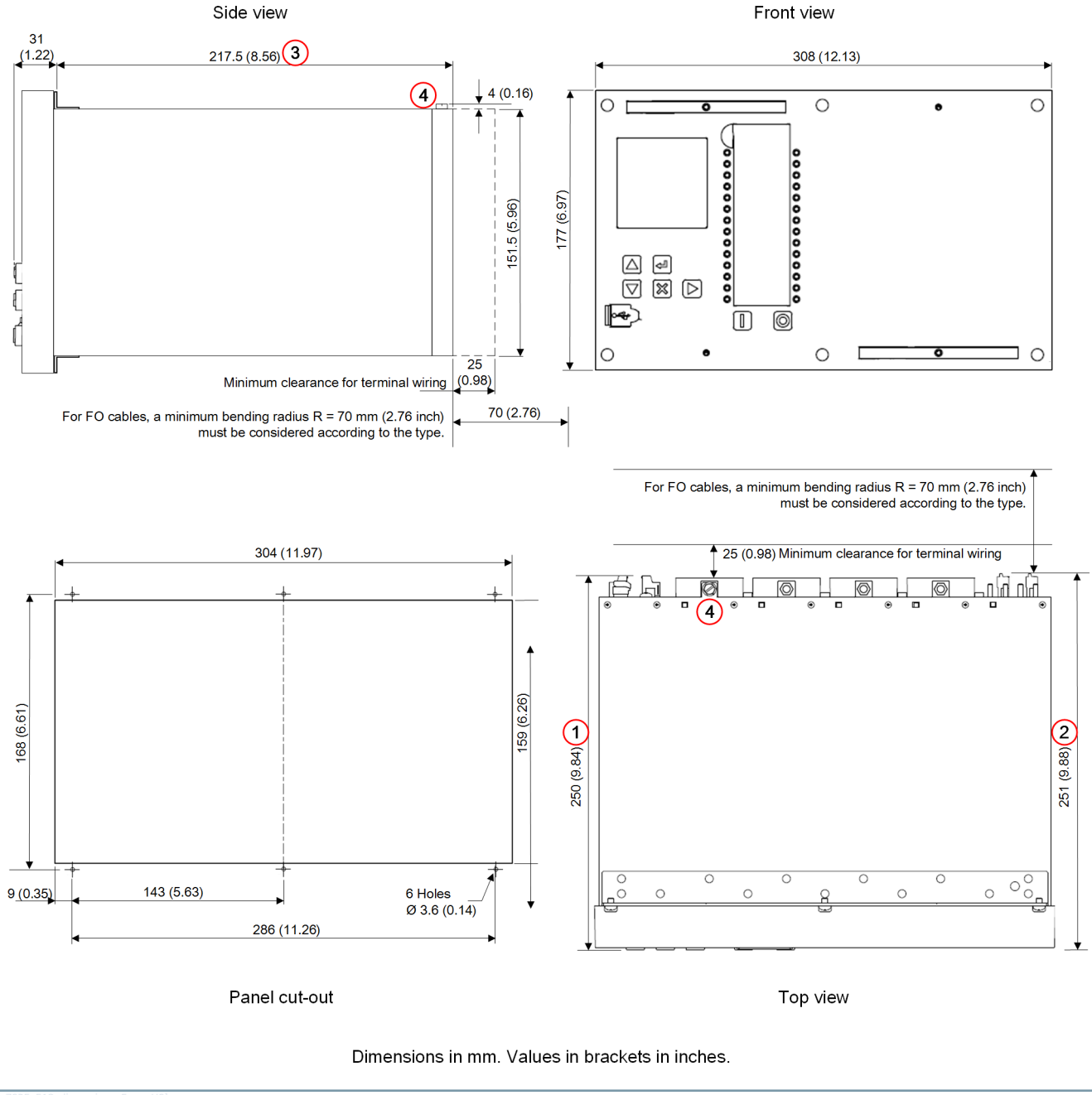
(2) Overall length with TSI plugs

(3) Overall length to standard terminal blocks

(4) Earth screw

NOTE

3.6 mm holes are suitable for M4 thread-forming screws supplied with the device for typical panel thickness.



[dw_7SR5_E12_dimensions, 5, en_US]

Figure 2.1/27 Size 12 Case: Dimensions and Panel Drilling Details

(1) Overall length with AFD/RS485 plugs

(2) Overall length with TSI plugs

(3) Overall length to standard terminal blocks

(4) Earth screw

NOTE

3.6 mm holes are suitable for M4 thread-forming screws supplied with the device for typical panel thickness.

Technical data

Inputs and Outputs

Current Inputs

(IEC 60255-1, IEC 60255-27)

Quantity	See MLFB structure
Rated current I_{rated}	1 A/5 A
Measuring range	0.05 to 80 · I_{rated} (phase) 0.005 to 32 · I_{rated} (EF/SEF)
Sampling rate	32 samples per cycle
Instrumentation (0.1 to 2 · I_{rated})	± 1 % or ± 1 % I_{rated}
Nominal frequency	50 Hz/60 Hz
Thermal withstand: Continuous 1 Second	 4.0 · I_{rated} (20 A) 100 · I_{rated} (500 A)
Burden @ I_{rated}	≤ 0.1 VA (phase and earth/SEF elements)

Voltage Inputs

(IEC 60255-1, IEC 60255-27)

Quantity	See MLFB structure
Rated voltage	AC 40 V to AC 160 V
Sampling rate	32 samples per cycle
Instrumentation (0.1 to 1.2 · V_{rated})	± 1 % or ± 1 % V_{rated}
Rated frequency	50 Hz/60 Hz
Thermal withstand: Continuous	 300 V
Burden @ 110 V	≤ 0.1 VA

Optional Temperature Sensor Inputs

Value	Reference	Accuracy
RTD	Cu10, 0 °C to 540 °C	± 3 °C (0 °C to 250 °C)
	Ni100, 0 °C to 400 °C	± 1 °C (0 °C to 250 °C)
	Ni120, 0 °C to 330 °C	
	Ni250, 0 °C to 535 °C	
	Pt100, 0 °C to 540 °C	
	Pt250, 0 °C to 540 °C	
	Pt1000, 0 °C to 260 °C	± 2 °C (0 °C to 250 °C)
Thermistor	100 Ω to 30 KΩ	± 2 % or ± 5 Ω

Auxiliary Supply

(IEC 60255-1, IEC 60255-26, IEC 60255-27)

Rated Voltage	Operating Range
DC 24 to 250 V	DC 19.2 V to DC 275 V
AC 100 to 230 V	AC 80 V to AC 253 V (50 Hz/60 Hz)

Rated Voltage	Quiescent Burden	Maximum Burden
DC 24 V	9.9 W	14.9 W
DC 48 V	9.3 W	14 W
DC 60 V	9.1 W	13.8 W
DC 110 V	8.9 W	13.2 W
DC 125 V	8.8 W	13.2 W
DC 220 V	8.1 W	12.3 W
DC 250 V	8.3 W	12.5 W

Rated Voltage	Quiescent Burden	Maximum Burden
AC 100 V	20.8 VA	29.2 VA
AC 110 V	20.9 VA	30.1 VA
AC 115 V	21 VA	30.1 VA
AC 120 V	21.1 VA	30.6 VA
AC 200 V	23.2 VA	33.2 VA
AC 230 V	24.6 VA	34.7 VA

(IEC 60255-26)

Allowable superimposed AC component	≤ 15 % of DC voltage
Allowable breaks/dips in supply (collapse to zero from nominal voltage)	≤ 50 ms

Binary Inputs

(IEC 60255-1, IEC 60255-26)

Operate voltage setting (user selectable)	DC 24 V/DC 110 V/DC 220 V
Maximum DC current for operation	2 mA
'High' level	> 80 % V_{rated}
'Low' level	< 40 % V_{rated}
Pick-up delay	0 to 14400 s
Dropoff delay	0 to 14400 s

Binary Outputs

(IEC 60255-1)

Operating voltage	AC 250 V/DC 250 V
Contact operate time Release time	8 ms typical (standard binary output) 6 ms typical (standard binary output)
Making capacity	1000 W at L/R ≤ 40 ms
Carry continuously	AC 5 A or DC 5 A
Make and carry (≤ AC 250 V/ DC 250 V)	30 A for 1 s

Breaking capacity (≤ 5 A and ≤ 250 V):	
AC resistive	1250 VA
DC resistive	75 W
DC inductive	30 W at L/R ≤ 40 ms
Mechanical endurance loaded	Make ≥ 1000 cycles
	Break ≥ 1000 cycles

Mechanical Tests

Vibration – Sinusoidal

(IEC 60255-21-1 Class I)

Type	Level	Variation
Vibration response	0.5 gn	≤ 5 %
Vibration endurance	1.0 gn	≤ 5 %

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	≤ 5 %
Bump test	10 gn, 16 ms	≤ 5 %

Seismic

(IEC 60255-21-3 Class I)

Type	Level	Variation
Seismic response	X-plane – 3.5 mm displacement below crossover frequency (8 to 9 Hz) 1 gn above.	≤ 5 %
	Y-plane – 1.5 mm displacement below crossover frequency (8 to 9 Hz) 0.5 gn above.	

IP Ratings

(IEC 60259)

Type	Level
Installed front face	IP 54
Rear enclosure(case)	IP 40
Rear wiring terminal access	IP 10
	IP 20 achieved with optional terminal covers fitted

Product Safety

Protection Class

Protection class	I

Insulation – Dielectric Withstand

(IEC 60255-27)

Type	Level
Between any terminal and earth	AC 2.5 kV RMS for 1 min
Between independent circuits	
Across open contacts	AC 1.0 kV RMS for 1 min

Transient Overvoltage – Impulse Voltage Withstand

(IEC 60255-27)

Between all terminals and earth or between any 2 independent circuits	5 kV, 1.2/50 µs, 0.5 J

Insulation Resistance

(IEC 60255-27)

Insulation resistance at 500 V	> 100 MΩ

Creepage Distances and Clearances

(IEC 60255-27)

Pollution degree	2
Overvoltage category	III

EMC Tests

Conducted Radio Frequency – Emissions

(IEC 60255-26)

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)

Radiated Radio Frequency – Emissions

(IEC 60255-26)

Type	Limits at 3 m, Quasi–peak
30 MHz to 230 MHz	50 dB (µV/m)
230 MHz to 1 GHz	57 dB (µV/m)
1 GHz to 3 GHz	76 dB (µV/m)
3 GHz to 6 GHz	80 dB (µV/m)

Radiated Immunity

(IEC 60255-26)

Type		Level
80 MHz to 1000 MHz	Sweep	10 V/m
1.4 GHz to 2.7 GHz	Sweep	10 V/m
80 MHz, 160 MHz, 380 MHz, 450 MHz, 900 MHz, 1850 MHz, 2150 MHz	Spot	10 V/m

Electrostatic Discharge

(IEC 60255-26)

Type	Level	Variation
Contact discharge	8 kV	≤ 5 %
Air discharge	15 kV	≤ 5 %

Conducted Disturbance Induced by Radio Frequency Fields

(IEC 60255-26)

Type	Level
0.15 MHz to 80 MHz	10 V

Fast Transient/Burst Immunity

(IEC 60255-26 Zone A)

Type	Level	Variation
Case, aux power, I/O & earth	4 kV, 5 kHz	≤ 10 %
Metallic communications	2.0 kV, 5 kHz	No data loss

Slow Damped Oscillatory Wave/HF Disturbance

(IEC 60255-26, IEC 61000-4-18)

Type	Level	Variation
Case, aux power & I/O: common (longitudinal) mode	2.5 kV	≤ 10 %
Case, aux power & I/O: differential (transverse) mode	1.0 kV	

Surge Immunity

(IEC 60255-26 Zone A, IEC 61000-4-5)

Type	Level	Variation
Aux power & I/O: between all terminals and earth	4 kV	≤ 10 %
Aux power & I/O: between any two independent circuits	2 kV	
Communications	4 kV	No data loss

Power Frequency Disturbance

(IEC 60255-26 Zone A, IEC 61000-4-16 level 4)

Type	Level 0 to 150 kHz
I/O common mode	300 V
I/O differential mode	150 V

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	

Climatic Tests

Temperature

(IEC 60068-2-1/2)

Operating range	-10°C to +55°C
	-20 °C to +70 °C, 96 hrs[13]
	-40 °C to +85 °C, 16 hrs[13]
Storage range	-25°C to +70°C
	-40 °C to +85 °C, 96 hrs[13]

Humidity

(IEC 60068-2-78)

Operational test	56 days at 40°C and 93 % relative humidity

Corrosive Gas

(IEC 60068-2-60)

Test Ke	Flowing mixed gas

Performance

Instrumentation

Current (0.1 to 2 · I_{rated})	±1 % or ±1 % · I_{rated}
Voltage (0.1 to 1.2 · V_{rated})	±1 % or ±1 % · V_{rated}

13 Basic hardware tested

2.1

W Power (P) VAr Reactive power (Q) VA Apparent power (S) ($S_{rated} = V_{rated} \cdot I_{rated}$ $V = V_{rated}$ I = 10 % to 200 % I_{rated} PF ≥ 0.8)	±3 % S_{rated}
Power factor ($V = V_{rated}$ I = 10 % to 200 % I_{rated} PF ≥ 0.8)	± 0.05
Frequency (f_{rated} ± 5 %)	± 10 mHz

21LB Load Blinder

I_{nps} (I_2) setting (3Ph) (I_{set})	0.05 · I_{rated} to 5 · I_{rated}
I_{zps} (I_0) setting (1Ph) (I_{set})	0.05 · I_{rated} to 5 · I_{rated}
V_{pps} (V_1) setting	1 V to 110 V
Angle + setting	5° to 85°
Angle – setting	5° to 85°
Z_{set} Impedance setting	1Ω to 100Ω
I_{op} Operate level	I_{set} ± 5 % or ± 1 % I_{rated}
V_{op} Operate level	V_{set} ± 2 % or ± 0.5 V
V Reset level	110 % V_{op} ± 5 % V_{rated}
Angle operate level	± 5°
Impedance operate level	Z_{set} ± 5 % or ± 0.1Ω

24 Overexcitation Protection

Setting (V/Hz_{set})	0.1 to 2 p.u.
Hysteresis setting	0 to 80 %
Delay setting	0 to 14400 s
V/Hz_{op} (Operate level)	100 % V/Hz_{set}, ± 0.01 p.u.
Reset level	(100 % - hysteresis) · V/Hz_{op}, ± 0.01 p.u.
Basic operate time	t_{basic} + t_{delay}, ± 1 % or ± 10 ms
Operate time following delay	t_{basic} + t_{delay}, ± 1 % or ± 10 ms

27 Undervoltage Protection – 3-Phase

Operate	Any, all
Voltage guard	1 to 200 V
Setting V_{set}	5 to 200 V
Hysteresis setting	0 to 80 %
V_{op} Operate level	V_{set} ± 2 % or ± 0.5 V
Reset level	V_{op} + hysteresis, ± 2 % or 0.5 V
Delay setting t_{delay}	0 to 14400 s
Basic operate time t_{basic}: (1.1 to 0.5 · V_{set})	 63 ms ± 10 ms
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms

27Vx Undervoltage Protection – Vx

Voltage guard	1 to 200 V
Setting V_{set}	5 to 200 V
Hysteresis setting	0 to 80 %
V_{op} Operate level	V_{set} ± 2 % or ± 0.5 V
Reset level	V_{op} + hysteresis, ± 2 % or 0.5 V
Delay setting t_{delay}	0 to 14400 s
Basic operate time t_{basic}: (1.1 to 0.5 · V_{set})	 63 ms ± 10 ms
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms

32 Power Protection

Operation	Under, over
Power	P, Q or S
U/C guard	0.05 to 1 · I_{rated}
Setting S_{set}	0.05 to 2 · S_{rated}
Operate level S_{op}	S_{set} ± 5 % or ± 2 % S_{rated}
Reset level	≥ 95 % S_{op} (operation = over) ≤ 105 % S_{op} (operation = under)
Basic operate time t_{basic}: (1.1 · S_{set} (over)) (2 · S_{set} (over)) (0.5 · S_{set} (under))	 60 ms ± 10 ms 45 ms ± 10 ms 40 ms ± 10 ms
Delay setting t_{delay}	0 to 14400 s
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms

37 Undercurrent Protection – Phase

Operate	Any, all
U/C guard	0.05 to 5 · I_{rated}
Setting range I_{set}	0.05 to 5 · I_{rated}
Operate level	I_{set} ± 5 % or ± 1 % · I_{rated}
Current guard	Phase 0.05 to 5 · I_{rated}
Delay setting t_{delay}	0 to 14400 s
Basic operate time t_{basic}: (1.1 to 0.5 · I_{rated})	 40 ms ± 10 ms
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms
Overshoot time	< 40 ms

37G Undercurrent Earth Fault – Measured

Operate	Any, all
U/C guard	0.05 to 5 · I_{rated}

Setting range I_{set}	0.005 to 5 · I_{rated}
Operate level	I_{set} ± 5 % or ± 1 % · I_{rated}
Current guard	Phase 0.05 to 5 · I_{rated}
Delay setting t_{delay}	0 to 14400 s
Basic operate time t_{basic}: (1.1 to 0.5 · I_{rated})	 40 ms ± 10 ms
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms
Overshoot time	< 40 ms

46 Negative-Sequence Overcurrent Protection

DT setting DT_{set}	0.05 to 4 · I_{rated}
DT operate level	DT_{set} ± 5 % or ± 1 % · I_{rated}
DT delay setting t_{delay}	0 to 14400 s
DT basic operate time t_{basic}	40 ms ± 10 ms (2 · DT_{set}) 30 ms ± 10 ms (5 · DT_{set})
DT operate time following delay	t_{basic} + t_{delay}, ± 1 % or ± 10 ms
IT char setting	IEC: NI,VI,EI,LTI ANSI: MI,VI,EI DTL
IT setting IT_{set}	0.05 to 2.5
Time multiplier Tm	0.025 to 100
IT operate level	105 % IT_{set}, ± 4 % or ± 1 % I_{rated}
Overshoot time	< 40 ms

46BC Broken Conductor Detection

U/C guard	0.05 to 5 · I_{rated}
Setting $(I_1/I_2)_{set}$	20 % to 100 %
Delay setting t_{delay}	0.03 to 14400 s
Operate level I_{op}	$(I_2/I_1)_{set}$ ± 5 %
Basic operate time t_{basic}	40 ms ± 10 ms
Operate time following delay	t_{basic} + t_{delay}, ± 1 % or ± 20 ms

47 Sequence Overvoltage Protection

Setting V_{set}	1 V to 90 V
Hysteresis setting	0 to 80 %
Operate level	V_{set} ± 2 % or ± 0.5 V
Delay setting t_{delay}	0 to 14400 s
Basic operate time t_{basic}: (0 V to 1.5 · V_{set}) (0 V to 10 · V_{set})	 80 ms ± 20 ms 55 ms ± 20 ms
Operate time following delay	t_{basic} + t_{delay} , ± 2 % or ± 20 ms
Overshoot time	< 40 ms

49 Thermal Overload Protection

Setting I_{set}	0.1 to 3 · I_{rated}
Operate level	I_{set} ± 5 % or ± 1 % · I_{rated}
Time constant setting	1 to 1000 min
Operate time	$T = \tau \cdot \ln\left[\frac{I^2 - I_p^2}{I^2 - I_\theta^2}\right]$ ± 5 % or ± 100 ms (I_{set}: 0.3 to 3 · I_{rated}) I = Average rms current I_p = Pre-load current I_θ = Thermal overload setting current τ = Thermal heating time constant (minutes) ln = Natural logarithm t = Operate time (minutes)

49M Motor Thermal Overload Protection

Setting I_{set}	0.1 to 3 · I_{rated}
NPS weighting factor (K)	0.1 to 10, Δ 0.1
TauH heating constant	0.5 to 1000 min, Δ 0.5 min
TauS starting constant	0.005 to 1 · TauH, Δ 0.005
TauC cooling constant	1 to 100 · TauH, Δ 1
Hot/cold ratio	Off, 1 to 100 %, Δ 1 %
Operate level	I_{set} ± 5 % or ± 1 % · I_{rated}
Operate time	$t = \tau \cdot \ln\left\{\frac{I_{EQ}^2 - \left(1 - \frac{H}{C}\right)I_P^2}{I_{EQ}^2 - I_\theta^2}\right\}$ ± 5 % or ± 100 ms (I_{set}: 0.3 to 3 · I_{rated}) I = Average rms current I_p = Pre-load current I_θ = Thermal overload setting current τ = Thermal heating time constant (minutes) ln = Natural logarithm t = Operate time (minutes)
Capacity alarm level	Disabled, 50 to 100 %
Load alarm level	Off, 0.5 to 1 · I_θ, Δ 0.05
Thermal restart inhibit	20 to 100 %, Δ 1 %
Inhibited by	Binary or virtual input

2.1

50 Instantaneous Overcurrent – Phase

Operation [14]	Non-directional, forward or reverse (see 67)
Setting I_{set}	0.05 to 25 · I_{rated}
Delay setting t_{delay}	0 to 14400 s
Operate level I_{op}	I_{set} ± 5 % or ± 1 % · I_{rated}
Reset level	≥ 95 % I_{op}
Basic operate time t_{basic}	35 ms ± 10 ms (2 · I_{set}) 25 ms ± 10 ms (5 · I_{set})
Operate time following delay	t_{basic} + t_{delay}, ± 1 % or ± 10 ms

50AFD Arc Flash Detection

Setting I_{set}	1 to 10 · I_{rated}
Operate level I_{op}	I_{set} ± 10 %
Reset level	≥ 95 % I_{op}
Operate time (Optional AFD/HSBO module)	< 6 ms (HSBO), light only >12 ms (HSBO), light and current

50BF Circuit-Breaker Failure Protection – 3-Pole

Setting I_{set}	0.05 to 2 · I_{rated}
Time delays t_{delay}	Timer 1: 20 to 60000 ms Timer 2: 20 to 60000 ms
Operate level	I_{set} ± 5 % or ± 1 % · I_{rated}
Operate time following delay	t_{delay} ± 1 % or ± 20 ms

50G Instantaneous Earth Fault – Measured

Operation [14]	Non-directional, forward or reverse (see 67G)
Setting I_{set}	0.005 to 25 · I_{rated}
Delay setting t_{delay}	0 to 14400 s
Operate level I_{op}	I_{set} ± 5 % or ± 1 % I_{rated}
Reset level	≥ 95 % I_{op}
Basic operate time t_{basic}	35 ms ± 10 ms (2 · I_{set}) 25 ms ± 10 ms (5 · I_{set})
Operate time following delay	t_{basic} + t_{delay}, ± 1 % or ± 10 ms

50GHS High Speed Earth Fault – Measured

Setting I_{set}	0.5 to 25 · I_{rated}
Delay setting t_{delay}	0 to 14400 s
Operate level I_{op}	I_{set} ± 5 % or ± 1 % I_{rated}
Reset level	≥ 95 % I_{op}
Basic operate time t_{basic}	20 ms ± 4 ms (2 · I_{set}) 14 ms ± 4 ms (5 · I_{set})
Operate time following delay	t_{basic} + t_{delay}, ± 1 % or ± 10 ms

50GI Intermittent Earth Fault

Setting I_{set}	0.005 to 2 · I_{rated}
Applied current pulse duration	> 5 ms
Minimum time between current pulses	40 ms
Operate level I_{op}	I_{set} ± 5 % or ± 1 % I_{rated}
Pickup Time at 4 · I_{set}	20 ms ± 5 ms
Basic operate time t_{basic}	± 1 % or ± 10 ms for each pulse

50GS Instantaneous Sensitive Earth Fault – Measured

Operation [14]	Non-directional, forward or reverse (see 67GS)
Setting I_{set}	0.005 to 1 · I_{rated}
Delay setting t_{delay}	0 to 14400 s
Operate level I_{op}	I_{set} ± 5 % or ± 1 % I_{rated}
Reset level	≥ 95 % I_{op}
Basic operate time t_{basic}	35 ms ± 10 ms (2 · I_{set}) 25 ms ± 10 ms (5 · I_{set})
Operate time following delay	t_{basic} + t_{delay}, ± 1 % or ± 10 ms

50HS High Speed Overcurrent – Phase

Setting I_{set}	0.5 to 50 · I_{rated}
Delay setting t_{delay}	0 to 14400 s
Operate level I_{op}	I_{set} ± 5 % or ± 1 % · I_{rated}
Reset level	≥ 95 % I_{op}
Basic operate time t_{basic}	20 ms ± 4 ms (2 · I_{set}) 14 ms ± 4 ms (5 · I_{set})
Operate time following delay	t_{basic} + t_{delay}, ± 1 % or ± 10 ms

50N Instantaneous Earth Fault – Calculated

Operation [14]	Non-directional, forward or reverse (see 67N)
Setting I_{set}	0.05 to 50 · I_{rated}
Delay setting t_{delay}	0 to 14400 s
Operate level I_{op}	I_{set} ± 5 % or ± 1 % I_{rated}
Reset level	≥ 95 % I_{op}
Basic operate time t_{basic}	40 ms ± 10 ms (2 · I_{set}) 30 ms ± 10 ms (5 · I_{set})
Operate time following delay	t_{basic} + t_{delay}, ± 1 % or ± 10 ms

14 Requires VT inputs

51 Time-Delayed Overcurrent – Phase

51V Setting V_{set} [14]	5 V to 200 V
51V Operate level	V_{set} ± 5 % or ± 1 % V_{rated}
51CL Reduced current level	0.05 to 2.5 · I_{rated}
Measurement	RMS, fundamental
Directional control [14]	Non-directional, forward or reverse (see 67)
Setting I_{set}	0.05 to 2.5 · I_{rated}
Characteristic	IEC: NI,VI,EI,LTI ANSI: MI,VI,EI DTL
Time multiplier Tm	0.025 to 100
Delay setting (DTL)	0 to 20 s
Minimum operate time	0 to 20 s
Follower delay	0 to 20 s
Reset	ANSI decaying 0 to 60 s
51V Multiplier [14]	0.25 to 1
Operate level	105 % I_{set}, ± 4 % or ± 1 % · I_{rated}
Basic operate time t_{basic}	20 ms ± 20 ms (2 · I_{set})
Operate time	
IEC	$t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1}\right] \cdot Tm$ ± 5 % or ± 30 ms
ANSI	$t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^{P} - 1} + B\right] \cdot Tm$ ± 5 % or ± 30 ms
DTL	DTL ± 1 % or ± 20 ms

51G Time-Delayed Earth Fault – Measured

Measurement	RMS, fundamental
Directional Control [14]	Non-directional, forward or reverse (see 67G)
Setting I_{set}	0.005 to 1 · I_{rated}
Characteristic	IEC: NI,VI,EI,LTI ANSI: MI,VI,EI DTL
Time multiplier Tm	0.025 to 100
Delay setting (DTL)	0 to 20 s
Minimum operate time	0 to 20 s
Follower delay	0 to 20 s
Reset	ANSI decaying 0 to 60 s
51V Multiplier [14]	0.25 to 1
Operate level	105 % I_{set}, ± 4 % or ± 1 % · I_{rated}
Basic operate time t_{basic}	20 ms ± 20 ms (2 · I_{set})
Operate time	
IEC	$t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1}\right] \cdot Tm$ ± 5 % or ± 30 ms
ANSI	$t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^{P} - 1} + B\right] \cdot Tm$ ± 5 % or ± 30 ms
DTL	DTL ± 1 % or ± 20 ms

51GS Time-Delayed Sensitive Earth Fault – Measured

Directional Control [14]	Non-directional, forward or reverse (see 67GS)
Setting I_{set}	0.005 to 1 · I_{rated}
Characteristic	IEC: NI,VI,EI,LTI ANSI: MI,VI,EI DTL
Time multiplier Tm	0.025 to 100
Delay setting (DTL)	0 to 20 s
Minimum operate time	0 to 20 s
Follower delay	0 to 20 s
Reset	ANSI decaying 0 to 60 s
51V Multiplier [14]	0.25 to 1
Operate level	105 % I_{set}, ± 4 % or ± 1 % · I_{rated}

2.1

Basic operate time t_{basic}	20 ms ± 20 ms (2 · I_{set})
Operate time	
IEC	$t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1}\right] \cdot Tm$ ± 5 % or ± 30 ms
ANSI	$t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^{P} - 1} + B\right] \cdot Tm$ ± 5 % or ± 30 ms
DTL	DTL ± 1 % or ± 20 ms

51N Time-Delayed Earth Fault – Calculated

Directional Control [14]	Non-directional, forward or reverse (see 67G)
Setting I_{set}	0.05 to 2.5 · I_{rated}
Characteristic	IEC: NI,VI,EI,LTI ANSI: MI,VI,EI DTL
Time multiplier Tm	0.025 to 100
Delay setting (DTL)	0 to 20 s
Minimum operate time	0 to 20 s
Follower delay	0 to 20 s
Reset	ANSI decaying 0 to 60 s
51V Multiplier [14]	0.25 to 1
Operate level	105 % I_{set}, ± 4 % or ± 1 % · I_{rated}

Basic operate time t_{basic}	20 ms ± 20 ms (2 · I_{set})
Operate time	
IEC	$t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1}\right] \cdot Tm$ ± 5 % or ± 30 ms
ANSI	$t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^{P} - 1} + B\right] \cdot Tm$ ± 5 % or ± 30 ms
DTL	DTL ± 1 % or ± 20 ms

55 Power Factor

Operation setting	Under, over
Directional control	Non-Directional, lead, lag
U/C guard setting	0.05 to 1
Setting PF_{set}	0.05 to 0.99
Delay setting t_{delay}	0 to 14400 s
Operate level	PF_{set} ± 0.05
Basic operate time t_{basic}	≤ 70 ms
Operate time following delay	t_{basic} + t_{delay} ± 1 % or ± 10 ms

59 Overvoltage Protection – 3 Phase

Operate	Any, all
Setting V_{set}	5 to 200 V
Hysteresis setting	0 to 80 %
Operate level	V_{set} ± 2 % or ± 0.5 V
Reset level	V_{op} - hysteresis, ± 2 % or 0.5 V
Delay setting t_{delay}	0 to 14400 s
Basic operate time t_{basic}	73 ms ± 10 ms (1.1 · V_{set}) 63 ms ± 10 ms (2 · V_{set})
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms

59N Neutral Voltage Displacement

DT setting DT_{set}	1 to 100 V
DT operate level	DT_{set} ± 2 % or ± 0.5 V
DT delay setting t_{delay}	0 to 14400 s
DT basic operate time t_{basic}	76 ms ± 20 ms (1.5 · DT_{set}) 63 ms ± 20 ms (10 · DT_{set})
DT operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 20 ms
IT char setting	IDMTL and DTL

IT setting IT_{set}	1 to 100 V
Time multiplier Tm	0.1 to 140
Delay (DTL)	0 to 20 s
Reset	ANSI decaying 0 to 60 s
IT operate level	IT_{set} ± 2 % or ± 0.5 V

59Vx Overvoltage Protection – Vx

Setting V_{set}	5 to 200 V
Hysteresis setting	0 to 80 %
Operate level	V_{set} ± 2 % or ± 0.5 V
Reset level	V_{op} - hysteresis, ± 2 % or 0.5 V
Delay setting t_{delay}	0 to 14400 s
Basic operate time t_{basic}	73 ms ± 10 ms (1.1 · V_{set}) 63 ms ± 10 ms (2 · V_{set})
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms

60CTS-I CT Supervision – Current Reference

CTS-I setting I_{set}	0.05 to 2 · I_{rated}
Delay setting t_{delay}	0.03 to 14400 s
Basic operate time t_{basic}	30 ms ± 20 ms
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 20 ms

60CTS-V CT Supervision – Voltage Reference

CTS-V I_{nps} (I_2) setting I_{nps}	0.05 to 1 · I_{rated}
CTS-V V_{nps} (V_2) setting V_{nps}	7 to 110 V
Delay setting t_{delay}	0.03 to 14400 s
Basic operate time t_{basic}	30 ms ± 20 ms
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 20 ms

60VTS VT Supervision

Component setting	NPS, ZPS
Current setting I_{set}	0.05 to 1 · I_{rated}
Voltage setting V_{set}	7 to 110 V
V_{pps} (V_1) setting	1 to 110 V
I_{pps} (I_1) load setting	0.05 to 1 · I_{rated}
I_{pps} (I_1) fault setting	0.05 to 20 · I_{rated}
Delay setting t_{delay}	0.03 to 14400 s
Basic operate time t_{basic}	32 ms ± 10 ms
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms

67 Directional Overcurrent – Phase

Angle setting θ_{set}	-95° to +95°
Minimum voltage setting	1 V to 20 V
Operating angle	θ_{set} - 85° ± 5° to θ_{set} - 85° ± 5° (Forward)
Minimum operating voltage	> 1 V ± 0.25 V
Operate time	Typically 32 ms < 40 ms at characteristic angle
Reset time	< 65 ms at characteristic angle

67G Directional Earth Fault – Measured

Angle setting θ_{set}	-95° to +95°
Minimum voltage setting	0.33 V to 3 V
Operating angle	θ_{set} - 85° ± 5° to θ_{set} - 85° ± 5° (Forward)
Minimum operating voltage	> 0.33 V ± 0.25 V
Operate time	Typically 32 ms < 40 ms at characteristic angle
Reset time	< 65 ms at characteristic angle

67GI Directional Intermittent Earth Fault

Angle setting θ_{set}	-95° to +95°
Minimum voltage setting	0.33 V to 3 V
Operating angle	θ_{set} - 85° ± 5° to θ_{set} - 85° ± 5° (Forward)
Minimum operating voltage	> 0.33 V ± 0.25 V
Operate time	< 25 ms at characteristic angle
Reset time	< 25 ms at characteristic angle

67GS Directional Sensitive Earth Fault – Measured

Angle setting θ_{set}	-95° to +95°
Minimum voltage setting	0.33 V to 3 V
Operating angle	θ_{set} - 85° ± 5° to θ_{set} - 85° ± 5° (Forward)
Minimum operating voltage	> 0.33 V ± 0.25 V
Operate time	Typically 32 ms < 40 ms at characteristic angle
Reset time	< 65 ms at characteristic angle

67N Directional Earth Fault – Calculated

Angle setting θ_{set}	-95° to +95°
Minimum voltage setting	0.33 V to 3 V
Operating angle	θ_{set} - 85° ± 5° to θ_{set} - 85° ± 5° (Forward)
Minimum operating voltage	> 0.33 V ± 0.25 V
Operate time	Typically 32 ms < 40 ms at characteristic angle
Reset time	< 65 ms at characteristic angle

2.1

78VS Voltage Vector Shift

Angle setting θ_{set}	2° to 30°
Operate level	θ_{set} ± 2°
Operate time	≤ 40 ms

79 Automatic Reclosing

Operating mode	Phase, earth, SEF, external
Number of reclosures	4
Number of trips	5
Dead time	0 to 14400 s
Reclaim time	0 to 600 s

81 Frequency Protection – "f>" or "f<"

Setting f_{set}	43 Hz to 68 Hz
Hysteresis setting	0 to 2 %
Delay setting t_{delay}	0 to 14400 s
Operate level	f_{set} ± 10 mHz
Basic operate time t_{basic}	< 150 ms
Operate time following delay	t_{basic} + t_{delay}, ± 1 % or ± 10 ms

81R Frequency Protection – "df/dt"

Setting df/dt_{set}	0.05 to 10 Hz/s
Hysteresis setting	0 to 2 %
Delay setting t_{delay}	0 to 14400 s
Operate level	df/dt_{set} ± 50 mHz/s
Basic operate time t_{basic}	< 200 ms, typically < 185 ms ($2 \cdot df/dt_{set}$)
Operate time following delay	t_{basic} + t_{delay}, ± 1 % or ± 10 ms

87GH Restricted Earth-Fault Protection – High-Impedance

Setting I_{set}	0.005 to 0.95 · I_{rated}
Delay setting t_{delay}	0 to 14400 s
Operate level	I_{set} ± 5 % or ± 1 % · I_{rated}
Basic operate time t_{basic}	3 · I_{op} < 30 ms (device firmware V2.30 onwards) 3 · I_{op} < 45 ms (prior to device firmware V2.30)
Operate time following delay	t_{basic} + t_{delay}, ± 1 % or ± 10 ms

87M-BD Motor Differential Protection – Biased

Differential settings:	
Initial setting I_{set}	0.05· I_{rated} to 2 · I_{rated}
S1 (1st bias slope)	0.1x to 0.7x
S1L (1st bias slope limit)	1 · I_{rated} to 20 · I_{rated}
S2 (2nd bias slope)	0.4x to 2x
Delay setting t_{delay}	0 to 1 s
Operate level $I_{op} = [I_{W1} + I_{W2}]$ $I_{BIAS} = \frac{[\lvert I_{W1} \rvert + \lvert I_{W2} \rvert]}{2}$	$S0L = \frac{I_S}{S1}$ I_{BIAS} = 0 to S0L: $I_{op} > I_s$ I_{BIAS} S0L to S1L: $I_{op} > S1(I_{BIAS} - S0L) + I_s$ I_{BIAS} > S1L: $I_{op} > S2 (I_{BIAS} - S1L) + S1(S1L - S0L) + I_s$
Reset level	> 90 % I_{op}
Basic operate time t_{basic}: (inrush action enabled)	< 30 ms (≥ 3 · I_{op})
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms

87M-HS Motor Differential Protection – Highset

Differential setting I_{set}	1 to 30 · I_{rated}
Delay setting t_{delay}	0 to 1 s
Operate level	± 10 % of setting or ± 0.01 I_{rated}
Reset level	> 90 % I_{op}
Basic operate time t_{basic}: $I_{op} = [I_{W1} + I_{W2}]$ (inrush action enabled)	< 25 ms (≥ 1.5 · I_{op})
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms

87NL Restricted Earth-Fault Protection – Low-Impedance

Guard setting	0.05 to 5 · I_{rated}
Differential settings:	
Initial setting I_{set}	0.05 · I_{rated} to 2 · I_{rated}
S1 (1st bias slope)	0.1x to 0.7x
S1L (1st bias slope limit)	0.5 · I_{rated} to 2 · I_{rated}
S2 (2nd bias slope)	1x to 2x
Delay setting t_{delay}	0 to 1 s

Operate level	$I_{op} = \lvert I_n \pm I_g \rvert$ $I_{BIAS} = \frac{\lvert I_g \rvert + \lvert I_n \rvert}{2}$ I_{BIAS} = 0 p.u. to 1 p.u.: $I_{op} > I_{set}$ I_{BIAS} = 1 p.u. to S1L: $I_{op} > S1\text{-}1 + I_{set}$ $I_{BIAS} > S1L$: $I_{op} > S2\ (I_{BIAS} - S1L) + S1(S1L - 1) + I_{set}$ ± 10 % of setting or ± 0.01 I_{rated}
Reset level	> 90 % I_{op}
Basic operate time t_{basic}:	< 30 ms (≥ 3 · I_{op})
Operate time following delay	$t_{basic} + t_{delay}$, ± 1 % or ± 10 ms

87T-BD Transformer Differential Protection – Biased

Differential settings: Initial setting I_{set} S1 (1st bias slope) S1L (1st bias slope limit) S2 type (bias slope 2) S2 (2nd bias slope)	 0.05 · I_{rated} to 2 · I_{rated} 0.1x to 0.7x 1 · I_{rated} to 20 · I_{rated} Line, curve 1x to 2x
Delay setting t_{delay}	0 to 1 s
Operate level $I_{op} = [I_{W1} + I_{W2} + I_{W3}]$ $I_{BIAS} = \frac{[\lvert I_{W1} \rvert + \lvert I_{W2} \rvert + \lvert I_{W3} \rvert]}{2}$	$S0L = \frac{I_s}{S1}$ I_{BIAS} = 0 to S0L: $I_{op} > I_s$ I_{BIAS} S0L to S1L: $I_{op} > S1(I_{BIAS} - S0L) + I_s$ $I_{BIAS} > S1L$: $I_{op} > S2\ (I_{BIAS} - S1L) + S1(S1L - S0L) + I_s$
Reset level	> 90 % I_{op}

Basic operate time t_{basic}: (inrush action enabled)	< 30 ms (≥ 3 · I_{op})
Operate time following delay	$t_{basic} + t_{delay}$, ± 1 % or ± 10 ms

87T-HS Transformer Differential Protection – Highset

Differential setting I_{set}	1 to 30 · I_{rated}
Delay setting t_{delay}	0 to 1 s
Operate level	± 10 % of setting or ± 0.01 I_{rated}
Reset level	> 90 % I_{op}
Basic operate time t_{basic}: $I_{op} = [I_{W1} + I_{W2} + I_{W3}]$ (inrush action enabled)	 < 25 ms (≥ 1.5 · I_{op})
Operate time following delay	$t_{basic} + t_{delay}$, ± 1 % or ± 10 ms

Control Functions

CB	Open, close
Inst prot	In/out
EF	In/out
SEF	In/out
Hot line	In/out
Relay mode	Local, remote, local or remote
Reset	LEDs & binary outputs

Circuit-Breaker Maintenance

Total trip counter	0 to 10000
Delta trip counter	0 to 10000
Counts to AR block	0 to 10000
Frequent operations	0 to 10000
I^2t alarm	10 to 100000

Ordering Information – 7SR51 Overcurrent Protection Relay

Product Description	Order No.																	
	1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
7SR51 Overcurrent Protection Relay	7	S	R	5	1	n	n	-	n	A	a	n	n	-	n	A	A	0
						|	|	-	|		|	|	|	-	|			
Overcurrent: I/O Configurations						*6*	*7*	-	*8*		*10*	|	*12*	-	|			
4 I, 8 BI, 6 BO						1	0	-	1		A	|	1	-	|			
4 I, 3 AFD, 8 BI, 9 BO (inc. 3 HSBO)						1	0	-	1		D	|	1	-	|			
4 I, 13 BI, 8 BO						1	0	-	2		A	|	1	-	|			
4 I, 3 AFD, 13 BI, 11 BO (inc. 3 HSBO)						1	0	-	2		D	|	1	-	|			
4 I, 8 TSI, 13 BI, 8 BO						1	0	-	2		F	|	1	-	|			
4 I, 18 BI, 10 BO						1	0	-	3		A	|	2	-	|			
4 I, 3 AFD, 18 BI, 13 BO (inc. 3 HSBO)						1	0	-	3		D	|	2	-	|			
4 I, 8 TSI, 18 BI, 10 BO						1	0	-	3		F	|	2	-	|			
4 I, 23 BI, 12 BO						1	0	-	4		A	|	2	-	|			
4 I, 23 BI, 12 BO						1	0	-	4		A	|	6	-	|			
4 I, 3 AFD, 23 BI, 15 BO (inc. 3 HSBO)						1	0	-	4		D	|	2	-	|			
4 I, 8 TSI, 23 BI, 12 BO						1	0	-	4		F	|	2	-	|			
4 I, 38 BI, 18 BO						1	0	-	7		A	|	6	-	|			
						|	|	-	|		|	|	|	-	|			
Directional Overcurrent: I/O Configurations						*6*	*7*	-	*8*		*10*	|	*12*	-	|			
4 I, 4 V, 9 BI, 8 BO						1	1	-	1		A	|	1	-	|			
4 I, 4 V, 3 AFD, 9 BI, 11 BO (inc. 3 HSBO)						1	1	-	1		D	|	1	-	|			
4 I, 4 V, 8 TSI, 9 BI, 8 BO						1	1	-	1		F	|	1	-	|			
4 I, 4 V, 14 BI, 10 BO						1	1	-	2		A	|	2	-	|			
4 I, 4 V, 14 BI, 10 BO						1	1	-	2		A	|	6	-	|			
4 I, 4 V, 19 BI, 12 BO						1	1	-	3		A	|	2	-	|			
4 I, 4 V, 19 BI, 12 BO						1	1	-	3		A	|	6	-	|			
4 I, 4 V, 3 AFD, 19 BI, 15 BO (inc. 3 HSBO)						1	1	-	3		D	|	2	-	|			
4 I, 4 V, 3 AFD, 19 BI, 15 BO (inc. 3 HSBO)						1	1	-	3		D	|	6	-	|			
4 I, 4 V, 8 TSI, 19 BI, 12 BO						1	1	-	3		F	|	2	-	|			
4 I, 4 V, 24 BI, 14 BO						1	1	-	4		A	|	6	-	|			
4 I, 4 V, 3 AFD, 24 BI, 17 BO (inc. 3 HSBO)						1	1	-	4		D	|	6	-	|			
4 I, 4 V, 39 BI, 20 BO						1	1	-	7		A	|	6	-	|			
4 I, 4 V, 3 AFD, 39 BI, 23 BO (inc. 3 HSBO)						1	1	-	7		D	|	6	-	|			
4 I, 4 V, 8 TSI, 39 BI, 20 BO						1	1	-	7		F	|	6	-	|			
						|	|	-	|		|	|	|	-	|			
Special Applications Overcurrent: I/O Configurations						*6*	*7*	-	*8*		*10*	|	*12*	-	|			
5 I, 4 V, 17 BI, 10 BO						2	1	-	2		A	|	2	-	|			
5 I, 4 V, 17 BI, 10 BO						2	1	-	2		A	|	6	-	|			
5 I, 4 V, 22 BI, 12 BO						2	1	-	3		A	|	6	-	|			
5 I, 4 V, 3 AFD, 22 BI, 15 BO (inc. 3 HSBO)						2	1	-	3		D	|	6	-	|			
5 I, 4 V, 37 BI, 18 BO						2	1	-	6		A	|	6	-	|			
5 I, 4 V, 3 AFD, 37 BI, 21 BO (inc. 3 HSBO)						2	1	-	6		D	|	6	-	|			
5 I, 4 V, 8 TSI, 37 BI, 18 BO						2	1	-	6		F	|	6	-	|			
											|	|	|	-	|			
Auxiliary I/O (Slot 2)											*10*	|	|	-	|			
No auxiliary I/O											A	|	|	-	|			
3 arc flash detector (AFD) inputs/3 BO (high speed)											D	|	|	-	|			
8 temperature sensor inputs (TSI)											F	|	|	-	|			
												|	|	-	|			
CPU/Data Communication (Standard: 1 x USB (front), RS485 (rear) ports)												*11*	|	-	|			

Product Description	Order No.							
2 x RJ45 ports	1	|	-	|			
2 x optical LC ports	2	|	-	|			
		|	-	|			
Case & Fascia		*12*	-	|			
Housing width 3/8 x 19" (size 6), Housing height 4U		1	-	|			
Housing width 1/2 x 19" (size 8), Housing height 4U		2	-	|			
Housing width 3/4 x 19" (size 12), Housing height 4U		6	-	|			
				|			
Conformal Coating				*13*			
Standard device (without conformal coating)				0			
Including conformal coating				1			

NOTE

CT inputs: 1 A/5 A, 50 Hz/60 Hz

VT inputs: 40 V to 160 V, 50 Hz/60 Hz

PSU: DC 24 V to DC 250 V, AC 100 V to AC 230 V

PSU: AC = 50 Hz/60 Hz

BI: DC 24 V/DC 110 V/DC 220 V

IEC 61850 Ethernet editions 1 and 2

Modbus TCP, DNP3 TCP

Modbus RTU, IEC 60870-5-103, DNP3

SNMP

Syslog

SNTP, IEEE 1588 PTP

User selectable languages: English, French, German, Portuguese, Spanish, Turkish

Ordering Information – 7SR54 Transformer Protection Relay

Product Description	Order No.																	
	1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
7SR54 Transformer Protection Relay	7	S	R	5	4	n	n	-	n	A	a	n	n	-	n	A	A	0
						|	|	-	|		|	|	|	-	|			
2 Wdg. Transformer: I/O Configurations						*6*	*7*	-	*8*		*10*	|	|	-	|			
8 I, 16 BI, 8 BO						2	0	-	2		A	|	2	-	|			
8 I, 16 BI, 8 BO						2	0	-	2		A	|	6	-	|			
8 I, 21 BI, 10 BO						2	0	-	3		A	|	2	-	|			
8 I, 3 AFD, 21 BI, 13 BO (inc. 3 HSBO)						2	0	-	3		D	|	2	-	|			
8 I, 3 AFD, 21 BI, 13 BO (inc. 3 HSBO)						2	0	-	3		D	|	6	-	|			
8 I, 8 TSI, 21 BI, 10 BO						2	0	-	3		F	|	2	-	|			
8 I, 4 V, 12 BI, 8 BO						2	1	-	1		A	|	6	-	|			
8 I, 4 V, 17 BI, 10 BO						2	1	-	2		A	|	2	-	|			
8 I, 4 V, 3 AFD, 17 BI, 13 BO (inc. 3 HSBO)						2	1	-	2		D	|	2	-	|			
8 I, 4 V, 3 AFD, 17 BI, 13 BO (inc. 3 HSBO)						2	1	-	2		D	|	6	-	|			
8 I, 4 V, 8 TSI, 17 BI, 10 BO						2	1	-	2		F	|	2	-	|			
8 I, 4 V, 22 BI, 12 BO						2	1	-	3		A	|	6	-	|			
8 I, 4 V, 3 AFD, 22 BI, 15 BO (inc. 3 HSBO)						2	1	-	3		D	|	6	-	|			
8 I, 4 V, 8 TSI, 22 BI, 12 BO						2	1	-	3		F	|	6	-	|			
8 I, 4 V, 37 BI, 18 BO						2	1	-	6		A	|	6	-	|			
8 I, 4 V, 3 AFD, 37 BI, 21 BO (inc. 3 HSBO)						2	1	-	6		D	|	6	-	|			
8 I, 4 V, 8 TSI, 37 BI, 18 BO						2	1	-	6		F	|	6	-	|			
						|	|	-	|		|	|	|	-	|			
3 Wdg. Transformer: I/O Configurations						*6*	*7*	-	*8*		*10*	|	|	-	|			
12 I, 24 BI, 10 BO						3	0	-	3		A	|	6	-	|			
12 I, 3 AFD, 24 BI, 13 BO (inc. 3 HSBO)						3	0	-	3		D	|	6	-	|			
12 I, 8 TSI, 24 BI, 10 BO						3	0	-	3		F	|	6	-	|			
12 I, 4 V, 25 BI, 12 BO						3	1	-	3		A	|	6	-	|			
12 I, 4 V, 3 AFD, 25 BI, 15 BO (inc. 3 HSBO)						3	1	-	3		D	|	6	-	|			
12 I, 4 V, 8 TSI, 25 BI, 12 BO						3	1	-	3		F	|	6	-	|			
12 I, 4 V, 35 BI, 16 BO						3	1	-	5		A	|	6	-	|			
12 I, 4 V, 3 AFD, 35 BI, 19 BO (inc. 3 HSBO)						3	1	-	5		D	|	6	-	|			
12 I, 4 V, 8 TSI, 35 BI, 16 BO						3	1	-	5		F	|	6	-	|			
											|	|	|	-	|			
Auxiliary I/O (Slot 2)											*10*	|	|	-	|			
No auxiliary I/O											A	|	|	-	|			
3 arc flash detector (AFD) inputs/3 BO (high speed)											D	|	|	-	|			
8 temperature sensor inputs (TSI)											F	|	|	-	|			
												|	|	-	|			
CPU/Data Communication (Standard: 1 x USB (front), RS485 (rear) ports)												*11*	|	-	|			
2 x RJ45 ports												1	|	-	|			
2 x optical LC ports												2	|	-	|			
													|	-	|			
Case & Fascia													*12*	-	|			
Housing width 1/2 x 19" (size 8), Housing height 4U													2	-	|			
Housing width 3/4 x 19" (size 12), Housing height 4U													6	-	|			
															|			
Conformal Coating															*13*			
Standard device (without conformal coating)															0			
Including conformal coating															1			

NOTE

CT inputs: 1 A/5 A, 50 Hz/60 Hz

VT inputs: 40 V to 160 V, 50 Hz/60 Hz

PSU: DC 24 V to DC 250 V, AC 100 V to AC 230 V

PSU: AC = 50 Hz/60 Hz

BI: DC 24 V/DC 110 V/DC 220 V

IEC 61850 Ethernet editions 1 and 2

Modbus TCP, DNP3 TCP

Modbus RTU, IEC 60870-5-103, DNP3

SNMP

Syslog

SNTP, IEEE 1588 PTP

User selectable languages: English, French, German, Portuguese, Spanish, Turkish

Ordering Information – 7SR57 Motor Protection Relay

2.1

Product Description	Order No.																	
	1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
7SR57 Motor Protection Relay	7	S	R	5	7	n	n	-	n	a	a	n	n	-	n	A	A	0
						|	|	-	|	|	|	|	|	-	|			
Motor: I/O Configurations						*6*	*7*	-	*8*	*9*	*10*	|	*12*	-	|			
4 I, 8 BI, 6 BO						1	0	-	1	A	A	|	1	-	|			
4 I, 3 AFD, 8 BI, 9 BO (inc. 3 HSBO)						1	0	-	1	A	D	|	1	-	|			
4 I, 8 TSI, 8 BI, 6 BO						1	0	-	1	A	F	|	1	-	|			
4 I, 13 BI, 8 BO						1	0	-	2	A	A	|	1	-	|			
4 I, 3 AFD, 13 BI, 11 BO (inc. 3 HSBO)						1	0	-	2	A	D	|	1	-	|			
4 I, 8 TSI, 13 BI, 8 BO						1	0	-	2	A	F	|	1	-	|			
4 I, 18 BI, 10 BO						1	0	-	3	A	A	|	2	-	|			
4 I, 3 AFD, 18 BI, 13 BO (inc. 3 HSBO)						1	0	-	3	A	D	|	2	-	|			
4 I, 8 TSI, 18 BI, 10 BO						1	0	-	3	A	F	|	2	-	|			
4 I, 23 BI, 12 BO						1	0	-	4	A	A	|	2	-	|			
4 I, 3 AFD, 23 BI, 15 BO (inc. 3 HSBO)						1	0	-	4	A	D	|	2	-	|			
4 I, 8 TSI, 23 BI, 12 BO						1	0	-	4	A	F	|	2	-	|			
4 I, 4 V, 9 BI, 8 BO						1	1	-	1	A	A	|	1	-	|			
4 I, 4 V, 3 AFD, 9 BI, 11 BO (inc. 3 HSBO)						1	1	-	1	A	D	|	1	-	|			
4 I, 4 V, 8 TSI, 9 BI, 8 BO						1	1	-	1	A	F	|	1	-	|			
4 I, 4 V, 19 BI, 12 BO						1	1	-	3	A	A	|	2	-	|			
4 I, 4 V, 19 BI, 12 BO						1	1	-	3	A	A	|	6	-	|			
4 I, 4 V, 3 AFD, 19 BI, 15 BO (inc. 3 HSBO)						1	1	-	3	A	D	|	2	-	|			
4 I, 4 V, 3 AFD, 19 BI, 15 BO (inc. 3 HSBO)						1	1	-	3	A	D	|	6	-	|			
4 I, 4 V, 8 TSI, 19 BI, 12 BO						1	1	-	3	A	F	|	2	-	|			
4 I, 4 V, 3 AFD, 16 TSI, 29 BI, 19 BO (inc. 3 HSBO)						1	1	-	5	D	D	|	6	-	|			
						|	|	-	|	|	|	|	|	-	|			
Motor Differential: I/O Configurations						*6*	*7*	-	*8*	*9*	*10*	|	*12*	-	|			
8 I, 4 V, 17 BI, 10 BO						2	1	-	2	A	A	|	2	-	|			
8 I, 4 V, 3 AFD, 17 BI, 13 BO (inc. 3 HSBO)						2	1	-	2	A	D	|	2	-	|			
8 I, 4 V, 8 TSI, 17 BI, 10 BO						2	1	-	2	A	F	|	2	-	|			
8 I, 4 V, 3 AFD, 16 TSI, 27 BI, 17 BO (inc. 3 HSBO)						2	1	-	4	D	D	|	6	-	|			
										|	|	|	|	-	|			
Extended I/O Configurations										*9*	*10*	|	*12*	-	|			
No extended I/O										A	|	|	|	-	|			
Standard I/O + 16 temperature sensor inputs (TSI)										D	|	|	6	-	|			
											|	|	|	-	|			
Auxiliary I/O (Slot 2)											*10*	|	|	-	|			
No auxiliary I/O											A	|	|	-	|			
3 arc flash detector (AFD) inputs / 3 BO (high speed)											D	|	|	-	|			
8 temperature sensor inputs (TSI)											F	|	|	-	|			
												|	|	-	|			
CPU/Data Communication (Standard: 1 x USB (front), RS485 (rear) ports)												*11*	|	-	|			
2 x RJ45 ports												1	|	-	|			
2 x optical LC ports												2	|	-	|			
													|	-	|			
Case & Fascia													*12*	-	|			
Housing width 3/8 x 19" (size 6), Housing height 4U													1	-	|			
Housing width 1/2 x 19" (size 8), Housing height 4U													2	-	|			
Housing width 3/4 x 19" (size 12), Housing height 4U													6	-	|			
															|			

Product Description	Order No.				
Conformal Coating	*13*				
Standard device (without conformal coating)	0				
Including conformal coating	1				

NOTE

CT inputs: 1 A/5 A, 50 Hz/60 Hz

VT inputs: 40 V to 160 V, 50 Hz/60 Hz

PSU: DC 24 V to DC 250 V, AC 100 V to AC 230 V

PSU: AC = 50 Hz/60 Hz

BI: DC 24 V/DC 110 V/DC 220 V

IEC 61850 Ethernet editions 1 and 2

Modbus TCP, DNP3 TCP

Modbus RTU, IEC 60870-5-103, DNP3

SNMP

Syslog

SNTP, IEEE 1588 PTP

User selectable languages: English, French, German, Portuguese, Spanish, Turkish

Ordering Information – 7SR5 Spares and Accessories

Product Description	Order No.																	
	1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
7SR5 Spares and Accessories	7	X	G	1	n	n	1	-	0	A	A	0	0	-	0	A	A	0
					|	|												
Fiber optic data communication port inserts (7SR5)					1	1												
Terminal plug for RS485 wiring (3-way)					1	3												
Terminal block cover (7SR5)					1	8												
Captive screws for fascia levers (7SR5)					6	1												
Hinged cover for fascia LED label (7SR5)					6	2												

Description

The Reyrolle 7SR10 Argus is an overcurrent and earth fault relay intended as a simple protection solution for distribution and industrial applications. It consists of non-directional functions and additional voltage inputs providing directional functions.

The conformal coating on device electronic modules increases protection against harmful environmental influences such as extreme moisture, corrosive gases and aggressive dust.

Main Function	Feeder protection, monitor and control for distribution and industrial networks	
Inputs and Outputs	4CT	3 Binary inputs, 3 binary outputs and 10 LEDs
	4CT	6 or 9 Binary inputs, 6 binary outputs and 10 LEDs
	4CT and 3VT	9 Binary inputs, 6 binary outputs and 10 LEDs
Communication	Front port: USB Rear port: RS-485 (optional for remote connection)	
Protocols	IEC 60870-5-103, DNP3 or Modbus RTU	
Housing	Size 4, 4U high – non draw-out case	

Benefits

- Circuit-breaker open and close fascia push button
- Protection settings can be viewed and edited from the fascia
- 9 user programmable tri-color LEDs
- Cold load protection
- 2 setting groups for non-directional relay
- 4 setting groups for directional relay
- Password protection– 2 levels[15]
- User programmable logic aided by 8 virtual inputs/outputs
- User specific curve
- Self monitoring
- Circuit-breaker tripping and maintenance counter
- Last 100 fault records are available
- Waveform recorder stores 15 records (1-s duration)
- 20 character x 4 line backlit LCD
- Up to 1 000 event records with 1 ms resolution

Functions

Protection Functions

- 27 Undervoltage protection – 3-phase
- 32 Power protection
- 32S Sensitive power protection
- 37 Undercurrent protection – phase
- 37G Undercurrent earth fault – measured
- 37SEF Undercurrent earth fault - sensitive

[sc_7SR10 device, 2, en_US]

Figure 2.2/1 7SR10 Device

- 46NPS Negative sequence overcurrent protection
- 47NPS Sequence overvoltage protection
- 49 Thermal overload protection
- 50 Instantaneous overcurrent – phase
- 50AFD Arc flash detection
- 50G Instantaneous earth fault – measured
- 50GLC Line-check overcurrent protection
- 50LC Line check
- 50N Instantaneous earth fault – calculated
- 50SEF Instantaneous sensitive earth fault – measured
- 50SEFLC Line check sensitive earth fault – measured
- 51 Time-delayed overcurrent – phase
- 51CL Cold load overcurrent – phase
- 51G Time delayed earth fault – measured
- 51N Time-delayed earth fault – calculated
- 51SEF Time-delayed sensitive earth fault – measured
- 51V Voltage-dependent overcurrent protection
- 55 Power factor
- 59 Overvoltage protection – 3-phase
- 59N Neutral voltage displacement
- 64H Restricted earth fault protection – high-impedance
- 67 Directional overcurrent – phase
- 67G Directional earth fault – measured
- 67N Directional earth fault – calculated
- 67SEF Directional sensitive earth fault – measured

15 This password is a confirmation ID for settings change and control functions.

- 67SEF Directional sensitive earth fault – measured 3V0/I0, φ
- 81 Frequency protection – "f>" or "f<"

Supervision Functions

- 46BC Broken conductor detection
- 50BF Circuit-breaker failure protection – 3-pole
- 60CTS CT supervision
- 60VTS VT supervision
- 74CCS Close-circuit supervision
- 74TCS Trip-circuit supervision
- 81HBL2 Inrush current detection
- 81I_THD Total harmonic distortion supervision

Control Functions

- 52 Circuit-breaker control
- 86 Lockout
- 79 Automatic reclosing

Additional Functions

- User-programmable logics
- User-defined curves

Communications

- IEC 60870-5-103
- MODBUS RTU
- DNP 3.0

Reydisp Software

Our user-friendly PC software tool ensures a smooth installation providing an efficient and intuitive interface to the relay.

Applications

- Feeder overcurrent protection
- Backup protection
- Compact substation
- Protection against harmonic injection into grid by non conventional sources of energy
- Focused on renewable energy sources
- Industry medium voltage and low voltage applications

Application

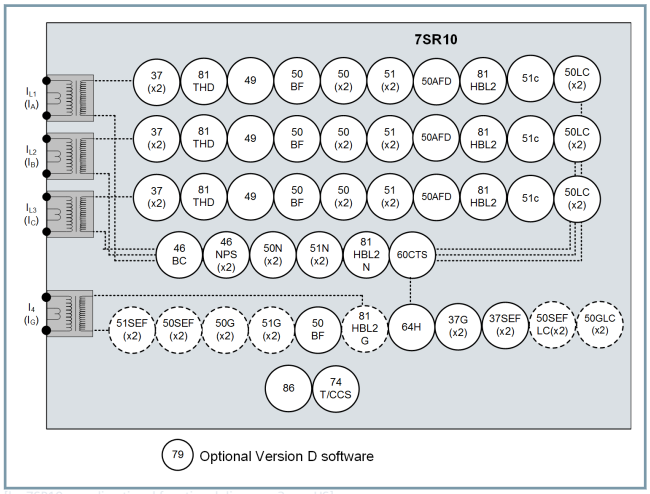
The 7SR10 overcurrent relay is a numerical overcurrent protection relay intended for use in the distribution and industrial networks. It provides a highly comprehensive functional software package with a range of integral application functions aimed at reducing installation, wiring, and engineering time.

The 7SR10 consists of overcurrent and earth fault protection functions with additional voltage inputs providing directional, voltage, frequency, and power protection functions.

A wide range of measured values can be viewed on the front LCD or remotely via the communication channel.

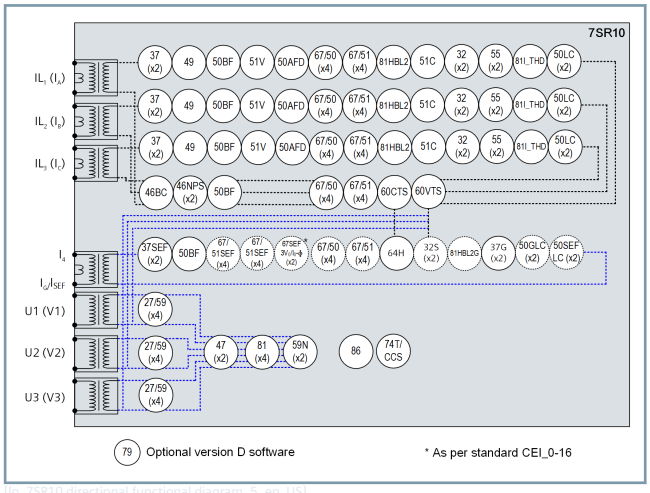
The integrated control feature allows the operation of a single circuit-breaker and the monitoring of it's trip and closed circuits.

7SR10 Functional Diagram



[Io_7SR10 non-directional functional diagram, 3, en_US]

Figure 2.2/2 7SR10 Non-Directional Overcurrent Relay



[Io_7SR10 directional functional diagram, 5, en_US]

Figure 2.2/3 7SR10 Directional Overcurrent Relay

Function Matrix

ANSI	Functions	7SR1002/3-1***0-2CA0	7SR1002/3-2***0-2CA0	7SR1002/3-1***0-2DA*	7SR1002/3-2***0-2DA0	7SR1004-3**20-2CA0	7SR1004-4**20-2CA0	7SR1004-3**20-2DA0	7SR1004-4**20-2DA0	7SR1004-5**20-2CA0
PROTECTION										
27	Undervoltage protection – 3-phase					■	■	■	■	■
32	Power protection					■	■	■	■	■
32S	Sensitive power protection						■		■	■
37	Undercurrent protection – phase	■	■	■	■	■	■	■	■	■
37G	Undercurrent earth fault – measured	■		■		■		■		
37SEF	Undercurrent earth fault - sensitive		■		■		■		■	■
46NPS	Negative sequence overcurrent protection	■	■	■	■	■	■	■	■	■
47NPS	Sequence overvoltage protection					■	■	■	■	■
49	Thermal overload protection	■	■	■	■	■	■	■	■	■
50	Instantaneous overcurrent – phase	■	■	■	■	■	■	■	■	■
50AFD	Arc flash detection	■	■	■	■	■	■	■	■	■
50G	Instantaneous earth fault – measured	■		■		■		■		
50GLC	Line-check overcurrent protection	■				■				
50LC	Line check	■	■			■	■			■
50N	Instantaneous earth fault – calculated	■	■	■	■	■	■	■	■	■
50SEF	Instantaneous sensitive earth fault – measured		■		■		■		■	■
50SEFLC	Line check sensitive earth fault – measured		■				■			■
51	Time-delayed overcurrent – phase	■	■	■	■	■	■	■	■	■
51CL	Cold load overcurrent – phase	■	■	■	■	■	■	■	■	■
51G	Time delayed earth fault – measured	■		■		■		■		
51N	Time-delayed earth fault – calculated	■	■	■	■	■	■	■	■	■
51SEF	Time-delayed sensitive earth fault – measured		■		■		■		■	■
51V	Voltage-dependent overcurrent protection					■	■	■	■	■
55	Power factor					■	■	■	■	■
59	Overvoltage protection – 3-phase					■	■	■	■	■
59N	Neutral voltage displacement					■	■	■	■	■
64H	Restricted earth fault protection – high-impedance	■	■	■	■	■	■	■	■	■
67	Directional overcurrent – phase					■	■	■	■	■
67G	Directional earth fault – measured					■		■		
67N	Directional earth fault – calculated					■	■	■	■	■
67SEF	Directional sensitive earth fault – measured						■		■	■
67SEF	Directional sensitive earth fault – measured 3V0/I0, φ									■
81	Frequency protection – "f>" or "f<"					■	■	■	■	■
SUPERVISION										
46BC	Broken conductor detection	■	■	■	■	■	■	■	■	■
50BF	Circuit-breaker failure protection – 3-pole	■	■	■	■	■	■	■	■	■
60CTS	CT supervision	■	■	■	■	■	■	■	■	■
60VTS	VT supervision					■	■	■	■	■
74CC	Close-circuit supervision	■	■	■	■	■	■	■	■	■
74TC	Trip-circuit supervision	■	■	■	■	■	■	■	■	■
81I_THD	Total harmonic distortion supervision	■	■	■	■	■	■	■	■	

7SR10 Platform – Devices and Application

ANSI	Functions	7SR1002/3-1***0-2CA0	7SR1002/3-2***0-2CA0	7SR1002/3-1***0-2DA*	7SR1002/3-2***0-2DA0	7SR1004-3**20-2CA0	7SR1004-4**20-2CA0	7SR1004-3**20-2DA0	7SR1004-4**20-2DA0	7SR1004-5**20-2CA0
81HBL2	Inrush current detection[16]	■	■	■	■	■	■	■	■	■
	CONTROL									
52	Circuit-breaker control	■	■	■	■	■	■	■	■	■
79	Automatic reclosing			■	■			■	■	
86	Lockout	■	■	■	■	■	■	■	■	■
	User-programmable logic and user-defined curves	■	■	■	■	■	■	■	■	■

■ Basic

16 Not applicable for SEF CT

Description

7SR105 relay is a numerical protection relay intended for use in motor protection applications. It provides a highly comprehensive functional software package with a range of integral application functions aimed at reducing installation, wiring, and engineering time.

The conformal coating on device electronic modules increases protection against harmful environmental influences such as extreme moisture, corrosive gases and aggressive dust.

Main Function	Protection, control and monitoring
Inputs and Outputs	4 Current transformers with 1 A and 5 A inputs, 6 binary inputs, and 6 binary outputs
	4 Current transformers with 1 A and 5 A inputs, 6 temperature inputs, 6 binary inputs, and 6 binary outputs
Communication	Front port: USB (for configuration via Reydisp)
	Rear port: RS-484
Housing	Size 4, 4U high – non draw-out case

[sc_7SR105 device, 1, en_US]

Figure 2.2/4 7SR105 Device

Benefits

- 2 settings groups
- Password protection – 2 levels[17]
- User-programmable logic
- Self monitoring
- Circuit-breaker trip and maintenance counter
- Tripping time
- Motor start/stop control
- Up to 1 000 events records with 1 ms resolution
- Protection settings can be viewed and edited from the fascia
- 9 user programmable tri-color LEDs
- Last 100 fault records are available
- Waveform recorder stores 15 records (1 second duration)
- 20 character x 4 line backlit LCD

Functions

Protection Functions

- 27 Locked rotor protection
- 37 Undercurrent protection – phase
- 46 Phase unbalance protection
- 48 Starting-time supervision
- 49 Thermal overload protection
- 50 Instantaneous overcurrent – phase
- 50G Instantaneous earth fault – measured
- 50N Instantaneous earth fault – calculated
- 51 Time-delayed overcurrent – phase
- 51G Time delayed earth fault – measured
- 51N Time-delayed earth fault – calculated
- 66 Number of starts

Supervision Functions

- 46PhRevPhase reversal
- 50BCL Break capacity limit
- 50BF Circuit-breaker failure protection – 3-pole
- 74CC Close-circuit supervision
- 74TC Trip-circuit supervision
- 81B Backspin monitor
- Temperature supervision
- Circuit-breaker wear monitoring

Control Functions

- 52 Circuit-breaker control
- 86 Lockout
- Motor start/stop control
- User-programmable logic

Communications

- IEC 60870-5-103
- MODBUS RTU
- DNP3

Reydisp Software

Our user friendly PC software tool ensures a smooth installation providing an efficient and intuitive interface to the relay.

17 This password is a confirmation ID for settings change and control functions.

2.2

Applications

- Motor protection for industrial applications
- Sewage, water treatment plants and pumping station
- Automotive conveying systems
- Typically for current based protection of motors less than 1 MW

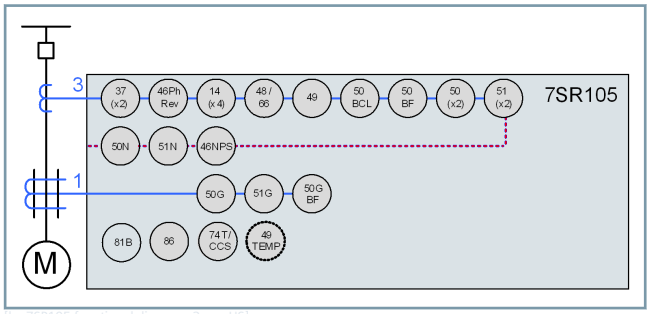
Application

The 7SR105 Rho motor protection relay is a numerical protection relay intended for use in the motor protection applications. It provides a highly comprehensive functional software package with a range of integral application functions aimed at reducing installation, wiring, and engineering time.

A wide range of measured values can be viewed on the front LCD or remotely via the communication channel.

The integrated control feature allows the safe operation of a motor and monitoring its start and stop operations.

7SR105 Functional Diagram



[fp_7SR105 functional diagram, 2, en_US]

Figure 2.2/5 7SR105 Rho Motor Protection Relay

Function Matrix

ANSI	Functions	7SR1053-2*A21-2EA0	7SR1053-2LA22-2FA0
	PROTECTION		
14	Locked rotor protection	■	■
37	Undercurrent protection – phase	■	■
46	Phase unbalance protection	■	■
48	Starting-time supervision	■	■
49	Thermal overload protection	■	■
50	Instantaneous overcurrent – phase	■	■
50G	Instantaneous earth fault – measured	■	■
50N	Instantaneous earth fault – calculated	■	■
51	Time-delayed overcurrent – phase	■	■
51G	Time delayed earth fault – measured	■	■
51N	Time-delayed earth fault – calculated	■	■
66	Number of starts	■	■
	SUPERVISION		
46PhRev	Phase reversal	■	■
50BCL	Break capacity limit	■	■
50BF	Circuit-breaker failure protection – 3-pole	■	■
74CC	Close-circuit supervision	■	■
74TC	Trip-circuit supervision	■	■
81B	Backspin monitor	■	■
TEMP	Temperature supervision		■
	CONTROL		
86	Lockout	■	■
	Motor start/stop control	■	■
	User-programmable logic	■	■

■ Included as standard

Protection and Supervision Functions

14 Locked Rotor Protection

Each element has a single definite time overcurrent characteristic with settings for pickup level and definite time lag (DTL) delays.

Operation can be controlled from motor stopped or running conditions.

27 Undervoltage Protection – 3-Phase

Each element has settings for pickup level, drop-off level and DTL delays. Operation occurs if voltage is below setting for duration of delay.

32 Power Protection

Each element has settings for pickup level, DTL delay and direction. Each element can be set as under or over power, to operate from apparent, real or reactive power and can be set for any phase or all 3 phases.

32S Sensitive Power Protection

This is provided in 4 pole SEF relays and provides elements operated by single phase measured current in the I_{SEF} input. Each element has settings for pickup level, DTL delay and direction. Each element can be set as under or over power, to operate from apparent, real or reactive power.

37 Undercurrent Protection – Phase

Each element has settings for pickup level and DTL delays. Operation occurs if current falls below setting for duration of delay.

37G Undercurrent Earth Fault - Measured

Each element has settings for pickup level and DTL delays. Operation occurs if current falls below setting for duration of delay.

37SEF Undercurrent Earth Fault – sensitive

Each element has settings for pickup level and DTL delays. Operation occurs if current falls below setting for duration of delay.

46BC Broken Conductor Protection

This element has settings for pickup level and DTL delay. With the circuit breaker closed, if the NPS: PPS current ratio is above setting this could be due to a broken conductor.

46 Phase Unbalance Protection

Unbalance current has a significant heating effect on the motor.

2 phase unbalance measurement modes are available. Either NPS current or the difference between maximum and minimum phase currents can be used as a measurement of the unbalance level. Inverse or definite time operation can be selected.

46PhRev Phase Reversal

Each element has a setting for pickup level and DTL delay. If the ratio of NPS and PPS current is above the set value, then this operation occurs. A high value indicates incorrect current phase rotation and this is used to prevent inadvertent reverse operation of the motor.

46NPS Negative Sequence Overcurrent Protection

Each element has user settings for pickup level and IDMTL or DTL delay. The element operates if NPS current exceeds setting and delay. NPS current elements can be used to detect unbalances on the system or remote earth faults when a delta-star transformer is in circuit.

47NPS Sequence Overvoltage Protection

Each element has settings for pickup level and DTL delays. Operation occurs if NPS voltage exceeds setting for duration of delay.

48 Starting-Time Supervision

The feature provides settings to control both the number of times a motor can be started within a specified time period and the minimum time between starts. Motor starting can be inhibited when this limit is reached.

Motor start time can also be monitored.

49 Thermal Overload Protection

The thermal algorithm calculates the thermal states from the measured currents and can be applied to lines, cables and transformers. Alarm outputs are given for thermal overload and thermal capacity.

49 Thermal Overload Protection – Rotating Field

The operating curves take into account the effects of present loading, prior loading and unbalanced currents on the motor operating temperature. A user definable thermal curve is selectable to allow matching of the relay thermal characteristic to all motor and cooling system types. 'Starting' and 'cooling' constants modify the thermal characteristic during motor run-up and stopped conditions.

50 Instantaneous Overcurrent – Phase

50 INST/DTL elements provide overcurrent protection, each with independent settings for pickup current and time delays.

50AFD Arc Flash Detection

The 7SR10 relays can be used with the 7XG31 ReyArc range of arc-flash detection devices. Arc fault protection is a technique employed for the fast clearance of arcing faults on busbars, within metal clad switchgear and associated cable boxes. The arc is detected using an optical sensor and the signal input to a protection device which also monitors the load current on the system. A trip signal can be achieved in less than 10 ms using arc detection only or within 20 ms when using overcurrent check.

7XG31 ReyArc arc flash detection devices can be ordered separately.

50BCL Break Capacity Limit

A motor trip or contactor release should not be attempted if the short circuit current exceeds the breaking capacity.

If any phase current exceeds the breaking capacity setting then the relay blocks the operation of all contacts assigned as **General Trip**.

50BF Circuit-Breaker Failure Protection – 3-Pole

The circuit-breaker fail function may be triggered from an internal trip signal or from a binary input. Line currents and earth currents are monitored following a trip signal and an output is issued if any current is still detected above the setting after a specified time interval. Alternatively, if the trip is from a mechanical protection the circuit-breaker position can be used to determine a failure. A 2nd time delay is available to enable another stage to be utilized if required. An input is also available to bypass the time delays when the circuit-breaker is known to be faulty.

50G Instantaneous Earth Fault – Measured

This function directly measures the earth current from an independent CT, or the residual connection of the 3 line CTs.

50G INST/DTL elements provide earth fault protection, each with independent settings for pickup current.

50GLC Line-Check Overcurrent Protection

This function prevents a CB being repeatedly manually closed onto a faulted line. It is enabled upon the Manual CB Close output being issued.

50LC Line Check

This function prevents a CB being repeatedly manually closed onto a faulted line. It is enabled upon the Manual CB Close output being issued.

50N Instantaneous Earth Fault – Calculated

This function derives the earth current internally from the 3 phase CT inputs to give earth fault.

2 earth fault measurement stages are available.

50N INST/DTL elements provide earth fault protection, each with independent settings for pickup current.

50SEF Instantaneous Sensitive Earth Fault – Measured

2 sensitive earth fault measurement stages are available. This function directly measures the earth current from an independent CT, or the residual connection of the 3 line CTs.

50SEF INST/DTL elements provide earth fault protection, each with independent settings for pickup current and time-delays.

50SEFLC Instantaneous Sensitive Earth Fault – Measured

This function prevents a CB being repeatedly manually closed onto a faulted line. It is enabled upon the Manual CB Close output being issued.

51 Time-Delayed Overcurrent – Phase

51 IDMTL/DTL elements provide overcurrent protection, each with independent settings for pickup current, time-multiplier (51) and time-delays. Users can select IEC or ANSI time current characteristics. The IDMT stage has a user selectable reset characteristic, either DTL or shaped reset characteristic to improve the grading with electromechanical protection.

51CL Cold Load Overcurrent – Phase

If a circuit-breaker is closed onto a cold load and is not powered for a prolonged period, then this condition imposes a higher than normal load-current demand on the system which could exceed normal settings. These conditions can exist for an extended period and must not be interpreted as a fault. To allow optimum setting levels to be applied for normal operation, the cold load pickup feature applies alternative current settings for a limited period.

The feature resets when either the circuit-breaker has been closed for a settable period or if the current has reduced beneath a set level for a user set period.

51G Time-Delayed Earth Fault – Measured

2 earth fault measurement stages are available. This mode directly measures the earth current from an independent CT, or the residual connection of the 3 line CTs.

51G IDMTL/DTL elements provide earth fault protection, each with independent settings for pickup current, time-multiplier, and time-delays. Users can select IEC or ANSI time current characteristics. The IDMT stage has a user selectable reset characteristic either DTL or shaped reset characteristic to improve grading with electromechanical protection.

51N Time-Delayed Earth Fault – Calculated

2 earth fault measurement stages are available.

This function derives the earth current internally from the 3 phase CT inputs to give earth fault.

51N IDMTL/DTL elements provide earth fault protection, each with independent settings for pickup current, time-multiplier, and time-delays. User can select IEC or ANSI time current characteristics. The IDMT stage has a user selectable reset characteristic either DTL or shaped reset characteristic to improve grading with electromechanical protection.

51SEF Time-Delayed Sensitive Earth Fault – Measured

2 sensitive earth fault measurement stages are available. This function directly measures the earth current from an independent CT, or the residual connection of the 3 line CTs.

51SEF IDMTL/DTL elements provide earth fault protection, each with independent settings for pickup current, time-multiplier, and time-delays. Users can select IEC or ANSI time current characteristics. The IDMT stage has a user selectable reset characteristic either DTL or shaped reset characteristic to improve grading with electromechanical protection.

51V Voltage-Dependent Overcurrent Protection

Each phase shaped overcurrent element can be independently controlled by the level of measured input voltage. For applied voltages above setting, the 51-n element operates in accordance with its current setting but for voltages below the setting a multiplier is applied to reduce the 51-n pick up current setting.

55 Power Factor

Each element has settings for under or over power factor pickup level, DTL delay and lead/lag direction. Each can also be set for any phase or all 3 phases operation.

59 Overvoltage Protection – 3 Phase

Each element has settings for pickup level, drop-off level and DTL delays. Operation occurs if voltage exceeds setting for duration of delay.

59N Neutral Voltage Displacement

Neutral overvoltage can be used to detect earth faults in high impedance earthed or isolated systems.

Operation occurs if the neutral voltage exceeds setting for duration of delay.

60CTS CT Supervision

The 7SR10 relay has 2 methods of CT supervision. The 7SR10 Directional relay monitors each phase current input and operates if any one or two inputs fall below the setting. An addition method that considers the presence of negative phase sequence current, without an equivalent level of negative phase sequence voltage, for a user set time as a CT failure.

Both element types have user operate and delay settings.

60VTS VT Supervision

The VT supervision uses a combination of negative phase sequence voltage and negative phase sequence current to detect a VT fuse failure. This condition may be alarmed or used to inhibit voltage dependent functions.

Element has user operate and delay settings.

64H Restricted Earth-Fault Protection – High-Impedance

The measured earth current input may be used in a 64H Restricted earth fault protection – high-impedance scheme to provide sensitive high-speed unit protection. A calculation is required to determine the values of the external series stabilizing resistor and non-linear shunt resistor which can be ordered separately.

66 Number of Starts

The feature provides settings to control both the number of times a motor can be started within a specified time period and the minimum time between starts. Motor starting can be inhibited when this limit is reached.

Motor start time can also be monitored.

67 Directional Overcurrent – Phase

Phase overcurrent elements can be directionalized.

You can set phase overcurrent stage to forward, reverse, or non-directional.

Directional phase fault elements are polarized from quadrature voltage.

67G Directional Earth Fault – Measured

Measured earth fault elements can be directionalized.

You can set measured earth faults to forward, reverse, or non-directional.

Directional measured earth fault elements are polarized from V0.

67N Directional Earth Fault – Calculated

Calculated earth fault elements can be directionalized.

You can set calculated earth fault stage to forward, reverse, or non-directional.

Directional calculated earth fault elements are user-defined and can be polarized from V0 or negative phase sequence voltage.

67SEF Directional Sensitive Earth Fault – Measured

Sensitive earth fault element can be directionalized.

Each element can be set to forward, reverse, or non-directional.

Directional sensitive earth fault elements are polarized from $3V_0$.

74CC Close-Circuit Supervision

The close circuit(s) can be monitored via binary inputs.

74TC Trip-Circuit Supervision

The trip circuit(s) can be monitored via binary inputs. Trip-circuit failure raises an HMI alarm and output(s).

79 Automatic Reclosing

A high proportion of faults on an overhead line network are transient and can be cleared quickly by high speed tripping followed by an automated circuit-breaker reclose sequence. The function provides independent phase fault and earth fault/sensitive earth fault sequences of up to 5 trips, that is 4 reclose attempts before lockout. The auto-reclose sequence can be initiated from internal protection operation or via binary input from an external protection.

81 Frequency Protection – "f>" or "f<"

Each element has settings for pickup level, drop-off level and DTL delays. Operates if frequency exceeds setting for duration of delay. Typically applied in load shedding schemes.

81B Backspin Monitor

To inhibit attempted restarting of the motor until after the rotor has completely stopped backspin protection is applied. Starting is inhibited until the time delay (81B) has elapsed.

81HBL2 Inrush Current Detection

Where second harmonic current is detected (for example, during transformer energization) user-selectable elements can be blocked and an alarm given.

81I_THD Total Harmonic Distortion Supervision

Total harmonic distortion is the percentage of harmonics present in fundamental frequency current. THD calculates the 2^{nd} to 15^{th} harmonic currents, presents inline current and displayed in the 'Harmonic Meter' window as a percentage of fundamental frequency current. Separate THD threshold setting and delay is available as a function.

86 Lockout

Output relays can be configured to self reset, pulsed or hand reset operation.

Output relays can be used to directly trip the circuit-breaker. The operate "break" duty of output relays is limited so the circuit-breaker trip coil must be open circuited by a suitably rated contact, typically a circuit-breaker auxiliary switch.

Temperature Supervision

Motor resistance temperature detectors (RTDs) can be connected via temperature inputs. Up to 6 RTD sensors can be monitored. Provision to configure 7 types of RTD inputs (3 wire

configuration). Temperature inputs can be configurable for RTD alarm and trip application.

NOTE

Any one of the RTD type can be configured for all 6 temperature inputs.

Programmable Logic

The user can map binary inputs, protection elements, LEDs and binary outputs together in a logical scheme.

Up to 4 logic equations can be defined using standard logic functions, for example timers, AND/OR gates, inverters and counters to provide the user required functionality.

Each logic equation output can be used for alarm and indication and/or tripping.

User-Specific Curves

User specific curves can be configured in Reydisp Manager or using curve editor. The custom curve appears as an additional option in the setting **`Char`** using the name that is entered in Reydisp Manager for all elements for which the curve is applicable.

Virtual Inputs/Outputs

There are 8 virtual inputs/outputs to provide internal logical states to assist in the application of the functions. Each virtual I/O can be assigned in the same way as a physical I/O.

Circuit-Breaker Maintenance

2 circuit breaker operations counters are provided to assist with maintenance scheduling. The maintenance counter records the overall number of operations and the delta counter records the number of operations since the last reset.

An I^2t summation counter provides a measure of the contact wear indicating the total energy interrupted by the circuit-breaker contacts.

Each counter has a user set target operations count which, when reached, can be mapped to raise alarms/binary outputs. A CB trip time meter is also available, which measures the time between the trip or open command being issued and the auxiliary contacts changing state.

Monitoring

Self-Monitoring

The self monitoring supervision includes monitoring of power supply signals, code execution watchdog, memory checks by check sum and processor/ADC health checks and the relay is connected to an auxiliary power supply.

Protection healthy LED is illuminated when the power supply signals are healthy.

If the internal relay watchdog detects an internal fault then the LED will continuously flash. A changeover contact can be programmed via the binary input matrix to provide an external protection healthy signal.

If the relay detects an internal failure a message will be displayed on the LCD and the relay will reset in an attempt to rectify the failure.

Instruments & Meters

The following information is monitored and displayed in the relays instrument menu.

Primary/Secondary Current Phases and Earth
Direction of Faults
Primary/Secondary Line and Phase Voltages
Apparent Power and Power Factor
Real and Reactive Power
W Hr & VAr Hr Forward and Reverse
Historical Demand Record
Positive Phase Sequence (PPS) Voltage & Current
Negative Phase Sequence (NPS) Voltage & Current
Zero Phase Sequence (ZPS) Voltage & Current
Thermal Equivalent and Unbalanced Currents
Total Harmonic Distortion
Frequency
Binary Input/Output Status
Trip Circuit Healthy/Failure
Time and Date
Starters
Fault Records
Event Records
Energy
Circuit-Breaker Trip Counters and Time to Trip
I^2t Summation for Contact Wear
Thermal Overload Status Monitoring
Temperature Input Values

Data Acquisition and Recording

Sequence of Event Records

Up to 1000 events are stored and time tagged to 1 ms resolution.

Fault Records

The last 100 fault records (non-directional and directional relay, motor protection relay) are displayed on the relay fascia and are also available through the communication interface with time and date of trip, measured quantities and type of fault.

Waveform Recorder

The waveform recorder stores analogue data for all poles and the states of protection functions, binary inputs, LEDs, and binary outputs with user settable pre and post trigger data. A record can be triggered from protection function, binary input or via data communications. 15 records of 1 s duration are stored.

Demand Metering

A rolling record of demand over the last 24 h is stored. The demand is averaged over a user selectable period of time. A rolling record of such demand averages is stored and provides the demand history. A typical application is to record 15 min averages for the last 7 days.

Real-Time Clock

The time and date can be set and are maintained while the relay is de-energized by a back up storage capacitor. The time can be synchronized from a binary input pulse or the data communication channel.

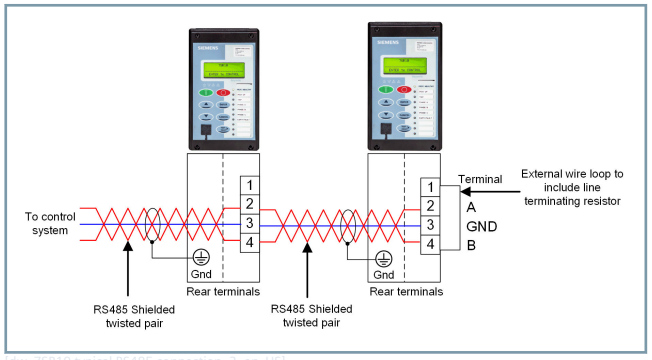
2.2

Serial Communications

The relay offers a USB serial port as standard on the front of all units. All of the relays functions can be set on a PC using Reydisp Evolution via the USB port. The connection is made with a USB cable and operates with a “plug and play” connection, so no pre-setting of the relay is required.

The front port can be switched off or set to use either the DNP3.0, MODBUS-RTU, IEC 60870-5-103, and ASCII protocols for testing purposes.

A rear RS485 electrical connection is optionally available on the relay for system interface connections. An internal terminating resistor is provided, which can be connected into the circuit by adding a wire loop between the relevant terminals.



{dw_7SR10 typical RS485 connection, 3, en_US}

Figure 2.2/6 Typical RS485 Connection

The rear RS485 can be user selected to be OFF, IEC 60870-5-103, MODBUS RTU or DNP3.0 protocol.

Language Editor

The language editor software gives the user the ability to customize the text displayed in the relays, menu structure and instrumentation views. The tool allows a language file to be created and transferred to the relay also containing western european characters.

The data acquisition via communication interface can be done by Reydisp Evolution.

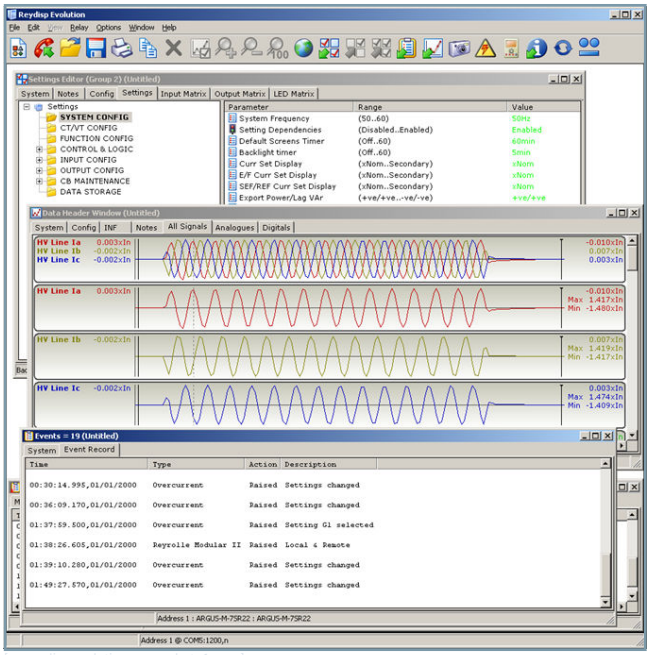
Communications Editor

To facilitate easier interfacing to a substation the relays default protocol configuration may be modified using the communication editor software tool.

The communication editor is a PC based software package provided within the Reydisp software suite which allows modification of the IEC 60870-5-103, DNP 3.0 and MODBUS protocols.

Reydisp Evolution

Reydisp Evolution is a Microsoft Windows-based software tool, providing the means for the user to apply settings, interrogate settings and retrieve events and disturbance waveforms from the device and is common to the entire range of Reyrolle protection relays.



{sc_reydisp evolution screenshot, 1, _ _}

Figure 2.2/7 Typical Reydisp Evolution

Reydisp Manager

Reydisp Manager is a Windows based application which enables configuration of multiple Reyrolle devices.

It provides the following features:

- Project based handling of all features of multiple devices to allow engineering of IEC 61850 projects
- Template based structure allowing offline configuration
- Configure and store device settings for all settings groups
- Create and edit graphical logic diagrams
- Configure data points and options for serial protocols
- Configure language
- Configure user curves
- Update device firmware

Please refer to the Reydisp Manager User Guide for further information.

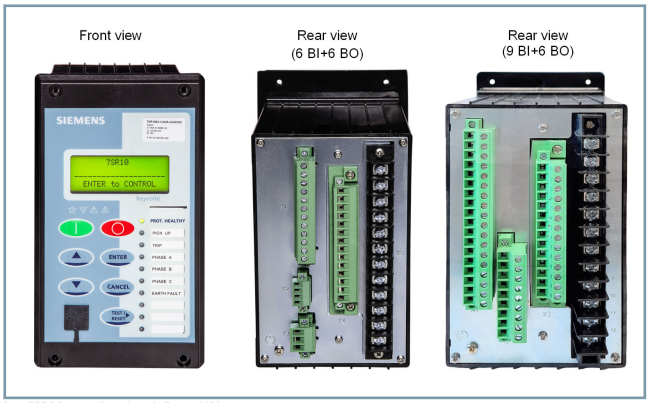
Hardware Construction

The relay is housed in a non draw-out case 4U high, size 4 case.

The rear connection comprises of user friendly pluggable type terminals for wire connections for BI, BO, VT [18], communication, temperature inputs [19], and power supply.

The fascia cover can be ordered with one push button to allow the user to reset the fault indication without removing the cover. [18]

The CT terminals are suitable for ring type lug connection to provide a secure and reliable termination.

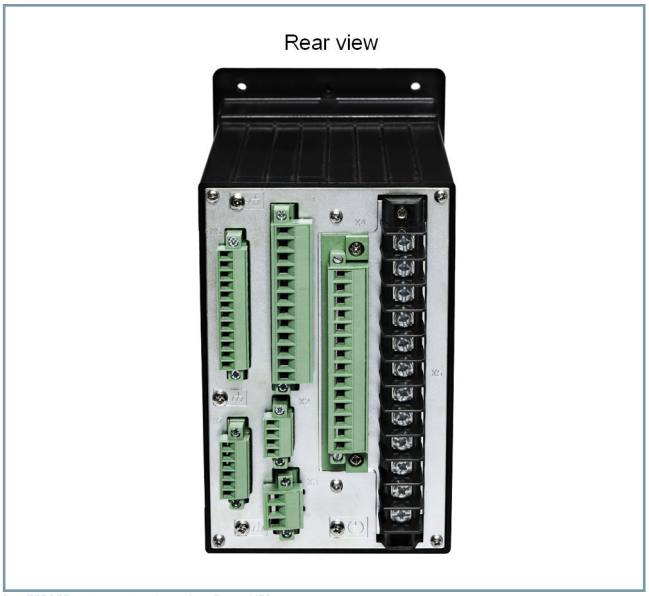


[sc_7SR10 non-directional, 3, en_US]

Figure 2.2/8 7SR10 Non-Directional Relay

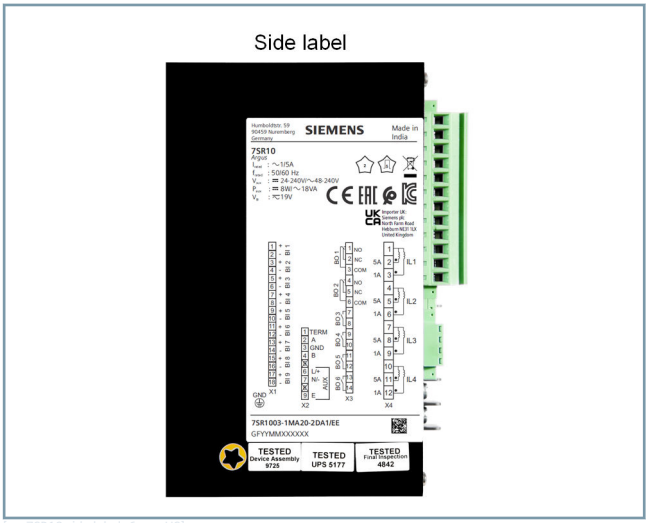
[sc_7SR10 directional, 2, en_US]

Figure 2.2/9 7SR10 Directional Relay



[sc_7SR105 motor protection relay, 2, en_US]

Figure 2.2/10 7SR105 Motor Protection Relay



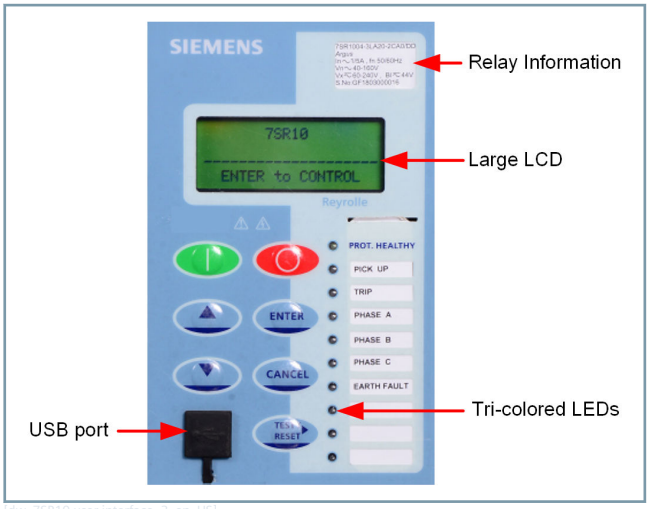
[sc_7SR10 side label, 6, en_US]

Figure 2.2/11 7SR10 Relay Side Label

18 7SR10 only
19 7SR105 only

2.2

User Interface



[dw_7SR10 user interface, 3, en_US]

Figure 2.2/12 User Interface

The operator interface is designed to provide a user friendly method of controlling, viewing menus, entering settings, and retrieving data from the relay. 5 buttons are provided for navigation around the menu structure.

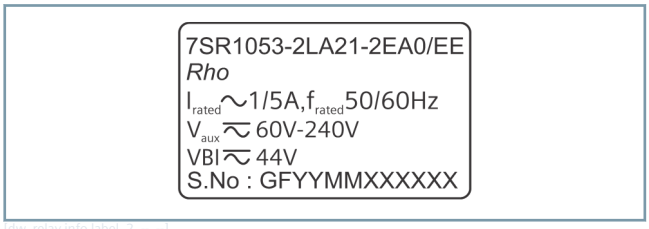
2 dedicated push buttons are provided on the HMI to execute the CB manual close and open operations on the 7SR10 or motor start/stop on the 7SR105.

LCD

A 4 line by 20 character liquid crystal display with power save operation indicates the relay identifier, settings, instrumentation, fault data and control commands. Up to 6 user programmable general alarms can be configured to display your own indications on the LCD.

Relay Information

The device is identified by the rating label on the front fascia. The user can also give the device its own identity by editing the **Relay Identifier** displayed on the LCD.



[dw_relay info label, 2, --]

Figure 2.2/13 Fascia Relay Rating Label

The device terminal label displays the MLFB code, serial number, relay description, terminal contact details, and safety symbols.

	QR code
2	AC 2 kV insulation test of the voltage inputs, current inputs, and binary outputs
5	5 kV impulse voltage test (type test) in compliance with Class III
	Electrical hazard
CE	European CE marking
	Caution, risk of danger Refer to device documentation before operation
	Waste Electrical and Electronic Equipment Directive (WEEE)
EAC	Guideline for the Eurasian Market
	Mandatory Conformity Mark for Electronics and Electrotechnical Products in Morocco
	South Korea KC Certification for Electrical and Electronic Products
UK CA	United Kingdom (UK) Conformity Assessed marking

LEDs

A green steadily illuminated LED indicates the **Protection Healthy** condition. 9 users programmable LEDs are available eliminating the need for expensive panel mounted pilot lights and associated wiring. Each LED is tri-color (red, green, yellow) allowing for clear indication of the associated function's state and has a label for identification.

Password Protection

The relay allows the user to set a 4 character configuration ID (shown as a **Password** in the relay LCD display). If a confirmation ID has already been set, then user must enter the confirmation ID to gain access to the editing mode for setting parameters.

General Alarms

Up to 4 general alarms of 16 characters can be configured to display a text message on the LCD. The general alarms can be triggered from one or more inputs.

Control Mode

The relay has a control menu with access to commonly used command operations. Access to the control commands is restricted by a 4 character control function confirmation ID (shown as a **Password** in the relay LCD display). Each command requires a select then execute operation, if the execute operation is not performed within a time window the command is aborted. The control mode supports the CB operation control function only.

CB Open/Close

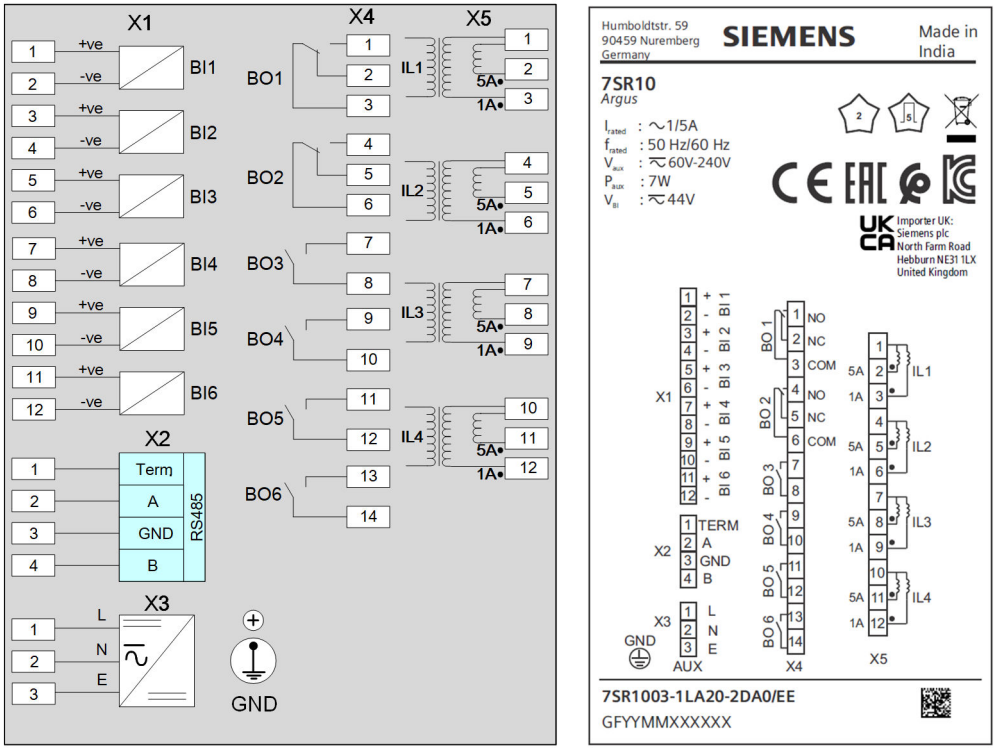
The circuit breaker (CB) control function is used to manually open and close the CB when it is connected to the power system. 2 dedicated push buttons are provided on the HMI to execute the CB manual close and open operations.

Motor Start/Stop

The motor control function is used to manually start and stop the motor when it is connected to the power network. 2 dedicated push buttons are provided on the HMI to execute the motor manual start and stop operations.

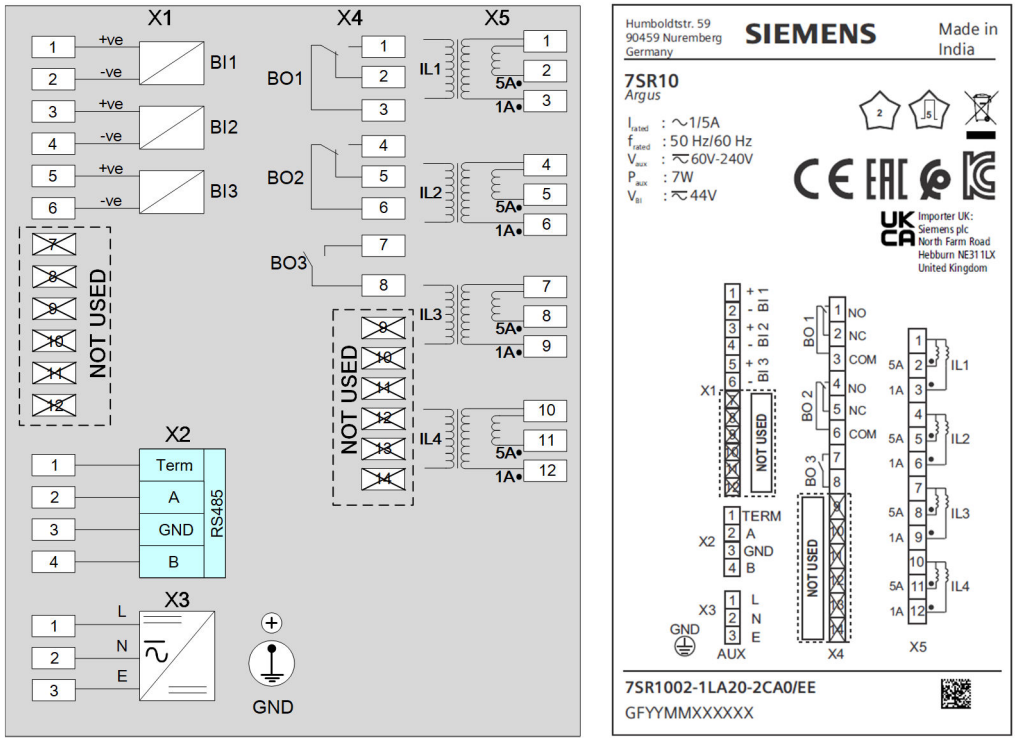
2.2

Connection Diagrams



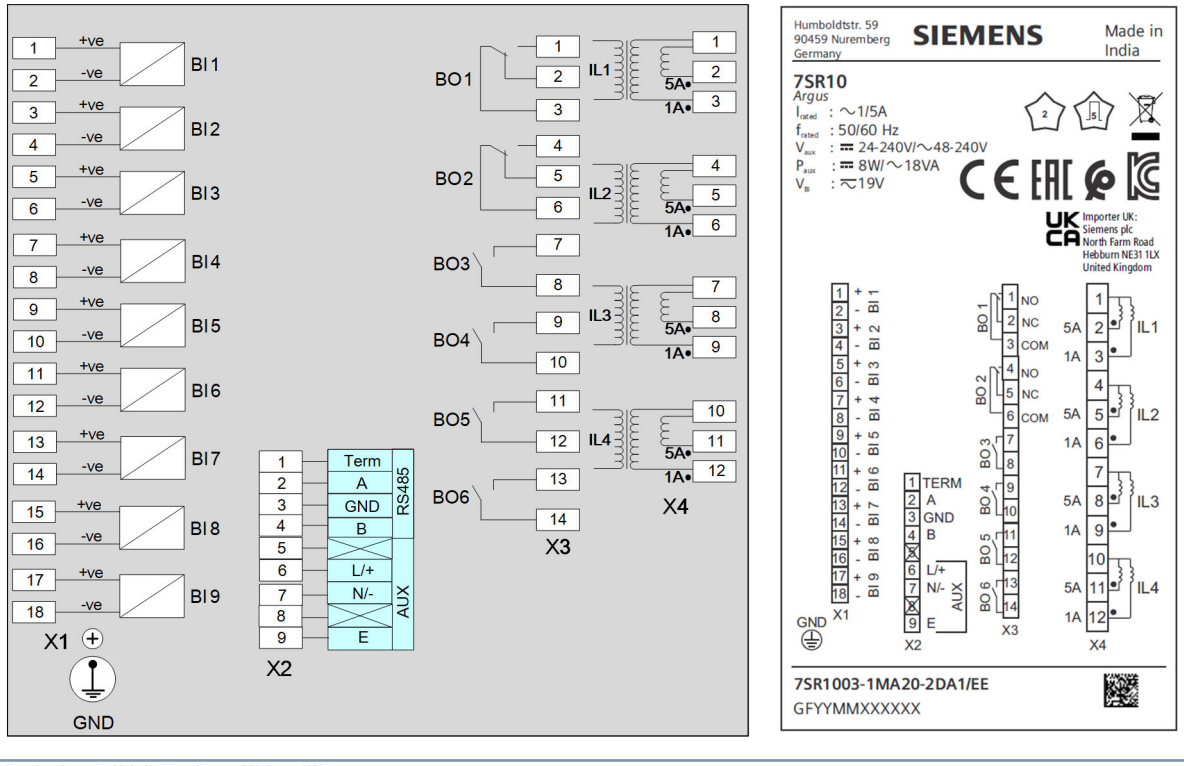
[Io_7SR10 non-directional terminal label/wiring diagram, 8, en_US]

Figure 2.2/14 Terminal/Wiring Diagram of 7SR10 Non-Directional Overcurrent Relay



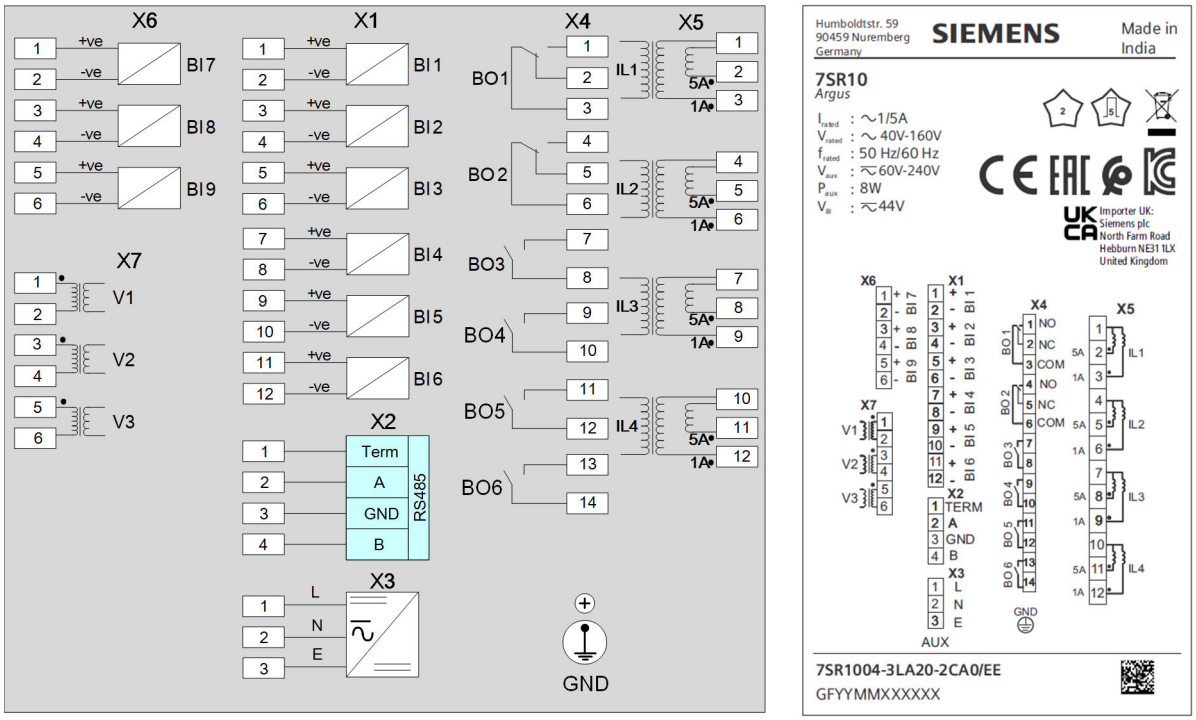
[io_7SR10 non-directional terminal label/wiring diagram3BI-3BO, 2, en_US]

Figure 2.2/15 Terminal/Wiring Diagram of 7SR10 Non-Directional Overcurrent Relay (3 BI, 3 BO)



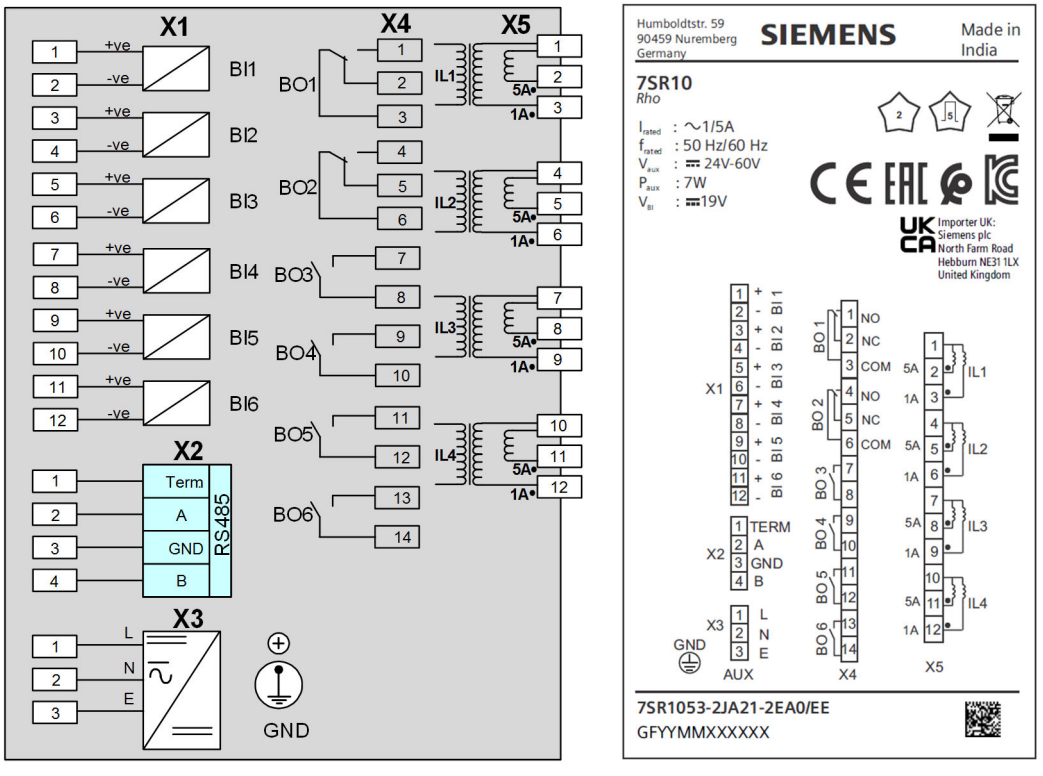
[io_7SR10 non-directional terminal label/wiring diagram9BI, 3, en_US]

Figure 2.2/16 Terminal/Wiring Diagram of 7SR10 Non-Directional Overcurrent Relay, Universal Power Supply



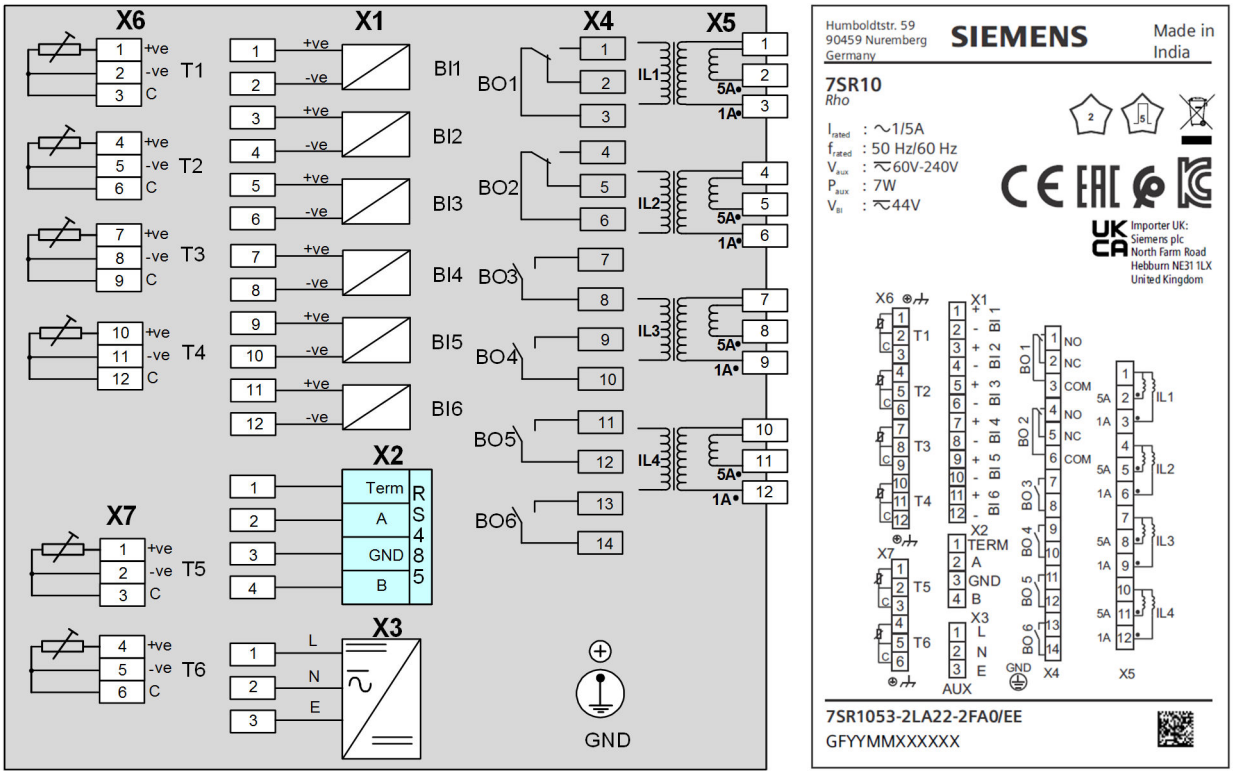
[to_7SR10 directional terminal label/wiring diagram, 7, en_US]

Figure 2.2/17 Terminal/Wiring Diagram of 7SR10 Directional Overcurrent Relay



[to_7SR105 nonRTD terminal label/wiring diagram, 5, en_US]

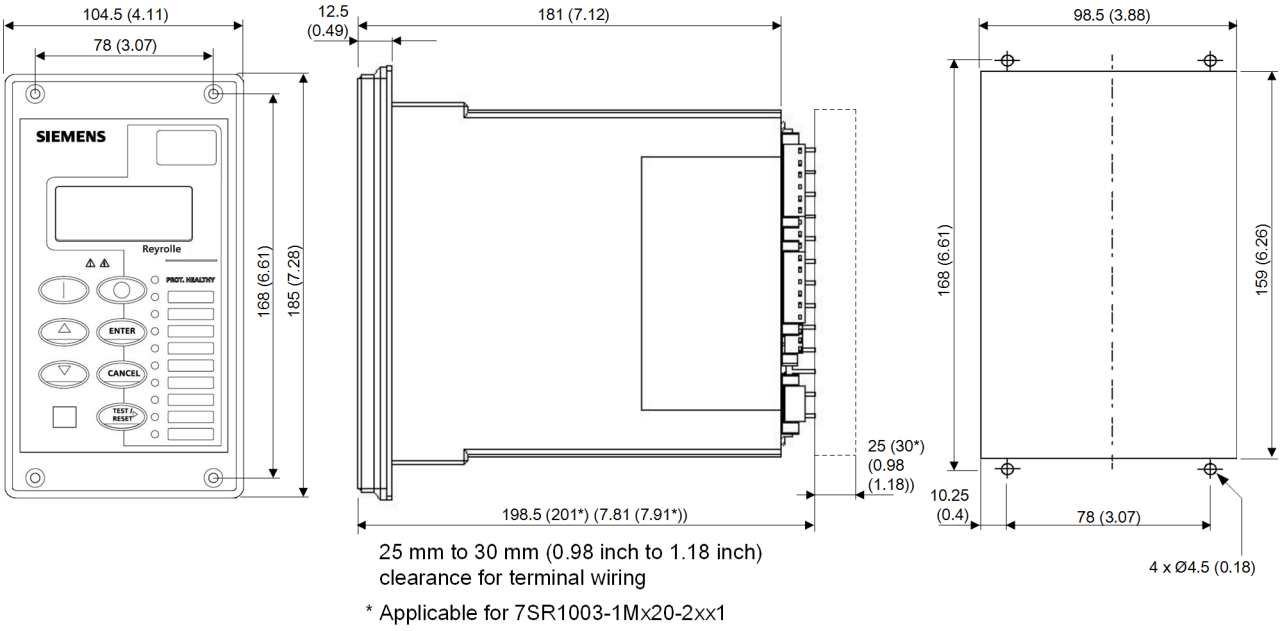
Figure 2.2/18 Terminal/Wiring Diagram of 7SR105 Non-RTD



[Io_7SR105 RTD terminal label/wiring diagram, 5, en_US]

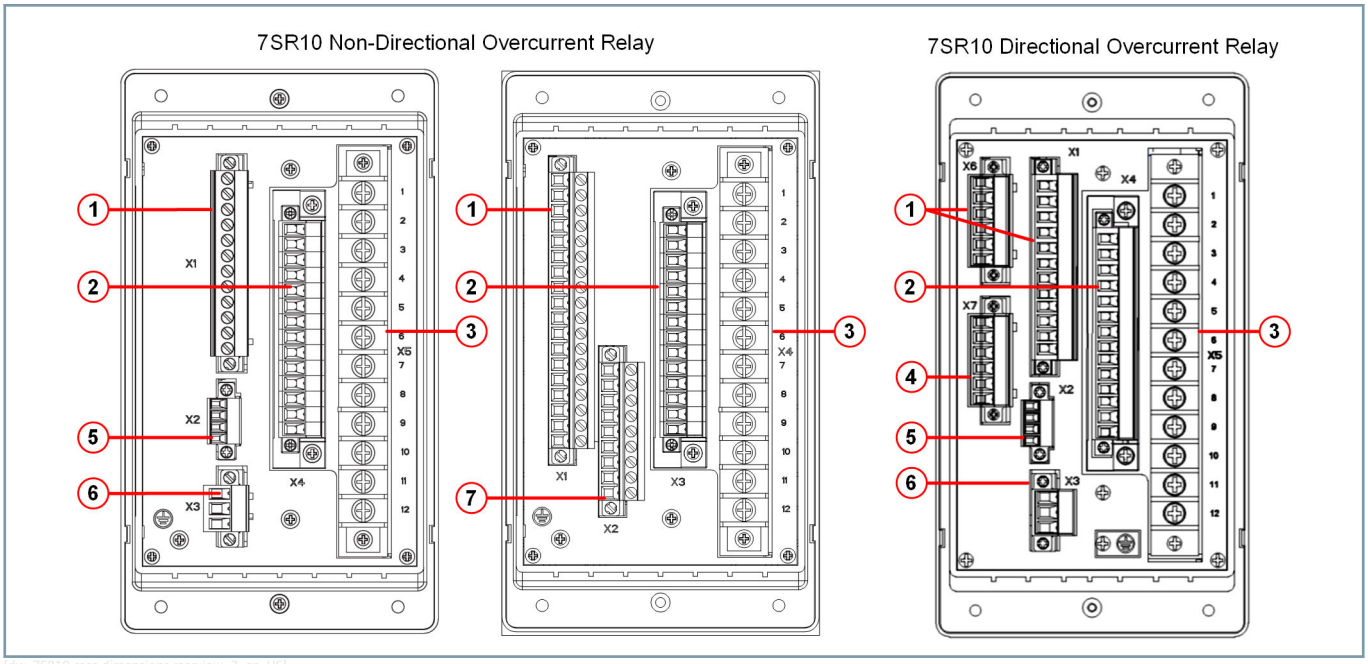
Figure 2.2/19 Terminal/Wiring Diagram of 7SR105 RTD

Dimension Drawings



[dw_7SR10-casedimensions, 1, en_US]

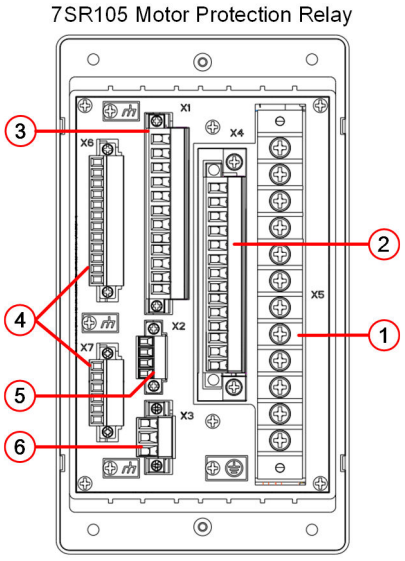
Figure 2.2/20 Front View, Side View and Panel Cut –out View



[dw_7SR10 case dimensions rearview, 3, en_US]

Figure 2.2/21 Rear View – Terminals

(1) Binary inputs
(2) Binary ouputs
(3) Current inputs
(4) Voltage inputs
(5) Rear communication port
(6) Auxiliary power supply
(7) Auxiliary power supply and rear communication port



[dw_7SR105 case dimensions rear view, 6, en_US]

Figure 2.2/22 Rear View – Terminals

(1) Current inputs

(2) Binary outputs

(3) Binary inputs

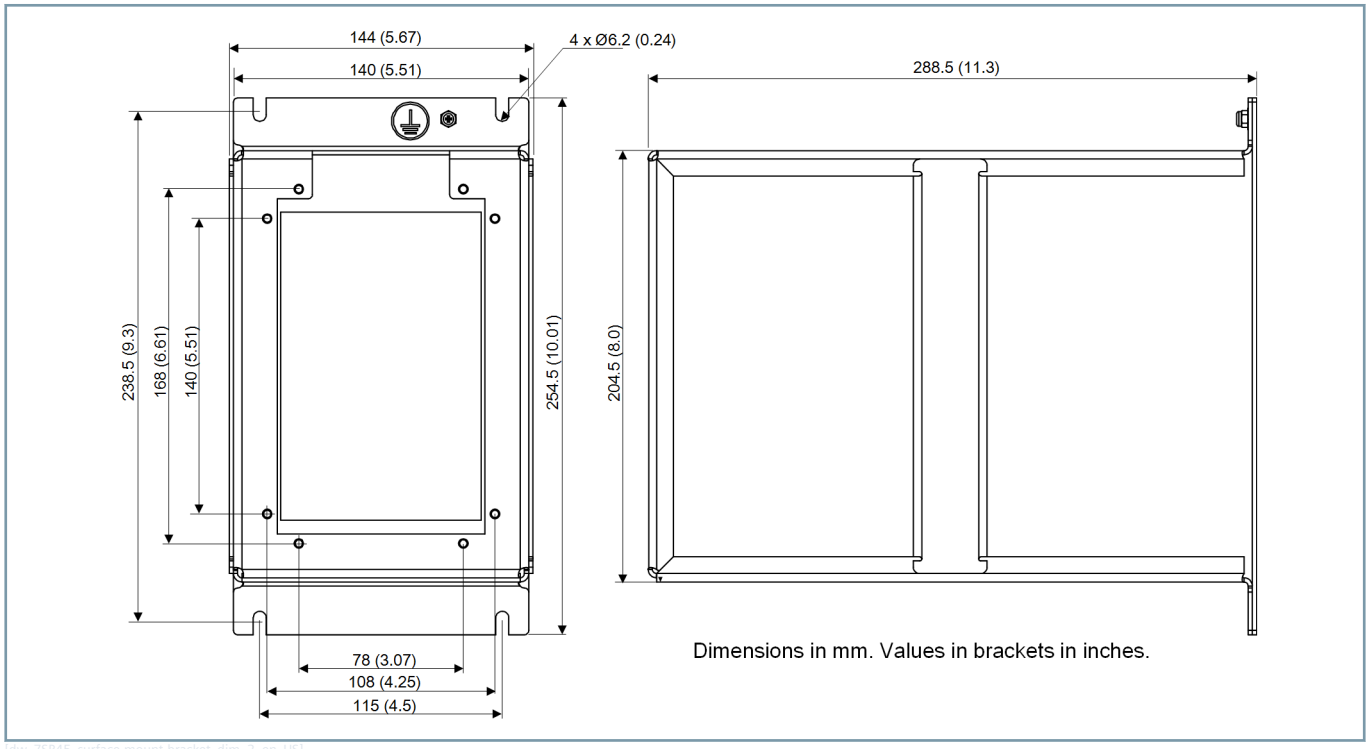
(4) RTD inputs

(5) Rear communication port

(6) Auxiliary power supply

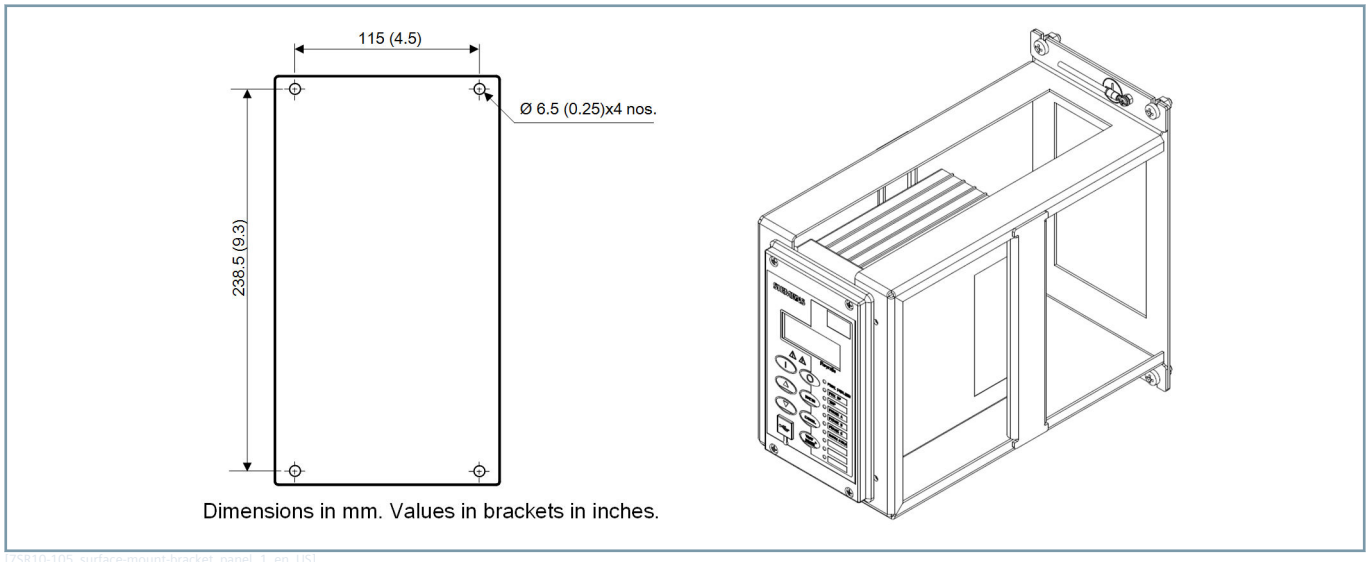
Surface Mounting Bracket Dimensions and Panel Cut-out View

Accessory Variant	Description
7XG1900-0MA55-0FC0	Surface mounting bracket



[dw_7SR45_surface-mount-bracket_dim, 2, en_US]

Figure 2.2/23 Front and Side Views



[7SR10-105_surface-mount-bracket_panel, 1, en_US]

Figure 2.2/24 Mounting Holes for Surface Mount Bracket and Assembled Bracket with 7SR10/7SR105

2.2

Technical Data

For full technical data, refer to the Technical Specification Section of the *7SR10 Operating Manual* and *7SR10 Device Manual*.

Indication of Conformity

This product complies with the directive of the Council of the European Communities on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 2014/30/EU) and concerning electrical equipment for use within specified voltage limits (Low Voltage Directive 2014/35/EU) as well as restriction on usage of hazardous substances in electrical and electronic equipment (RoHS Directive 2011/65/EU).

This conformity has been proved by tests conducted by Siemens AG in accordance of the Council Directive in accordance with the product standard IEC/EN 60255-26 for the EMC directives, and with the standard IEC/EN 60255-27 for the low-voltage directive.

RoHS directive 2011/65/EU is met using the standard IEC/EN 63000. The device has been designed and produced for industrial use.

Technical Data Overview

Product family (Auxiliary powered)	Overcurrent Relay
Case and LEDs	Non draw-out polycarbonate case (size 4 standard, non draw-out design), 10 LEDs
Measuring inputs	1 A/5 A 40 V to 160 V, 50 Hz/60 Hz
Auxiliary voltage	AC/DC 60 V to 240 V DC 24 V to 60 V AC 48 V to 240 V/DC 24 V to 240 V
Communication	Default front communication port Back port: RS485 (optional – IEC 60870-5-103 or Modbus RTU or DNP3)
Protection functions	27, 32, 32S, 37, 37G, 37SEF, 46NPS, 47, 49, 50, 50G, 50N, 50SEF, 50LC, 50GLC, 50SEF LC, 50AFD, 51, 51c, 51G, 51N, 51SEF, 51V, 55, 59, 59N, 64H, 67, 67G, 67N, 67SEF, 81
Supervision and control functions	46BC, 50BF, 60CTS, 60VTS, 74CCS, 74TCS, 79AR, 81HBL2, 81ITHD, 86
Binary input	3 BI or 6 BI or 9 BI
Binary output	3 BO or 6 BO (2 changeover contact)
Overvoltage	Category III
Pollution degree	2

Product family (Auxiliary powered)	Motor Protection Relay
Case and LEDs	Non draw-out polycarbonate case (size 4 standard, non draw-out design), 10 LEDs
Measuring inputs (current)	1 A/5 A, 50 Hz/60 Hz
Auxiliary voltage	AC 60 V to 240 V DC 60 V to 240 V DC 24 V to 60 V
Communication	Default front communication port (IEC 60870-5-103 or Modbus RTU) Rear port: RS485 (optional - IEC 60870-5-103 or Modbus RTU or DNP3)
Protection functions	14, 37, 46, 48, 49, 50, 50G, 50N, 51, 51G, 51N, 66
Supervision and control functions	46PhRev, 50BCL, 50BF, 74CCS, 74TCS, 81B, 86, TEMP
Binary input	6 BI
Binary output	6 BO (2 changeover contact)
Overvoltage	Category III
Pollution degree	2

Mechanical Specifications

Design	Flush mounting, non draw-out polycarbonate moulded case
Enclosure	IP 54 (front panel) IP 20 protection for terminals (rear side) Depth is 199 mm
Weight	1.6 kg (approx)

Terminal Blocks (7SR10 Non-directional Overcurrent Relay)

Current inputs (X5)	Terminal connectivity PIDG series insulated tin plated crimp ring terminal, M3.5 stud size, 2.6 mm^2 to 6.6 mm^2, 12 AWG
Binary outputs (X4)	8 or 14 position, M3 screw-type plug-in terminals suitable for 2.5 mm^2 cable
Binary inputs (X1)	6 or 12 position, M3 screw-type plug-in terminals suitable for 2.5 mm^2 cable
Rear communication port (X2)	4 position, M2 screw-type plug-in terminals suitable for 1.5 mm^2 cable
Auxiliary supply (X3)	3 position, M3 screw-type plug-in terminals suitable for 2.5 mm^2 cable
Ground terminal	Tin plated crimp ring terminal, M3 stud size, 4 mm^2 to 6 mm^2, 12 AWG to 10 AWG, yellow
Front communication port	USB, type B

Terminal Blocks (7SR10 Non-directional Overcurrent Relay, Universal Power Supply)

Current inputs (X4)	Terminal connectivity PIDG series insulated tin plated crimp ring terminal, M3.5 stud size, 2.6 mm^2 to 6.6 mm^2, 12 AWG
Binary outputs (X3)	14 position, M2.5 screw-type plug-in terminals suitable for 2.5 mm^2 cable
Binary inputs (X1)	18 position, M2.5 screw-type plug-in terminals suitable for 2.5 mm^2 cable
Rear communication port and auxiliary power supply (X2)	9 position, M2.5 screw-type plug-in terminals suitable for 2.5 mm^2 cable
Ground terminal	Tin plated crimp ring terminal, M3 stud size, 4 mm^2 to 6 mm^2, 12 AWG to 10 AWG, yellow
Front communication port	USB, type B

Terminal Blocks (7SR10 Directional Overcurrent Relay)

Current inputs (X5)	Terminal connectivity PIDG series insulated tin plated crimp ring terminal, M3.5 stud size, 2.6 mm^2 to 6.6 mm^2, 12 AWG
Binary outputs (X4)	8 or 14 position, M3 screw-type plug-in terminals suitable for 2.5 mm^2 cable
Binary inputs (X1)	6 or 12 position, M3 screw-type plug-in terminals suitable for 2.5 mm^2 cable
Binary inputs (X6)	6 position, M3 screw-type plug-in terminals suitable for 2.5 mm^2 cable
Rear communication port (X2)	4 position, M2 screw-type plug-in terminals suitable for 1.5 mm^2 cable
Auxiliary supply (X3)	3 position, M3 screw-type plug-in terminals suitable for 2.5 mm^2 cable
Ground terminal	Tin plated crimp ring terminal, M3 stud size, 4 mm^2 to 6 mm^2, 12 AWG to 10 AWG, yellow
Front communication port	USB, type B

Terminal Blocks (7SR105 Motor Protection Relay)

Current inputs (X5)	Terminal connectivity PIDG series insulated tin plated crimp ring terminal, M3.5 stud size, 2.6 mm^2 to 6.6 mm^2, 12 AWG
Binary outputs (X4)	8 or 14 position, M3 screw-type plug-in terminals suitable for 2.5 mm^2 cable
Binary inputs (X1)	6 or 12 position, M3 screw-type plug-in terminals suitable for 2.5 mm^2 cable
RTD inputs/Temperature inputs (X6, X7)	Pin type lug/1.5 mm^2 control cable
Rear communication port (X2)	4 position, M2 screw-type plug-in terminals suitable for 1.5 mm^2 cable
Auxiliary supply (X3)	3 position, M3 screw-type plug-in terminals suitable for 2.5 mm^2 cable
Ground terminal	Tin plated crimp ring terminal, M3 stud size, 4 mm^2 to 6 mm^2, 12 AWG to 10 AWG, yellow
Front communication port	USB, type B

Inputs and Outputs

Current Inputs

Quantity	3 x phase and 1 x earth
Rated current I_{rated}	1 A/5 A
Measuring range	80 · I_{rated} 8 · I_{rated} (SEF)
Instrumentation	± 1 % or ± 1 % I_{rated} (0.1 · I_{rated} to 3 · I_{rated}) ± 3 % (> 3 · I_{rated} to 80 · I_{rated}) SEF: ± 1 % (typical) (0.01 · I_{rated} to 0.3 · I_{rated}) ± 3 % (> 0.3 · I_{rated} to 8 · I_{rated})
Rated frequency	50 Hz (range: 47.5 Hz to 52.5 Hz) 60 Hz (range: 57 Hz to 63 Hz)
Thermal withstand [20] Continuous 1 second	 4 · I_{rated} 100 A (1 A) and 350 A (5 A)
Burden @ I_{rated}	≤ 0.3 VA per phase and earth for both 1 A and 5 A

Voltage Inputs

Rated voltage (V_{rated})	40 to 160 V_{RMS}
Operating range	0 to 200 V_{RMS}
Instrumentation ≥ 0.8 · V_{rated}	± 1 % V_{rated}
Burden @ 110 V	Approx 0.06 VA
Overvoltage withstand	300 V_{RMS}

20 ZY20 – Special version with thermal withstand 500 A (5 A CT) for 1 s.

2.2

Auxiliary Supply

Rated auxiliary voltage	AC 60 V to 240 V/DC 60 V to 240 V Tolerance -20 % to +10 %
Allowable super imposed AC component	15 % of DC voltage
Typical power consumption (DC)	< 8 W
Typical power consumption (AC)	< 16 VA (< 7 VA 0.5 PF [21])
Max interruption time (collapse to 0)	≤ 100 ms (DC 110 V) ≤ 1000 ms (AC 230 V)

Auxiliary Supply

Rated voltage	AC 48 V to 240 V/DC 24 V to 240 V Tolerance -20 % to +10 %
Allowable super imposed AC component	15 % of DC voltage
Typical power consumption (DC)	< 8 W
Typical power consumption (AC)	< 18 VA
Max interruption time (collapse to zero)	≤ 50 ms (DC 24 V) ≤ 50 ms (AC 48 V)
Inrush current	74 A at AC 230 V ≤ 200 µS (Applicable only for MFLB 7SR1003-1Mx20-2xx1)

Auxiliary Supply

Rated voltage	DC 24 V to 60 V Tolerance -20 % to +10 %
Allowable super imposed AC component	15 % of DC voltage
Typical power consumption (DC)	< 8 W
Max interruption time (collapse to zero)	20 ms (DC 24 V)

Binary Inputs

Parameter	BI Voltage Rating	BI Operating Range
BI Threshold/Operating range	DC 19 V	DC 19 V to 66 V
	AC 44 V/DC 44 V	AC 36 V to 265 V DC 44 V to 265 V
	AC 71 V/DC 88 V	AC 71 V to 265 V DC 88 V to 265 V
	AC 15 V/ DC 19 V	AC 15 V to 265 V DC 19 V to 265 V
Current for operation (Applicable only for MFLBs 7SR10xx-x[J/K/L]xxx-2xx0)	1.5 mA to 3.5 mA	

Parameter	BI Voltage Rating	BI Operating Range
Current for operation (Applicable only for MFLB 7SR1003-1Mx20-2xx1)	0.65 mA to 2.5 mA	
Pick Up Delay	User selectable 0 to 14,400,000 ms (up to 4 hours)	
Drop Off Delay	User selectable 0 to 14,400,000 ms (up to 4 hours)	
Number of binary inputs	3 or 6 or 9	

For more details about binary inputs, refer to the *7SR10 Operating Manual* and *7SR10 Device Manual*.

DC Performance

Attribute	Value
Reset/operate voltage ratio	≥ 90 %
Response time	< 9 ms
Response time when programmed to energize an output relay contact (i.e. includes output relay operation)	< 20 ms

Binary Outputs

Number	3 or 6 (2 change over contacts)
Operating voltage	Voltage free
Operating mode	User selectable – self or hand/electrical reset or pulsed
Operating time from energizing binary input	< 20 ms
Making capacity	Carry continuously: AC 5 A/DC 5 A
	Make and carry: AC 30 A/DC 30 A for 0.5 s
Making capacity (L/R ≤ 40 ms)	1000 W
Breaking capacity: (≤ 5 A and ≤ 300 V): AC resistive AC inductive DC resistive DC inductive	 1250 VA 250 VA at PF ≤ 0.4 75 W 30 W at L/R ≤ 40 ms 50 W at L/R ≤ 10 ms
Disengaging time	< 20 ms

Temperature Inputs (7SR105)

Number	6
Measuring range	-50 °C to +250 °C 100 % T_{set}, ±2 % or ±2 °C For Cu10: ±2 % or ±5 °C
Response time	< 3 s
Sensing current	< 0.5 mA

21 7SR105 only

Rear Communication Port

Quantity	1 no. (optional)
Electrical connection	RS485, 2 wire electrical
Protocol support	MODBUS RTU, IEC 60870-5-103, DNP3
Rate	Data transfer rate: 75 Bit/s to 38400 Bit/s

Front Communication Port

Quantity	1 no.
Electrical connection	USB, type B

Data Storage

Fault record	100 (non-directional and directional relay, motor protection relay)
Waveform record	15 rec · 1 s 7 rec · 2 s 3 rec · 5 s 1 rec · 15 s Pre trigger 10 to 90 %
Events	1000 events (1 ms resolution)

Mechanical Tests

Test	Standard
Degree of protection	IEC 60529 IP 54 front IP 20 rear
Vibration	IEC 60255-21-1 Response and endurance, class 1
Shock and bump	IEC 60255-21-2 Shock response and withstand, class 1 Bump, class 1
Seismic	IEC 60255-21-3, class 1
Contact	IEC 60255-1 (Ref: std IEC 61810-1)
Electrical endurance test	IEC 60255-1 (Ref: std IEC 61810-1) (10000 operations at 250 V, 5 A)

Electrical Tests

Test	Standard
Insulation resistance	IEC 60255-27 [22] DC 500 V, > 100 MΩ
Impulse voltage withstand	IEC 60255-27 [22] 5 kV, 5 +ve, -ve pulses
AC dielectric voltage	IEC 60255-27 [22] 2 kV RMS @1 min (Between any terminal and earth, independent circuits) AC 1 kV_{RMS} for 1 min (across normally open contacts)
Slow damped oscillatory wave	IEC 60255-26 **Common-mode:** Test voltage: 2.5 kV peak voltage **Differential-mode:** Test voltage: 1.0 kV peak voltage Voltage oscillation frequency: 1 MHz Repetition frequency: 400 Hz
Electrostatic discharge	IEC 60255-26 8 kV air discharge 6 kV contact discharge
Electrical fast transient or burst [23]	IEC 60255-26 Zone A Test severity amplitude: ± 4 kV Repetition frequency: 5 kHz
Surge immunity [23]	IEC 60255-26 Test level: zone A Line to line: 0.5, 1, 2 kV Line to earth: 0.5, 1, 2, 4 kV Front time/time to half-value: 1.2/50 µs Source impedance: 2 Ω
Radiated immunity	IEC 60255-26 80 MHz to 1.0 GHz and 1.4 GHz to 2.7 GHz Both frequency at 10 V/m
Conducted radio frequency interference	IEC 60255-26 150 kHz to 80 MHz 10 V_{RMS}
Power frequency magnetic field	IEC 60255-26 30 A/m applied 1 min, 300 A/m applied for 3 s [24]

22 All aspect of IEC 60255-5 have been covered under IEC 60255-27

23 60 ms [MLFBs 7SR10xx-x[J/K/L]xxx-2xx0] or 100 ms [MLFB 7SR1003-1Mx20-2xx1] DTL pick-up delay applied to binary inputs

24 5 % · I_{rated} additional tolerance needs to be considered for SEF CT

Test	Standard
Conducted emissions	IEC 60255-26
Radiated emissions	IEC 60255-26
Thermal withstand Continuous 1 s	IEC 60255-27 $4 \cdot I_{rated}$ 100 A (1 A) 350 A (5 A) [25]
Burden (at 1 A and 5 A)	IEC 60255-1 ≤ 0.3 VA per phase and earth
Functional	IEC 60255-1 IEC 60255-12 IEC 60255-127 IEC 60255-149 IEC 60255-151
Maximum allowable temperature	IEC 60255-6 Max. temperature limit +100 °C
Limiting dynamic value	10 ms 700 A peak AC (1 A) and 2500 A peak AC (5 A)
Gradual shutdown/start-up test	IEC 60255-26 Shut down/start up ramp 60 s Power off 5 min
Power frequency immunity test[26]	IEC 60255-26 **Common-mode:** • Test voltage: 300 V • Coupling resistor: 220 Ω • Coupling capacitor: 0.47 µF

Climatic Environmental Tests

Temperature

IEC 60068-2-1/IEC 60068-2-2/IEC 60255-1

Operating temperature range	-10 °C to +60 °C (continuous)
Permissible temporary service temperature range (tested for 16 h)	-40 °C to +70 °C [27],[28]

Humidity

IEC 60068-2-30/IEC 60068-2-78/IEC 60255-1

Damp heat test, cyclic	6 days at 25 °C to 40 °C (12 h + 12 h cycle) and 93 % relative humidity
Damp heat test, steady state	10 days at 95 % RH, +40 °C
Maximum altitude of operation	Up to 2000 m

Corrosion Test

IEC 60068-2-60:2015 (Method 4)

Mixed gas corrosion test (Environment condition as per ISA 71.04: 2013 G3)	H_2S 10 ppb, NO_2 200 ppb, Cl_2 10 ppb and SO_2 200 ppb

Product Safety Test

IEC/EN 60255-27

Type Test	Parameters	Values
Clearances and creepage distances	Clearances and creepage distances between external circuits mutual and to the enclosure	≥ 4 mm
Protective bonding resistance	Test voltage: < AC 12 V/DC 12 V Test duration: 1 min Bonding resistance	 < 0.1 Ω
Protective bonding continuity	Accessible conductive parts should be bonded with the protective conductor terminal	Low current continuity test
Flammability of insulating materials, components and fire enclosures	Structure part Terminals Terminal mounting Wiring (CT) Components mounting Enclosure PCB LCD	Standard for insulating material of flammability class Class UL 94 V-0 Class UL 94 V-0 (N)2GFAF (VDE) Class UL 94 V-0 Class UL 94 V-0 Class UL 94 V-0 Class UL 94 V-0
Single fault condition	Assessment of: • Insulation between circuits and parts • Compliance with requirements for protection against the spread of fire • Overloads • Intermittently rated resistors • Compliance with requirements for mechanical protection	The equipment shall not present a risk of electric shock or fire after a single-fault test.

25 ZY20 – Special version with thermal withstand 500 A (5 A CT) for 1 s

26 DC binary input ports interfacing with cables whose total length is more than 10 m, need to have a multi core twisted screened cable for providing immunity against high level of power frequency interferences.

27 Outside the operating-temperature range, the characters of the LCD display are not clearly visible and there is degradation in MTBF.

28 Temporary deviation of VT accuracies and intermittent loss in communication beyond the lower temperature limit (-10 °C)

IEC/EN 61010-1

Test Description	Applicable Clause Number
Marking and documentation	5
Protection against electric shock	6
Protection against mechanical hazard	7
Resistance to mechanical stresses (shock and impact)	8
Protection against the spread of fire	9
Equipment temperature limits and resistance to heat	10
Protection against liberated gases and substances, explosion and implosion	13
Components and sub assemblies	14
Hazards resulting from application	16
Risk assessment	17

Performance

14 Locked Rotor Protection

Number of elements	4
Setting range I_{set}	0.05 to 10 · I_{rated}
Time delay	0.00 to 14400 s
Operate level	100 % I_{set} ± 5 % or ± 1 % · I_{rated}
Operate time 2 · I_{set} 5 · I_{set}	 35 ms ± 10 ms 25 ms ± 10 ms
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms
Control	Stopped, no acceleration, running, none
Disengaging time	< 50 ms

27 Undervoltage Protection – 3-Phase/59 Overvoltage Protection – 3 Phase

Number of elements	4 (under or over)
Operate	Any phase or all phases
Voltage guard V_g	1 to 200 V
Setting range V_{set}	5 to 200 V
Hysteresis setting	0 to 80 %
Operate level V_{set}	100 % V_{set}, ± 1 % or ± 0.25 V
Reset level: Overvoltage Undervoltage	 = (100 % - hysteresis) · V_{op}, ± 1 % = (100 % + hysteresis) · V_{op}, ± 1 %
Delay setting t_{delay}	0.00, 0.01 to 20, 20.5 to 100, 101 to 1000, 1010 to 10000, 10100 to 14400 s
Basic operate time: 0 to 1.1 · V_{set} (over) 0 to 2.0 · V_{set} (over) 1.1 to 0.5 · V_{set} (under)	 73 ms ± 10 ms 63 ms ± 10 ms 58 ms ± 10 ms
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms
Inhibited by	Binary or virtual Input VT supervision Voltage guard

32 Power Protection

Number of elements	2 forward or reverse
Operate	P, Q or S
U/C guard	0.05 to 1.0 · I_{rated}
Setting range S_{set}	0.05 to 2.0 · S_{rated}
Operate level S_{op}	100 % S_{set}, ± 5 % or ± 2 % S_{rated}
Reset level	≥ 95 % S_{op}
Basic operate time: 1.1 · S_{set} (over) 2.0 · S_{set} (over) 0.5 · S_{set} (under)	 60 ms ± 10 ms 45 ms ± 10 ms 30 ms ± 10 ms
Delay setting t_{delay}	0 s to 14400 s
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms
Inhibited by	Undercurrent guard, VTS, binary or virtual input

32S Sensitive Power Protection

Number of elements	2 forward or reverse
Operate	P, Q or S
U/C guard	0.005 to 1.0 · I_{rated}
Setting range S_{set}	0.005 to 2.0 · S_{rated}
Operate level	100 % S_{set}, ± 5 % or ± 2 % S_{rated}
Reset level	≥ 95 % S_{op}
Basic operate time: 1.1 · S_{set} (over) 2.0 · S_{set} (over) 0.5 · S_{set} (under)	 60 ms ± 10 ms 45 ms ± 10 ms 30 ms ± 10 ms
Delay setting t_{delay}	0 s to 14400 s
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms
Inhibited by	Undercurrent guard, VTS, binary or virtual input

37 Undercurrent Protection – Phase

Number of elements	2 element
Operate	Any phase or all
Setting range I_{set}	0.05 to 5.0 · I_{rated}
Operate level	100 % I_{set}, ± 5 % or ± 1 % · I_{rated}

Reset level	≤ 105 % I_{op}
Current guard	0.05 to 5.0 · I_{rated}
Delay setting t_{delay}	0.00, 0.01 to 20, 20.5 to 100, 101 to 1000, 1010 to 10000, 10100 to 14400 s
Basic operate time: 1.1 to 0.5 · I_{rated}	 35 ms ± 10 ms
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms
Overshoot time	< 40 ms
Inhibited by	Binary or virtual input

37G Undercurrent Earth Fault - Measured

Number of elements	2 element
Setting range I_{set}	0.05 to 5.0 · I_{rated}
Operate level	100 % I_{set}, ± 5 % or ± 1 % · I_{rated}
Reset level	≤ 105 % I_{op}
Delay setting t_{delay}	0.00, 0.01 to 20, 20.5 to 100, 101 to 1000, 1010 to 10000, 10100 to 14400 s
Basic operate time: 1.1 to 0.5 · I_{rated}	 35 ms ± 10 ms
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms
Overshoot time	< 40 ms
Inhibited by	Binary or virtual input

37SEF Undercurrent Earth Fault – sensitive

Number of elements	2 element
Setting range I_{set}	0.005 to 5.0 · I_{rated}
Operate level	100 % I_{set}, ± 5 % or ± 1 % · I_{rated}
Reset level	≤ 105 % I_{op}
Delay setting t_{delay}	0.00, 0.01 to 20, 20.5 to 100, 101 to 1000, 1010 to 10000, 10100 to 14400 s
Basic operate time: 1.1 to 0.5 · I_{rated}	 35 ms ± 10 ms
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms
Overshoot time	< 40 ms
Inhibited by	Binary or virtual input

46 Phase Unbalance Protection

Number of elements	1 (magnitude difference or NPS)
Setting range I_{set}	0.1 to 0.4 · θ
Operate level	100 % I_{set}, ± 5 % or ± 1 % · I_{rated}
IT min. operate time	0 to 20 s
DT delay setting t_{delay}	0 to 20 s
DT basic operate time for NPS 2 · I_{set} 5 · I_{set}	 65 ms ± 10 ms 60 ms ± 10 ms
DT basic operate time for magnitude 2 · I_{set} 5 · I_{set}	 60 ms ± 10 ms 50 ms ± 10 ms
DT operate time following delay	t_{delay} ± 1 % or ± 30 ms
Tm time multiplier	0.025 to 2.0
Disengaging time	< 80 ms
Inhibited by	Binary or virtual input

46BC Broken Conductor Protection

46BC setting, NPS to PPS ratio	20 to 100 %	
Delay setting t_{delay}	0.03, 04, 20.0, 20.1, 100, 101, 1000, 1010 to 14400 s	
Operate level I_{op}	100 % I_{set} ± 5 % or 1 % of I_{rated}	
Reset level	90 % I_{op} ± 5 %	
Basic operate time t_{basic}	1 · I_{rated} to 0 A	40 ms
Operate time	t_{delay} + t_{basic} , ± 1 % or ± 20 ms	

46NPS Negative Sequence Overcurrent Protection

Number of elements	DT & IT
DT setting range I_{set}	0.05 to 4.0 · I_{rated}
DT operate level	100 % I_{set}, ± 5 % or ± 1 % · I_{rated}
DT delay setting t_{delay}	0.00, 0.01 to 20, 20.5 to 100,101 to 1000, 1010 to 10000, 10100 to 14400 s
DT basic operate time 0 to 2 · I_{set} 0 to 5 · I_{set}	 40 ms ± 10 ms 30 ms ± 10 ms
DT operate time following delay	t_{basic} +t_{delay} , ± 1 % or ± 10 ms
IT char setting	IEC NI,VI,EI,LTI, ANSI MI,VI,EI & DTL
IT setting range	0.05 to 2.5
Tm time multiplier	0.025, 0.030 to 1.6, 1.7 to 5, 6 to 100
Char operate level	105 % I_{set}, ± 4 % or ± 1 % I_{rated}
Overshoot time	< 40 ms
Inhibited by	Binary or virtual input

46PhRev Phase Reversal

NPS to PPS ratio	20 to 100 %
Delay setting	0 to 14400 s
Operate level	100 % I_{set} ± 5 %
Reset level	> 85 % I_{op}
Basic operate time	1 · I_{rated} to 0 A (60 ms)
Operate time	t_{basic} + t_{delay}, ± 1 % or ± 20 ms

47NPS Sequence Overvoltage Protection

Number of elements	2
Setting range V_{set}	1 to 90 V
Hysteresis setting	0 to 80 %
Operate level	100 % V_{set}, ± 2 % or ± 0.5 V
Delay setting t_{delay}	0.00, 0.01 to 20, 20.5 to 100, 101 to 1000, 1010 to 10000, 10100 to 14400 s
Basic operate time: 0 V to 1.5 · V_{set} 0 V to 10 · V_{set}	 80 ms ± 20 ms 55 ms ± 20 ms
Operate time following delay	t_{basic} + t_{delay} , ± 2 % or ± 20 ms
Overshoot time	< 40 ms
Inhibited by	Binary or virtual input, voltage guard

48 Starting-Time Supervision

Max. no. of starts	OFF, 1 to 20
Max. starts period	1 min to 60 min
Start inhibit delay	1 min to 60 min
Time between starts	OFF, 1 min to 60 min

49 Thermal Overload Protection (7SR10)

Operate levels	Operate and alarm
Setting range I_{set}	0.10 to 3.0 · I_{rated}
Operate level	100 % I_{set}, ± 5 % or ± 1 % · I_{rated}
Time constant setting	1 min to 1000 min
Operate time (minutes)	$t = \tau \cdot I_n \left[\frac{I^2 - I_{pre-load}^2}{I^2 - (k \cdot I_B)^2}\right]$ t = Time in minutes τ = 49 Time Constant setting (minutes) I = Measured thermal current I_n = Log natural I_P = Previous steady state current level/pre-load k = Constant (predefined, k = 1.05) I_B = Basic current, typically same as I_n k.I_B = 49 Overload Setting (I_θ)
Alarm level	Disabled, 50 to 100 %
Inhibited by	Binary or virtual input

49 Thermal Overload Protection (7SR105)

Operate levels	Operate and alarm
Setting range I_{set}	0.10 to 3.0 · I_{rated}
NPS weighting factor (K)	0.1 to 10.0 Δ 0.1
Tauh heating constant	0.5 min to 1000 min, Δ 0.5 min
Taus starting constant	0.005 to 1.0 · Tauh , Δ 0.005
Tauc cooling constant	1 to 100 · Tauh , Δ 1
Hot/cold ratio	OFF, 1 to 100 %, Δ 1 %
Operate level	100 % I_{set}, ± 5 % or ± 1 % · I_{rated}
Time constant setting	1 min to 1000 min
Operate time (minutes)	$t = \tau \cdot \ln\left[\frac{I_{equiv}^2 - \left(1 - \frac{H}{C}\right) I_{pre-load}^2}{I_{equiv}^2 - I_\theta^2}\right]$ t ± 5 % or ± 100 ms (Iθ: 0.3 to 3 · I_{rated} $I_{equiv} = \sqrt{I_1^2 + kI_2^2}$ τ = Thermal heating time constant (49 Tauh - heating constant or 49 Taus - starting constant) $\frac{H}{C}$ = Hot/cold ratio setting I_1 = Positive phase sequence current I_2 = Negative phase sequence current I_{equiv} = Equivalent heating current $I_{pre-load}$ = Pre-load current I_θ = Thermal overload setting current K = NPS weighting factor ln = Natural logarithm
Capacity alarm level	Disabled, 50 to 100 %
Load alarm level	OFF, 0.5 to 1.0 · Iθ, Δ 0.05
Thermal restart inhibit	20 to 100 %, Δ 1 %
Inhibited by	Binary or virtual input

50 Instantaneous Overcurrent – Phase / 67 Directional Overcurrent – Phase

Operation	Non-directional, forward and reverse
Elements	Phase fault
Setting range I_{set} (50)	0.05 to 50 · I_{rated}
Time delay	0.00 to 14400 s
Operate level I_{op}	100 % I_{set}, ± 5 % or ± 1 % · I_{rated}
Reset level	≥ 95 % I_{op}
Operate time	0 to 2 · I_{set} - 35 ms, ± 10 ms 0 to 5 · I_{set} - 25 ms, ± 10 ms
Directional (67)	Typically 32 ms, < 40 ms at characteristic angle + 50 element operate time

Operate time following delay	$t_{basic} + t_{delay}$, ± 1 % or ± 10 ms
Inhibited by	Binary or virtual input Inrush detector VT supervision

50AFD Arc Flash Detection

Setting	1 to 10 · I_{rated}
Operate level (no DC transient) I_{op}	100 % I_{set}, ± 10 %
Reset level	≥ 95 % I_{op}
Repeatability	± 5 %
50AFD Overcurrent operate time t_{basic}	10 ms to 16 ms
AFD Zone Operate time (Flash and 50AFD) t_{op}	15 ms to 25 ms
Repeatability	± 10 ms
Disengaging time	< 50 ms

50BCL Break Capacity Limit

Setting	1.0 to 50 · I_{rated}
Operate level	100 % I_{set}, ± 5 % or ± 1 % I_{rated}
Reset level	≥ 95 % I_{op}
Element basic operate time	0 to 2 · I_{set}: 20 ms or ± 10 ms 0 to 5 · I_{set}: 15 ms or ± 10 ms

50BF Circuit-Breaker Failure Protection – 3-Pole

Operation	Current check – phase and measured earth with independent settings Mechanical trip CB faulty monitor
Setting range I_{set}	0.05 to 2.0 · I_{rated}
2 stage time delays	Timer 1: 20 to 60000 ms Timer 2: 20 to 60000 ms
Operate level	100 % I_{set}, ± 5 % or ± 1 % · I_{rated}
Disengaging time	< 20 ms
Operate time following delay	Tcbf ± 1 % or ± 20 ms
Triggered by	Any function mapped as trip contact
Inhibited by	Binary/virtual input
Timer by pass	Yes, 50BF CB faulty input

50G Instantaneous Earth Fault – Measured / 67G Directional Earth Fault – Measured

Operation	Non-directional, forward and reverse
Elements	Measured earth fault
Setting range I_{set} (50G)	0.05 to 50 · I_{rated}
Time delay	0.00 to 14400 s
Operate level I_{op}	100 % I_{set}, ± 5 % or ± 1 % · I_{rated}
Reset level	≥ 95 % I_{op}
Operate time	0 to 2 · I_{set} - 35 ms, ± 10 ms 0 to 5 · I_{set} - 25 ms, ± 10 ms
Directional (67G)	Typically 32 ms, < 40 ms at characteristic angle + 50G element operate time
Operate time following delay	$t_{basic} + t_{delay}$, ± 1 % or ± 10 ms
Inhibited by	Binary or virtual input Inrush detector VT supervision

50LC Line Check / 50GLC Line-Check Overcurrent Protection

Setting I_{set}	0.05 to 50 · I_{rated}
Delay setting t_{delay}	0.00 to 14400 s
Operate level I_{op}	100 % I_{set}, ± 5 % or ± 1 % I_{rated}
Reset level Repeatability	≥ 95 % I_{op} ± 1 %
Element basic operate time t_{basic} [29]	0 to 2 · I_{set}: 35 ms, ± 10 ms 0 to 5 · I_{set}: 25 ms, ± 10 ms
Operate time following delay t_{op} [29]	$t_{basic} + t_{delay}$, ± 1 % or ± 10 ms
Repeatability	± 1 % or ± 10 ms
Overshoot time	< 40 ms
Disengaging time	< 50 ms

50N Instantaneous Earth Fault – Calculated / 67N Directional Earth Fault – Calculated

Operation	Non-directional, forward and reverse
Elements	Derived earth fault
Setting range I_{set} (50N)	0.05 to 50 · I_{rated}
Time delay	0.00 to 14400 s
Operate level I_{op}	100 % I_{set}, ± 5 % or ± 1 % · I_{rated}
Reset level	≥ 95 % I_{op}
Operate time	0 to 2 · I_{set} - 40 ms, ± 10 ms 0 to 5 · I_{set} - 30 ms, ± 10 ms
Directional (67N)	Typically 32 ms, < 40 ms at characteristic angle + 50N element operate time
Operate time following delay	$t_{basic} + t_{delay}$, ± 1 % or ± 10 ms
Inhibited by	Binary or virtual input Inrush detection VT supervision

29 Additional 9 ms to be considered when binary input is used for initiating 50LC.

50SEF Instantaneous Sensitive Earth Fault – Measured / 67SEF Directional Sensitive Earth Fault – Measured

Operation	Non-directional, forward and reverse
Elements	Sensitive earth fault
Setting range I_{set} (50SEF)	0.005 to 5 · I_{rated}
	0.005 to 1.6 · I_{rated} [30]
Time delay	0.00 to 14400 s
Operate level I_{op}	100 % I_{set}, ± 5 % or ± 1 % · I_{rated}
Reset level (50SEF)	≥ 95 % I_{op} or I_{op} - 0.1 % · I_{rated}
Operate time	0 to 2 · I_{set} - 35 ms, ± 10 ms
	0 to 5 · I_{set} - 25 ms, ± 10 ms
Operate time (67SEF)	Typically 32 ms, < 40 ms at characteristic angle + 50SEF element operate time
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms
Inhibited by	Binary or virtual input
	Inrush detector
	VT supervision
Directional SEF – Wattmetric	
Setting (P_o)	0.05 to 20 · I_{rated} · W (where I_{rated} = 1 A or 5 A)
Operate level (P_{op})	100 % P_o, ± 25 % or ± 25 mW
Reset level	≥ 90 % P_{op}
Element basic operate time t_{basic}	< 50 ms
Repeatability	± 1 % or ± 10 ms

67SEF Directional Sensitive Earth Fault – Measured 3V0/I0, φ

Setting range I_{set}	0.01 to 0.5 · I_{rated}
Elements	Sensitive earth fault for resonant and isolated networks
Characteristic angle (CA)	-180° to +180°
Operating angle (OA)	0° to 180°
Operate level	100 % I_{set}, ± 5 % or 1 mA for I_{rated}= 1 A
	100 % I_{set}, ± 5 % or 5 mA for I_{rated}= 5 A
Reset level	≥ 90 % I_{op}
Operating angle accuracy (forward)	CA+OA±3° to CA-OA±3°
Non-directional element operating time	0 to 2 · I_{set} - 35 ms, ± 10 ms
	0 to 5 · I_{set} - 25 ms, ± 10 ms
Directional element operate time t_{basic}	Typically 35 ms, < 50 ms at characteristic angle + non-directional element operate time
Operate time following delay	t_{basic} + t_{delay} , ± 1 % or ± 10 ms
Reset time	< 100 ms

50SEFLC Line Check Sensitive Earth Fault – Measured

Setting range I_{set}	0.005 to 5 · I_{rated}
	0.005 to 1.6 · I_{rated} [31]
Delay setting t_{delay}	0.00 to 14400 s
Operate level I_{op}	100 % I_{set}, ± 5 % or ± 1 % I_{rated}
Reset level	≥ 95 % I_{op} or I_{op} - 0.1 % I_{rated}
Repeatability	± 1 %
Element basic operate time t_{basic}	0 to 2 · I_{set}: 35 ms, ± 10 ms
	0 to 5 · I_{set}: 25 ms, ± 10 ms
Operate time following delay t_{op}	t_{basic} + t_{delay} , ± 1 % or ± 10 ms
Repeatability	± 1 % or ± 10 ms
Overshoot time	< 40 ms
Disengaging time	< 50 ms

51 Time-Delayed Overcurrent – Phase / 67 Directional Overcurrent – Phase

Operation	Non-directional, forward and reverse
Elements	Phase fault
Characteristic	IEC-NI, -VI, -EI, -LTI; ANSI-MI, -VI, -EI; DTL
Setting range I_{set} (51)	0.05 to 4 · I_{rated}
Time multiplier	0.01, 0.015 to 1.6, 1.7 to 5, 6 to 100
Time delay	0 to 20 s
Operate level	105 % I_{set}, ± 4 % or ± 1 % · I_{rated}
Operate time IEC	$t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1}\right] \cdot Tm$
ANSI	$t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^{P} - 1} + B\right] \cdot Tm$
Reset time IEC and ANSI Decaying curve	$t_{res} = \left[\frac{R}{\left\{1 - \left(\frac{I}{I_{set}}\right)^{2}\right\}}\right] \cdot Tm$
Directional (67)	± 5 % or absolute ± 40 ms for TMS setting (0.01 to 0.245)
	± 5 % or absolute ± 30 ms for TMS setting (0.25 to 100)
	Typically 32, < 40 ms at characteristic angle + 51 element operate time
Follower delay	0 s to 20 s

30 Applicable for MLFB 7SR1004-5-20-2CAO

31 Applicable for MLFB 7SR1004-5-20-2CAO

Reset	ANSI decaying, 0 s to 60 s
Inhibited by	Binary or virtual input Inrush detector VT supervision

51G Time-Delayed Earth Fault – Measured / 67G Directional Earth Fault – Measured

Operation	Non-directional, forward and reverse
Elements	Measured earth fault
Characteristic	IEC-NI, -VI, -EI, -LTI; ANSI-MI, -VI, -EI; DTL
Setting range I_{set} (51G)	0.05 to 4 · I_{rated}(7SR10) 0.01 to 0.5 · I_{rated}(7SR105)
Time multiplier	0.01, 0.015 to 1.6, 1.7 to 5, 6 to 100
Time delay	0 to 20 s
Operate level	105 % I_{set}, ± 4 % or ± 1 % · I_{rated}
Operate time IEC ANSI	$t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1}\right] \cdot Tm$ $t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^{P} - 1} + B\right] \cdot Tm$
Reset time IEC ANSI	$t_{res} = \left[\frac{R}{\left\{1 - \left(\frac{I}{I_{set}}\right)^{2}\right\}}\right] \cdot Tm$ $t_{res} = \left[\frac{R}{\left\{1 - \left(\frac{I}{I_{set}}\right)^{2}\right\}}\right] \cdot Tm$
Directional (67G)	± 5 % or absolute ± 40 ms for TMS setting (0.01 to 0.245) ± 5 % or absolute ± 30 ms for TMS setting (0.25 to 100) Typically 32, < 40 ms at characteristic angle + 51G element operate time
Follower delay	0 s to 20 s
Reset	ANSI decaying, 0 s to 60 s
Inhibited by	Binary or virtual input Inrush detector VT supervision

51N Time-Delayed Earth Fault – Calculated / 67N Directional Earth Fault – Calculated

Operation	Non-directional, forward and reverse
Elements	Derived earth fault
Characteristic	IEC-NI, -VI, -EI, -LTI; ANSI-MI, -VI, -EI; DTL
Setting range I_{set} (51N)	0.05 to 4 · I_{rated}
Time multiplier	0.01, 0.015 to 1.6, 1.7 to 5, 6 to 100
Time delay	0 to 20 s
Operate level	105 % I_{set}, ± 4 % or ± 1 % · I_{rated}
Operate time IEC ANSI	$t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1}\right] \cdot Tm$ $t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^{P} - 1} + B\right] \cdot Tm$
Reset time IEC ANSI	$t_{res} = \left[\frac{R}{\left\{1 - \left(\frac{I}{I_{set}}\right)^{2}\right\}}\right] \cdot Tm$ $t_{res} = \left[\frac{R}{\left\{1 - \left(\frac{I}{I_{set}}\right)^{2}\right\}}\right] \cdot Tm$
Directional (67N)	± 5 % or absolute ± 40 ms for TMS setting (0.01 to 0.245) ± 5 % or absolute ± 30 ms for TMS setting (0.25 to 100) Typically 32, < 40 ms at characteristic angle + 51N element operate time
Follower delay	0 s to 20 s
Reset	ANSI decaying, 0 s to 60 s
Inhibited by	Binary or virtual input Inrush detector VT supervision

51SEF Time-Delayed Sensitive Earth Fault – Measured / 67SEF Directional Sensitive Earth Fault – Measured

Operation	Non-directional, forward and reverse
Elements	Sensitive earth fault
Characteristic	IEC-NI, -VI, -EI, -LTI; ANSI-MI, -VI, -EI; DTL
Setting range I_{set} (51SEF)	0.005 to 0.5 · I_{rated}
Time multiplier	0.01, 0.015 to 1.6, 1.7 to 5, 6 to 100
Time delay	0 to 20 s

Operate level	105 % I_{set}, ± 4 % or ± 1 % · I_{rated}
Operate time IEC ANSI	$t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1}\right] \cdot Tm$ $t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^{P} - 1} + B\right] \cdot Tm$
Reset time IEC ANSI	$t_{res} = \left[\frac{R}{\left\{1 - \left(\frac{I}{I_{set}}\right)^{2}\right\}}\right] \cdot Tm$ $t_{res} = \left[\frac{R}{\left\{1 - \left(\frac{I}{I_{set}}\right)^{2}\right\}}\right] \cdot Tm$
Directional (67SEF)	± 5 % or absolute ± 40 ms for TMS setting (0.01 to 0.245) ± 5 % or absolute ± 30 ms for TMS setting (0.25 to 100) Typically 32, < 40 ms at characteristic angle + 51SEF element operate time
Follower delay	0 s to 20 s
Reset	ANSI decaying, 0 s to 60 s
Inhibited by	Binary or virtual input Inrush detector VT supervision

51V Voltage-Dependent Overcurrent Protection

Setting range	5 to 200 V
Operate level	100 % V_{set}, ± 5 % or ± 1 % · V_{rated}
Multiplier	0.25 to 1 · 51 I_{set}
Inhibited by	VT supervision

55 Power Factor

Number of elements	2
Operation	Under or over, lead or lag
U/C guard	0.05 to 1.0
Setting range PF_{set}	0.05 to 0.99
Time delays	0 to 14400 s
Operate level	± 0.05
Basic operate time	≤ 80 ms
Operate time following delay	t_{basic} + t_{delay} ± 1 % or ± 10 ms
Inhibited by	Undercurrent guard, VTS, binary/ virtual input

59N Neutral Voltage Displacement

Number of elements	DT & IT
DT setting range I_{set}	1 to 100 V
DT operate level	100 % V_{set}, ± 2 % or ± 0.5 V
DT delay setting t_{delay}	0 to 14400 s
DT basic operate time: 0 V to 1.5 · V_{set} 0 V to 10 · V_{set}	 76 ms ± 20 ms 63 ms ± 20 ms
DT operate time following delay	t_{basic} + t_{delay} ± 1 % or ± 20 ms
IT char setting	IDMTL & DTL
IT setting range	1 to 100 V
Tm time multiplier (IDMT)	0.1 to 140
Delay (DTL)	0 to 20 s
Reset	0 to 60 s
Char operate level	105 % V_{set}, ± 2 % or ± 0.5 V
Inhibited by	Binary or virtual input

60CTS CT Supervision

CT	Current or V_{nps} & I_{nps}

60VTS VT Supervision

VT	NPS/ZPS

64H Restricted Earth-Fault Protection – High-Impedance

Setting range	SEF input EF input	0.005, 0.006 to 0.100, 0.105 to 0.950 · I_{rated} 0.05, 0.055 to 0.95 · I_{rated}
Operate level	100 % I_{set}, ± 5 % or ± 1 % · I_{rated}	
Time delay	0.00 to 14400 s	
Basic operate time	0 to 2 · I_{set} 45 ms ± 10 ms 0 to 5 · I_{set} 35 ms ± 10 ms	
Inhibited by	Binary or virtual input	

66 Number of Starts

Max. number of starts	OFF, 1 to 20
Max. starts period	1 min to 60 min
Start inhibit delay	1 min to 60 min
Time between starts	OFF, 1 min to 60 min

74CC Close-Circuit Supervision

Number of supervisable circuits	3 x close
Number of BI's required	1 or 2 per function

74TC Trip-Circuit Supervision

Number of supervisable circuits	3 x trip
Number of BI's required	1 or 2 per function

NOTE

Use the correct threshold voltages for BI when using TCS with 2 BI.

79 Automatic Reclosing

Operating mode	Phase, earth, SEF, external
Number of reclose	1 to 4
Number of trips to lockout	1 to 5
Dead time	0 to 14400
Reclaim timer	0 to 600
Lockout reset	CB, timer & BI

81 Frequency Protection – "f>" or "f<"

Number of elements	4 under or over
Under voltage guard	Yes/no
Setting range Hz	43 to 68 Hz
Hysteresis setting	0 to 2 %
Operate level	100 % f_{set} ± 10 mHz
Operate time	Typical < 190 ms
Operate delay V_{set}	0 to 14400 s

81HBL2 Inrush Current Detection

I setting (Ratio of 2nd harmonic current to fundamental component current)	0.10 to 0.5
Element basic operate time t_{basic}	Will pickup before operation of any protection element due to magnetic inrush
Reset time	Will operate until drop-off of any protection element due to magnetic inrush

81I_THD Total Harmonic Distortion Supervision

Setting I_{THD}	5 to 100 %
Delay setting t_{delay}	0.02, 0.03 to 20.00, 20.10 to 100, 101 to 1000, 1010 to 10000, 10100 to 14400 s

TEMP Temperature Supervision

Temperature input type (temperature coefficient resistance based on DIN/IEC 60751 standard)	Cu10 (0.00427) Ni100 (0.00618) Pt100 (0.00385) Ni120 (0.00672) Pt250 (0.00385) Ni250 (0.00618) Pt1000 (0.00385)
Temperature input alarm	0 to 250 °C
Temperature input trip	0 to 250 °C
Operate value	100 % T_{set}, ± 2% or ± 2 °C, For Cu10: ± 2 % or ± 5 °C
Response time	< 3 s
Sensing current	≤ 0.5 mA
Maximum lead resistance	25 Ω/lead; For Cu10: 2.5 Ω/lead

Control Functions

CB	Trip/close
AR	In/out
Inst prot	In/out
EF	In/out
SEF	In/out
Hot line	In/out
Relay mode	Local/remote/local or remote
Reset	LEDs & BOs (test/reset key)
Motor (7SR105)	Start/stop

CB Maintenance

Trip counter	Total and delta, 0 to 10000
Alarm I^2t	10 to 100000

Ordering Information – 7SR10 Non-Directional Overcurrent Relay

Product Description	Order Number																					
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16		17	18	19	20
7SR10 Argus	7	S	R	1	0	0	□	–	□	□	□	□	0	–	□		□	|		□	□	□	□
							|		|	|	|	|			|	|	|		|	|	|	|
Non-Directional O/C Relay (Argus)							|		|	|	|	|			|	|	|		|	|	|	|
Case, I/O and Fascia							|		|	|	|	|			|	|	|		|	|	|	|
Size 4 moulded case, 4 CT, 3 binary inputs, 3 binary outputs, 10 LEDs							2		1	|	|	|			|	|	A	0		|	|	|	|
Size 4 moulded case, 4 CT, 6 binary inputs, 6 binary outputs, 10 LEDs							3		|	|	|	2		|	|	|	0		|	|	|	|
Size 4 moulded case, 4 CT, 9 binary inputs, 6 binary outputs, 10 LEDs							3		|	M	|	2		|	|	|	1		|	|	|	|
							|		|	|	|	|		|	|	|	|		|	|	|	|
Measuring Input							|		|	|	|	|		|	|	|	|		|	|	|	|
1 A/5 A, 50 Hz/60 Hz [32]							2/3		1	|	|	|			|	|	|	|		|	|	|	|
1 A/5 A, 50 Hz /60 Hz with SEF input [33]							3		2	|	|	|			|	|	|	|		|	|	|	|
							|		|	|	|	|		|	|	|	|		|	|	|	|
Auxiliary Voltage							|		|	|	|	|		|	|	|	|		|	|	|	|
AC 60 V to AC 240 V/DC 60 V to DC 240 V, binary input threshold AC 44 V/DC 44 V							|		|	L	|	|		|	|	|	0		|	|	|	|
AC 60 V to AC 240 V/DC 60 V to DC 240 V, binary input threshold AC 88 V/DC 88 V							|		|	K	|	|		|	|	|	0		|	|	|	|
DC 24 V to DC 60 V, binary input threshold DC 19 V							|		|	J	|	|		|	|	|	0		|	|	|	|
DC 24 V to DC 240 V/AC 48 V to AC 240 V, binary input threshold AC/DC 19 V							|		1	M	|	|		|	|	|	1		|	|	|	|
							|				|	|		|	|	|	|		|	|	|	|
Protective Cover							|				|	|		|	|	|	|		|	|	|	|
Standard version – no cover							|				A	|		|	|	|	|		|	|	|	|
Plastic cover with 1 push button for test/reset							|				B	|		|	|	|	|		|	|	|	|
							|					|		|	|	|	|		|	|	|	|
Communication							|					|		|	|	|	|		|	|	|	|
Front port: USB							2					1			|	|	|	|		|	|	|	|
Front port: USB and rear port: RS-485 supporting IEC 60870-5-103 or Modbus RTU or DNP3							2/3					2			|	|	|	|		|	|	|	|
															|	|	|	|		|	|	|	|
Front Fascia															|	|	|	|		|	|	|	|
Standard version – with breaker control push buttons															2	|	|	|		|	|	|	|
																|	|	|		|	|	|	|
Protection and Supervision Function Packages																C	|	|		|	|	|	|
Standard version – included in all models																|	|	|		|	|	|	|
37 Undercurrent protection – phase																|	|	|		|	|	|	|
37G Undercurrent earth fault – measured [32]																|	|	|		|	|	|	|
37SEF Undercurrent earth fault - sensitive [33]																|	|	|		|	|	|	|
46BC Broken conductor detection																|	|	|		|	|	|	|
46NPS Negative sequence overcurrent protection																|	|	|		|	|	|	|
49 Thermal overload protection																|	|	|		|	|	|	|
50 Instantaneous overcurrent – phase																|	|	|		|	|	|	|
50AFD Arc flash detection [34]																|	|	|		|	|	|	|
50BF Circuit-breaker failure protection – 3-pole																|	|	|		|	|	|	|
50G Instantaneous earth fault – measured																|	|	|		|	|	|	|

32 4CT is configured as 3PF + EF

33 4CT is configured as 3PF + SEF

34 Refer 7XG31XX documents for Arc Fault Interface Module and sensor ordering information.

Product Description	Order Number								
50GLC Line-check overcurrent protection	|	|	|		|	|	|	|
50LC Line check	|	|	|		|	|	|	|
50N Instantaneous earth fault – calculated	|	|	|		|	|	|	|
50SEF Instantaneous sensitive earth fault – measured [33] [35]	|	|	|		|	|	|	|
50SEFLC Line check sensitive earth fault – measured	|	|	|		|	|	|	|
51 Time-delayed overcurrent – phase	|	|	|		|	|	|	|
51CL Cold load overcurrent – phase	|	|	|		|	|	|	|
51G Time delayed earth fault – measured	|	|	|		|	|	|	|
51N Time-delayed earth fault – calculated	|	|	|		|	|	|	|
51SEF Time-delayed sensitive earth fault – measured [33] [35]	|	|	|		|	|	|	|
60CTS CT supervision	|	|	|		|	|	|	|
64H Restricted earth fault protection – high-impedance	|	|	|		|	|	|	|
74CC Close-circuit supervision	|	|	|		|	|	|	|
74TC Trip-circuit supervision	|	|	|		|	|	|	|
81HBL2 Inrush current detection [36]	|	|	|		|	|	|	|
81I_THD Total harmonic distortion supervision	|	|	|		|	|	|	|
86 Lockout	|	|	|		|	|	|	|
Programmable logic	|	|	|		|	|	|	|
	|	|	|		|	|	|	|
Standard Version – Plus	|	|	|		|	|	|	|
79 Automatic reclosing	D	|	|		|	|	|	|
	|	|	|		|	|	|	|
Conformal Coat	|	|	|		|	|	|	|
Standard version - No conformal coating on PCBA	|	A	|		|	|	|	|
Conformal coating on PCBA	|	B	|		|	|	|	|
	|		|					
Additional Hardware	|		|					
No additional BI/BO	|		0					
3 BI additional	|		1					
	|				|	|	|	|
Special version [37]	D				Z	Y	2	0

35 Only with position 7 = 3

36 Not available on SEF input

37 Special version for Turkey market with thermal withstand capability of 500 A (5 A CT), 1 sec and supporting Turkish scripts. Applicable only for MLFBs 7SR1003-1[L/J]A20-2DA0-ZY20 and 7SR1003-1MA20-2Dx1-ZY20.

Ordering Information – 7SR10 Directional Overcurrent Relay

Product Description	Order Number																				
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16				
7SR10 Argus	7	S	R	1	0	0	□	–	□	□	□	□	0	–	□		□	0	□	□	□	□
							|		|	|	|	|			|	|	|		|	|	|	|
Directional O/C Relay (Argus)							|		|	|	|	|			|	|	|		|	|	|	|
Case, I/O and Fascia							|		|	|	|	|			|	|	|		|	|	|	|
Size 4 moulded case, 4 CT, 3 VT, 9 binary inputs, 6 binary outputs, 10 LEDs							4		|	|	|	|			|	|	|		|	|	|	|
									|	|	|	|			|	|	|		|	|	|	|
Measuring Input									|	|	|	|			|	|	|		|	|	|	|
1 A/5 A, 40 V to 160 V, 50 Hz/60 Hz [38]									3	|	|	|			|	|	|		|	|	|	|
1 A/5 A, with SEF input, 40 V to 160 V, 50 Hz/60 Hz [39]									4	|	|	|			|	|	|		|	|	|	|
1 A/5 A, 50 Hz/6 0Hz with SEF input, 63.5 V/110 V [40]									5	|	|	|			|	|	|		|	|	|	|
										|	|	|			|	|	|		|	|	|	|
Auxiliary Voltage										|	|	|			|	|	|		|	|	|	|
AC 60 V to AC 240 V/DC 60 V to DC 240 V, binary input threshold AC 44 V/DC 44 V										L	|	|			|	|	|		|	|	|	|
AC 60 V to AC 240 V/DC 60 V to DC 240 V, binary input threshold AC 88 V/DC 88 V										K	|	|			|	|	|		|	|	|	|
DC 24 V to DC 60 V, binary input threshold DC 19 V										J	|	|			|	|	|		|	|	|	|
											|	|			|	|	|		|	|	|	|
Protective Cover											|	|			|	|	|		|	|	|	|
Standard version – no cover											A	|			|	|	|		|	|	|	|
Plastic cover with 1 push button for test/reset											B	|			|	|	|		|	|	|	|
												|			|	|	|		|	|	|	|
Communication												|			|	|	|		|	|	|	|
Front port: USB and rear port: RS-485 supporting IEC 60870-5-103 or Modbus RTU or DNP3												2			|	|	|		|	|	|	|
															|	|	|		|	|	|	|
Front Fascia															|	|	|		|	|	|	|
Standard version – with breaker control push buttons															2	|	|		|	|	|	|
																|	|		|	|	|	|
Protection and Supervision Function Packages																C	|		|	|	|	|
Standard version – included in all models																|	|		|	|	|	|
27 Undervoltage protection – 3-phase																|	|		|	|	|	|
32 Power protection																|	|		|	|	|	|
32S Sensitive power protection [39]																|	|		|	|	|	|
37 Undercurrent protection – phase																|	|		|	|	|	|
37G Undercurrent earth fault – measured [38]																|	|		|	|	|	|
37SEF Undercurrent earth fault - sensitive [39]																|	|		|	|	|	|
46BC Broken conductor detection																|	|		|	|	|	|
46NPS Negative sequence overcurrent protection																|	|		|	|	|	|
47NPS Sequence overvoltage protection																|	|		|	|	|	|
49 Thermal overload protection																|	|		|	|	|	|
50 Instantaneous overcurrent – phase																|	|		|	|	|	|
50AFD Arc flash detection [41]																|	|		|	|	|	|
50BF Break capacity limit																|	|		|	|	|	|
50G Instantaneous earth fault – measured [38]																|	|		|	|	|	|
50GLC Line-check overcurrent protection																|	|		|	|	|	|

38 4CT is configured as 3PF + EF

39 4CT is configured as 3PF + SEF

40 4CT is configured as 3PF+SEF and this hardware supports Directional Earth fault V_0/I_0 Phase angle measurement function as per CEI 0-16:2012 specification. Refer to setting range for 7SR1004-5xx20-2CA0 for 50SEF and 50SEFLC functions. 81I_THD function is not available.

41 Refer 7XG31XX documents for Arc Fault Interface Module and sensor ordering information.

Product Description	Order Number							
50LC Line check		|	|		|	|	|	|
50N Instantaneous earth fault – calculated		|	|		|	|	|	|
50SEF Instantaneous sensitive earth fault – measured [39]		|	|		|	|	|	|
50SEFLC Line check sensitive earth fault – measured		|	|		|	|	|	|
51 Time-delayed overcurrent – phase		|	|		|	|	|	|
51CL Cold load overcurrent – phase		|	|		|	|	|	|
51G Time delayed earth fault – measured [38]		|	|		|	|	|	|
51N Time-delayed earth fault – calculated		|	|		|	|	|	|
51SEF Time-delayed sensitive earth fault – measured [39]		|	|		|	|	|	|
51V Voltage-dependent overcurrent protection		|	|		|	|	|	|
55 Power factor		|	|		|	|	|	|
59 Overvoltage protection – 3-phase		|	|		|	|	|	|
59N Neutral voltage displacement		|	|		|	|	|	|
60CTS CT supervision		|	|		|	|	|	|
60VTS VT supervision		|	|		|	|	|	|
64H Restricted earth fault protection – high-impedance		|	|		|	|	|	|
67 Directional overcurrent – phase		|	|		|	|	|	|
67G Directional earth fault – measured		|	|		|	|	|	|
67N Directional earth fault – calculated		|	|		|	|	|	|
67SEF Directional sensitive earth fault – measured		|	|		|	|	|	|
67SEF Directional sensitive earth fault – measured 3V0/I0, φ (Resonant and Isolated Networks)[40]		|	|		|	|	|	|
74CC Close-circuit supervision		|	|		|	|	|	|
74TC Trip-circuit supervision		|	|		|	|	|	|
81 Frequency protection – "f>" or "f<"		|	|		|	|	|	|
81HBL2Inrush current detection [42]		|	|		|	|	|	|
81I_THD Total harmonic distortion supervision		|	|		|	|	|	|
86 Lockout		|	|		|	|	|	|
Programmable logic		|	|		|	|	|	|
		|	|		|	|	|	|
Standard Version – Plus		|	|		|	|	|	|
79 Automatic reclosing		D	|		|	|	|	|
		|	|		|	|	|	|
Conformal Coat		|	|		|	|	|	|
Standard version - No conformal coating on PCBA		|	A		|	|	|	|
Conformal coating on PCBA		|	B		|	|	|	|
		|			|	|	|	|
Special version [43]		D			Z	Y	2	0

42 Not available on SEF input

43 Special version for Turkey market with thermal withstand capability of 500 A (5 A CT), 1 sec and supporting Turkish scripts. Applicable only for MLFBs 7SR1004-3xx20-2Dx0-ZY20.

Ordering Information – 7SR105 Motor Protection Relay

Product Description	Order Number																				
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16				
7SR105 Rho	7	S	R	1	0	5	□	–	□	□	□	□	□	–	□	□	□	0	□	□	□	□
Case, I/O and Fascia							|		|	|	|	|	|		|	|	|		|	|	|	|
Size 4 moulded case, 4 CT inputs, 6 binary inputs, 6 binary outputs, 10 LEDs							3		|	|	|	|	|		|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|		|	|	|	|
Measuring Input									|	|	|	|	|		|	|	|		|	|	|	|
1 A/5 A, 50 Hz/60 Hz									2	|	|	|	|		|	|	|		|	|	|	|
										|	|	|	|		|	|	|		|	|	|	|
Auxiliary Voltage										|	|	|	|		|	|	|		|	|	|	|
AC 60 V to AC 240 V/DC 60 V to DC 240 V, binary input threshold AC 44 V/DC 44 V										L	|	|	|		|	|	|		|	|	|	|
DC 24 V to DC 60 V, binary input threshold DC 19 V										J	|	|	1		|	|	|		|	|	|	|
											|	|	|		|	|	|		|	|	|	|
Protective Cover											|	|	|		|	|	|		|	|	|	|
Standard version – no cover											A	|	|		|	|	|		|	|	|	|
												|	|		|	|	|		|	|	|	|
Communication												|	|		|	|	|		|	|	|	|
Front port: USB and rear port: RS-485 supporting IEC 60870-5-103 or Modbus RTU or DNP3												2	|		|	|	|		|	|	|	|
													|		|	|	|		|	|	|	|
Temperature Input													|		|	|	|		|	|	|	|
Without RTD													1		|	|	|		|	|	|	|
6 RTD input													2		|	|	|		|	|	|	|
															|	|	|		|	|	|	|
Front Fascia															|	|	|		|	|	|	|
Standard version – with breaker control push buttons															2	|	|		|	|	|	|
																|	|		|	|	|	|
Protection Function Packages																E	|		|	|	|	|
Standard version – included in all models																|	|		|	|	|	|
14 Locked rotor protection																|	|		|	|	|	|
37 Undercurrent protection – phase																|	|		|	|	|	|
46 Phase unbalance protection																|	|		|	|	|	|
46PhRev Phase reversal																|	|		|	|	|	|
48 Starting-time supervision																|	|		|	|	|	|
49 Thermal overload protection																|	|		|	|	|	|
50 Instantaneous overcurrent – phase																|	|		|	|	|	|
50BCL Break capacity limit																|	|		|	|	|	|
50BF Circuit-breaker failure protection – 3-pole																|	|		|	|	|	|
50G Circuit-breaker failure protection – 3-pole																|	|		|	|	|	|
50N Instantaneous earth fault – calculated																|	|		|	|	|	|
51 Time-delayed overcurrent – phase																|	|		|	|	|	|
51G Time delayed earth fault – measured																|	|		|	|	|	|
51N Time-delayed earth fault – calculated																|	|		|	|	|	|
66 Number of starts																|	|		|	|	|	|
74CC Close-circuit supervision																|	|		|	|	|	|
74TC Trip-circuit supervision																|	|		|	|	|	|
81B Backspin monitor																|	|		|	|	|	|
CB counters																|	|		|	|	|	|
I^2T CB wears																|	|		|	|	|	|
Programmable logic																|	|		|	|	|	|
Standard Version Plus																|	|		|	|	|	|
Additional function in temperature input version model																F	|		|	|	|	|

Product Description	Order Number							
Additional Functionality		|	|		|	|	|	|
Without conformal coating			A		|	|	|	|
With conformal coating			B		|	|	|	|

The following information is applicable to all devices in the 7SR1 range.

Data Acquisition - Via Communication Interface

Sequence of event records

Up to 1000 events are stored and time tagged to 1ms resolution.

Fault Records

The last 10 fault records are displayed on the relay fascia and are also available through the communication interface, with time and date of trip, measured quantities and type of fault. (5 records for 7SR1102-1*A12-*AA0 versions).

Waveform recorder

The waveform recorder stores analogue data for all poles and the states of protection functions, binary inputs, LEDs and binary outputs with user settable pre & post trigger data. A record can be triggered from protection function, binary input or via data communications. 10 records of 1 second duration are stored. (8 records for the 7SR18 and 5 records for 7SR1102-1*A12-*AA0 versions).

Demand Metering

A record of demand is available. The demand minimum, maximum and average values for currents, frequency and if applicable, voltages and real, reactive and apparent power, over a user selectable period of time, is displayed and available via data communications. Typically this is set as a rolling value for the last 24 hours.

Real Time Clock

The time and date can be set and are maintained while the relay is de-energised by a back up storage capacitor. The time can be synchronized from a binary input pulse or the data communication channel.

Data Storage and Communication

Standard Communication Ports

Front USB port + Rear RS485 port

Additional Optional Communication Ports

2x Electrical RJ45 Ethernet ports

2x LC Fibre Optic Ethernet ports

Standard Protocols

IEC60870-5-103, DNP3.0 or Modbus RTU

User Selectable with programmable data points

Optional Protocols

IEC61850 (E6 Case)

Ethernet Redundancy Protocols:

Standard in all IEC61850 models:

PRP (Parallel Redundancy Protocol)

RSTP (Rapid Spanning Tree Protocol)

HSR (High-availability Seamless Redundancy)

Data

Event Records – User Configurable

Fault Records

Waveform Records

Measurands

Commands

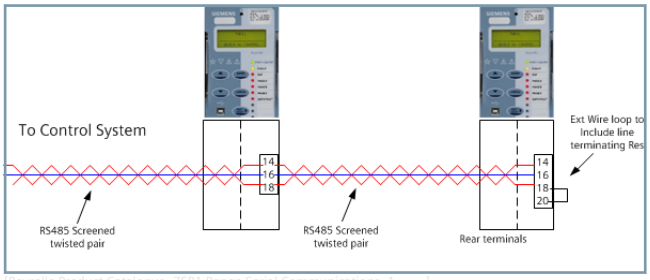
Time Synchronism

Viewing and Changing Settings

Serial Communications

The relay offers a USB serial port as standard on the front of all units. All of the relays functions can be set on a PC using Reydisp Evolution via the USB port. The connection is made with a USB cable and operates with a 'plug and play' connection, so no pre-setting of the relay is required. The front port can be switched off or set to use either the DNP3.0, MODBUS-RTU, IEC60870-5-103 and ASCII protocols for testing purposes.

A rear RS485 electrical connection is available on all units for system interface connections. An internal terminating resistor is provided, which can be connected into the circuit by adding a wire loop between the relevant terminals.



[Reyrolle Product Catalogue, 7SR1 Range Serial Communications, 1, _--]

Figure 2.3/1 Typical RS485 connection

The rear RS485 can be user selected to be OFF, IEC60870-5-103, MODBUS RTU or DNP3.0 protocol.

IEC 61850

IEC61850 communication is available through an optional EN100 communication module. The EN100 Module can be ordered with either 2x Electrical RJ45 or 2x Fibre optic LC Ethernet ports.

Information on IEC61850 functionality can be found in the following 7SR1 documents:

Model Implementation Conformance Statement (MICS)

Protocol Implementation (PICS,PIXIT & TICS)

Ethernet Communications

IEC 61850

IEC61850 communication is available through an optional EN100 communication module. The EN100 Module can be ordered with either 2x Electrical RJ45 or 2x Fibre optic LC Ethernet ports.

Information on IEC61850 functionality can be found in the following 7SR157 documents:

Model Implementation Conformance Statement (MICS)

Protocol Implementation Conformance Statement (PICS)

Protocol Implementation Extra Information for Testing (PIXIT

2.3

Reydisp Evolution

Reydisp Evolution is a Windows based software tool, providing the means for the user to apply settings, interrogate settings and retrieve events and disturbance waveforms from the device and is common to the entire range of Reyrolle protection relays.

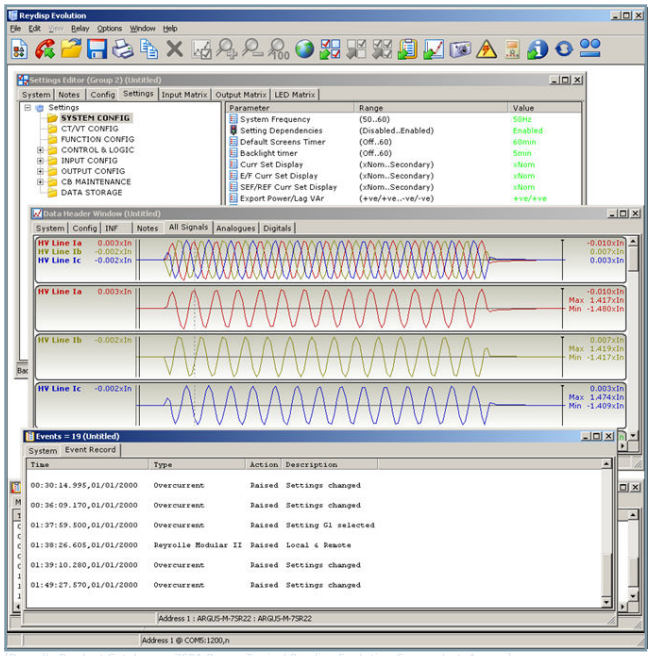


Figure 2.3/2 Typical Reydisp Evolution Screenshot

Language Editor

The Language editor software gives the user the ability to customize the text displayed in the relays, Menu structure and instrumentation views. The tool allows a language file to be created and transferred to the relay also containing Western European characters.

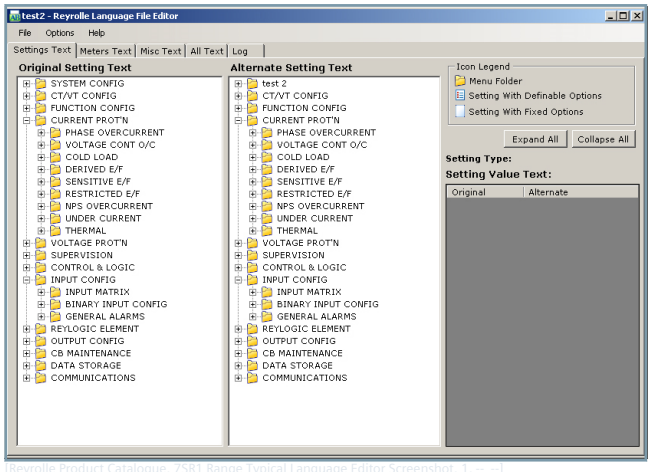


Figure 2.3/3 Typical Language Editor Screenshot

Communications Editor

To facilitate easier interfacing to a substation the relays default Protocol configuration may be modified using the communication editor software tool.

The communication editor is a PC based software package provided within the Reydisp software suite which allows modification of the IEC60870-5-103, DNP 3.0 and MODBUS Protocols.

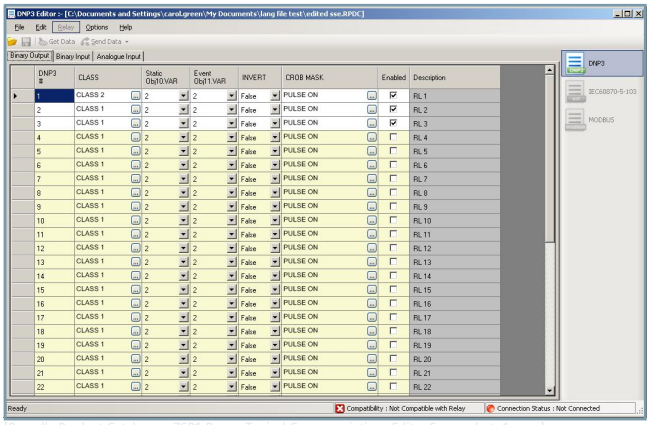


Figure 2.3/4 Typical Communications Editor Screenshot

Curve Editor

The Curve Editor tool can be used to add user defined characteristics for use by any of the Voltage, Current or Thermal IDMTL elements.

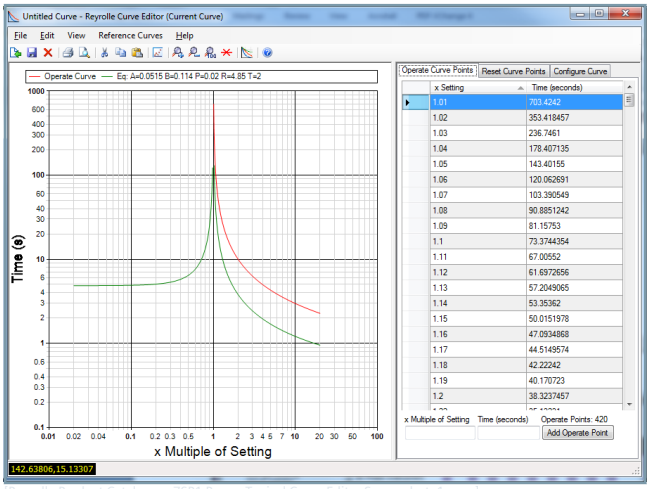


Figure 2.3/5 Typical Curve Editor Screenshot

Reydisp Manager

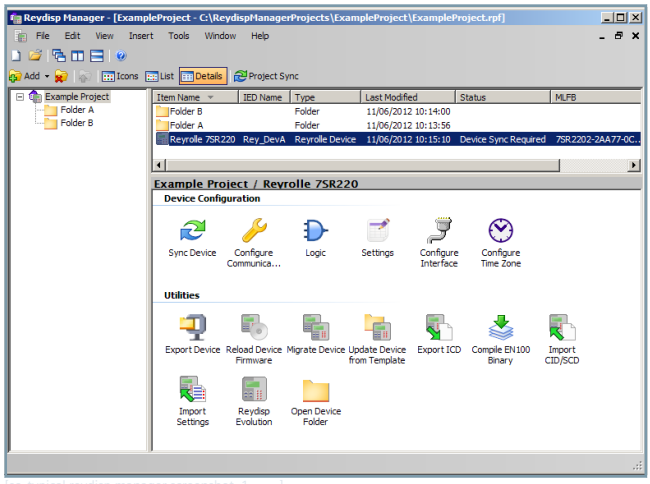
Reydisp Manager is a Windows based application which enables configuration of multiple Reyrolle devices.

It provides the following features:

- Project based handling of all features of multiple devices to allow engineering of IEC61850 projects.
- Template based structure allowing offline configuration • Configure and store device settings for all settings groups

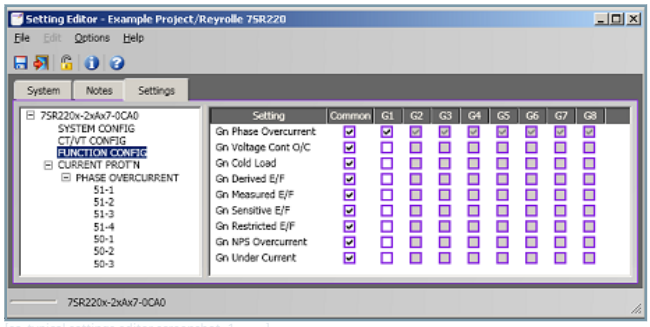
- Create and edit graphical logic diagrams
- Configure data points and options for serial protocols
- Configure Language
- Configure User Curves
- Update device firmware

Please refer to the Reydisp Manager User Guide for further information.



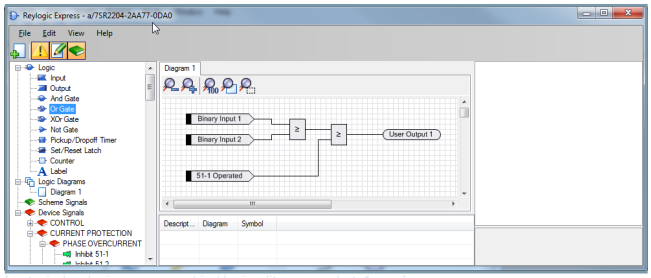
[sc_typical reydisp manager screenshot, 1, -, -]

Figure 2.3/6 Typical Reydisp Manager Screenshot



[sc_typical settings editor screenshot, 1, -, -]

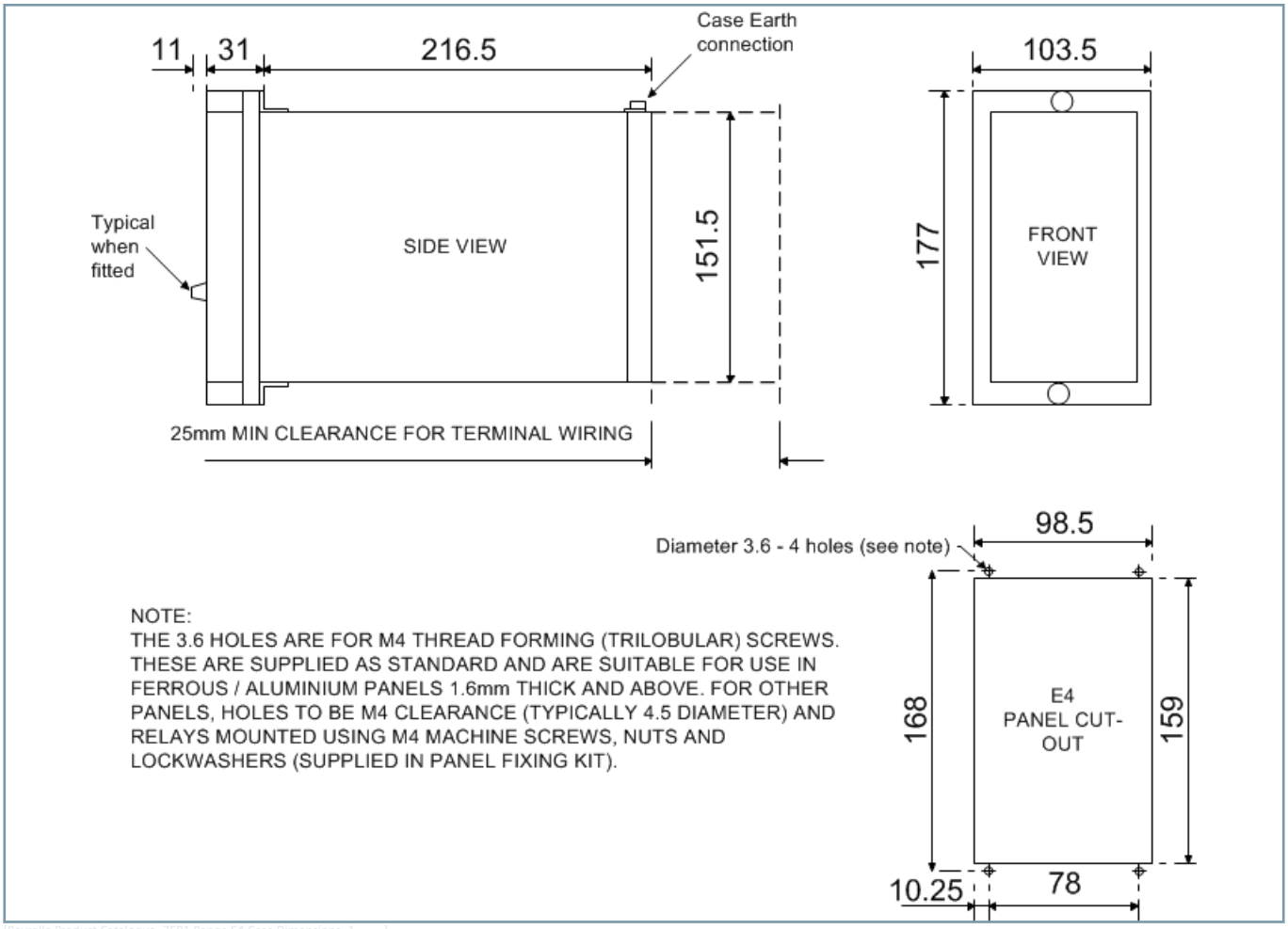
Figure 2.3/7 Typical Settings Editor Screenshot



[sc_typical reylogic express graphical logic editor screenshot, 1, -, -]

Figure 2.3/8 Typical Reylogic Express graphical logic editor Screenshot

Case Dimensions



[Reyrolle Product Catalogue, 7SR1 Range E4 Case Dimensions, 1, --_--]

Figure 2.3/9 E4 Case Dimensions

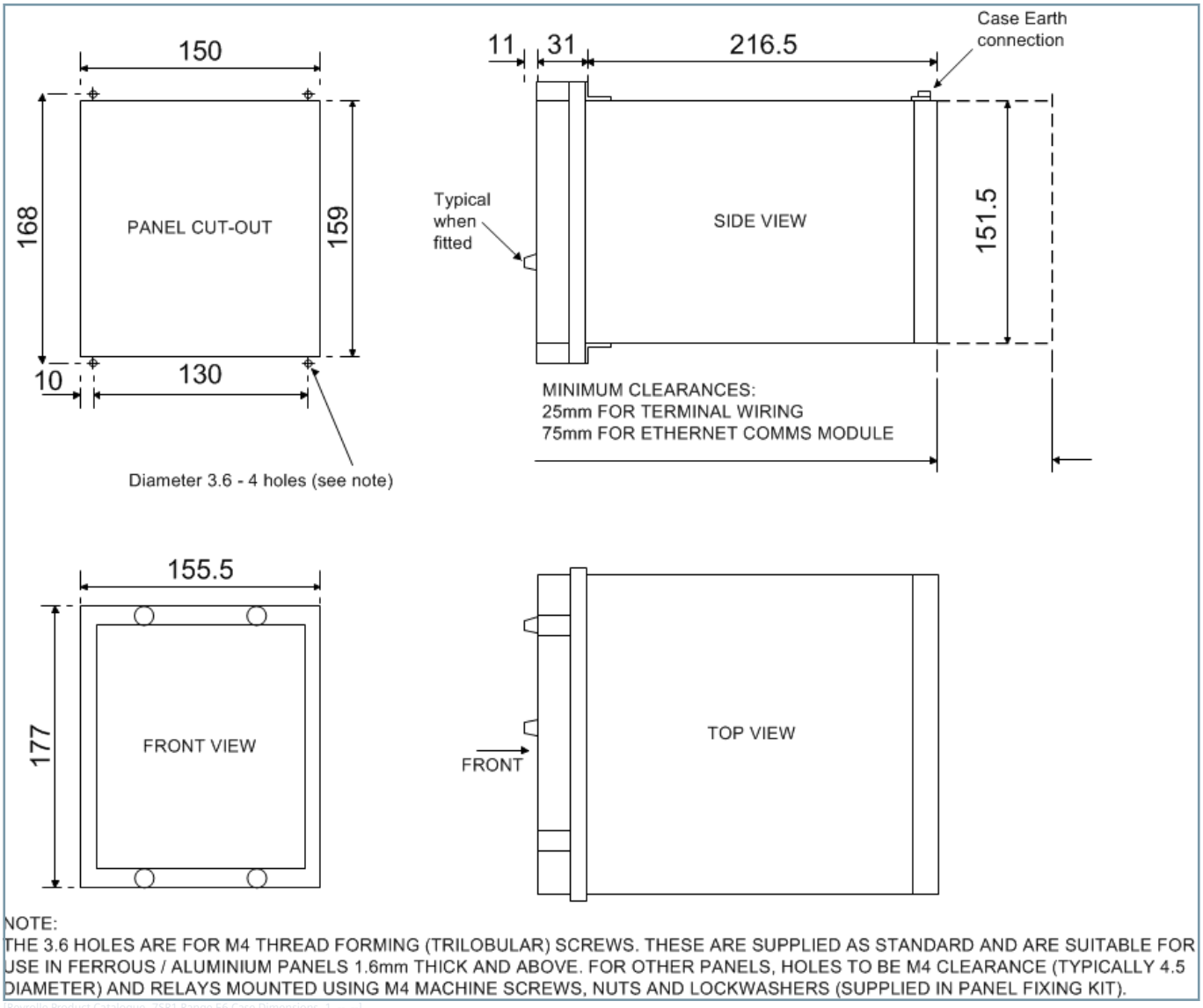


Figure 2.3/10 E6 Case Dimensions

7SR1 Range – 7SR11 and 7SR12 Non-Directional/Directional Overcurrent Relays

7SR11 and 7SR12 Non-Directional/Directional Overcurrent Relays

[Reyrolle Product Catalogue, 7SR11 & 7SR12, 1, ←_←]

Description

The 7SR11 & 7SR12 are overcurrent protection relays developed to enhance the Argus family of products by providing a familiar product using the latest generation of hardware technology.

The 7SR11 provides overcurrent and earth fault protection, the 7SR12 comes with additional voltage inputs providing directional protection. Both relays are available in single and four pole variants.

Housed in a 4U high, size E4 or E6 (Optional IEC61850 model) cases, these relays provide protection, monitoring, instrumentation and metering with integrated input and output logic, data logging & fault reports. Communication access to the relay functionality is via a front USB port for local PC connection, a rear electrical RS485 port for remote connection & optional IEC61850 communication through two rear Ethernet ports (Electrical or Optical).

Function Overview

Protection

37	Undercurrent
46BC	Broken Conductor / Load Unbalance
46NPS	Negative Phase Sequence Overcurrent
49	Thermal Overload
50	Instantaneous Overcurrent
50G/N/SEF	Instantaneous Earth Fault
50AFD	Arc Flash Detection (6 zones)
50BF	Circuit Breaker Fail
51	Time Delayed Overcurrent
51G/N/SEF	Time Delayed Measured/Derived/Sensitive Earth Fault
64H	High Impedance REF
27/59	Under/Over Voltage
47	Negative Phase Sequence Voltage
51V	Voltage Controlled Overcurrent
59N	Neutral Voltage Displacement
67/50	Directional Instantaneous Overcurrent
67/50G/N	Directional Instantaneous Earth Fault
67/51	Directional Time Delayed Overcurrent
67/51G/N	Directional Time Delayed Earth Fault
32	Directional Power
32S	Directional Sensitive Power
55	Power Factor
81HBL2	Inrush Detector
81	Under/Over Frequency
	Line Check/Switch onto Fault

Supervision

60CTS	CT Supervision
74T/CCS	Trip & Close Circuit Supervision
60VTS	VT Supervision

Control

79	Auto Reclose
86	Lockout
	CB Control

Features

Cold Load Settings
Four Settings Groups
Password Protection – 2 levels
User Programmable Logic
Self Monitoring
Circuit Breaker Trip and Maintenance Counter
Trip Timers

User Interface

20 Character x 4 Line Backlit LCD
Menu Navigation Keys
9 User Programmable Tri-colour LEDs
User Language Configuration

Monitoring Functions

Primary/Secondary Current Phases and Earth Direction
Primary/Secondary Line and Phase Voltages
Apparent Power and Power Factor
Real and Reactive Power
W Hr & VAr Hr Forward and Reverse
Historical Demand Record
Positive Phase Sequence (PPS) Voltage & Current
Negative Phase Sequence (NPS) Voltage & Current
Zero Phase Sequence (ZPS) Voltage
Frequency
Direction
Binary Input/Output status
Trip circuit healthy/failure
Time and date
Starters
Fault records
Event records
Energy

Circuit breaker trip counters
I^2t summation for contact wear

Hardware

1 CT 3 Binary Inputs 5 Binary Outputs
4 CT 3 Binary Inputs 5 Binary Outputs
4 CT 6 Binary Inputs 8 Binary Outputs
4 CT 4 Bin.In. 8 Bin.Out. (segregated rear terminals)
1 CT 3 VT 3 Binary Inputs 5 Binary Outputs
4 CT 3 VT 3 Binary Inputs 5 Binary Outputs
4 CT 3 VT 6 Binary Inputs 8 Binary Outputs
4 CT 3 VT 4 Bin. In. 8 Bin.Out. (segregated rear terminals)

Application

The Argus is a numerical overcurrent protection relay intended for use on distribution and industrial networks. It provides a highly comprehensive functional software package with a range of integral application functions aimed at reducing installation, wiring and engineering time. An extensive range of metered values can be viewed on the front LCD or at a remote point via the communication channel.

The integrated control feature allows operation of a single circuit breaker and monitoring of its trip and close circuits (except 7SR1102-1*A12-*AA0 models).

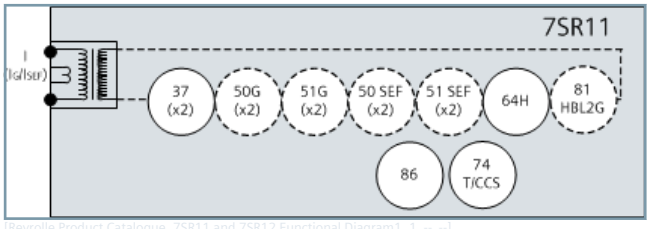
Function Matrix

Function	Functional Requirement	7SR1101-1*A**-**A0	7SR1101-3*A**-**A0	7SR1102-1*A12-*AA0	7SR1102-1*A**-*[C/D]A0	7SR1102-3*A**-**A0	7SR1204-2*A**-**A0	7SR1204-4*A**-**A0	7SR1205-2*A**-**A0	7SR1205-4*A**-**A0
27	Undervoltage						■	■	■	■
32	Directional Power								■	■
32S	Directional Sensitive Power									■
37	Undercurrent	■	■		■	■	■	■	■	■
46BC	Broken Conductor / Load Unbalance			■	■	■			■	■
46NPS	Negative Phase Sequence Overcurrent				■	■			■	■
47	Negative Phase Sequence Voltage								■	■
49	Thermal Overload				■	■			■	■
50	Instantaneous Overcurrent			■	■	■			■	■
50G	Measured Instantaneous Earth Fault	■		■	■		■		■	
50SEF	Measured Instantaneous Sensitive Earth Fault		■			■		■		■
50N	Derived Instantaneous Earth Fault			■	■	■			■	■
50AFD	Arc Flash Detection				■	■			■	■
50BF	CB Failure			■	■	■			■	■
51	Time Delayed Overcurrent			■	■	■			■	■
51G	Measured Time Delayed Earth Fault	■		■	■		■		■	
51SEF	Measured Time Delayed Sensitive Earth Fault		■			■		■		■
51N	Derived Time Delayed Earth Fault			■	■	■			■	■
55	Power Factor								■	■
59	Overvoltage						■	■	■	■
59N	Neutral Voltage Displacement						■	■	■	■
64H	High Impedance Restricted Earth Fault	■	■	■	■	■	■	■	■	■
67	Directional Overcurrent								■	■
67G	Directional Measured Earth Fault						■		■	
67SEF	Directional Sensitive Earth Fault							■		■
67N	Directional Derived Earth Fault								■	■
81HBL	Inrush Detector	■			■	■	■		■	■
81	Under/Over Frequency						■	■	■	■
	CONTROL/MONITOR									
51c	Cold Load - Phase Only				■	■			■	■
60CTS	CT Supervision			■	■	■			■	■
60VTS	VT Supervision						■	■	■	■
74T/CCS	Trip & Close Circuit Supervision	■	■	■	■	■	■	■	■	■
79	Autoreclose				□	□			□	□
86	Lockout	■	■	■	■	■	■	■	■	■
	Line Check/SOTF	■	■		■	■	■	■	■	■

Key -

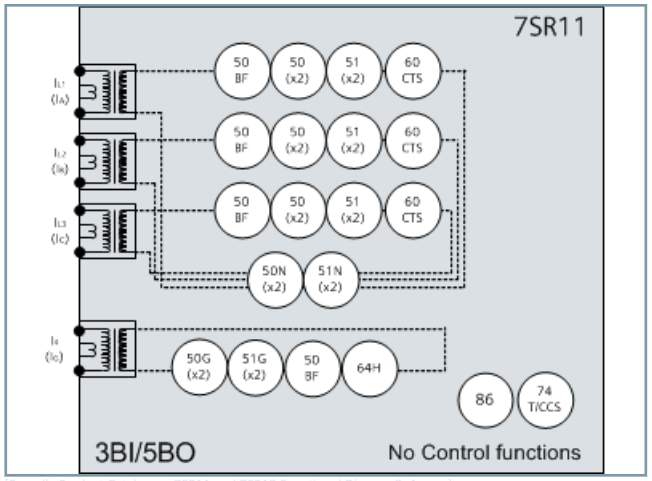
- ■ - Included as standard
- □ - Ordering option

7SR11 Functional Diagrams



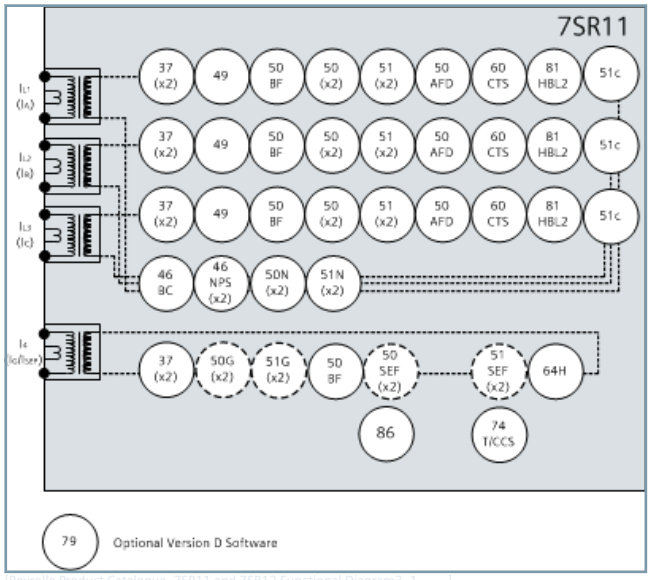
[Reyrolle Product Catalogue, 7SR11 and 7SR12 Functional Diagram1, 1, _]

Figure 2.3/11 Single Pole Overcurrent Relay



[Reyrolle Product Catalogue, 7SR11 and 7SR12 Functional Diagram2, 1, --_--]

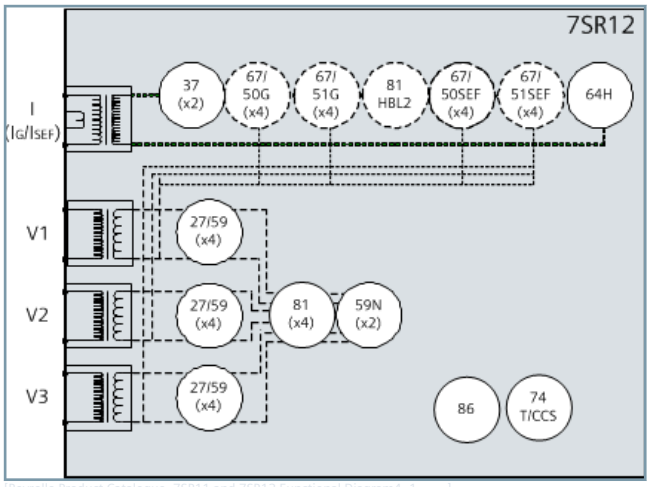
Figure 2.3/12 Four Pole Overcurrent Relay Version A Software



[Reyrolle Product Catalogue, 7SR11 and 7SR12 Functional Diagram3, 1, --_--]

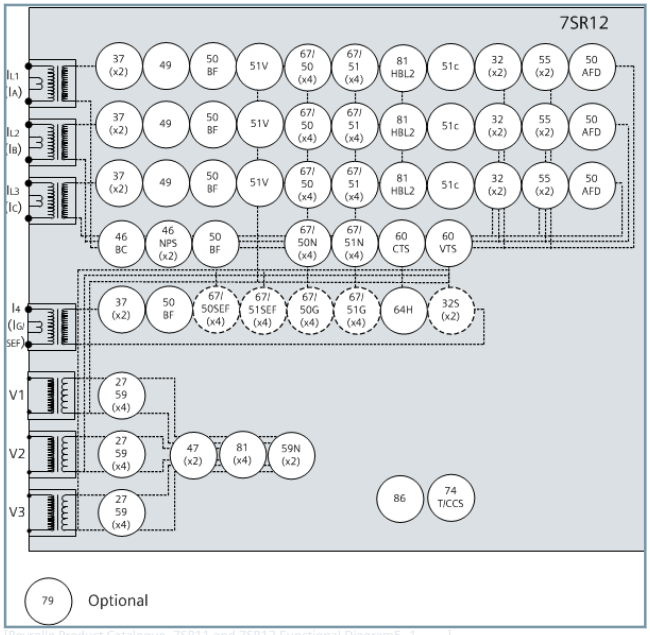
Figure 2.3/13 Four Pole Overcurrent Relay Version C Software

7SR12 Functional Diagrams



[Reyrolle Product Catalogue, 7SR11 and 7SR12 Functional Diagram4, 1, --_--]

Figure 2.3/14 Single Pole Directional Relay



[Reyrolle Product Catalogue, 7SR11 and 7SR12 Functional Diagram5, 1, --_--]

Figure 2.3/15 Four Pole Directional Overcurrent Relay

Notes

- Items shown dotted are only available in some models; please refer to the Ordering Information Section.
- The use of some functions are mutually exclusive

Description of Functionality

27/59 Under/Over Voltage

Each element has settings for pickup level, drop-off level and Definite Time Lag (DTL) delays. Operates if voltage exceeds setting for duration of delay.

32 Power

Each element has settings for pickup level, Definite Time Lag (DTL) delay and Direction. Each element can be set as Under or Over power, to operate from Apparent , Real or Reactive power and can be set for any phase or all three phases.

32S Sensitive Power

This is provided in 4 pole SEF relays and provides elements operated by single phase measured current in the ISEF input. Each element has settings for pickup level, Definite Time Lag (DTL) delay and Direction. Each element can be set as Under or Over power, to operate from Apparent, Real or Reactive power.

37 Undercurrent

Each element has settings for pickup level and Definite Time Lag (DTL) delays. Operates if current falls below setting for duration of delay.

46BC Phase Unbalance/Broken Conductor

Element has settings for pickup level and DTL delay. With the circuit breaker closed, if the NPS: PPS current ratio is above setting this could be due to a broken conductor.

46NPS Negative Phase Sequence Overcurrent

Each element has user settings for pickup level and IDMTL or DTL delay, operates if NPS current exceeds setting and delay. NPS current elements can be used to detect unbalances on the system or remote earth faults when a delta-star transformer is in circuit.

47 Negative Phase Sequence Voltage

Each element has settings for pickup level and Definite Time Lag (DTL) delays. Operates if NPS voltage exceeds setting for duration of delay.

49 Thermal Overload

The thermal algorithm calculates the thermal states from the measured currents and can be applied to lines, cables and transformers. Alarm outputs are given for thermal overload and thermal capacity.

50BF Circuit Breaker Fail

The circuit breaker fail function may be triggered from an internal trip signal or from a binary input. Line currents and earth currents are monitored following a trip signal and an output is issued if any current is still detected, above setting, after a specified time interval. Alternatively, if the trip is from a mechanical protection the circuit breaker position can be used to determine a failure. A second time delay is available to enable another stage to be utilized if required. An input is also available to bypass the time delays when the circuit breaker is known to be faulty.

51c Cold Load Protection

If a circuit breaker is closed onto a 'cold' load, i.e. one that has not been powered for a prolonged period, this can impose a higher than normal load-current demand on the system which could exceed normal settings. These conditions can exist for an extended period and must not be interpreted as a fault. To allow optimum setting levels to be applied for normal operation, the cold load pickup feature will apply alternative current settings for a limited period. The feature resets when either the circuit breaker has been closed for a settable period, or if the current has reduced beneath a set level for a user set period.

50/51 Phase Fault

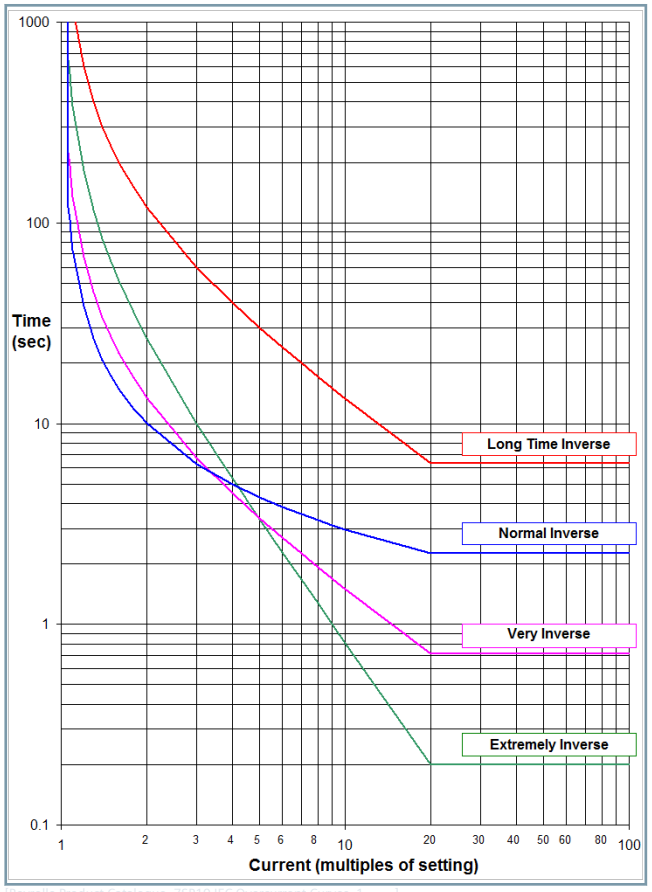
50 INST/DTL and 51 IDMTL/DTL elements provide overcurrent protection, each with independent settings for pickup current, time-multiplier (51) and time-delays. User can select IEC or ANSI time current characteristics. The IDMT stage has a user programmable reset characteristic, either DTL or shaped current ~ time reset characteristic, to improve grading with electromechanical protection.

50G/51G/50N/51N Earth Fault/Sensitive Earth Fault

Two earth fault measurement modes are available. One mode directly measures the earth current from an independent CT, or the residual connection of the 3 line CTs. This input can be ordered as either earth fault or sensitive earth fault (50G/51G).

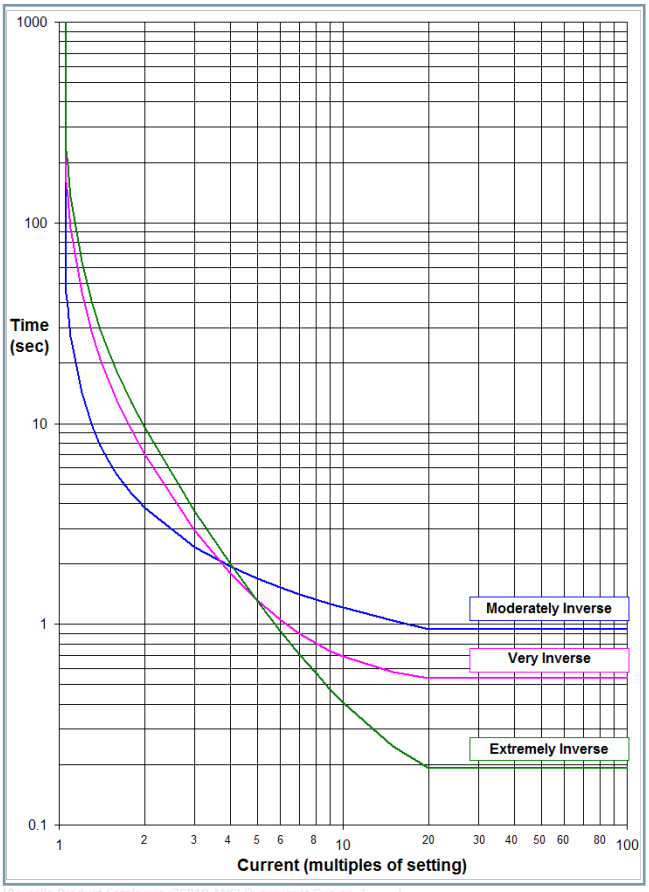
The second mode derives the earth current internally from the 3 phase CT inputs to give earth fault (50N/51N). 50 INST/DTL and 51 IDMTL/DTL elements provide overcurrent protection, each with independent settings for pickup current, time-multiplier (51) and time-delays. User can select IEC or ANSI time current characteristics. The IDMT stage has a user programmable reset characteristic either DTL or shaped current ~ time reset characteristic to improve grading with electromechanical protection.

The directional SEF element is also suitable for use on compensated networks.



[Reyrolle Product Catalogue, 7SR10 IEC Overcurrent Curves, 1, _ _]

Figure 2.3/16 IEC Overcurrent Curves



[Reyrolle Product Catalogue, 7SR10 ANSI Overcurrent Curves, 1, _ _]

Figure 2.3/17 ANSI Overcurrent Curves

51V Voltage Controlled Overcurrent

Each phase shaped overcurrent element can be independently controlled by the level of measured input voltage. For applied voltages above setting the 51-n element operates in accordance with its current setting but for voltages below the setting a multiplier is applied to reduce the 51-n pick up current setting.

50AFD Arc Flash Detector

The 7SR1 relays can be used with the 7XG31 ReyArc range of Arc Flash Detection devices. Arc fault protection is a technique employed for the fast clearance of arcing faults on busbars, within metal clad switchgear & associated cable boxes. The arc is detected using an optical sensor & the signal input to a protection device which also monitors the load current on the system. A trip signal can be achieved in less than 10 ms using arc detection only or within 20 ms when using overcurrent check.

55 Power Factor

Each element has settings for Under or Over Power Factor pickup level, Definite Time Lag (DTL) delay and Lead/Lag Direction. Each can also be set for any phase or all three phases operation.

59N Neutral Overvoltage

Neutral overvoltage can be used to detect earth faults in high impedance earthed or isolated systems.

Operates if the neutral voltage exceeds setting for duration of delay.

60CTS CT Supervision

The relay has two methods of CT supervision.. The 7SR11 monitors each phase current input and operates if any one or two inputs fall below the setting. The 7SR12 has the above method and an addition method that considers the presence of negative phase sequence current, without an equivalent level of negative phase sequence voltage, for a user set time as a CT failure.

Both element types have user operate and delay settings.

60VTS VT Supervision

The VT supervision uses a combination of negative phase sequence voltage and negative phase sequence current to detect a VT fuse failure. This condition may be alarmed or used to inhibit voltage dependent functions. Element has user operate and delay settings.

64H Restricted Earth Fault

The measured earth fault input may be used in a 64H high impedance restricted earth fault scheme to provide sensitive high speed unit protection. A calculation is required to determine the values of the external series stabilising resistor and non-linear shunt resistor which can be ordered separately.

67/67N Directional Control

Phase, earth and sensitive earth fault elements can be directionalised. Each element can be user set to Forward, Reverse, or Non-directional. Directional Phase Fault elements are polarised from quadrature voltage. Derived earth fault elements can be user set to be polarised from residual voltage or negative phase sequence voltage. Measured earth fault elements are polarized from Vo.

74T/CCS Trip and Close Circuit Supervision

The trip or close circuit(s) can be monitored via binary inputs. Trip circuit failure raises an HMI alarm and output(s).

81HBL2 Inrush Restraint

Where second harmonic current is detected (i.e. during transformer energisation) user selectable elements can be blocked and an alarm given.

81 Under/Overfrequency

Each element has settings for pickup level, drop-off level and Definite Time Lag (DTL) delays. Operates if frequency exceeds setting for duration of delay. Typically applied in load shedding schemes.

Standard Version – Plus 79 Auto-Reclose

A high proportion of faults on an overhead line network are transient and can be cleared quickly by high speed tripping followed by an automated circuit breaker reclose sequence.

The function provides independent phase fault and earth fault / sensitive earth fault sequences of up to 5 trip i.e. 4 reclose attempts before lockout. An auto-reclose sequence can be user set to be initiated from internal protection operation or via binary input from an external protection.

Programmable Logic

The user can map binary inputs, protection elements, LEDs and binary outputs together in a logical scheme. Up to 4 logic equations can be defined using standard logic functions e.g. Timers, AND/OR gates, Inverters and Counters to provide the user required functionality. Each logic equation output can be used for alarm & indication and/or tripping.

Virtual Inputs/Outputs

There are 8 virtual inputs/outputs to provide internal logical states to assist in the application of the functions. Each virtual I/O can be assigned in the same way as a physical I/O.

Circuit Breaker Maintenance

Two circuit breaker operations counters are provided to assist with maintenance scheduling. The maintenance counter records the overall number of operations and the delta counter records the number of operations since the last reset.

An I^2t summation counter provides a measure of the contact wear indicating the total energy interrupted by the circuit breaker contacts.

Each counter has a user set target operations count which, when reached, can be mapped to raise alarms/ binary outputs. A CB Trip Time meter is also available, which measures the time between the trip or open command being issued and the auxiliary contacts changing state.

Control Mode

The relay has a control menu with access to commonly used command operations (except 7SR1102-1*A12-*AA0 models). Access to the control commands is restricted by a 4 character control function password. Each command requires a select then execute operation, if the execute operation is not performed within a time window the command is aborted. The following control functions are available:

- CB Operation
- Auto Reclose In/Out
- Auto Reclose Trip & Reclose
- Auto Reclose Trip & Lockout
- SEF In/Out
- Inst Prot In/Out
- Hot Line Working In/Out

[Reyrolle Product Catalogue, 7SR11 and 7SR12 Control Fuction View, 1, --_--]

Figure 2.3/18 Example of Control Function View

Construction

The relay is housed in a 4U high, size E4 or E6 (Optional IEC61850 model) case with a removable clear fascia cover. The fascia cover can be ordered with or without two push buttons to allow the user to view the settings and instruments without removing the cover.

Two handles are provided to allow the relay to be withdrawn from its case, contacts in the case ensure that the CT circuits and normally closed contacts remain short circuited when the relay is withdrawn.

The rear terminal blocks comprise M4 female terminals for ring crimp wire connections, to provide a secure and reliable termination.

[Reyrolle Product Catalogue, 7SR11 and 7SR12 Rear view of relay (E4 Case), 1, --_--]

Figure 2.3/19 Rear view of relay (E4 Case)

[Reyrolle Product Catalogue, 7SR11 and 7SR12 Rear view of relay with 2x LC Fibre Optic ports (E6 Case with IEC61850), 1, –_–]

Figure 2.3/20 Rear view of relay with 2x LC Fibre Optic ports (E6 Case with IEC61850)

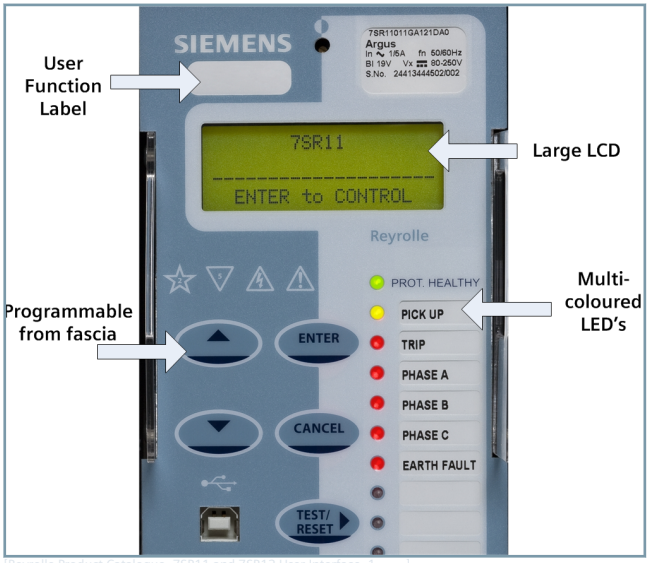
[Reyrolle Product Catalogue, 7SR11 and 7SR12 Front view of relay (E4 Case with push buttons), 1, –_–]

Figure 2.3/21 Front view of relay (E4 Case with push buttons)

[Reyrolle Product Catalogue, 7SR11 and 7SR12 Front view of relay (E6 Case with IEC61850), 1, –_–]

Figure 2.3/22 Front view of relay (E6 Case with IEC61850)

User Interface



[Reyrolle Product Catalogue, 7SR11 and 7SR12 User Interface, 1, –_–]

Figure 2.3/23 User Interface

The operator interface is designed to provide a user friendly method of controlling, viewing menus, entering settings and retrieving data from the relay. Five buttons are provided for navigation around the menu structure.

LCD

A 4 line by 20 character liquid crystal display with power save operation indicates the relay identifier, settings, instrumentation, fault data and control commands. Up to 6 user programmable general alarms can be configured to display your own indications on the LCD.

LEDs

A green steadily illuminated LED indicates the 'Protection Healthy' condition.

9 user programmable LEDs are available eliminating the need for expensive panel mounted pilot lights and associated wiring. Each LED is tri-color (red, green, yellow) allowing for clear indication of the associated function's state and has a label insert for identification.

Relay Information

The device is identified by the rating label on the fascia. The user can also give the device its own identity by editing the 'Relay Identifier' displayed on the LCD or space is provided to place a slip in label giving the relays function.

Technical Data

For full technical data refer to the Performance Specification Section of the Technical Manual.

Inputs and Outputs

Current Inputs

Quantity	3 x Phase & 1 x Earth or Sensitive Earth
Rated Current I_n	1 A/5 A
Measuring Range	80 x I_n
Instrumentation ≥ 0.1 x I_n	±1% I_n
Frequency	50/60Hz
Thermal Withstand: Continuous 10 Minutes 2 Minutes 1 Second 1 Cycle	 3 x I_n 3.5 x I_n 6 x I_n 100 A (1 A) 350 A (5 A) 700A (1A) 2500A (5A)
Burden @ I_n	≤ 0.02VA (1A phase and Earth element) ≤ 0.2VA (5A phase and earth element)

Voltage Inputs

Nominal	40...160 V_{RMS}
Operating Range	0... 200 V_{RMS}
Instrumentation ≥ 0.8 x V_n	±1% V_n
Burden @ 110V	≤ 0.06 VA
Overvoltage Withstand	300 V_{RMS}

Auxiliary Supply

Rated DC Voltage	24 V - 250 V DC Operating Range 19.2 to 275V	
Allowable super imposed AC component	12% of DC voltage	
Rated AC Voltage	100-230 V AC 50/60Hz Range 80 to 253 V rms AC 50/60Hz ±5%	
Power Consumption:	Min (DC)	3.6W(6.1W with IEC61850)
	Max (DC)	8.4W (11W with IEC61850)
	Min (AC)	9VA (14.5VA with IEC61850)
	Max (AC)	17VA (23VA with IEC61850)
Allowable breaks/dips in supply (collapse to zero)	DC	50ms
	AC	2.5/3 cycles @50/60Hz

Binary Inputs

Number	3.4 or 6	
Operating Voltage	19 V dc	Range 19 to 320V dc Minimum threshold 17V dc
	88 V dc	Range 88 to 320V dc Minimum threshold 68.75V dc
Maximum current for operation	1.5 mA DC	
Pick Up Delay	User selectable 0 to 14,400,000 ms (up to 4 hours)	
Drop Off Delay	User selectable 0 to 14,400,000 ms (up to 4 hours)	

Binary Outputs

Number	5 or 8 (3 change over contacts)
Operating Voltage	Voltage Free
Operating Mode	User selectable - Self or Hand/Electrical Reset or pulsed
Operating Time from Energizing Binary Input	< 20 ms

Making Capacity:	
Carry continuously	5 A ac or dc
Make and carry	20 A ac or dc for 0.5 s
(L/R ≤ 40 ms and V ≤ 300 V)	30 A ac or dc for 0.2 s
Breaking Capacity:	
(≤ 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 ≤ 40 ms
	50 W at L/R ≤ 10 ms

Unit Design

Housing	E4 or E6(see dimension drawing)
Indication	20 Character 4 line Display Relay Healthy LED 9 Tri Coloured User Programmable Self or Hand Reset LED's
With-drawable Element	Yes
User Interface	5 Navigation Keys
Weight	Typical 3.1Kg
IP Rating installed with cover	IP 51 from front
IP Rating installed without cover	IP 20 from front

Data Communication Interface

Communication Port	Front USB Type B Rear RS485 2 wire electrical IEC61850 optional ports: 2x Electrical RJ45 Ethernet 2x LC Fibre Optic Ethernet
Protocols	IEC60870-5-103 MODBUS RTU (Serial) DNP3.0 O (Serial) IEC61850 - optional
Fibre Optic Ethernet Data Communication Interface (IEC 61850 Option)	

EN100 Fibre Optic Data Communication Interface

IEC 61850 Option

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

EN100 Electrical Ethernet Data Communication Interface

IEC 61850 Option

Physical	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	20m

Data Storage

Fault Record	10 (5 for 7SR1102-1*A12-*AA0).
Waveform Record	10 x 1sec 2 x 5sec 5 x 2sec 1 x 10sec (5x1sec, 2x2sec, 1x5sec for 7SR1102-1*A12-*AA0) Pre trigger 10...90%
Events	1000 1ms Resolution

Mechanical Tests

Vibration (Sinusoidal)

IEC 60255-27 & IEC 60255-21-1 Class I

Type	Level	Variation
Vibration response	0.5 gn	≤ 5 %
Vibration response	1.0 gn	≤ 5 %

Shock and Bump

IEC 60255-27 & IEC 60255-21-2 Class I

Type	Level	Variation
Shock response	5 gn, 11 ms	≤ 5 %
Shock withstand	15 gn, 11 ms	≤ 5 %
Bump test	10 gn, 16 ms	≤ 5 %

Seismic

IEC 60255-27 & IEC 60255-21-3 Class I

Type	Level	Variation
Seismic response	X-plane - 3.5mm displacement below crossover freq (8-9Hz) 1gn and above Y-plane – 1.5mm displacement below crossover freq (8-9Hz) 0.5gn above	≤ 5 %

Mechanical Classification

Durability	>10^6 operations

Electrical Tests

Insulation

IEC 60255-27

Type	Level
Between any terminal and earth	2.0 kV AC RMS for 1 min
Between independent circuits	2.0 kV AC RMS for 1 min
Across normally open contacts	1.5 kV AC RMS for 1 min

Slow Damped Oscillatory Wave (High Frequency Disturbance)

IEC 60255-26

Type	Level	Variation
Common (longitu-dinal) mode	2.5 kV	≤ 5 %
Series (transverse) mode	1.0 kV	≤ 5 %

Electrostatic Discharge

IEC 60255-26

Type	Level	Variation
Front Cover Fitted	Class IV, 15 kV Air Discharge	≤ 5 %
Front Cover Removed	Class III, 8 kV Air Discharge	≤ 5 %

Fast Transients

IEC 60255-26

5/50 ns 5 kHz Repetitive	Level	Variation
Analog Inputs, Aux supply & I/O	4kV	≤ 5 %
RS485 port	2kV	≤ 5 %

Surge Immunity

IEC 60255-26

Type	Level	Variation
Analog Inputs: Line to Earth	4.0 kV	≤ 10 %
Case, Aux Power & I/O: Line to Earth	2.0 kV	≤ 10 %
RS485 Comms port: Line to Earth	1.0 kV	No Data Loss
Analog Inputs: Line to Line	1.0 kV	≤ 10 %
Case, Aux Power & I/O: Line to Line	1.0 kV *	≤ 10 %

NOTE

* 50ms DTL pick-up delay applied to binary inputs

Conducted Radio Frequency Interference Immunity

IEC 60255-26

Type	Level	Variation
0.15 to 80 MHz	10 V	≤ 5 %

Radiated Radio Frequency Emissions

IEC 60255-26

Type	Limits at 10 m, Quasi-peak
30 to 230 MHz	40 dB(µV)
230 to 10000 MHz	47 dB(µV)

Conducted Radio Frequency Emissions

Type	Limits	
	Quasi-peak	Average
0.15 to 0.5 MHz	79 dB(µV)	66 dB(µV)
0.5 to 30 MHz	73 dB(µV)	60 dB(µV)

Radiated Immunity

IEC 60255-26

Type	Level
80 MHz to 1000 MHz Sweep	10 V/m
1.4GHz to 2.7GHz Sweep	10 V/m
80,160,380,450,900,1850,2150 MHz Spot	10 V/m

Climatic Tests

Temperature

IEC 60255-1 & IEC 60068-2-1/2

Operating Range	-10°C to + 55°C
Storage Range	- 25°C to + 70°C

Humidity

IEC 60255-1 & IEC 60068-2-78

Operational test	56 days at 40°C and 93% relative humidity

Cyclic Temperature and Humidity

IEC 60255-1 & IEC 60068-2-30

Operational test	25°C to 55°C (outdoor equipment) and 97/93 % relative humidity. 6 x 24h (12h+12h) cycles.

Performance

27/59 Under/Over Voltage

Number of Elements	4 Under or Over
Operate	Any phase or All phases
Voltage Guard	1,1.5...200V
Setting Range V_s	5,5.5...200V
Hysteresis Setting	0.0.1...80%
V_s Operate Level	100% V_s, ±1% or ±0.25V
Reset Level: Overvoltage Undervoltage	=(100%-hyst) x V_{op}, ±1% =(100%+hyst) x V_{op}, ±1%
Delay Setting t_{delay}	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400s
Basic Operate Time : 0 to 1.1 x V_s 0 to 2.0 x V_s 1.1 to 0.5 x V_s	73ms ±10ms 63ms ±10ms 58ms ±10ms
Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±10ms
Inhibited by	Binary or Virtual Input VT Supervision Voltage Guard

32 Power (7SR12)

Number of Elements	2 Forward or Reverse
Operate	P, Q or S
U/C Guard	0.05 to 1.0 x I_n
Setting Range S_s	0.05 to 2.0 x S_n
Operate Level S_{op}	100% S_s, ± 5% or ± 2% S_n
Reset Level: -	≥95% S_{op}
Basic Operate Time: - 1.1 x S_s (over) 2.0 x S_s (over) 0.5 x S_s (under)	60ms ± 10ms 45ms ± 10ms 30ms ± 10ms
Delay Setting t_{delay}	0 to 14400s
Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±10ms
Inhibited by	Undercurrent Guard, VTS

32S Sensitive Power (7SR12 SEF)

Number of Elements	2 Forward or Reverse
Operate	P, Q or S
U/C Guard	0.005 to 1.0 x I_n
Setting Range S_s	0.005 to 2.0 x S_n
Operate Level	100% S_s, ± 5% or ± 2% S_n
Reset Level: -	≥95% S_{op}

Basic Operate Time: - 1.1 x S_s (over) 2.0 x S_s (over) 0.5 x S_s (under)	60ms ± 10ms 45ms ± 10ms 30ms ± 10ms
Delay Setting t_{delay}	0 to 14400s
Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±10ms
Inhibited by	Undercurrent Guard, VTS

37 Undercurrent

Number of Elements	2 Phase and 2 EF/SEF
Operate	Any phase or ALL
Setting Range I_s	Phase and EF 0.05,0.10...5.0 x I_n SEF 0.005,0.010...5.0 x I_n
Operate Level	100% I_s, ±5% or ±1% x I_n
Current Guard	Phase 0.05,0.1...5.0 x I_n
Delay Setting t_{delay}	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400s
Basic Operate Time: 1.1 to 0.5 x I_n	35ms ±10ms
Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±10ms
Overshoot Time	< 40ms
Inhibited by	Binary or Virtual Input

46 Negative Phase Sequence Overcurrent

Number of Elements	DT & IT
DT Setting Range I_s	0.05,0.10...4.0 x I_n
DT Operate Level	100% I_s, ±5% or ±1% x I_n
DT Delay Setting t_{delay}	0.00, 0.01...20, 20.5...100,101...1000, 1010...10000, 10100...14400 s
DT Basic Operate Time 0 to 2 x I_s 0 to 5 x I_s	40 ms ±10 ms 30 ms ±10 ms
DT Operate time following delay	t_{basic} +t_{delay} , ±1% or ±10 ms
IT Char Setting	IEC NI,VI,EI,LTI, ANSI MI,VI,EI & DTL
IT Setting Range	0.05..2.5
Tm Time Multiplier	0.025, 0.030... 1.6, 1.7... 5, 6...100
Char Operate Level	105% I_s, ±4% or ±1% I_n
Overshoot Time	< 40 ms
Inhibited by	Binary or Virtual Input

47 Negative Phase Sequence

Number of Elements	2
Setting Range V_s	1,1.5...90V
Hysteresis Setting	0,0.1...80%
Operate Level	100% V_s, ±2% or ±0.5V
Delay Setting t_{delay}	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400s

Basic Operate Time 0V to 1.5 x V_s 0V to 10 x V_s	80 ms ±20 ms 55 ms ±20 ms
Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±10 ms
Overshoot Time	< 40 ms
Inhibited by	Binary or Virtual Input

49 Thermal Overload

Operate levels	Operate and Alarm
Setting Range I_s	0.10,0.11...3.0 x I_n
Operate Level	100% I_s, ±5% or ±1% x I_n
Time Constant Setting	1,1.5...1000 min
Operate time	$t = \tau \times ln\left\{\frac{I^2 - I_p^2}{I^2 - (k \times I_s)^2}\right\}$ ±5% absolute or ±100 ms where Ip = prior current
Alarm Level	Disabled, 50,51...100%
Inhibited by	Binary or Virtual Input

50 (67) Instantaneous & DTL OC&EF (Directional)

Operation - 7SR12 only	Non directional, Forward or reverse
Elements	Phase, Derived Earth, Measured Earth & SEF
Number of Elements 2 x 7SR11 4 x 7SR12	2/4 x OC 2/4 x Derived EF 'N' 2/4 x Measured EF 'G' where fitted 2/4 x SEF where fitted
Setting Range I_s	0.05,0.06...50 x I_n SEF 0.005...5 x I_n
Time Delay	0.00...14400 s
Operate Level I_{op}	100% I_s, ±5% or ±1% x I_n
Reset level	≥ 95 % I_{op}
Operate time: 50 50N	0 to 2 x I_s – 35 ms, ±10 ms, 0 to 5 x I_s – 25 ms, ±10 ms 0 to 2 x I_s – 40 ms, ±10 ms, 0 to 5 x I_s – 30 ms, ±10 ms
Operate time following delay	t_{basic} +t_{delay} , ±1% or ±10 ms
Inhibited by	Binary or Virtual Input Inrush detector VT Supervision

51(67) Time Delayed OC&EF (Directional)

Operation – 7SR12 only	Non directional, Forward or reverse
Elements	Phase, Derived Earth, Measured Earth & SEF

Number of Elements 2 x 7SR11 4 x 7SR12	2/4 x OC 2/4 x Derived EF 'N' 2/4 x Measured EF 'G' 2/4 x SEF where fitted
Characteristic	IEC NI, VI, EI, LTI; ANSI MI, VI, EI & DTL
Setting Range I_s	0.05,0.06...2.5 x I_n SEF 0.005...0.5 x I_n
Time Multiplier	0.025,0.030...1.6,1.7...5,6...100
Time Delay	0,0.01... 20 s
Operate Level	105% I_s, ±4% or ±1% x I_n
Minimum Operate time IEC ANSI	$t_{op} = \frac{K}{\left[\frac{I}{Is}\right]^{\alpha} - 1} \times Tm$ $t_{op} = \left[\frac{A}{\left[\frac{I}{Is}\right]^{P} - 1} + B\right] \times Tm$ ± 5% absolute or ± 30ms
Follower Delay	0 - 20 s
Reset	ANSI decaying, 0 - 60 s
Inhibited by	Binary or Virtual Input Inrush detector VT Supervision

51V Voltage Controlled Overcurrent

Setting Range	5,5.5...200V
Operate Level	100% V_s, ±5% or ±1% x V_n
Multiplier	0.25.0.3...1 x 51I_s
Inhibited by	VT Supervision

50AFD Arc Flash Detector

Number of Zones	6, segregated outputs with and without current supervision.
Setting Range I_s	1,2...10 x I_n
Operate Level I_{op}	100% I_s, ±5% or ±1% x I_n
Reset level	≥ 95 % I_{op}
Operate time:	50AFD Overcurrent < 16ms AFD Zone Operate Time < 25ms

50BF Circuit Breaker Fail

Operation	Current check - Phase and Measured Earth with independent settings Mechanical Trip CB Faulty Monitor
Setting Range I_s	0.05,0.055...2.0 x I_n
2 Stage Time Delays	Timer 1 20...60000 ms Timer 2 20...60000 ms
Operate Level	100% I_s, ±5% or ±1% x I_n
Disengaging time	< 20 ms
Operate time following delay	Tcbf ±1% or ±2 ms
Triggered by	Any function mapped as trip contact
Inhibited by	Binary/Virtual Input
Timer By pass	Yes, 50BF CB Faulty Input

55 Power factor (7SR12)

Number of Elements	2
Operation	Under or Over, Lead or Lag
U/C Guard	0.05 to 1.0
Setting Range PFs	0.05 to 0.99
Time Delays	0 to 14400s
Operate Level	± 0.05
Basic Operate time	≤ 70ms
Operate time following delay	t_{basic} +t_{delay} ± 1% or ± 10ms
Inhibited by	Undercurrent Guard, VTS

59N Neutral Voltage Displacement

Number of Elements	DT & IT
DT Setting Range I_s	1...100V
DT Operate Level	100% V_s, ±2% or ±0.5V
DT Delay Setting t_{delay}	0 ...14400s
DT Basic Operate Time 0V to 1.5 x V_s 0V to 10 x V_s	76ms ±20ms 63ms ±20ms
DT Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±20ms
IT Char Setting	IDMTL & DTL
IT Setting Range	1...100V
Tm Time Multiplier(IDMT)	0.1...140
Delay (DTL)	0...20s
Reset	ANSI Decaying, 0...60s
Char Operate Level	105% V_s, ±2% or ±0.5V
Inhibited by	Binary or Virtual Input

7SR1 Range – 7SR11 and 7SR12 Non-Directional/Directional Overcurrent Relays

60 Supervision

CT	7SR11 Current 7SR12 Current or V_{nps} & I_{nps}
VT	nps/zps

64H Restricted Earth Fault

Setting Range	SEF input	0.005, 0.006 ... 0.100, 0.105 ... 0.950 x I_n
	EF input	0.05, 0.055... 0.95 x I_n
Operate Level	100% I_s, ±5% or ±1%x I_n	
Time Delay	0.00... 14400s	
Basic Operate Time	0 to 2 x I_s 45ms ±10ms 0 to 5 x I_s 35ms ±10ms	
Inhibited by	Binary or Virtual Input	

74T/CCS Trip/Close Circuit Supervision

Number of supervisable circuits	3 x Trip and 3 x Close
Number of BI's Required	1 or 2 per function

79 AutoReclose

Operating Mode	Phase, Earth, SEF External
Number of Reclosures	4
Number of Trips	5
Dead Time	0...14400
Reclaim Timer	0...600
Lockout Reset	CB, Timer & BI

81 Under/Over Frequency

Number of Elements	4 Under or Over
Under Voltage Guard	Yes/No
Setting Range Hz	43,43.01...68Hz
Hysteresis Setting	0, 0.1... 2%
Operate Level	100% F_s ±10mHz
Operate Time	Typical < 150ms
V_s Operate Delay	0...14400s

7SR11 Connection Diagram

Control Functions

CB	Open/Close
Inst Prot	IN/OUT
EF	IN/OUT
SEF	IN/OUT
Hot Line	IN/OUT
Relay Mode	Local/Remote/Local or Remote
Reset	LED's & O/P's

NOTE

Not available in 7SR1102-1*A12-*AA0

CB Maintenance

Trip Counter	Total & Delta 0...10000
Counts to AR Block	0...10000
Frequent Operations	0...10000
I^2t Alarm	10...100000

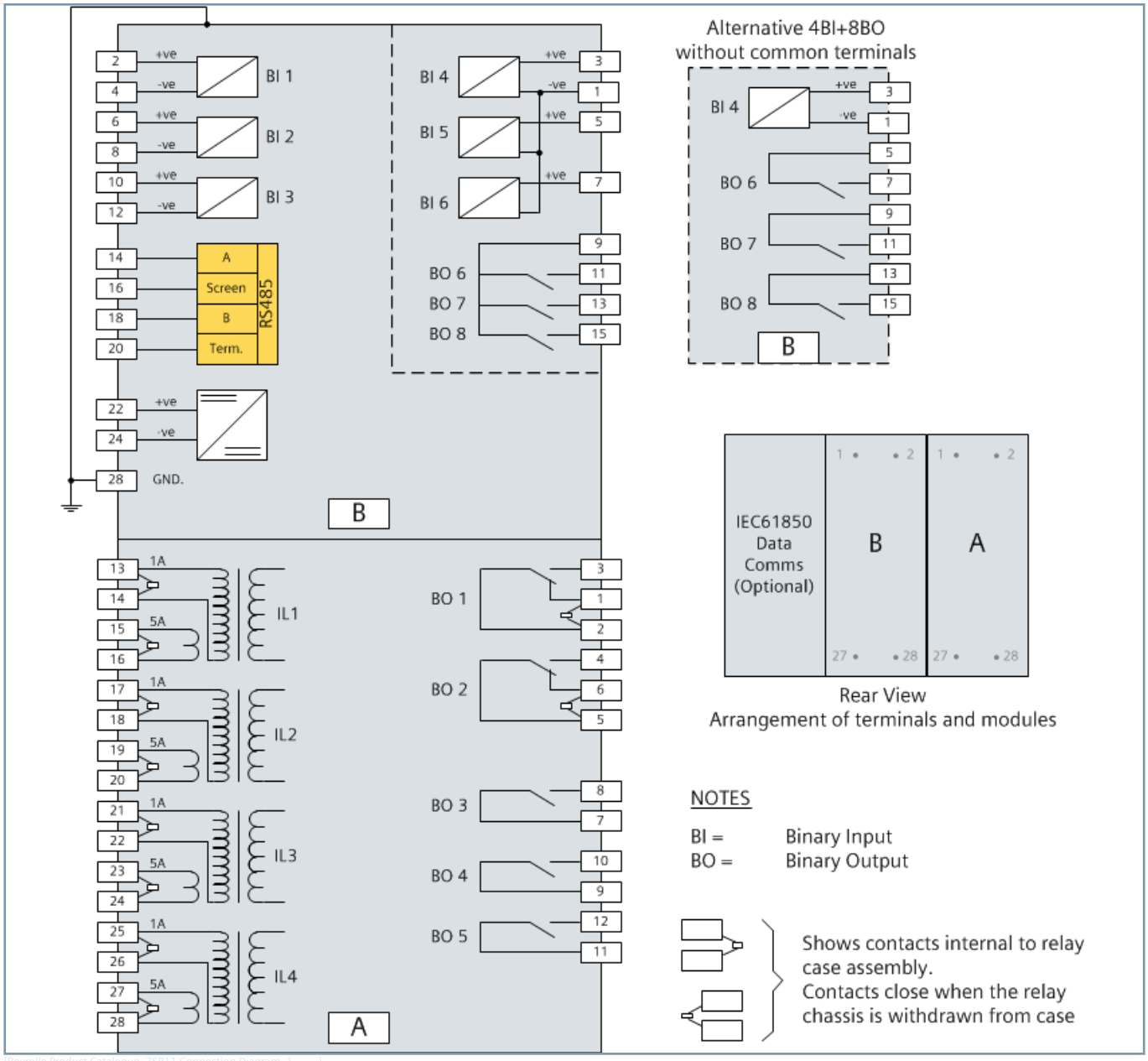
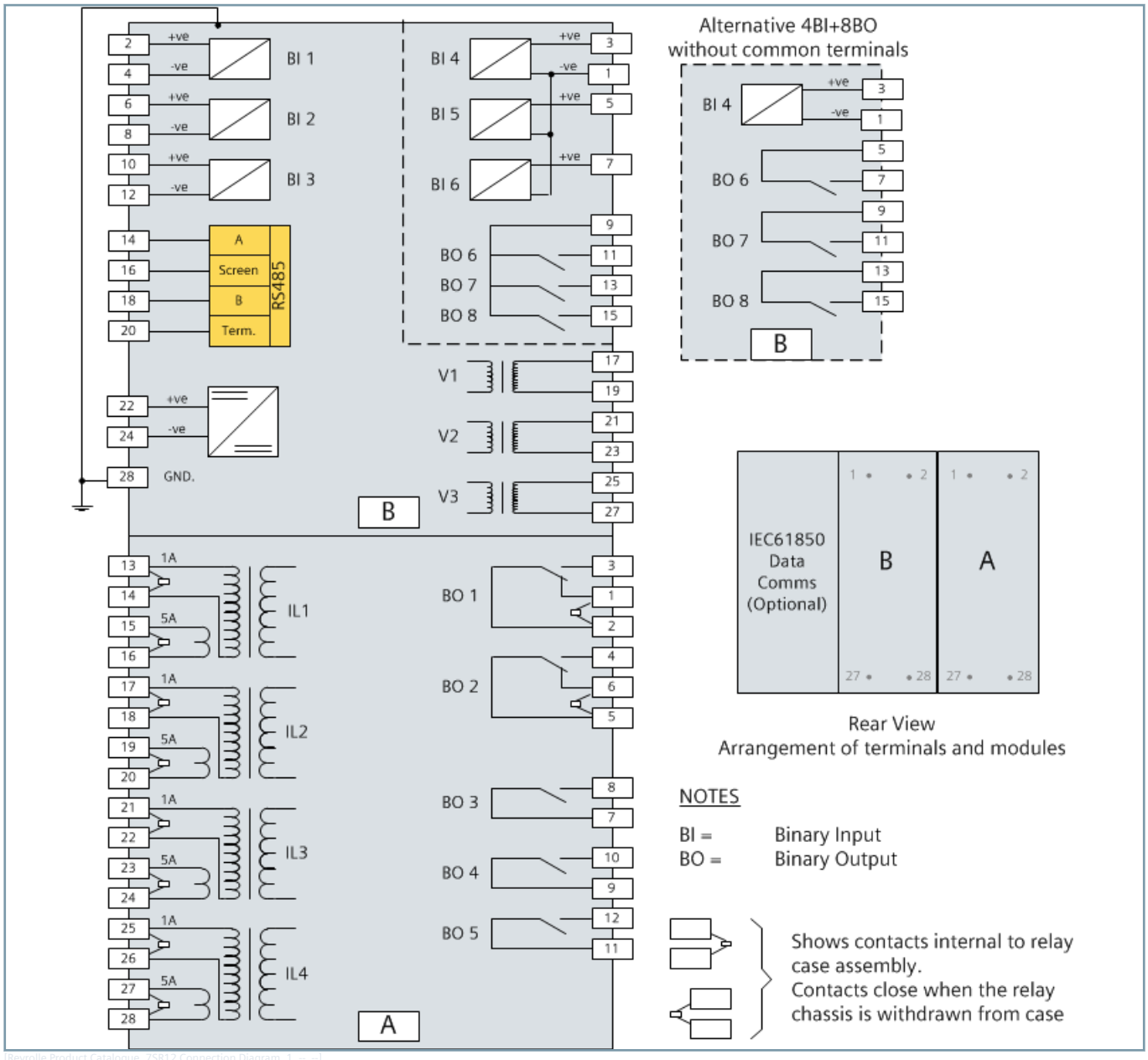


Figure 2.3/24 Diagram showing 7SR11 relay with 4 CT inputs, up to 6 binary inputs and 8 binary outputs.

7SR12 Connection Diagram



[Reyrolle Product Catalogue, 7SR12 Connection Diagram, 1, –_–]

Figure 2.3/25 Diagram showing 7SR12 relay with 4 CT inputs, 3 VT inputs, up to 6 binary inputs and 8 binary outputs.

Ordering Information - 7SR11 Argus Non-Directional Overcurrent

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Nondirectional O/C Relay (Argus)	7	S	R	1	1	0	□	-	□	□	A	□	□	-	□	□	A	0
					|		|		|	|		|	|		|	|	|	
Overcurrent and earth fault Protection relay					|		|		|	|		|	|		|	|	|	
Protection Product					|		|		|	|		|	|		|	|	|	
Overcurrent - Non Directional					1		|		|	|		|	|		|	|	|	
							|		|	|		|	|		|	|	|	
Housing I/O and Fascia							|		|	|		|	|		|	|	|	
1 CT, 3 Binary Inputs / 5 Binary Outputs, 10 LEDs							1		|	|		1	|		|	C	|	
4 CT, 3 Binary Inputs / 5 Binary Outputs, 10 LEDs							2		|	|		|	|		|	A/C/D	|	
4 CT, 6 Binary Inputs / 8 Binary Outputs, 10 LEDs							3		|	|		|	|		|	C/D	|	
4 CT, 4 Binary Inputs / 8 Binary Outputs, 10 LEDs [7]							7		|	|		|	|		|	C/D	|	
									|	|		|	|		|	|	|	
Measuring Input									|	|		|	|		|	|	|	
1/5 A, 50/60Hz [1]									1	|		|	|		|	A/C/D	|	
1/5 A, 50/60Hz with SEF Input [2]									3	|		|	|		|	C/D	|	
										|		|	|		|	|	|	
Auxiliary Voltage										|		|	|		|	|	|	
PSU Rated: 24-250V DC / 100-230V AC. BI threshold 19V DC (Rated: 24-250V DC / 100-120V AC)										M		|	|		|	|	|	
PSU Rated: 24-250V DC / 100-230V AC. BI threshold 88V DC (Rated: 110-250V DC)										N		|	|		|	|	|	
												|	|		|	|	|	
Communication Interface												|	|		|	|	|	
Standard version - included in all models, USB front port, RS485 rear port (E4 Case)												1	2		|	|	|	
Standard version - plus additional rear electrical Ethernet RJ45 (x2), E6 Case [6]												7	7		|	C/D	|	
Standard version - plus additional rear optical Ethernet duplex (x2), E6 Case [6]												8	7		|	C/D	|	
													|		|	|	|	
Protocol													|		|	|	|	
IEC 60870-5-103 Modbus RTU and DNP3 (user selectable)													2		|	|	|	
IEC 60870-5-103 Modbus RTU, DNP3 and IEC 61850(user selectable settings) [6]													7		|	|	|	
															|	|	|	
Relay Cover															|	|	|	
Standard Version - No Push Buttons															1	|	|	
Push Buttons - Down and Right Arrows															2	|	|	
																|	|	
Protection Function Packages																|	|	
Basic version [5]																A	|	
46BC [3] Broken conductor/load unbalance																|	|	
50 [3] Instantaneous phase fault overcurrent																|	|	
50BF [3] Circuit breaker fail																|	|	
50G/50N Instantaneous earth fault																|	|	
51 [3] Time delayed phase fault overcurrent																|	|	
51G/51N Time delayed earth fault																|	|	
60CTS [3] CT Supervision																|	|	
64H High impedance REF																|	|	
74T&C Trip and close circuit supervision																|	|	
86 Hand reset contacts																|	|	
																|	|	

7SR1 Range – 7SR11 and 7SR12 Non-Directional/Directional Overcurrent Relays

Product Description	Order No.			
Standard version		C	|	
37 Undercurrent		|	|	
46BC [3] Broken conductor/load unbalance		|	|	
46NPS [3] Negative phase sequence overcurrent		|	|	
49 [3] Thermal overload		|	|	
50 [3] Instantaneous phase fault overcurrent		|	|	
50AFD Arc Flash Detection		|	|	
50BF [3] Circuit breaker fail		|	|	
50G/50N Instantaneous earth fault		|	|	
50SEF [2] Instantaneous sensitive earth fault		|	|	
51 [3] Time delayed phase fault overcurrent		|	|	
51G/51N Time delayed earth fault		|	|	
51SEF [2] Time delayed sensitive earth fault		|	|	
60CT [3] CT Supervision		|	|	
64H High Impedance REF		|	|	
74T/CC Trip and Close circuit supervision		|	|	
81HBL2 [4] 2nd Harmonic block/Inrush restraint		|	|	
51C [3] Cold load pickup		|	|	
86 Hand reset contacts		|	|	
Programmable logic		|	|	
		|	|	
Standard version – plus		D	|	
79 Autoreclose			|	
			|	
Additional Functionality			|	
No Additional Functionality			A	

NOTE

1) 4CT is configured as 3PF + EF

2) 4CT is configured as 3PF + SEF/REF

3) Functions only available in 4CT relay

4) Not available on SEF input

5) Protection function package ordering option A is only available on hardware variant 7SR1102-1XAA0-4CT 3BI 5BO

6) E4 case is standard, E6 case is required if IEC61850 model ordered

7) 4 Binary Input variant provides segregated Binary Outputs without a common terminal

Ordering Information - 7SR12 Argus Directional Overcurrent

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Directional O/C Relay (Argus)	7	S	R	1	2	0	□	-	□	□	A	□	□	-	□	□	A	0
					|		|		|	|		|	|		|	|	|	
Directional overcurrent and earth fault protection relay					|		|		|	|		|	|		|	|	|	
Protection Product					|		|		|	|		|	|		|	|	|	
Overcurrent - Directional					2		|		|	|		|	|		|	|	|	
							|		|	|		|	|		|	|	|	
Housing I/O and Fascia							|		|	|		|	|		|	|	|	
1 CT, 3 VT, 3 Binary Inputs / 5 Binary Outputs, 10 LEDs							4		|	|		1	|		|	C	|	
4 CT, 3 VT, 3 Binary Inputs / 5 Binary Outputs, 10 LEDs							5		|	|		|	|		|	|	|	
4 CT, 3 VT, 6 Binary Inputs / 8 Binary Outputs, 10 LEDs							6		|	|		|	|		|	|	|	
4 CT, 3 VT, 4 Binary Inputs / 8 Binary Outputs, 10 LEDs [6]							8		|	|		|	|		|	|	|	
									|	|		|	|		|	|	|	
Measuring Input									|	|		|	|		|	|	|	
1/5 A, 40 to 160 V, 50/60Hz [1]									2	|		|	|		|	|	|	
1/5 A, 40 to 160 V, 50/60Hz with SEF Input [2]									4	|		|	|		|	|	|	
										|		|	|		|	|	|	
Auxiliary Voltage										|		|	|		|	|	|	
PSU Rated: 24-250V DC / 100-230V AC. BI threshold 19V DC (Rated: 24-250V DC / 100-120V AC)										M		|	|		|	|	|	
PSU Rated: 24-250V DC / 100-230V AC. BI threshold 88V DC (Rated: 110-250V DC)										N		|	|		|	|	|	
												|	|		|	|	|	
Communication Interface												|	|		|	|	|	
Standard version - included in all models, USB front port, RS485 rear port (E4 Case)												1	2		|	|	|	
Standard version - plus additional rear electrical Ethernet RJ45 (x2), E6 Case [5]												7	7		|	|	|	
Standard version - plus additional rear optical Ethernet duplex (x2), E6 Case [5]												8	7		|	|	|	
													|		|	|	|	
Protocol													|		|	|	|	
IEC 60870-5-103 Modbus RTU and DNP3 (user selectable)													2		|	|	|	
IEC 60870-5-103 Modbus RTU, DNP3 and IEC 61850(user selectable settings) [5]													7		|	|	|	
															|	|	|	
Relay Cover															|	|	|	
Standard Version - No Push Buttons															1	|	|	
Push Buttons - Down and Right Arrows															2	|	|	
																|	|	
Protection Function Packages																|	|	
Standard version - Included in all models																C	|	
27/59 Under/overvoltage																|	|	
32 [3] Power																|	|	
32S [7] Sensitive Power																|	|	
37 Undercurrent																|	|	
46BC [3] Broken conductor/load unbalance																|	|	
46NPS [3] Negative phase sequence overcurrent																|	|	
47 Negative phase sequence voltage																|	|	
49 [3] Thermal overload																|	|	
50AFD Arc Flash Detection																|	|	
50BF [3] Circuit breaker fail																|	|	
51V [3] Voltage controlled overcurrent																|	|	
55 [3] Power Factor																|	|	
59N Neutral voltage displacement																|	|	

7SR1 Range – 7SR11 and 7SR12 Non-Directional/Directional Overcurrent Relays

Product Description	Order No.			
60CTS [3] CT supervision			|	|	
60VTS [3] VT supervision			|	|	
64H High Impedance REF			|	|	
67/50 Directional instantaneous phase fault overcurrent			|	|	
67/50G 67/50N Directional instantaneous earth fault			|	|	
67/50SEF [2] Instantaneous sensitive earth fault			|	|	
67/51 Directional time delayed phase fault overcurrent			|	|	
67/51G 67/51N Directional time delayed earth fault			|	|	
67/51/SEF [2] Time delayed sensitive earth fault			|	|	
81HBL2 [4] 2nd Harmonic block/inrush restraint			|	|	
74T/CC Trip & Close circuit supervision			|	|	
51C [3] Cold load pickup			|	|	
81U/O Under/Over Frequency			|	|	
86 Hand reset contacts			|	|	
Programmable logic			|	|	
			|	|	
Standard version – plus			D	|	
79 Autoreclose				|	
				|	
Additional Functionality				|	
No Additional Functionality				A	

NOTE

1) 4CT is configured as 3PF + EF

2) 4CT is configured as 3PF + SEF/REF

3) Functions only available in 4CT relay

4) Not available on SEF input

5) E4 case is standard, E6 case is required if IEC61850 model ordered

6) 4 Binary Input variant provides segregated Binary Outputs without a common terminal

7) Functions only available in 4CT SEF relay

7SR157 Check Synchronising Relay

[Reyrolle Product Catalogue, 7SR157, 1, –_–]

Figure 2.3/26 7SR157 Fascia

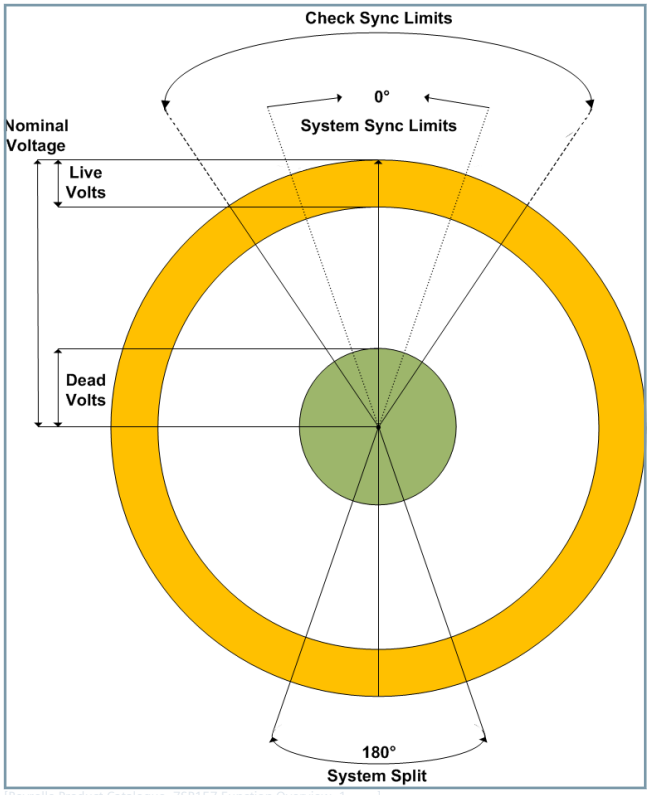
Description

The 7SR157 Argus is a combined check and system synchronising relay which can carry out controlled closing of a circuit breaker using measurements of the line and bus voltages. The relay will prevent closure of the circuit breaker if the differences in phase angle, slip frequency or magnitude of the voltages fall outside prescribed limits.

If the parameters are within limits, the relay will issue an output which can be used to close the circuit breaker directly or in conjunction with an auto-reclose scheme.

Housed in a 4U high, size E4 or E6 (Optional IEC61850 model) case, the relay provides instrumentation and fault data with integrated input and output logic, data logging & fault reports. Communication access to the relay functionality is via a front USB port for local PC connection or rear electrical RS485 port for remote connection & optional IEC61850 communication through two rear Ethernet ports (Electrical or Optical).

Function Overview



[Reyrolle Product Catalogue, 7SR157 Function Overview, 1, –_–]

- Independent check, system synchronising and close on zero settings.
- Adjustable slip frequency, phase angle, voltage blocking and Differential voltage blocking.
- Split system detection.
- Configurable dead/live bus and dead/live line voltage settings, (2 State and 3 State).
- Synchronising bypass logic is provided to connect a dead line or bus to a live line or bus.
- For manual synchronising the relay includes a circuit breaker close guard feature, which is used to prevent the control switch being held closed during a synchronising operation.

Monitoring

25	Undervoltage Detector
	Differential Voltage Detector
	Voltage Levels (Live and Dead status)

Control

25	Voltage Trim (Magnitude and Phase)
	System Split Detector
	Check Synchronising
	Check Synchronising Close Guard
	System Synchronising
	Close On Zero Synchronising

	System Split Lockout
	Synchronising Bypass

Supervision

74	Close Circuit Supervision
60	VT Fail
	Demand Metering

Features

Four Settings Groups
Password Protection – 2 levels
User Programmable Logic
Self Monitoring

User Interface

20 Character x 4 Line Backlit LCD
Menu Navigation Keys
9 User Programmable Tri-colour LEDs
User Language Configuration

Hardware

2 VT, 3 Binary Inputs, 5 Binary Outputs
2 VT, 6 Binary Inputs, 8 Binary Outputs

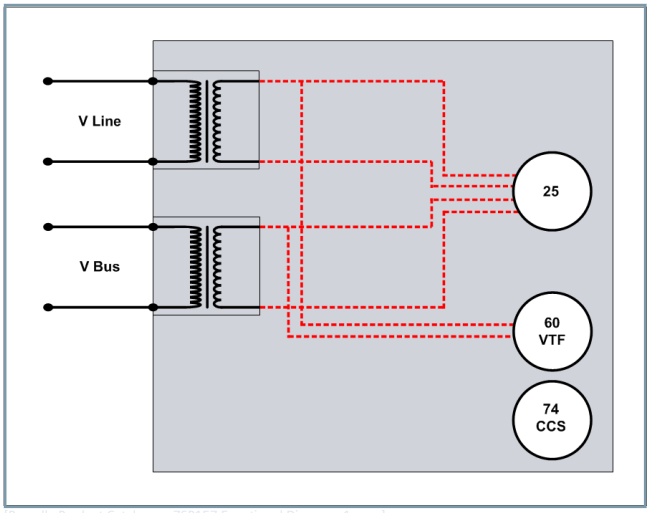
Application

Check or system synchronising is required whenever two parts of a power system network, each containing generation, have to be connected or re-connected together. To avoid shock loading and possible damage to primary electrical plant the voltage, frequency and phase angle difference between the two systems should be within acceptable limits relative to one another.

Where two systems have been previously interconnected, the frequencies of the two systems will drift apart slowly following circuit breaker tripping and the phase angle difference will increase. Here the slip rate will be small and the circuit breaker can be closed using check synchronising settings as the limiting parameters.

However, if the two systems become asynchronous so one system is an 'island' of generation then a high rate of slip may result causing the two systems to pass through anti-phase conditions. The relay will detect this system split condition, inhibit the check synchronising algorithms and apply system synchronising settings as limiting parameters. Typically in this mode the slip rate will be much higher and so there will be a narrower allowable phase angle difference before closing. In addition, closure of the circuit breaker will only be allowed under conditions of decreasing difference in phase angle.

Functional Diagram



[Reyrolle Product Catalogue, 7SR157 Functional Diagram, 1, ~_~]

Figure 2.3/27 VLine, Vbus connection

Description of Functionality

25 Line/Bus Undervolts

The undervoltage detector element can block a close output command if either the line or bus voltages are below the 25 Line U/V / 25 Bus U/V setting value.

25 Voltage Diff

The Differential Voltage Detector Element can block a close output command if the scalar difference between the line and bus voltages is greater than the 25 Volt Differential setting value.

VT Level Mode

Option of 2 State or 3 State, to determine when a voltage is live or dead:

2 State – Line or Bus voltages are dead until they exceed the live threshold. The voltages are then live until they drop below the dead threshold.

3 State - The Line or Bus Voltages are only classed as live when above the live threshold. When the voltage falls below the live threshold, the live output is RESET but the Dead output does not SET until the voltage falls below the Dead threshold. This is an indeterminate state, where both Live and Dead outputs have the same value, both are RESET.

25 Voltage Trim

The relay incorporates a Voltage Trim Magnitude feature and a Voltage Trim Angle feature for both the line and bus voltages. This allows small adjustments to the input voltages and phase angles of the relay.

25 System Split Detector

The method used to detect a system split can be selected as either phase angle or slip frequency. When the selected condition is exceeded the 25 System Split output is set; indicating the system is split. A drop-off delay timer 25 System Split Timer is applied to the output, to suppress flickering.

25 Check Sync

Check Synchronising sets 25 InSyncCS and 25 Check Sync Close outputs when the Line and Bus voltages are healthy and synchronised. The phase angle tolerance for being synchronised is set by 25 Check Sync Angle setting. The synchronised conditions must be held for a minimum time of 25 Check Sync Timer setting. An optional setting 25 Check Sync Slip may be applied to limit Slip Frequency.

There are two modes of operation, Auto and Manual.

AUTO: 25 Check Sync Close output is set when the Check synchronizing conditions are met.

MANUAL: 25 Check Sync Close output is set when Check synchronizing conditions are met and a manual close command is received, via Start Check Sync input.

Close Guard

If manual closes are required to be carried out via an operator, the Close Guard feature can be enabled. This issues an alert message and a general alarm, intended to warn the operator about initiating a CB close before the relay issues a valid Check Sync Close signal. This prevents the operator from pre-empting the relays' decision.

25 System Synchronising

System Synchronising is triggered by a system split. After a split, System Sync will wait for Line and Bus phases to realign, before setting 25 InSyncSS and 25 System Sync Close outputs. The phase angle tolerance for being synchronised is set by 25 System Sync Angle setting (for the System Sync outputs to be set the phase angle between the two voltages must be decreasing). The slip frequency must not be excessive, within 25 System Sync Slip setting. The synchronised conditions must be held for a minimum time of 25 System Sync Timer setting.

There are two modes of operation, Auto and Manual, there is also a lockout mode.

AUTO: 25 System Sync Close output is set when the Check synchronizing conditions are met.

MANUAL: 25 System Sync Close output is set when Check synchronizing conditions are met and a manual close command is received, via Start Check Sync input.

LOCKOUT: The System Split Lockout output is set when there is a 25 System Split event.

25 Close On Zero

If the 25 Split Mode is set to COZ and a 25 System Split occurs, a Close On Zero operation will be activated. Close On Zero differs from System Sync, by attempting to issue a close output when phase angle is precisely zero. The phase angle, slip frequency and CB Close time delay are used to predict when zero phase angle will occur.

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.

25 Synchronising Bypass

Sync Bypass is triggered for switching operations, which involve connecting a dead line or bus to a live line or live bus. For these switching operations the synchronising conditions will not be met, the Sync Bypass setting is required to bypass the synchronising operations and allow the Bypass Close output.

74 Close Circuit Supervision

Monitors the open/closed status of up to 3 circuits. If circuit status is open for a minimum time of 74CCS-n-Delay setting, Close Circuit Fail and Close Circuit Fail n events are raised.

60 VT Fail

When the circuit breaker is closed, both voltages should be either Live or Dead. If this is not true, a VT Fail output is set (60VTS, to indicate the Line VT has failed and 60VTF-Bus to indicate the Bus VT has failed). A time delay setting (60VTF – Line/Bus Delay) suppresses spurious operations during transient switching conditions.

Programmable Logic

The user can map binary inputs, protection elements, LEDs and binary outputs together in a logical scheme.

Up to 4 logic equations can be defined using standard logic functions e.g. Timers, AND/OR gates, Inverters and Counters to provide the user required functionality.

Each logic equation output can be used for alarm & indication and/or tripping.

Virtual Inputs/Outputs

There are 8 virtual inputs/outputs to provide internal logical states to assist in the application of the functions. Each virtual I/O can be assigned in the same way as a physical I/O.

Construction

The relay is housed in a 4U high size E4 case with a removable clear plastic fascia cover. The plastic fascia cover can be ordered with or without two push buttons to allow the user to view the settings and instruments without removing the cover.

Two plastic handles are provided to allow the relay to be withdrawn from its case.

The rear terminal blocks comprise M4 female terminals for ring crimp wire connections, to provide a secure and reliable termination.

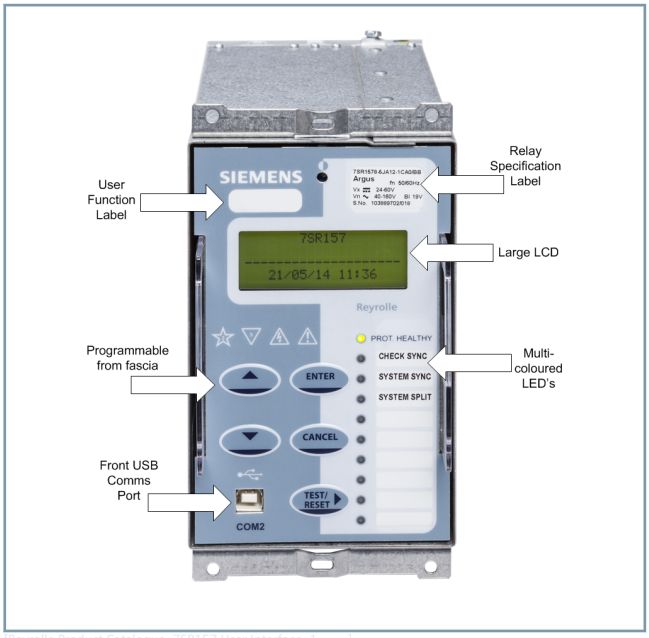
[Reyrolle Product Catalogue, 7SR11 and 7SR12 Rear view of relay (E4 Case), 1, --_--]

Figure 2.3/28 Rear view of Standard E4 relay

[Reyrolle Product Catalogue, 7SR11 and 7SR12 Rear view of relay with 2x LC Fibre Optic ports (E6 Case with IEC61850), 1, --_--]

Figure 2.3/29 Rear view of relay with 2x LC Fibre Optic ports (E6 Case with IEC61850)

User Interface



[Reyrolle Product Catalogue, 7SR157 User Interface, 1, _ _]

Figure 2.3/30 User Interface

The operator interface is designed to provide a user friendly method of controlling, viewing menus, entering settings and retrieving data from the relay. Five buttons are provided for navigation around the menu structure.

LCD

A 4 line by 20 character liquid crystal display with power save operation indicates the relay identifier, settings, instrumentation, fault data and control commands. Up to 6 user programmable general alarms can be configured to display your own indications on the LCD.

LEDs

A green steadily illuminated LED indicates the 'Protection Healthy' condition.

9 user programmable LEDs are available eliminating the need for expensive panel mounted pilot lights and associated wiring. Each LED is tri-color (red, green, yellow) allowing for clear indication of the associated function's state and has a label insert for identification.

Relay Information

The device is identified by the rating label on the fascia. The user can also give the device its own identity by editing the 'Relay Identifier' displayed on the LCD or space is provided to place a slip in label giving the relays function.

Technical Data

For full technical data refer to the Performance Specification Section of the Technical Manual.

Inputs and Outputs

Voltage Inputs

Nominal	40...160 V_{RMS}
Operating Range	0... 200 V_{RMS}
Instrumentation ≥ 0.8 x V_n	±1% V_n
Burden @ 110V	≤ 0.06 VA
Overvoltage Withstand	300 V_{RMS}

Auxiliary Supply

Rated DC Voltage	24-250 V DC Operating Range 19.2 to 275V	
Allowable superimposed ac component	12% of DC voltage	
Rated AC Voltage	100-230 V AC 50/60Hz Range 80 to 253 V_{RMS} AC 50/60Hz ±5%	
Power Consumption:	Min (DC) Max (DC)	3W (4.5W with IEC61850) 8W (10W with IEC61850)
	Min (AC) Max (AC)	5.5VA (8.5VA with IEC61850) 17VA (21VA with IEC61850)
Allowable breaks/ dips in supply (collapse to zero)	DC	50ms
	AC	2.5/3 cycles @50/60Hz

Binary Inputs

Number	6 or 3	
Operating Voltage	19 V dc	DC Range 19 to 320V dc AC Range 92 to 138 V_{RMS}AC Minimum threshold 17V dc
	88 V dc	Range 88 to 320V dc Minimum threshold 68.75V dc
Maximum dc current for operation	1.5 mA	
Maximum peak ac current for operation	1.5 mA	
Pick Up Delay	User selectable 0 to 14,400,000 ms (up to 4 hours)	
Drop Off Delay	User selectable 0 to 14,400,000 ms (up to 4 hours)	

NOTE

For AC operation the BI pick-up delay should be set to 0ms and the drop-off delay to 20ms.

Binary Outputs

Number	8 (2 change over contacts) 5 (2 change over contacts)
Operating Voltage	Voltage Free
Operating Mode	User selectable - Self or Hand/Electrical Reset or pulsed
Operating Time from Energizing Binary Input	< 20 ms
Making Capacity: Carry continuously Make and carry (L/R ≤ 40 ms and V ≤ 300 V)	5 A ac or dc 20 A ac or dc for 0.5 s 30 A ac or dc for 0.2 s
Breaking Capacity: (≤ 5 A and ≤ 300 V): AC Resistive AC Inductive DC Resistive DC Inductive	1250 VA 250 VA at p.f. ≤ 0.4 75 W 30 W at L/R ≤ 40 ms 50 W at L/R ≤ 10 ms

Unit Design

Housing	E4 or E6 (see dimension drawing)
Indication	20 Character 4 line Display Relay Healthy LED 9 Tri Coloured User Programmable Self or Hand Reset LED's
Withdrawable Element	Yes
User Interface	5 Navigation Keys
Weight	Typical 3.2kg E4 case, 4.15 kg E6 case. Additional Transport packaging: add 0.4kg
IP Rating installed with cover	IP 51 from front
IP Rating installed without cover	IP 20 from front

Data Communication Interface

Communication Port	Front USB Type B Rear RS485 2 wire electrical IEC61850 optional ports: 2x Electrical RJ45 Ethernet 2x LC Fibre Optic Ethernet
Protocols	IEC60870-5-103 MODBUS RTU (Serial) DNP3.0 O (Serial) IEC61850 - optional
Fibre Optic Ethernet Data Communication Interface (IEC 61850 Option)	

EN100 Fibre Optic Data Communication Interface (IEC 61850 Option)

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

EN100 Electrical Ethernet Data Communication Interface (IEC 61850 Option)

Physical	Electrical
Connectors	RJ45 100BaseT in acc. With IEEE802.3
Transmission Speed	100 MBits/s
Test Voltage (with regard to socket)	500 VAC 50 Hz
Bridgeable distance	20m

Data Storage

Fault Record	10
Waveform Record	10 x 1sec 2 x 5sec 5 x 2sec 1 x 10sec Pre trigger 10...90%
Events	1000 1ms Resolution

Mechanical Tests

Vibration (Sinusoidal)

IEC 60255-27 & IEC 60255-21-1 Class I

Type	Level	Variation
Vibration response	0.5 gn	≤ 5 %
Vibration response	1.0 gn	≤ 5 %

Shock and Bump

IEC 60255-27 & IEC 60255-21-2 Class I

Type	Level	Variation
Shock response	5 gn, 11 ms	≤ 5 %
Shock withstand	15 gn, 11 ms	≤ 5 %
Bump test	10 gn, 16 ms	≤ 5 %

Seismic

IEC 60255-27 & IEC 60255-21-3 Class I

Type	Level	Variation
Seismic response	X-plane - 3.5mm displacement below crossover freq (8-9Hz) 1gn and above Y-plane – 1.5mm displacement below crossover freq (8-9Hz) 0.5gn above	≤ 5 %

Mechanical Classification

Durability	>10^6 operations

Electrical Tests

Insulation

IEC 60255-27

Type	Level
Between any terminal and earth	2.0 kV AC RMS for 1 min
Between independent circuits	2.0 kV AC RMS for 1 min
Across normally open contacts	1.0 kV AC RMS for 1 min

Slow Damped Oscillatory Wave (High Frequency Disturbance)

IEC 60255-26

Type	Level	Variation
Common (longitu-dinal) mode	2.5 kV	≤ 5 %
Series (transverse) mode	1.0 kV	≤ 5 %

Electrostatic Discharge

IEC 60255-26

Type	Level	Variation
Contact discharge	8.0 kV	≤ 5 %

Fast Transients

IEC 60255-26

Type	Level	Variation
5/50 ns 2.5 kHz repetitive	4kV	≤ 5 %

Surge Immunity

IEC 60255-26

Type	Level	Variation
Analog Inputs: Line to Earth	4.0 kV	≤ 10 %
Case, Aux Power & I/O: Line to Earth	2.0 kV	≤ 10 %
RS485 Comms port: Line to Earth	1.0 kV	No Data Loss
Analog Inputs: Line to Line	1.0 kV	≤ 10 %
Case, Aux Power & I/O: Line to Line	1.0 kV *	≤ 10 %

NOTE

* 50ms DTL pick-up delay applied to binary inputs

Conducted Radio Frequency Interference

IEC 60255-26

Type	Level	Variation
0.15 to 80 MHz	10 V	≤ 5 %

Radiated Radio Frequency

IEC 60255-26

Type	Limits at 10 m, Quasi-peak
30 to 230 MHz	40 dB(µV)
230 to 10000 MHz	47 dB(µV)

Conducted Radio Frequency

Type	Limits	
	Quasi-peak	Average
0.15 to 0.5 MHz	79 dB(µV)	66 dB(µV)
0.5 to 30 MHz	73 dB(µV)	60 dB(µV)

Radiated Immunity

IEC 60255-26

Type	Level
80 MHz to 1000 MHz Sweep	10 V/m
1.4GHz to 2.7GHz Sweep	10 V/m
80,160,380,450,900,1850,2150 MHz Spot	10 V/m

Climatic Tests

Temperature

IEC 60255-1 & IEC 60068-2-1/2

Operating Range	-10°C to + 55°C
Storage Range	- 25°C to + 70°C

Humidity

IEC 60255-1 & IEC 60068-2-78

Operational test	56 days at 40°C and 93% relative humidity

Cyclic Temperature and Humidity

IEC 60255-1 & IEC 60068-2-30

Operational test	25°C to 55°C (outdoor equipment) and 97/93 % relative humidity. 6 x 24h (12h+12h) cycles.

IP Ratings

IEC 60529

Type	Level
Installed with cover	IP 51 from front of relay
Installed with cover removed	IP 20 from front of relay

Performance

25 Check Synchronising

Line Nom Voltage	40-160 V
Bus Nom Voltage	40-160 V
System Frequency	50/60 Hz
25 Check Sync Angle	0 – 90°
25 Check Sync Slip	0 – 2Hz
25 Check Sync Timer	0-100 s
25 Split Slip	0 – 2Hz
25 System Split Timer	0 – 60 s

25 Check Sync Angle Difference

Operate angle	θ_{diff}, ± 1°
Reset angle	θ_{op}, ± 1°
Repeatability	±1°

25 Check Sync Slip Frequency

Operate frequency	f_{slip}, ± 10 mHz
Reset frequency	f_{op}, - 10 mHz
Repeatability	± 10 mHz

25 Split Angle Detector

Operate angle	θ_{diff}, ± 1°

25 Split Slip Frequency Detector

Operate frequency	f_{slip}, ± 10 mHz
Reset frequency	f_{op}, - 10 mHz
Repeatability	± 10 mHz

25 Check Sync Timer

Accuracy	± 1 % or ± 20ms
Repeatability	± 1 % or ± 20ms
Variation	-10 °C to +55 °C: ≤ 5 %
	f_{nom} ± 5 %: ≤ 5 %

25 System Synchronising

Line Nom Voltage	40-160 V
Bus Nom Voltage	40-160 V
System Frequency	50/60 Hz
25 System Sync Angle	0 – 90°
25 COZ Slip Freq	0 – 2Hz
25 System Sync Slip	0 – 2Hz
25 System Sync Timer	0-100 s
25 SS Close Pulse	0-60 s

25 System Sync Angle Difference

Operate angle	θ_{diff}, ± 1°
Reset angle	θ_{op}, ± 1°
Repeatability	±1°

25 System Sync Slip Frequency

Operate frequency	f_{slip}, ± 10 mHz
Reset frequency	f_{op}, - 10 mHz
Repeatability	± 10 mHz

25 Close on Zero Slip Frequency

Operate frequency	f_{slip}, ± 10 mHz
Reset frequency	f_{op}, - 10 mHz
Repeatability	± 10 mHz

25 System Sync Timer

Accuracy	± 1 % or ± 20ms
Repeatability	± 1 % or ± 20ms
Variation	-10 °C to +55 °C: ≤ 5 %
	f_{nom} ± 5 %: ≤ 5 %

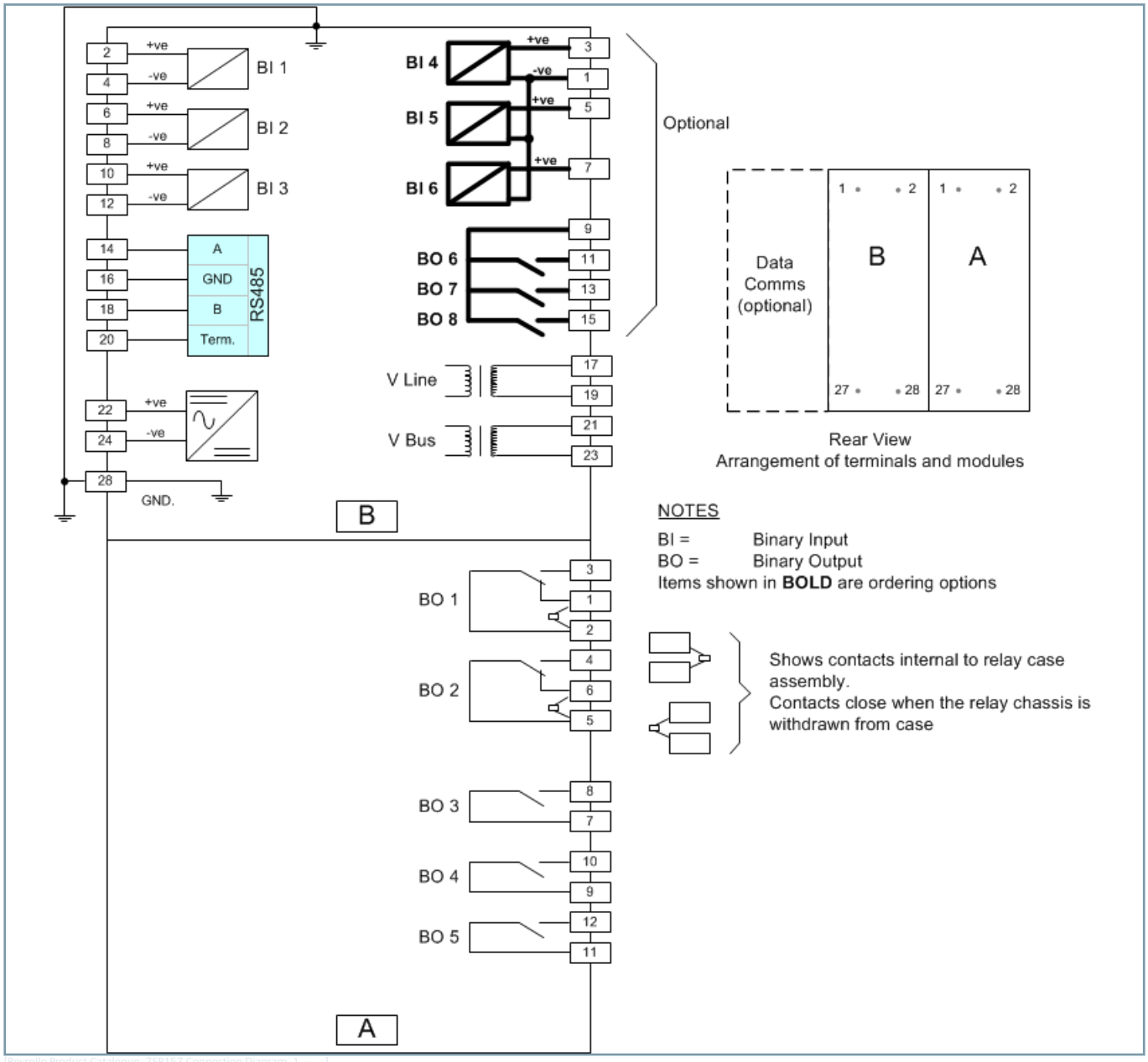
74 CCS Close Circuit Supervision Operate and Reset Time

Element basic operate time	25ms
Operate time following delay	t_{basic} + t_{delay}, ± 1 % or ± 20ms
Repeatability	± 1 % or ± 20ms
Variation	-10 °C to +55 °C: ≤ 5 %
	f_{nom} ± 5 %: ≤ 5 %

60 VTF VT Failure Operate and Reset Time

Element basic operate time	63 ms, ± 10ms
Operate time following delay	t_{basic} + t_{delay}, ± 1 % or ± 20ms
Repeatability	± 1 % or ± 20ms
Variation	-10 °C to +55 °C: ≤ 5 %
	f_{nom} ± 5 %: ≤ 5 %

Connection Diagram



[Reyrolle Product Catalogue, 7SR157 Connection Diagram, 1, -_-]

Figure 2.3/31 Connection Diagram

Ordering Information - 7SR157 Check Synchronising Relay

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Voltage Relay (Argus)	7	S	R	1	5	7	□	-	5	□	A	□	□	-	□	C	A	0
					|	|	|		|	|	|	|	|		|	|	|	|
Protection Product					|	|	|		|	|	|	|	|		|	|	|	|
Voltage					5	|	|		|	|	|	|	|		|	|	|	|
						|	|		|	|	|	|	|		|	|	|	|
Relay Type						|	|		|	|	|	|	|		|	|	|	|
Check Synchronising						7	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Case, I/O and Fascia							|		|	|	|	|	|		|	|	|	|
2 VT, 3 Binary Inputs / 5 Binary Outputs, 10 LEDs							7		|	|	|	|	|		|	|	|	|
2 VT, 6 Binary Inputs / 8 Binary Outputs, 10 LEDs							8		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Measuring Input									|	|	|	|	|		|	|	|	|
40/160V, 50/60Hz									5	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Auxiliary Voltage										|	|	|	|		|	|	|	|
PSU Rated: 24-250V DC / 100-230V AC Binary input threshold 19 V DC (Rated: 24-250V DC)										M	|	|	|		|	|	|	|
PSU Rated: 24-250V DC / 100-230V AC Binary input threshold 88 V DC (Rated: 110-250V DC)										N	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Spare											A	|	|		|	|	|	|
												|	|		|	|	|	|
Communication Interface												|	|		|	|	|	|
Standard version - included in all models, USB front port, RS485 rear port (E4 Case) [1]												1	2		|	|	|	|
Standard version - plus additional rear electrical Ethernet RJ45 (x2), (E6 Case) [1]												7	7		|	|	|	|
Standard version - plus additional rear optical Ethernet duplex (x2), (E6 Case) [1]												8	7		|	|	|	|
													|		|	|	|	|
Protocol													|		|	|	|	|
IEC 60870-5-103 Modbus RTU and DNP3 (user selectable setting)													2		|	|	|	|
IEC 60870-5-103 Modbus RTU, DNP3 and IEC 61850(user selectable settings)													7		|	|	|	|
															|	|	|	|
Front Cover															|	|	|	|
Standard Version - No Push Buttons															1	|	|	|
Push Buttons - Down and right arrows															2	|	|	|
																|	|	|
Protection Function Packages																|	|	|
Standard version																|	|	|
25 Check Synchronising																C	|	|
																	|	|
Additional Functionality																	|	|
No Additional Functionality																	A	|
																		|
Spare																		0

NOTE

1) E4 case is standard, E6 case is required if IEC61850 option fitted

7SR158 Voltage and Frequency Relay

[Reyrolle Product Catalogue, 7SR158, 1, =_=]

Figure 2.3/32 7SR158 Fascia

Description

The 7SR158 is a voltage and frequency protection relay developed to enhance the Argus family of products by providing a familiar device using the latest generation of hardware technology.

Housed in a 4U high, size E4 or E6 (Optional IEC61850 model) case, these relays provide protection, monitoring, instrumentation and metering with integrated input and output logic, data logging & fault reports. Communication access to the relay functionality is via a front USB port for local PC connection or rear electrical RS485 port for remote connection & optional IEC61850 communication through two rear Ethernet ports (Electrical or Optical).

Function Overview

Protection (can include)

27/59	Under/Over Voltage
47	Negative Phase Sequence Voltage
59N	Neutral Voltage Displacement
78	Vector Shift
82	Under/Over Frequency
81R	Rate-of-Change-of-Frequency (df/dt)

Supervision

74T/CCS	Trip & Close Circuit Supervision

Control

86	Lockout
	CB Control
	User Programmable Logic

Features

Four Settings Groups
Password Protection – 2 levels
Self Monitoring

User Interface

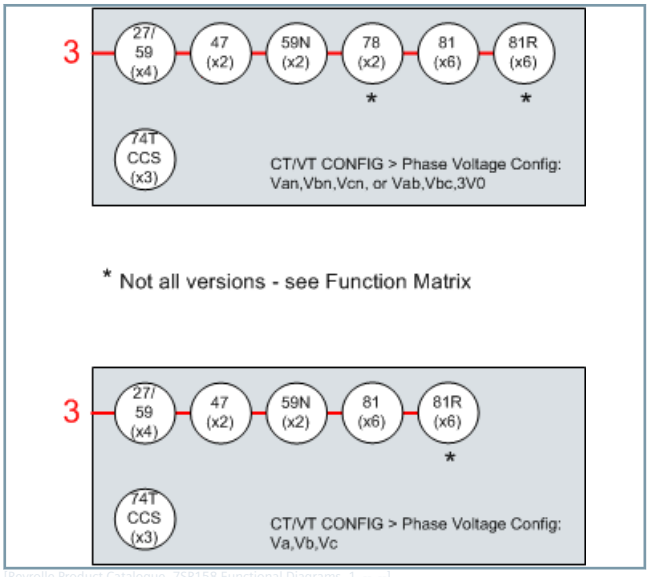
20 Character x 4 Line Backlit LCD
Menu Navigation Keys
9 User Programmable Tri-colour LEDs

Monitoring Functions

Primary/Secondary Line and Phase Voltages
Positive Phase Sequence (PPS) Voltage
Negative Phase Sequence (NPS) Voltage
Zero Phase Sequence (ZPS) Voltage
Frequency
Binary Input/Output status
Time and date
Starters
Fault data
Event records
CB trip and maintenance counters and Time to Trip

Functional Matrix

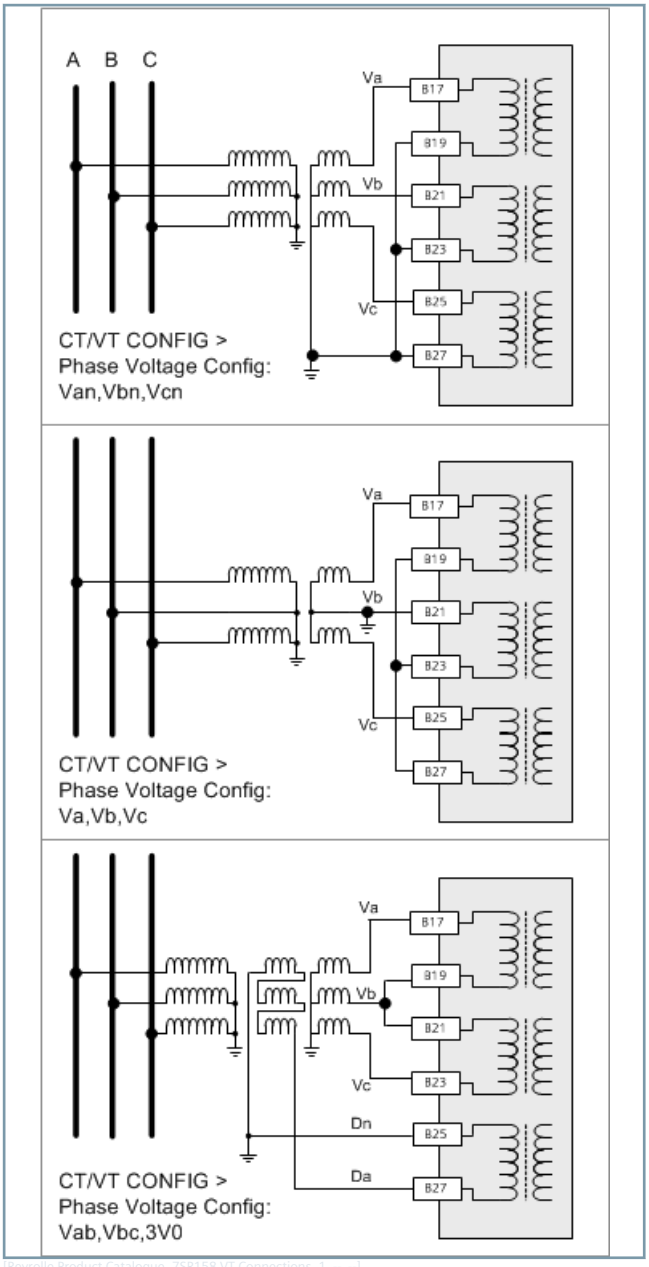
Function	Functional Requirement	7SR1587-5*A**-*CA0	7SR1587-5*A**-*DA0
27	Undervoltage	■	■
47	Negative Phase Sequence Voltage	■	■
59	Overvoltage	■	■
59N	Neutral Voltage Displacement	■	■
78	Vector Shift		■
81	Under/Over Frequency	■	■
81R	Rate of Change of Frequency		■
CONTROL/MONITOR			
74T/CCS	Trip & Close Circuit Supervision	■	■
86	Lockout	■	■



[Reyrolle Product Catalogue, 7SR158 Functional Diagrams, 1, –_–]

Figure 2.3/33 Functional Diagrams

VT Connections



[Reyrolle Product Catalogue, 7SR158 VT Connections, 1, –_–]

Figure 2.3/34 VT Connections

Description of Functionality

With reference to the Function Diagrams.

27/59 Under/Over Voltage

Each element has settings for pickup level, drop-off level and Definite Time Lag (DTL) delay. Operates when voltage exceeds setting for the duration of delay.

47 Negative Phase Sequence Voltage

Each element has settings for pickup level and Definite Time Lag (DTL) delays. Operates when NPS voltage exceeds setting for the duration of delay.

59N Neutral Overvoltage

Neutral overvoltage can be used to detect earth faults in high impedance earthed or isolated systems.

Operates when neutral voltage exceeds setting for the duration of delay.

74T/CCS Trip & Close Circuit Supervision

The trip or close circuit(s) can be monitored via binary inputs. Detection of trip circuit failure can be used to raise an HMI alarm (general alarm) and/or output(s).

78 Vector Shift

Operates if the voltage vector 'jumps' by more than setting during abrupt change in load. The function is applied to detect 'islanding' or loss of connection between a generator and the main utility supply.

81 Under/Overfrequency

Each element has settings for pickup level, drop-off level and Definite Time Lag (DTL) delays. Operates if frequency exceeds setting for duration of delay.

The function is typically applied in load shedding schemes.

81R Rate of Change of Frequency (df/dt)

Each element has settings for pickup level and Definite Time Lag (DTL) delay. Operates when the df/dt gradient exceeds setting for duration of delay.

The function is typically applied in load shedding schemes or to detect 'islanding' or loss of connection between a generator and the main utility supply.

Programmable Logic

The user can map binary inputs, protection elements, LEDs and binary outputs together in a logical scheme.

Up to 4 logic equations can be defined using standard logic functions e.g. Timers, AND/OR gates, Inverters and Counters to provide the user required functionality.

Each logic equation output can be used for alarm & indication and/or tripping.

Virtual Inputs/Outputs

There are 8 virtual inputs/outputs to provide internal logical states to assist in the application of the functions. Each virtual I/O can be assigned in the same way as a physical I/O.

Circuit Breaker Maintenance

Two circuit breaker operations counters are provided to assist with maintenance scheduling. The maintenance counter records the overall number of operations and the delta counter records the number of operations since the last reset.

Each counter has a user set target operations count which, when reached, can be mapped to raise alarms/ binary outputs. A CB Trip Time meter is also available, which measures the time between the trip or open command being issued and the auxiliary contacts changing state.

Control Mode

The relay has a control menu with access to commonly used command operations. Access to the control commands is restricted by a 4 character control function password. Each command requires a select then execute operation, if the execute operation is not performed within a time window the command is aborted. The following control functions are available:

- CB Control
- Local or remote operation

[Reyrolle Product Catalogue, 7SR11 and 7SR12 Control Fuction View, 1, —_—]

Figure 2.3/35 Example of Control Function View

Construction

The relay is housed in a 4U high size E4 or E6 case with a removable clear plastic fascia cover. The plastic fascia cover can be ordered with or without two push buttons to allow the user to view the settings and instruments without removing the cover.

Two plastic handles are provided to allow the relay to be withdrawn from its case, contacts in the case ensure that the normally closed contacts remain short circuited when the relay is withdrawn.

The rear terminal blocks comprise M4 female terminals for ring crimp wire connections, to provide a secure and reliable termination.

[Reyrolle Product Catalogue, 7SR11 and 7SR12 Rear view of relay (E4 Case), 1, --_--]

Figure 2.3/36 Rear view of relay (E4 Case)

[Reyrolle Product Catalogue, 7SR11 and 7SR12 Rear view of relay with 2x LC Fibre Optic ports (E6 Case with IEC61850), 1, --_--]

Figure 2.3/37 Rear view of relay with 2x LC Fibre Optic ports (E6 Case with IEC61850)

User Interface

[Reyrolle Product Catalogue, 7SR158 User Interface, 1, --_--]

Figure 2.3/38 User Interface

The operator interface is designed to provide a user friendly method of controlling, viewing menus, entering settings and retrieving data from the relay. Five buttons are provided for navigation around the menu structure.

LCD

A 4 line by 20 character liquid crystal display with power save operation indicates the relay identifier, settings, instrumentation, fault data and control commands. Up to 6 user programmable general alarms can be configured to display your own indications on the LCD.

LEDs

A green steadily illuminated LED indicates the 'Protection Healthy' condition.

9 user programmable LEDs are available eliminating the need for expensive panel mounted pilot lights and associated wiring. Each LED is tri-color (red, green, yellow) allowing for clear indication of the associated function's state and has a label insert for identification.

Relay Information

The device is identified by the rating label on the fascia. The user can give the device its own unique identity by editing the 'Relay Identifier' displayed on the LCD, also space is provided for a further slip-in label.

Technical Data

For full technical data refer to the Performance Specification Section of the Technical Manual.

Inputs and Outputs

Voltage Inputs

Nominal	40...160 V_{RMS}
Operating Range	0... 200 V_{RMS}
Instrumentation ≥ 0.8 x V_n	±1% V_n
Burden @ 110V	≤ 0.06 VA
Overvoltage Withstand	300 V_{RMS}

Auxiliary Supply

Rated DC Voltage	24-250 V DC Operating Range 19.2 to 275 V
Allowable superimposed ac component	12% of DC voltage
Rated AC Voltage	100-230 V AC 50/60Hz Range 80 to 253 V_{RMS} AC 50/60Hz ±5%
Power Consumption:	E4 Min (DC) 3W E4 Max (DC) 8W E4 Min (AC) 5.5VA 0.5PF E4 Max (AC) 17VA 0.5PF E6 Min (DC) 4.5W E6 Max (DC) 10W E6 Min (AC) 8.5VA 0.5PF E6 Max (AC) 21VA 0.5PF
Allowable breaks/ dips in supply (collapse to zero)	DC 50ms AC 2.5/3 cycles @50/60Hz

Binary Inputs

Number	6	
Operating Voltage	19 V dc	DC Range 19 to 320V dc AC Range 92 to 138 V_{RMS}AC Minimum threshold 17V dc
	88 V dc	Range 88 to 320V dc Minimum threshold 68.75V dc
Maximum dc current for operation	1.5 mA	
Maximum peak ac current for operation	1.5 mA	
Pick Up Delay	User selectable 0 to 14,400,000 ms (up to 4 hours)	
Drop Off Delay	User selectable 0 to 14,400,000 ms (up to 4 hours)	

NOTE

For AC operation the BI pick-up delay should be set to 0ms and the drop-off delay to 20ms.

Binary Outputs

Number	8 (2 change over contacts)
Operating Voltage	Voltage Free
Operating Mode	User selectable - Self or Hand/Electrical Reset or pulsed
Operating Time from Energizing Binary Input	< 20 ms

Making Capacity: Carry continuously Make and carry (L/R ≤ 40 ms and V ≤ 300 V)	5 A ac or dc 20 A ac or dc for 0.5 s 30 A ac or dc for 0.2 s
Breaking Capacity: (≤ 5 A and ≤ 300 V): AC Resistive AC Inductive DC Resistive DC Inductive	 1250 VA 250 VA at p.f. ≤ 0.4 75 W 30 W at L/R ≤ 40 ms 50 W at L/R ≤ 10 ms

Unit Design

Housing	E4 or E6 (see dimension drawing)
Indication	20 Character 4 line Display Relay Healthy LED 9 Tri Coloured User Programmable Self or Hand Reset LED's
Withdrawable Element	Yes
User Interface	5 Navigation Keys
Weight	Typical 2.7kg E4 case, 3.65 kg E6 case. Additional Transport packaging: add 0.4kg
IP Rating installed with cover	IP 51 from front
IP Rating installed without cover	IP 20 from front

Data Communication Interface

Communication Port	Front USB Type B Rear RS485 2 wire electrical IEC61850 optional ports: 2x Electrical RJ45 Ethernet 2x LC Fibre Optic Ethernet
Protocols	IEC60870-5-103 MODBUS RTU (Serial) DNP3.0 O (Serial) IEC61850 - optional
Fibre Optic Ethernet Data Communication Interface (IEC 61850 Option)	

EN100 Fibre Optic Data Communication Interface (IEC 61850 Option)

Physical	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

EN100 Electrical Ethernet Data Communication Interface (IEC 61850 Option)

Physical	Electrical
Connectors	RJ45 100BaseT in acc. With IEEE802.3
Transmission Speed	100 MBits/s
Test Voltage (with regard to socket)	500 VAC 50 Hz
Bridgeable distance	20m

Data Storage

Fault Record	10
Waveform Record	10 x 1sec 2 x 5sec 5 x 2sec 1 x 10sec Pre trigger 10...90%
Events	1000 1ms Resolution

Mechanical Tests

Vibration (Sinusoidal)

IEC 60255-27 & IEC 60255-21-1 Class I

Type	Level	Variation
Vibration response	0.5 gn	≤ 5 %
Vibration response	1.0 gn	≤ 5 %

Shock and Bump

IEC 60255-27 & IEC 60255-21-2 Class I

Type	Level	Variation
Shock response	5 gn, 11 ms	≤ 5 %
Shock withstand	15 gn, 11 ms	≤ 5 %
Bump test	10 gn, 16 ms	≤ 5 %

Seismic

IEC 60255-27 & IEC 60255-21-3 Class I

Type	Level	Variation
Seismic response	X-plane - 3.5mm displacement below crossover freq (8-9Hz) 1gn and above Y-plane – 1.5mm displacement below crossover freq (8-9Hz) 0.5gn above	≤ 5 %

Mechanical Classification

Durability	>10^6 operations

Electrical Tests

Insulation

IEC 60255-27

Type	Level
Between any terminal and earth	2.0 kV AC RMS for 1 min
Between independent circuits	2.0 kV AC RMS for 1 min
Across normally open contacts	1.0 kV AC RMS for 1 min

Slow Damped Oscillatory Wave (High Frequency Disturbance)

IEC 60255-26

Type	Level	Variation
Common (longitu-dinal) mode	2.5 kV	≤ 5 %
Series (transverse) mode	1.0 kV	≤ 5 %

Electrostatic Discharge

IEC 60255-26

Type	Level	Variation
Contact discharge	8.0 kV	≤ 5 %

Fast Transients

IEC 60255-26

Type	Level	Variation
5/50 ns 2.5 kHz repetitive	4kV	≤ 5 %

Surge Immunity

IEC 60255-26

Type	Level	Variation
Analog Inputs: Line to Earth	4.0 kV	≤ 10 %
Case, Aux Power & I/O: Line to Earth	2.0 kV	≤ 10 %
RS485 Comms port: Line to Earth	1.0 kV	No Data Loss
Analog Inputs: Line to Line	1.0 kV	≤ 10 %
Case, Aux Power & I/O: Line to Line	1.0 kV *	≤ 10 %

NOTE

* 50ms DTL pick-up delay applied to binary inputs

Conducted Radio Frequency Interference

IEC 60255-26

Type	Level	Variation
0.15 to 80 MHz	10 V	≤ 5 %

Radiated Radio Frequency

IEC 60255-26

Type	Limits at 10 m, Quasi-peak
30 to 230 MHz	40 dB(µV)
230 to 10000 MHz	47 dB(µV)

Conducted Radio Frequency

Type	Limits	
	Quasi-peak	Average
0.15 to 0.5 MHz	79 dB(µV)	66 dB(µV)
0.5 to 30 MHz	73 dB(µV)	60 dB(µV)

Radiated Immunity

IEC 60255-26

Type	Level
80 MHz to 1000 MHz Sweep	10 V/m
1.4GHz to 2.7GHz Sweep	10 V/m
80,160,380,450,900,1850,2150 MHz Spot	10 V/m

Magnetic Field with Power Frequency

IEC 60255-26

Type	Level
100A/m (0.126mT) continuous	50Hz
1000A/m (1.26mT) for 3s	

Environmental Tests

Temperature

IEC 60255-1 & IEC 60068-2-1/2

Operating Range	-10°C to + 55°C
Storage Range	- 25°C to + 70°C

Humidity

IEC 60255-1 & IEC 60068-2-78

Operational test	56 days at 40°C and 93% relative humidity

IP Ratings

IEC 60529

Type	Level
Installed with cover	IP 51 from front of relay
Installed with cover removed	IP 20 from front of relay

Performance

27/59 Under/Over Voltage

Number of Elements	4 Under or Over
Operate	Any phase or All phases
Under-Voltage Guard	1,1.5...200V
Setting Range V_s	5,5.5...200V
Hysteresis Setting	0.0.1...80%
V_s Operate Level	100% V_s, ±1% or ±0.25V
Reset Level: Overvoltage Undervoltage	= (100% - hyst) x V_{op}, ±1% = (100% + hyst) x V_{op}, ±1%
Delay Setting t_{delay}	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400s
Basic Operate Time : 0 to 1.1 x V_s 0 to 2.0 x V_s 1.1 to 0.5 x V_s	73ms ±10ms 63ms ±10ms 58ms ±10ms
Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±10ms
Inhibited by	Binary or Virtual Input Voltage Guard

47 Negative Phase Sequence Voltage

Number of Elements	2
Under-Voltage Guard	1,1.5...200V
Setting Range V_s	1,1.5...90V
Hysteresis Setting	0.0.1...80%
Operate Level	100% V_s, ±2% or ±0.5V
Reset Level	(100% - hyst) x V_{op}, ±1% or ± 0.25V
Delay Setting t_{delay}	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400s
Basic Operate Time : 0 to 2.0 x V_s 0 to 10 x V_s	80ms ±20ms 70ms ±20ms
Operate time following delay.	t_{basic} +t_{delay} , ±2% or ±20ms
Inhibited by	Binary or Virtual Input Voltage Guard

74T/CC Trip/Close Circuit Supervision

Number of supervisable circuits	3 x Trip and 3 x Close
Number of BI's Required	1 or 2 per function

78 Vector Shift

Number of Elements	2
Under-Voltage Guard	1,1.5...200V
Setting Range VS_s	2.0, 2.5 ... 30°
Operate Level	100% VS_s, ± 2°
Operate Time	≤ 40ms

81 Under/Over Frequency

Number of Elements	6 Under or Over
Under Voltage Guard	35,35.5...200V
Setting Range	43,43.01...68Hz
Hysteresis Setting	0, 0.1... 2%
Operate Level	100% F_s ±10mHz
Operate Time	Maximum < 150ms
Operate Delay	0...14400s

81R Rate of Change of Frequency (df/dt)

Number of Elements	6
Under Voltage Guard	35,35.5...200V
Setting Range R_s	0.050, 0.075 ...10.0 Hz/s
Operate Level	Rs ± 50mHz/s (F_{nom} ± 3Hz)
Operate Time for ROCOF 1.3x setting for ROCOF 2x setting	≤ 300ms ≤ 200ms
Operate Delay	0...200s

59N Neutral Voltage Displacement

Number of Elements	DT & IT
DT Setting Range I_s	1...100V
DT Operate Level	100% V_s, ±2% or ±0.5V
DT Delay Setting t_{delay}	0 ...14400s
DT Basic Operate Time 0V to 1.5 x V_s 0V to 10 x V_s	76ms ±20ms 63ms ±20ms
DT Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±20ms
IT Char Setting	IDMTL & DTL
IT Setting Range	1...100V
Tm Time Multiplier(IDMT)	0.1...140
Delay (DTL)	0...20s
Reset	ANSI Decaying, 0...60s
Char Operate Level	100% V_s, ±2% or ±0.5V
Inhibited by	Binary or Virtual Input

Control Functions

CB	Open/Close

CB Maintenance

Trip Counter	Total & Delta 0...10000
Counts to AR Block	0...10000
Frequent Operations	0...10000
I^2t Alarm	10...100000

Connection Diagram

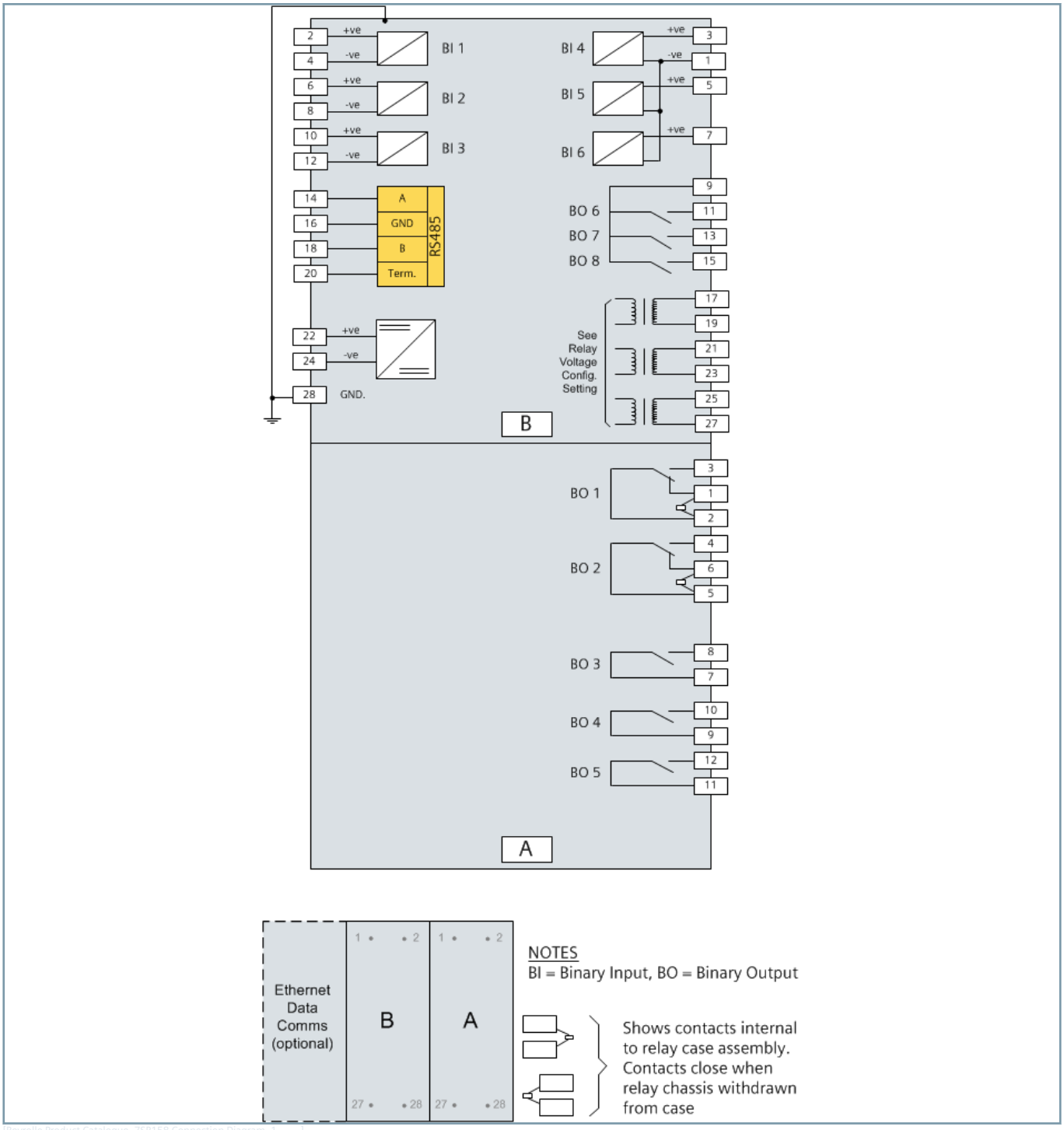


Figure 2.3/39 7SR158 Connection Diagram

Ordering Information - 7SR158 Voltage and Frequency Relay

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Voltage/frequency relay	7	S	R	1	5	8	7	-	5	□	A	□	□	-	□	□	A	0
					|	|	|		|	|	|	|	|		|	|	|	|
Protect Product Family					|	|	|		|	|	|	|	|		|	|	|	|
Voltage					5	|	|		|	|	|	|	|	|		|	|	|	|
						|	|		|	|	|	|	|	|		|	|	|	|
Relay Type						|	|		|	|	|	|	|	|		|	|	|	|
Voltage & Frequency						8	|		|	|	|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|	|	|		|	|	|	|
Case, I/O and Fasicia							|		|	|	|	|	|	|	|		|	|	|	|
E4 case, 3 VT, 6 Binary Inputs / 8 Binary Outputs, 10 LEDs							7		|	|	|	|	|	|	|		|	|	|	|
									|	|	|	|	|	|	|		|	|	|	|
Measuring Input									|	|	|	|	|	|	|		|	|	|	|
40 to 160V, 50/60Hz									5	|	|	|	|	|	|	|		|	|	|	|
										|	|	|	|	|	|	|		|	|	|	|
Auxiliary Voltage										|	|	|	|	|	|	|		|	|	|	|
PSU Rated: 24 to 250 V DC / 100 to 230 V AC Binary input threshold 19 V DC (Rated: 24 to 250 V DC)										M	|	|	|		|	|	|	|
PSU Rated: 24 to 250 V DC / 100 to 230 V AC Binary input threshold 88 V DC (Rated: 110 to 250 V DC)										N	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Spare											A	|	|		|	|	|	|
												|	|		|	|	|	|
Communication Interface												|	|		|	|	|	|
Standard version - included in all models, USB front port, RS485 rear port (E6 Case) [1)]												1	2		|	|	|	|
Standard version - plus additional rear electrical Ethernet RJ45 (x2), (E6 Case) [1)]												7	7		|	|	|	|
Standard version - plus additional rear optical Ethernet duplex (x2), (E6 Case) [1)]												8	7		|	|	|	|
													|		|	|	|	|
Protocol													|		|	|	|	|
IEC 60870-5-103 Modbus RTU and DNP3 (user selectable setting)													2		|	|	|	|
IEC 60870-5-103 Modbus RTU, DNP3 and IEC 61850. (user selectable settings)													7		|	|	|	|
															|	|	|	|
Front Cover															|	|	|	|
Standard Version - No Push Buttons															1	|	|	|
Push Buttons - Down and right Arrows															2	|	|	|
																|	|	|
Protection Function Packages																|	|	|
For future development																A	|	|
For future development																B	|	|
Standard Version																C	|	|
27/59 Under/overvoltage																|	|	|
47 Negative phase sequence voltage																|	|	|
59N Neutral voltage displacement																|	|	|
74T&C Trip & Close circuit supervision																|	|	|
81 Under/overfrequency																|	|	|
																|	|	|
Standard version – plus																D	|	|
78 Voltage Vector Shift																	|	|
81R Rate of Change of Frequency																	|	|

7SR1 Range – 7SR158 Voltage and Frequency Relay

Product Description	Order No.		
		|	|
Additional Functionality		|	|
No additional functionality		A	|
			|
Spare			0

NOTE

1) E4 case is standard, E6 case is required if IEC61850 option fitted

7SR191 Capacitor Protection Relay

[Reyrolle Product Catalogue, 7SR191, 1, _ _]

Description

The 7SR191 Capa devices are numeric protection relays designed for application on shunt connected distribution capacitor banks arranged in all common connection configurations, typically single star, double star, delta or in an H configuration. These relays provide all protection functions required in a single device. Relay versions which can be connected to primary voltage transformers provide additional voltage protection functions and metering.

The 7SR191 relays are developed from the proven 7SR11 & 7SR12 Argus family of products providing a familiar product using the latest generation of hardware technology. Housed in a 4U high, size E4 or E6 (Optional IEC61850 model) case, these relays provide protection, monitoring, instrumentation and metering with integrated input and output logic, data logging & fault reports. Communication access to the relay functionality is via a front USB port for local PC connection or rear electrical RS485 port for remote connection & optional IEC61850 communication through two rear Ethernet ports (Electrical or Optical).

Function Overview

Protection

37	Undercurrent/Loss of Supply
46MDT	Phase Unbalance
46	Negative Phase Sequence Overcurrent
49	Thermal Overload
50	Instantaneous Overcurrent
50N	Instantaneous Earth Fault
50BF	Circuit Breaker Fail
51	Time Delayed Overcurrent
51N	Time Delayed Derived Earth Fault
59C	Overvoltage by Current Integration
60C	Capacitor Unbalance Current
87REF	High Impedance REF
27/59	Under/Over Voltage
47	Negative Phase Sequence Voltage
59IT	Inverse Time Overvoltage
59N	Neutral Voltage Displacement
67/50	Directional Instantaneous Overcurrent
67/50N	Directional Instantaneous Earth Fault
67/51	Directional Time Delayed Overcurrent
67/51N	Directional Time Delayed Earth Fault
81	Under/Over Frequency

Supervision

60CTS	CT Supervision
74T/CCS	Trip & Close Circuit Supervision
60VTS	VT Supervision

Control

CB Control
Reswitch Blocking

Features

Cold Load Settings
Four Settings Groups
Password Protection – 2 levels
User Programmable Logic
User specified voltage, current & thermal protection curves
Self Monitoring
Circuit Breaker Trip and Maintenance Counter
Trip Timers

User Interface

20 Character x 4 Line Backlit LCD
Menu Navigation Keys
9 User Programmable Tri-colour LEDs
User Language Configuration

Monitoring Functions

Primary/Secondary Current Phases and Earth Direction
Primary/Secondary Line and Phase Voltages
Capacitor Overvoltage
Capacitor Unbalance Current
Apparent Power and Power Factor
Real and Reactive Power
Import and Export, Real and Reactive Energy
Historical Demand Record
Positive Phase Sequence (PPS) Voltage & Current
Negative Phase Sequence (NPS) Voltage & Current
Zero Phase Sequence (ZPS) Voltage
Frequency
Harmonic currents up to 15th and Total Harmonic Distortion
Binary Input/Output status
Trip circuit healthy/failure
Time and date
Starters
Fault records
Event records
Circuit breaker trip counters
I^2t summation for contact wear

Hardware

4 CT 3 Binary Inputs 5 Binary Outputs
4 CT 6 Binary Inputs 8 Binary Outputs
4 CT 3 VT 3 Binary Inputs 5 Binary Outputs
4 CT 3 VT 6 Binary Inputs 8 Binary Outputs

Application

The 7SR191 Capa is a numerical protection relay intended for use on shunt connected distribution capacitor banks. It provides a highly comprehensive functional software package with a range of integral application functions aimed at reducing installation, wiring and engineering time.

An extensive range of metered values can be viewed on the front LCD or at a remote point via the communication channel.

The integrated control feature allows local and remote operation of a single circuit breaker and monitoring of its trip and close circuits. Loss of supply to the capacitor is detected and can be used to disconnect from the network. Automatic blocking of subsequent reconnection until the capacitor has safely discharged is also provided.

Distribution capacitor banks are constructed from a large number of individual capacitor units. These units will periodically fail due to the electrical stress applied during normal service. Failure of a single unit is acceptable as the resulting short circuit will be cleared by either operation of fuses, in internally or externally fused arrangements, or simply be coped with by design in unfused and fuseless arrangements. However, the failure of one unit will impose increased stress on remaining units increasing the probability that these units will fail. This will further increase stresses and if not disconnected, could eventually lead to cascading failure of the whole bank. The bank is often split into similar sections, arranged such that the balanced nature can be used as a basis for early failure detection. Current transformers are typically fitted at suitable locations to allow unbalance current to be measured by protection devices. In addition to this, measurement of the total bank current is measured to detect unbalance between phases caused by capacitor unit failure as well as overload protection and for detection of insulation failure faults such as phase to phase and phase to earth flashover.

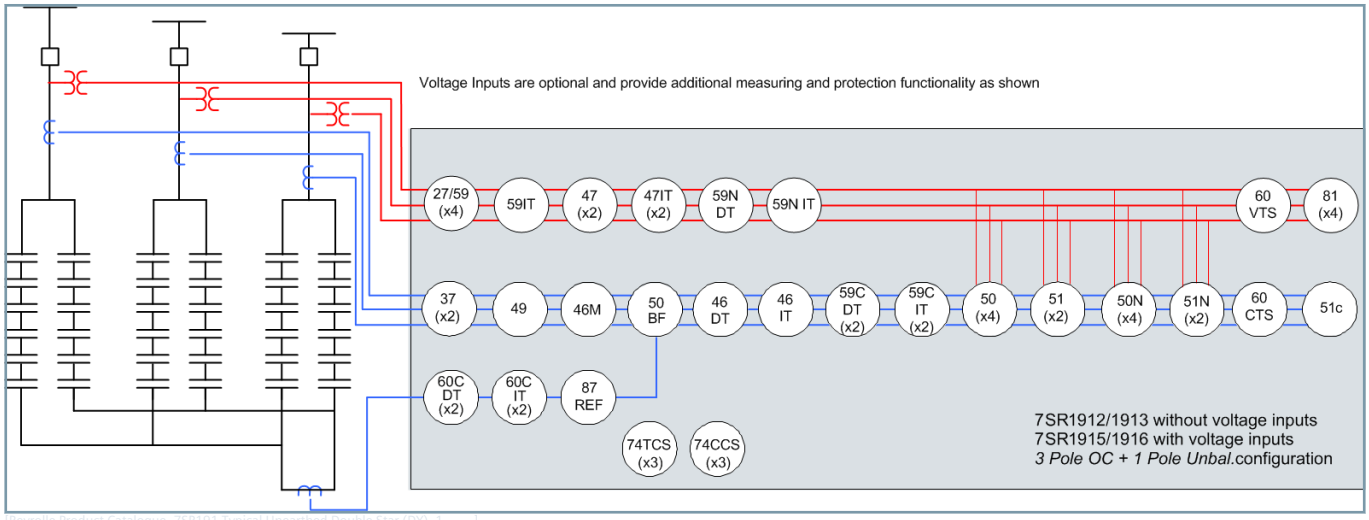
The 7SR191 provides user configuration settings for operating mode to allow the current inputs to be allocated to the protection functions to cater for all common bank arrangements with a single ordering code. When set in 3 Pole Overcurrent + 1 Pole Unbalance mode, the four current inputs are allocated as three phase current inputs plus one unbalance input. In 1 Pole Overcurrent + 3 Pole Unbalance mode, the four inputs are allocated instead to provide three phase segregated inputs plus a single phase reference input.

Function Matrix

Functional Requirement	7SR1912/7SR1913 3P OC + 1P UB mode *	7SR1912/7SR1913 1P OC + 3P UB mode *	7SR1915/7SR1916 3P OC + 1P UB mode *	7SR1915/7SR1916 1P OC + 3P UB mode *
59C Overvoltage by current integration	■	■	■	■
60C Capacitor unbalance	■	■	■	■
37 Undercurrent, Loss of Supply	■	■	■	■
Reswitch Blocking	■	■	■	■
46MDT Phase Unbalance	■		■	
46 Negative Phase Sequence Overcurrent	■		■	
47 Negative Phase Sequence Voltage			■	■
49 Thermal Overload	■	■	■	■
50 Instantaneous Overcurrent	■		■	
50N Derived Instantaneous Earth Fault	■		■	
50BF CB Failure	■	■	■	■
51 Time Delayed Overcurrent	■		■	
51N Derived Time Delayed Earth Fault	■		■	
27 Undervoltage			■	■
59 Overvoltage			■	■
59N Neutral Voltage Displacement			■	■
87REF High Impedance Restricted Earth Fault	■		■	
67 Directional Overcurrent			■	
67N Directional Derived Earth Fault			■	
81 Under/Over Frequency			■	■
CONTROL/MONITOR				
51c Cold Load	■	■	■	■
60CTS CT Supervision	■		■	■
60VTS VT Supervision			■	■
50BF Circuit breaker Fail	■	■	■	■

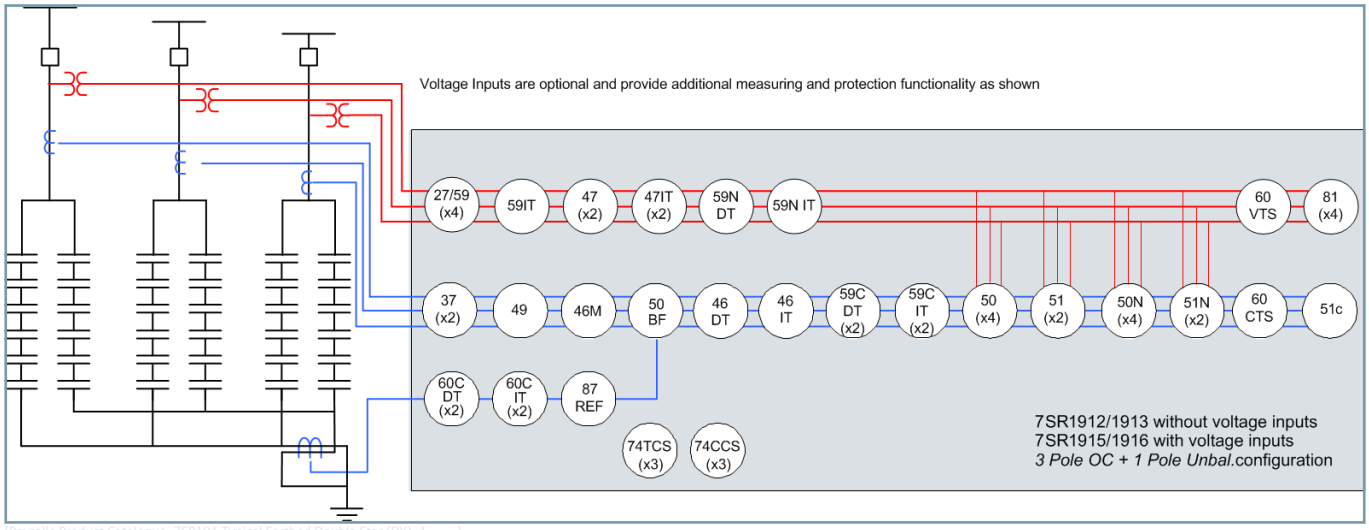
Key -

- ■ - Included as standard
- * - Mode is selectable by user setting



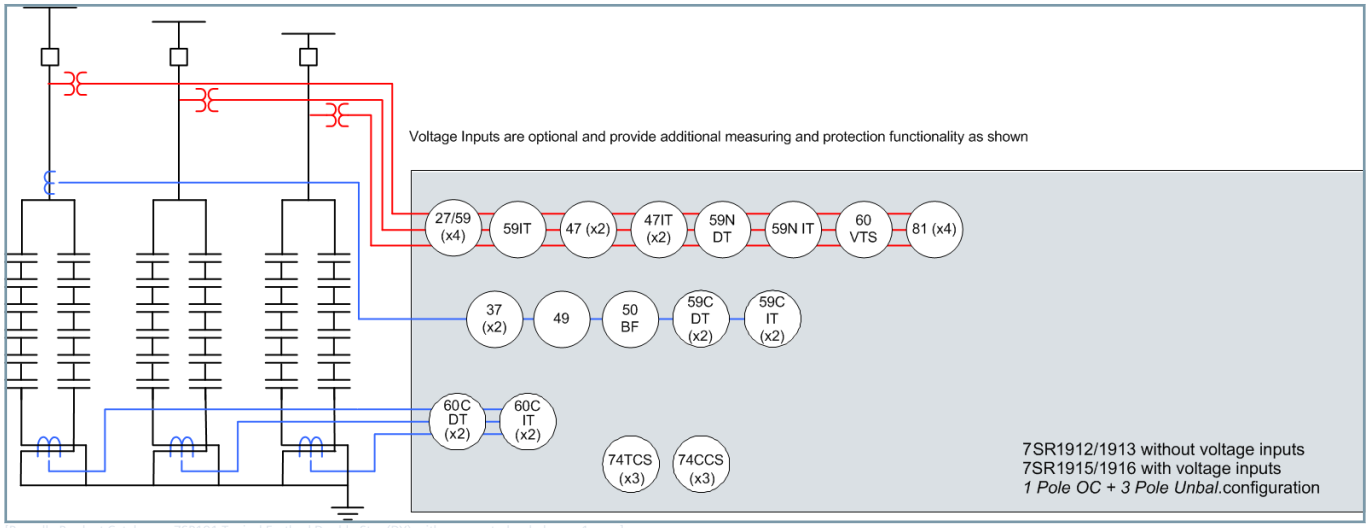
[Reyrolle Product Catalogue, 7SR191 Typical Unearthed Double Star (DY), 1, -_--]

Figure 2.3/40 Typical Unearthed Double Star (DY)



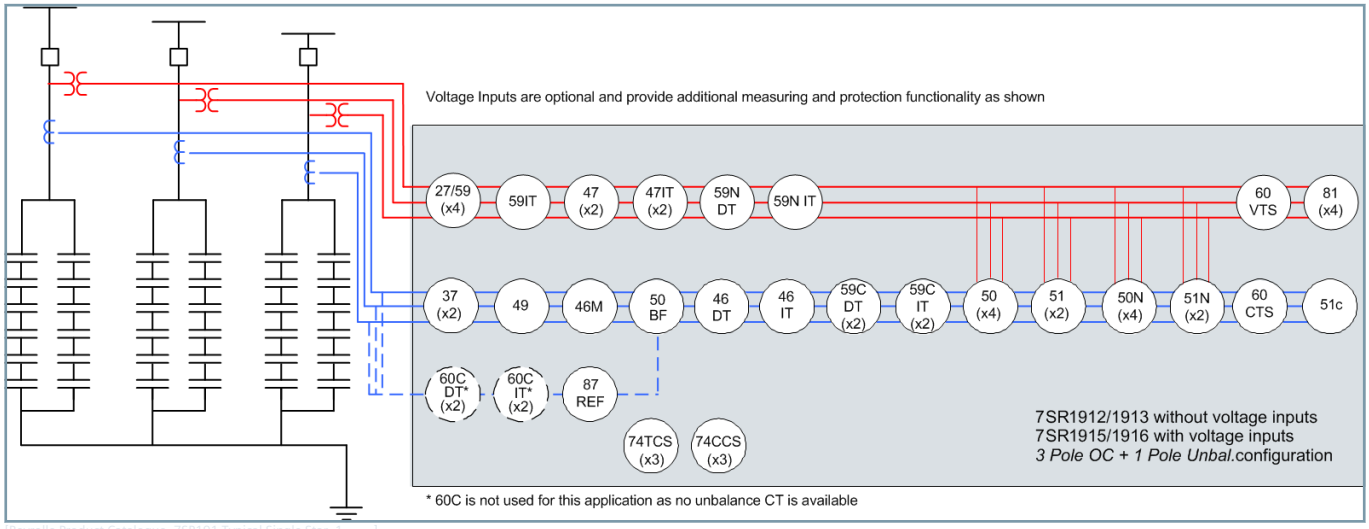
[Reyrolle Product Catalogue, 7SR191 Typical Earthed Double Star (DY), 1, -_--]

Figure 2.3/41 Typical Earthed Double Star (DY)



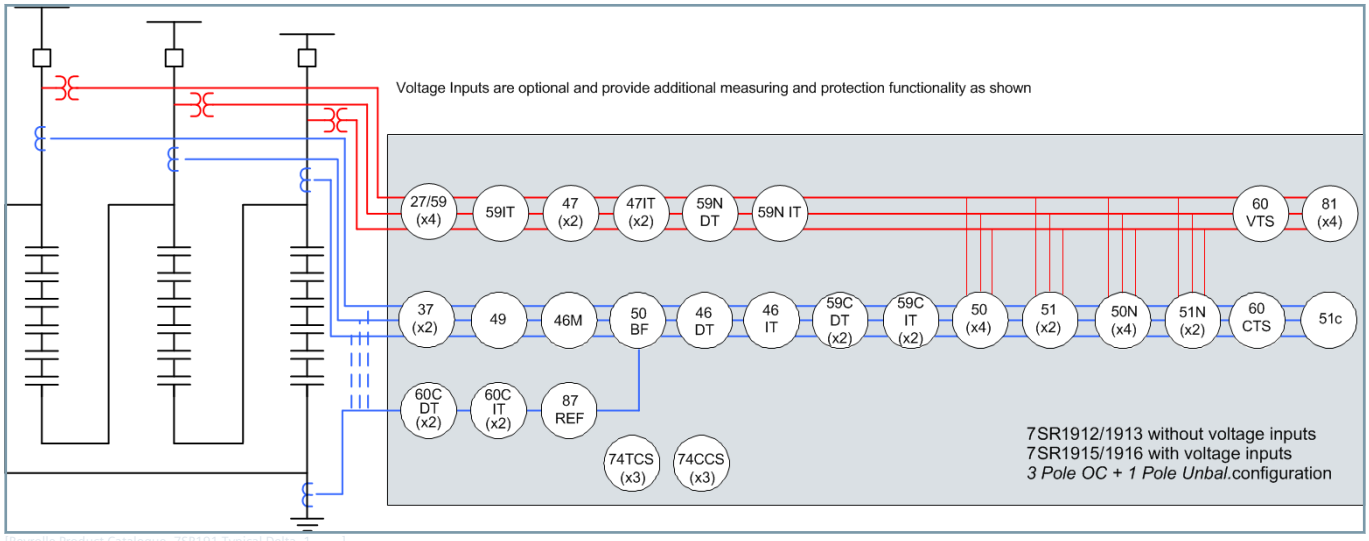
[Reyrolle Product Catalogue, 7SR191 Typical Earthed Double Star (DY) with segregated unbalance, 1, -_-]

Figure 2.3/42 Typical Earthed Double Star (DY) with segregated unbalance



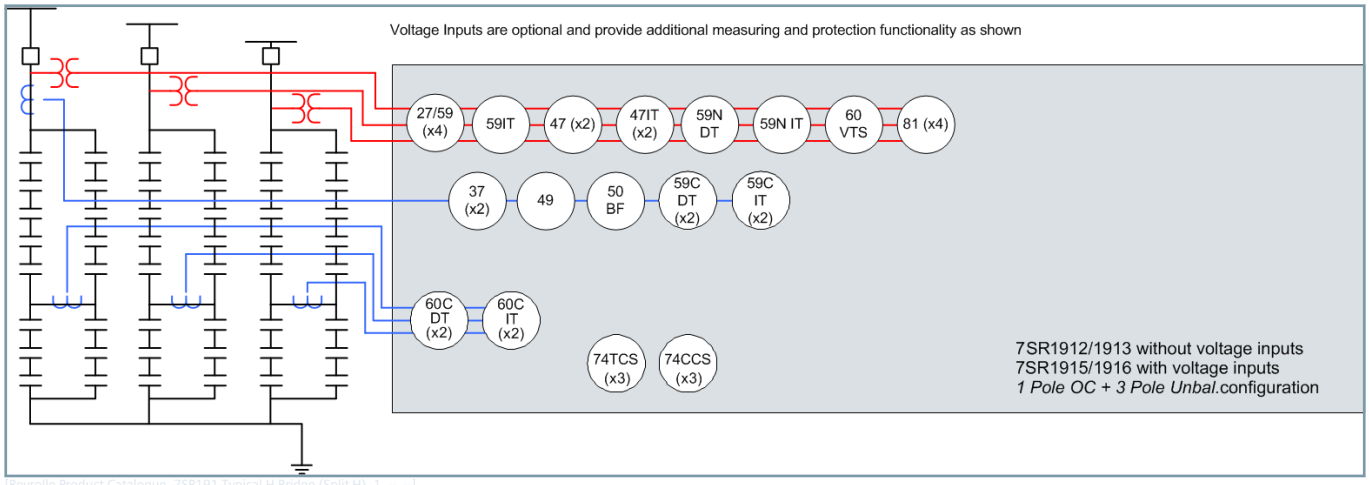
[Reyrolle Product Catalogue, 7SR191 Typical Single Star, 1, -_-]

Figure 2.3/43 Typical Single Star



[Reyrolle Product Catalogue, 7SR191 Typical Delta, 1, -, -]

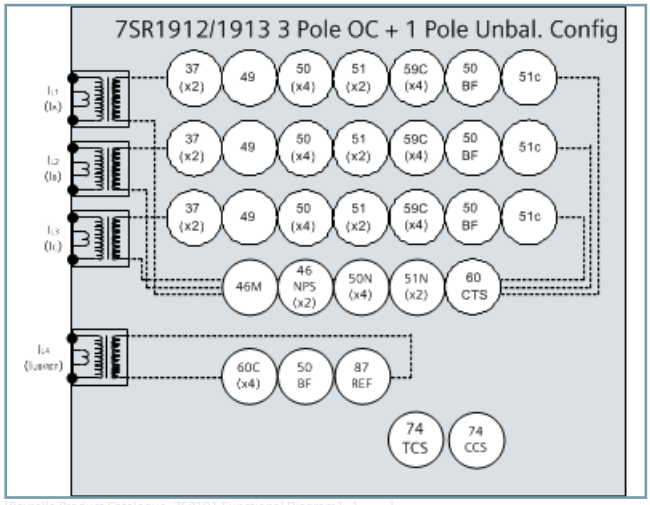
Figure 2.3/44 Typical Delta



[Reyrolle Product Catalogue, 7SR191 Typical H Bridge (Split H), 1, -, -]

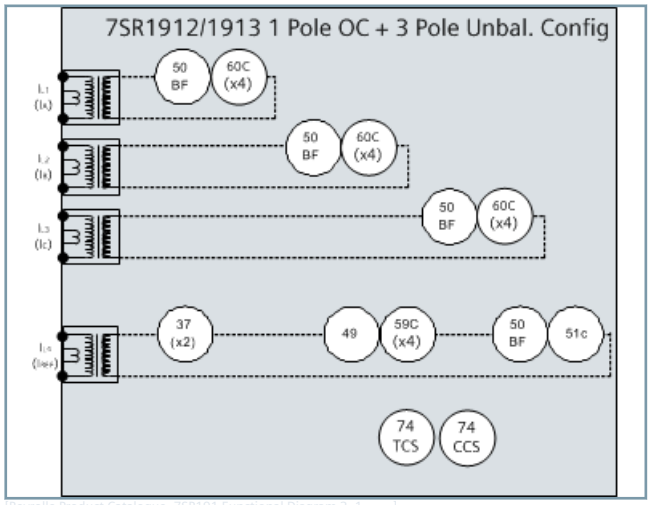
Figure 2.3/45 Typical H Bridge (Split H)

7SR1912/3 Functional Diagrams



[Reyrolle Product Catalogue, 7SR191 Functional Diagram1, 1, –_–]

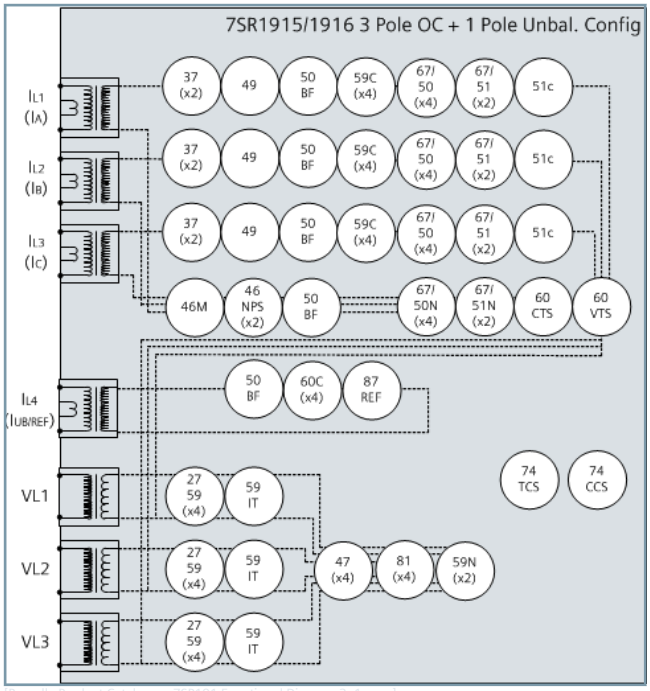
Figure 2.3/46 7SR1912/1913 3 Pole OC + 1 Pole Unbal. Configuration



[Reyrolle Product Catalogue, 7SR191 Functional Diagram 2, 1, –_–]

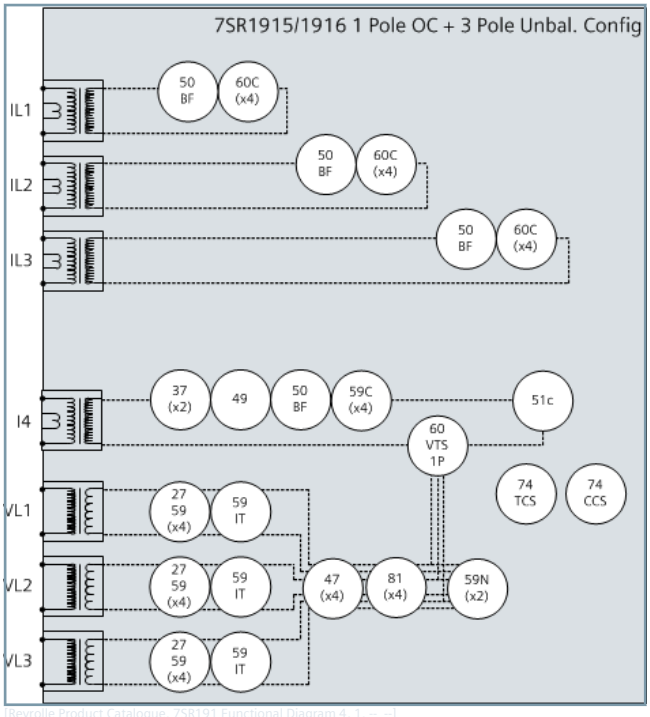
Figure 2.3/47 7SR1912/1913 1 Pole OC + 3 Pole Unbal. Configuration

7SR1915/6 Functional Diagrams



[Reyrolle Product Catalogue, 7SR191 Functional Diagram 3, 1, –_–]

Figure 2.3/48 7SR1915/1916 3 Pole OC + 1 Pole Unbal. Configuration



[Reyrolle Product Catalogue, 7SR191 Functional Diagram 4, 1, –_–]

Figure 2.3/49 7SR1915/1916 1 Pole OC + 3 Pole Unbal. Configuration

NOTE

The use of some functions are mutually exclusive. e.g. 60C/87REF

Some functions are dependent on the operating mode selection.

Description of Functionality

27/59 Under/Over Voltage

Each element has settings for pickup level, drop-off level and Definite Time Lag (DTL) delays. Operates if voltage exceeds setting for duration of delay.

37 Loss of Supply/Undercurrent

Each element has settings for pickup level and Definite Time Lag (DTL) delays. Operates if current falls below setting for duration of delay.

Re-switch Blocking

If the capacitor is disconnected or otherwise de-energised, automatic blocking of re-energisation can be applied utilising a user selectable timer to allow the capacitor voltage to discharge before re-energisation. Detection of de-energisation can be selected from current level or CB status signals or combinations of both.

46M Phase Unbalance

The element has settings for pickup level and DTL delay. The difference in magnitude of the highest and lowest phase current is compared to the average phase current. This can be used to detect that a number of capacitor units have failed in such a pattern that measured unbalance spill current is negligible.

46NPS Negative Phase Sequence Overcurrent

Each element has user settings for pickup level and IDMTL or DTL delay, operates if NPS current exceeds setting and delay. NPS current elements can be used to detect that a number of capacitor units have failed in such a pattern that measured unbalance spill current is negligible.

47 Negative Phase Sequence Voltage

Each element has settings for pickup level and Definite Time Lag (DTL) delays. Operates if NPS voltage exceeds setting for duration of delay.

49 Thermal Overload

The thermal algorithm continuously calculates the present thermal state of the capacitor bank from the measured currents and the previous thermal state thus including long term overload conditions. Alarm outputs are given for thermal overload and thermal capacity.

50BF Circuit Breaker Fail

The circuit breaker fail function may be triggered from an internal trip signal or from a binary input. Line currents and earth currents are monitored following a trip signal and an output is issued if any current is still detected, above setting, after a specified time interval. Alternatively, if the trip is from an external protection the circuit breaker position can be used to determine a failure. A second time delay is available to enable another stage to be utilized if required. An input is also available to bypass the time delays when the circuit breaker is known to be faulty.

51c Cold Load Protection

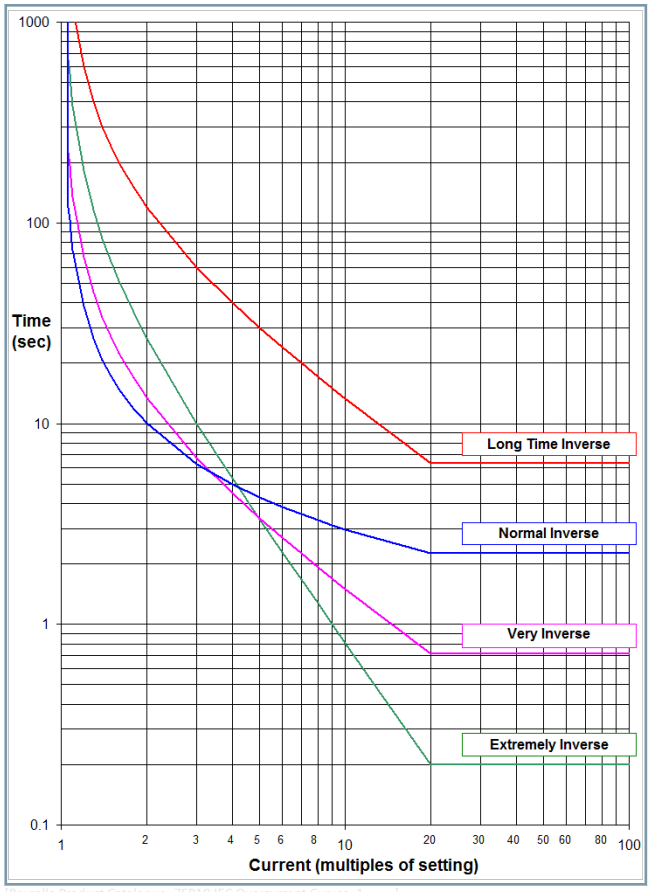
When a capacitor bank is initially energized the connected system may create transient effects which could appear as operating currents at the relay. These conditions can exist for an extended period and must not be interpreted as a fault. To allow optimum setting levels to be applied for normal operation, the cold load pickup feature will apply alternative current settings or protection element inhibits for a limited period. The feature resets when either the circuit breaker has been closed for a settable period, or if the current has reduced beneath a set level for a user set period.

50/51 Phase Fault

50 INST/DTL and 51 IDMTL/DTL elements provide 3 phase overcurrent protection in 3P OC + 1P UB mode, each with independent settings for pickup current, time-multiplier (51) and time-delays. User can select IEC or ANSI time current characteristics. The IDMT stage has a user programmable reset characteristic, either DTL or shaped current ~ time reset characteristic, to improve grading with electromechanical protection.

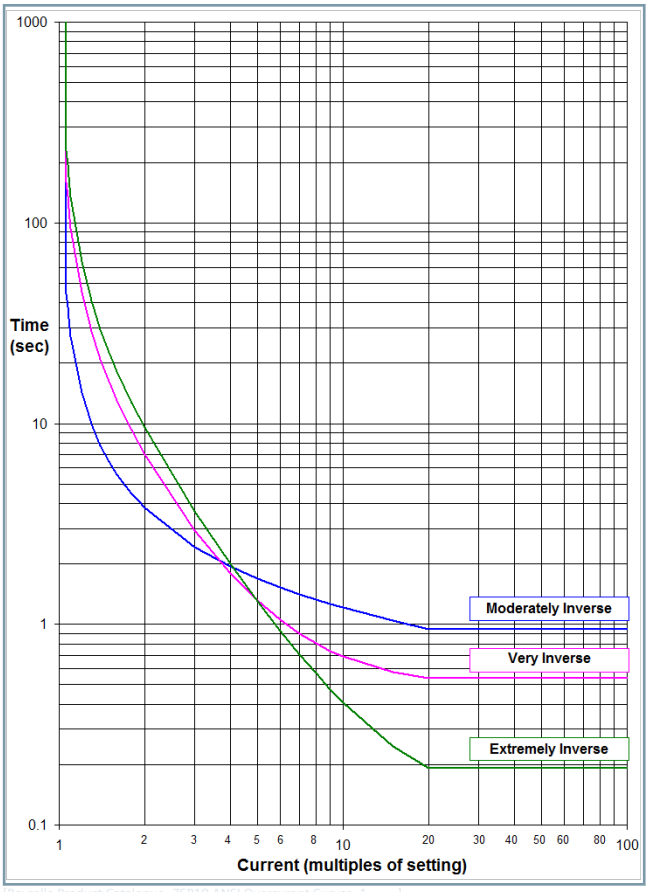
50N/51N Earth Fault

The earth fault current is internally derived from the 3 phase CT inputs in normal operating mode. 50N INST/DTL and 51N IDMTL/DTL elements provide overcurrent protection, each with independent settings for pickup current, time-multiplier (51) and time-delays. User can select IEC or ANSI time current characteristics. The IDMT stage has a user programmable reset characteristic either DTL or shaped current ~ time reset characteristic to improve grading with electromechanical protection.



[Reyrolle Product Catalogue, 7SR10 IEC Overcurrent Curves, 1, _ _]

Figure 2.3/50 IEC Overcurrent Curves



[Reyrolle Product Catalogue, 7SR10 ANSI Overcurrent Curves, 1, _ _]

Figure 2.3/51 ANSI Overcurrent Curves

59C Overvoltage

The effective applied voltage is calculated from the measured capacitor current by numeric integration techniques such that all harmonic frequency components of the current are correctly incorporated.

The capacitor units are rated to withstand 110% of rated voltage continuously. IEC and ANSI standards specify withstand times for higher voltage levels. These requirements are used to construct an overvoltage withstand curve. Time Multiplier set to default setting = 0.9 is recommended to provide safety margin.

i> (vc>)	Standard duration (s)	
1.1	infinite	
1.15	1,800	IEC 871-1
1.20	300	IEC 871-1
1.30	60	ANSI 18-1980, IEC 871-1
1.40	15	ANSI 18-1980
1.7	1	ANSI 18-1980
2.00	0.3	ANSI 18-1980
2.20	0.12	ANSI 18-1980

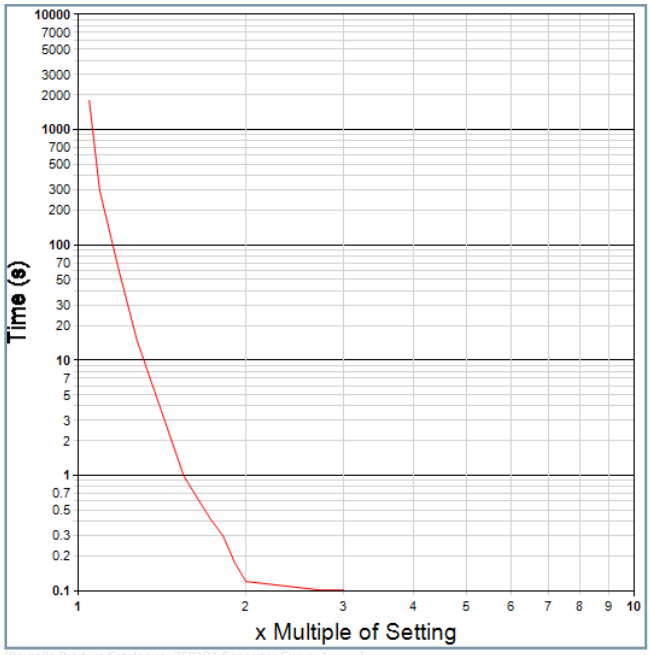


Figure 2.3/52 Capacitor Curve (Time Multiplier = 1)

59N Neutral Overvoltage

Neutral overvoltage can be used to detect unbalance in the capacitor bank in ungrounded arrangements.

Operates if the calculated neutral voltage exceeds setting for duration of delay.

60C Capacitor Unbalance

In 3P OC + 1P UB mode, 60C is applied at the 4th current input, typically connected to an unbalance CT. In 1P OC + 3P UB mode, 60C is applied at each of the 3 phase segregated current inputs, typically connected to an unbalance CT. Each element has user settings for pickup level and IDMTL or DTL delay, operates if measured current exceeds setting and delay. In 3P OC + 1P UB mode the 1P unbalance element can be trimmed for phase and magnitude to suit the natural unbalance current and also can be zeroed manually. This calibration is compensated to allows for the switch-off condition. The compensation feature is not available in 1P OC + 3P UB mode.

60CTS CT Supervision

The relay has two methods of CT supervision. The 7SR1912/3 monitors each phase current input and operates if any one or two inputs fall below the setting. The 7SR1915/6 has the above method and an addition method that considers the presence of negative phase sequence current, without an equivalent level of negative phase sequence voltage, for a user set time as a CT failure.

This function is not used in 1 Pole OC + 3 Pole UB mode. Both element types have user operate and delay settings.

60VTS VT Supervision

The VT supervision uses a combination of negative phase sequence voltage and negative phase sequence current to detect a VT fuse failure in 3 Pole OC + 1 Pole UB mode. This condition may be alarmed or used to inhibit voltage dependent functions. Element has user operate and delay settings.

In1 Pole OC + 3 Pole UB mode, a simpler element using current and voltage magnitudes is provided.

87REF Restricted Earth Fault

The measured earth fault input may be used in a 87REF high impedance restricted earth fault scheme to provide sensitive high speed unit protection. A calculation is required to determine the values of the external series stabilising resistor and non-linear shunt resistor which can be ordered separately. This function is used on single-star arrangements where no unbalance CT is available and is connected to the unused 4th current input.

67/67N Directional Control

Phase, earth and sensitive earth fault elements can be directionalised. Each element can be user set to Forward, Reverse, or Non-directional.

Directional Phase Fault elements are polarised from quadrature voltage.

Derived earth fault elements can be user set to be polarised from residual voltage or negative phase sequence voltage. Measured earth fault elements are polarized from Vo.

74T/CCS Trip & Close Circuit Supervision

The trip or close circuit(s) can be monitored via binary inputs. Trip circuit failure raises an HMI alarm and output(s).

81 Under/Overfrequency

Each element has settings for pickup level, drop-off level and Definite Time Lag (DTL) delays. Operates if frequency exceeds setting for duration of delay.

Programmable Logic

The user can map binary inputs, protection elements, LEDs and binary outputs together in a logical scheme.

Up to 8 logic equations can be defined using standard logic functions e.g. Timers, AND/OR gates, Inverters and Counters to provide the user required functionality.

Each logic equation output can be used for alarm & indication and/or tripping.

Virtual Inputs/Outputs

There are 8 virtual inputs/outputs to provide internal logical states to assist in the application of the functions. Each virtual I/O can be assigned in the same way as a physical I/O.

Circuit Breaker Maintenance

Two circuit breaker operations counters are provided to assist with maintenance scheduling. The maintenance counter records the overall number of operations and the delta counter records the number of operations since the last reset.

An I^2t summation counter provides a measure of the contact wear indicating the total energy interrupted by the circuit breaker contacts.

Each counter has a user set target operations count which, when reached, can be mapped to raise alarms/ binary outputs. A CB Trip Time meter is also available, which measures the

time between the trip or open command being issued and the auxiliary contacts changing state.

Control Mode

The relay has a control menu with access to commonly used command operations. Access to the control commands is restricted by a 4 character control function password. Each command requires a select then execute operation, if the execute operation is not performed within a time window the command is aborted. The following control functions are available: CB Operation

[Reyrolle Product Catalogue, 7SR11 and 7SR12 Control Fuction View, 1, -_-]

Figure 2.3/53 Example of Control Function View

Construction

The relay is housed in a 4U high size E4 or E6 case with a removable clear plastic fascia cover. The plastic fascia cover can be ordered with or without two push buttons to allow the user to view the settings and instruments without removing the cover.

Two plastic handles are provided to allow the relay to be withdrawn from its case, contacts in the case ensure that the CT circuits and normally closed contacts remain short circuited when the relay is withdrawn.

The rear terminal blocks comprise M4 female terminals for ring crimp wire connections, to provide a secure and reliable termination.

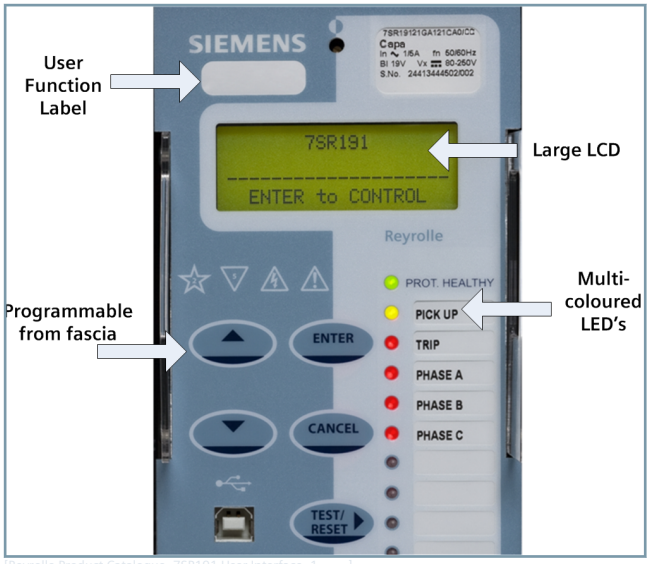
[Reyrolle Product Catalogue, 7SR11 and 7SR12 Rear view of relay (E4 Case), 1, -_-]

Figure 2.3/54 Rear view of E4 relay

[Reyrolle Product Catalogue, 7SR11 and 7SR12 Rear view of relay with 2x LC Fibre Optic ports (E6 Case with IEC61850), 1, --_--]

Figure 2.3/55 Rear view of relay with 2x LC Fibre Optic ports (E6 Case with IEC61850)

User Interface



[Reyrolle Product Catalogue, 7SR191 User Interface, 1, --_--]

Figure 2.3/56 User Interface

The operator interface is designed to provide a user friendly method of controlling, viewing menus, entering settings and retrieving data from the relay. Five buttons are provided for navigation around the menu structure.

LCD

A 4 line by 20 character liquid crystal display with power save operation indicates the relay identifier, settings, instrumentation, fault data and control commands. Up to 6 user programmable general alarms can be configured to display your own indications on the LCD.

LEDs

A green steadily illuminated LED indicates the 'Protection Healthy' condition.

9 user programmable LEDs are available eliminating the need for expensive panel mounted pilot lights and associated wiring. Each LED is tri-colour (red, green, yellow) allowing for clear indication of the associated function's state and has a label insert for identification.

Relay Information

The device is identified by the rating label on the fascia. The user can also give the device its own identity by editing the 'Relay Identifier' displayed on the LCD or space is provided to place a slip in label giving the relays function.

Technical Data

For full technical data refer to the Performance Specification Section of the Technical Manual.

Inputs and Outputs

Current Inputs

Quantity	4
Rated Current I_n	1/5 A

Measuring Range	80 x I_n
Instrumentation ≥ 0.1 x I_n	±1% I_n
Frequency	50/60Hz
Thermal Withstand: Continuous 1 Second 1 Cycle	4 x I_n 100A (1A) 350A (5A) 700A (1A) 2500A (5A)
Burden @ I_n	≤ 0.2VA (1A phase and Earth element) ≤ 0.2VA (5A phase and earth element)

Voltage Inputs (optional)

Quantity	3, ph-ph or ph-n
Nominal	40...160 V_{RMS}
Operating Range	0... 200 V_{RMS}
Instrumentation ≥ 0.8 x V_n	±1% V_n
Burden @ 110V	≤ 0.06 VA
Overvoltage Withstand	300 V_{RMS}

Auxiliary Supply

Rated DC Voltage	24-250 V DC Operating range 19.2 to 275V	
Allowable superimposed ac component	12% of DC voltage	
Rated AC Voltage	100-230 V AC 50/60Hz Range 80 to 253 V_{RMS} AC 50/60Hz ±5%	
Power Consumption:	Min (DC)	3W (6W with IEC61850)
	Max (DC)	8.4W (11W with IEC61850)
	Min (AC)	9VA (14.5VA with IEC61850)
	Max (AC)	17VA (23VA with IEC61850)
Allowable breaks/ dips in supply (collapse to zero)	DC	50ms
	AC	2.5/3 cycles @50/60Hz

Binary Inputs

Number	3 or 6	
Operating Voltage	19V dc	DC Range 19 to 320V dc AC Range 92 to 138 V_{RMS}AC Minimum threshold 17V dc
	88V dc	Range 88 to 320V dc Minimum threshold 68.75V dc
Maximum dc current for operation	1.5 mA	
Maximum peak ac current for operation	1.5 mA	
Pick Up Delay	User selectable 0 to 14,400,000 ms (up to 4 hours)	
Drop Off Delay	User selectable 0 to 14,400,000 ms (up to 4 hours)	

NOTE

For AC operation the BI pick-up delay should be set to 0ms and the drop-off delay to 20ms.

Binary Outputs

Number	5 or 8 (3 change over contacts)
Operating Voltage	Voltage Free
Operating Mode	User selectable - Self or Hand/Electrical Reset or pulsed
Operating Time from Energizing Binary Input	< 20 ms
Making Capacity: Carry continuously Make and carry (L/R ≤ 40 ms and V ≤ 300 V)	5A ac or dc 20A ac or dc for 0.5 s 30A ac or dc for 0.2 s
Breaking Capacity: (≤ 5 A and ≤ 300 V): AC Resistive AC Inductive DC Resistive DC Inductive	1250 VA 250 VA at p.f. ≤ 0.4 75 W 30 W at L/R ≤ 40 ms 50 W at L/R ≤ 10 ms

Unit Design

Housing	E4 or E6(see dimension drawing)
Indication	20 Character 4 line Display Relay Healthy LED 9 Tri Coloured User Programmable Self or Hand Reset LED's
Withdrawable Element	Yes
User Interface	5 Navigation Keys
Weight	Typical 3.2kg E4 case, 4.15 kg E6 case. Additional Transport packaging: add 0.4kg

Data Communication Interface

Communication Port	Front USB Type B Rear RS485 2 wire electrical IEC61850 optional ports: 2x Electrical RJ45 Ethernet 2x LC Fibre Optic Ethernet
Protocols	IEC60870-5-103 MODBUS RTU (Serial) DNP3.0 O (Serial) IEC61850 - optional
Fibre Optic Ethernet Data Communication Interface (IEC 61850 Option)	

EN100 Fibre Optic Data Communication Interface (IEC 61850 Option)

Physical	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

EN100 Electrical Ethernet Data Communication Interface (IEC 61850 Option)

Physical	Electrical
Connectors	RJ45 100BaseT in acc. With IEEE802.3
Transmission Speed	100 MBits/s
Test Voltage (with regard to socket)	500 VAC 50 Hz
Bridgeable distance	20m

Data Storage

Fault Record	10
Waveform Record	10 x 1sec 2 x 5sec 5 x 2sec 1 x 10sec Pre trigger 10...90%
Events	1000 1ms Resolution

Mechanical Tests

Vibration (Sinusoidal)

IEC 60255-27 & IEC 60255-21-1 Class I

Type	Level	Variation
Vibration response	0.5 gn	≤ 5 %
Vibration response	1.0 gn	≤ 5 %

Shock and Bump

IEC 60255-27 & IEC 60255-21-2 Class I

Type	Level	Variation
Shock response	5 gn, 11 ms	≤ 5 %
Shock withstand	15 gn, 11 ms	≤ 5 %
Bump test	10 gn, 16 ms	≤ 5 %

Seismic

IEC 60255-27 & IEC 60255-21-3 Class I

Type	Level	Variation
Seismic response	X-plane - 3.5mm displacement below crossover freq (8-9Hz) 1gn above Y-plane – 1.5mm displacement below crossover freq (8-9Hz) 0.5gn above	≤ 5 %

Mechanical Classification

Durability	>10^6 operations

Electrical Tests

Insulation

IEC 60255-27

Type	Level
Between any terminal and earth	2.5 kV AC RMS for 1 min
Between independent circuits	2.5 kV AC RMS for 1 min
Across normally open contacts	1.0 kV AC RMS for 1 min

Slow Damped Oscillatory Wave (High Frequency Disturbance)

IEC 60255-26

Type	Level	Variation
Case, Aux Power & I/O. Common mode	2.5 kV	≤ 10 %
Case, Aux Power & I/O. Transverse mode	1.0 kV	≤ 10 %
RS485 Comms	1.0 kV	No data loss

Electrostatic Discharge

IEC 60255-26

Type	Level	Variation
Contact discharge	8.0 kV	≤ 5 %

Fast Transients

IEC 60255-26

Type	Level	Variation
Case, Aux Power & I/O	4kV	≤ 10 %
RS485 Comms	2.0kV	No data loss

Surge Immunity

IEC 60255-26

Type	Level	Variation
Analog Inputs: Line to Earth	4.0 kV	≤ 10 %
Case, Aux Power & I/O: Line to Earth	2.0 kV	≤ 10 %
RS485 Comms port: Line to Earth	1.0 kV	No Data Loss
Analog Inputs: Line to Line	1.0 kV	≤ 10 %
Case, Aux Power & I/O: Line to Line	1.0 kV *	≤ 10 %

NOTE

* 50ms DTL pick-up delay applied to binary inputs

Conducted Radio Frequency Interference

IEC 60255-22-6

Type	Level	Variation
0.15 to 80 MHz	10 V	≤ 5 %

Radiated Radio Frequency

IEC 60255-26

Type	Limits at 10 m, Quasi-peak
30 to 230 MHz	40 dB(µV/m)
230 to 10000 MHz	47 dB(µV/m)

Conducted Radio Frequency

Type	Limits	
	Quasi-peak	Average
0.15 to 0.5 MHz	79 dB(µV)	66 dB(µV/m)
0.5 to 30 MHz	73 dB(µV)	60 dB(µV/m)

Radiated Immunity

IEC 60255-26

Type	Level
80 MHz to 1000 MHz Sweep	10 V/m
1.4GHz to 2.7GHz Sweep	10 V/m
80,160,380,450,900,1850,2150 MHz Spot	10 V/m

Magnetic Field with Power Frequency

IEC 60255-26

Type	Level
100A/m (0.126mT) continuous	50Hz
1000A/m (1.26mT) for 3s	

Environmental Tests

Temperature

IEC 60255-1 & IEC 60068-2-1/2

Operating Range	-10°C to + 55°C
Storage Range	- 25°C to + 70°C

Humidity

IEC 60255-1 & IEC 60068-2-78

Operational test	56 days at 40°C and 93% relative humidity

Cyclic Temperature and Humidity

IEC 60255-1 & IEC 60068-2-30

Operational test	25°C to 55°C (outdoor equipment) and 97/93 % relative humidity. 6 x 24h (12h+12h) cycles.

IP Ratings

IEC 60529

Type	Level
Installed with cover	IP 51 from front of relay
Installed with cover removed	IP 20 from front of relay

Performance

27/59 Under/Over Voltage

Number of Elements	4 Under or Over
Operate	Any phase or All phases
Voltage Guard	1 to 200V
Setting Range V_s	5 to 200V
Hysteresis Setting	0 to 80%
V_s Operate Level	100% V_s, ±1% or ±0.25V

Reset Level: Overvoltage Undervoltage	=(100%-hyst) x V_{op}, ±1% or ±0.25V =(100%+hyst) x V_{op}, ±1% or±0.25V
Delay Setting t_{delay}	0.00 to 14400s
Basic Operate Time : 0 to 1.1 x V_s 0 to 2.0 x V_s 1.1 to 0.5 x V_s	73ms ±10ms 63ms ±10ms 58ms ±10ms
Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±10ms
Inhibited by	Binary or Virtual Input VT Supervision, Voltage Guard

37 Undercurrent

Number of Elements	2
Operate	Any phase or ALL
Setting Range I_s	0.05 to 5.0 x I_n
Operate Level	100% I_s, ±5% or ±1% x I_n
Current Guard	0.05 to 5.0 x I_n
Delay Setting t_{delay}	0.00 to 14400s
Basic Operate Time: 1.1 to 0.5 x I_n	35ms ±10ms
Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±10ms
Overshoot Time	< 40ms
Inhibited by	Binary or Virtual Input, Guard

46MDT Phase Unbalance

Number of Elements	1
Setting Range S_s	0.01 to 1.0
Operate Level	100% S_s, ±5% for Imean ≥0.1 x I_n
Delay Setting t_{delay}	0.00 to 14400s
Basic Operate Time 0.01 to 1	95ms ±10ms
Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±10ms
Inhibited by	Binary or Virtual Input

46 Negative Phase Sequence Overcurrent

Number of Elements	DT & IT
DT Setting Range I_s	0.05,0.10...4.0 x I_n
DT Operate Level	100% I_s, ±5% or ±1% x I_n
DT Delay Setting t_{delay}	0.00 to 14400s
DT Basic Operate Time 0 to 2 x I_s 0 to 5 x I_s	40 ms ±10 ms 30 ms ±10 ms
DT Operate time following delay	t_{basic} +t_{delay} , ±1% or ±10 ms
IT Char Setting	IEC NI,VI,EI,LTI, ANSI MI,VI,EI & DTL
IT Setting Range	0.05 to 2.5
Tm Time Multiplier	0.025 to 100
Char Operate Level	105% I_s, ±4% or ±1% I_n
Overshoot Time	< 40 ms
Inhibited by	Binary or Virtual Input

47 Negative Phase Sequence Overvoltage

Number of Elements	2xDT & 2xIT
Setting Range V_s	1 to 90V
DT Hysteresis Setting	0 to 80%
Operate Level	100% V_s, ±2% or ±0.5V
DT Delay Setting t_{delay}	0.00 to14400s
Basic Operate Time 0V to 1.5 x V_s 0V to 10 x V_s	80 ms ±20 ms 55 ms ±20 ms
DT Operate time following delay.	t_{basic} +t_{delay} , ±2% or ±20 ms
IT Char Setting	IDMTL, DTL
IT Tm Time Multiplier	0.025 to 100
IT Char Operate Level	100% I_s, ±2% or ±0.5V
Overshoot Time	< 40 ms
Inhibited by	Binary or Virtual Input

49 Thermal Overload

Operate levels	Operate and Alarm
Setting Range I_s	0.10 to 3.0 x I_n
Operate Level	100% I_s, ±5% or ±1% x I_n
Time Constant Setting	1 to 1000min
Operate time	$t = \tau \times ln\left\{\frac{I^2 - I_p^2}{I^2 - (k \times I_s)^2}\right\}$ ±5% absolute or ±100 ms where Ip = prior current
Alarm Level	Disabled, 50,51...100%
Inhibited by	Binary or Virtual Input

50 (67) Instantaneous & DTL OC&EF (Directional)

Operation 7SR1915/6 only	Non directional, Forward or reverse
Elements	Phase (50)& Derived Earth (50N)
Number of Elements	4 x OC 4 x Derived EF
Operating Current	RMS or Fundamental frequency
Setting Range I_s	0.05 to 50 x I_n
Time Delay	0.00 to 14400s
Operate Level	100% I_s, ±5% or ±1% x I_n
Operate time: 50 50N	0 to 2 x I_s – 35 ms, ±10 ms, 0 to 5 x I_s – 25 ms, ±10 ms 0 to 2 x I_s – 40 ms, ±10 ms, 0 to 5 x I_s – 30 ms, ±10 ms

Operate time following delay	t_{basic} +t_{delay} , ±1% or ±10 ms
Inhibited by	Binary or Virtual Input VT Supervision

51(67) Time Delayed OC&EF (Directional)

Operation – 7SR1915/6 only	Non directional, Forward or reverse
Elements	Phase & Derived Earth
Number of Elements	2 x OC 2 x Derived EF
Operating Current	RMS or Fundamental frequency
Characteristic	IEC NI, VI, EI, LTI; ANSI MI, VI, EI & DTL
Setting Range I_s	0.05 to 2.5 x I_n
Time Multiplier	0.025 to 100
Time Delay	0,0.01... 20s
Operate Level	105% I_s, ±4% or ±1% x I_n
Minimum Operate time IEC ANSI	$t_{op} = \frac{K}{\left[\frac{I}{Is}\right]^{\alpha} - 1} \times Tm$ $t_{op} = \left[\frac{A}{\left[\frac{I}{Is}\right]^{P} - 1} + B\right] \times Tm$ ± 5% absolute or ± 30ms
Follower Delay	0 - 20 s
Reset	ANSI decaying, 0 - 60 s
Inhibited by	Binary or Virtual Input VT Supervision

50BF Circuit Breaker Fail

Operation	Current check - Phase and Measured I4 with independent settings, Mechanical Trip, CB Faulty Monitor
Setting Range I_s	0.05 to 2.0 x I_n
2 Stage Time Delays	Timer 1 - 20...60000 ms Timer 2 - 20...60000 ms
Operate Level	100% I_s, ±5% or ±1% x I_n
Disengaging time	< 20 ms
Operate time following delay	Tcbf ±1% or ±2 ms
Triggered by	Any function mapped as trip contact
Inhibited by	Binary/Virtual Input
Timer By pass	Yes, 50BF CB Faulty Input

59IT Time Delayed Phase Overvoltage

Number of Elements	1
IT Char Setting	IDMTL, Capacitor & DTL
IT Setting Range	1 to 100V
Tm Time Multiplier(IDMT)	0.1 to 140
Delay (DTL)	0 to 20s
Operate time IDMTL Capacitor DTL	$t_{op} = \frac{M}{\left[\frac{V}{Vs}\right] - 1}$ ± 5 % or ± 65 ms. See above, ± 5 % or ± 65 ms. t_{delay}, ± 1 % or ± 40ms
Reset	0 to 60s
Char Operate Level	105% V_s, ±2% or ±0.5V
Inhibited by	Binary or Virtual Input

59C Capacitor Overvoltage

Number of Elements	2xDT & 2xIT
Capacitor Rated Current, equivalent to Vcr	0.1 to 5 x I_n
Setting Range I_s	80 to 150% Vcr
DT Operate Level	100% V_s, ±2% or ±0.5V
DT Delay Setting t_{delay}	0 to 14400s
DT Basic Operate Time 0 to 2 x V_s 0 to 5 x V_s	50ms ±10ms 45ms ±10ms
DT Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±20ms
IT Char Setting	Capacitor, IDMTL, DTL
IT Setting Range	80 to 150% Vcr
IT Tm Time Multiplier	0.025 to 1.6
IT Char Operate Level	100% I_s, ±2% or ±0.5V
Operate time IDMTL Capacitor DTL	$t_{op} = \frac{M}{\left[\frac{V}{Vs}\right] - 1}$ ± 5 % or ± 65 ms. See above, ± 5 % or ± 65 ms. t_{delay}, ± 1 % or ± 50ms
Overshoot Time	< 40ms
Inhibited by	Binary or Virtual Input

59N Neutral Voltage Displacement

Number of Elements	DT & IT
DT Setting Range I_s	1 to 100V
DT Operate Level	100% V_s, ±2% or ±0.5V
DT Delay Setting t_{delay}	0 to 14400s
DT Basic Operate Time 0V to 1.5 x V_s 0V to 10 x V_s	76ms ±20ms 63ms ±20ms
DT Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±20ms
IT Char Setting	IDMTL & DTL
IT Setting Range	1 to 100V
Tm Time Multiplier(IDMT)	0.1 to 140

Delay (DTL)	0 to 20s
Operate time IDMTL	$t_{op} = \frac{M}{\left[\frac{I}{I_s}\right]-1}$ ± 5 % or ± 65 ms.
Reset	IEC/ANSI Decaying, 0 to 60s
Char Operate Level	105% V_s, ±2% or ±0.5V
Inhibited by	Binary or Virtual Input

60C Capacitor Unbalance

Number of Elements	DT & IT
DT Setting Range I_s	0.01 to 2.0 x I_n
DT Operate Level	100% I_s, ±5% or ±1% x I_n
DT Delay Setting t_{delay}	0.00 to 14400s
DT Basic Operate Time 0 to 2 x I_s 0 to 5 x I_s	50ms ±10ms 40ms ±10ms
DT Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±10ms
IT Char Setting	DTL & User Specified
IT Setting Range	0.01 to 2
Tm Time Multiplier(IDMT)	0.025 to 100
Char Operate Level	105% I_s, ±4% or ±1% I_n
Overshoot Time	< 40ms
Inhibited by	Binary or Virtual Input

60 Supervision

CT	7SR1912/3 Current 7SR1915/6 Current or V_{nps} & I_{nps}
VT	7SR1915/6 nps/zps

87REF Restricted Earth Fault

Setting Range	0.05 to 0.95 x I_n
Operate Level	100% I_s, ±5% or ±1% x I_n
Time Delay	0 to 60s

7SR1912/1913 Connection Diagram

Basic Operate Time	0 to 2 x I_s 40ms ±10ms 0 to 5 x I_s 30ms ±10ms
Inhibited by	Binary or Virtual Input

74T/CC Trip/Close Circuit Supervision

Number of supervisable circuits	3 x Trip and 3 x Close
Number of BI's Required	1 or 2 per function

81 Under/Over Frequency

Number of Elements	4 Under or Over
Under Voltage Guard	Yes/No
Setting Range Hz	43 to 57Hz (50Hz) 53 to 68Hz (60Hz)
Hysteresis Setting	0 to 2%
Operate Level	100% F_s ±10mHz
Operate Time	Typical < 150ms
V_s Operate Delay	0 to 14400s

Reswitch Blocking

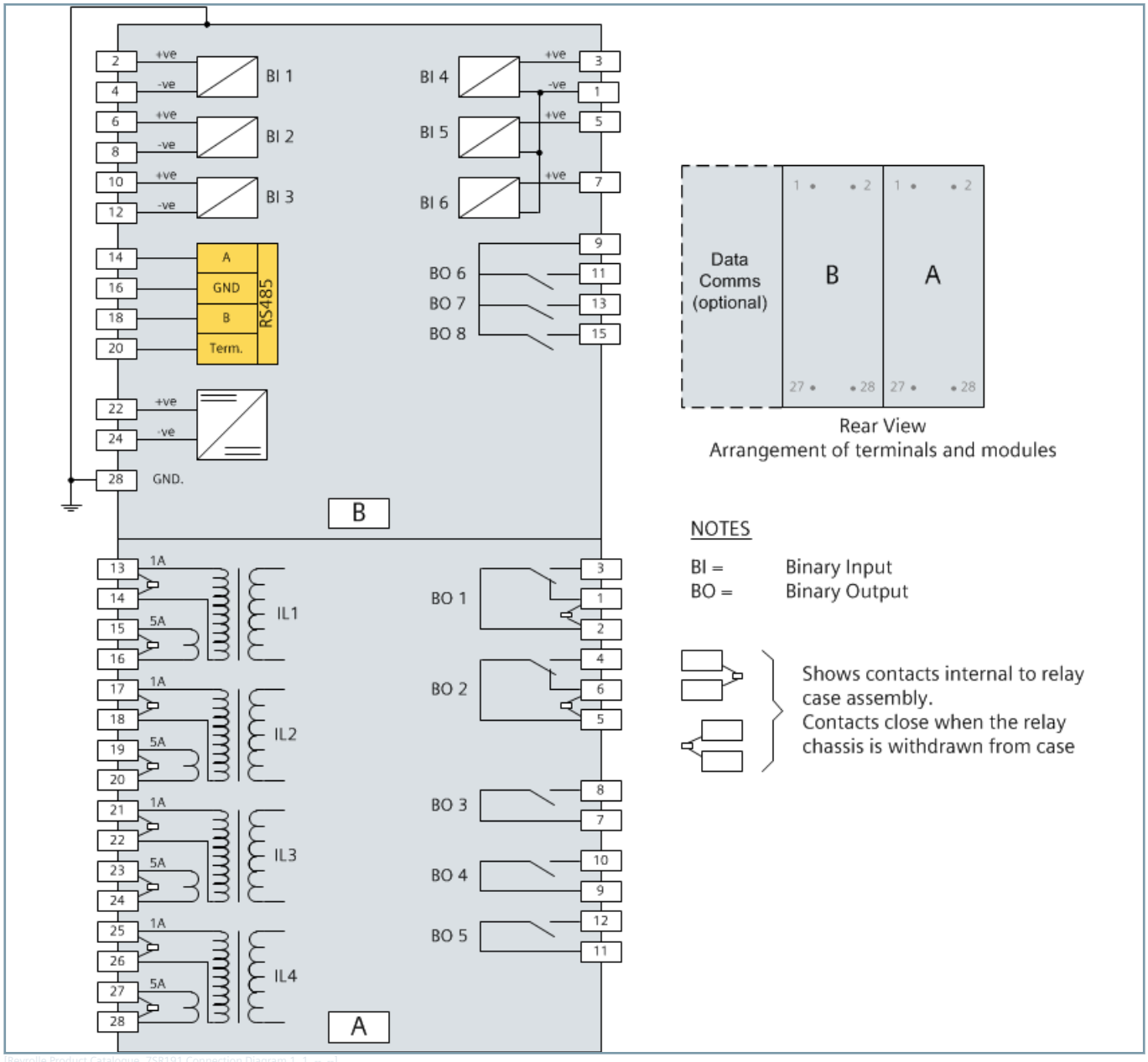
Operation	UC, CB position, UC&CB, UC or CB
Blocking time	0 to 60000s
Setting Range I_s	0.05 to 5.0 x I_n
Operate Level	100% I_s, ±5% or ±1% x I_n
Delay Setting t_{delay}	0.00 to 14400s
Basic Operate Time: 1.1 to 0.5 x I_n	50ms ±10ms
Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±10ms

CB Maintenance

Trip Counter	Total & Delta 0...10000
I^2t Alarm	10...100000

Control Functions

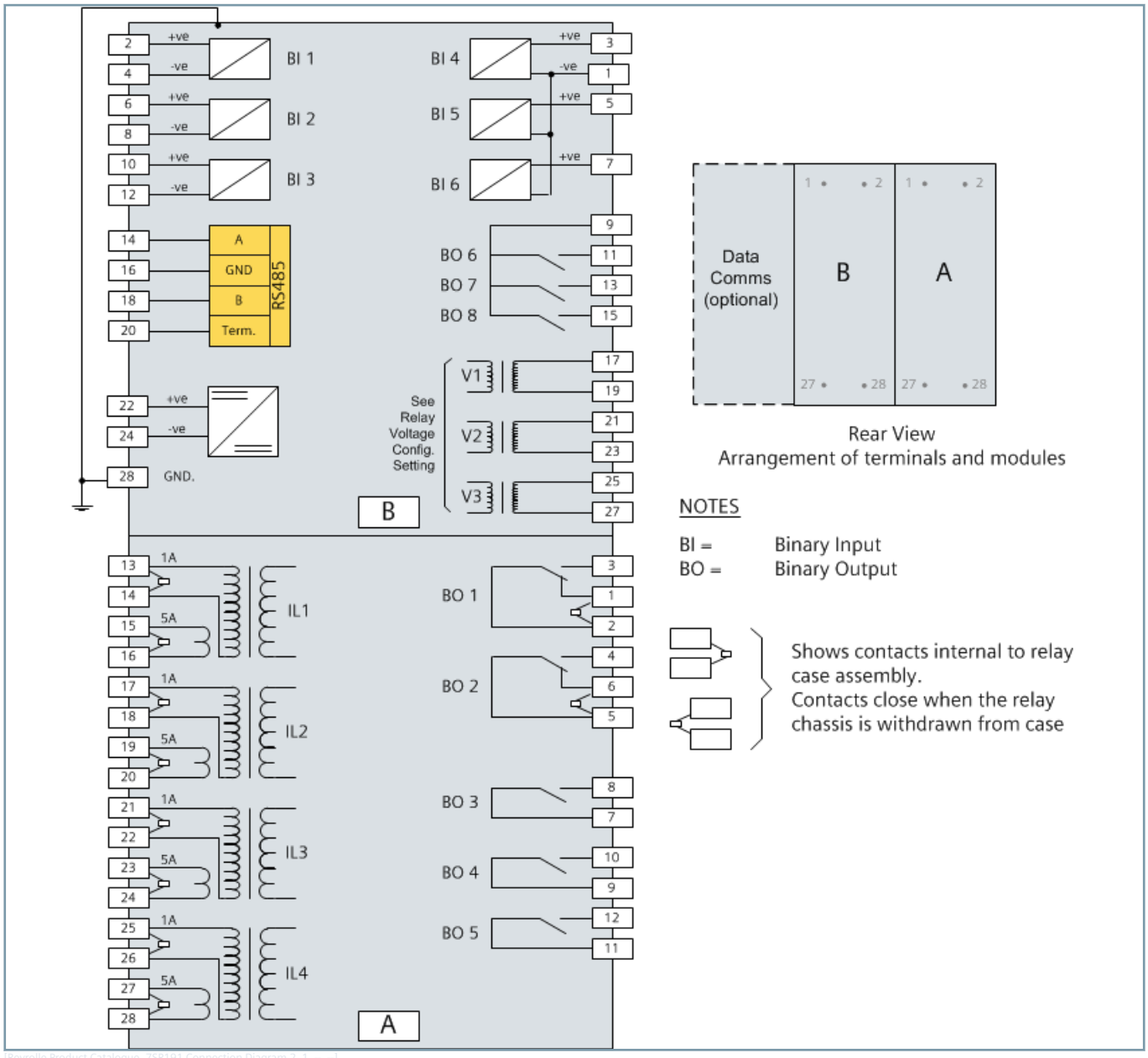
CB	Open/Close
EF	IN/OUT
Relay Mode	Local/Remote/Local or Remote
Reset	LED's & O/P's



[Reyrolle Product Catalogue, 7SR191 Connection Diagram 1, 1, –_–]

Figure 2.3/57 Diagram showing 7SR1913 relay with 4 CT inputs, 6 binary inputs and 8 binary outputs

7SR1915/1916 Connection Diagram



[Reyrolle Product Catalogue, 7SR191 Connection Diagram 2, 1, –_–]

Figure 2.3/58 Diagram showing 7SR1916 relay with 4 CT inputs, 3 VT inputs, 6 binary inputs and 8 binary outputs

7SR1 Range – 7SR191 Capacitor Protection Relay

Ordering Information - 7SR191 Capa Capacitor Bank Protection

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Capacitor Protection	7	S	R	1	9	1	□	-	1	□	A	□	□	-	□	C	A	0
					|	|	|		|	|		|	|		|	|	|	
Capacitor Bank protection relay					|	|	|		|	|		|	|		|	|	|	
Protection Product					|	|	|		|	|		|	|		|	|	|	
Miscallaneous Protection					9	|	|		|	|		|	|		|	|	|	
						|	|		|	|		|	|		|	|	|	
Capacitor Protection						1	|		|	|		|	|		|	|	|	
							|		|	|		|	|		|	|	|	
Case I/O and Fascia							|		|	|		|	|		|	|	|	
4 CT, 3 Binary Inputs / 5 Binary Outputs, 10 LEDs							2		|	|		|	|		|	|	|	
4 CT, 6 Binary Inputs / 8 Binary Outputs, 10 LEDs							3		|	|		|	|		|	|	|	
4 CT, 3VT, 3 Binary Inputs / 5 Binary Outputs, 10 LEDs							5		|	|		|	|		|	|	|	
4 CT, 3VT, 6 Binary Inputs / 8 Binary Outputs, 10 LEDs							6		|	|		|	|		|	|	|	
									|	|		|	|		|	|	|	
Measuring Input									|	|		|	|		|	|	|	
1/5 A, 50/60Hz[1], 40-160V[2]									1	|		|	|		|	|	|	
										|		|	|		|	|	|	
Auxiliary Voltage										|		|	|		|	|	|	
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		|	|		|	|	|	
												|	|		|	|	|	
Communication Interface												|	|		|	|	|	
Standard version – included in all models, USB front port, RS485 rear port (E4 case) [3]												1	2		|	|	|	
Standard version - plus additional rear electrical Ethernet RJ45 (x2) (E6 Case) [3]												7	7		|	|	|	
Standard version - plus additional rear optical Ethernet duplex (x2) (E6 Case) [3]												8	7		|	|	|	
													|		|	|	|	
Protocol													|		|	|	|	
IEC 60870-5-103, Modbus RTU and DNP3 (user selectable)													2		|	|	|	
IEC 60870-5-103, Modbus RTU, DNP3 and IEC 61850. (user selectable settings)													7		|	|	|	
															|	|	|	
Relay Cover															|	|	|	
Standard Version - No Push Buttons															1	|	|	
Push Buttons - Down and Right Arrows															2	|	|	
																|	|	
Protection Function Packages																|	|	
Standard version																C	|	
																	|	
37 Undercurrent																	|	
46M Phase unbalance																	|	
46 Negative phase sequence overcurrent																	|	
49 Thermal overload																	|	
50 Instantaneous phase fault overcurrent																	|	
50BF Circuit breaker fail																	|	
50N Instantaneous earth fault																	|	
51 Time delayed phase fault overcurrent																	|	

Product Description	Order No.		
51c Cold load pickup		|	
51N Time delayed earth fault		|	
59C Overvoltage by current integration		|	
60C Unbalance Overcurrent		|	
60CTS CT supervision		|	
87REF High Impedance REF		|	
74T/CCS Trip & Close circuit supervision		|	
Re-energisation Blocking		|	
Programmable Logic		|	
		|	
For variants with 3 x VT inputs, as above plus:		|	
27/59 Under/overvoltage		|	
47 Negative phase sequence voltage		|	
59N Neutral voltage displacement		|	
60VTS VT Supervision		|	
67/50 Directional instantaneous phase fault overcurrent		|	
67/50N Directional instantaneous earth fault		|	
67/51 Directional time delayed phase fault overcurrent		|	
67/51N Directional time delayed earth fault		|	
81U/0 Under/Over Frequency		|	
		|	
Additional Functionality		|	
No Additional Functionality		A	

NOTE

1) 4CT is configured by user setting as: 3PF + 1 Unbalance OR 1PF +3 Unbalance

2) Voltage rating applies to models with optional VT inputs only.

3) E4 case is standard, E6 case is required if IEC61850 option fitted

7SR17 Motor Protection Relay

[Reyrolle Product Catalogue, 7SR17, 1, —_–]

Figure 2.3/59 7SR17 Rho Fascia

Description

The 7SR17 motor protection relay range utilises service and design experience accumulated with the previous generations of Rho family of products.

Housed in 4U high, size E4 or E6 cases the 7SR17 Rho can provide protection, control, monitoring, instrumentation and metering with integrated input and output logic, data logging and fault reports.

Relay functionality is accessed via a familiar user friendly interface.

Communication access to relay functionality is via a front USB port for local PC connection, rear RS485 port for remote connection or optional IEC61850 communication through two rear Ethernet ports (Electrical or Optical).

Function Overview

Protection (can include)

14	Stall Protection
46	Phase Unbalance Protection
49	Thermal Overload
48/66	Start Protection
37	Undercurrent
67/50, 67/51	Directional Overcurrent
67G/67N	Directional Earth Fault
87REF	High Impedance REF
27/59	Under/Over Voltage
47	NPS Voltage/Phase Reversal
81	Under/Over Frequency
32	Power
32S	Sensitive Power
55	Power Factor

Supervision (can include)

46PhRev	Phase Reversal
50BCL	Breaking Capacity Limit
50BF	Circuit Breaker Fail
60CTS-I	CT Supervision
60CTS	Enhanced CT Supervision
60VTS	VT Supervision
74T/CCS	Trip Circuit Supervision
81B	Anti Backspin
Temp	Temperature Input Monitoring

Control (can include)

86	Lockout
Motor Start/Stop Control	
User Programmable Logic	

Features

4 Settings Groups
Password Protection – 2 levels (protection and control)
User Programmable Logic

User Interface

20 Character x 4 line backlit LCD
Menu navigation keys
9 Programmable Tri-colour LEDs

Monitoring Functions

Monitoring Functionality (can include)

Phase, earth and sequence currents
Thermal equivalent and phase difference currents
Line, phase, neutral and sequence voltages
Power - Apparent, Real and Reactive. Power factor Energy - WHr and VAr Hr
Demand metering
Start/Run Monitoring Profiles:
Number of Starts, Starts per hour Start currents, voltages and power Start method (Local/remote/comms) Motor run / start / trip times, thermal status,
Binary Input / Output status
General Alarms inc. trip circuit healthy/failure
Starters
Fault data
CB trip and maintenance counters and Time to Trip
Temperature input (optional) values

Description of Functionality

With reference to the 7SR17 functional diagrams.

14 Stall Protection

Each element has a single definite time overcurrent characteristic with settings for pickup level and Definite Time Lag (DTL) delays.

Operation can be controlled from motor stopped or running conditions.

37 Undercurrent

Each element has settings for the pickup level and the definite time lag (DTL) delay. The element operates when current falls below setting for the duration of the delay.

46 Phase Unbalance protection

Unbalance current has a significant heating effect on the motor. Two phase unbalance measurement modes are available. Either NPS current or the difference between maximum and minimum phase currents can be used as a measurement of the unbalance level. Inverse or definite time operation can be selected.

48/66 Start Protection

The feature provides settings to control both the number of times a motor can be started within a specified time period and the minimum time between starts. Motor starting can be inhibited when this limit is reached.

Motor start time can also be monitored.

49 Thermal Protection – Rotating Plant

The enhanced thermal algorithm provides compliance with IEC60255-8 (Thermal Electrical relays).

The operating curves take into account the effects of present loading, prior loading and unbalanced currents on the motor operating temperature.

A user definable thermal curve is selectable to allow matching of the relay thermal characteristic to all motor and cooling system types.

'Starting' and 'cooling' constants modify the thermal characteristic during motor run-up and stopped conditions.

Temperature Inputs

Motor resistance temperature detectors (RTDs) can be connected via an optional external 7XV5662-6AD10 Temperature Monitoring Interface. Up to twelve Pt100 sensors can be monitored.

The interface is connected to the COM1-RS485 port of the relay.

50/51, G/N Earth Fault

Two earth fault measurement modes are available.

Measured earth fault mode (G) directly measures the earth current from an independent CT, or the residual connection of the 3 line CT's.

Derived earth fault mode (N) derives the earth current internally from the line CT inputs.

Independent settings are available for pickup current and time-delays.

IDMT curves are available.

50/51 Overcurrent

Definite time elements provide short circuit overcurrent protection with independent settings for pickup current and time-delays.

IDMT curves can also be selected.

50BF Circuit Breaker Fail

The circuit breaker fail function may be triggered from an internal trip signal or from a binary input. Where a CB closed is detected following a trip signal an output is issued after a specified time interval. This can be used to re-trip the CB or to back-trip an upstream CB. A second time delay is available to enable another stage to be utilized if required.

60CTS CT Supervision

Two types of CT wiring monitoring is available dependent on the availability of VT inputs:

60CTS-I determines CT failure from a comparison of phase current levels.

Where VT inputs are available 60CTS considers the presence of negative phase sequence current, without an equivalent level of negative phase sequence voltage.

The element has user operate and delay settings.

81B Anti Backspin

To inhibit attempted restarting of the motor until after the rotor has completely stopped backspin protection is applied. Starting is inhibited until the 81B time delay has elapsed.

87REF High Impedance REF

The 87REF function can provide high speed earth fault protection for motor winding faults. This function requires an external series stabilising resistor and voltage limiting non-linear resistor.

74TCS Trip Circuit Supervision

The trip circuits can be monitored via binary inputs connected in H4/H5/H6 or H7 schemes. Trip circuit failure raises an HMI alarm and output(s).

Programmable User Logic

The user can map Binary Inputs and Protection operated outputs to Function Inhibits, Logic Inputs, LEDs and/or Binary Outputs.

The user can also enter up to 4 equations defining scheme logic using standard functions e.g. Timers, AND/OR gates, Inverters and Counters.

Each Protection element output can be used for Alarm/Indication and/or tripping.

Function LED's

Ten user programmable tri-colour LED's are provided eliminating the need for separate panel mounted indicators and associated wiring. Each LED can be user set to red, green or yellow allowing for indication of the associated function's status. A slip-in pocket adjacent to the LEDs enables the user to insert customised labels. A printer compatible template is available.

Optional Functionality

27/59 Under/Over Voltage

Each element has settings for pickup level, drop-off level and Definite Time Lag (DTL) delayed operation.

The elements can be independently selected to under or over voltage operation.

32 Power

This feature can be used to detect loss of motor load.

Each element can be set to measure real, apparent or reactive power and has independent settings for pickup level and Definite Time Lag (DTL) delayed operation.

32S Sensitive Power

Sensitive power is measured from the 4th CT input (IG) and user selected voltage inputs.

Each element can be set to measure real, apparent or reactive power and has independent settings for pickup level and Definite Time Lag (DTL) delayed operation.

47 Negative Phase Sequence (NPS) Overvoltage

Unbalance (NPS) voltage can be caused by uneven system loading.

Each element has independent settings for pickup level and Definite Time Lag (DTL) delayed operation.

49TS Integral Temperature Sensor Inputs

4 or 8 Temperature Sensors can be connected to the optional integral temperature sensor inputs.

RTD or thermistor sensors can be used. All sensors must be of the same type.

55 Power factor

This feature is used to monitor motor operating conditions. Each element has independent settings for pickup level and Definite Time Lag (DTL) delayed operation.

60VTS VT Supervision

The VT Supervision uses a combination of sequence component voltage and current to detect a VT fuse failure. This condition can provide an output for indications/alarms or used to inhibit voltage dependent functions. Element has user operate and delay settings.

67 Directional Control for Overcurrent and Earth Fault

Directional control can be used to provide additional protection discrimination e.g. correct discrimination for earth faults in non-effectively earthed systems with appreciable capacitance.

81 Under/Over Frequency

Frequency elements can be used to monitor suuply quality e.g. under-frequency causing motor deceleration.

Each element has independent settings for pickup level, drop-off level and Definite Time Lag (DTL) delayed operation.

Technical Data

For full technical data refer to the Performance Specification Section of the Technical Manual.

Inputs and Outputs

Current Inputs

Quantity	3 x Phase, 1 x SEF
Rated Current I_n	1/5 A
Measuring Range	Phase: 80 x I_n
	SEF: 10 x I_n
Instrumentation 10% to 200% I_n	±1% or ±1% I_n
Frequency	50/60Hz
Thermal Withstand: Continuous 1 Second	4.0 x I_n 100A (1A) 350A (5A)
Burden @ I_n	≤ 0.1VA (1A Phase and SEF) ≤ 0.2VA (5A Phase and SEF)

Voltage Inputs

Quantity	3 (Optional)
Rated Voltage V_n	40 – 160V
Instrumentation 10% to 200% V_n	±1% or ±1% V_n
Frequency	50/60Hz
Thermal Withstand: Continuous	300V_{RMS}
Burden @ 110V	≤ 0.6 VA

Temperature Detector Inputs

Value	Reference	Accuracy
RTD	Cu10, 0 – 540°C	±3°C (0 – 250°C)
	Ni100, 0 – 400°C	±1°C (0 – 250°C)
	Ni120, 0 – 330°C	
	Ni250, 0 – 535°C	
	Pt100, 0 – 540°C	
	Pt250, 0 – 540°C	
	Pt1000, 0 – 260°C	±2°C (0 – 250°C)
Thermistor	100Ω – 40KΩ	±2% or ± 5Ω

Auxiliary Supply

Nominal voltage	Operating Range V
24 to 60V dc	18 to 72V dc
24 to 250 V dc 100 to 230 V ac	19.2 to 275 V dc 80 – 253V ac
Allowable superimposed ac component	12% of DC voltage
Allowable breaks/ dips in supply (collapse to zero)	50ms (DC) 2.5/3 cycles (AC)

Auxiliary supply: Burdens

Power Consumption	Min (DC) Max (DC)	3.9W (6W with IEC61850) 8W (10.1W with IEC61850)
	Min (AC) Max (AC)	9VA (14.5VA with IEC61850) 15VA (20.5VA with IEC61850)

Binary Inputs

Operating Voltage	19V: Range 17 to 320V dc 19V: Range 92 to 138 V ac 88V: Range 74 to 320V dc
Maximum current for operation	1.5mA dc 1.5mA peak ac

Binary Outputs

Operating Voltage	Voltage Free
Operating Mode	User selectable - Self or Hand Reset
Contact Operate / Release Time.	7ms / 3ms
Making Capacity: Carry continuously Make and carry (L/R ≤ 40 ms and V ≤ 300 V)	5A ac or dc 20A ac or dc for 0.5 s 30A ac or dc for 0.2 s
Breaking Capacity: (≤ 5 A and ≤ 300 V): AC Resistive AC Inductive DC Resistive DC Inductive	1250 VA 250 VA at PF ≤ 0.4 75 W 30 W at L/R ≤ 40 ms 50 W at L/R ≤ 10 ms

Data Communication Interface

Communication Port	Front USB Type B Rear RS485 2 wire electrical IEC61850 optional ports: 2x Electrical RJ45 Ethernet 2x LC Fibre Optic Ethernet
Fibre Optic Ethernet Data Communication Interface (IEC 61850 Option)	

EN100 Fibre Optic Data Communication Interface
(IEC 61850 Option)

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

EN100 Electrical Ethernet Data Communication Interface
(IEC 61850 Option)

Physical Layer	Electrical
Connectors	RJ45 100BaseF in acc. With IEEE802.3
Recommended cable	Minimum: Category 5 S/FTP (shielded/screened twisted pair)
Transmission Speed	100 MBits/s
Test Voltage (with regard to socket)	500 VAC 50 Hz
Bridgeable distance	20m

Mechanical Tests

Vibration (Sinusoidal)

IEC 60255-21-1 Class I

Type	Level	Variation
Vibration response	0.5 gn	≤ 5 %
Vibration endurance	1.0 gn	≤ 5 %

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	≤ 5 %
Bump test	10 gn, 16 ms	≤ 5 %

Seismic

IEC 60255-21-3 Class I

Type	Level	Variation
Seismic response	1gn	≤ 5 %

Mechanical Classification

Durability	>10^6 operations

Electrical Tests

Insulation

IEC 60255-5

Type	Level
Between any terminal and earth	2.0kV AC RMS for 1min
Between independent circuits	
Across normally open contacts	1.0 kV AC RMS for 1 min

High Frequency Disturbance

IEC 60255-22-1 Class III

Type	Level	Variation
Case, Aux Power & I/O. Common mode	2.5 kV	≤ 10 %
Case, Aux Power & I/O. Transverse mode	1.0 kV	≤ 10 %
RS485 Comms	1.0 kV	No data loss

Electrostatic Discharge

IEC 60255-22-2

Type	Level	Variation
Front Cover Fitted	Class IV, 15 kV Air Discharge	≤ 5 %
Front Cover Removed	Class III, 8 kV Air Discharge	≤ 5 %

Electrical Fast Transient / Burst Immunity

IEC 60255-22-4 Class A (2002)

Type	Level	Variation
Case, Aux Power & I/O	4.0kV	≤ 10 %
RS485 Comms	2.0kV	No data loss

Surge Immunity

IEC 60255-22-5

Type	Level	Variation
Analog Inputs. Line to Earth	4.0 kV	≤ 10 %
Case, Aux Power & I/O. Line to Earth	2.0 kV	
Analog Inputs. Line to Line	1.0 kV	
Case, Aux Power & I/O. Line to Line	1.0 kV *	
RS485 Comms port. Line to Earth	1.0 kV	No data loss

NOTE

* 50ms pick up delay applied to binary inputs

Conducted Radio Frequency Interference

IEC 60255-22-6

Type	Level	Variation
0.15 to 80 MHz	10 V	≤ 5 %

Radiated Radio Frequency

IEC 60255-25

Type	Limits at 10 m, Quasi-peak
30 to 230 MHz	40 dB(µV/m)
230 to 10000 MHz	47 dB(µV/m)

Conducted Radio Frequency

Type	Limits	
	Quasi-peak	Average
0.15 to 0.5 MHz	79 dB(µV)	66 dB(µV/m)
0.5 to 30 MHz	73 dB(µV)	60 dB(µV/m)

Radiated Immunity

IEC 60255-22-3 Class III

Type	Level	Variation
80 MHz to 1000 MHz	10 V/m	≤ 5 %

Magnetic Field with Power Frequency

IEC 61000-4-8, Class V

Type	Level
100A/m (0.126mT) continuous	50Hz
1000A/m (1.26mT) for 3s	

Environmental Tests

Temperature

IEC 60068-2-1/2

Operating Range	-10°C to + 55°C
Storage Range	- 25°C to + 70°C

Humidity

IEC 60068-2-78

Operational test	56 days at 40°C and 93% relative humidity

IP Ratings

IEC 60529

Type	Level
Installed with cover	IP 51 from front of relay
Installed with cover removed	IP 20 from front of relay

For full technical data refer to the Performance Specification Section of the Technical Manual.

Performance

14 Stall Protection

Number of Elements	4
Setting Range I_s: -	0.05 to 10 x I_n
Time Delay	0.00 to 14400s
Operate Level	100% I_s ±5% or ±1% x I_n
Operate time 2 x I_s 5 x I_s	35ms ± 10ms, 25ms ± 10ms

Operate time following delay	t_{basic} +t_{delay} , ±1% or ±10ms
Controlled by	Stopped, No acceleration, Running, None

27/59 Under/Over Voltage

Number of Elements	4 Under or Over
Operate	Any or All phases
U/V Guard	1 to 200V
Setting Range V_s	5 to 200V
Hysteresis Setting	0 to 80%
Operate Level V_{op}	100% V_s, ±1% or ±0.25V
Reset Level: Undervoltage Overvoltage	=(100%+hyst) x V_{op}, ±1% or ±0.25V =(100%-hyst) x V_{op}, ±1% or±0.25V
Delay Setting t_{delay}	0 to 14400s
Basic Operate Time : - 1.1 x V_s (OV) 2.0 x V_s (OV) 0.5 x V_s (UV)	73ms ±10ms 63ms ±10ms 58ms ±10ms
Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±10ms
Inhibited by	Binary or Virtual Input VT Supervision, Voltage Guard

32 Power

Number of Elements	2 Forward or Reverse
Operate	P, Q or S
U/C Guard	0.05 to 1.0 x I_n
Setting Range S_s	0.05 to 2.0 x S_n
Operate Level S_{op}	100% S_s, ± 5% or ± 2% S_n
Reset Level:	≥95% S_{op}
Basic Operate Time : - 1.1 x S_s (over) 2.0 x S_s (over) 0.5 x S_s (under)	60ms ±10ms 45ms ±10ms 40ms ±10ms
Delay Setting t_{delay}	0 to 14400s
Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±10ms
Inhibited by	Motor not running, VTS

32S Sensitive Power

Number of Elements	2 Forward or Reverse
Operate	P, Q or S
U/C Guard	0.005 to 1.0 x I_n
Setting Range S_s	0.005 to 2.0 x S_n
Operate Level	100% S_s, ± 5% or ± 2% S_n
Reset Level:	≥95% S_{op}
Basic Operate Time : - 1.1 x S_s (over) 2.0 x S_s (over) 0.5 x S_s (under)	60ms ±10ms 45ms ±10ms 30ms ±10ms
Delay Setting t_{delay}	0 to 14400s
Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±10ms
Inhibited by	Motor not running, VTS

37 Undercurrent

Number of Elements	2
U/C Guard	0.05 to 5.0 x I_n
Setting Range I_s	0.05 to 5.0 x I_n
Operate Level	100% I_s, ±5% or ±1% x I_n
Delay Setting t_{delay}	0 to 14400s
Basic Operate Time: 0.5 x I_s	50ms ± 10ms
Operate time following delay.	t_{basic} +t_{delay} , ±1% or ±10ms
Overshoot Time	< 40ms
Inhibited by	Binary or Virtual Input

46 Phase Unbalance Protection

Number of Elements	1 (Magnitude difference or NPS)
Setting Range I_s	0.1 to 0.4 x Itheta
Operate Level	100% I_s ±5% or ±1% x I_n
IT Min. Operate Time	0 to 20s
DT Delay Setting t_{delay}	0 to 20s
Basic Operate (Magnitude Difference) 2 x I_s 5 x I_s	55ms ±10ms 50ms ±10ms
Basic Operate (NPS) 2 x I_s 5 x I_s	70ms ±10ms 60ms ±10ms
DT Operate time following delay.	t_{delay} ±1% or ±30ms
Tm Time Multiplier	0.025 to 2.0
Overshoot Time	< 40ms
Inhibited by	Binary or Virtual Input

47 Negative Phase Sequence Voltage

Number of Elements	2
Setting Range V_s	1 to 90V
Hysteresis Setting	0 to 80%
Operate Level	100% V_s, ±2% or ±0.5V
Delay Setting t_{delay}	0 to 14400s
Basic Operate Time 2 x V_s 10 x V_s	80 ms ±20 ms 55 ms ±20 ms
Operate time following delay.	t_{basic} +t_{delay} , ±2% or ±20 ms

Overshoot Time	< 40 ms
Inhibited by	Binary or Virtual Input

48/66 Start Protection

Max. No. of Starts	OFF, 1 to 20
Max. Starts Period	1 to 60 minutes
Start Inhibit Delay	1 to 60 minutes
Time Between Starts	OFF, 1 to 60 minutes

49 Thermal Protection

Setting Range Itheta	0.1 to 3.0 x I_n
NPS Weighting Factor (K)	0.1 to 10.0 Δ0.1
TauH Heating Constant	0.5 to 1000 mins, Δ 0.5 mins
TauS Starting Constant	0.005 to 1.0 x TauH , Δ 0.005
TauC Cooling Constant	1 to 100 x TauH , Δ 1
Hot/cold ratio	OFF, 1 to 100%, Δ 1%
Operate Level	100% I_s, ±5% or ±1% x I_n
Operate time	$t = \tau \times In \left\{ \frac{I_{EQ}^2 - \left(1 - \frac{H}{C}\right) I_p^2}{I_{EQ}^2 - I_E^2} \right\}$ ±5% absolute or ±100 ms (Itheta = 0.3 to 3 x I_n) (1.2 to 20 x Itheta)
	User defined
Capacity Alarm Level	Disabled, 50,51...100%
Load Alarm Level	OFF, 0.5 to 1.0 x Itheta , Δ 0.05
Thermal restart inhibit	20 to 100%, Δ 1%
Inhibited by	Binary or Virtual Input

50 (67) Instantaneous/DTL OC & EF

Operation 7SR17n2/3 7SR17n5/6	Non directional. Non directional, Forward or reverse
Elements	Phase, Derived Earth, Measured Earth
Setting Range I_s: - O/C '50' Derived E/F '50N' Measured E/F '50G'	0.05 to 50 x I_n 0.05 to 50 x I_n 0.005 to 5 x I_n
Time Delay	0.00...14400s
Operate Level	100% I_s, ±5% or ±1% x I_n
Operate time: 50 50N	0 to 2 x I_s – 35 ms, ±10 ms, 0 to 5 x I_s – 25 ms, ±10 ms 0 to 2 x I_s – 40 ms, ±10 ms, 0 to 5 x I_s – 30 ms, ±10 ms
Operate time following delay	t_{basic} +t_{delay} , ±1% or ±10 ms
Inhibited by	Binary or Virtual Input Inrush detector VT Supervision

51(67) Time Delayed OC&EF

Operation 7SR17n2/3 7SR17n5/6	Non directional. Non directional, Forward or reverse
Elements	Phase, Derived Earth, Measured Earth
Characteristic	IEC: NI, VI, EI, LTI ANSI: MI, VI, EI DTL
Setting Range I_s	0.05 to 2.5 x I_n (OC, N) 0.005 to 0.5 x I_n (G)
Time Multiplier (IEC/ANSI)	0.025 to 100
Time Delay	0 to 20s
Operate Level	105% I_s, ±4% or ±1% x I_n
Minimum Operate time IEC ANSI	$t_{op} = \frac{K}{\left[\frac{I}{Is}\right]^{\alpha} - 1} \times Tm$ $t_{op} = \left[\frac{A}{\left[\frac{I}{Is}\right]^{P} - 1} + B\right] \times Tm$ ± 5% or ± 30ms
Follower Delay	0 - 20 s
Reset	ANSI decaying, 0 - 60 s
Inhibited by	Binary or Virtual Input VT Supervision

50BF Circuit Breaker Fail

Operation	Current check - Phase and Measured Earth with independent settings, Mechanical Trip, CB Faulty Monitor
Setting Range I_s	0.05 to 2 x I_n (50BF) 0.005 to 2 x I_n (50BF-I4)
2 Stage Time Delays	Timer 1: 0.02 to 60s Timer 2: 0.02 to 60s
Operate Level	100% I_s, ±5% or ±1% x I_n
Basic Operate time	< 20 ms
Operate time following delay	t_{delay} ±1% or ±20 ms
Triggered by	Any function mapped as trip contact

Inhibited by	Binary/Virtual Input
Timer By pass	Yes, 50BF CB Faulty Input

55 Power factor

Number of Elements	2
Operation	Under or Over
U/C Guard	0.05 to 1.0
Setting Range PFs	0.05 to 0.99
Time Delays	0 to 14400s
Operate Level	± 0.05
Basic Operate time	≤ 80ms
Operate time following delay	t_{basic} +t_{delay} ±1% or ± 10ms
Inhibited by	Motor not running, VTS

81 Under/Over Frequency

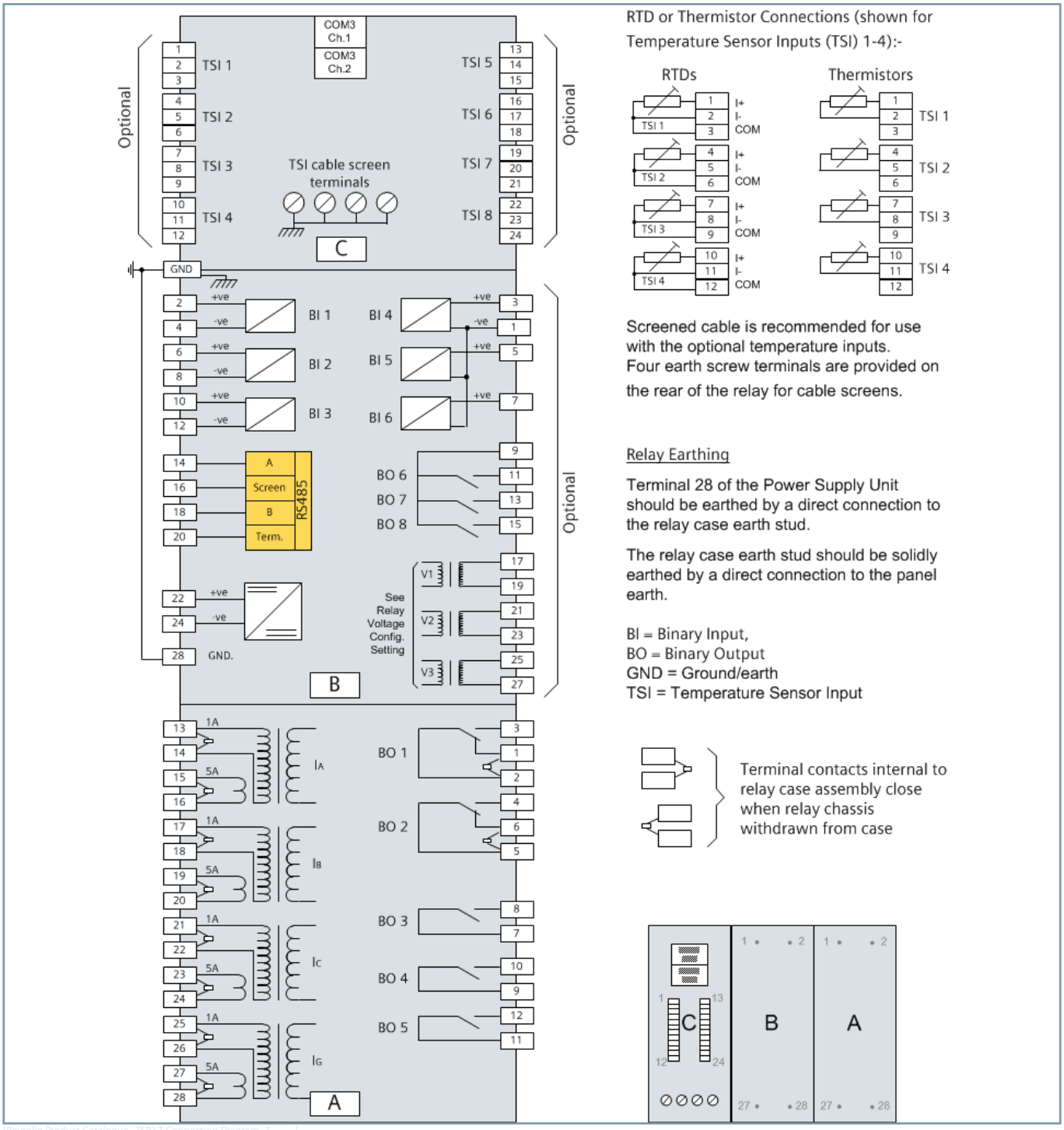
Number of Elements	2 Under or Over
U/V Guard	35 to 200V
Setting Range F_s	43 to 68Hz
Hysteresis Setting	0 to 2%
Operate Level F_{op}	100% F_s ±10mHz

Connection Diagrams

Reset Level: - Under Frequency Over Frequency	 (100% + hyst) x F_{op} ± 10mHz (100% - hyst) x F_{op} ± 10mHz
Delay Setting t_{delay}	0 to 14400s
Basic Operate Time: - For ROCOF between 0.1 and 5Hz/ second	 Typically < 110ms Maximum < 150ms
Operate time following delay.	t_{basic} +t_{delay} ± 1% or ± 10ms
Inhibited by	Binary or Virtual Input, Voltage Guard

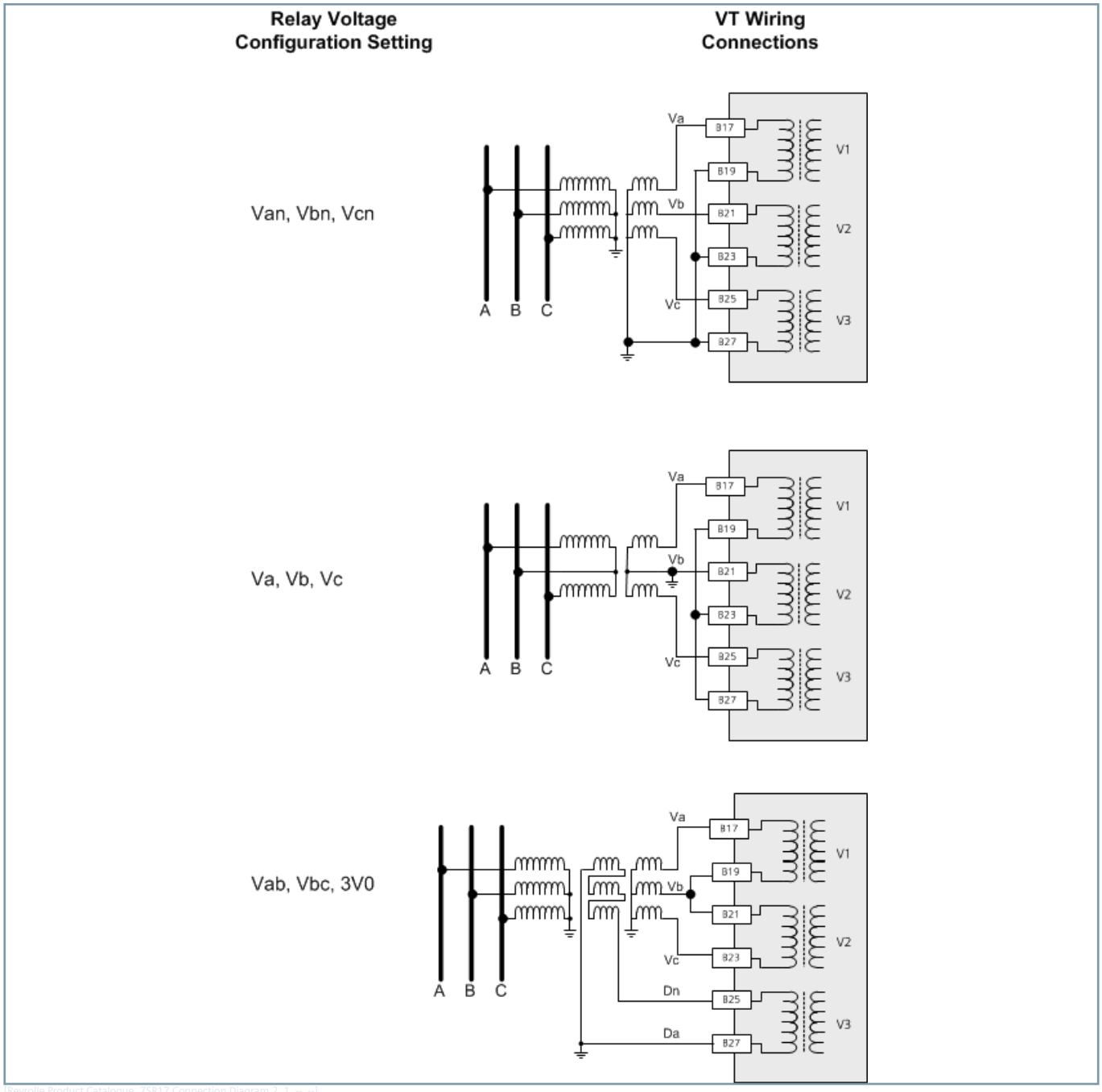
87REF Restricted Earth Fault

Setting Range I_s	0.005 to 2.0 x I_n
Operate Level	100% I_s, ±5% or ±1% x I_n
Time Delay	0 to 60s
Basic Operate Time 2 x I_s 5 x I_s	40ms ±10ms 30ms ±10ms
Inhibited by	Binary or Virtual Input



[Reyrolle Product Catalogue, 7SR17 Connection Diagram, 1, – _]

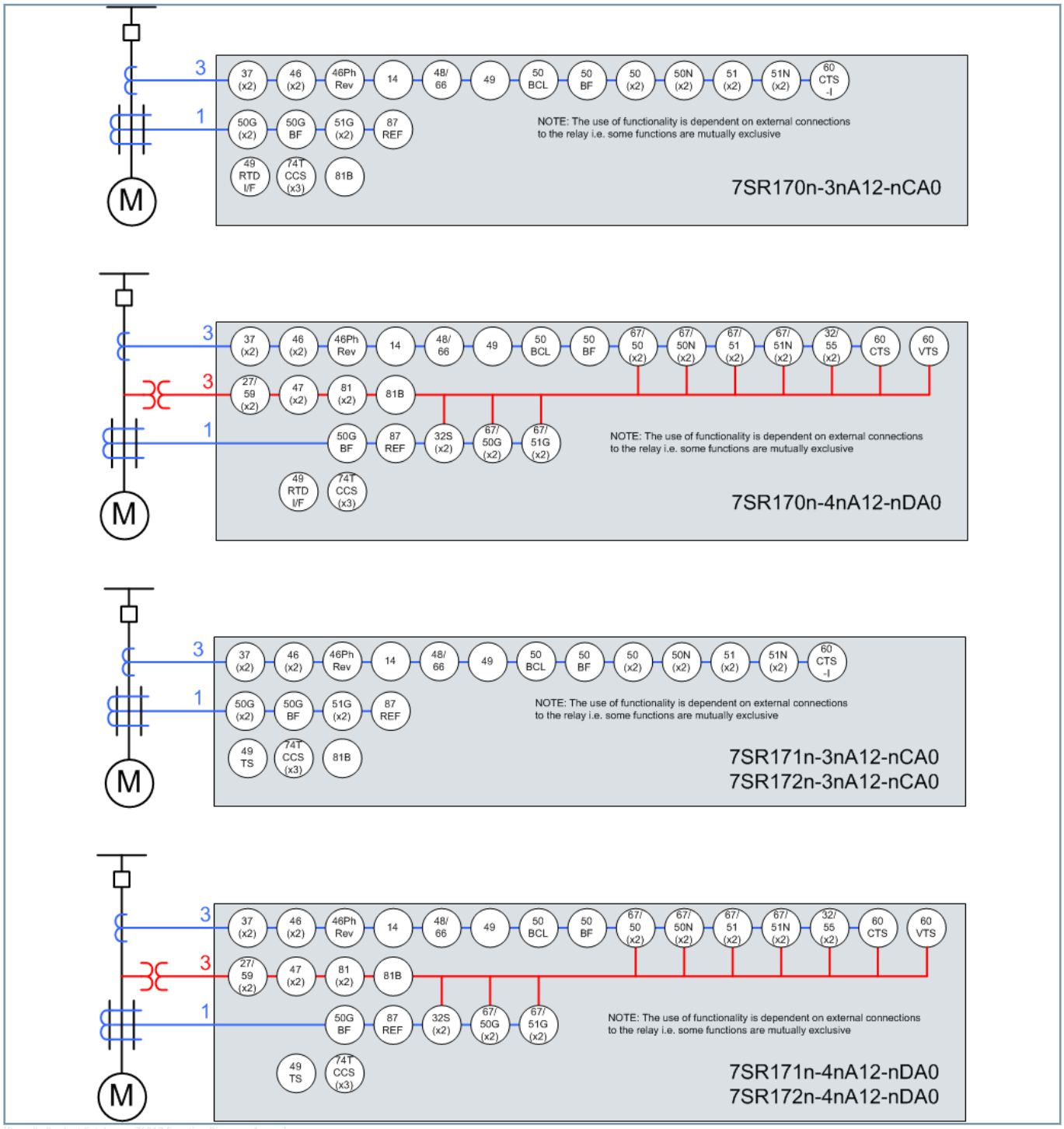
Figure 2.3/60 7SR17 Rho Wiring Diagram



[Reyrolle Product Catalogue, 7SR17 Connection Diagram 2, 1, __-]

Figure 2.3/61 7SR17 Rho VT Wiring Connections

7SR17 Rho Function Diagram



[Reyrolle Product Catalogue, 7SR17 Function Diagram, 1, -_-]

Figure 2.3/62 Function Diagrams - 7SR17 Relays

Ordering Information - 7SR17 Rho Motor Protection Relay

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Rho Motor Protection Relay	7	S	R	1	7	□	□	-	□	□	A	□	□	-	□	C	A	0
					|	|	|		|	|	|	|	|		|	|	|	|
Protection Product Family					5	|	|		|	|	|	|	|		|	|	|	|
Motor Protection					7	|	|		|	|	|	|	|		|	|	|	|
						|	|		|	|	|	|	|		|	|	|	|
Relay Type						6	|		|	|	|	|	|		|	|	|	|
Basic Relay (See Note 1)						0	|		|	|	|	|	|		|	|	|	|
Relay with 4 Temperature inputs (See Note 1)						1	|		|	M/N	|	|	|		|	|	|	|
Relay with 8 Temperature inputs (See Note 1)						2	|		|	M/N	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Case, I/O and Fascia							7		|	|	|	|	|		|	|	|	|
4 CT, 3 Binary Inputs / 5 Binary Outputs, 10 LEDs							2		3	|	|	|	|		|	|	|	|
4 CT, 6 Binary Inputs / 8 Binary Outputs, 10 LEDs							3		3	|	|	|	|		|	|	|	|
4 CT, 3 VT, 3 Binary Inputs / 5 Binary Outputs, 10 LEDs							5		4	|	|	|	|		|	|	|	|
4 CT, 3 VT, 6 Binary Inputs / 8 Binary Outputs, 10 LEDs							6		4	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Measuring Input									8	|	|	|	|		|	|	|	|
1/5 A, 50/60Hz with SEF Input							2/3		3	|	|	|	|		|	|	|	|
1/5 A, 40-160V, 50/60Hz with SEF Input							5/6		4	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Auxiliary Voltage										9	|	|	|		|	|	|	|
24-60V DC, binary input threshold 19V DC										J	|	|	|		|	|	|	|
24-250V DC / 100-230V AC. Binary Input threshold 19V DC										M	|	|	|		|	|	|	|
24-250V DC / 100-230V AC. Binary Input threshold 88V DC										N	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Additional Options											10	|	|		|	|	|	|
Standard relay											A	|	|		|	|	|	|
												|	|		|	|	|	|
Communication Interface												11	|		|	|	|	|
Standard version - included in all models, USB front port, RS485 rear port (See Note 1)												1	2		|	|	|	|
Standard version - plus additional rear electrical Ethernet RJ45 (x2) (See Note 1)										M/N		7	7		|	|	|	|
Standard version - plus additional rear optical Ethernet duplex (x2) (See Note 1)										M/N		8	7		|	|	|	|
													|		|	|	|	|
Protocol													12		|	|	|	|
IEC 60870-5-103, Modbus RTU, DNP 3.0 (user selectable). Also Modbus RTD Client (see Note 2)													2		|	|	|	|
IEC 60870-5-103, Modbus RTU, DNP 3.0 (user selectable) and IEC61850. Also Modbus RTD Client (see Note 2)												7/8	7		|	|	|	|
															|	|	|	|
Front Cover															13	|	|	|
Standard Version - No Push Buttons															1	|	|	|
Push Buttons - DOWN and RIGHT Arrows															2	|	|	|
																|	|	|
Protection Function Packages																14	|	|
For future development																A	|	|
For future development																B	|	|
Standard version - included in all models																C	|	|
14 Stall Protection																	|	|
37 Undercurrent																	|	|
46 Phase Unbalance																	|	|
46PhRev Phase Reversal																	|	|

7SR1 Range – 7SR17 Motor Protection Relay

Product Description	Order No.		
48/66 Start Protection		|	|
49 Thermal Overload		|	|
49 RTD I/F (See Note 2) RTD Monitoring via comms		|	|
50/51 Overcurrent		|	|
50/51, G/N Earth Fault		|	|
50BF Circuit Breaker Fail		|	|
50BCL Break Capacity Limit		|	|
60CTS-I CT Supervision		|	|
74T/CCS Trip/Close Circuit Supervision		|	|
81B Backspin Protection		|	|
87REF High Impedance Restricted Earth Fault		|	|
Programmable Logic		|	|
		|	|
For variants with Temperature inputs		|	|
49 Temp Temperature Input Monitoring		|	|
		|	|
For variants with 3 x VT inputs as above - plus		|	|
27/59 Under/Over Voltage		|	|
32/55 Directional Power/Power Factor		|	|
47 Negative Phase Sequence Overvoltage		|	|
60CTS Enhanced CT Supervision		|	|
60VTS VT Supervision		|	|
67/50, 67/51 Directional Overcurrent		|	|
67G/N Directional Earth Fault		|	|
81 Frequency		|	|
		|	|
Additional Functionality		15	|
No Additional Functionality		A	|
		|	|
Spare			16
			0

NOTE

1) E4 case is standard, E6 case is required if IEC61850 and/or Temperature Input options are ordered.

2) Applicable to non-integral Temperature Input variants. Requires selection of Protocol - Modbus RTD Client, which precludes use of system comms.

7SR18 Differential Protection Relay

[Reyrolle Product Catalogue, 7SR18, 1, —_–]

Figure 2.3/63 Typical Fascia showing additional LED variant

Description

The Solkor, two-ended, line differential relay has been developed to enhance the Reyrolle family of products. Designed using state-of-the-art hardware technology, it provides differential protection and control for overhead lines and cable feeders. Housed in a 4U high, size E6 case, it provides protection, monitoring, instrumentation and metering with integrated input and output logic, data logging & fault reports. Communication access to the relay functionality is via a front USB port for local PC connection or rear RS485 communications port for remote connection. EMC emission class A, EMC immunity zone A.

Function Overview

87L	Three-phase differential (two elements)
85	Inter-trip Feature
50	Instantaneous Overcurrent
50G/50N	Instantaneous Earth Fault
51	Time Delayed Overcurrent
51G/51N	Time Delayed Measured/Derived/Earth Fault
60CTS-I	CT Supervision

Two, three-pole differential elements, each with two stage bias characteristics, are provided for differential protection. Inter-tripping comes from internal or six independent external initiation channels. Overcurrent protection can operate as a stand-alone feature, it can also be configured to operate as 'guard' feature and/or back-up in case of protection signalling communications failure. Connection to CTs is via selectable 1 A or 5 A inputs. Ratio correction for miss-matched line current transformer ratios is available. The ability to invert CT inputs is provided to facilitate commissioning. There are five or eight user-programmable binary output contacts and three or six user programmable status inputs with pick-up and drop-off timers.

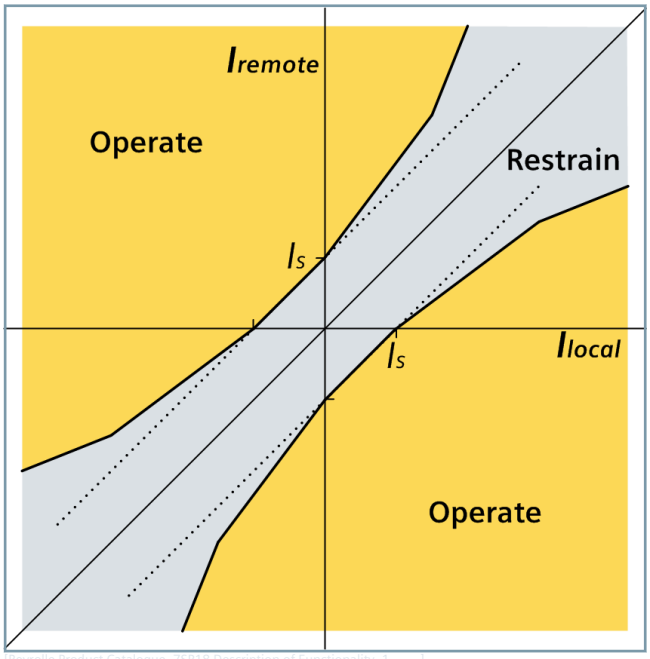
Monitoring Functions

Local end and remote end ammeters,
Differential starters,
Protection signalling link status,
General alarms,
Binary Input / Output status,
Trip circuit supervision
Time and date
Fault records
Event records
Circuit breaker trip counters
I^2t summation for contact wear
Communication loop-back test modes
Communication link supervision
Starters
Power on counter

Description of Functionality

Current Differential Protection

The relay compares magnitude of measured currents at either end of the protected feeder, it operates for faults detected within the protected zone. The three-pole, phase-fault differential comparators each provide two bias-slopes. The first stage of bias accommodates proportional measuring errors in the system. The second stage accommodates additional spill current caused by CT saturation at high fault levels.



[Reyrolle Product Catalogue, 7SR18 Description of Functionality, 1, —_–]

Figure 2.3/64 Differential Protection Operating Characteristic

It is not necessary to have the same CT ratios at either end of a protected feeder, since ratio compensation is settable. It is also possible to invert the current inputs to aid in commissioning.

Backup Overcurrent Protection

In addition to the differential protection, comprehensive over-current protection for phase and earth faults provides back-up IDMTL and DTL characteristics in the event of a communications link failure.

Guard Relays

If it is necessary to add security to the differential scheme it is possible to configure an overcurrent element as a 'guard' feature. The appropriate overcurrent element must operate at the same instance as the differential element to allow a trip command to be issued.

Inter-tripping

Auxiliary signalling channels are provided for inter-tripping. Internal inter-trip dedicated to the differential protection and independent inter-trips which can be used for either direct or permissive inter-tripping from an internal or external source. Where an internal fault is fed largely from one end, the differential comparators at both ends operate identically, but the guard at the low current end may not pick up and so block the trip. To overcome this, an internal inter-trip signal is sent which can be used at the receive end to either override the guard so allowing the differential to trip or operate the trip contacts directly.

Protection Signalling

The end-to-end protection signalling channel is via a direct optical link for distances up to 2 km* using multi-mode fibres (ST®) bayonet style connectors or up to 40 km using single-mode fibres Duplex LC connectors. Continuous protection signalling link supervision is provided. Two test modes, loop test & line test, are included to assist with commissioning the signalling link. In loop test mode the local transmit and receive terminals can be connected together, allowing relays at each end to be tested in isolation. Line test mode allows the integrity of the whole signalling channel to be checked. The relay commands the remote end to 'echo' all received data back to the local end. In line test mode, the remote differential protection is suspended.

NOTE

* For distances greater than 2 km consider using the additional 7XV5461-xxxxx devices

Circuit Breaker Maintenance

A circuit-breaker operations counter is provided. A summation of I2 broken by the circuit-breaker provides a measure of the contact erosion. Operations count and I2 alarm levels can be set which, when reached, can be used as an input to a condition-based maintenance regime.

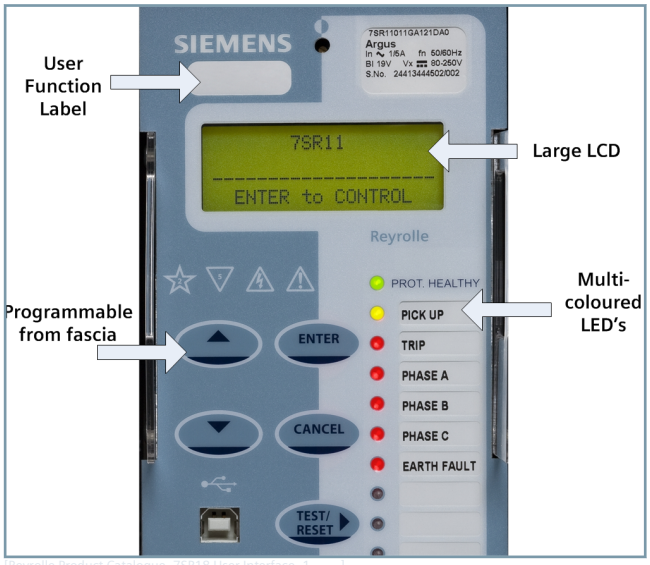
Construction

The relay is housed in a 4U high size E6 case with a removable clear plastic fascia cover. Two handles are provided to facilitate the withdrawal of the relay element from its case. Internal contacts within the case ensure the CT circuits and normally closed contacts remain short-circuit when the relay is withdrawn. The rear connection blocks are comprised of screw terminals facilitating M4 ring-crimp connections, providing a secure and reliable termination.

[Reyrolle Product Catalogue, 7SR18 Construction, 1, –_–]

Figure 2.3/65 Typical Rear view of relay

User Interface



[Reyrolle Product Catalogue, 7SR18 User Interface, 1, –_–]

Figure 2.3/66 Typical User Interface

The operator interface is designed to provide a user friendly method of controlling, viewing menus, entering settings and retrieving data from the relay. Five buttons are provided for navigation around the menu structure.

LCD

A 4 line by 20 character liquid crystal display (LCD) with power save operation permits viewing of the relay identifier, settings,

instrumentation, fault data and control commands. Up to 6 user programmable general alarms can be configured for status indication.

LEDs

A steadily illuminated LED indicates the 'Protection Healthy' condition. There are 9 or 17 user programmable LEDs available eliminating the need for additional expensive panel mounted indication and associated wiring. Each is tri-coloured (red, green, yellow) allowing for indication severity classification of the associated function's state and has a label insert for text identification.

Relay Information

The device type and rating information is shown as standard on the fascia slip-in label. There is also provision for relay designation to be displayed on the LCD showing 'Relay Identifier' & 'Circuit Identifier' information. In addition space is provided on the fascia via a slip-in label repeating such information.

Technical Data

For full technical data refer to the Performance Specification Section of the Technical Manual.

Inputs and Outputs

Current Inputs

Quantity	3 x Phase & 1 x Earth
Rated Current I_n	1 A or 5 A
Measuring Range	80 x I_n
Instrumentation ≥ 0.1 x I_n	±1% I_n
Frequency	50 Hz or 60 Hz
Thermal Withstand: Continuous 2 Minutes 1 Second 1 Cycle	 4 x I_n 6 x I_n 100 A (1 A) 350 A (5 A) 700 A (1 A) 2500 A (5 A)
Burden @ I_n	≤ 0.02 VA (1 A phase and Earth element) ≤0.2 VA (5 A phase and earth element)

Auxiliary Supply

Rated DC Voltage	Nominal Range 24 V to 250 V Absolute Range 19.2 V to 275 V	
Allowable superimposed ac component	12% of DC voltage	
Rated AC Voltage	Nominal Range 100 V to 230 V AC 50 Hz or 60 Hz Absolute Range 88 V to 253 V_{RMS} AC	
Power Consumption:	Min (DC) Max (DC)	3.9 W 8 W
	Min (AC) Max (AC)	9 VA 0.5 PF 15 VA 0.5 PF
Allowable breaks/ dips in supply (collapse to zero)	DC	50 ms
	AC	2.5 cycles or 3 cycles @50 Hz or 60 Hz

Binary Inputs

Number	3 or 6	
Operating Voltage	19 V dc	DC Range 19 to 320 V dc AC Range 92 to 138 V_{RMS}AC Minimum threshold 17 V dc
	88 V dc	Range 88 to 320V dc Minimum threshold 68.75 V dc
Maximum dc current for operation	1.5mA	
Maximum peak ac current for operation	1.5mA	
Pick Up Delay	User Selectable 0 s to 14400 s (up to 4 hours)	
Drop Off Delay	User Selectable 0 s to 14400 s (up to 4 hours)	

NOTE

For AC operation the BI pick-up delay should be set to 0 ms and the drop-off delay to 20 ms.

Binary Outputs

Number	5 or 8 (2 are change-over contacts)
Operating Voltage	Voltage Free
Operating Mode	User selectable - Self or Hand/Electrical Reset or pulsed.
Operating Time from Energizing Binary Input	<20ms
Making Capacity: Carry continuously Make and carry (L/R ≤ 40 ms and V ≤ 300 V)	 5A ac or dc 20A ac or dc for 0.5 s 30A ac or dc for 0.2 s
Breaking Capacity: (≤ 5 A and ≤ 300 V): AC Resistive AC Inductive DC Resistive DC Inductive	 1250 VA 250 VA at p.f. ≤ 0.4 75 W 30 W at L/R ≤ 40 ms 50 W at L/R ≤ 10 ms

Unit Design

Housing	E6 (see dimension drawing)
Indication	20 Character 4 line Display Relay Healthy LED Tri-Coloured User Programmable Self or Hand Reset LED's
Withdrawable Element.	Yes
User Interface.	5 Navigation Keys
Weight.	Typical 4.26 Kg
IP Rating installed with cover fitted.	IP 51 from front
IP Rating installed with cover removed.	IP 20 from front

Phase/Earth Current Inputs: Thermal Withstand

Continuous	4.0 x I_n	
3 minutes	5.0 x I_n	
2 minutes	6.0 x I_n	
	1 A Input	5 A Input
3 Second	57.7 A	230 A
2 Second	70.7 A	282 A
1 Second	100 A	400 A
I Cycle	700 A	2500 A

Operate State	Burden
Quiescent (Typical)	3 W
Maximum	10 W
Allowable superimposed ac component	≤ 12% of dc voltage
Allowable breaks/dips in supply (collapse to zero from nominal voltage)	≤ 20 ms

Serial Interface

Communication Port	Front USB Type standard B Rear RS485 2 wire electrical Rear EN100+ IEC 61850 Electrical or Optical (Optional)2x LC Fibre Optic Ethernet
Protocol	IEC60870-5-103 MODBUS RTU IEC61850 DNP3.0

Mechanical

Vibration (Sinusoidal)

IEC 60255-21-1:1988 Class I

Vibration response	0.5 gn
Vibration endurance	1.0 gn

Shock and Bump

IEC 60255-21-2:1988 Class I

Shock response	5 gn, 11 ms
Shock withstand	15 gn, 11 ms
10 gn, Bump test, 16 ms	10 gn, 16 ms

Seismic

IEC 60255-21-3 Class I

Seismic Response	1gn

Mechanical Classification

Durability	In excess of 10^6 operations

Electrical Tests

Insulation

IEC 60255-27

Between all terminals and earth for 1 minute	2.5 kV_{RMS}
Between independent circuits for 1 minute	2.5 kV_{RMS}
Across normally open contacts for 1 minute	1.0 kV_{RMS}

Transient overvoltage

IEC 60255-27

Between all the terminals and earth or between any two independent circuits without damage or flashover	5 kV 1.2/50 µs 0.5 J

Slow Damped Oscillatory Wave

IEC 60255-26

2.5 kV Common mode	< 3 % deviation
1.0 kV Differential mode	

Electrostatic Discharge

IEC 60255-26

8 kV, Contact discharge	≤ 5 % variation

Radiated Radio Frequency Electromagnetic Field Immunity

IEC60255-26

10 V/m, 80 MHz to 1000 MHz (Sweep)	≤ 5 % variation
10 V/m, 1.4 GHz to 2.7 GHz (Sweep)	≤ 5 % variation
10 V/m, 80 MHz, 160 MHz, 380 MHz, 450 MHz, 900 MHz, 1850 MHz, 2150 MHz (Spot)	≤ 5 % variation

Fast Transient

IEC 60255-26

4 kV, 5/50 ns, 5 kHz, repetitive	≤ 3% variation

NOTE

* 20 ms drop-off delay applied to binary inputs

Conducted Disturbance Induced by Radio Frequency Interference

IEC 60255-26

10 V, 0.15 MHz to 80 MHz	≤ 5 % variation

Conducted Disturbance Induced by Radio Frequency Interference Limits

IEC 60255-26

Frequency Range	Limits dB(µV)	
	Quasi-peak	Average
0.15 MHz to 0.5 MHz	79	66
0.5 MHz to 30 MHz	73	60

Radiated Radio Frequency Electromagnetic Field Immunity Limits

IEC 60255-26

Frequency Range	Limits at 10 m Quasi-peak, dB(µV/m)
30 to 230 MHz	40
230 to 1000 MHz	47

Surge

IEC 60255-26

Type	Level	Variation
Analogue Inputs, Auxiliary Power: Line to Earth	4.0 kV	≤ 10 %
I/O: Line to Earth	2.0 kV*	≤ 10 %
RS485 Comms port: Line to Earth	1.0 kV	No data loss
Analogue Inputs, Auxiliary Power: Line to Line	2.0 kV	≤ 10 %
I/O: Line to Line	1.0 kV*	≤ 10 %

NOTE

* 50 ms pick-up delay and 20 ms drop-off delay applied to binary inputs

Environmental

Temperature

IEC 60068-2-1

Operating range	-10°C to + 55°C
Storage range	- 25°C to + 70°C

Humidity

IEC 60068-2-78

Operational test	56 days at +40°C and 93% RH

Protection Elements

General Accuracy

Reference Conditions	
General	IEC 60255-151
Current settings	100% of I_n
Current input	IDMTL – 0.05 to 2.5 x I_s
	DTL – 0.05 to 50 x I_s
Auxiliary supply	Nominal
Frequency	50 Hz or 60 Hz
Ambient temperature	20 °C

General Settings	
Transient overreach of highset/ lowset (X/R = 100)	≤ 5 %
Disengaging time (see note)	< 42 ms
Overshoot time	< 40 ms

NOTE

Output contacts have a programmable minimum dwell time, after which the disengaging time is as above.

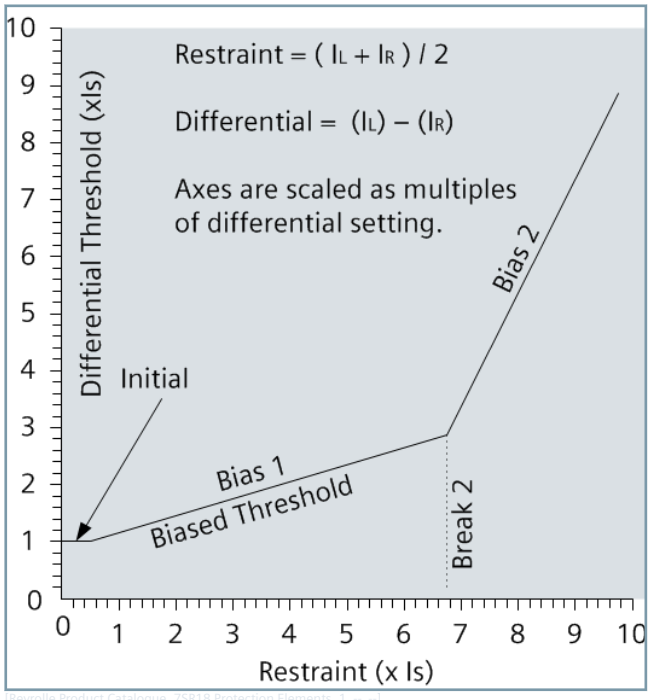
Accuracy Influencing Factors

Temperature		
-10 °C to +55 °C	≤ 5 % variation	
Frequency		
47 Hz to 52 Hz 57 Hz to 62 Hz	Level:	≤ 5 % variation
	Operating time:	≤ 5 % variation
Harmonic content		
Frequencies to 550 Hz	≤ 5 % variation	

Current differential

Level	
No. of elements	2
Initial Setting	0.1 to 2.5
1st Bias Slope	0.1 to 0.7
2nd Bias Slope	0.5 to 2

Typical operating threshold characteristics are shown below: -



[Reyrolle Product Catalogue, 7SR18 Protection Elements, 1, _ _]

Figure 2.3/67 Differential Protection Operating Characteristic

The error limits on these diagrams are as follows: -

Operate Levels	
Initial Setting	± 10% of I_{OP} or ± 0.1I_n
Biased slope	±(10 % of Restraint) or ± 10 mA

Differential and Inter-trip operate times are given by: -

$t = t0 + t_{delay}$

Where

t0 is the base operating time

t_{delay} is the Differential Delay time

Operate Times (Typical)	
Differential base operate time (Idiff > 10 I_s)	30 ms ± 5 ms (Fault Line) 50 ms ± 5 ms (below fault line)
Differential Delay Time	± 1 % or ± 10 ms

Overcurrent protection

Characteristic	
Setting	IEC Normal Inverse (NI) IEC Very Inverse (VI) IEC Extremely Inverse (EI) IEC Long Time Inverse, (LTI) DTL ANSI Moderatly Inverse (MI) ANSI Very Inverse (VI) ANSI Extremely Inverse (EI)
No. of elements	4
Level	
Setting Range I_s	0.05, 0.01...2.5 x I_n
Accuracy	Operate: 105 % I_s, ±4 % or ±1 % x I_n
	Reset ≥ 95% of operate current
Repeatability	± 1%
IDMTL Time Multiplier	
Setting	0.025, 0.05...100
Accuracy	± 5 % or ± 30 ms
Repeatability	± 1 % or ± 5 ms
DTL Delay	
Setting	0.00 s to 14400 s
Accuracy	± 10 ms
Repeatability	± 5 ms
Reset	
Setting	0 s to 60 s
Accuracy	± 1 % or ± 10 ms
Repeatability	± 1 % or ± 5 ms

DTL	
No. of elements	4
Level	
Setting Range I_s	0.05 x I_n to 50 x I_n
Accuracy	Operate: 100 % I_s, ±5 % or, ±10 mA
	Reset ≥ 95 % of operate current
Repeatability	± 1 %
DTL Delay	
Setting	0.0 s to 14400 s

Accuracy	± 5 ms
Repeatability	± 1 % or ± 5 ms

Connection Diagrams

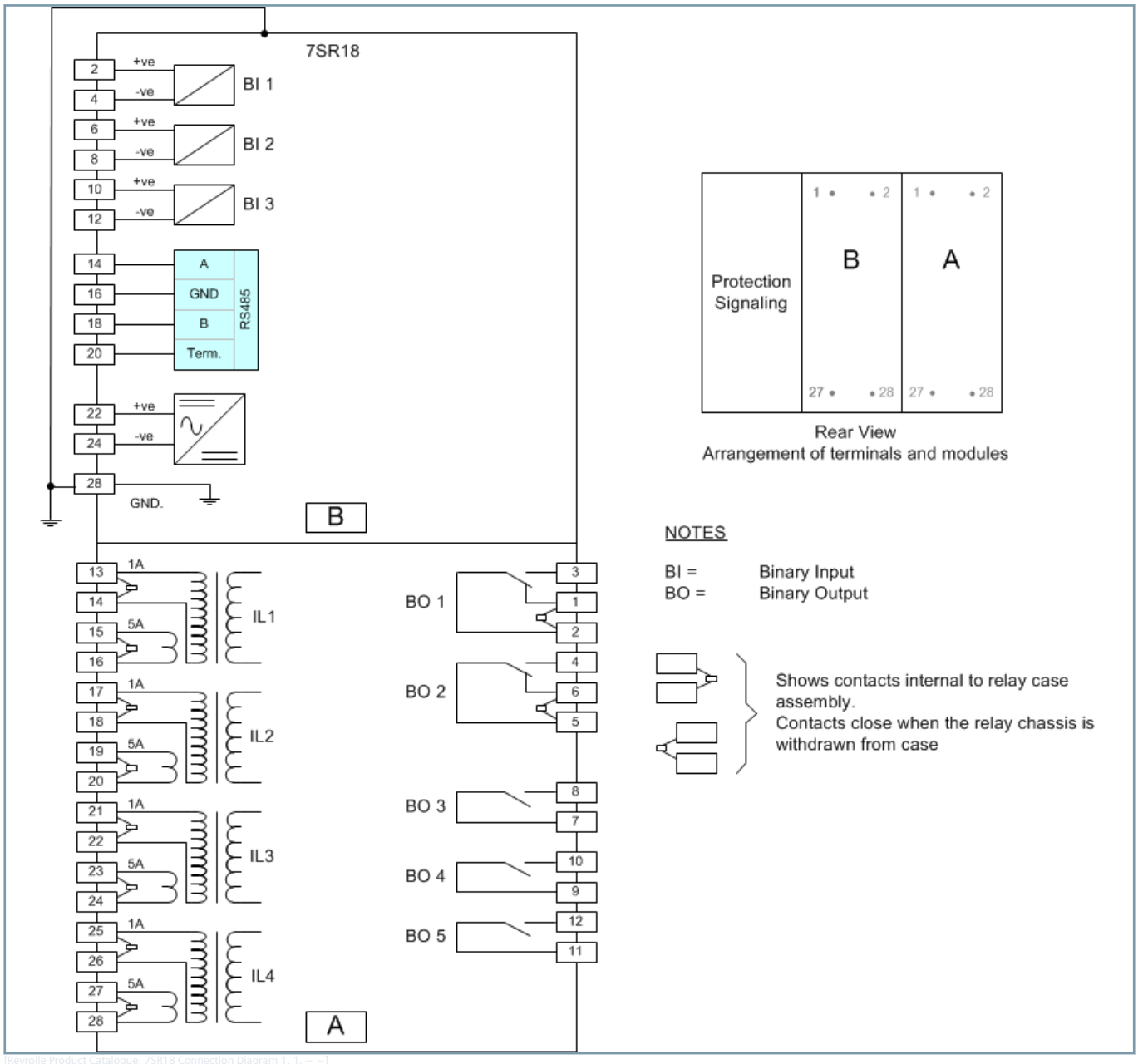
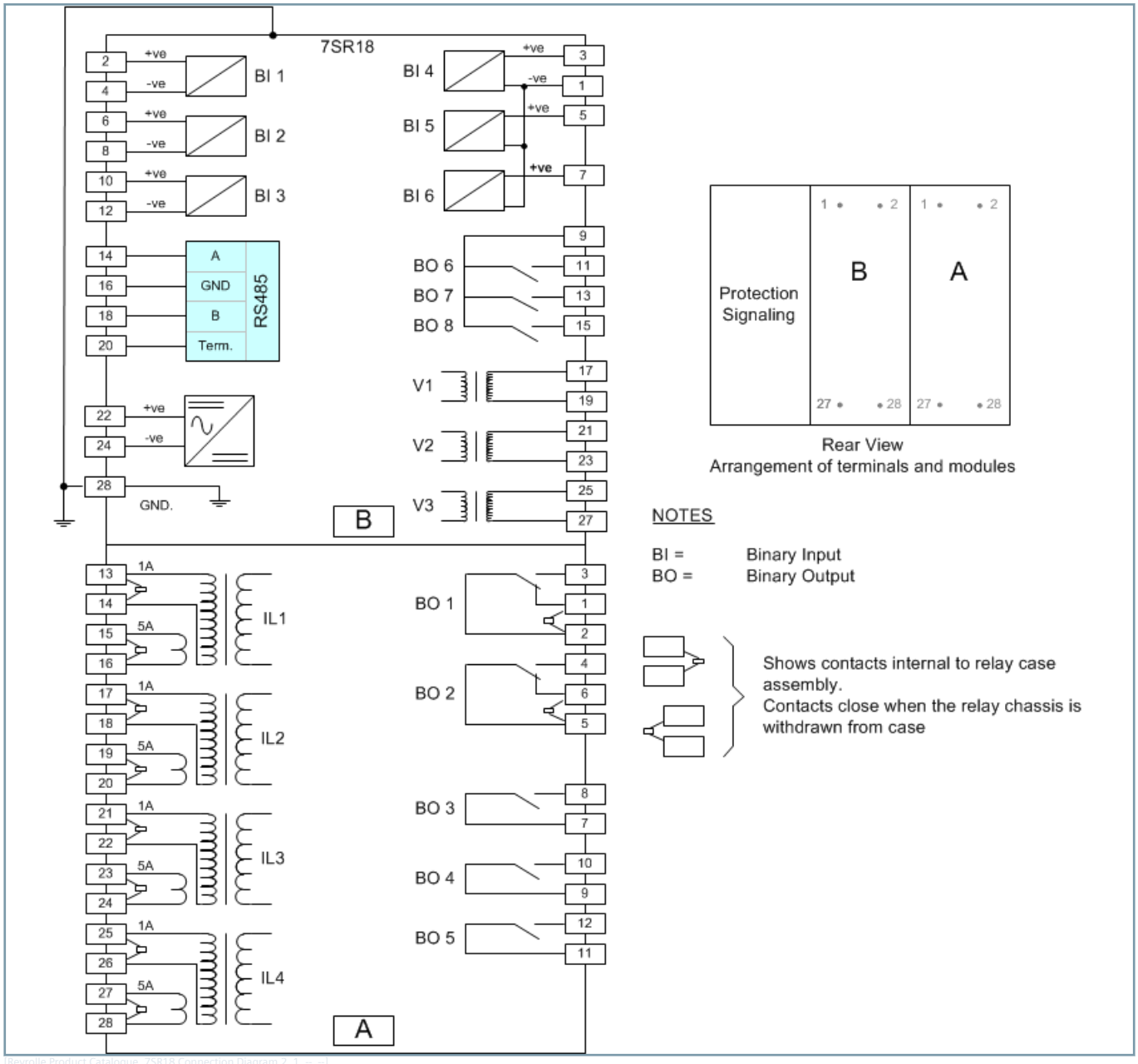


Figure 2.3/68 Connections Diagram for 7SR18 Non-Directional Relay (3BI and 5BO)



[Reyrolle Product Catalogue, 7SR18 Connection Diagram 2, 1, =_=]

Figure 2.3/69 Connections Diagram for 7SR18 Directional Relay (6BI and 8BO)

Ordering Information - 7SR18 Differential Protection Relay

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Differential Protection Relay	7	S	R	1	8	1	□	-	□	□	□	□	□	-	0	□	A	0
					|	|	|		|	|	|	|	|		|	|	|	|
Protection Product Family					|	|	|		|	|	|	|	|		|	|	|	|
Differential Protection					8	|	|		|	|	|	|	|		|	|	|	|
						|	|		|	|	|	|	|		|	|	|	|
Case size						|	|		|	|	|	|	|		|	|	|	|
E6 [2]						1	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
I/O and Fascia							|		|	|	|	|	|		|	|	|	|
3 Binary Inputs, 5 Binary Outputs, 18 LEDs							1		|	|	|	|	|		|	C	|	|
3 Binary Inputs, 5 Binary Outputs, 10 LEDs + (6 keys each with LED)							2		|	|	|	|	|		|	C	|	|
6 Binary Inputs, 8 Binary Outputs, 18 LEDs							3		|	|	|	|	|		|	|	|	|
6 Binary Inputs, 8 Binary Outputs, 10 LEDs + (6 keys each with LED)							4		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Measuring input									|	|	|	|	|		|	|	|	|
4 CTs (1 A or 5 A)									1	|	|	|	|		|	|	|	|
4 CTs (1 A or 5 A), 3 VTs (40 V to 160 V)									2	|	C	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Auxiliary voltage										|	|	|	|		|	|	|	|
24 V DC to 250 V DC, 100 V AC to 230 V AC, binary input threshold 19 V DC										M	|	|	|		|	|	|	|
24 V DC to 250 V DC, 100 V AC to 230 V AC, binary input threshold 88 V DC										N	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Protection Signalling Channel											|	|	|		|	|	|	|
Optical fibre link (820 nm)(ST connection) 2 km [1]											B	1	|		|	|	|	|
Optical fibre link (1300 nm)(LC connection) 40 km [1]											C	|	|		|	|	|	|
												|	|		|	|	|	|
Data Communication Interface												|	|		|	|	|	|
USB front port, RS485 (Terminal block) rear port												1	2		|	|	|	|
USB front port, RS485 (Terminal block) rear port, Electrical Ethernet RJ45 (x2) rear port												7	7		|	|	|	|
USB front port, RS485 (Terminal block) rear port, Optical Ethernet Duplex (x2) rear port												8	7		|	|	|	|
													|		|	|	|	|
Protocol													|		|	|	|	|
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		|	|	|	|
															|	|	|	|
Spare															|	|	|	|
															0	|	|	|
																|	|	|
Protection Function Packages																|	|	|
Standard version																C	|	|
87L 3-Phase differential (with variable settings)																	|	|
87HS 3-Phase Differential High Set																	|	|
85 Inter-Trip																	|	|
50 Instantaneous phase fault overcurrent																	|	|
50G/50N Instantaneous earth fault																	|	|
51 Time delayed phase fault overcurrent																	|	|
51G/51N Time delayed earth fault																	|	|
50LC Line Check																	|	|
37 Undercurrent																	|	|

7SR1 Range – 7SR18 Differential Protection Relay

Product Description	Order No.		
46NPS Negative phase sequence overcurrent		|	|
49 Thermal overload		|	|
50BF Circuit breaker fail		|	|
46BC Broken conductor/load unbalance		|	|
60CTS-I CT Supervision		|	|
74T&C Trip & Close circuit supervision		|	|
51c Cold load pickup		|	|
81HBL2 Inrush Detector		|	|
Programmable Logic		|	|
		|	|
For variants with 3 x VT inputs as above plus		|	|
51V Voltage Controlled Overcurrent		|	|
60CTS CT Supervision		|	|
60VTS VT Supervision		|	|
67/50, 67/51 Directional Overcurrent		|	|
67G/N Directional Earth Fault		|	|
		|	|
Version C - plus	D	|	|
79 Autoreclose		|	|
		|	|
Additional Functionality		|	|
No Additional Functionality		A	|
			|
Spare			|
			0

NOTE

1) Refer to Technical Manual

2) Standard Version Cover - No Push Buttons

The following information is applicable to all devices in the 7SR2 range.

Data Acquisition - Via Communication Interface

Sequence of event records

Up to 5000 events are stored and time tagged to 1 ms resolution. These can be viewed on the fascia LCD.

Fault Records

A minimum of the previous 10 fault records are displayed on the relay fascia and are also available through the communication interface, with time and date of trip, measured quantities and type of fault.

Waveform recorder

The waveform recorder stores analogue data for all poles and the states of protection functions, binary inputs, LEDs and binary outputs with user settable pre & post trigger data. The last ten waveform records are stored for easy selection. Their duration is user selectable from 1 second, 2 seconds, 5 seconds or 10 seconds.

Demand Monitoring

A record of demand is available. The demand minimum, maximum and average values for currents, frequency and if applicable, voltages and real, reactive and apparent power and power factor, over a user selectable period of time, is displayed and available via data communications. Typically this is set as a rolling value for the last 24 hours.

Data Log

The average values of voltages, current and real & reactive power are recorded at a user selectable interval and stored to provide data in the form of a Data Log which can be downloaded for further analysis. A typical application is to record 15 minute intervals over the last 7 days.

Real Time Clock

The time and date can be set and are maintained while the relay is de-energised by a back up storage capacitor. The time can be synchronized from a binary input pulse or the data communication channel.

Data Storage and Communication

Standard Communication Ports

Communication access to relay functionality is via a front USB port for local PC connection or rear electrical RS485 port for remote connection

Additional Optional Communication Ports

2x Electrical RJ45 Ethernet ports

2x LC Fibre Optic Ethernet ports

Optional Communications Ports

2 Rear ST fibre optic ports (2 x Tx/Rx) + IRIG-B port

1 Rear RS485 + IRIG-B port

1 Rear RS232 + IRIG-B port

2 Electrical Ethernet

2 Optical Ethernet

Protocols

IEC60870-5-103, Modbus RTU and optional DNP 3.0 protocols – User selectable with programmable data points

IEC61850 over Ethernet – optional

Ethernet Redundancy: RSTP, HSR & PRP – standard on ethernet equipped models

Data

Event records

Fault records

Waveform records

Measurands

Commands

Time synchronism

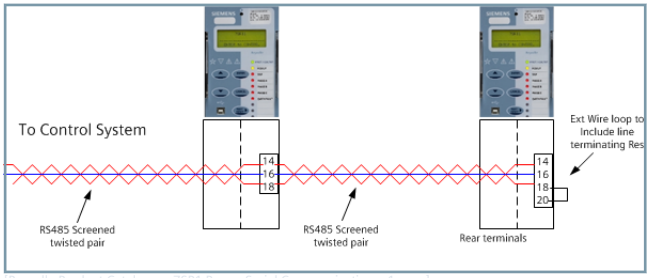
Viewing and changing settings

Serial Communications

The relay offers a USB serial port as standard on the front of all units. All of the relays functions can be set on a PC using Reydisp Evolution via the USB port. The connection is made with a USB cable and operates with a 'plug and play' connection, so no pre-setting of the relay is required.

The front port can be switched off or set to use either the DNP3.0, MODBUS-RTU, IEC60870-5-103 and ASCII protocols for testing purposes.

A rear RS485 electrical connection is available on all units for system interface connections. An internal terminating resistor is provided, which can be connected into the circuit by adding a wire loop between the relevant terminals.



[Reyrolle Product Catalogue, 7SR1 Range Serial Communications, 1, --]

Figure 2.4/1 Typical RS485 connection

The rear RS485 can be user selected to be OFF, IEC60870-5-103, MODBUS RTU or DNP3.0 protocol.

Ethernet Communications

IEC 61850

IEC61850 communication is available through an optional EN100 communication module. The EN100 Module can be ordered with either 2x Electrical RJ45 or 2x Fibre optic LC Ethernet ports.

Information on IEC61850 functionality can be found in the following 7SR2 documents:

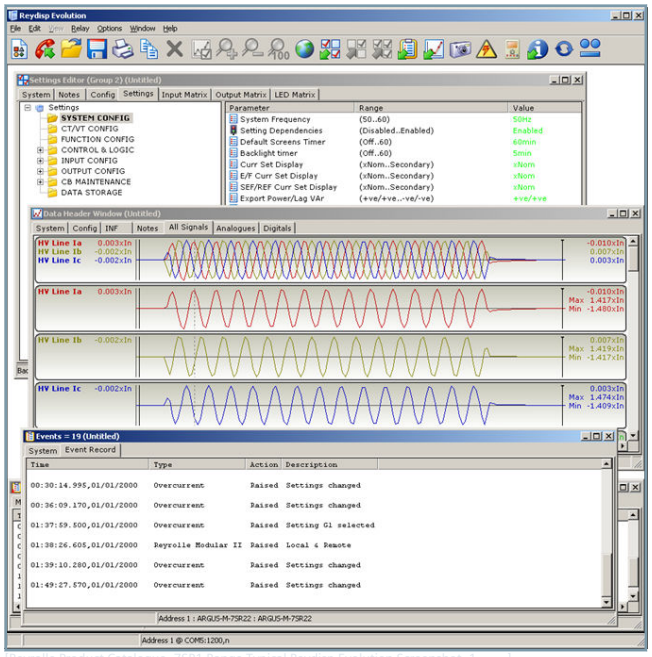
Model Implementation Conformance Statement (MICS)

Protocol Implementation (PICS,PIXIT & TICS)

2.4

Reydisp Evolution

Reydisp Evolution is a Windows based software tool, providing the means for the user to apply settings, interrogate settings and retrieve events and disturbance waveforms from the device and is common to the entire range of Reyrolle protection relays.

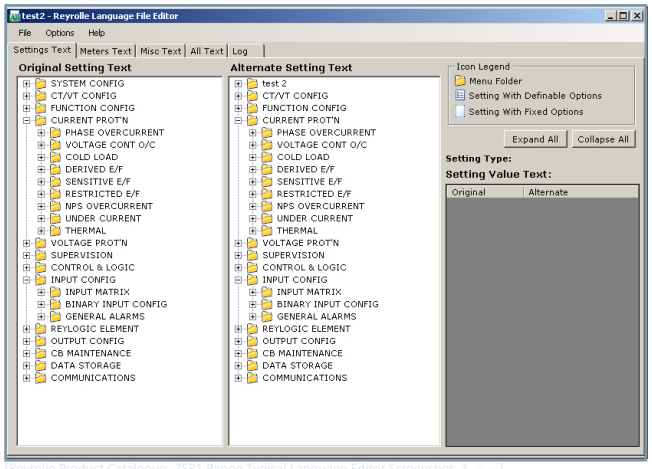


[Reyrolle Product Catalogue, 7SR1 Range Typical Reydisp Evolution Screenshot, 1, --_--]

Figure 2.4/2 Typical Reydisp Evolution Screenshot

Language Editor

The Language editor software gives the user the ability to customize the text displayed in the relays, Menu structure and instrumentation views. The tool allows a language file to be created and transferred to the relay also containing Western European characters.



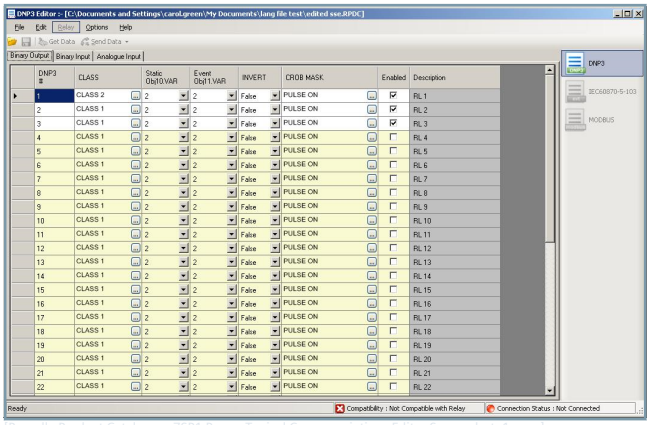
[Reyrolle Product Catalogue, 7SR1 Range Typical Language Editor Screenshot, 1, --_--]

Figure 2.4/3 Typical Language Editor Screenshot

Communications Editor

To facilitate easier interfacing to a substation the relays default Protocol configuration may be modified using the communication editor software tool.

The communication editor is a PC based software package provided within the Reydisp software suite which allows modification of the IEC60870-5-103, DNP 3.0 and MODBUS Protocols.

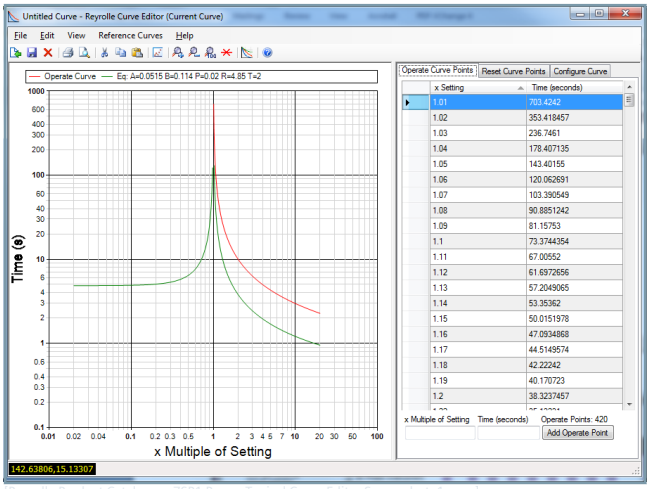


[Reyrolle Product Catalogue, 7SR1 Range Typical Communciations Editor Screenshot, 1, --_--]

Figure 2.4/4 Typical Communications Editor Screenshot

Curve Editor

The Curve Editor tool can be used to add user defined characteristics for use by any of the Voltage, Current or Thermal IDMTL elements.



[Reyrolle Product Catalogue, 7SR1 Range Typical Curve Editor Screenshot, 1, --_--]

Figure 2.4/5 Typical Curve Editor Screenshot

Reydisp Manager

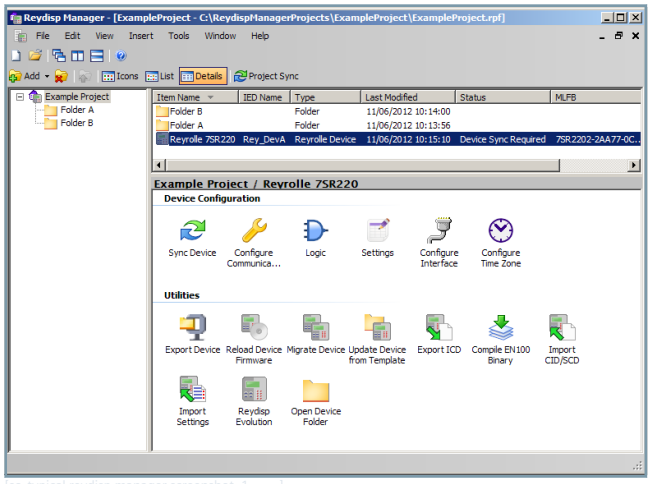
Reydisp Manager is a Windows based application which enables configuration of multiple Reyrolle devices.

It provides the following features:

- Project based handling of all features of multiple devices to allow engineering of IEC61850 projects.
- Template based structure allowing offline configuration
- Configure and store device settings for all settings groups

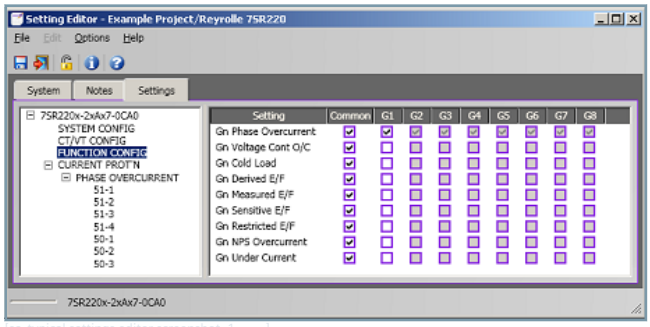
- Create and edit graphical logic diagrams
- Configure data points and options for serial protocols
- Configure Language
- Configure User Curves
- Update device firmware

Please refer to the Reydisp Manager User Guide for further information.



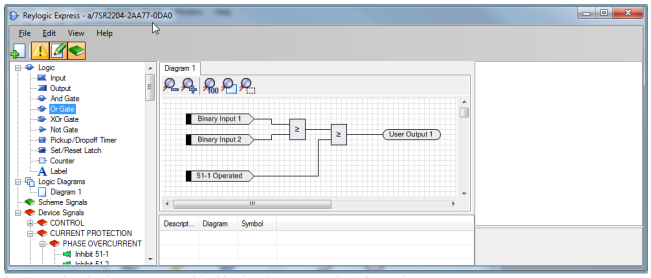
[sc_typical reydisp manager screenshot, 1, -, -]

Figure 2.4/6 Typical Reydisp Manager Screenshot



[sc_typical settings editor screenshot, 1, -, -]

Figure 2.4/7 Typical Settings Editor Screenshot



[sc_typical reylogic express graphical logic editor screenshot, 1, -, -]

Figure 2.4/8 Typical Reylogic Express graphical logic editor Screenshot

Case Dimensions

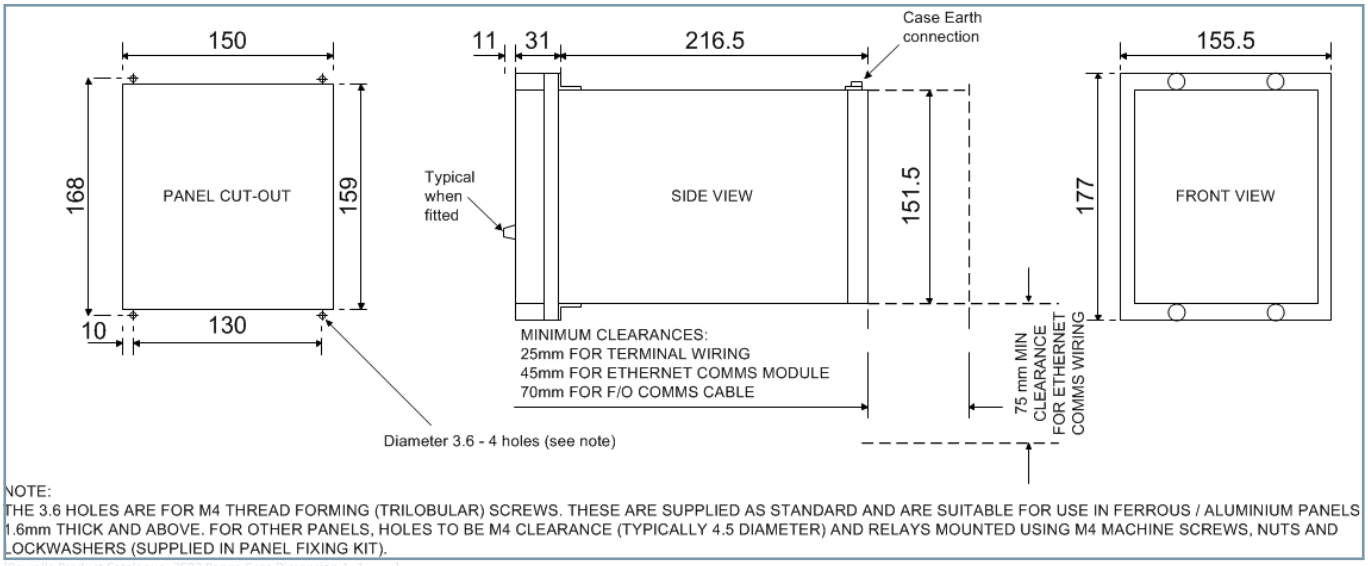


Figure 2.4/9 E6 Case overall dimensions and panel drilling details (All dimensions in are mm)

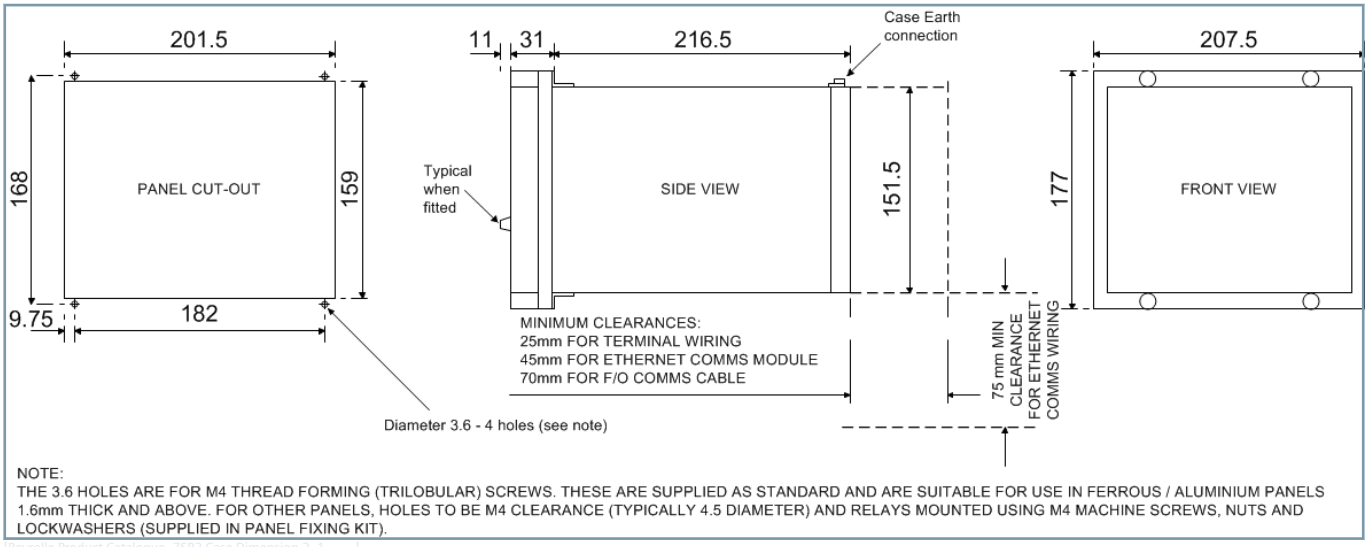
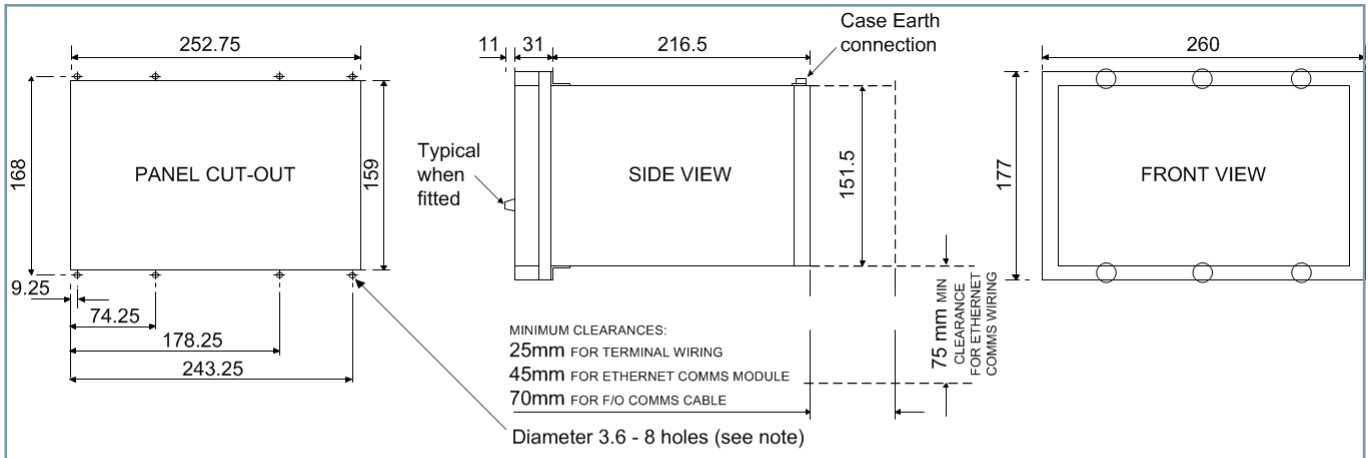
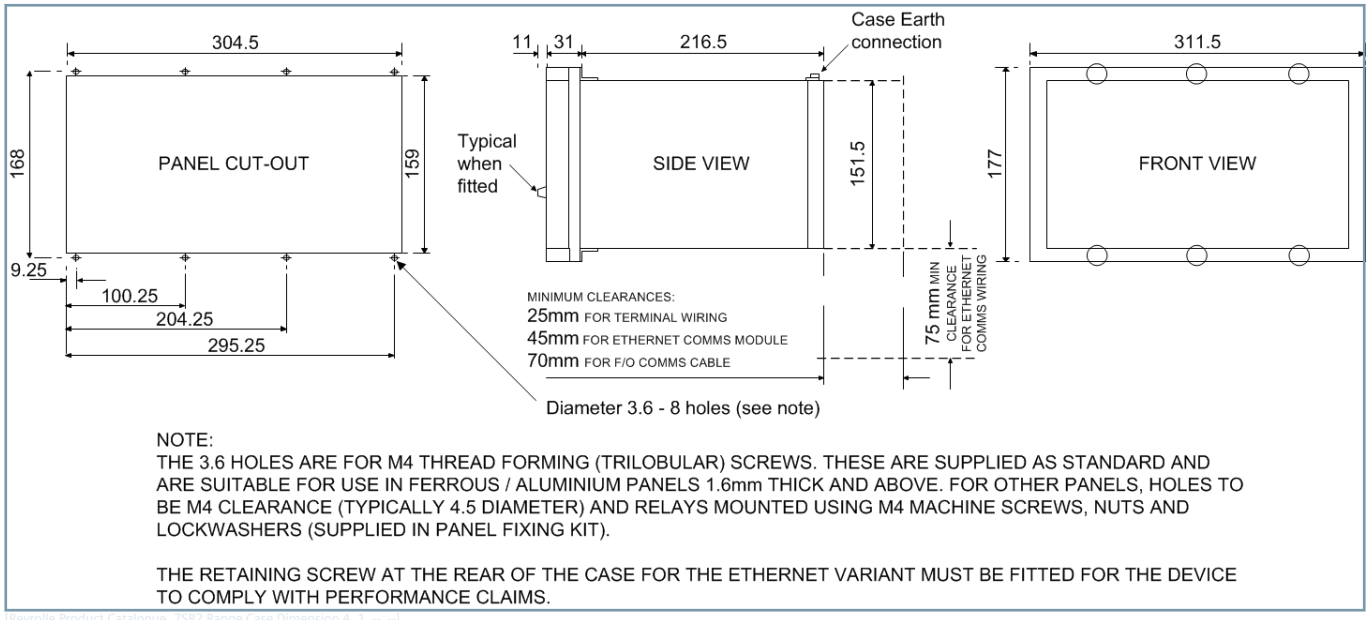


Figure 2.4/10 E8 Case overall dimensions and panel drilling details (All dimensions are in mm)



[Reyrolle Product Catalogue, 7SR2 Range Case Dimension 3, 1, --_-]

Figure 2.4/11 E10 Case overall dimensions and panel drilling details (All dimensions in are mm)



[Reyrolle Product Catalogue, 7SR2 Range Case Dimension 4, 1, --_-]

Figure 2.4/12 E12 Case overall dimensions and panel drilling details (All dimensions are in mm)

7SR210 and 7SR220 Non-Directional/Directional Overcurrent Relays

[Reyrolle Product Catalogue, 7SR210 and 7SR220, 1, _ _]

Description

The 7SR210 and 7SR220 are a new generation of non-directional and directional overcurrent protection relays, built on years of numeric relay protection experience with the Argus family of products. Housed in 4U high, size E6, E8 or E12 cases, these relays provide protection, control, monitoring, instrumentation and metering with integrated input and output logic, data logging & fault reports. Communication access to relay functionality is via a front USB port for local PC connection or rear electrical RS485 port for remote connection. Additional rear port options are available.

Function Overview

Standard Functionality – 7SR210 & 7SR220

37	Undercurrent
46BC	Broken Conductor / Load Unbalance
46NPS	Negative Phase Sequence Overcurrent
49	Thermal Overload
50	Instantaneous Overcurrent
50G/N	Instantaneous Earth Fault
50BF	Circuit Breaker Fail
50AFD	Arc Flash Detector
51	Time Delayed Overcurrent
51G/N	Time Delayed Measured Earth Fault/SEF
60CTS-I	CT Supervision
64H	High Impedance REF
74TC/CC	Trip/Close Circuit Supervision
81HBL2	2nd Harmonic Block/Inrush Restraint
51c	Cold Load Pickup
8 Settings Groups	
Password Protection – 2 levels	
User Programmable Logic	
Self Monitoring	
CB Control	

Standard Functionality - 7SR220 Directional Relay

21FL	Fault Locator
21LB	Load Blinder
32	Power
32S	Sensitive Power
27/59	Under/Over Voltage
47	Negative Phase Sequence (NPS) voltage
51V	Voltage Controlled Overcurrent
55	Power Factor
59N	Neutral Voltage Displacement
60CTS	CT Supervision
60VTS	VT Supervision
67/50	Bi-Directional Instantaneous Overcurrent
67/50G/N	Bi-Directional Instantaneous Earth Fault
67/51	Bi-Directional Time Delayed Overcurrent
67/51G/N	Bi-Directional Time Delayed Earth Fault
67/50/51	SEF for Compensated Networks
81	Under/Over Frequency
86	Lockout

Optional Functionality – 7SR210 & 7SR220

79 + 25	Auto Reclose + Check Sync

User Interface

20 Character x 4 Line Backlit LCD
Menu navigation keys
3 fixed LEDs
8, 16 or 32 Programmable Tri-colour LEDs (Option)
6 or 12 Programmable Function Keys each with Tri-colour LED (Option)

Monitoring Functions

Standard Monitoring – 7SR210 & 7SR220

Primary & Secondary current phases and earth
Positive Phase Sequence (PPS) Current
Negative Phase Sequence (NPS) Current
Zero Phase Sequence (ZPS) Current
Binary Input/Output status
Trip circuit healthy/failure
Time and date
Starters
Fault records
Event records
Waveform records
Circuit breaker trip counters

I^2t summation for contact wear
Demand metering

Standard Monitoring - 7SR220 Directional Relay

Direction
Frequency
Primary line and phase voltages
Secondary voltages
Apparent power and power factor
Real and reactive power
W Hr forward and reverse
VAr Hr forward and reverse
Historical demand record
Positive phase sequence (PPS) Voltage
Negative phase sequence (NPS) Voltage
Zero phase sequence (ZPS) Voltage

Description of Functionality

With reference to 'Function Diagrams'.

Standard Functionality

37 Undercurrent

Each element has settings for pickup level and Definite Time Lag (DTL) delays. Operates if current falls below setting for duration of delay.

46BC Phase Unbalance/Broken Conductor

Element has settings for pickup level and DTL delay. With the circuit breaker closed, if one or two of the line currents fall below setting this could be due to a broken conductor.

46NPS Negative Phase Sequence Overcurrent

Two elements, one DTL and one IDMT, with user settings for pickup level and delays, will operate if NPS Current exceeds setting and delay. NPS Current elements can be used to detect unbalances on the system or remote earth faults when a delta-star transformer is in circuit.

49 Thermal Overload

The thermal algorithm calculates the thermal states from the measured currents and can be applied to lines, cables and transformers. Outputs are available for thermal overload and thermal capacity.

50/51 Phase Fault

50 INST/DTL and 51 IDMTL/DTL elements provide overcurrent protection, each with independent settings for pickup current, time-multiplier (51) and time-delays. User can select IEC or ANSI Time Current Characteristics. The IDMT stage has a user programmable reset characteristic, either DTL or shaped current/time reset characteristic, to improve grading with electromechanical protection.

50G/51G/50N/51N Earth Fault/Sensitive Earth Fault

Two earth fault measurement modes are available. One mode directly measures the earth current from an independent CT, or the residual connection of the 3 line CTs. This input can be set to be either earth fault or sensitive earth fault (50G/51G).

The second mode derives the earth current internally from the 3 phase CTs (50N/51N). 50 INST/DTL and 51 IDMTL/DTL elements provide overcurrent protection, each with independent settings for pickup current, time-multiplier (51) and time-delays. User can select IEC or ANSI Time Current Characteristics. The IDMT stage has a user programmable reset characteristic either DTL or shaped current/time reset characteristic to improve grading with electromechanical protection.

50BF Circuit Breaker Fail

The circuit breaker fail function may be triggered from an internal trip signal or from a binary input. Line currents and earth currents are monitored following a trip signal and an output is issued if any current is still detected, above setting, after a specified time interval. Alternatively, if the trip is from a mechanical protection the circuit breaker position can be used to determine a failure. A second time delay is available to enable another stage to be utilized if required. An input is also available to bypass the time delays when the circuit breaker is known to be faulty.

60CTS-I CT Supervision

The CTS-I CT Supervision function monitors each phase current input and operates if any one or two inputs fall below the setting. The element types have user operate and delay settings.

64H Restricted Earth Fault - scheme

The measured earth fault input may be used in a 64H high impedance restricted earth fault scheme. Required external series stabilising resistor and non-linear shunt resistor can be supplied.

74T/CC Trip/Close Circuit Supervision

The trip/close circuit(s) can be monitored via binary inputs connected in H4/H5/H6 or H7 schemes. Trip/Close circuit failure raises an HMI alarm and output(s).

81HBL2/5 Harmonic Block / Inrush Restraint / Overfluxing

Where second harmonic current is detected (i.e. during transformer energisation) user selectable elements can be blocked.

51c Cold Load

If a circuit breaker is closed onto a 'cold' load, i.e. one that has not been powered for a prolonged period, this can impose a higher than normal load-current demand on the system which could exceed normal settings. These conditions can exist for an extended period and must not be interpreted as a fault. To allow optimum setting levels to be applied for normal operation, the cold load pickup feature will apply alternative settings for a limited period. The feature resets when either the circuit breaker has been closed for a settable period, or if the current has reduced beneath a set level for a user set period.

21FL Fault Locator

The relay provides a basic 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.

21LB Load Blinder

Load Blinders are used with overcurrent elements to block tripping during periods of high reverse 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.

50AFD Arc Flash Detector

The 7SR2 relays can be used with the 7XG31 ReyArc range of Arc Flash Detection devices. Arc fault protection is a technique employed for the fast clearance of arcing faults on busbars, within metal clad switchgear & associated cable boxes. The arc is detected using an optical sensor & the signal input to a protection device which also monitors the load current on the system. A trip signal can be achieved in less than 10 ms using arc detection only or within 20 ms when using overcurrent check.

Programmable User Logic

The user can map Binary Inputs and Protection operated outputs to Function Inhibits, Logic Inputs, LEDs and/or Binary Outputs. The user can also enter up to 16 equations defining scheme logic using standard functions e.g. Timers, AND/OR gates, Inverters and Counters. Each Protection element output can be used for Alarm & Indication and/or tripping.

Circuit Breaker Maintenance

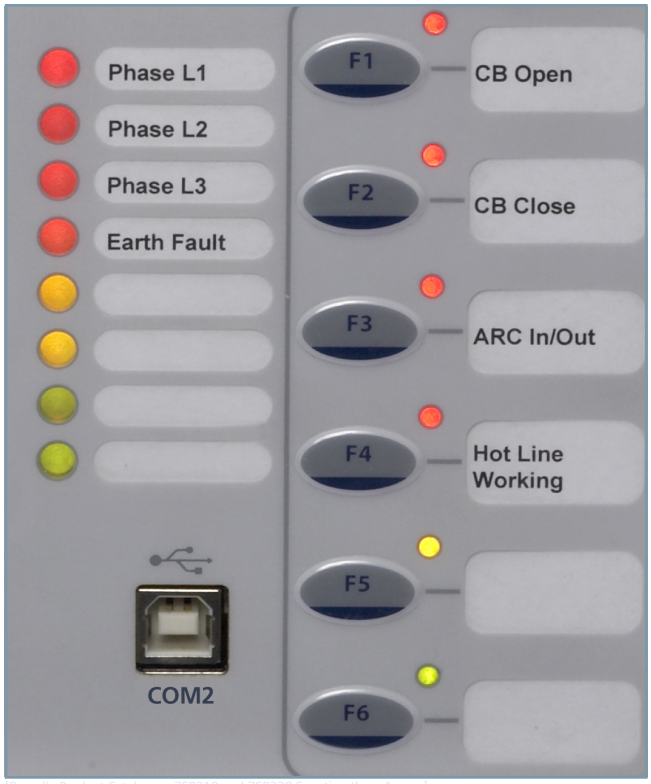
Two circuit breaker operations counters are provided. The Maintenance Counters record the overall number of operations and the Delta Counter the number of operations since the last reset. An I^2t summation Counter provides a measure of the contact wear indicating the total energy interrupted by the circuit breaker contacts. Each counter has a user set target operations count which, when reached, can be mapped to raise Alarms/ Binary Outputs. These counters assist with maintenance scheduling.

Function LED's

Eight, sixteen or thirty-two user programmable tri-colour LED's are provided eliminating the need for expensive panel mounted pilot lights and associated wiring. Each LED can be user set to red, green or yellow allowing for clear indication of the associated function's state. A slip-in label pocket along-side enables the user to insert customised notation. A printer compatible template is available.

Function Keys

Six or twelve user programmable function keys are available for implementing User logic and scheme control functionality, eliminating the need for expensive panel mounted control switches and associated wiring. Each function key has an associated user programmable tri-color LED (red, green, yellow) allowing for clear indication of the associated function's state. A slip-in label pocket along-side enables the user to insert his own notation for the function Key LED Identification. Each Function Key can be mapped directly to any of the built-in Command functions or to the User Logic equations.



[Reyrolle Product Catalogue, 7SR210 and 7SR220 Function Keys, 1, –;_–]

Figure 2.4/13 Tri-colour LED's and function keys

Additional Functionality

27/59 Under/Over Voltage

Each element has settings for pickup level, drop-off level and Definite Time Lag (DTL) delays. Operates if voltage 'exceeds' setting for duration of delay. Can be applied in load shedding schemes.

47 Negative Phase Sequence Overvoltage

Each element has settings for pickup level and Definite Time Lag (DTL) delays. Operates if NPS Voltage exceeds setting for duration of delay.

51V Voltage Controlled Overcurrent

Element has settings for UnderVoltage pickup level and operates if voltage falls below setting. On Pick-up this element applies the set 51v Multiplier to the pickup setting of the 67/51 phase fault elements.

59N Neutral Overvoltage

Two elements, one DTL and one IDMTL, have user settings for pickup level and delays. These will operate if the Neutral voltage exceeds the setting for duration of delay. Neutral overvoltage can be used to detect earth faults in high impedance earthed or isolated systems.

60CTS CT Supervision

The CT Supervision considers the presence of negative phase sequence current, without an equivalent level of negative phase sequence voltage, for a user set time as a CT failure. Element has user operate and delay settings.

60VTS VT Supervision

The VT Supervision uses a combination of negative phase sequence voltage and negative phase sequence current to detect a VT fuse failure. This condition may be alarmed or used to inhibit voltage dependent functions. Element has user operate and delay settings.

67/67N Directional Control

Phase fault, Earth fault and Sensitive Earth fault elements can be directionalised. Each element can be user set to Forward, Reverse, or Non-directional. Directional Phase fault elements are polarised from quadrature voltage. Earth fault elements can be user set to be polarised from residual voltage or negative phase sequence voltage.

81 Under/Overfrequency

Each element has settings for pickup level, drop-off level and Definite Time Lag (DTL) delays. Operates if frequency exceeds setting for duration of delay. Typically applied in load shedding schemes.

Optional Functionality

79 Auto-Reclose

This function provides independent Phase fault and Earth Fault/ Sensitive Earth fault sequences of up to 5 Trips i.e. 4 Reclose attempts before Lockout. Auto-Reclose sequence can be user set to be initiated from internal protection operation or via Binary Input from an external Protection. The user can set each trip in the sequence to be either instantaneous (Fast) or delayed. Independent times can be set by the user for Reclose (Dead) time and Reclaim time.

25 Check Sync

The check synchronizing 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 or disturbance to the system.

Technical Data

For full technical data refer to the Performance Specification Section of the Technical Manual.

Inputs and Outputs

Current Inputs

Quantity	3 x Phase & 1 x Earth or Sensitive Earth
Rated Current I_n	1 A / 5 A
Measuring Range	80 x I_n
Instrumentation ≥ 0.1 x I_n	±1 % I_n
Frequency	50 Hz / 60 Hz
Thermal Withstand: Continuous 10 Minutes 5 Minutes 3 Minutes 2 Minutes 3 Seconds 2 Seconds 1 Second 1 Cycle	3.0 x I_n 3.5 x I_n 4.0 x I_n 5.0 x I_n 6.0 x I_n 57.7 A (1 A) 202 A (5 A) 70.7 A (1 A) 247 A (5 A) 100 A (1 A) 350 A (5 A) 700 A (1 A) 2500 A (5 A)
Burden @ I_n	≤ 0.1 VA (1 A phase and Earth element) ≤ 0.3 VA (5 A phase and earth element)

Voltage Inputs

Quantity	4
Nominal Voltage	40...160 V a.c. Range
Instrumentation ≥ 0.8 x V_n	±1 % V_n
Thermal Withstand: Continuous and 1 Second	300 V
Burden @ 110 V	≤ 0.1 VA

DC Auxiliary Supply

Nominal Voltage	Operating Range
24 V dc to 250 V dc	19.2 V dc to 275 V dc
100 V ac to 230 V ac	80 V ac to 253 V ac
Allowable superimposed ac component	12 % of DC voltage
Allowable breaks/dips in supply (collapse to zero)	50 ms (DC) 2.5/3 cycles (AC)

Auxiliary supply: Power Consumption

Quiescent State (DC)	24 V: 8 W
	110 V: 7 W
	250 V: 7 W
Maximum Load (DC)	24 V: 12 W
	110 V: 11 W
	250 V: 11 W
Quiescent State (AC)	100 V: 16 VA
	230 V: 21 VA
Maximum Load (AC)	100 V: 23 VA
	230 V: 30 VA

Binary Inputs

Operating Voltage	19 V dc: Range 17 to 290 V dc 88 V: Range 74 to 290 V dc
Maximum dc current for operation	1.5 mA

Binary Outputs

Operating Voltage	Voltage Free
Operating Mode	User selectable - Self or Hand Reset
Contact Operate / Release Time.	7 ms / 3 ms
Making Capacity: Carry continuously Make and carry (L/R ≤ 40 ms and V ≤ 300 V)	5 A ac or dc 20 A ac or dc for 0.5 s 30 A ac or dc for 0.2 s
Breaking Capacity: (≤ 5 A and ≤ 300 V): AC Resistive AC Inductive DC Resistive DC Inductive	1250 VA 250 VA at p.f. ≤ 0.4 75 W 30 W at L/R ≤ 40 ms 50 W at L/R ≤ 10 ms

Mechanical Tests

Vibration (Sinusoidal)

IEC 60255-21-1 Class I

Type	Level	Variation
Vibration response	0.5 gn	≤ 5 %
Vibration endurance	1.0 gn	≤ 5 %

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	≤ 5 %
Bump test	10 gn, 16 ms	≤ 5 %

Seismic

IEC 60255-21-3 Class I

Type	Level	Variation
Seismic response	1 gn	≤ 5 %

Mechanical Classification

Durability	>10^6 operations

Electrical Tests

Insulation

IEC 60255-5

Type	Level
Between any terminal and earth	2.0 kV AC RMS for 1 min
Between independent circuits	2.0 kV AC RMS for 1 min
Across normally open contacts	1.0 kV AC RMS for 1 min

High Frequency Disturbance

IEC 60255-22-1 Class III

Type	Level	Variation
Common (longitudinal)	2.5 kV	≤ 5 %
Series (transverse) mode	1.0 kV	≤ 5 %

Electrostatic Discharge

IEC 60255-22-2 Class IV

Type	Level	Variation
Contact discharge	8.0 kV	≤ 5 %

Fast Transients

IEC 60255-22-4 Class IV

Type	Level	Variation
5/50 ns 2.5 kHz repetitive	4 kV	≤ 5 %

Surge Immunity

IEC 60255-22-5

Type	Level	Variation
Between all terminals and earth	4.0 kV	≤ 10 % or 1 mA
Between any two independent circuits	2.0 kV	

Conducted Radio Frequency Interference

IEC 60255-22-6

Type	Level	Variation
0.15 to 80 MHz	10 V	≤ 5 %

Radiated Radio Frequency

IEC 60255-25

Type	Limits at 10 m, Quasi-peak
30 to 230 MHz	40 dB(µV)
230 to 10000 MHz	47 dB(µV)

Conducted Radio Frequency

Type	Limits	
	Quasi-peak	Average
0.15 to 0.5 MHz	79 dB(µV)	66 dB(µV)
0.5 to 30 MHz	73 dB(µV)	60 dB(µV)

Radiated Immunity

IEC 60255-22-3 Class III

Type	Level	Variation
80 MHz to 1000 MHz	10 V/m	≤ 5%

Magnetic Field with Power Frequency

IEC 61000-4-8, Class V

Type	Level
100 A/m (0.126 mT) continuous	50 Hz
1000 A/m (1.26 mT) for 3s	

Environmental Tests

Temperature

IEC 60068-2-1, IEC 60068-2-2

Operating Range	-10°C to + 55°C
Storage Range	- 25°C to + 70°C

Humidity

IEC 60068-2-30, IEC 60068-2-78

Operational test (Indoor)	56 days at 40°C and 93% relative humidity (r.h.)
Operational test (Outdoor)	6 cycles at 24 h between +25 °C (97% r.h.) and +55 °C (93% r.h.)

IP Ratings

IEC 60529

Type	Level
Installed with cover	IP 51 from front of relay
Installed with cover removed	IP 20 from front of relay

NOTE

For full technical data refer to the Performance Specification Section of the Technical Manual.

Performance

27/59 Under/Over Voltage

Number of Elements	4 Under or Over
Operate	Any phase or All phases
Voltage Guard	1,1.5...200 V
Setting Range V_s	5,5.5...200 V
Hysteresis Setting	0.0.1...80 %
V_s Operate Level	100 % V_s, ±1 % or ±0.25 V
Reset Level: Undervoltage Overvoltage	 =(100 %+hyst) xV_{op}, ±1 % or 0.25 V =(100 %-hyst) x V_{op}, ±1 % or 0.25 V
Delay Setting t_{delay}	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400 s
Basic Operate Time : - 0 to 1.1 x V_s 0 to 2.0 x V_s 1.1 to 0.5 x V_s	 73 ms ±10 ms 63 ms ±10 ms 58 ms ±10 ms
Operate time following delay.	t_{basic} +t_{delay} , ±1 % or ±10 ms
Inhibited by	Binary or Virtual Input VT Supervision, Voltage Guard

37 Undercurrent

Number of Elements	2
Setting Range I_s	0.05,0.10...5.0 x I_n
Operate Level	100 % I_s, ±5% or ±1 % x I_n
Delay Setting t_{delay}	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400 s
Basic Operate Time: 1.1 to 0.5 x I_n	35 ms ±10 ms
Operate time following delay.	t_{basic} +t_{delay} , ±1 % or ±10 ms
Overshoot Time	< 40 ms
Inhibited by	Binary or Virtual Input

46 Negative Phase Sequence Overcurrent

Number of Elements	DT & IT
DT Setting Range I_s	0.05,0.10...4.0 x I_n
DT Operate Level	100 % I_s, ±5 % or ±1 % x I_n
DT Delay Setting t_{delay}	0.00, 0.01...20, 20.5...100,101...1000, 1010...10000, 10100...14400 s
DT Basic Operate Time - 0 to 2 x I_s 0 to 5 x I_s	 40 ms ±10 ms 30 ms ±10 ms
DT Operate time following delay	t_{basic} +t_{delay} , ±1 % or ±10 ms
IT Char Setting	IEC NI,VI,EI,LTI, ANSI MI,VI,EI & DTL
IT Setting Range	0.05, 0.06..2.5 x I_n
Tm Time Multiplier	0.025,0.050...1.6
Char Operate Level	105 % I_s, ±4 % or ±1 % x I_n
Overshoot Time	< 40 ms
Inhibited by	Binary or Virtual Input

47 Negative Phase Sequence Voltage

Number of Elements	2
Setting Range V_s	1,1.5...90 V
Hysteresis Setting	0,0.1...80 %
Operate Level	100 % V_s, ±2 % or ±0.5 V
Delay Setting t_{delay}	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400 s

Basic Operate Time: - 0 V to 2.0 x V_s 0 V to 10 x V_s	80 ms ±20 ms 55 ms ±20 ms
Operate time following delay.	t_{basic} +t_{delay} , ±2 % or ±20 ms
Overshoot Time	< 40 ms
Inhibited by	Binary or Virtual Input

49 Thermal Overload

Operate levels	Operate and Alarm
Setting Range I_s	0.10,0.11...3.0 x I_n
Operate Level	100 % I_s, ±5 % or ±1 % x I_n
Time Constant Setting	1,1.5...1000 min
Operate time $t = \tau \times ln\left\{\frac{I^2 - I_p^2}{I^2 - (k \times I_s)^2}\right\}$ ±5 % absolute or ±100 ms where Ip = prior current	
Capacity Alarm Level	Disabled, 50,51...100 %
Inhibited by	Binary or Virtual Input

50(67) Instantaneous & DTL OC & EF (Directional)

Operation	Non directional, Forward or reverse
Elements	Phase, Derived Earth, Measured Earth & SEF
Number of Elements	4 x OC 4 x Derived E/F 'N' 4 x Measured E/F 'G' 4 x SEF
Setting Range I_s: - O/C Derived E/F 'N' Measured E/F 'G' SEF	0.05,0.06...50 x I_n 0.05,0.06...50 x I_n 0.005...25 x I_n 0.005...5 x I_n
Time Delay	0.00...14400 s
Operate Level	100 % I_s, ±5 % or ±1 % x I_n
Operate time: Current switched from 0 to 2x Current switched from 0 to 5x	2 x I_s: 40 ms, ±10 ms, 5 x I_s: 30 ms, ±10 ms
Operate time following delay	t_{basic} +t_{delay} , ±1 % or ±10 ms
Inhibited by	Binary or Virtual Input Inrush detector VT Supervision

51(67) Time Delayed OC&EF (Directional)

Operation	Non directional, Forward or reverse
Elements	Phase, Derived Earth, Measured Earth & SEF
Number of Elements:-	4 x OC 4 x Derived E/F 'N' 4 x Measured E/F 'G' 4 x SEF
Characteristic	IEC NI, VI, EI, LTI; ANSI MI, VI, EI & DTL
Setting Range I_s:- O/C Derived E/F 'N' Measured E/F 'G' SEF	0.05,0.06...2.5 x I_n 0.05,0.06...2.5 x I_n 0.005...1 x I_n 0.005...1 x I_n
Time Multiplier	0.025,0.05...1.6
Time Delay	0,0.01... 20 s
Operate Level	105 % I_s, ±4 % or ±1 % x I_n
Minimum Operate time IEC ANSI $t_{op} = \frac{K}{\left[\frac{I}{Is}\right]^{\alpha} - 1} \times Tm$ $t_{op} = \left[\frac{A}{\left[\frac{I}{Is}\right]^{P} - 1} + B\right] \times Tm$ ± 5 % absolute or ± 30 ms	
Follower Delay	0 - 20 s
Reset	ANSI decaying, 0 - 60 s
Inhibited by	Binary or Virtual Input Inrush detector VT Supervision

51V Voltage Controlled Overcurrent

Setting Range	5,5.5...200 V
Operate Level	100 % V_s, ±5 % or ±1 % x V_n
Multiplier	0.25.0.3...1
Inhibited by	VT Supervision

50BF Circuit Breaker Fail

Operation	Current check - Phase and Measured Earth with independent settings Mechanical Trip CB Faulty Monitor
Setting Range I_s	0.05,0.055...2.0 x I_n
2 Stage Time Delays	Timer 1 20...60000 ms Timer 2 20...60000 ms
Operate Level	100 % I_s, ±5 % or ±1 % x I_n
Basic Operate time	< 20 ms
Operate time following delay	t_{delay} ±1 % or ±20 ms
Triggered by	Any function mapped as trip contact

Inhibited by	Binary/Virtual Input
Timer By pass	Yes, 50BF CB Faulty Input

59N Neutral Voltage Displacement

Number of Elements	NDT & NIT
NDT Operate Level	100 % V_s, ±2 % or ±0.5 V
NDT Delay Setting t_{delay}	0, 0.01 20, 20.5... 100, 101... 1000, 1010... 10000, 10100... 14400 s
NDT Basic Operate Time 0 V to 1.5 x V_s 0 V to 10 x V_s	76 ms ±20 ms 63 ms ±20 ms
NDT Operate time following delay.	t_{basic} +t_{delay} , ±1 % or ±20 ms
NDT & NIT Setting Range I_s	1, 1.5...100 V
Tm Time Multiplier(IDMT)	0.1, 0.2... 10, 10.5... 140
Delay (DTL)	0, 0.01...20 s
Reset	ANSI Decaying, 0...60 s

NIT Operate Level	105 % V_s, ±2 % or ±0.5 V
Inhibited by	Binary or Virtual Input

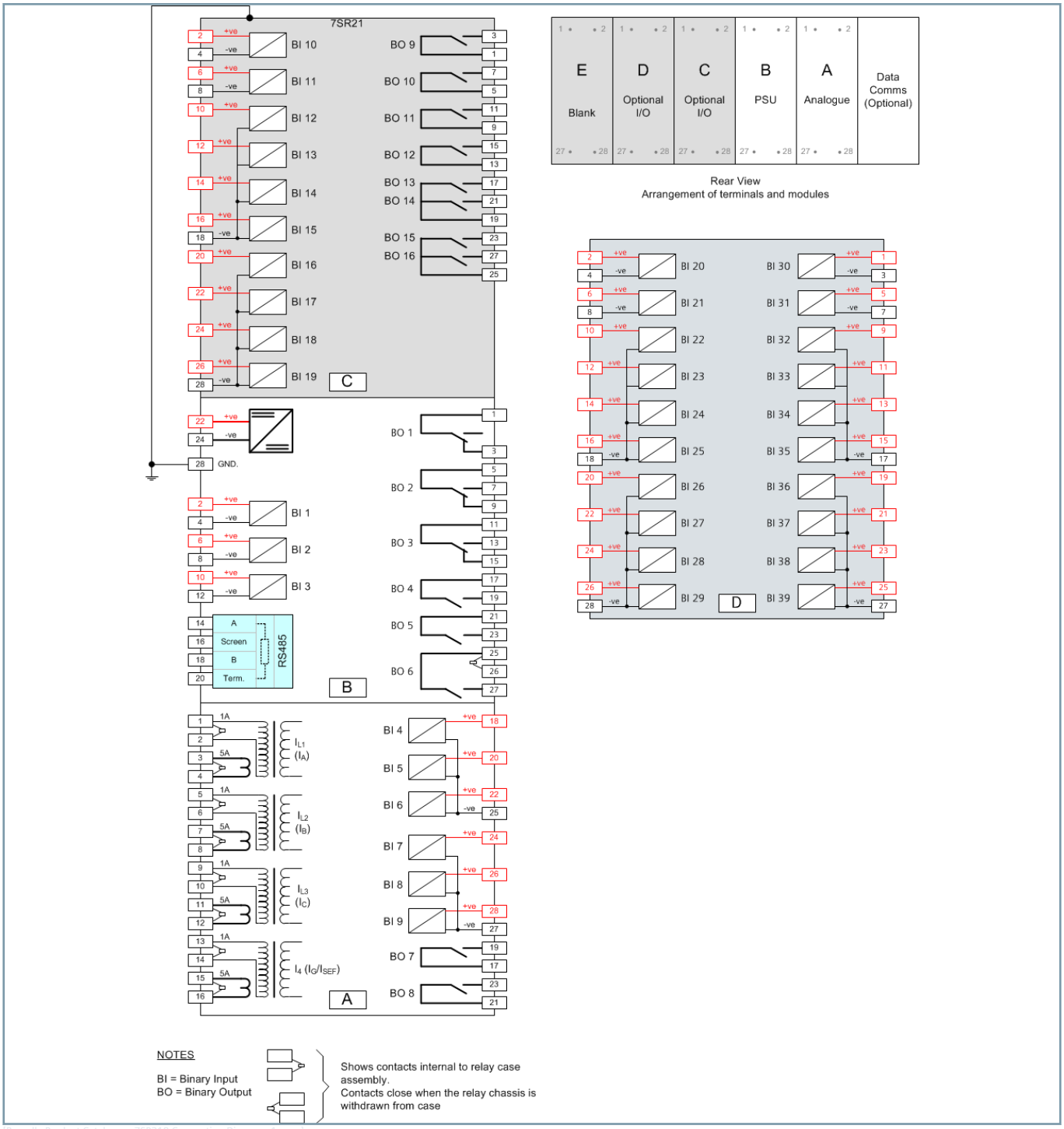
60 Supervision

CT	(7SR210n) CTS-I (7SR220n) CTS-I, CTS V_{nps}, CTS I_{nps}
VT	(7SR220n) VTS V_{nps}, VTS V_{zps}
Delay	0.03, 0.04... 20.00, 20.50... 100, 101... 1000, 1010...10000, 10100... 14400 s

64H Restricted Earth Fault

Setting Range	0.005...0.95 x I_n
Operate Level	100 % I_s, ±5 % or ±1 % x I_n
Time Delay	0.00... 14400 s
Basic Operate Time	0 to 2 x I_s 40 ms ±10 ms 0 to 5 x I_s 30 ms ±10 ms
Inhibited by	Binary or Virtual Input

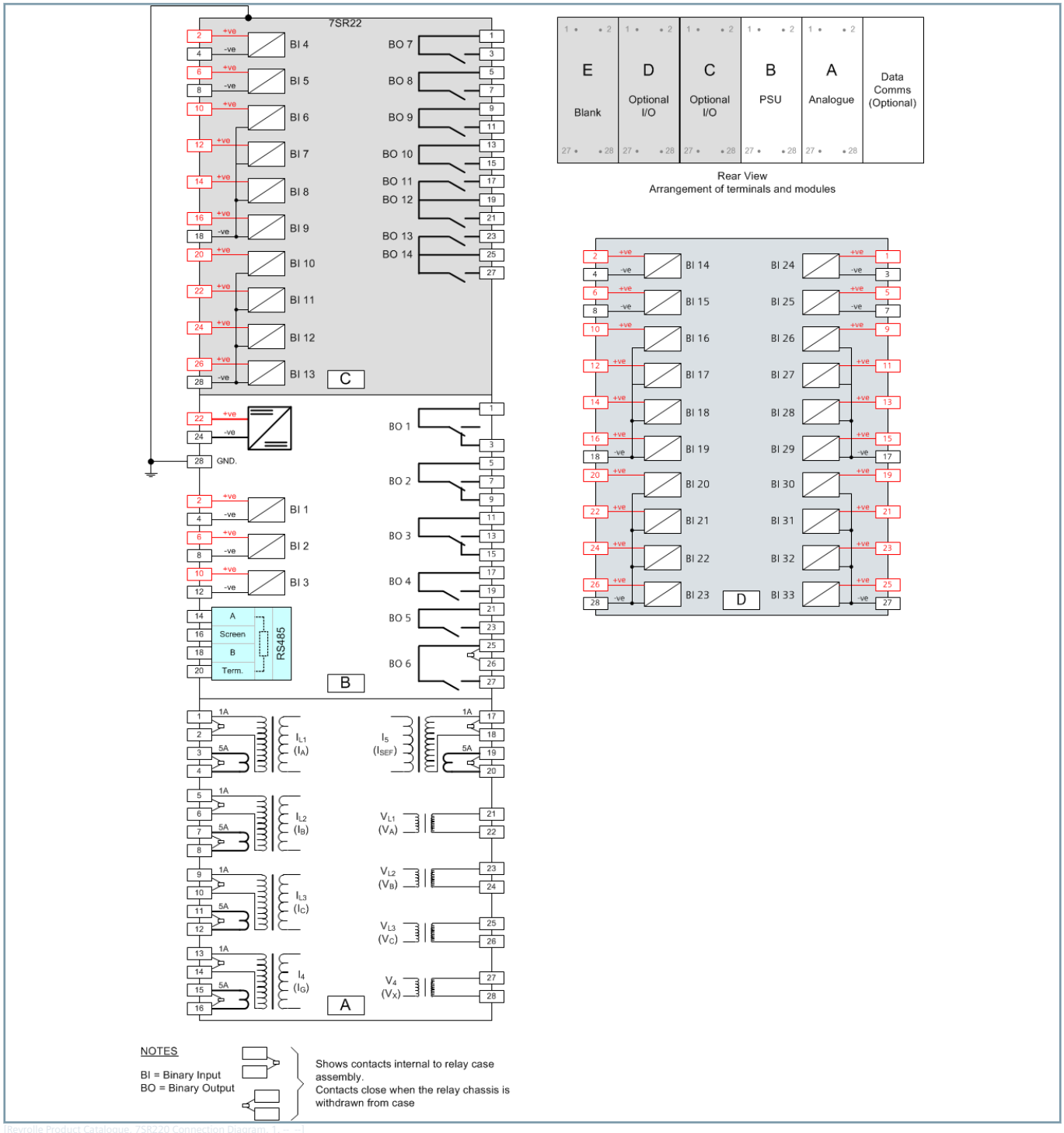
7SR210 Connection Diagram



[Reyrolle Product Catalogue, 7SR210 Connection Diagram, 1, "_"]

Figure 2.4/14 7SR210 Wiring Diagram

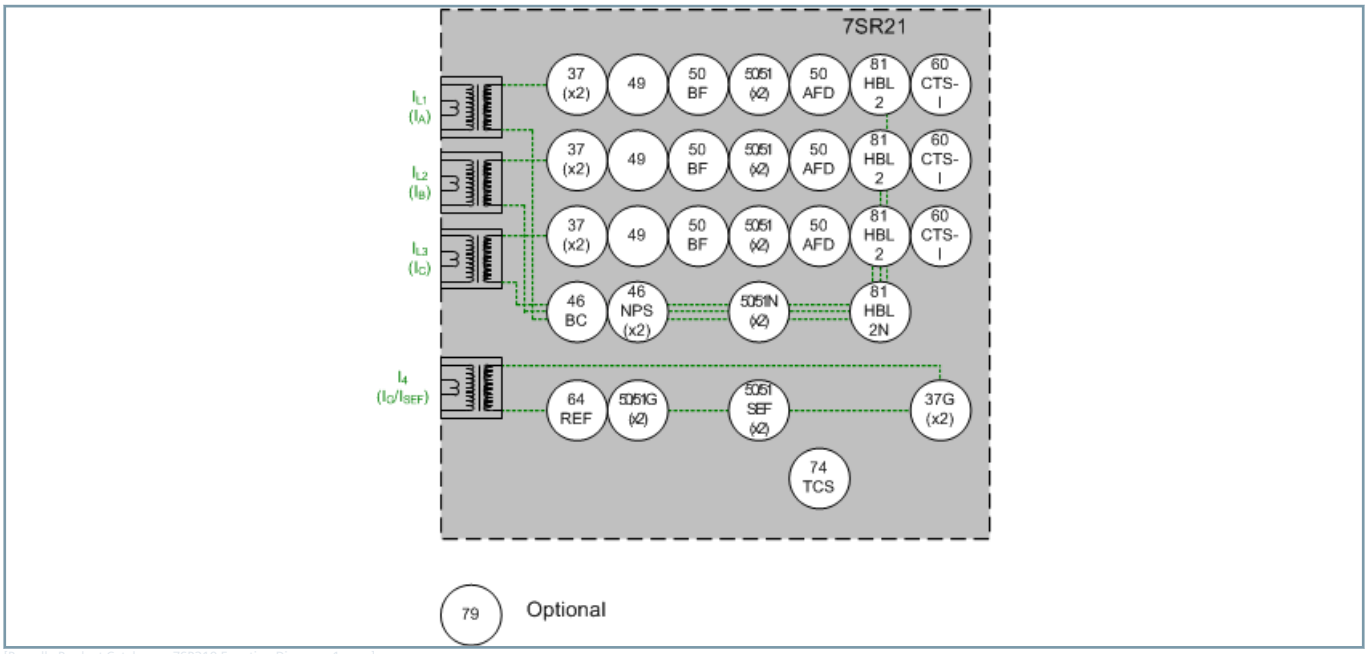
7SR220 Connection Diagram



[Reyrolle Product Catalogue, 7SR220 Connection Diagram, 1, -*-]

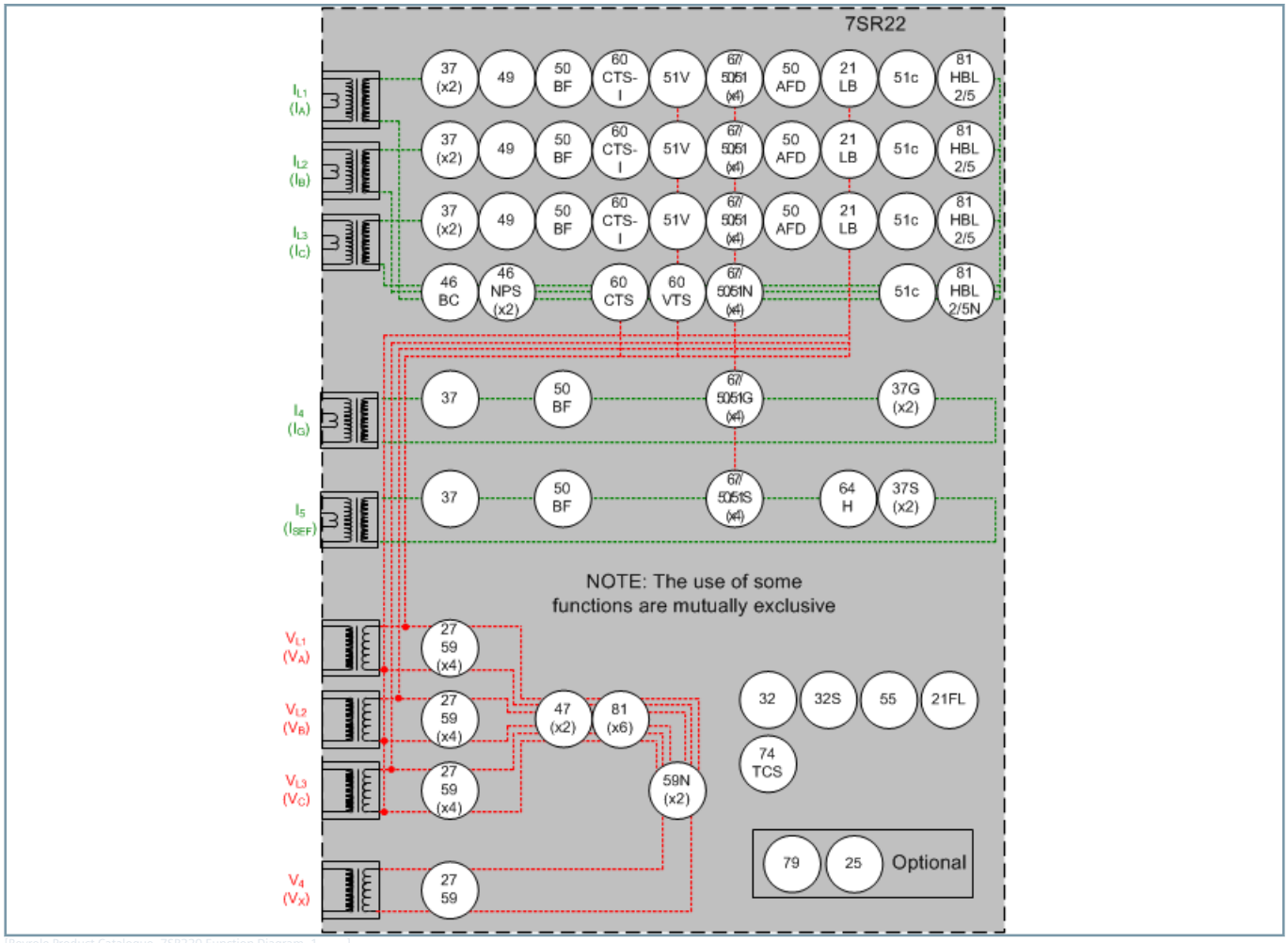
Figure 2.4/15 7SR220 Wiring Diagram

Function Diagrams for 7SR210 & 7SR220



[Reyrolle Product Catalogue, 7SR210 Function Diagram, 1, –_–]

Figure 2.4/16 7SR210 Function Diagram



[Reyrolle Product Catalogue, 7SR220 Function Diagram, 1: _ _]

Figure 2.4/17 7SR220 Function Diagram

7SR2 Range – 7SR210 and 7SR220 Non-Directional/Directional Overcurrent Relays

Ordering Information - 7SR210 Overcurrent Relay

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Overcurrent Relay	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: 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 Modbus RTU (user selectable)													1		|	|	|	|
IEC 60870-5-103 Modbus RTU and DNP3 3.0 (user selectable)													2		|	|	|	|
IEC 60870-5-103 Modbus RTU and DNP3 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																	|	|

Product Description	Order No.			
50AFD 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

NOTE

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

Ordering Information - 7SR220 Directional Overcurrent Relay

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Directional Overcurrent Relay	7	S	R	2	2	0	□	-	2	□	A	□	□	-	0	□	A	0
					|	|	|		|	|	|	|	|		|	|	|	|
Protection Product Family					|	|	|		|	|	|	|		|	|	|	|
Overcurrent - Directional					2	|	|		|	|	|	|	|		|	|	|	|
						|	|		|	|	|	|	|		|	|	|	|
Relay Type						|	|		|	|	|	|	|		|	|	|	|
						0	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Case, I/O and Fascia [1)]							|		|	|	|	|	|		|	|	|	|
E6 case, 5 CT, 4 VT, 3 Binary Inputs, 6 Binary Outputs, 8 LEDs							2		|	|	|	|	|		|	C	|	|
E8 case, 5 CT, 4 VT, 13 Binary Inputs, 14 Binary Outputs, 16 LEDs							3		|	|	|	|	|		|	|	|	|
E8 case, 5 CT, 4 VT, 13 Binary Inputs, 14 Binary Outputs, 8 LEDs + 6 keys							4		|	|	|	|	|		|	|	|	|
E12 case, 5 CT, 4 VT, 33 Binary Inputs / 14 Binary Outputs, 32 LEDs							5		|	|	|	|	|		|	|	|	|
E12 case, 5 CT, 4 VT, 33 Binary Inputs / 14 Binary Outputs, 16 LEDs, 12 keys							6		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Measuring Input									|	|	|	|	|		|	|	|	|
1 A or 5 A, 40 V to 160 V, 50 Hz or 60 Hz									2	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Auxiliary Voltage										|	|	|	|		|	|	|	|
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 Modbus RTU (user selectable)													1		|	|	|	|
IEC 60870-5-103 Modbus RTU and DNP3 3.0 (user selectable)													2		|	|	|	|
IEC 60870-5-103 Modbus RTU and DNP3 3.0 (user selectable) and IEC61850												7-8	7		|	|	|	|
															|	|	|	|
Spare															|	|	|	|
															0	|	|	|
																|	|	|
Protection Function Packages																|	|	|
Standard version - included in all models																C	|	|
21FL Fault Locator																	|	|
21LB Load Blinder																	|	|
27/59[1)] Under/overvoltage																	|	|
32 Power																	|	|
32S Sensitive Power																	|	|
37 Undercurrent																	|	|
37G[1)] Ground Undercurrent																	|	|

Product Description	Order No.		
37SEF[1)] SEF Undercurrent		|	|
46BC Broken conductor/load unbalance		|	|
46NPS Negative phase sequence overcurrent		|	|
47[1)] Negative phase sequence voltage		|	|
49 Thermal overload		|	|
50 Instantaneous phase fault overcurrent		|	|
50BF Circuit breaker fail		|	|
50G/50N Instantaneous earth fault		|	|
50AFD Arc Flash Detector		|	|
51V Voltage dependent overcurrent		|	|
55 Power factor		|	|
59N Neutral voltage displacement		|	|
60CTS CT supervision		|	|
60CTS-I CT supervision		|	|
60VTS VT supervision		|	|
64H High impedance REF		|	|
67/50 Directional instantaneous phase fault overcurrent		|	|
67/50G&67/50N Directional instantaneous earth fault/SEF		|	|
67/51 Directional time delayed phase fault overcurrent		|	|
67/51G&67/51N Directional time delayed earth fault/SEF		|	|
74TC/CCS Trip & close circuit supervision		|	|
81 Under/overfrequency		|	|
81HBL2 Inrush Detector		|	|
81HBL5 Overfluxing		|	|
86 Lockout		|	|
Cold load pickup		|	|
Programmable logic		|	|
CB Control		|	|
		|	|
Standard version – plus	D	|	|
79 Autoreclose		|	|
		|	|
Standard version – plus	E	|	|
79+25 Autoreclose + Check Sync		|	|
		|	|
Additional Functionality		|	|
No additional functionality		A	|
			|
Spare			|
			0

NOTE

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

7SR224 Recloser Controller

[Reyrolle Product Catalogue, 7SR224, 1, –_–]

Description

The 7SR224 Recloser Controller is one of a range of generation devices providing comprehensive directional and non-directional overcurrent protection integrated with associated protection elements and Autoreclose scheme logic. It builds on the years of in-service experience gained from the Argus family of products. The Controller provides independent Phase Fault, Earth Fault and Sensitive Earth Fault autoreclose sequences. Each sequence can be user set to any mix of Instantaneous (fast time current characteristic (TCC)) or Delayed TCC protection and independent Reclose (Dead) times. The Controller also provides a separate Autoreclose sequence for external protection.

Functions included are: - Control, monitoring, instruments, Voltage - Sag & Swell, together with integrated input and output logic, data logging & fault report functions.

Controllers are housed in 4U high, size E10 or E12 cases.

Function Overview

Standard Functionality

21FL	Fault Location
27/59	Under/Overvoltage
27Sag/ 59Swell	SARFIx Power Quality Counters
37	Undercurrent
46BC	Broken Conductor / Load Unbalance
46NPS	Negative Phase Sequence Overcurrent
47NPS	Negative Phase Sequence Overvoltage
49	Thermal Overload –Pole Segregated
50BF	Circuit Breaker Fail
51c	Cold Load Pickup
51V	Voltage Controlled Overcurrent
59N	Neutral Voltage Displacement
60CTS	CT Supervision
60VTS	VT Supervision
64H	High Impedance Restricted Earth Fault (EF)
67/50	Directional Instantaneous Phase Fault O/C
67/50G	Directional Instantaneous Earth Fault O/C
67/51	Directional Time Delayed Phase Fault O/C
67/51G	Directional Time Delayed Earth Fault O/C
67/50SEF	Directional Instantaneous Sensitive EF
67/51SEF	Directional Time Delayed Sensitive EF
74TCS	Trip Circuit Supervision H4/5/6/7 schemes
79	Autoreclose
81	Under/Over Frequency
81HBL2	Inrush Restraint
86	Lockout
User Programmable Logic Equations, via HMI	
Graphical Programmable Logic, via pc application	
8 Settings Groups - Password access - 2 levels	
Self Monitoring	

Optional Functionality

25	Synchronising
Loop Automation by Loss of Voltage	
Single /Triple Pole Autoreclose for Three Single Pole Circuit Breakers	

User Interface

20 character x 4 line backlit LCD
Menu navigation keys
3 fixed function LEDs
8 or 16 Programmable Tri-colour LEDs
12 Programmable Function Keys with Tri-colour LEDs

Monitoring Functions

Fault Data Mode – displays Date & Time, Type of fault and currents & voltages for each of last 10 faults.
Favourite (Default) meters – User selectable from:-
Currents - Primary, Secondary, xIn, Earth/SEF, Sequence Components and 2nd Harmonic
Voltages – 3 phase Primary, Secondary & xVn, Ph-Ph and Ph-n, Sequence Components, Calculated Earth Voltage. Voltage (Vx) from a 4th voltage input, Primary, Secondary & xVn. Synchronising phase, magnitude & frequency difference. Optional 3 phase from the source side providing Primary, Secondary & xVn, Ph-Ph and Ph-n, Sequence Components, Calculated Earth Voltage.
Frequency
Power – MW, MVar, MVA, Power Factor
Energy – Export & Import - MWh, MVarh,
Direction – Load Flow Indication
Thermal capacity – %
Autoreclose – status and shot number
CB Maintenance: 2 Independent Trip Counters, Frequent Operations Counter Lockout handle operations counter I^2t summation for contact wear
General alarms
Battery Condition monitoring and automatic cyclical test.
Power quality – 27 Sag and 59 Swell (Per pole Counters for SIARFIx, SMARFIx, STARFIx and Interruption Events,)
Binary Input status indication
Binary Output status indication
Virtual internal status indication

Communications Meters
Miscellaneous Meters, Date, Time, Waveform, Fault, Event & Data Log records-counters.
Demand Monitoring

Description of Functionality

With reference to 'Function Diagram'.

21FL Fault Location

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.

25 Synchronising

Synchronising is used with three pole Manual Closing and Autoreclose operations to ensure that voltages are within safe limits before allowing the close operation to proceed. The 7SR224 provides settings for voltages, phase and frequency difference for Check Synchronising as well as System Synchronising and Close on Zero phase difference for automatic selection following detection of a split system. Automatic Synchronising bypass is also available to allow closure to energise a dead feeder or busbar.

27/59 Under/over Voltage

4 elements which can be set independently as Under or overvoltage. Each element has settings for pickup level and Definite Time Lag (DTL) delays, operates if voltage 'exceeds' setting for duration of delay, Typically applied in load shedding schemes.

37 Undercurrent

2 element with settings for pickup level and Definite Time Lag (DTL) delays. Each operates if current falls below its setting for duration of its delay.

46BC Broken Conductor

Each element has settings for pickup level and DTL delay. With the circuit breaker closed, if the NPS / PPS current ratio is above setting this could be due to a broken conductor.

46NPS Negative Phase Sequence Overcurrent

Two elements, one DTL and one IDMT, with user settings for pickup levels and delays. NPS Current elements can be used to detect unbalances on the system. The negative sequence phase component of current is derived from the three phase currents. It is a measure of the quantity of unbalanced current on the system.

47NPS Negative Phase Sequence OverVoltage

Two DTL elements with independent user settings for NPS overvoltage pickup level and delays. NPS Voltage elements can be used to detect unbalances on the system. The negative sequence phase component of voltage is derived from the three phase voltages. It is a measure of the quantity of unbalanced voltage on the system.

49 Thermal Overload

The thermal algorithm calculates the thermal state of each pole from the measured currents and can be applied to lines, cables and transformers; operates if the user set thermal overload is exceeded. Capacity Alarm operates if a user set percentage of overload is reached.

50BF Circuit Breaker Fail

The circuit breaker fail function may be triggered from an internal trip signal or from a binary input. All measured currents can be monitored following a trip signal and an output is issued if any current is still detected after a specified time interval. This can be used to re-trip the CB or to back-trip an upstream CB. A second back-trip time delay is provided to enable another stage to be utilized if required.

59N Neutral Overvoltage

Two elements, one DTL and one IDMTL, have user settings for pickup level and delays. These will operate if the Neutral voltage exceeds the setting for duration of delay. Neutral overvoltage can be used to detect earth faults in high impedance earthed or isolated systems.

67/50 Phase Fault Elements

Provide Directional Instantaneous or Definite Time (DTL) Overcurrent protection, with independent settings for pickup current and time-delay. Four elements are provided. Elements can be Inrush-inhibited

67/51 Phase Fault Elements

Provide Directional - Inverse Definite Time Overcurrent protection, TCC/DTL with independent settings for pickup current, TCC and minimum/follower time-delay. Four elements are provided. User can select the TCC from standard IEC/ANSI or Legacy Characteristics e.g. 101 (A) etc. Reset TCC can be user set to either DTL or shaped, to integrate grading with electromechanical or other protection devices.

Earth Fault/Sensitive Earth Fault

The Earth Fault current is measured directly via a dedicated current analogue input. This input is used for both Earth Fault and Sensitive Earth Fault elements.

67/50G Earth Fault

Provide Directional Instantaneous or Definite Time (DTL) earth fault protection, with independent settings for pickup current and time-delay. Four elements are provided. Elements can be Inrush-inhibited.

67/51G Earth Fault

Provide Directional - Inverse Definite Time earth fault protection, TCC/DTL with independent settings for pickup current, TCC and minimum/follower time-delay. Four elements are provided. User can select the TCC from standard IEC/ANSI or Legacy Characteristics e.g. 101 (A) etc. Reset TCC can be user set to either DTL or shaped, to integrate grading with electromechanical or other protection devices.

67/50SEF Sensitive Earth Fault

Provide Directional Instantaneous or Definite Time (DTL) earth fault protection, with independent settings for pickup current and time-delay. Four elements are provided. Elements can be Inrush-inhibited

67/51SEF Sensitive Earth Fault

Provide Directional Instantaneous or Definite Time (DTL) earth fault protection, with independent settings for pickup current and time-delay. Four elements are provided. Elements can be Inrush-inhibited User can select the TCC from standard IEC/ANSI or Legacy Characteristics e.g. 101 (A) etc. Reset TCC can be user set to either DTL or shaped, to integrate grading with electromechanical or other protection devices.

67 Directional Control

Phase Fault, Earth Fault and Sensitive Earth Fault elements can be directionalised. Each element can be user set to Forward, Reverse, or Non-directional. Where multiple elements are provided two could be set for Forward and two for Reverse, thus providing Bi-Directional Tri-state protection is a single device. Phase Fault elements are polarised from the calculated quadrature voltage i.e. Ia~Vbc, Ib~Vca & Ic~Vab. Earth Fault/SEF elements are polarized from internally calculated Zero sequence Voltage, i.e. Io~Vo.

51c Cold Load

When a circuit breaker is closed onto a 'cold' load, i.e. one that has not been powered for a prolonged period, this can impose a higher than normal load-current demand on the system which could exceed 'Normal settings'. These conditions can exist for an extended period and must not be interpreted as a fault.
To allow optimum setting levels to be applied for normal operation, Cold Load causes the 67/51 elements to change to 67/51c settings i.e. Setting/TCC/Time Multiplier /Follower delay times, for a limited period. Cold Load resets and returns to 'Normal settings' when either the circuit breaker has been closed for a User set period, or if the current has fallen to below a set level for a set time and it is safe to return.

51V Voltage Controlled Overcurrent

Element has settings for UnderVoltage pickup level and operates if voltage falls below setting. On Pick-up this element applies the set 51v Multiplier to the pickup setting of the 67/51 phase fault elements.

60CTS CT Supervision

The CT Supervision considers the presence of negative phase sequence current, without an equivalent level of negative phase sequence voltage, for a user set time as a CT failure. Element has user operate and delay settings.

60VTS VT Supervision

The VT Supervision uses a combination of negative phase sequence voltage and negative phase sequence current to detect a VT fuse failure. This condition may be alarmed or used to inhibit voltage dependent functions. Element has user operate and delay settings.

64H Restricted Earth Fault - scheme

The measured earth fault input may be used in a 64H high-impedance, restricted earth fault scheme. The required external series stabilising resistor and shunt non-linear Varistor can be supplied.

74TC Trip Circuit Supervision

Up to three trip circuits can be monitored using binary inputs connected in H4/H5/H6 or H7 schemes. Trip circuit failure raises an HMI alarm and output(s).

79 Auto Reclose

The controller provides independent Phase Fault, Earth Fault and Sensitive Earth Fault sequences. They can be set for up to 4 Shots i.e. 5 Trips + 4 Reclose attempts to Lockout. These sequences can be user set to any configuration of Instantaneous (fast TCC) or Delayed TCC protection, with independent Reclose (Dead) times. As the user defines which elements are Instantaneous, the combination of TCC1 plus 50 High set elements & TCC2 plus 50 High Set elements, provides the user with full flexibility. It enables the optimisation of the protection characteristics, which will be applied at each point in the protection sequence. Limits can be set by the user on the number of Delayed Trips to Lockout or High set trips to Lockout. The External Protection Auto Reclose sequence allows AutoReclose to be provided for a separate high speed Protection device with options for Blocking External Trips to allow Overcurrent grading to take place.

Single/Triple Auto Reclose

Additional optional functionality is available to provide tripping, auto reclose and control of three single pole Reclosers located together and controlled by a single 7SR224 device. The facility to operate each of the three phases independently for systems where single phase loads are connected is common in some countries. The 7SR224 provides flexible schemes which are used to provide single and three pole trip and reclose operations depending on the fault type detected.

Dead/Live indication

Detection of live voltage is provided for each phase on both sides of the Recloser. This can be set to provide indication and alarms.

Loss of Voltage LOV Automation

Additional optional functionality is available to provide control of Normally Open Points (NOP) and other Reclosers in the distribution network to provide an automation sequence of load restoration following a persistent fault. The sequence is started by the loss of voltage detection, for an extended period of time, following a complete but unsuccessful auto reclose sequence, which has caused Lockout of a Recloser at any point in the network.

81 Under/Over Frequency

Each of the 4 elements has settings for pickup level, drop-off level and Definite Time Lag (DTL) delays. This function operates if frequency 'exceeds' setting for duration of delay. Typically applied in load shedding schemes.

81HBL2 Second Harmonic Block

Where second harmonic current is detected i.e. during transformer energisation the user selected elements can be blocked

27/59 Under/Over Voltage

Power System Utilities use SARFI indices of Voltage Sag and Swell, which express the magnitude and duration of Sag and

Swell variations occurring on their systems. These indices are based on the 'ride-through' capability of the customer's plant and are usually expressed in terms of the number of a specific class (index) of r.m.s. variation per customer per specified period. These elements provide the raw data in the form of counters that display the total count of each type of index value. Sags have a greater impact on plant performance than Swells. Disturbances are classified according to their magnitude and duration, the limits can be User set for SIARFI, SMARFI & STARFI. Breaks above 60s duration are Interruptions. Counters for each are provided per pole.

Programmable User Logic

Each Protection element output can be used for Alarm & Indication and/or tripping. User can freely map any protection element output to any Binary Output(s); and any Binary Input(s) to any Function Inhibit(s), Binary Output, LED's and/or internal Virtual signal points. User can also enter up to 16 Equations via the HMI or from a pc, defining User scheme-logic using standard Boolean Logic e.g. ( )/AND/OR/NOT/XOR, to combine BI, other Equations, Function Keys, LEDs, BO, and internal Virtual signal points. Each equation has PU/DO Time Delays and a Target Counter. Each Equation appears in the Output matrix and can be freely mapped to LEDs/BO. In addition, the Reydisp Manager pc application provides graphical programming of user logic within the device.

Circuit Breaker Maintenance

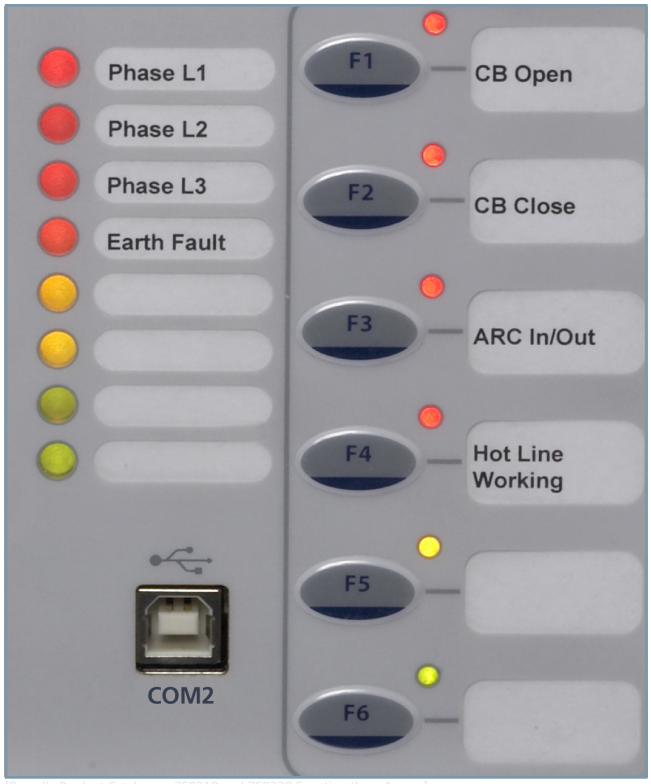
Four circuit breaker trip counters are provided:- Total Trip Count increments upon each trip command issued to give data for maintenance. Delta Trip Count is an additional counter which can be reset independently of the Total Trip Counter and counts the number of operations since the last reset. Frequent Operations Counter monitors the number of trip operations in a rolling window period of one hour and operates to stop cyclical sequences if the set number is exceeded. An I^2t summation Counter provides a means monitoring contact wear indicating the total energy interrupted by the circuit breaker contacts. Each counter has a user set target operations count which, when reached, can be mapped to raise Alarms/ Binary Outputs.

Function LED's

Eight (E10 case) or sixteen (E12) user programmable tri-colour LED's are provided eliminating the need for expensive panel mounted pilot lights and associated wiring. Each LED can be user set to red, green or yellow allowing for clear indication of the associated function's state. A slip-in label pocket along-side enables the user to insert his own notation. A printer compatible template is available.

Function Keys

Twelve user programmable function keys are available for implementing User logic and scheme control functionality, eliminating the need for expensive panel mounted control switches and associated wiring. Each function key has an associated user programmable tri-color LED (red, green, yellow) allowing for clear indication of the associated function's state. A slip-in label pocket along-side enables the user to insert his own notation for the Function Key LED Identification. Each Function Key can be mapped directly to any of the built-in Controller/Circuit Breaker Command functions or to the User Logic equations.



[Reyrolle Product Catalogue, 7SR210 and 7SR220 Function Keys, 1, -_-]

Figure 2.4/18 Tri-colour LED's and function keys

Technical Data

For full technical data refer to the Performance Specification Section of the Technical Manual.

Inputs and Outputs

Current Inputs

Quantity	3 x Phase & 1 x Earth or Sensitive Earth
Rated Current I_n	1/5 A
Measuring Range	80 x I_n
Instrumentation ≥ 0.1 x I_n	±1 % I_n
Frequency	50/60 Hz

Thermal Withstand: Continuous 10 Minutes 5 Minutes 3 Minutes 2 Minutes 3 Seconds 2 Seconds 1 Second 1 Cycle	3.0 x I_n 3.5 x I_n 4.0 x I_n 5.0 x I_n 6.0 x I_n 57.7 A (1 A) 202 A (5 A) 70.7 A (1 A) 247 A (5 A) 100 A (1 A) 350 A (5 A) 700 A (1 A) 2500 A (5 A)
Burden @ I_n	≤ 0.1 VA (1 A phase and earth element) ≤ 0.3 VA (5 A phase and earth element)

Voltage Inputs

Quantity	4 or 6
Nominal Voltage	40...160 V_{RMS} a.c. Range
Instrumentation ≥ 0.8 x V_n	±1 % V_n
Operating Range	4x VT models: 0-270 V_{RMS} 6x VT models: 0-270 V_{RMS} V1,V2,V3. 0-132 V_{RMS} for V4,V5,V6
Thermal Withstand: Continuous 1 Second	300 V_{RMS}
Burden @ 110 V	≤ 0.1 VA

Binary Inputs

Operating Voltage	19 V dc: Range 17 to 290 V dc 88 V: Range 74 to 290 V dc
Maximum dc current for operation	1.5 mA

Binary Outputs

Operating Voltage	Voltage Free
Operating Mode	User selectable - Self or Hand Reset
Contact Operate / Release Time.	7 ms / 3 ms
Making Capacity: Carry continuously Make and carry (L/R ≤ 40 ms and V ≤ 300 V)	5 A ac or dc 20 A ac or dc for 0.5 s 30 A ac or dc for 0.2 s
Breaking Capacity: (≤ 5 A and ≤ 300 V): AC Resistive AC Inductive DC Resistive DC Inductive	1250 VA 250 VA at p.f. ≤ 0.4 75 W 30 W at L/R ≤ 40 ms 50 W at L/R ≤ 10 ms

Auxiliary Supply

Rated DC Voltage	24-250 V DC Operating Range 19.2 to 275 V	
Allowable superimposed ac component	12 % of DC voltage	
Rated AC Voltage	100-230 VAC 50/60Hz Range 80 to 253 V_{RMS} AC 50/60Hz ±5 %	
Power Consumption:	Quiescent State (DC) Maximum Load (DC)	24 V: 8 W 110 V: 7 W 250 V: 7 W 24 V: 12 W 110 V: 11 W 250 V: 11 W
	Quiescent State (AC) Maximum Load (AC)	100 V: 16 VA 230 V: 22 VA 100 V: 23 VA 230 V: 32 VA
Allowable breaks/ dips in supply (collapse to zero)	DC	50 ms
	AC	2.5/3 cycles @50/60Hz

Mechanical Tests

Vibration (Sinusoidal)

IEC 60255-21-1 Class I

Type	Level	Variation
Vibration response	0.5 gn	≤ 5 %
Vibration endurance	1.0 gn	≤ 5 %

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	≤ 5 %
Bump test	10 gn, 16 ms	≤ 5 %

Seismic

IEC 60255-21-3 Class I

Type	Level	Variation
Seismic response	1 gn	≤ 5 %

Mechanical Classification

Durability	>10^6 operations

Electrical Tests

Insulation

IEC 60255-5

Type	Level
Between any terminal and earth	2.0 kV AC RMS for 1 min
Between independent circuits	2.0 kV AC RMS for 1 min
Across normally open contacts	1.0 kV AC RMS for 1 min

High Frequency Disturbance

IEC 60255-22-1 Class III

Type	Level	Variation
Common (longitu-dinal)	2.5 kV	≤ 10 %
Series (transverse) mode	1.0 kV	≤ 10 %
RS485 standard rear port	1.0 kV	No data loss

Electrostatic Discharge

IEC 60255-22-2 Class IV

Type	Level	Variation
Contact discharge	8.0 kV	≤ 5 %

Fast Transient Immunity

IEC 60255-22- 4 Class A (2002)

Type	Level	Variation
5/50 ns 2.5 kHz repetitive	4 kV	≤ 10 %
RS485 standard rear port	2 kV	No data loss

Surge Immunity

IEC 60255-22-5; IEC 61000-4-5

Type	Level	Variation
Analog Inputs. Line to Earth	4.0 kV	≤ 10 %
Case, Aux Power & I/O. Line to Earth	2.0 kV	≤ 10 %
RS485 Comms port Line to Earth	1.0 kV	No data loss
Analog Inputs. Line to Line	1.0 kV	≤ 10 %
Case, Aux Power & I/O. Line to Line	1.0 kV	≤ 10 %

NOTE

* 45ms DTL pick up delay applied to binary inputs

Conducted Radio Frequency Interference Immunity

IEC 60255-22-6

Type	Level	Variation
0.15 to 80 MHz	10 V	≤ 5 %

Radiated Radio Frequency Emissions

IEC 60255-25

Type	Limits at 10 m, Open Area test site, Quasi-peak
30 to 230 MHz	40 dB(µV)
230 to 10000 MHz	47 dB(µV)

Conducted Radio Frequency Emissions

IEC 60255-25

Type	Limits	
	Quasi-peak	Average
0.15 to 0.5 MHz	79 dB(µV)	66 dB(µV)
0.5 to 30 MHz	73 dB(µV)	60 dB(µV)

Radiated Immunity

IEC 60255-22-3 Class III

Type	Level	Variation
80 MHz to 1000 MHz	10 V/m	≤ 5%

Climatic Tests

Temperature

IEC 60068-2-1/2

Operating Range	-10°C to + 55°C
Storage Range	- 25°C to + 70°C

Humidity

IEC 60068-2-78

Operational test	56 days at 40°C and 93 % relative humidity

IP Ratings

IEC 60529

Type	Level
Installed with cover	IP 51 from front of relay
Installed with cover removed	IP 20 from front of relay

NOTE

For full technical data refer to the Performance Specification Section of the Technical Manual.

Performance

27/59 Under/Over Voltage

Number of Elements	4 Under or Over
Operate	Any phase or All phases
Voltage Guard	1,1.5...200 V
Setting Range V_s	5,5.5...200 V
Hysteresis Setting	0.0.1...80 %
V_s Operate Level	100 % V_s, ±1 % or ±0.25 V
Reset Level: Undervoltage Overvoltage	=(100 %+hyst) x V_{op}, ±1 % or 0.25 V =(100 %-hyst) x V_{op}, ±1 % or 0.25 V
Delay Setting t_{delay}	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400 s
Basic Operate Time : - 0 to 1.1 x V_s 0 to 2.0 x V_s 1.1 to 0.5 x V_s	73 ms ±10 ms 63 ms ±10 ms 58 ms ±10 ms
Operate time following delay.	t_{basic} +t_{delay} , ±1 % or ±10 ms
Inhibited by	Binary or Virtual Input VT Supervision, Voltage Guard

Vx 27/59 Under/Over Voltage

Number of Elements	1 Under or Over for 4xVT variants
Operate	Any phase or All phases
Voltage Guard	1,1.5...200 V for 4xVT variants 1,1.5...120 V for 6xVT variants
Setting Range V_s	5,5.5...200 V for 4xVT variants 5,5.5...120 V for 6xVT variants
Hysteresis Setting	0.0.1...80 %
V_s Operate Level	100 % V_s, ±1 % or ±0.25 V
Reset Level: Undervoltage Overvoltage	=(100 %+hyst) x V_{op}, ±1 % or 0.25 V =(100 %-hyst) x V_{op}, ±1 % or 0.25 V
Delay Setting t_{delay}	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400 s
Basic Operate Time : - 0 to 1.1 x V_s 0 to 2.0 x V_s 1.1 to 0.5 x V_s	73 ms ±10 ms 63 ms ±10 ms 58 ms ±10 ms
Operate time following delay.	t_{basic} +t_{delay} , ±1 % or ±10 ms
Inhibited by	Binary or Virtual Input VT Supervision, Voltage Guard

37 Undercurrent

Number of Elements	2
Setting Range I_s	0.05,0.10...5.0 x I_n
Operate Level	100 % I_s, ±5 % or ±1 % x I_n
Delay Setting t_{delay}	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400 s
Basic Operate Time: 1.1 to 0.5 x I_s	35 ms ±10 ms
Operate time following delay.	t_{basic} +t_{delay} , ±1 % or ±10 ms
Overshoot Time	< 40 ms
Inhibited by	Binary or Virtual Input

46 Negative Phase Sequence Overcurrent

Number of Elements	DT & IT
DT Setting Range I_s	0.05,0.10...5.0 x I_n
DT Operate Level	100 % I_s, ±5 % or ±1 % x I_n
DT Delay Setting t_{delay}	0.00, 0.01...20, 20.5...100,101...1000, 1010...10000, 10100...14400 s
DT Basic Operate Time - 0 to 2 x I_s 0 to 5 x I_s	40 ms ±10 ms 30 ms ±10 ms
DT Operate time following delay	t_{basic} +t_{delay} , ±1 % or ±10 ms
IT Char Setting	IEC NI,VI,EI,LTI, ANSI MI,VI,EI & DTL
IT Setting Range	0.05..2.5
Tm Time Multiplier	0.025,0.03...1.6,1.7... 5,6... 100
Char Operate Level	105 % I_s, ±4 % or ±1 % x I_n
Overshoot Time	< 40 ms
Inhibited by	Binary or Virtual Input

47 Negative Phase Sequence Voltage

Number of Elements	2
Setting Range V_s	1,1.5...90 V
Hysteresis Setting	0,0.1...80 %
Operate Level	100 % V_s, ±2 % or ±0.5 V
Delay Setting t_{delay}	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400 s
Basic Operate Time: - 0 V to 1.5 x V_s 0 V to 10 x V_s	80 ms ±20 ms 55 ms ±20 ms
Operate time following delay.	t_{basic} +t_{delay} , ±2 % or ±20 ms
Overshoot Time	< 40 ms
Inhibited by	Binary or Virtual Input

49 Thermal Overload

Operate levels	Operate and Alarm
Setting Range I_s	0.10,0.11...3.0 x I_n
Operate Level	100 % I_s, ±5 % or ±1 % x I_n

Time Constant Setting	1,1.5...1000 min
Operate time	$t = \tau \times ln\left\{\frac{I^2 - I_p^2}{I^2 - (k \times I_s)^2}\right\}$ ±5 % absolute or ±100 ms where Ip = prior current (Is 0.3 x I_n to 3 x I_n)
Alarm Level	Disabled, 50,51...100 %
Inhibited by	Binary or Virtual Input

50(67) Instantaneous & DTL OC & EF (Directional)

Operation	Non directional, Forward or reverse
Elements	Phase and Measured Earth
Number of Elements	4 x OC 4 x Measured E/F 'G' where fitted 4 x SEF where fitted
Setting Range I_s	0.05,0.06...50 x I_n SEF 0.005...5 x I_n
Time Delay	0.00...14400 s
Operate Level I_{op}	100 % I_s, ±5 % or ±1 % x I_n
Reset Level	≥ 95 % I_{op}
Operate time: 50	0 to 2 x I_s – 35 ms, ±10 ms, 0 to 5 x I_s – 25 ms, ±10 ms
Operate time following delay	t_{basic} +t_{delay} , ±1 % or ±10 ms
Inhibited by	Binary or Virtual Input Inrush detector VT Supervision

51(67) Time Delayed OC&EF (Directional)

Elements	Phase Measured Earth & SEF
Number of Elements:-	4 x OC 4 x Measured E/F 'G' 4 x SEF
Operation	Non directional, Forward or reverse
Characteristic	IEC NI,VI,EI,LTI ANSI MI,VI,EI & DTL & Legacy (101 etc.)
Setting Range I_s	0.05,0.1...2.5 x I_n SEF 0.005...1 x I_n
Time Multiplier	0.025,0.03...1.6,1.7... 5,6... 100
Time Delay	0,0.01... 20 s
Operate Level I_{op}	105 % I_s, ±4 % or ±1 % x I_n

Minimum Operate time IEC ANSI	$t_{op} = \frac{K}{\left[\frac{I}{Is}\right]^{\alpha} - 1} \times Tm$ $t_{op} = \left[\frac{A}{\left[\frac{I}{Is}\right]^{P} - 1} + B\right] \times Tm$ ± 5 % absolute or ± 30 ms
Follower Delay	0 - 20 s
Reset	ANSI decaying, 0 - 60 s
Inhibited by	Binary or Virtual Input Inrush detector VT Supervision

51V Voltage Controlled Overcurrent

Setting Range	5,5.5...200 V
Operate Level	100 % V_s, ±5 % or ±1 % x V_n
Multiplier	0.25.0.3...1 x I_s(51)
Inhibited by	VT Supervision

50BF Circuit Breaker Fail

Operation	Current check - Phase and Measured Earth with independent settings Mechanical Trip CB Faulty Monitor
Setting Range I_s	0.05,0.055...2.0 x I_n
2 Stage Time Delays	Timer 1 20...60000 ms Timer 2 20...60000 ms
Operate Level	100 % I_s, ±5 % or ±1 % x I_n
Basic Operate time	< 20 ms
Operate time following delay	t_{delay} ±1 % or ±10 ms
Triggered by	Any function mapped as trip contact
Inhibited by	Binary/Virtual Input
Timer By pass	Yes, 50BF CB Faulty Input

59N Neutral Voltage Displacement

Number of Elements	1xDT & 1xIT
DT Setting Range I_s	1...100 V
DT Operate Level	100 % V_s, ±5 % or ±1 % x V_n
DT Delay Setting t_{delay}	0 ...14400 s
DT Basic Operate Time 0 V to 1.5 x V_s	76 ms ±20 ms
DT Operate time following delay.	t_{basic} +t_{delay} , ±1 % or ±20 ms
IT Setting Range	1...100 V
Tm Time Multiplier(IDMT)	0.1...140

Delay (DTL)	0...20 s
Reset	ANSI Decaying, 0...60 s
Char Operate Level	105 % V_s, ±2 % or ±0.5 V
Inhibited by	Binary or Virtual Input

60 Supervision

CT	V_{nps} & I_{nps}
VT	nps/zps

7SR224 Connection Diagram

64H Restricted Earth Fault

Setting Range	0.005...0.95 x I_n
Operate Level	100 % I_s, ±5 % or ±1 % x I_n
Time Delay	0.00... 14400 s
Basic Operate Time	0 to 2 x I_s 45 ms ±10 ms 0 to 5 x I_s 35 ms ±10 ms
Inhibited by	Binary or Virtual Input

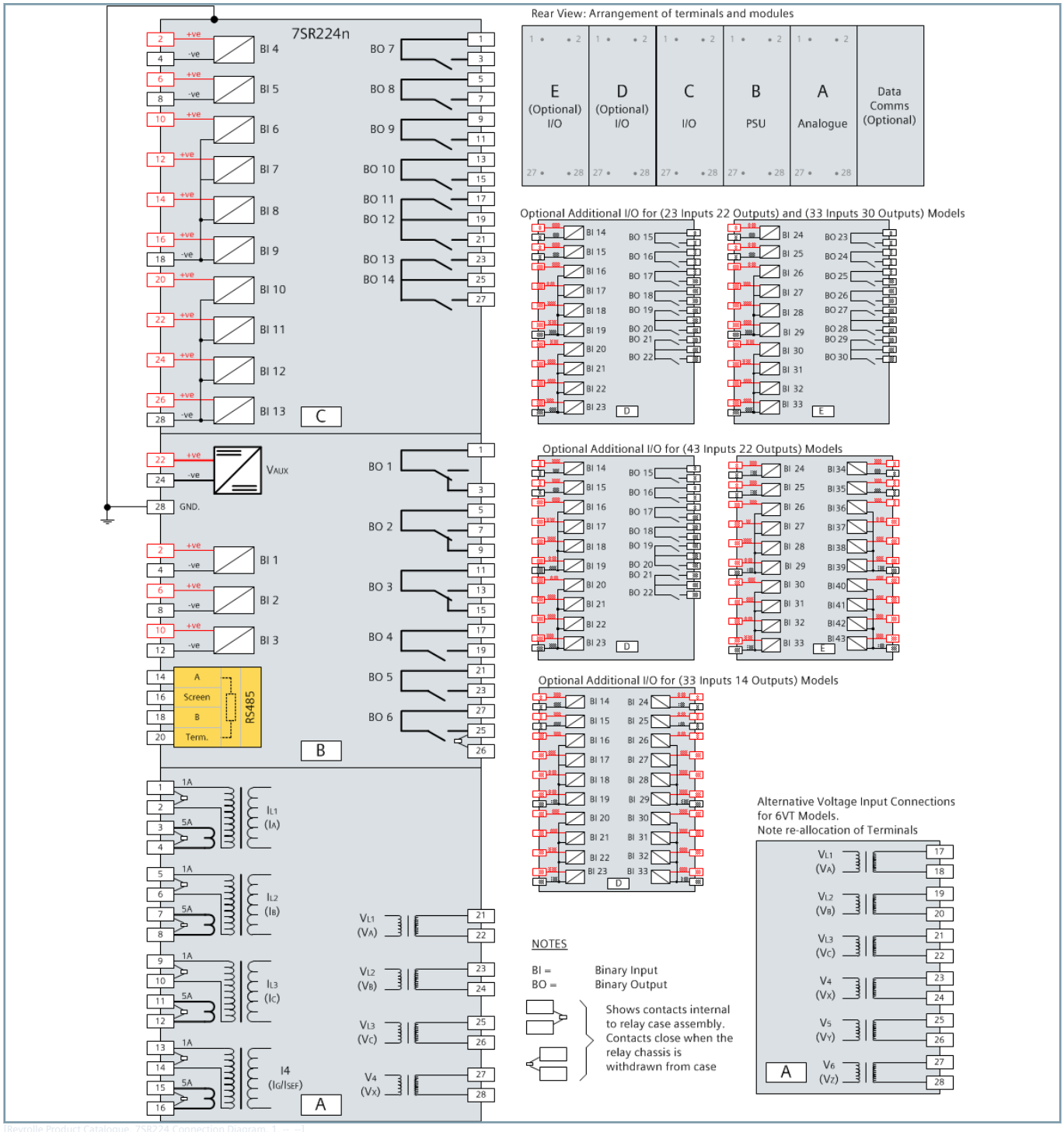
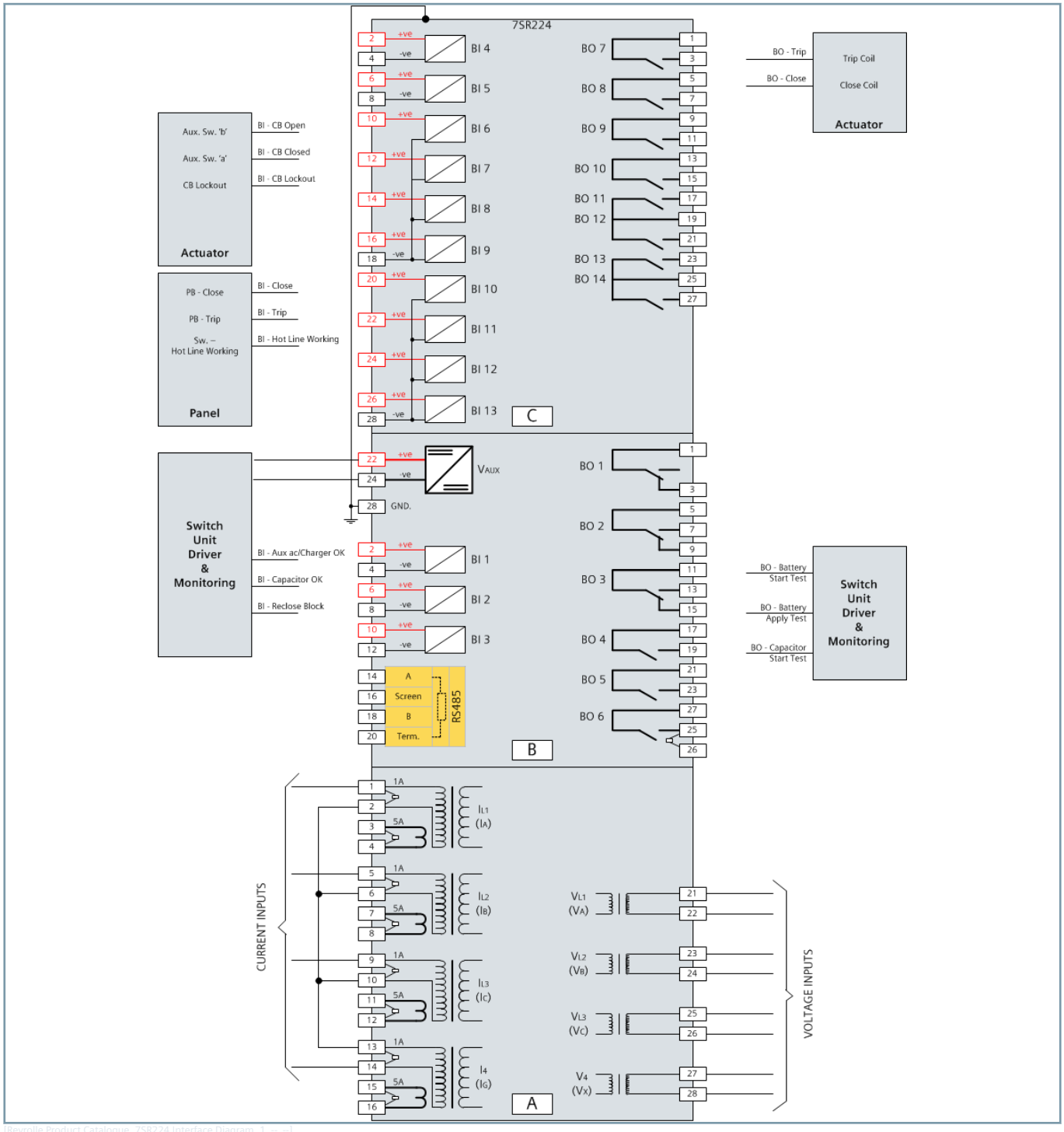


Figure 2.4/19 7SR224 Wiring Diagram

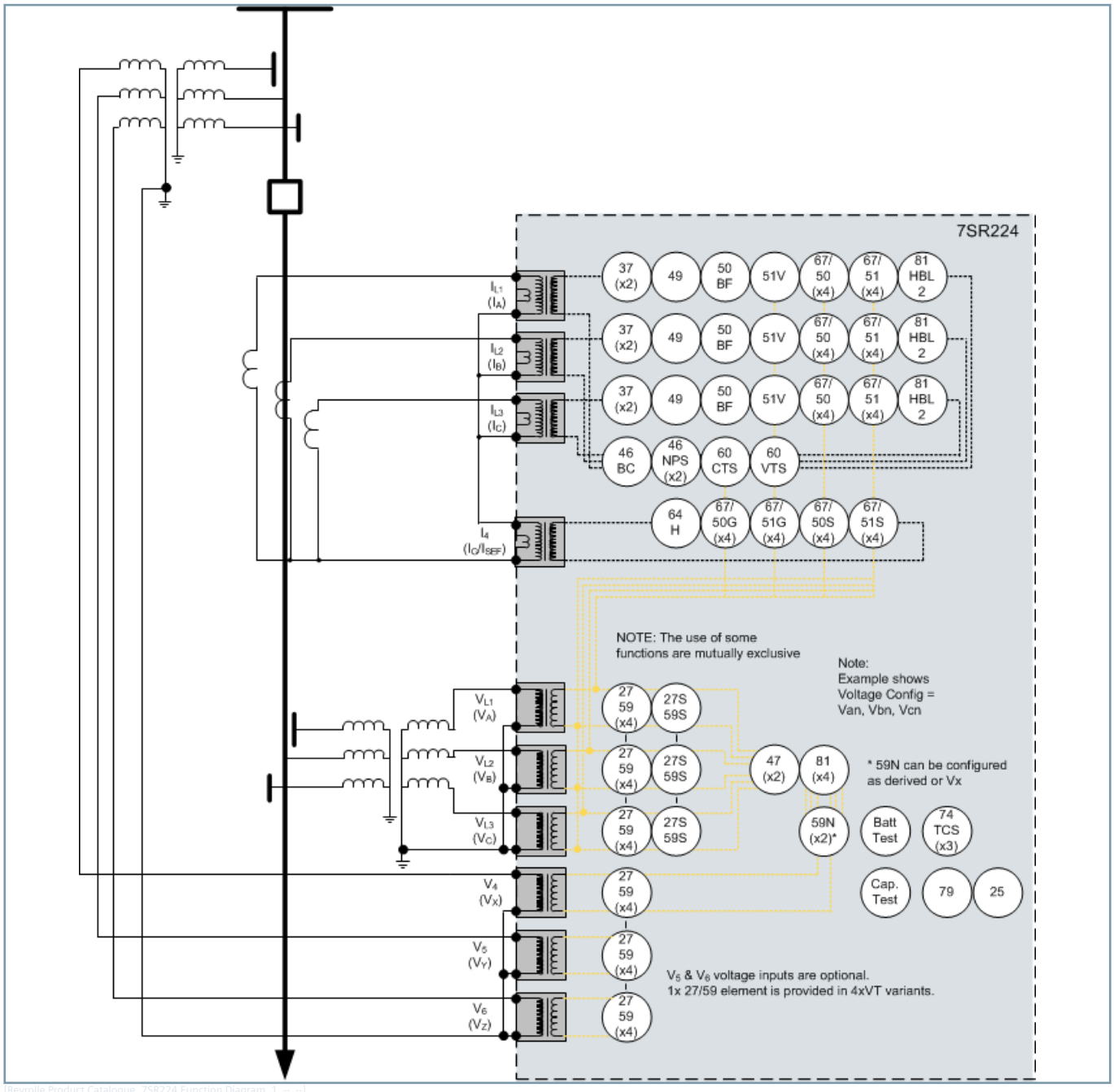
7SR224 Interface Diagram



[Reyrolle Product Catalogue, 7SR224 Interface Diagram, 1, –_–]

Figure 2.4/20 7SR224 Interface Diagram

Function Diagram for 7SR224 Recloser Controller



[Reyrolle Product Catalogue, 7SR224 Function Diagram, 1, "_"]

Figure 2.4/21 7SR224 Function Diagram

Ordering Information - 7SR224 Argus Recloser Controller

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	16	18
Argus Recloser Controller	7	S	R	2	2	4	□	-	□	□	□	□	□	-	0	□	□	0
					|	|	|		|	|	|	|	|		|	|	|	|
Protection Product Family					5	|	|		|	|	|	|	|		|	|	|	|
Overcurrent - Directional					2	|	|		|	|	|	|	|		|	|	|	|
						|	|		|	|	|	|	|		|	|	|	|
Relay Type						6	|		|	|	|	|	|		|	|	|	|
Recloser						4	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Case I/O and Fascia [1)]							7		|	|	|	|	|		|	|	|	|
E10 case, 13 Binary Inputs / 14 Binary Outputs, 8 LEDs + 12 keys							2		|	|	|	|	|		|	C	|	|
									3	|	|	|	|		|	D	A	|
E10 case, 23 Binary Inputs / 22 Binary Outputs, 8 LEDs + 12 keys							3		|	|	|	1-4	2-3		|	C	|	|
									3	|	|				|	D	A	|
E10 case, 33 Binary Inputs / 14 Binary Outputs, 8 LEDs + 12 keys							4		|	|	|	|	|		|	C	|	|
									3	|	|	|	|		|	D	A	|
E12 case, 33 Binary Inputs / 14 Binary Outputs, 16 LEDs + 12 keys							6		|	|	|	|	|		|	C	|	|
									|	|	|	|	|		|	E	A	|
E12 case, 33 Binary Inputs / 30 Binary Outputs, 16 LEDs + 12 keys							7		|	|	|	1-4	2-3		|	C	|	|
									|	|	|				|	E	A	|
E12 case, 43 Binary Inputs / 22 Binary Outputs, 16 LEDs + 12 keys							8		|	|	|	1-4	2-3		|	C	|	|
									|	|	|				|	E	A	|
									|	|	|	|	|		|	|	|	|
Measuring Input									8	|	|	|	|		|	|	|	|
4xCT 1/5 A, 4xVT 63.5/110V									2	|	|	|	|		|	C/E	|	|
4xCT 1/5 A, 6xVT 63.5/110V									3	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Auxiliary Nominal Voltage										9	|	|	|		|	|	|	|
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	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Region Specific Functions											10	|	|		|	|	|	|
Region World, 50/60Hz, language English, (language changeable) Reyrolle fascia											A	|	|		|	|	|	|
Region World, 50/60Hz, language English, (language changeable) Siemens fascia											B	|	|		|	|	|	|
Region USA, 50/60Hz, language English-US (ANSI), (language changeable) Siemens fascia											C	|	|		|	|	|	|
												|	|		|	|	|	|
Communication Interface												11	|		|	|	|	|
Standard version – included in all models, USB front port, RS485 rear port												1	2-3		|	|	|	|
Standard version - plus additional rear F/O ST connectors (x2) and IRIG-B												2	2-3		|	|	|	|
Standard version - plus additional rear RS485 and IRIG-B												3	2-3		|	|	|	|
Standard version - plus additional rear RS232 and IRIG-B												4	2-3		|	|	|	|
Standard version - plus additional rear Electrical Ethernet RJ45 (x2)												7	8		|	|	|	|
Standard version - plus additional rear Optical Ethernet Duplex (x2)												8	8		|	|	|	|
													|		|	|	|	|
Protocol													12		|	|	|	|
IEC 60870-5-103 and Modbus RTU and DNP 3.0 (user selectable setting)												1-4	2		|	|	|	|
IEC 60870-5-103 and IEC60870-5-101 and Modbus RTU (user selectable setting)												1-4	3		|	|	|	|
IEC 60870-5-103 and IEC60870-5-101 and Modbus RTU and DNP 3.0 (user selectable setting) and IEC61850												7-8	8		|	|	|	|
															|	|	|	|
Spare															13	|	|	|

Product Description	Order No.					
			0	|	|	|
				|	|	|
Protection Function Packages				14	|	|
Standard version - included in all models				C	|	|
21FL Fault Locator					|	|
27/59 Under/overvoltage					|	|
27/59 Under/overvoltage, Sag/swell					|	|
37 Undercurrent					|	|
46BC Broken conductor/load unbalance					|	|
46NPS Negative phase sequence overcurrent					|	|
47NPS Negative phase sequence overvoltage					|	|
49 Thermal overload					|	|
50BF Circuit breaker fail					|	|
51V Voltage dependent overcurrent					|	|
59N Neutral voltage displacement					|	|
60CTS CT supervision					|	|
60VTS VT supervision					|	|
67/50 Directional instantaneous phase fault overcurrent					|	|
67/50G Directional instantaneous earth fault					|	|
67/51 Directional time delayed phase fault overcurrent					|	|
67/51G Directional time delayed earth fault					|	|
67/50HIZ Directional instantaneous sensitive earth fault					|	|
67/51HIZ Directional time delayed sensitive earth fault					|	|
74TC Trip circuit supervision					|	|
74BF Circuit breaker close fail					|	|
79 Autoreclose					|	|
81 Under/overfrequency					|	|
81HBL2 Inrush restraint					|	|
86 Lockout					|	|
Battery and capacitor test					|	|
Cold load pickup					|	|
Programmable logic					|	|
					|	|
Standard version - plus	2-4	3		D	A	|
27/59 Under/overvoltage					|	|
60VTS VT supervision					|	|
Loop automation by loss of voltage					|	|
					|	|
Standard version - plus	6-8			E	A	|
Single/triple pole autoreclose					|	|
					|	|
Additional Functionality					15	|
No Additional Functionality					A	|
25 Synchronising, synchronising check				C	D	|
						|
Settings File						16
Standard settings and standard labels for Siemens Recloser						0

2.4

7SR23 High Impedance Circulating Current Relay

[Reyrolle Product Catalogue, 7SR23, 1, –_–]

Figure 2.4/22 7SR23 DAD fascia

Description

The 7SR23 DAD provides comprehensive, configurable high impedance protections with enhanced functionality and performance. Relay functionality is accessed via a familiar user friendly interface.

Housed in 4U high, size E6 or E8 cases, these relays provide protection, control, monitoring, instrumentation and metering with integrated input and output logic, data logging & fault reports. Communication access to relay functionality is via a front USB port for local PC connection or rear electrical RS485 port for remote connection.

Additional rear port options are available.

Function Overview

Protection

50G	Instantaneous/DTL Earth Fault
87REF	High Impedance REF
87/50	Phase Segregated Differential Protection

Supervision

CT50	CT Supervision
74TCS	Trip Circuit Supervision

Control

86	Lockout

Features

Password Protection – 2 levels
User Programmable Logic Equations, via HMI
Graphical Programmable Logic, via PC application
Self Monitoring

User Interface

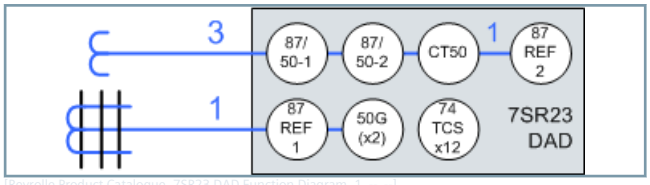
20 character x 4 line backlit LCD
Menu navigation keys
3 fixed function LEDs
8 or 16 Programmable Tri-colour LEDs (Option)

Monitoring Functions

Standard Monitoring Functionality

Primary differential current phases and earth
Secondary differential current phases and earth
Binary Input/Output status
Trip circuit healthy/failure
Time and date
Starters
Fault records
Event records
Waveform records

Description of Functionality



[Reyrolle Product Catalogue, 7SR23 DAD Function Diagram, 1, –_–]

Figure 2.4/23 7SR DAD Function Diagram

The figure above illustrates the functionality available within the 7SR23. The relay can be configured to provide the following modes of operation:

- 3 Pole Diff + REF
- 3 Pole Diff + EF
- REF1 + REF2

87/50 Differential Protection - scheme

Two sets of differential protection are provided, 87/50-1 and 87/50-2.

Current inputs can be connected to provide overall phase segregated high impedance differential protection. External series stabilising resistors and non-linear, voltage limiting, shunt resistors are required for each phase. To facilitate ordering, installation and commissioning these external components can be provided in a separate optional 'High Impedance Component Box'. See separate publication. Output contacts of the relay are configured to trip the connected CBs and to short circuit the

series stabilising resistors thereby ensuring that thermal ratings of the components are not exceeded.

CT50 CT Supervision

The CT Supervision feature measures the unbalance current in the CT circuits. Any unbalance current may indicate an open circuit in the CT secondary connections.

The phase segregated elements have user selectable operate current and time delay settings. This allows the faulted phase(s) to be short circuited and/or alarmed.

50G Earth Fault

Earth current is directly measured current from an independent CT or the residual connection of the 3 line CTs (Holmgreen connection).

Elements have independent settings for pickup current, and time-delay.

87REF Restricted Earth Fault - scheme

Analogue inputs can be connected and configured to provide one or two high impedance restricted earth fault protections (87 REF).

Each 87REF protection requires an external series stabilising resistor and non-linear shunt resistor.

In/Out Switching

When the protection is selected to 'Switched Out' the 87/50 functions are inhibited, trip contacts are disabled and contacts selected to the CT50 and 'Switched Out' functions are energized.

74TCS Trip Circuit Supervision

The trip circuits can be monitored via binary inputs connected in H4/H5/H6 or H7 schemes. Trip circuit failure raises an HMI alarm and output(s).

Programmable User Logic

The user can map Binary Inputs and Protection operated outputs to Function Inhibits, Logic Inputs, LEDs and/or Binary Outputs.

The user can also enter up to 16 equations defining scheme logic using standard functions e.g. Timers, AND/OR gates, Inverters and Counters.

Each Protection element output can be used for Alarm/Indication and/or tripping. In addition, the Reydisp Manager PC application provides graphical programming of user logic within the device.

Function LED's

Eight or sixteen user programmable tri-colour LED's are provided eliminating the need for separate panel mounted indicators and associated wiring. Each LED can be user set to red, green or yellow allowing for indication of the associated function's status. A slip-in pocket adjacent to the LEDs enables the user to insert customised labels. A printer compatible template is available.

Application

3 phase high impedance differential protection is typically applied to busbars, connections, auto-transformers, reactors and motors. Restricted earth fault protection is typically applied to provide protection of transformer windings.

High impedance protection is recommended for all applications where faults must be cleared in the shortest possible time and where discrimination must be ensured. High impedance schemes can provide lower fault settings and better through fault stability than is possible with most other schemes.

The stability of the high impedance scheme is ensured because the applied operate voltage setting is greater than the maximum voltage that can appear across the relay circuit under through fault conditions. An external series stabilising resistor (RSTAB) is installed to provide a relay circuit operate voltage is above that required to guarantee stability.

External non-linear resistors (Metrosils) are connected in parallel with the relay circuit to limit circuit over-voltages.

The relay current setting and the operating voltage of the relay/stabilising resistor combination is calculated taking into account:-

- Transient stability under through fault conditions as verified by calculation assuming worst case conditions.
- The required operate level for internal fault conditions

It is recommended that low reactance CTs to IEC 61869-2 Class PX are used.

The CT supervision function (CT50) provides monitoring of CT secondary wiring connections.

CT supervision commonly supplements 3-phase differential protection as a fault in the CT secondary circuit wiring will cause unbalance current to flow during normal load conditions. Where the unbalance current is above the protection operate level this will cause unnecessary tripping of the protected zone. This is particularly relevant where current transformer wiring is switched as in some busbar protection arrangements.

Detection of a CT secondary wiring fault is arranged to provide an alarm and/or inhibit the differential protection (87/50) after a time delay. The time delay is required such that the CT supervision function does not operate during internal fault conditions.

Theory of High Impedance Current Balance Protective Schemes and their Application

Determination of Stability

The stability of a current balance scheme using a high impedance relay circuit depends upon the relay voltage setting being greater than the maximum voltage which can appear across the relay during a through fault condition. This maximum voltage can be determined by means of a simple calculation which makes the following assumptions: One current transformer is fully saturated making its excitation impedance negligible.

The resistance of the secondary winding of the saturated current transformer together with the leads connecting it to the relay circuit terminals constitute the only burden in parallel with the relay.

The remaining current transformers maintain their ratio.

Thus the maximum voltage is given by:

$$V = I_F \left(R_{CT} + R_L \right) \times T$$

[Reyrolle Product Catalogue, 7SR23 Determination of Stability, 1, -_-]

Where:

- V = Maximum voltage across relay circuit during through fault conditions.
- R_L = Resistance current transformer connection leads.
- R_{CT} = Current transformer secondary winding resistance
- I_F = Maximum steady state through fault current.
- T = Turns ratio of all current transformers (Primary turns / secondary turns)

For stability, the voltage setting of the relay V_S must be made equal to or exceed, the highest value of V calculated above.

Experience and extensive laboratory tests have proved that if this method of estimating the relay setting voltage is adopted, the stability of the protection will be very much greater than the value of I used in the calculation. This is because a current transformer is normally not continuously saturated and consequently any voltage generated by this current transformer will reduce the voltage appearing across the relay circuit.

Method of Establishing Relay Setting Current

Relay setting current is given by:

$$I_S = P.O.C - \left(\sum I_{mag} + I_{NLR}\right) / T$$

[Reyrolle Product Catalogue, 7SR23 Method of Establishing Relay Setting Current, 1, --_--]

Where:

- I_S = Relay setting current
- P.O.C. = Primary operate current (fault setting).
- I_{mag} = Current transformer magnetising currents at the value of VS.
- I_{NLR} = Current taken by the non-linear resistor/voltage limiting device at VS (this value is usually small and often may be neglected).

The above equation should properly be the vector sum, however arithmetic addition is normally used.

Establishing the Value of Setting Resistors

Stabilising resistor value RSTAB is given by:

$$R_{STAB} = \frac{V_S}{I_S}$$

[Reyrolle Product Catalogue, 7SR23 Establishing the Value of Setting Resistors, 1, --_--]

Where:

- V_s = Relay circuit operate voltage

Exact resistor values are not necessary, a higher standard resistance value may be chosen. A check is made to confirm that the finalized value of Vs provides stability and is compatible with the installed CTs ie:

- $V < V_s < 0.5V$ x CT knee point voltage

The required watt-second rating of the resistor is established at setting and at the maximum fault rating – short time rating. The power dissipation of the resistors should be considered, they should be mounted vertically in a well ventilated location and clear of all other wiring and equipment.

Technical Data

For full technical data refer to the Performance Specification Section of the Technical Manual.

Inputs and Outputs

Current Inputs

Quantity	4
Rated Current I_n	1/5 A
Measuring Range	80 x I_n max
Instrumentation	±1 % I_n or ±10 mA
Frequency	50/60 Hz
Thermal Withstand: Continuous 1 Second	4.0 x I_n 100 A (1 A) 350 A (5 A)
Burden @ I_n	≤ 0.1 VA (1 A input) ≤ 0.3 VA (5 A input)

Auxiliary Supply

Rated DC Voltage	24-250 V DC Operating Range 19.2 to 275 V	
Allowable superimposed ac component	12 % of DC voltage	
Rated AC Voltage	100-230 VAC 50/60Hz Range 80 to 253 V_{RMS} AC 50/60Hz ±5 %	
Power Consumption:	Quiescent State (DC) Maximum Load (DC)	24 V: 8 W 110 V: 7 W 250 V: 7 W 24 V: 12 W 110 V: 11 W 250 V: 11 W
	Quiescent State(AC) Maximum Load (AC)	100 V: 16 VA 230 V: 21 VA 100 V: 23 VA 230 V: 30 VA
Allowable breaks/ dips in supply (collapse to zero)	DC	50 ms
	AC	2.5/3 cycles @50/60Hz

Binary Inputs

Operating Voltage	19 V dc: Range 17 to 290 V dc 88 V: Range 74 to 290 V dc
Maximum dc current for operation	1.5 mA

Binary Outputs

Operating Voltage	Voltage Free
Operating Mode	User selectable - Self or Hand Reset
Contact Operate / Release Time.	7 ms / 3 ms

Making Capacity: Carry continuously Make and carry (L/R ≤ 40 ms and V ≤ 300 V)	5 A ac or dc 20 A ac or dc for 0.5 s 30 A ac or dc for 0.2 s
Breaking Capacity: (≤ 5 A and ≤ 300 V): AC Resistive AC Inductive DC Resistive DC Inductive	1250 VA 250 VA at p.f. ≤ 0.4 75 W 30 W at L/R ≤ 40 ms 50 W at L/R ≤ 10 ms

Mechanical Tests

Vibration (Sinusoidal)

IEC 60255-21-1 Class I

Type	Level	Variation
Vibration response	0.5 gn	≤ 5 %
Vibration endurance	1.0 gn	≤ 5 %

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	≤ 5 %
Bump test	10 gn, 16 ms	≤ 5 %

Seismic

IEC 60255-21-3 Class I

Type	Level	Variation
Seismic response	1 gn	≤ 5 %

Mechanical Classification

Durability	>10^6 operations

Electrical Tests

Insulation

IEC 60255-5

Type	Level
Between any terminal and earth	2.0 kV AC RMS for 1 min
Between independent circuits	
Across normally open contacts	1.0 kV AC RMS for 1 min

High Frequency Disturbance

IEC 60255-22-1 Class III

Type	Level	Variation
Case, Aux Power & I/O. Common mode	2.5 kV	≤ 10 %
Case, Aux Power & I/O. Transverse mode	1.0 kV	≤ 10 %
RS485 Comms	1.0 kV	No data loss

Electrostatic Discharge

IEC 60255-22-2 Class IV

Type	Level	Variation
Contact discharge	8.0 kV	≤ 5 %

Electrical Fast Transient / Burst Immunity

IEC 60255-22-4 Class A (2002)

Type	Level	Variation
Case, Aux Power & I/O	4 kV	≤ 10 %
RS485 Comms	2 kV	No data loss

Surge Immunity

IEC 60255-22-5

Type	Level	Variation
Analog Inputs. Line to Earth	4.0 kV	≤ 10 %
Case, Aux Power & I/O. Line to Earth	2.0 kV	≤ 10 %
Analog Inputs. Line to Line	1.0 kV	≤ 10 %
Case, Aux Power & I/O. Line to Line	1.0 kV*	≤ 10 %
RS485 Comms port. Line to Earth	1.0 kV	No data loss

NOTE

* 45ms pick up delay applied to binary inputs

Conducted Radio Frequency Interference

IEC 60255-22-6

Type	Level	Variation
0.15 to 80 MHz	10 V	≤ 5 %

Radiated Radio Frequency

IEC 60255-25

Type	Limits at 10 m, Quasi-peak
30 to 230 MHz	40 dB(µV)
230 to 10000 MHz	47 dB(µV)

Conducted Radio Frequency

IEC 60255-25

Type	Limits	
	Quasi-peak	Average
0.15 to 0.5 MHz	79 dB(µV)	66 dB(µV)
0.5 to 30 MHz	73 dB(µV)	60 dB(µV)

Radiated Immunity

IEC 60255-22-3 Class III

Type	Level	Variation
80 MHz to 1000 MHz	10 V/m	≤ 5 %

Magnetic Field with Power Frequency

IEC 61000-4-8, Class V

Type	Level
100A/m (0.126mT) continuous	50Hz
1000A/m (1.26mT) for 3 s	

Environmental Tests

Temperature

IEC 60068-2-1/2

Operating Range	-10°C to + 55°C
Storage Range	- 25°C to + 70°C

Humidity

IEC 60068-2-78

Operational test	56 days at 40°C and 95 % relative humidity

IP Ratings

IEC 60529

Type	Level
Installed with cover	IP 51 from front of relay
Installed with cover removed	IP 20 from front of relay

Performance

87/50 Differential Protection

Setting Range	0.01...2.00 x I_n
Operate Level	100 % I_s, ±5 % or ±1 % x I_n
Time Delay	0.00... 60 s
Basic Operate Time	2 x I_s: 22 ms ± 5 ms, 50Hz 2 x I_s: 20 ms ± 5 ms, 60Hz 3 x I_s: 1 cycle ± 5 ms 5 x I_s: < 1 cycle
Reset Time	< 50 ms
Harmonic Rejection	40:1 minimum (2nd to 15th harmonic)
Inhibited by	CT50, Binary or Virtual Input

CT50 CT Supervision

Setting Range	0.005...2.00 x I_n
Operate Level	100 % I_s, ±5 % or ±1 % x I_n
Time Delay	0.00... 60 s
Basic Operate Time	2 x I_s: 22 ms ± 5 ms, 50Hz 2 x I_s: 20 ms ± 5 ms, 60Hz 3 x I_s: 1 cycle ± 5 ms 5 x I_s: < 1 cycle
Inhibited by	Binary or Virtual Input

87REF Restricted Earth Fault

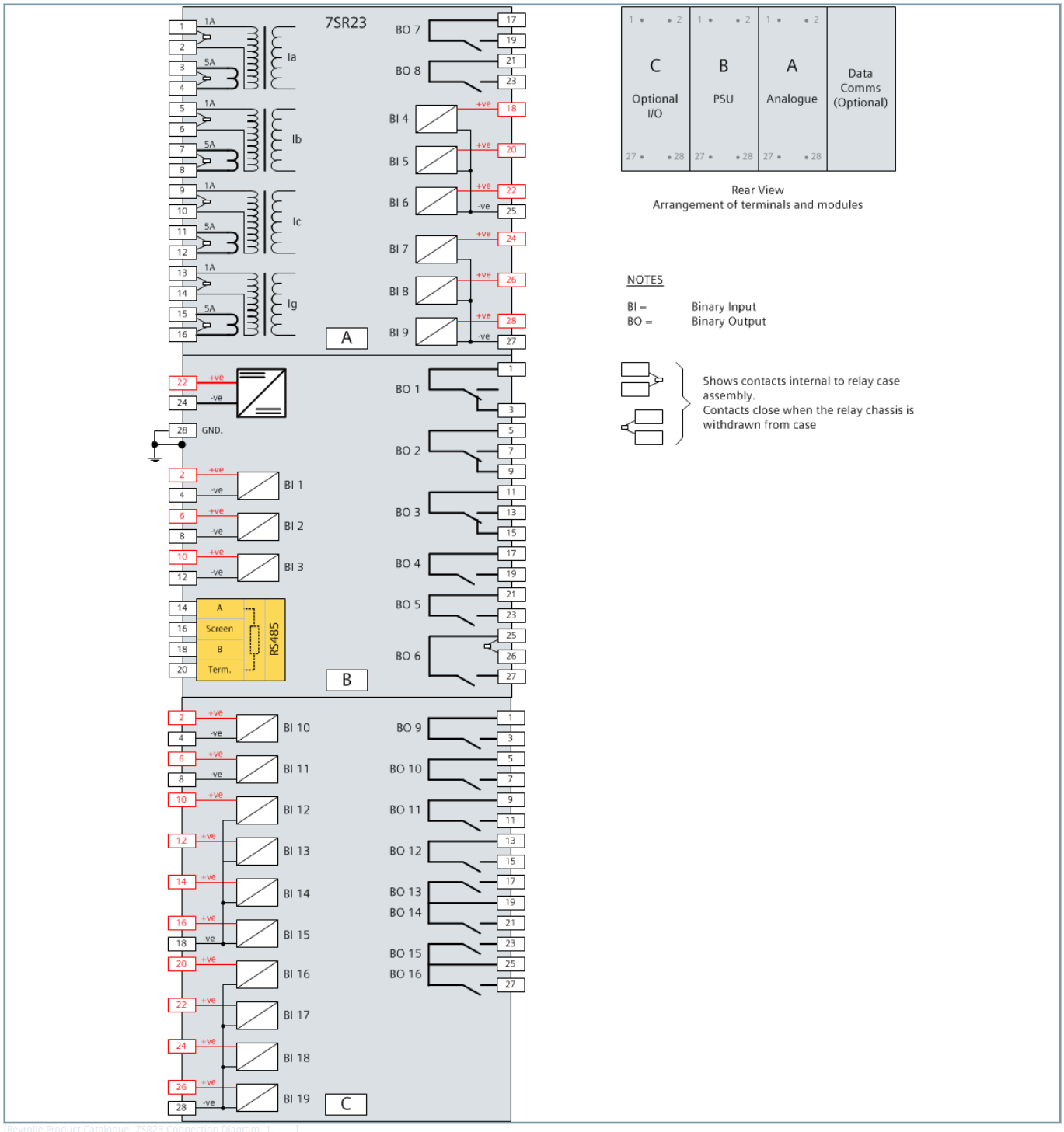
Setting Range	0.01...2.00 x I_n
Operate Level	100 % I_s, ±5 % or ±1 % x I_n
Time Delay	0.00... 60 s
Basic Operate Time	2 x I_s: 22 ms ± 5 ms, 50Hz 2 x I_s: 20 ms ± 5 ms, 60Hz 3 x I_s: 1 cycle ± 5 ms 5 x I_s: < 1 cycle
Reset Time	< 50 ms
Harmonic Rejection	40:1 minimum (2nd to 15th harmonic)
Inhibited by	Binary or Virtual Input

50G Instantaneous & DTL Measured EF

Elements	Measured Earth
Number of Elements	2
Setting Range I_s: - Measured E/F'G'	0.01...2.00 x I_n
Time Delay	0.00... 60 s
Operate Level	100 % I_s, ±5 % or ±1 % x I_n
Operate Time	2 x I_s: 22 ms ± 5 ms, 50Hz 2 x I_s: 20 ms ± 5 ms, 60Hz 3 x I_s: 1 cycle ± 5 ms 5 x I_s: < 1 cycle
Operate time following delay	t_{basic} +t_{delay} , ±1 % or ±10 ms
Inhibited by	Binary or Virtual Input

7SR23 Connection Diagram

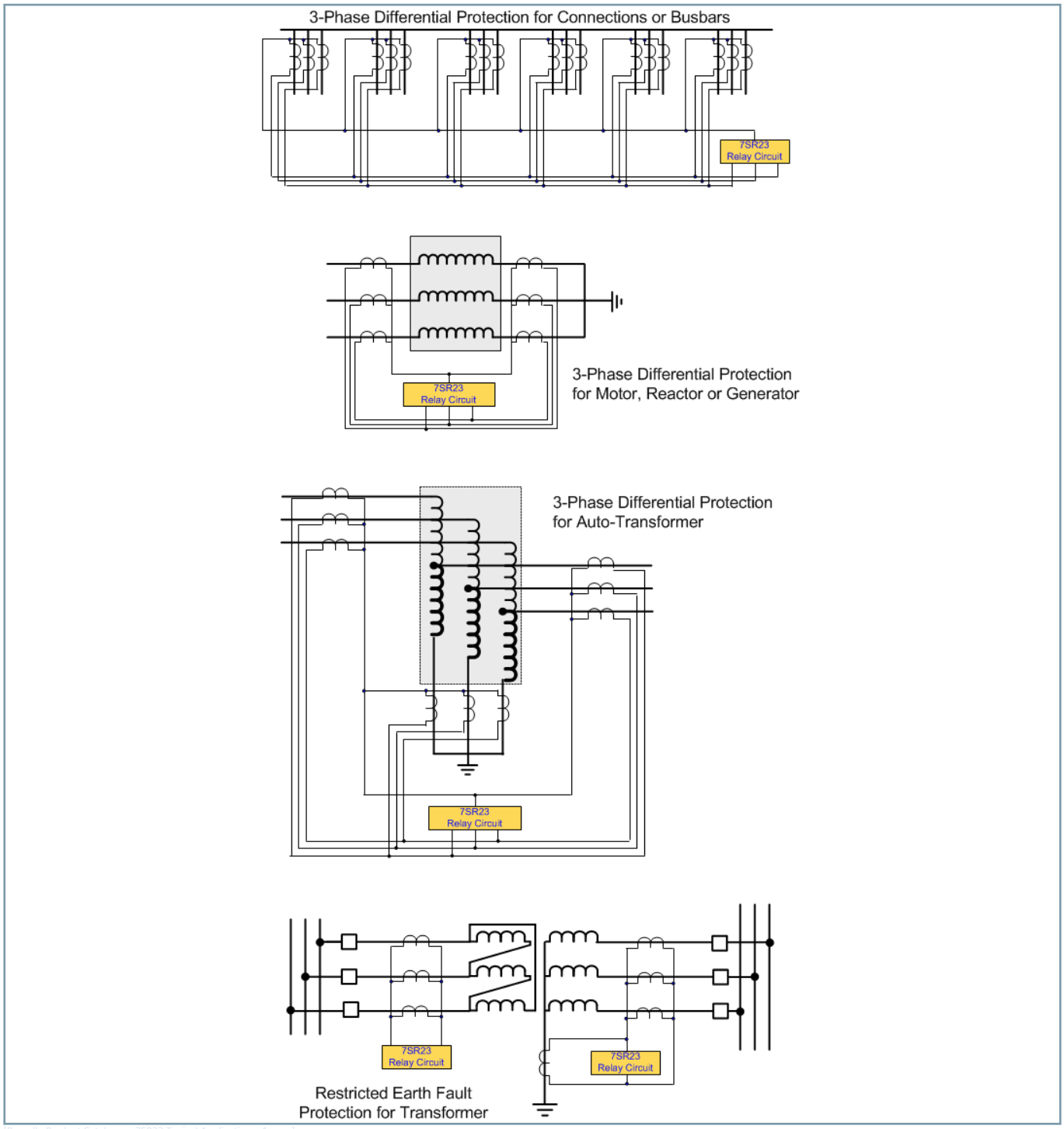
7SR DAD Connection Diagram



[Reyrolle Product Catalogue, 7SR23 Connection Diagram, 1, -_-]

Figure 2.4/24 7SR DAD Wiring Diagram

Typical Applications



[Reyrolle Product Catalogue, 7SR23 Typical Applications, 1, -_-]

Figure 2.4/25 Typical Applications for the 7SR23 DAD

Ordering Information - 7SR23 DAD High Impedance Relay

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	16	18
High Impedance Relay	7	S	R	2	3	0	□	-	1	□	A	□	□	-	0	C	A	0
					|	|	|		|	|		|	|			|		
Protection Product					|	|	|		|	|		|	|			|		
Circulating Current					3	0	|		|	|		|	|			|		
						|	|		|	|		|	|			|		
Case I/O and Fascia [1]							|		|	|		|	|			|		
4 CT, 9BI, 8 BO, 8 LEDs E6 Case [1]							2		|	|		|	|			|		
4 CT, 19 BI, 16 BO, 16 LEDs E8 Case [1]							3		|	|		|	|			|		
									|	|		|	|			|		
Measuring Input									|	|		|	|			|		
1/5 A, 50/60Hz									1	|		|	|			|		
										|		|	|			|		
Auxiliary Voltage										|		|	|			|		
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		|	|			|		
												|	|			|		
Communication Interface												|	|			|		
Standard version – included in all models, USB front port, RS485 rear port												1	2				|		
Standard version - plus additional rear F/O ST connectors (x2) and IRIG-B												2	2				|		
Standard version - plus additional rear RS485 and IRIG-B												3	2				|		
Standard version - plus additional rear RS232 and IRIG-B												4	2				|		
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 and DNP 3.0 (user selectable setting)													2				|		
IEC 60870-5-103 and Modbus RTU and DNP 3.0 (user selectable) and IEC 61850													7				|		
																	|		
Protection Function Packages																	|		
50G Measured Earth Fault Protection																	C		
87/50 Phase Segregated High Impedance Differential Protection																			
87REF High Impedance Restricted Earth Fault Protection																			
CT50 CT Supervision																			
74TCS																			
Programmable logic																			

NOTE

1) BI = Binary Input, BO = Binary Output

2.4

7SR242 Transformer Protection Relay

[Reyrolle Product Catalogue, 7SR242, 1, –_–]

Description

Our new generation of integrated transformer protection relays are designated the 7SR24 series. The relays utilise years of numeric relay protection experience with the 'Duobias' family of products.

Housed in 4U high, size E8, E10 or E12 cases, these relays provide protection, control, monitoring, instrumentation and metering with integrated input and output logic, data logging & fault reports. Communication access to relay functionality is via a front USB port for local PC connection or rear electrical RS485 port for remote connection. Additional rear port options are available.

Function Overview

Standard Functionality

50BF	Circuit Breaker Fail
64H	High Impedance REF
74TCS/CCS	Trip/Close Circuit Supervision
81HBL2	Inrush Detector
81HBL5	Overfluxing Detector
87BD	Biased Differential (2Windings)
87HS	Current Differential High-Set
8 Settings Groups	
Password Protection - 2 levels	
User Programmable Logic Equations, via HMI	
Graphical Programmable Logic, via pc application	
Self Monitoring	

Optional Functionality

24	Over-Fluxing
27/59	Under/Over Voltage
37/37G	Undercurrent
46BC	Open Circuit
46NPS	Negative Phase Sequence Overcurrent
49	Thermal Overload
50	Instantaneous Overcurrent
50G/N	Instantaneous Earth Fault
51	Time Delayed Overcurrent
51G/N	Time Delayed Measured Earth Fault /SEF
59N	Neutral Voltage Displacement
81	Under/Over Frequency

User Interface

20 character x 4 line backlit LCD
Menu navigation keys
3 fixed LEDs
16, 24 or 32 Programmable Tri-colour LEDs (Option)

Monitoring Functions

Primary current phases and earth
Secondary current phases and earth
Relay Operate and restraint currents
Positive Phase Sequence (PPS) Current
Negative Phase Sequence (NPS) Current
Zero Phase Sequence (ZPS) Current
Thermal status
Primary Single phase voltage*
Secondary single phase voltage*
Data logging and Demand Metering
Frequency & fluxing*
Binary Input/binary output and virtual I/O status
Trip circuit healthy/failure
Time and date
Fault records
Event records
Waveform records
Circuit breaker trip counters
I^2t summation for contact wear

NOTE

* Optional voltage measurements from single phase VT input

Description of Functionality

50BF Circuit Breaker Fail

The circuit breaker fail function may be triggered from an internal trip signal or from a binary input. Line and neutral currents are monitored following a trip signal and an output is issued if any current is still detected after a specified time interval. Alternatively, if the trip is from a mechanical protection the circuit breaker position can be used to determine a failure. A second time delay is available to enable another stage to be utilized if required. An input is also available to bypass the time delays when the circuit breaker is known to be faulty.

64H Restricted Earth Fault - scheme

The measured earth fault input may be used in a high impedance restricted earth fault scheme. Required external series stabilising resistor and non-linear voltage limiting shunt resistor can be supplied.

74TCS/CCS Trip/Close Circuit Supervision

The trip and close circuit(s) can be monitored via binary inputs. Circuit failure raises an HMI alarm and output(s).

81HBL2 Inrush Detector

Where second harmonic current is detected (i.e. during transformer energisation) user selectable elements can be blocked.

81HBL5 Overfluxing Detector

Fifth Harmonic Detectors can be user selected to block the Biased Differential Elements.

87BD Biased Differential

The differential characteristic incorporates two bias stages – the first stage for steady state errors i.e. tap position and CT ratios the second stage for transient errors i.e. CT saturation.

87HS High-Set Differential

High speed differential elements provide protection against high levels of internal fault current.

Programmable Logic

The user can map Binary Inputs and Protection operated outputs to Function Inhibits, Logic Inputs, LEDs and/or Binary Outputs.

The user can also enter up to 16 equations defining scheme logic using standard functions e.g. Timers, Latches, AND/OR gates, Inverters and Counters.

Each Protection element output can be used for Alarm & Indication and/or tripping.

In addition, the Reydisp Manager PC application provides graphical programming of user logic within the device.

Circuit Breaker Maintenance

For each winding two circuit breaker operations counters are provided. The Maintenance Counter records the overall number of operations and the Delta Counter the number of operations since the last reset.

I^2t summation Counters provide a measure of the contact wear indicating the total energy interrupted by the circuit breaker contacts.

Each counter has a user set target operations count which, when reached, can be mapped to raise Alarms/ Binary Outputs.

These counters assist with maintenance scheduling.

Function LED's

16 or 24 user programmable tri-colour LED's are provided eliminating the need for expensive panel mounted pilot lights and associated wiring. Each LED can be user set to red, green or yellow allowing for clear indication of the associated function's state. A slip-in label pocket along-side enables the user to insert his own notation. A printer compatible template is available.

[Reyrolle Product Catalogue, 7SR242 Tri-colour LED's, 1, –,–]

Figure 2.4/26 Tri-colour LED's

Optional Functionality

24 Over-Fluxing

Two elements each provide a definite time lag (DTL) characteristic, the third element provides a user defined characteristic. Operates if Volts/Hertz ratio is above setting for duration of delay.

27/59 Under/Over Voltage

Each element has settings for pickup level, drop-off level and Definite Time Lag (DTL) delays. Operates if voltage 'exceeds' setting for duration of delay. This function can be used within load shedding schemes.

37/37G Undercurrent

Each element has settings for pickup level and Definite Time Lag (DTL) delays. Operates if current falls below setting for duration of delay.

46NPS Negative Phase Sequence Overcurrent

Two DTL and two inverse/DTL elements are provided. NPS Current elements can be used to detect unbalances on the system or remote earth faults when a delta-star transformer is in circuit.

46BC Open Circuit

Each element has settings for pickup level and DTL delay. With the circuit breaker closed, if the NPS:PPS current ratio is above setting this could be due to an open circuit.

49 Thermal Overload

The thermal algorithm calculates the thermal states from the measured line currents. Outputs are available for thermal overload and thermal capacity.

50/51 Phase Fault

50 INST/DTL and 51 IDMTL/DTL elements provide overcurrent protection, each with independent settings for pickup current, time-multiplier (51) and time-delays. IEC, ANSI or user defined Time Current Characteristics can be selected. The IDMT stage has a user programmable DTL or shaped current/time reset char-

acteristic, to improve grading with electromechanical protection.

50G/51G/50N/51N Earth Fault

Two earth fault measurement modes are available. One mode directly measures the earth current from an independent CT, or the residual connection of the 3 line CTs (50G/51G). The second mode derives the earth current internally from the 3 phase CTs (50N/51N). 50 INST/DTL and 51 IDMTL/DTL elements provide overcurrent protection, each with independent settings for pickup current, time-multiplier (51) and time-delays. IEC, ANSI or user defined Time Current Characteristics can be selected.. The IDMT stage has a user programmable reset characteristic either DTL or shaped current/time reset characteristic to improve grading with electromechanical protection.

59N Neutral Overvoltage

One element provides a definite time lag (DTL) characteristic; the second element provides an inverse/DTL characteristic. Operates if Neutral voltage exceeds setting for duration of delay. Neutral overvoltage can be used to detect earth faults in high impedance earthed or isolated systems.

81 Under/Overfrequency

Each element has settings for pickup level, drop-off level and Definite Time Lag (DTL) delays. Each element operates if frequency exceeds setting for duration of delay. Typically applied in load shedding schemes.

Technical Data

For full technical data refer to the Performance Specification Chapter of the Technical Manual.

Inputs and Outputs

Current Inputs

Quantity	6 x Phase & 2 x Earth
Rated Current I_n	1/5 A
Measuring Range	80 x I_n
Instrumentation ≥ 0.1 x I_n	±1 % I_n
Frequency	50/60 Hz
Thermal Withstand: Continuous 10 Minutes 5 Minutes 3 Minutes 2 Minutes 3 Seconds 2 Seconds 1 Second 1 Cycle	 3.0 x I_n 3.5 x I_n 4.0 x I_n 5.0 x I_n 6.0 x I_n 57.7 A (1 A) 202 A (5 A) 70.7 A (1 A) 247 A (5 A) 100 A (1 A) 350 A (5 A) 700 A (1 A) 2500 A (5 A)
Burden @ I_n	≤ 0.1 VA (1 A phase and Earth element) ≤ 0.3 VA (5 A phase and earth element)

Voltage Inputs

Quantity	1 (optional)
Nominal Voltage	40...160 V a.c.
Instrumentation ≥ 0.8 x V_n	±1 % V_n
Thermal Withstand: Continuous 1 Second	300 V
Burden @ 110 V	≤ 0.1 VA

Auxiliary Supply

Nominal Voltage	Operating Range
24 - 250 V dc	19.2 - 275 V dc
100 - 230 V ac	80 - 253 V ac

Nominal Voltage	Quiescent Burden (typical)	Quiescent Burden (back-light)
24 V dc	6.0 W	7.4 W
48 V dc	5.8 W	7.1 W
60 V dc	5.8 W	7.0 W
110 V dc	6.5 W	7.5 W
125 V dc	5.4 W	1.2 W
220 V dc	5.2 W	6.4 W
250 V dc	5.2 W	6.4 W
100 V ac	13.4 VA	15.9 VA
110 V ac	13.7 VA	16.2 VA
115 V ac	13.7 VA	16.2 VA
120 V ac	14.0 VA	16.6 VA
200 V ac	16.0 VA	19.0 VA
230 V ac	17.0 VA	20.2 VA

Allowable superimposed ac component	≤ 12 % of dc voltage
Allowable breaks/dips in supply (collapse to zero from nominal voltage)	≤ 20 ms

Binary Inputs

Operating Voltage	19 V dc: Range 17 to 290 V dc 88 V dc: Range 74 to 290 V dc
Maximum dc current for operation	1.5 mA

Binary Outputs

Operating Voltage	Voltage Free
Operating Mode	User selectable - Self or Hand Reset
Contact Operate / Release Time.	7 ms / 3 ms

Making Capacity: Carry continuously Make and carry (L/R ≤ 40 ms and V ≤ 300 V)	5 A ac or dc 20 A ac or dc for 0.5 s 30 A ac or dc for 0.2 s
Breaking Capacity: (≤ 5 A and ≤ 300 V): AC Resistive AC Inductive DC Resistive DC Inductive	1250 VA 250 VA at p.f. ≤ 0.4 75 W 30 W at L/R ≤ 40 ms 50 W at L/R ≤ 10 ms

Mechanical Tests

Vibration (Sinusoidal)

IEC 60255-21-1 Class I

Type	Level	Variation
Vibration response	0.5 gn	≤ 5 %
Vibration endurance	1.0 gn	≤ 5 %

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	≤ 5 %
Bump test	10 gn, 16 ms	≤ 5 %

Seismic

IEC 60255-21-3 Class I

Type	Level	Variation
Seismic response	1 gn	≤ 5 %

Mechanical Classification

Durability	>10^6 operations

Electrical Tests

Insulation

IEC 60255-5

Type	Level
Between any terminal and earth	2.0 kV AC RMS for 1 min
Between independent circuits	2.0 kV AC RMS for 1 min
Across normally open contacts	1.0 kV AC RMS for 1 min

Transient Overvoltage

IEC 60255-5

Between all terminals and earth or between any two independent circuits	5 kV 1.2/50 µs 0.5 J

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	≤ 5 %

Electrostatic Discharge

IEC 60255-22-2 Class IV

Type	Level	Variation
Contact discharge	8.0 kV	≤ 5 %

Fast Transients

IEC 60255-22- 4 Class IV

Type	Level	Variation
5/50 ns 2.5 kHz repetitive	4 kV	≤ 5 %

Surge Immunity

IEC 60255-22-5

Type	Level	Variation
Between all terminals and earth	4.0 kV	≤ 10 %
Between any two independent circuits	2.0 kV	≤ 10 %

Conducted Radio Frequency Interference

IEC 60255-22-6

Type	Level	Variation
0.15 to 80 MHz	10 V	≤ 5 %

Radiated Radio Frequency

IEC 60255-25

Type	Limits at 10 m, Quasi-peak
30 to 230 MHz	40 dB(µV)
230 to 10000 MHz	47 dB(µV)

Conducted Radio Frequency

Type	Limits	
	Quasi-peak	Average
0.15 to 0.5 MHz	79 dB(µV)	66 dB(µV)
0.5 to 30 MHz	73 dB(µV)	60 dB(µV)

Radiated Immunity

IEC 60255-22-3 Class III

Type	Level	Variation
80 MHz to 1000 MHz	10 V/m	≤ 5%

Magnetic Field with Power Frequency

IEC 61000-4-8, Class V

100 A/m continuous	50Hz; 1.257mT
1000 A/m for 3 s	

Climatic Tests

Temperature

IEC 60068-2-1/2

Operating Range	-10°C to + 55°C
Storage Range	- 25°C to + 70°C

Humidity

IEC 60068-2-3

Operational test	56 days at 40°C and 93 % relative humidity

IP Ratings

Type	Level
Installed with cover	IP 51 from front of relay
Installed with cover removed	IP 20 from front of relay

Performance

27/59 Under/Over Voltage

Number of Elements	4 Under or Over
Setting Range V_s	5,5.5...200 V
Hysteresis Setting	0.0.1...80 %
V_s Operate Level	100 % V_s, ±1 % or ±0.25 V
Reset Level: Undervoltage Overvoltage	 =(100 %+hyst) x V_{op}, ±1 % or 0.25 V =(100 %-hyst) x V_{op}, ±1 % or 0.25 V
Delay Setting t_{delay}	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400 s
Basic Operate Time : - 0 to 1.1 x V_s 0 to 2.0 x V_s 1.1 to 0.5 x V_s	 73 ms ±10 ms 63 ms ±10 ms 58 ms ±10 ms
Operate time following delay.	t_{basic} +t_{delay} , ±1 % or ±10 ms
Inhibited by	Binary or Virtual Input U/V Guard

37,37G Undercurrent

Number of Elements	Phase (37) x 2 Earth (37G) x 2
Setting Range I_s	0.05,0.10...5.0 x I_n
Operate Level	100 % I_s, ±5 % or ±1 % x I_n
Delay Setting t_{delay}	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400 s
Basic Operate Time: 1.1 to 0.5 x I_s	35 ms ±10 ms
Operate time following delay.	t_{basic} +t_{delay} , ±1 % or ±10 ms
Overshoot Time	< 40 ms
Inhibited by	Binary or Virtual Input U/I Guard (37)

46 Negative Phase Sequence Overcurrent

Number of Elements	DT & IT
DT Setting Range I_s	0.05, 0.06...4.0 x I_n
DT Operate Level	100 % I_s, ±5 % or ±1 % x I_n
DT Delay Setting t_{delay}	0.00, 0.01...20, 20.5...100,101...1000, 1010...10000, 10100...14400 s
DT Basic Operate Time - 0 to 2 x I_s	40 ms ±10 ms
DT Operate time following delay	t_{basic} +t_{delay} , ±1 % or ±10 ms
IT Char Setting	IEC NI,VI,EI,LTI, ANSI MI,VI,EI & DTL
IT Setting Range	0.05, 0.06 ..2.5
Tm Time Multiplier	0.025, 0.050...1.6
Char Operate Level	105 % I_s, ±4 % or ±1 % x I_n
Overshoot Time	< 40 ms
Inhibited by	Binary or Virtual Input

49 Thermal Overload

Operate levels	Operate and Alarm
Setting Range I_s	0.10,0.11...3.0 x I_n
Operate Level	100 % I_s, ±5 % or ±1 % x I_n
Time Constant Setting	1,1.5...1000 min
Operate time	$t = \tau \times In\left\{\frac{I^2 - I_p^2}{I^2 - (k \times I_s)^2}\right\}$ ±5 % absolute or ±100 ms where Ip = prior current

Alarm Level	Disabled, 50,51...100 %
Inhibited by	Binary or Virtual Input

50 Instantaneous & DTL OC & EF

Elements	Phase (OC), Derived Earth (N) and Measured Earth (G)
Number of Elements	2 x OC 2 x Derived EF (N) 2 x Measured EF (G)
Setting Range I_s	0.05,0.06...50 x I_n (OC, N) 0.005...25 x I_n (G)
Time Delay	0.00...14400 s
Operate Level	100 % I_s, ±5 % or ±1 % x I_n
Operate time: 50, 50G 50N	0 to 2 x I_s – 35 ms, ±10 ms, 0 to 5 x I_s – 25 ms, ±10 ms 0 to 2 x I_s – 40 ms, ±10 ms, 0 to 5 x I_s – 30 ms, ±10 ms
Operate time following delay	t_{basic} +t_{delay} , ±1 % or ±10 ms
Inhibited by	Binary or Virtual Input Inrush detector

51 Time Delayed OC&EF

Elements	Phase (OC), Derived Earth (N) and Measured Earth (G)
Number of Elements	2 x OC 2 x Derived EF (N) 4 x Measured EF (G)
Characteristic	IEC NI,VI,EI,LTI ANSI MI,VI,EI & DTL
Setting Range I_s	0.05, 0.1...2.5 x I_n (OC, N) 0.005, 0.01...1.0 x I_n (G)
Time Multiplier	0.025,0.05...1.6
Time Delay	0,0.01... 20 s
Operate Level	105 % I_s, ±4 % or ±1 % x I_n
Minimum Operate time IEC ANSI	$t_{op} = \frac{K}{\left[\frac{I}{Is}\right]^{\alpha} - 1} \times Tm$ $t_{op} = \left[\frac{A}{\left[\frac{I}{Is}\right]^{P} - 1} + B\right] \times Tm$ ± 5 % absolute or ± 30 ms
Follower Delay	0 - 20 s
Reset	ANSI decaying, 0 - 60 s
Inhibited by	Binary or Virtual Input Inrush detector

50BF Circuit Breaker Fail

Operation	Current check
Setting Range I_s	0.05,0.055...2.0 x I_n (Phase) 0.005,0.010...2.0 x I_n (Earth)
2 Stage Time Delays	Timer 1 0,5...60000 ms Timer 2 0,5...60000 ms
Operate Level	100 % I_s, ±5 % or ±1 % x I_n
Basic Operate time	< 20 ms
Operate time following delay	t_{delay} ±1 % or ±10 ms
Triggered by	Any function mapped as trip contact
Inhibited by	Binary or Virtual Input

59N Neutral Voltage Displacement

Number of Elements	DT & IT
DT Setting Range I_s	1...100 V
DT Operate Level	100 % V_s, ±5 % or ±1 % x V_n
DT Delay Setting t_{delay}	0 ...14400 s
DT Basic Operate Time 0 V to 1.5 x V_s	76 ms ±20 ms
DT Operate time following delay.	t_{basic} +t_{delay} , ±1 % or ±20 ms
IT Setting Range	1...100 V
Tm Time Multiplier(IDMT)	0.1...140
Delay (DTL)	0...20 s
Reset	ANSI Decaying, 0...60 s
Char Operate Level	105 % V_s, ±2 % or ±0.5 V
Inhibited by	Binary or Virtual Input

64H Restricted Earth Fault

Setting Range	0.005...0.95 x I_n
Operate Level	100 % I_s, ±5 % or ±1 % x I_n
Time Delay	0.00... 14400 s
Basic Operate Time	0 to 2 x I_s 45 ms ±10 ms 0 to 5 x I_s 35 ms ±10 ms
Inhibited by	Binary or Virtual Input

74TCS Trip Circuit Supervision

Number of supervisable circuits	6
Number of BI's Required	1 or 2 per function

81 Under/Over Frequency

Number of Elements	6 Under or Over
Setting Range V_s	40 ... 69.99Hz
Hysteresis Setting	0. 0.1...80 %
V_s Operate Level	100 % F_s, ±10mHz

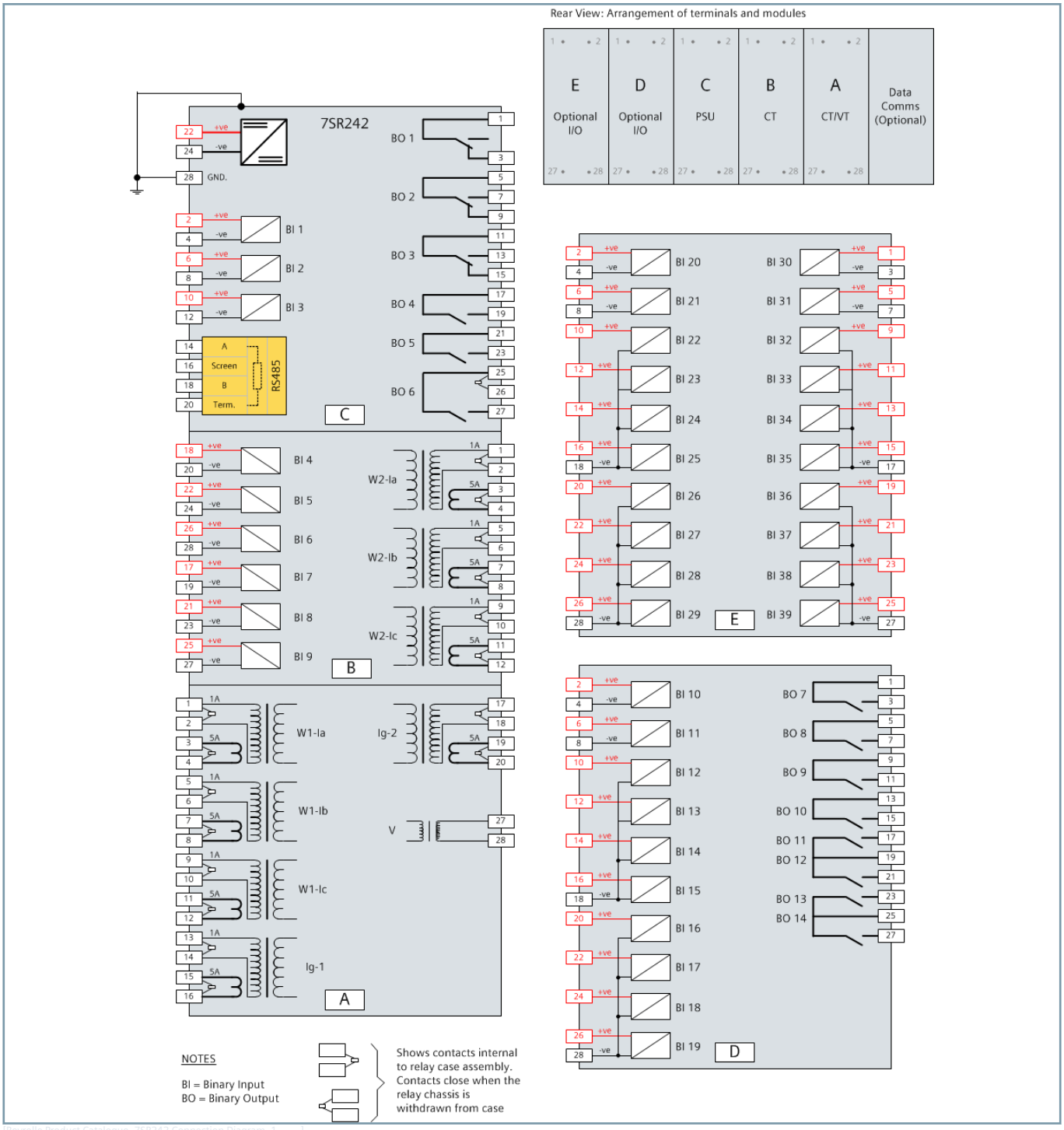
Reset Level: Over frequency Under frequency	(100 % - hyst) x F_{op}, ±10mHz (100 % + hyst) x F_{op}, ±10mHz
Delay Setting t_{delay}	0.00, 0.01...20, 20.5...100, 101...1000, 1010...10000, 10100...14400 s
Basic Operate Time : (for ROCOF between 0.1 and 5.0 Hz/sec)	Typically < 110 ms Maximum < 150 ms
Operate time following delay.	t_{basic} + t_{delay} , ±1 % or ±10 ms
Inhibited by	Binary or Virtual Input

87BD Biased Differential

Number of Elements	1
Setting Range Initial 1st Bias Slope 1st Bias Slope Limit 2nd Bias Slope 2nd Bias Slope Type	0.1, 0.15 ... 2 x I_n 0.1, 0.15 ... 0.7x 1, 2 ... 20 x I_n 1, 1.5 ... 2x Line, curve

7SR24 Connection Diagram

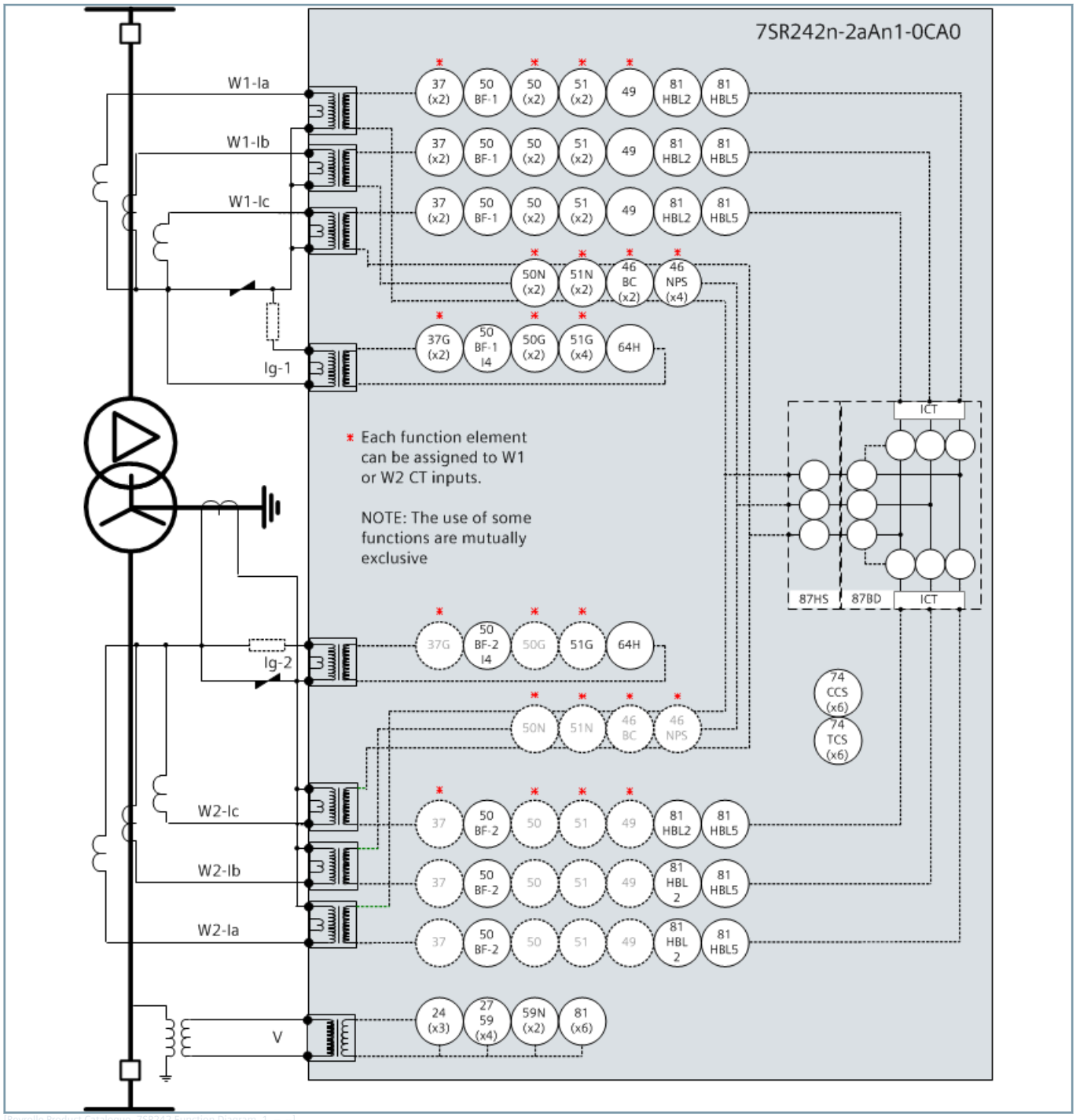
Operate Level: Initial setting Bias slope	±5 % of setting or ±0.01 I_n ±10 % of setting or ±0.01 I_n
Reset Level: Over frequency Under frequency	(100 % - hyst) x F_{op}, ±10mHz (100 % + hyst) x F_{op}, ±10mHz
Delay Setting t_{delay}	0.000, 0.005 ... 1 s
Basic Operate Time : (inrush action Enabled) 0 to 3 x I_{OP} 0 to 10 x I_{OP}	35 ms ±10 ms 30 ms ±10 ms
Operate time following delay.	t_{basic} + t_{delay} , ±1 % or ±10 ms
Inhibited by	Binary or Virtual Input



[Reyrolle Product Catalogue, 7SR242 Connection Diagram, 1, _ _]

Figure 2.4/27 7SR242 Wiring Diagram

7SR24 Function diagram / example of external connections



[Reyrolle Product Catalogue, 7SR242 Function Diagram, 1, '_']

Figure 2.4/28 Standard and Optional Functionality of 7SR24 Relay

Ordering Information - 7SR242 Winding Transformer Protection

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	16	18
Multifunctional 2 winding transformer differential protection	7	S	R	2	4	2	□	-	2	□	A	□	□	-	0	□	A	0
					|	|	|		|	|		|	|			|	|	
Protection Product					|	|	|		|	|		|	|			|	|	
Transformer					4	|	|		|	|		|	|			|	|	
						|	|		|	|		|	|			|	|	
Relay Type						|	|		|	|		|	|			|	|	
Differential (2 winding)						2	|		|	|		|	|			|	|	
							|		|	|		|	|			|	|	
Case I/O and Fascia [1)]							|		|	|		|	|			|	|	
E8 case, 6 CT, 2 EF/REF CT, 1 VT, 9 Binary Inputs / 6 Binary Outputs, 16 LEDs							2		|	|		|	|			|	|	
E10 case, 6 CT, 2 EF/REF CT, 1 VT, 19 Binary Inputs / 14 Binary Outputs, 24 LEDs							3		|	|		|	|			|	|	
E12 case, 6 CT, 2 EF/REF CT, 1 VT, 39 Binary Inputs / 14 Binary Outputs, 32 LEDs							4		|	|		|	|			|	|	
									|	|		|	|			|	|	
Measuring Input									|	|		|	|			|	|	
1/5 A, 40/160V, 50/60Hz									2	|		|	|			|	|	
										|		|	|			|	|	
Auxiliary Voltage										|		|	|			|	|	
24-250V DC / 100-230V AC. Binary input threshold 19V DC										M		|	|			|	|	
24-250V DC / 100-230V AC. Binary input threshold 88V DC										N		|	|			|	|	
												|	|			|	|	
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 (x1) and IRIG-B												3	|			|	|	
Standard version – plus additional rear RS232 (x1) and IRIG-B												4	|			|	|	
Standard version - plus additional rear Electrical Ethernet RJ45 (x2)												7	|			|	|	
Standard version - plus additional rear Optical Ethernet Duplex (x2)												8	|			|	|	
													|			|	|	
Protocol													|			|	|	
IEC 60870-5-103 and Modbus RTU (user selectable setting)													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			|	|	
																|	|	
Protection Function Packages																|	|	
Option A:	Standard version - included in all models															A	|	
	81HBL2 Inrush Detector																|	
	81HBL5 Overfluxing detector																|	
	87BD Biased current differential																|	
	87HS Current differential highset																|	
	Programmable logic																|	
	For each winding/circuit breaker																|	
	50BF Circuit breaker fail																|	
	64H High impedance REF																|	
	74TCS/CCS Trip/Close circuit supervision																|	
Option B:	Standard version – plus															B	|	
	37/37G Undercurrent																|	
	46BC Open circuit																|	

7SR2 Range – 7SR242 Transformer Protection Relay

Product Description		Order No.		
	46NPS Negative phase sequence overcurrent		|	
	49 Thermal overload		|	
	50 Instantaneous phase fault overcurrent		|	
	50G/50N Instantaneous earth fault		|	
	51 Time delayed phase fault overcurrent		|	
	51G/51N Time delayed earth fault		|	
Option C:	Standard version - plus	C	|	
	24 Overfluxing		|	
	27/59 Under/overvoltage		|	
	59N Neutral voltage displacement		|	
	81 Under/overfrequency		|	
	37/37G Undercurrent		|	
	46BC Open circuit		|	
	46NPS Negative phase sequence overcurrent		|	
	49 Thermal overload		|	
	50 Instantaneous phase fault overcurrent		|	
	50G/50N Instantaneous earth fault		|	
	51 Time delayed phase fault overcurrent		|	
	51G/51N Time delayed earth fault		|	
			|	
Additional Functionality			|	
No Additional Functionality			A	

Description

The 7SR45 numerical overcurrent and earth fault protection relay provides both definite-time and inverse-time overcurrent and earth fault protection functions. The relay is CT powered with an option for connection to an external auxiliary supply.

The relay functionality can be configured via a front USB port for local PC connection or rear electrical RS485 (optional) port for remote connection. By using the Reydisp Evolution software, the user can update the settings and view the fault records (trip log) and the event records (event log).

The relay supports the IEC 60870-5-103 and Modbus communication protocols which helps in establishing connection to SCADA. The relay can indicate the trip with local and remote flag indicator based on the ordering options.

The conformal coating on device electronic modules increases protection against harmful environmental influences such as extreme moisture, corrosive gases and aggressive dust.

Main Function	Overcurrent and Earth Fault Protection
Inputs and Outputs	4 current transformers with 1 A or 5 A inputs, 2 or 4 binary inputs and 2 or 4 binary outputs, pulse output, remote flag output and local flag output (optional)
Communication	Front USB port (for configuration via Reydisp Evolution) and rear RS485 port (optional)
Housing	Size 4 – non draw-out case with side mounting arrangement

Benefits

- CT powered with option for external auxiliary supply connection
- Dedicated switch onto fault (SOTF) protection
- Self monitoring – Including battery-condition monitor
- High sensitivity – Trip ready at 20 % of I_{rated} (1-phase) and 10 % of I_{rated} (3-phase)
- Intelligent power management – Fail-safe start up and shut down modes
- Internal lithium battery back-up for viewing fault data, setting the protection, and resetting of indications
- 4 user-programmable LEDs for indicating protection and other relay functions
- Mechanical flag indication
- Suitable for RMU mounting

Functions

Protection Functions

- 49 Thermal overload
- 50 Instantaneous overcurrent – phase
- 50G Instantaneous earth fault – measured
- 50LC Line check/Switch onto fault
- 50N Instantaneous earth fault – calculated
- 51 Time-delayed overcurrent – phase

[sc_7SR45_devices, 2, --_--]

Figure 2.5/1 7SR45 Device

- 51G Time-delayed earth fault – measured
- 51N Time-delayed earth fault – calculated

Supervision Functions

- 81HBL2 Inrush-current detection
- 74TCS Trip-circuit supervision

Ancillary Functions

- 49T High-speed external trip via BI
- 86 Lockout

Communication

- IEC 60870-5-103
- Modbus RTU

Reydisp Evolution Software

Our user-friendly PC software tool ensures a smooth installation providing an efficient and intuitive interface to the relay.

Application

7SR45 Self Powered/Dual Powered Relay is a numerical overcurrent and earth fault protection relay primarily intended for secondary distribution in electrical networks.

The 7SR45 Relay is designed to operate with/without an auxiliary supply. The relay is powered primarily from the auxiliary voltage even though all other power sources are available.

In the absence of auxiliary voltage, the relay is powered by CT input.

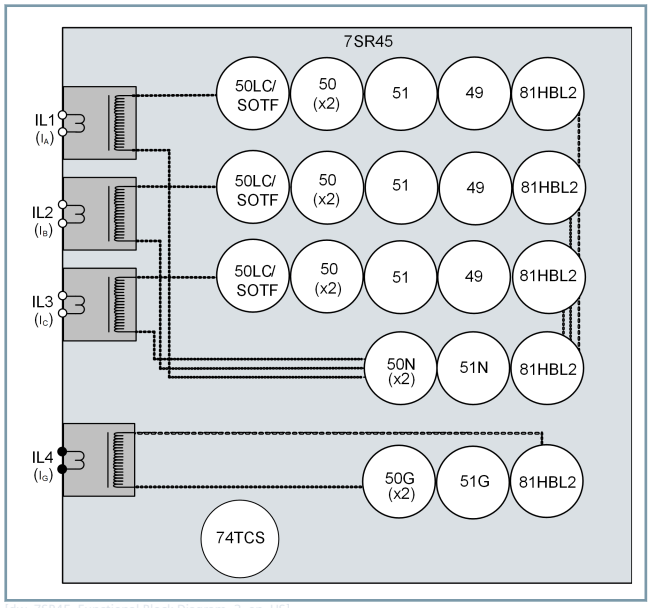
The relay offers definite-time and inverse-time overcurrent and earth fault protection functions in accordance to IEC and ANSI standards.

The 7SR45 relay has a built-in capacitor discharge pulse output for low-energy trip coil of the circuit breaker. Changeover binary outputs are also available for trip via an auxiliary powered shunt trip coil.

The 7SR45 relay is targeted for the following applications:

- Protection relay for Ring Main Units (RMU)
- Backup protection relay for the medium-voltage applications
- Protection applications in remote locations where auxiliary supply is not available
- Incomers, Feeders, and MV/LV transformers
- Panel refurbishment of old electromechanical protection relays.

Functional Diagram



[dw_7SR45_Functional Block Diagram, 2, en_US]

Figure 2.5/2 Functional Diagram of 7SR45 Self Powered/Dual Powered Non-Directional Overcurrent and Earth Fault Relay

The relay provides 2 setting groups - Group number (Gn) 1 to 2 which can both be viewed/edited via the fascia or PC Software tool.

Protection

49 Thermal Overload

The thermal overload function monitors thermal levels (Θ) of the electrical equipment thus tripping them in case of thermal overload.

One 49 thermal overload element is provided.

50 Instantaneous Overcurrent – Phase

2 earth-fault measurement stages are available.

50 INST/DTL elements provide overcurrent protection, each with independent settings for pickup current and time delays.

50G Instantaneous Earth Fault – Measured

2 earth fault measurement stages are available.

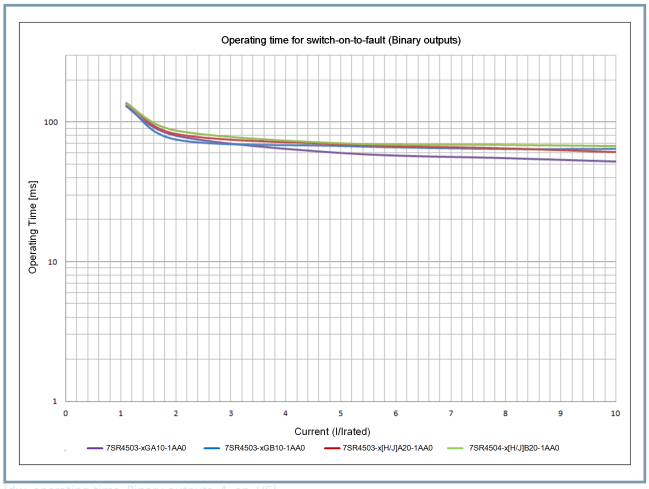
This function directly measures the earth current from an independent CT, or the residual connection of the 3 line CTs.

50G INST/DTL elements provide earth fault protection, each with independent settings for pickup current.

50LC Line Check/Switch Onto Fault

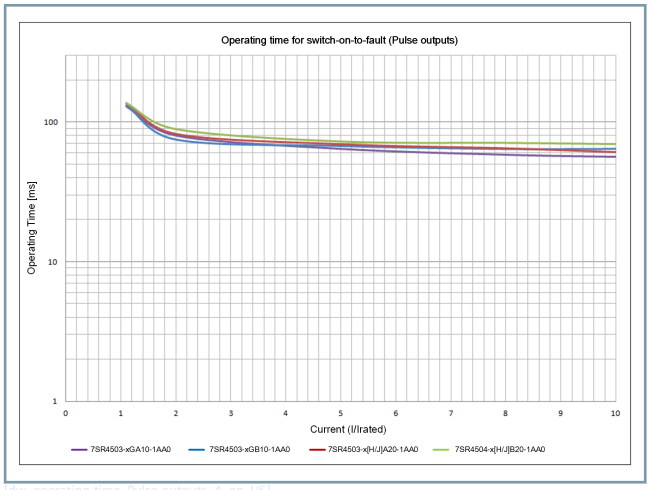
SOTF functionality provides high-speed tripping if a fault is still present on the feeder after the reclosure of the circuit breaker (Close onto Fault) or if earthing clamps are left connected after maintenance.

The following graph shows the SOTF operating time depending on the fault currents.



[dw_operating-time_Binary-outputs, 4, en_US]

Figure 2.5/3 Operating Time for Switch Onto Fault with Binary Output



[dw_operating-time_Pulse-outputs, 4, en_US]

Figure 2.5/4 Operating Time for Switch Onto Fault with Pulse Output

NOTE

Multi–phase faults will result in shorter operating time.

50N Instantaneous Earth Fault – Calculated

This function derives the earth current internally from the 3-phase CT inputs to indicate earth fault.

2 earth fault measurement stages are available.

50N INST/DTL elements provide earth fault protection, each with independent settings for pickup current.

51 Time Delayed Overcurrent – Phase

51 IDMTL/DTL elements provide overcurrent protection, each with independent settings for pickup current, time multiplier (51), and time delays. The user can select IEC or ANSI time-current characteristics. The IDMT stage has a user-selectable reset characteristic; either DTL or IEC/ANSI reset characteristic to improve the grading with electromechanical protection.

51G Time Delayed Earth Fault – Measured

This mode directly measures the earth current from an independent CT, or the residual connection of the 3 line CTs.

51G IDMTL/DTL elements provide earth fault protection, each with independent settings for pickup current, time multiplier, and time delays. The user can select IEC or ANSI time current characteristics. The IDMT stage has a user selectable reset characteristic either; either DTL or IEC/ANSI time reset characteristic to improve grading with electromechanical protection.

51N Time Delayed Earth Fault – Calculated

This function derives the earth current internally from the 3-phase CT inputs to give earth fault.

51N IDMTL/DTL elements provide earth fault protection, each with independent settings for pickup current, time multiplier, and time delays. The user can select IEC or ANSI time current characteristics. The IDMT stage has a user selectable reset char-

acteristic either; either DTL or IEC/ANSI time reset characteristic to improve grading with electromechanical protection.

74TC Trip-Circuit Supervision

The trip circuit(s) can be monitored via binary inputs. Trip-circuit failure raises an HMI alarm and output(s).

81HBL2 Inrush Detector

Where a second harmonic current is detected (i.e. during transformer energization), user selectable protection function elements can be blocked.

86 Lockout

Output relays can be configured to self reset, pulsed or hand reset operation.

Output relays can be used to directly trip the circuit breaker. The operate **break** duty of output relays is limited so the circuit-breaker trip coil must be open circuited by a suitably rated contact, typically a circuit-breaker auxiliary switch.

Trip Counter

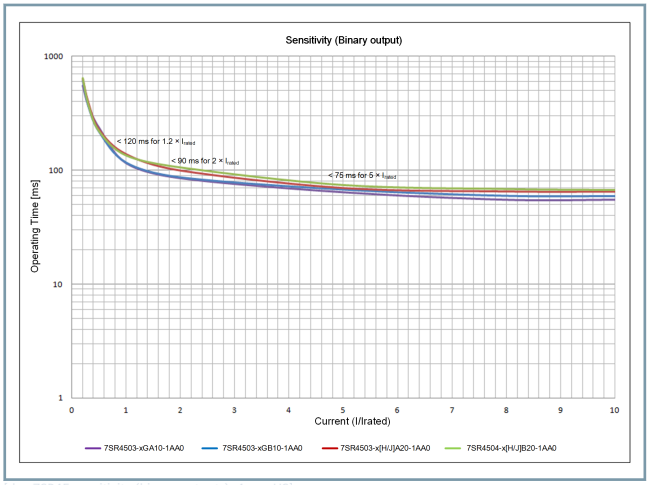
The trip counter records the overall number of trip operations performed by the relay.

Sensitivity

In case of absence of auxiliary voltage, the sensitivity of the relay is the minimum phase current required for the relay to energize, detect a fault, and trip as per the configuration.

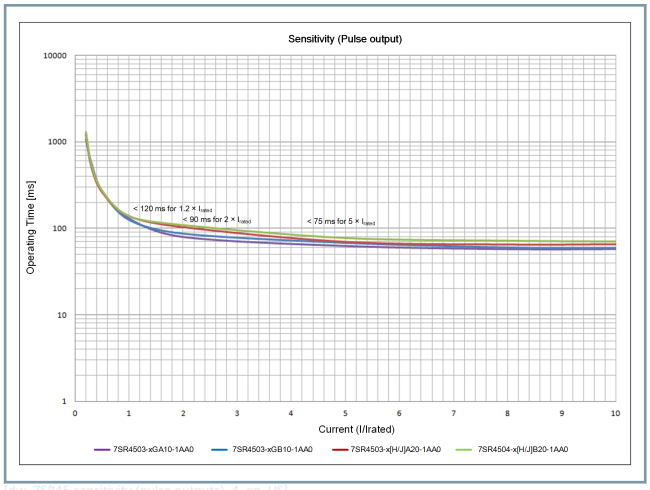
The sensitivity of 7SR45 Self Powered/Dual Powered Non-Directional Overcurrent and Earth Fault Relay is 20 % of rated current for 1-phase and 10 % of rated current for 3-phase. The PROTECTION HEALTHY LED and TRIP READY LED turn on when the relay is TRIP ready at the above mentioned current levels.

The following graphs show the sensitivity of the relay and corresponding operating time for different starting currents.



[dw_7SR45 sensitivity (binary outputs), 4, en_US]

Figure 2.5/5 Sensitivity for 1-Phase Fault with Binary Output



[dw_7SR45 sensitivity (pulse outputs), 4, en_US]

Figure 2.5/6 Sensitivity for 1-Phase Fault with Pulse Output

NOTE

Multi-phase current will improve the sensitivity.

Monitoring

The relay is designed with a number of monitoring features.

Self-Monitoring

The self-monitoring supervision includes monitoring of power-supply signals, code execution watchdog, memory checks by check sum, RTC check, and battery health checks.

The protection healthy LED is illuminated when the power supply signals are healthy. An internal relay fail feature provides indication of when an internal error is detected. The error codes are available in the instrument mode.

Configurable LED and BO is provided for internal relay failure feature.

Battery Monitoring

The battery profile menu provides the consumption on battery power of the different applications, and in addition, a Low battery indication is provided.

Instruments & Meters

The following measured values and status information are monitored and displayed in the relay under the Instrument mode.

Primary/secondary current phases and earth
Binary input/binary output status
Thermal capacity
Time and date
Fault records (Trip log)
Event records (Event log)
Trip Counter

Intelligent power management ensures a healthy shut down below the operating ranges and fail-safe start-up mode.

Data Acquisition and Recording

Sequence-of-Event Records (Event Log)

Up to 100 events can be stored and time tagged to 1-ms resolution. The events are stored on first-in-first-out basis. The events are available through the communication interface.

Fault Records (Trip Log)

The last 10 fault records are displayed on the relay fascia and are also available through the communication interface with time and date of trip, measured quantities, and type of fault.

Real-Time Clock

The time and date can be set and is maintained while the relay is de-energized by a coin cell battery.

Communications

The relay offers a USB port as standard on the front of all units. All of the relay functions can be set on a PC using the Reydisp Evolution software via the USB port. The connection is made with a USB cable and operates with a “plug and play” connection, so no presetting of the relay is required.

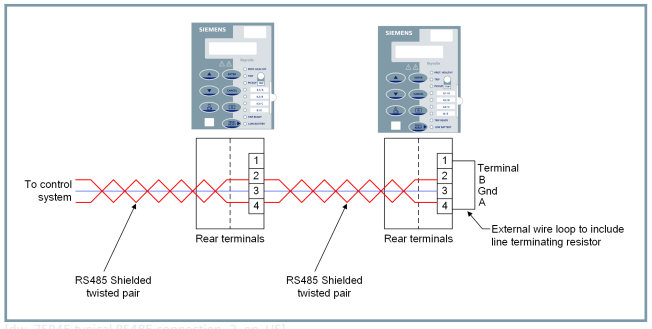
In the dual powered relays, the front port can be switched off or set to use either the Modbus RTU or IEC 60870-5-103 protocols for testing purposes. For self powered relays, the default protocol is IEC 608070-5-103.

NOTE

The Reydisp Evolution software will work with the relay only when the USB port is configured to the IEC 60870-5-103 protocol in the dual-powered relays.

A rear RS485 electrical connection is optionally available on the relay for system-interface connections.

An internal terminating resistor is provided, which can be connected into the circuit by adding a wire loop between the relevant terminals.



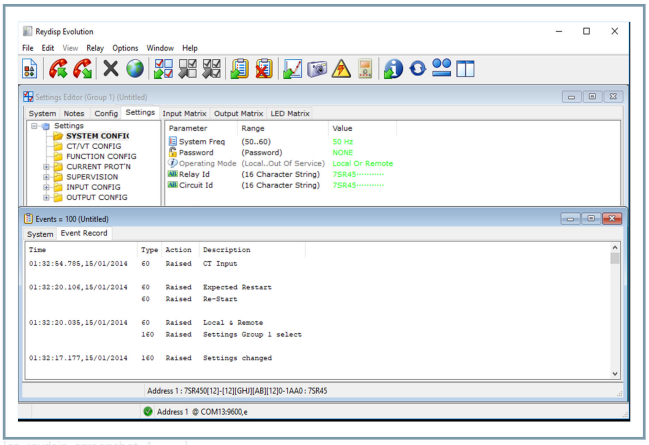
[dw_7SR45 typical RS485 connection, 2, en_US]

Figure 2.5/7 Typical RS485 Connection

The rear RS485 can be user-selected to be OFF, IEC 60870-5-103, or Modbus RTU.

Reydisp Evolution

Reydisp Evolution is a Windows-based software tool, providing the means for the user to apply settings, interrogate settings, and retrieve events and disturbance waveforms from the device. It is common to the entire range of Reyrolle protection relays.



[sc_reydisp_screenshot, 1, "_"]

Figure 2.5/8 Example Application of the Reydisp Evolution

Hardware Construction

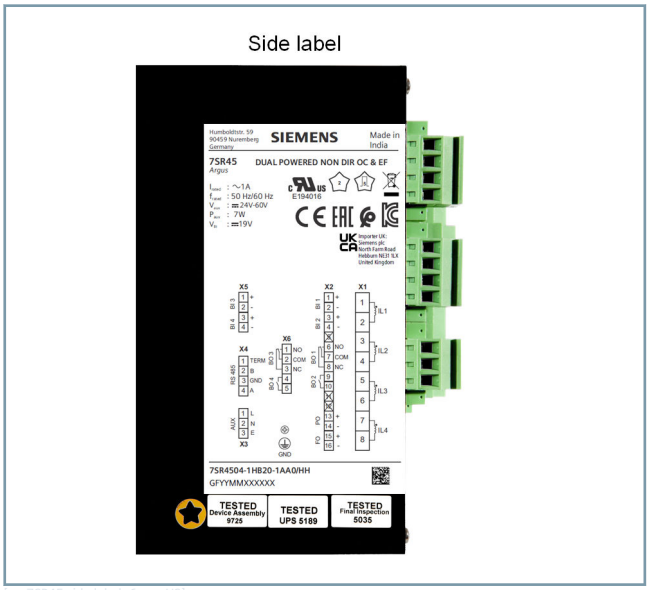
The relay is housed in a non draw-out 4U high, size 4 case.

The rear connection comprises user-friendly pluggable type terminals for pulse and flag output, binary inputs, binary outputs, RS485 communication, and auxiliary input.

The CT terminals are suitable for ring-type lug connection to provide a secure and reliable termination.

[sc_7SR4504, 4, en_US]

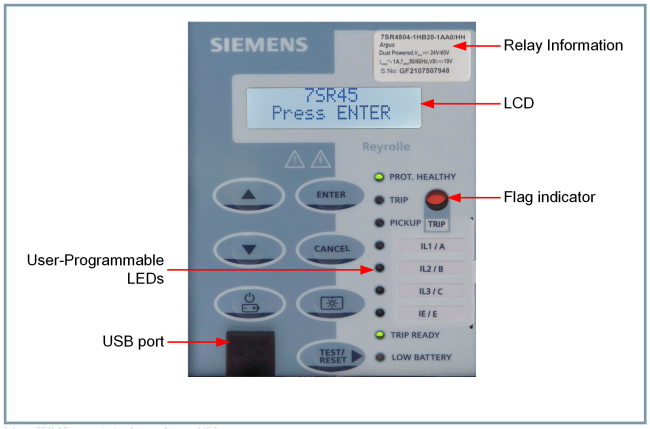
Figure 2.5/9 7SR4503/04



[sc_7SR45 side label, 6, en_US]

Figure 2.5/10 7SR45 Terminal Label

User Interface



[dw_7SR45 user interface, 4, en_US]

Figure 2.5/11 User Interface

The user interface is designed to provide a user-friendly method of viewing menus, entering settings, and retrieving data from the relay. 5 buttons are provided for navigation around the menu structure. Additionally, 2 buttons are provided for the battery ON/OFF and backlight ON/OFF functionality.

LCD

A 2 line by 16 character liquid crystal display with power save operation indicates the relay identifier, settings, instrumentation, and fault data. The relay also provides 3 alert screens – Fault Trip Alert, Alarm Alert, and User Information Alert.

LEDs

5 non-programmable LEDs and 4 user-programmable LEDs are provided on the front fascia. Each non-programmable LED shows clear indication of the associated functions state and has a label for identification.

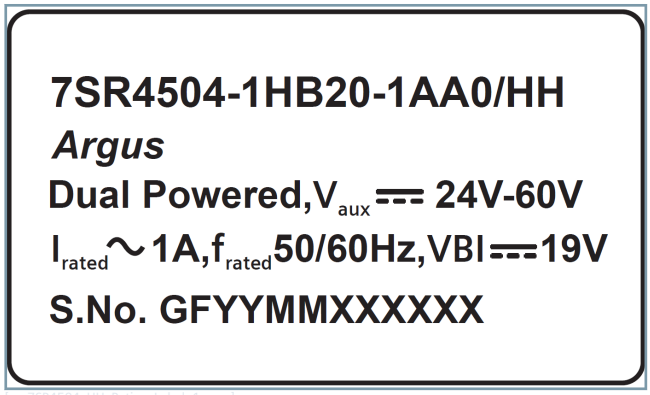
The 4 user-programmable LEDs can be configured for protection and other relay functions. By default, these LEDs are mapped to Phase IL1/A, IL2/B, IL3/C, IE/E. This default configuration is printed on one side of the paper label provided with the decal. If the user prefers to change the configuration of user-programmable LEDs, then the user must manually write the function name (to which the LED is mapped) on the paper label. You can select the color of the pickup LED (Amber or Green) while selecting the MLFB.

Flag Indicator

1 local flag indicator is provided and configured for the trip indication.

Relay Information

The device is identified by the rating label on the front fascia. The user can also give the device its own identity by editing the “Relay Identifier” displayed on the LCD.



2.5

Figure 2.5/12 Fascia Relay Rating Label

The device terminal label displays the MLFB code, serial number, relay description, terminal contact details, and safety symbols.

	2 kV Dielectric test voltage
	5 kV impulse test voltage
	European CE marking
	Waste Electrical and Electronic Equipment Directive (WEEE)
	Guideline for the Eurasian Market
	Mandatory Conformity Mark for Electronics and Electro-technical Products in Morocco
	South Korea KC Certification for Electrical and Electronic Products
	UL recognized component marks for Canada and United States
	United Kingdom (UK) Conformity Assessed marking

Power

7SR45 Self Powered/Dual Powered Non-Directional Overcurrent and Earth Fault Relay can be powered in the following modes and their priority is as follows:

- Auxiliary power supply (only for dual powered relay)
- CT power
- USB power
- Battery power

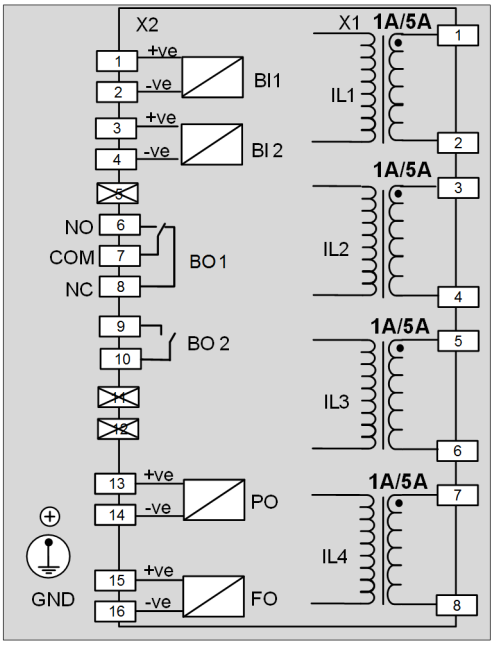
Confirmation ID (Password Protection)

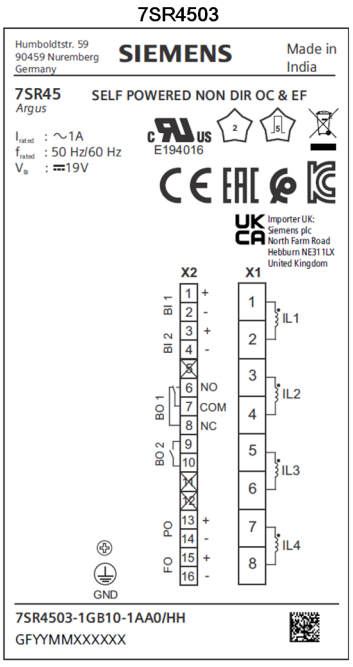
The relay allows the user to set a 4-character confirmation ID (shown as Password in the relay LCD display). If a confirmation ID has already been set, then the user must enter the confirmation ID to gain access to the editing mode for setting parameters.

General Alarms

Up to 4 general alarms of 16 characters can be configured to display a text message on the LCD. The general alarms can be triggered from one or more inputs.

Connection Diagrams



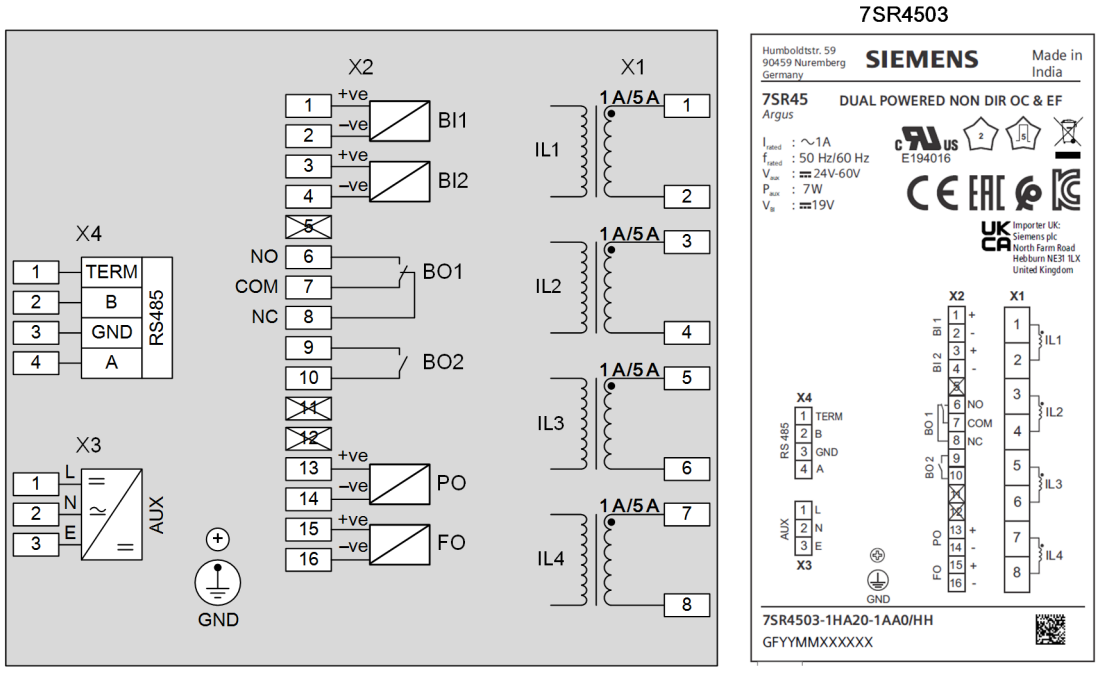


NOTES
Items shown in BOLD are ordering options

Terminal label

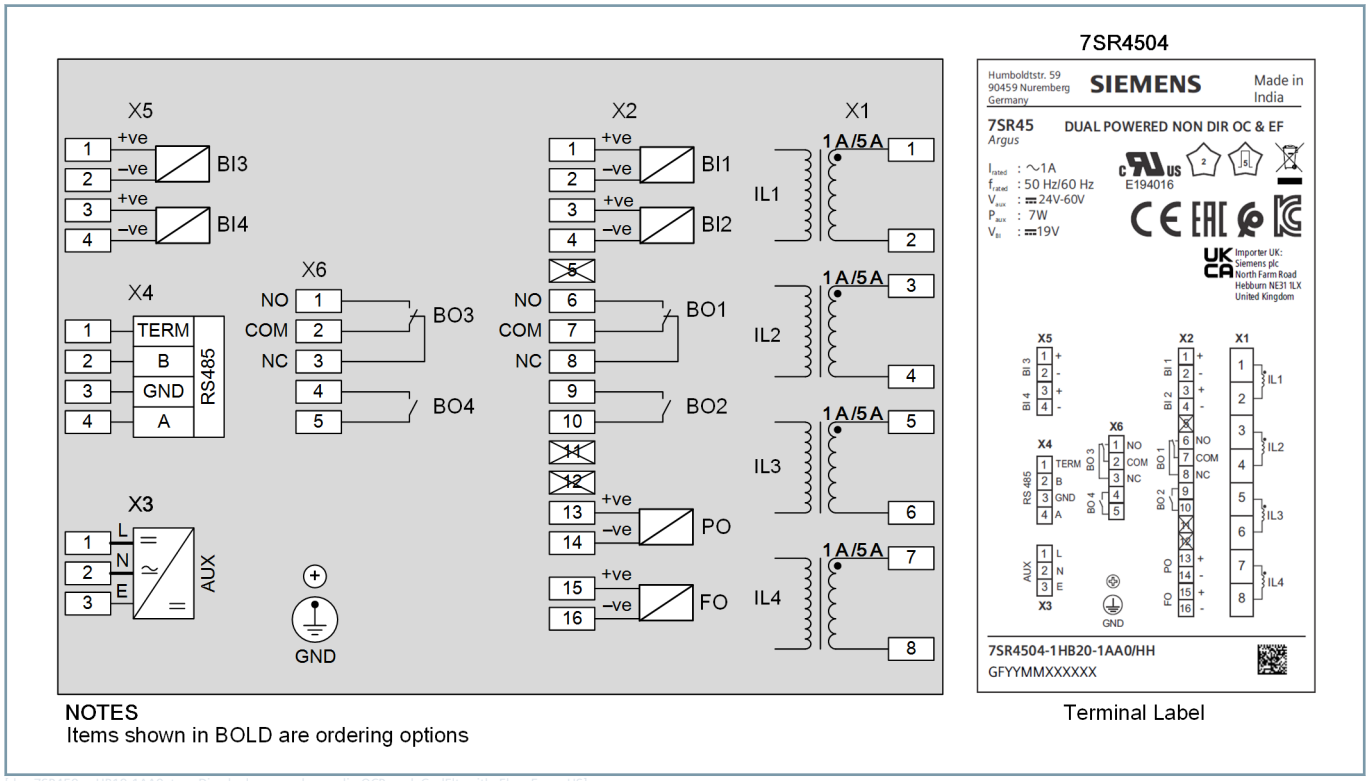
[IO_7SR4501(03)-xGB1O terminal label/wiring diagram, 7, en_US]

Figure 2.5/13 Terminal Diagram of Self Powered (7SR4503-xGx10-1Ax0) Non-Directional Overcurrent and Earth Fault Relay with Flag



[dw_7SR450x-xH-J-A20-1AA0_termDia_dual-powered_non-dir_OCP_and_GndFlt_without_Flag, 5, en_US]

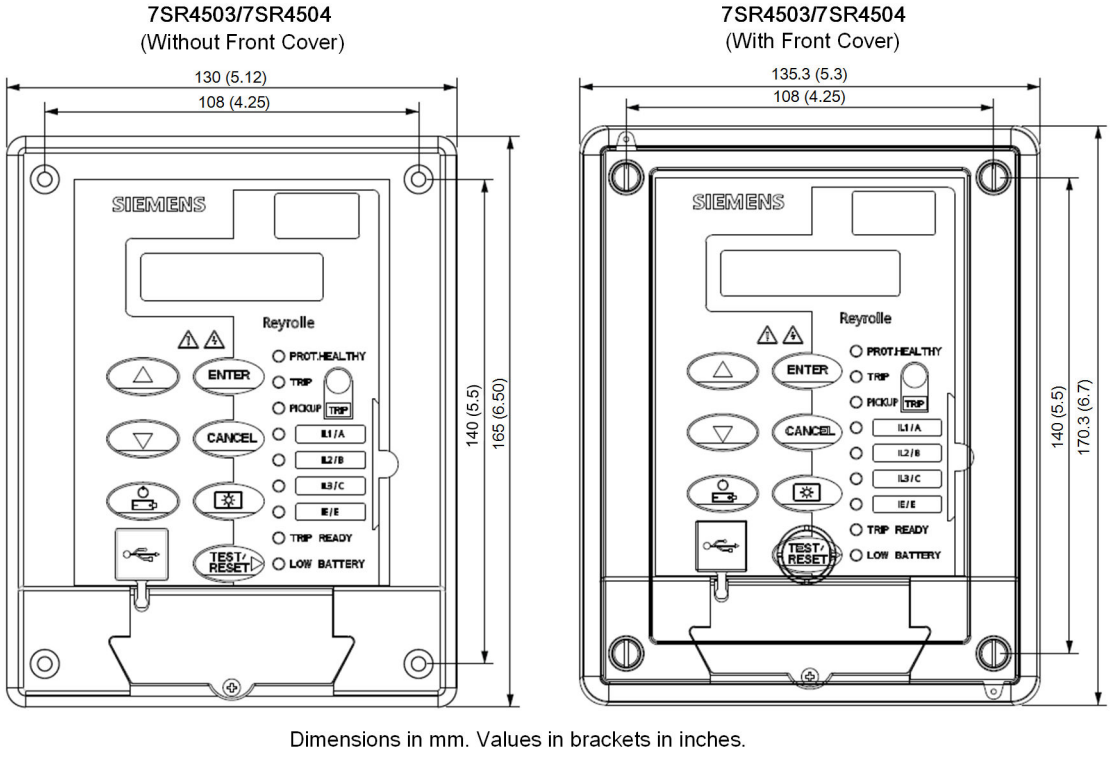
Figure 2.5/14 Terminal Diagram of Dual Powered (7SR4503-x[H/J]A20-1Ax0) Non-Directional Overcurrent and Earth Fault Relay without Flag



[dw_7SR450x-xH810-1AA0_termDia_dual-powered_non-dir_OCP_and_GndFlt_with_Flag, 5, en_US]

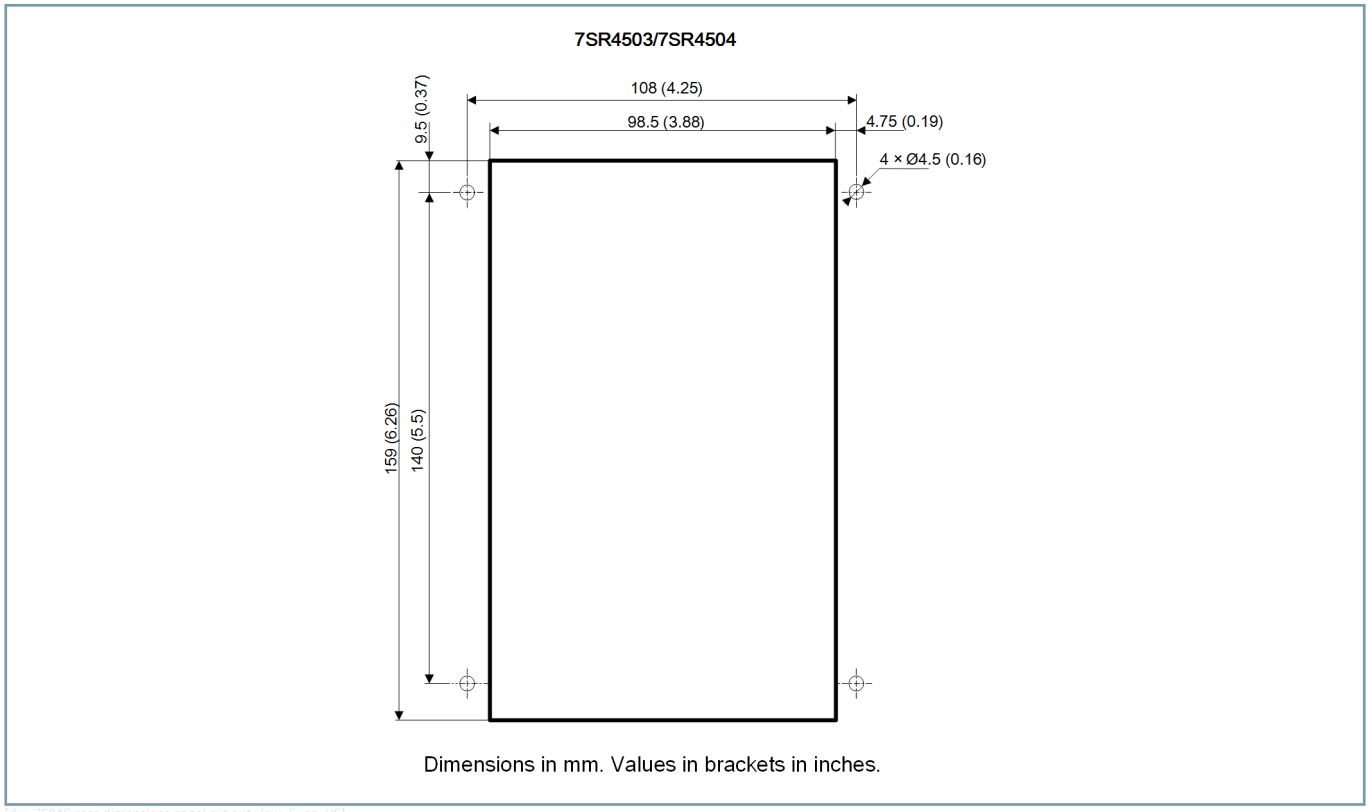
Figure 2.5/15 Terminal Diagram of Dual Powered (7SR4504-x[H/J]B20-1Ax0) Non-Directional Overcurrent and Earth Fault Relay with Flag

Dimension Drawings



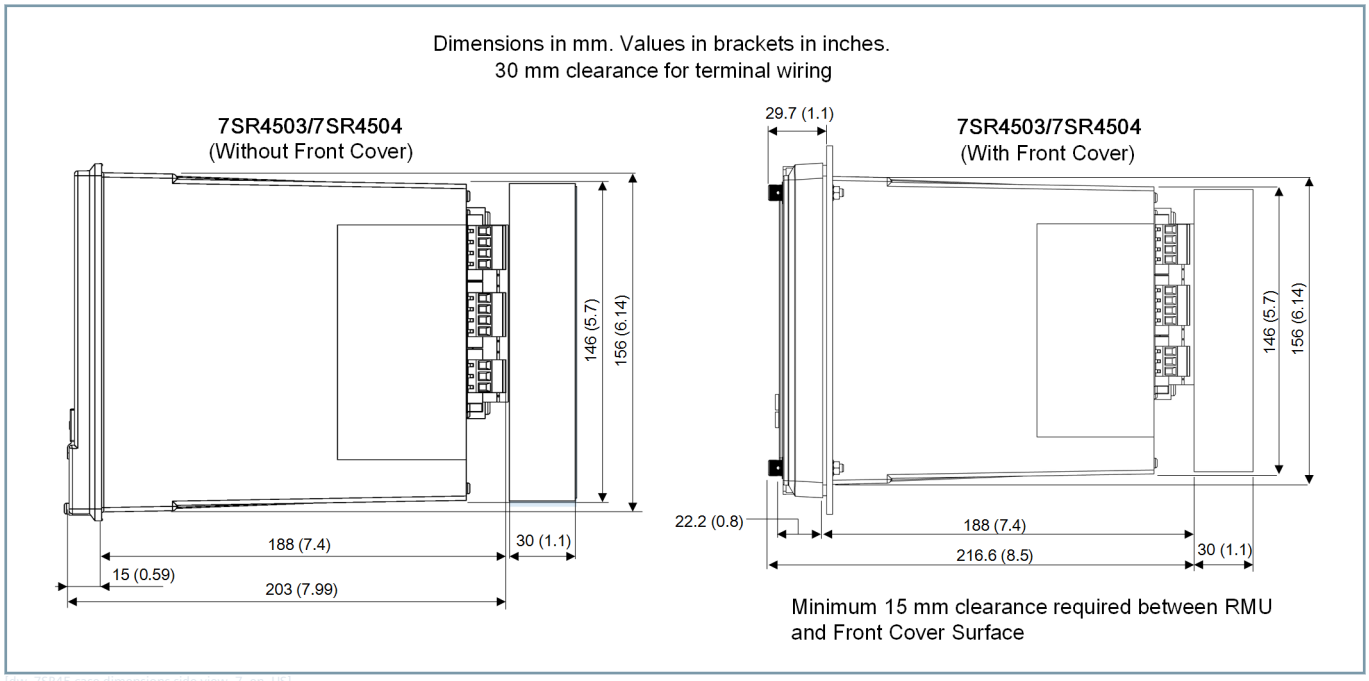
[dw_7SR45 case dimensions front view, 6, en_US]

Figure 2.5/16 Front View



[dw_7SR45 case dimensions panel cut out view, 5, en_US]

Figure 2.5/17 Panel Cut-out View



[dw_7SR45 case dimensions side view, 7, en_US]

Figure 2.5/18 Side View

Rear Terminal Details

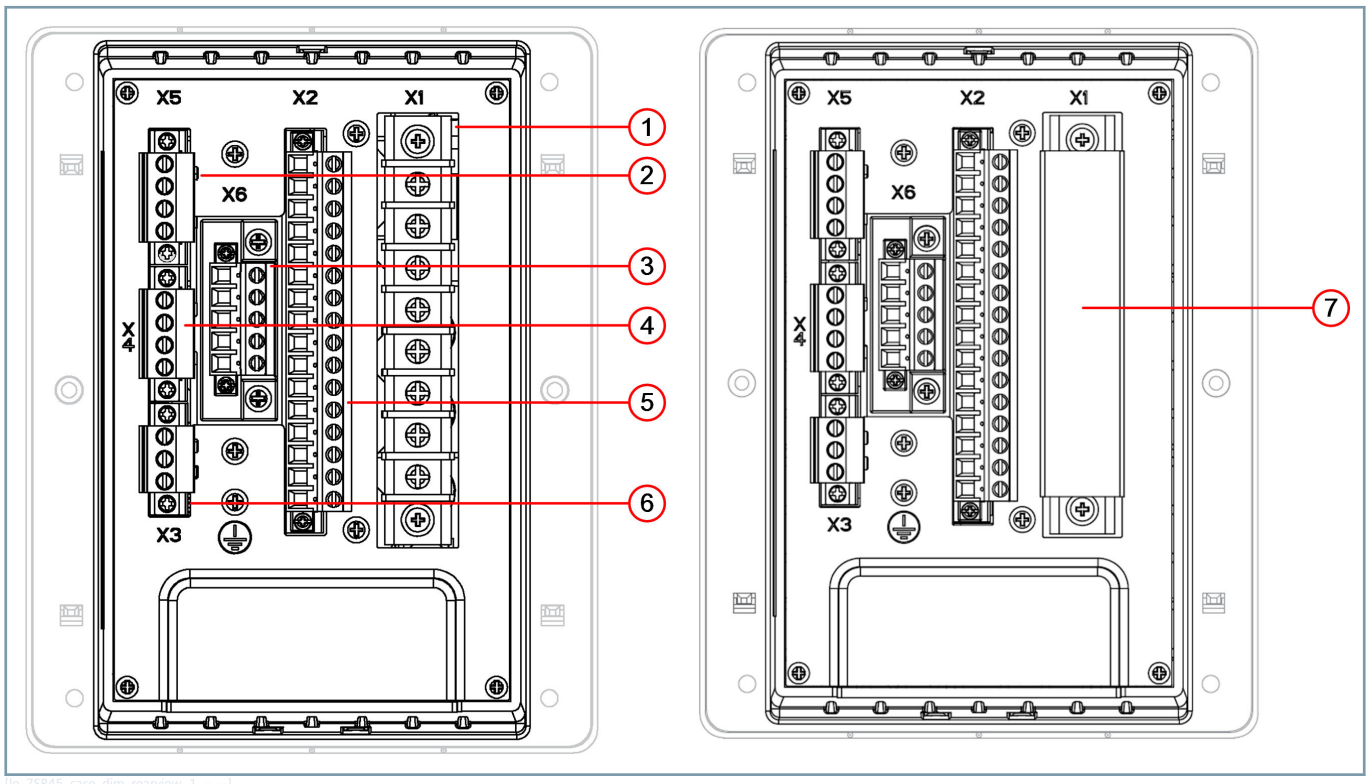


Figure 2.5/19 Rear Terminal Details (Dual Powered Full Version)

(1) Current inputs
(2) Additional binary inputs
(3) Additional binary outputs
(4) Rear communication port
(5) Binary inputs/binary outputs/remote flag output/pulse output
(6) Auxiliary power supply
(7) IP20 cover for current terminals

Technical Data

For full technical data, refer to the Technical Data chapter in the Device Manual and in the Hardware Manual.

Indication of Conformity

This product complies with the directive of the Council of the European Communities on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 2014/30/EU) and concerning electrical equipment for use within specified voltage limits (Low Voltage Directive 2014/35/EU) as well as restriction on usage of hazardous substances in electrical and electronic equipment (RoHS Directive 2011/65/EU).

This conformity has been proved by tests conducted by Siemens AG in accordance of the Council Directive in accordance with the product standard IEC/EN 60255-26 for the EMC directives, and with the standard IEC/EN 60255-27 for the low-voltage directive.

RoHS directive 2011/65/EU is met using the standard IEC/EN 63000. The device has been designed and produced for industrial use.

IEEE Std C 37.90

The technical data of the product is approved in accordance with UL.

For more information about the UL database, see ul.com

You can find the product with the UL File Number: E194016

General Technical Data

Product family	Non-Directional Self Powered/Dual Powered Overcurrent and Earth Fault Relay
Case and LEDs	Non draw-out polycarbonate case (size 4 standard, non draw-out design), 5 non-programmable LEDs & 4 programmable LEDs Non-programmable pickup LED– Green or Amber color[44]
Measuring inputs (current)	1 A or 5 A[44] 50 Hz/60 Hz
Auxiliary voltage	DC 24 V to DC 60 V, AC 60 V to AC 240 V/DC 60 V to DC 240 V[44]
Communication	Front communication port: USB (IEC 60870-5-103 or Modbus RTU) Rear communication port: RS485 (IEC 60870-5-103 or Modbus RTU)
Protection functions	49, 50, 50G/N, 51, 51G/N, 50LC/SOTF
Supervision functions	81HBL2 (Inrush-current detector)
Binary input and binary output	4 BI and 4 BO or 2 BI and 2 BO[44]
Remote flag	24 V, 0.01 Ws
Local flag	Mechanical flag indicator[44] ● Normal – green color ● Trip – red color
Pulse output	24 V, 0.1 Ws pulse output
Overvoltage	Category III
Pollution degree	2
Altitude of operation	Maximum up to 2000 m

Sensitivity

Minimum phase current for relay operation	20 % of I_{rated} in 1-phase 10 % of I_{rated} in 3-phase

Mechanical Specifications

Design	Panel mounting, non draw-out polycarbonate moulded case
Enclosure	IP 52 (front side without cover) IP 54 (front side with cover)[45] IP 40 (enclosure sides) IP 10 (rear side without cover for current terminal) IP 20 (rear side with cover for current terminal)
For operator protection	IP 1x for current terminal without cover IP 2x for other terminal and current terminal with cover
Weight	approx. 1.97 kg (without front cover) approx. 2.08 kg (with front cover)

Installation Category

Installation category (overvoltage category)	Class III

Pollution

Pollution degree	2

44 Depending on the ordering option

45 Applicable for 7SR4503/7SR4504 variants only

Recommended Terminal Lugs Specifications

Current inputs	Terminal connectivity PIDG series insulated tin plated crimp ring terminal, M3.5 stud size, 2.6 mm^2 to 6.6 mm^2, 12 AWG, torque is required of 1.0 Nm
Auxiliary supply	Insulated tin plated crimp pin connector, 2.6 mm^2 to 6.6 mm^2, 12 AWG to 10 AWG, torque is required 0.5 Nm to 0.6 Nm
Rear communication port	Pin type lug/1.5 mm^2 control cable, torque is required 0.5 Nm to 0.6 Nm
Front communication port	USB, type B
Binary input/binary output/pulse output/flag output	Insulated tin plated crimp pin connector, 2.6 mm^2 to 6.6 mm^2, 12 AWG to 10 AWG, torque is required 0.5 Nm to 0.6 Nm
Ground terminal	Tin plated crimp ring terminal, M3 stud size, 4 mm^2 to 6 mm^2, 12 AWG to 10 AWG, yellow, torque is required 0.5 Nm to 0.6 Nm

Inputs and Outputs

Auxiliary Supply

Rated auxilliary voltage	AC 60 V to 240 V/DC 60 V to 240 V, Tolerance: -20 % to +10 % DC 24 V to 60 V, Tolerance: -20 % to +10 %[44]
Rated frequency	50 Hz (range: 45 Hz to 55 Hz) 60 Hz (range: 54 Hz to 66 Hz)
Allowable alternating component in DC (ripple)	15 % of DC voltage
Typical power consumption (DC)	< 7 W
Typical power consumption (AC)	< 13 VA
Max interruption time (collapse to zero)	≤ 20 ms (DC 19.2 V) ≤ 20 ms (DC 48 V) ≤ 500 ms (AC 230 V)

Current Inputs

Quantity	3 x phase and 1 x earth
Rated current I_{rated}	1 A or 5 A[44]
Measuring range	Phase current: 0.1 · I_{rated} to 20 · I_{rated} Earth current: 0.06 · I_{rated} to 20 · I_{rated}
Instrumentation	Fundamental ±5 % (relative) or ±2 % I_{rated} (absolute) (≥ 0.10 · I_{rated} to 2 · I_{rated}) – whichever is greater ±3 % (> 2 · I_{rated} to 20 · I_{rated}) RMS ±5 % (relative) or ±2 % I_{rated} (absolute)(≥ 0.10 · I_{rated} to 10 · I_{rated}) – whichever is greater
Rated frequency	50 Hz (range: 45 Hz to 55 Hz) 60 Hz (range: 54 Hz to 66 Hz)
Rated CT burden [measured at Rated currents (1 A and 5 A)]	≤ 2.5 VA per phase and ≤ 0.2 VA earth for 1 A CT input ≤ 2.5 VA per phase and ≤ 0.2 VA earth for 5 A CT input

Binary Inputs (BI)

Number	2 or 4[44]	
BI threshold/operating range	**BI Voltage rating** DC 19 V DC 88 V AC 88 V	**BI Operating range** DC 18 V to 66 V DC 86 V to 265 V AC 71 V to 265 V
Maximum AC/DC current for operation	3.5 mA	
Pick up delay	User-selectable 0 s to 600 s (up to 10 min)	
Drop off delay	User-selectable 0 s to 600 s (up to 10 min)	
Maximum cable length	< 10 m For larger cable length, always use a multi-core screened or twisted pair (screened or unscreened) cables.	

Binary Outputs (BO)

Number	2 (1 make contact and 1 change-over contact) or 4 (2 make contacts and 2 change-over contacts)[44]
Operating voltage	Potential-free
Operating mode	User selectable – BO 1 and BO 2 self or hand/electrical reset BO 3 and BO 4 self reset (operated only with auxiliary input is present)
Operating time from energizing binary input	< 20 ms
Disengaging time	< 20 ms
BO 1 and BO 2 Output Contact Details	
Switching voltage	AC 250 V and DC 125 V

Contact current rating: Continuous Short time	AC 5 A/DC 5 A AC 20 A/DC 20 A for 0.5 s AC 30 A/DC 30 A for 0.2 s	
Limiting making capacity: (L/R ≤ 40 ms)	1000 W	
Limiting breaking capacity: AC resistive AC inductive DC resistive DC inductive (L/R ≤ 40 ms)	 1250 VA 250 VA 75 W 30 W	 V/I = 250/5 V/I = 250/1@ PF ≤ 0.4 V/I = 48/1.5; 110/0.7 V/I = 48/0.7; 110/0.3
Mechanical/electrical endurance	10 000 operations	
BO 3 and BO 4 Output Contact Details		
Switching voltage	AC 250 V/DC 250 V	
Contact current rating: Continuous Short time	AC 5 A/DC 5 A AC 20 A/DC 20 A for 0.5 s AC 30 A/DC 30 A for 0.2 s	
Limiting making capacity: (L/R ≤ 40 ms)	1000 W	
Limiting breaking capacity: AC resistive AC inductive DC resistive DC inductive (L/R ≤ 40 ms)	 1250 VA 250 VA 75 W 30 W	 V/I = 250/5 V/I = 250/1@ PF ≤ 0.4 V/I = 48/1.5; 110/0.7; 220/0.3 V/I = 48/0.7; 110/0.3; 220/0.14
Mechanical/electrical endurance	10000 operations	

Front Communication Port

Quantity	1
Electrical connection	USB, type B
Protocol support	Modbus RTU, IEC 60870-5-103[44]

Rear Communication Port

Quantity	1[44]
Electrical connection	RS485, 2-wire electrical, twisted pair
Protocol support	Modbus RTU, IEC 60870-5-103
Rate	Data transfer rate: 1200 Bit/s to 57 600 Bit/s

Data Storage

Fault record (trip log)	10 records
Events (event log)	100 events (1 ms resolution)

Mechanical Tests

Test	Standard
Degree of protection	IEC 60529, IP54 front with cover[45] IP52 front IP 10 (rear side without cover for current terminal) IP 20 (rear side with cover for current terminal)
Vibration	IEC 60255-21-1, Response and endurance, Class I
Shock and bump	IEC 60255-21-2, Shock response and withstand, Class I Bump, class I
Seismic	IEC 60255-21-3, Class I
Contact performance	IEC 60255-1, (Ref: Std IEC 61810-1)

Electrical Tests

Test	Standard
Insulation resistance	IEC 60255-27[46] Insulation resistance > 100 MΩ at DC 500 V Test duration: > 5 s (Between any terminal and earth, independent circuits)[47]
Impulse voltage withstand	IEC 60255-27[46] 5 kV, 1.2/50 µs, 0.5 J 5 +ve, -ve pulses (Between all terminals and case earth and any 2 independent circuits)[47]
AC dielectric voltage	IEC 60255-27[46] AC 2 kV RMS for 1 min (Between any terminal and earth, independent circuits)[47] AC 1 kV RMS for 1 min (across normally open contacts)

46 All aspect of IEC 60255-5 have been covered under IEC 60255-27.

47 Flag output and pulse output are excluded between any terminals and earth.

Test	Standard
Slow damped oscillatory wave[48]	IEC 60255-26 **Common-mode:** Test voltage: 2.5 kV peak voltage **Differential mode:** Test voltage: 1.0 kV peak voltage Test duration: 2 s Source impedance: 200Ω Voltage oscillation frequency: 1 MHz Repetition frequency: 400 Hz
Electrostatic discharge	IEC 60255-26 8 kV air discharge 6 kV contact discharge
Electrical fast transient or burst[48]	Zone B Test severity amplitude: ±2 kV Repetition frequency: 5 kHz
Surge immunity[49], [48]	IEC 60255-26 Test level: zone A Line to line: 0.5, 1, 2 kV Line to earth: 0.5, 1, 2, 4 kV Front time/time to half-value: 1.2/50 µs Source impedance: 2 Ω
Radiated immunity	IEC 60255-26 80 MHz to 1.0 GHz and 1.4 GHz to 2.7 GHz Field strength: 10 V/m (RMS) Amplitude modulated: 80 % AM
Conducted radio frequency interference[48]	IEC 60255-26 150 kHz to 80 MHz, 10 V_{RMS} , dwell time: 0.5 s
Power frequency magnetic field	IEC 60255-26 30 A/m applied 1 min, 300 A/m applied for 3 s
Damped oscillatory magnetic field value	IEC 61000-4-10 0.1 and 1.0 MHz,100 A/m
Radiated emissions	IEC 60255-26
Conducted emissions	IEC 60255-26

Test	Standard
Thermal withstand	IEC 60255-27[46] Continuous withstand: 2 · I_{rated} Short time withstand: Test duration 1 s 50 A (1 A current input) 150 A (5 A current input)
Functional performance	IEC 60255-151, IEC 60255-149 and IEC 60255-1
Maximum allowable temperature	IEC 60255-6 Max. temperature limit +100 °C
Gradual shutdown/start-up test	IEC 60255-26 Shut down/start up ramp 60 s Power off 5 min
Power frequency immunity test[50]	IEC 60255-26 **Common-mode:** • Test voltage: 300 V • Coupling resistor: 220 Ω • Coupling capacitor: 0.47 µF
Fast transient burst (Common mode and differential mode test)	IEEE Std C37.90.1 Peak voltage level: 2 kV Rise time: 5 ns Impulse duration: 50 ns Repetition rate during the burst: 5 kHz Burst duration: 15 ms Burst period: 300 ms Output impedance: 50 Ω Test duration: 1 min on each polarity
Oscillatory waves (Common mode and differential mode test)	IEEE Std C37.90.1 Peak voltage level: 2.5 kV Rise time on the first peak: 75 ns Repetition rate: 6 to 10 bursts Oscillation frequency: 1 MHz Output impedance: 200 Ω Test duration: 2 s Waveform envelope decay: between pk5-pk10

48 Not applicable for flag output and pulse output.

49 Additional 50 ms DTL pick-up delay applied to binary inputs.

50 DC binary input ports interfacing with cables whose total length is more than 10 m, need to have a multi core twisted screened cable for providing immunity against high level of power frequency interferences.

Climatic Environmental Tests

Temperature

IEC 60068-2-1/IEC 60068-2-2/IEC 60255-1

Ambient operating temperature	-10 °C to +60 °C
Permissible temporary operating temperature, (tested for 16 h)[51], [52]	-40 °C to +70 °C
Storage temperature (non-operational)[53]	-25 °C to +70 °C

Humidity

IEC 60068-2-30/IEC 60068-2-78/IEC 60255-1

Damp heat test, cyclic	+25 to 55 °C, RH > 93 % RH (6 cycles) At lower temperature, 97 %, -2 % to +3 % RH At upper temperature, 93 %, ±3 % RH
Damp heat test, steady state	10 days at 93 ±3 % RH, +40 °C

Product Safety Test

Clearances and creepage distances	IEC/EN 60255-27: edition 2 ≥ 4 mm
IP rating	IEC/EN 60255-27: edition 2 IP52 (front side) IP54 (front side with cover)[45] IP10 (rear side)
Impulse voltage	IEC/EN 60255-27: edition 2 5 kV, 5 +ve, -ve pulses
AC dielectric voltage	IEC/EN 60255-27: edition 2 AC 2 kV, 50 Hz, 1 min
Insulation resistance	IEC/EN 60255-27: edition 2 DC 500 V, > 5 s, > 100 MΩ
Protective bonding resistance	IEC/EN 60255-27: edition 2 < AC 12 V/DC 12 V, 1 min, < 0.1 Ω
Protective bonding continuity	IEC/EN 60255-27: edition 2
Flammability	IEC/EN 60255-27: edition 2
Single-fault condition	IEC/EN 60255-27: edition 2

Performance

49 Thermal Overload

Elements	Thermal Overload
Setting range I_{set} (49)	0.2 · I_{rated} to 1.5 · I_{rated}
Heating time constant	1 min to 300 min
Cooling time constant	1 to 6 · TauH
Capacity alarm	50 % to 100 %
Initial thermal level	0 % to 40 %
Thermal operate level	100 % ±3 %
Reset level	≥ 95 % I_{op}
Overload trip operate time (t_{op})	$t = \tau \cdot \ln\left[\frac{I^2 - I_P^2}{I^2 - I_\theta^2}\right]$
Operating time tolerance	±5 % t_{op} or 10 s
Inhibited by	Binary input

50 Instantaneous Overcurrent – Phase

Operation	Non-directional
Elements	Phase fault
Setting range I_{set}	0.2 · I_{rated} to 20.0 · I_{rated}
Time delay	0 s to 600 s
Operate level I_{op}	100 % I_{set}, ± 5 %
Reset level	≥ 0.2 · I_{rated} to 0.9 · I_{rated} setting: ≥ 90 % I_{op} ≥ 1 · I_{rated} to 20 · I_{rated} setting: ≥ 94 % I_{op}
Basic operate time (with auxiliary power/load current):	2 · I_{set}: 25 ms, ±15 ms, 5 · I_{set}: 20 ms, ±15 ms
Operate time following delay	t_{basic} + t_{delay} , ±1 % or ±30 ms
Inhibited by	Binary input or Inrush detector
Disengaging time	< 50 ms[54]

50G Instantaneous Earth Fault – Measured

Operation	Non-directional
Elements	Measured earth fault
Setting range I_{set}	0.2 · I_{rated} to 20.0 · I_{rated}
Time delay	0 s to 600 s
Operate level I_{op}	100 % I_{set}, ± 5 %
Reset level	≥ 0.2 · I_{rated} to 0.9 · I_{rated} setting: ≥ 90 % I_{op} ≥ 1 · I_{rated} to 20 · I_{rated} setting: ≥ 94 % I_{op}
Basic operate time (with auxiliary power/load current):	2 · I_{set} 25 ms, ±15 ms, 5 · I_{set} 20 ms, ±15 ms
Operate time following delay	t_{basic} + t_{delay} , ±1 % or ±30 ms

51 Applicable for the self powered relay with the rated current and the dual powered relay with the rated auxiliary voltage of DC 110 V and above.

52 Permissible temporary operating temperature is not applicable for UL.

53 To retain the battery life during the transportation and storage, it is recommended to maintain the permissible temperature range from -20 °C to +45 °C

54 With auxiliary power supply

Inhibited by	Binary input or Inrush detector
Disengaging time	< 50 ms[54]

50LC Line Check/Switch Onto Fault

Operate level	100 % I_{set}, ±5 %
Setting range	1 · I_{rated} to 20 · I_{rated}
Disengaging time	< 50 ms
Operating time	< 20 ms for 1.2 · I_{rated} < 90 ms for 2 · I_{rated} < 75 ms for 5 · I_{rated}
Inhibited by	Binary input or Inrush detector

For more information about 50LC, refer to SOTF.

50N Instantaneous Earth Fault – Calculated

Operation	Non-directional
Elements	Calculated earth fault
Setting range I_{set}	0.2 · I_{rated} to 20.0 · I_{rated}
Time delay	0 s to 600 s
Operate level I_{op}	100 % I_{set}, ±5 %
Reset level	≥ 0.2 · I_{rated} to 0.9 · I_{rated} setting: ≥ 90 % I_{op} ≥ 1 · I_{rated} to 20 · I_{rated} setting: ≥ 94 % I_{op}
Basic operate time (with auxiliary power/load current):	2 · I_{set} 25 ms, ±15 ms, 5 · I_{set} 20 ms, ±15 ms
Operate time following delay	t_{basic} + t_{delay} , ±1 % or ±30 ms
Inhibited by	Binary input or Inrush detector
Disengaging time	< 50 ms[54]

51 Time Delayed Overcurrent – Phase

Operation	Non-directional
Elements	Phase fault
Setting range I_{set}	0.1 · I_{rated} to 2.0 · I_{rated}
Time multiplier	0.01 to 10
Time delay (DTL)	0.00 s to 15 s
Operate level	110 % I_{set}, ±5 % or ±2 % · I_{rated}
Reset level	≥ 90 % I_{op}

Operate time (with auxiliary power/load current)	**IEC:** $t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1}\right] \cdot Tm$ **ANSI:** $t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^{P} - 1} + B\right] \cdot Tm$ ±5 % or ±50 ms[55]
Follower delay	0.00 s to 20 s
Reset	IEC/ANSI decaying, 0 to 60 s
Inhibited by	Binary input or Inrush detector

51G Time Delayed Earth Fault – Measured

Operation	Non-directional
Elements	Measured earth fault
Setting range I_{set}	0.06 · I_{rated} to 0.8 · I_{rated}
Time multiplier	0.01 to 10
Time delay (DTL)	0.00 s to 15 s
Operate level	110 % I_{set}, ±5 % or ±2 % · I_{rated}
Reset level	≥ 90 % I_{op}
Operate time (with auxiliary power/load current)	**IEC:** $t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1}\right] \cdot Tm$ **ANSI:** $t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^{P} - 1} + B\right] \cdot Tm$ ±5 % or ±50 ms[55]
Follower delay	0.00 s to 20 s
Reset	IEC/ANSI decaying, 0 s to 60 s
Inhibited by	Binary input or Inrush detector

51N Time Delayed Earth Fault – Calculated

Operation	Non-directional
Elements	Calculated earth fault
Setting range I_{set}	0.10 · I_{rated} to 0.8 · I_{rated}
Time multiplier	0.01 to 10
Time delay (DTL)	0.00 s to 15 s

55 Add current tolerance of ±5 % or ±2 % · I_{rated} (whichever is greater) to the operating time tolerance for TMS below 0.1

Operate level	110 % I_{set}, ±5 % or ±2 % · I_{rated}
Reset level	≥ 90 % I_{op}
Operate time (with auxiliary power/load current)	**IEC:** $t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1}\right] \cdot Tm$ **ANSI:** $t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^{P} - 1} + B\right] \cdot Tm$ ±5 % or ±50 ms[55]
Follower delay	0.00 s to 20 s
Reset	IEC/ANSI decaying, 0 s to 60 s
Inhibited by	Binary input or Inrush detector

81HBL2 Inrush detector

81HBL2 Inrush setting (ratio of 2nd harmonic current to fundamental component current)	0.10 to 0.50 · I Where, $I = I_2/I_1$
81HBL2 Inrush release block	0.30 · I_{rated} to 20 · I_{rated}
t_{basic} Element basic operate time	Will pick-up before operation of any protection element due to magnetic inrush
Reset time	Will pick-up before operation of any protection element due to magnetic inrush

NOTE

For better inrush accuracy, the fundamental current must be minimum of 0.15 · I_{rated} in at least one phase.

74TC Trip-Circuit Supervision

Number of supervisable circuits	1 x trip
Number of BI's required	1 or 2 per function

NOTE

Use the correct threshold voltages for BI when using TCS with 2 BI.

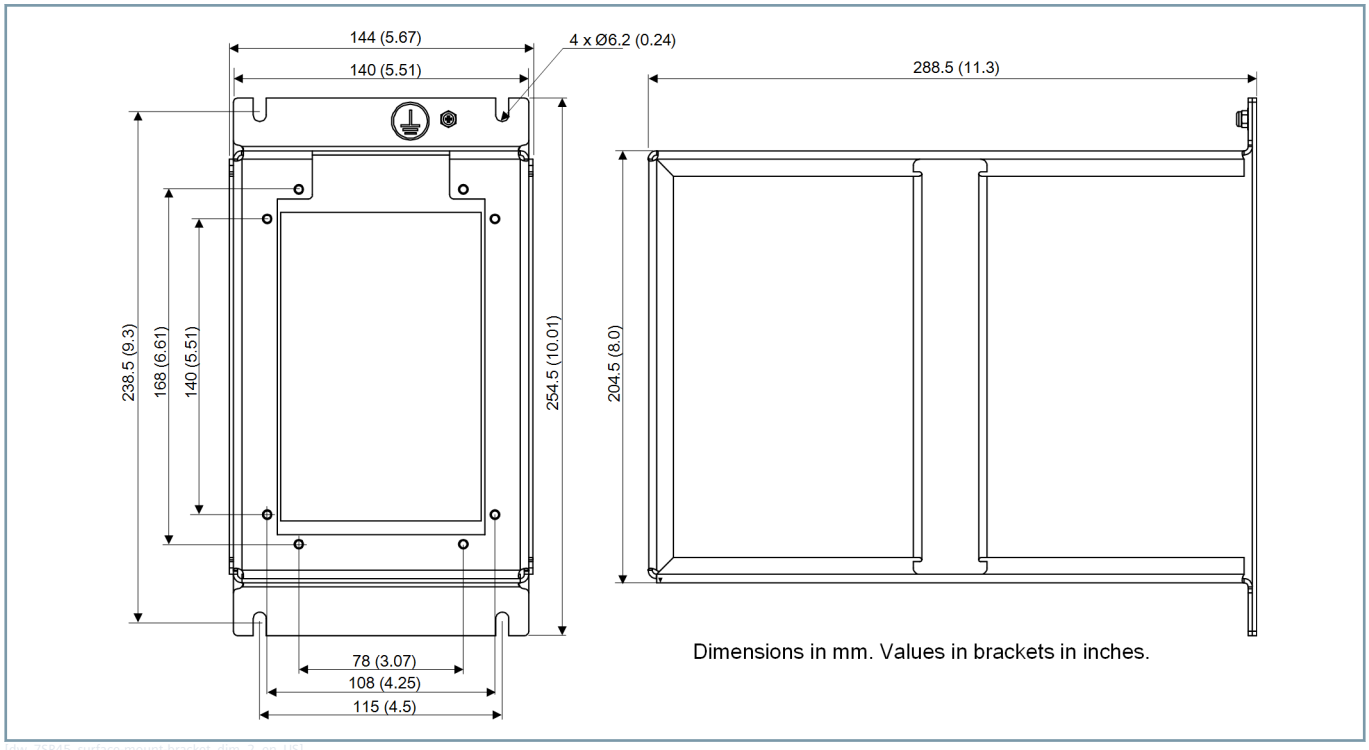
Ordering Information – 7SR45 Argus

Product Description	Order Number																	
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Non-Directional Overcurrent and Earth Fault Relay	7	S	R	4	5	0	□	–	□	□	□	□	0	–	□	A	□	0
							|		|	|	|	|			|	|	|	
Case I/O and Fascia							|		|	|	|	|			|	|	|	
Size 4 moulded case (height reduced), 4 CT, 2 BI/2 BO, pulse output, 9 LEDs							3		|	G	A/B	|			|	|	|	
Size 4 moulded case (height reduced), 4 CT, 2 BI/2 BO, pulse output, 9 LEDs							3		|	H/J	A	|			|	|	|	
Size 4 moulded case (height reduced), 4 CT, 4 BI/4 BO, pulse output, 9 LEDs							4		|	H/J	B	|			|	|	|	
									|	|	|	|			|	|	|	
Measuring Input									|	|	|	|			|	|	|	
1 A, 50 Hz/60 Hz									1	|	|	|				|	|	|	
5 A, 50 Hz/60 Hz									2	|	|	|				|	|	|	
										|	|	|				|	|	|	
Auxiliary Voltage										|	|	|				|	|	|	
Self powered (CT powered : BI threshold DC 19 V)										G	|	1				|	|	|	
Dual powered (CT powered + Aux. powered : DC 24 V to 60 V, BI threshold: DC 19 V)										H	|	2				|	|	|	
Dual powered (CT powered + Aux. powered : AC 60 V to 240 V/DC 60 V to 240 V, BI threshold: AC 88 V/DC 88 V)										J	|	2				|	|	|	
											|	|				|	|	|	
Front Fascia											|	|				|	|	|	
Standard version											A	|				|	|	|	
Standard version – with trip flag indicator											B	|				|	|	|	
												|				|	|	|	
Communication Options												|				|	|	|	
Front port : USB												1				|	|	|	
Front port: USB and rear port: RS485 supporting IEC 60870-5-103 and Modbus RTU (user-selectable setting)												2				|	|	|	
																|	|	|	
LED Configuration																|	|	|	
Standard pickup LEDs, Amber color															1	|	|	|	
Pickup LED, Green color															2	|	|	|	
																	|	|	
Protection and Supervision Function Packages																A	|	|	
49 Thermal overload																	|	|	
50 Instantaneous overcurrent – phase																	|	|	
50G Instantaneous earth fault – measured																	|	|	
50LC Line check/Switch onto fault																	|	|	
50N Instantaneous earth fault – calculated																	|	|	
51 Time-delayed overcurrent – phase																	|	|	
51G Time-delayed earth fault – measured																	|	|	
51N Time-delayed earth fault – calculated																	|	|	
74TC Trip-circuit supervision																	|	|	
81HBL2 Inrush detector																	|	|	
																	|		
Conformal coating																	|	|	
Standard version – No conformal coating on PCBA																	A	|	
Conformal coating on PCBA																	B	|	

Ordering Information – 7SR45 Argus Spares and Accessories

Variants	Description
7XG1900-1AA00-0AA0	Main battery CR123A [56]
7XG1900-2AA00-0AA0	RTC battery CR1632[56]
7XG1900-3AA00-0AA0	Main battery CR123A + RTC battery CR1632 [56]
7XG1900-0MA54-0FC0	Transparent front cover
7XG1900-0MA55-0FC0	Surface mounting bracket
7XG1900-0MA56-0FC0	CT terminal cover for IP20

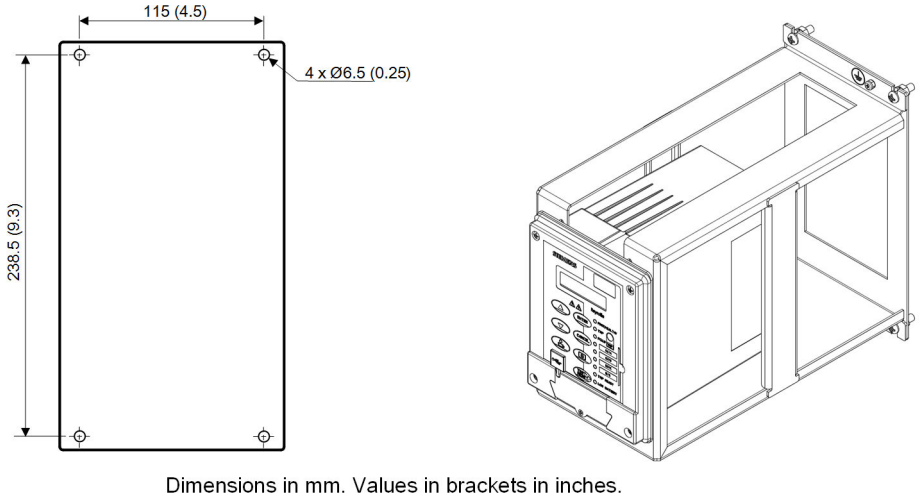
Surface Mounting Bracket Dimensions and Panel Cut-out View



[dw_7SR45_surface-mount-bracket_dim, 2, en_US]

Figure 2.5/20 Front and Side Views

56 Siemens recommends to procure these battery spares from local market.



[dw_7SR45_surface-mount-bracket_panel, 1, en_US]

Figure 2.5/21 Mounting Holes for Surface Mount Bracket and Assembled Bracket with 7SR45

7SR46 Self/Dual Powered Overcurrent Protection – Devices and Application

Description

The Reyrolle 7SR46 Argus is a dual-powered non-directional overcurrent and earth-fault protection device - with specific CTs. The relay provides both definite-time and inverse-time overcurrent and earth-fault protection functions. The relay is CT-powered with an option for connection to an external auxiliary supply.

The relay functionality is configured via a front USB port for local PC connection or via a rear electrical RS485 port for remote connection. With Reydisp Evolution software, you can update the settings and view the fault records (trip log) and the event records (event log).

The relay supports the communication protocols IEC 60870-5-103 and MODBUS RTU which help to establish connection with SCADA. Based on the ordering options, the relay can indicate the trip with local and remote flag indicator.

Main function	Overcurrent and earth-fault protection
Inputs and outputs	3 current transformers, 2 binary inputs, external trip initiation input, 2 binary outputs, pulse output, remote flag output, and local flag output
Communication	Front USB port (for configuration via Reydisp Evolution) and rear RS485 port
Housing	Non-draw-out polycarbonate case with side mounting arrangement

Benefits

- CT-powered with option for external auxiliary supply connection
- Dedicated switch onto fault (SOTF) protection
- Self-monitoring – Including battery-condition monitor
- High sensitivity – Trip ready at 80 % of I_{smin} (1-phase) and 40 % of I_{smin} (3-phase)
- Intelligent power management – Fail-safe startup and shut-down modes
- Internal lithium battery backup for viewing fault data, setting options for protection and real-time clock, and resetting of indications
- Compatible with 6 types of specific CTs (class 5P80) - giving wide range of operation
- RS485 port communication is available in the self-powered and the auxiliary power supply mode.
- 2 user-programmable LEDs for indicating protection and other relay functions
- Mechanical flag indication
- External trip initiation input
- Suitable for RMU assembly

Functions

Protection functions:

Figure 2.6/1 7SR46 Device

- 49 Thermal overload protection
- 50 Instantaneous overcurrent – phase
- 50LC/SOTF Line check/switch onto fault
- 50N Instantaneous earth fault – derived
- 51 Time-delayed overcurrent – phase
- 51N Time-delayed earth fault – derived

Supervision functions:

- 81HBL2 Inrush current detection

Ancillary functions:

- 49T High-speed trip via BI
- 49T High-speed trip via external trip initiation
- 86 Lockout

Communication

- IEC 60870-5-103
- MODBUS RTU

Reydisp Evolution Software

The user-friendly PC software tool ensures a smooth installation providing an efficient and intuitive interface to the relay.

Application

The 7SR46 dual-powered relay is an overcurrent and earth-fault protection device primarily intended for secondary distribution in electrical networks.

The 7SR46 relay is designed to operate with/without an auxiliary supply. The relay is powered primarily from the auxiliary voltage even though all other power sources are available.

In the absence of auxiliary voltage, the relay is powered by CT input.

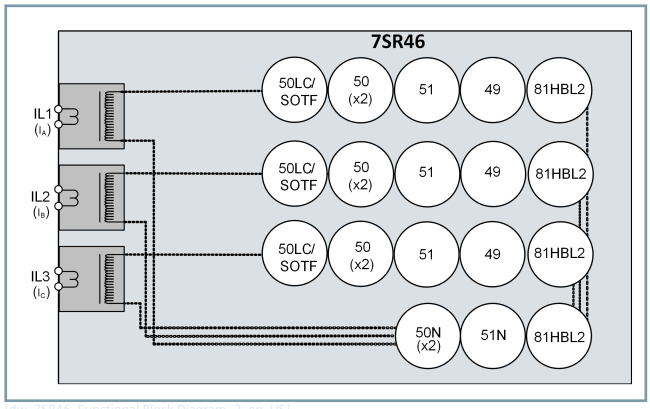
The device provides definite-time and inverse-time overcurrent and earth-fault protection functions in accordance with IEC and ANSI standards.

The 7SR46 relay has a pulse output that operates when any configured protection function trips. The pulse output is used to interface directly with the low energy circuit breaker trip coil. The trip energy for the trip coil is stored in a capacitor built into the protection device.

The 7SR46 relay is targeted for the following applications:

- Protection device for Ring Main Units (RMU)
- Backup protection device for the medium-voltage applications
- Protection applications in remote locations where auxiliary supply is not available
- Incomers, feeders, and Medium Voltage/Low Voltage transformers
- Panel refurbishment of old electromechanical protection relays.

Functional Diagram



[dw_7SR46_Functional Block Diagram, 2, en_US]

Figure 2.6/2 Functional Diagram of 7SR46 Dual-Powered Non-Directional Overcurrent and Earth Fault Relay

The relay provides 2 settings groups - Group number (Gn) 1 and 2 which can both be viewed/edited via the fascia or PC Software tool.

Protection

49 Thermal overload protection

The thermal overload function monitors thermal levels (Θ) of the electrical equipment thus tripping them in case of thermal overload.

1 thermal overload element is provided.

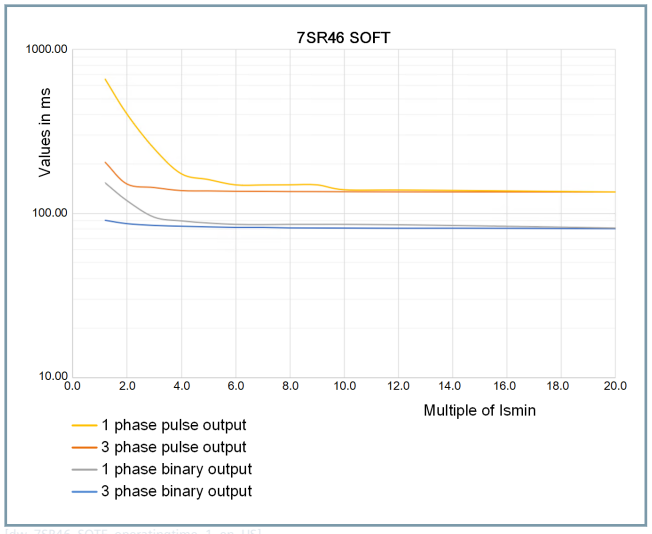
50 Instantaneous Overcurrent – Phase

50 INST/DTL elements provide overcurrent protection, each with independent settings for pickup current and time delays.

2 overcurrent measurement stages are available.

50LC/SOTF Line Check/Switch onto Fault

The SOTF functionality provides high-speed tripping if a fault is still present on the feeder after the reclosure of the circuit breaker (close onto fault) or if earthing clamps are left connected after maintenance.



[dw_7SR46_SOTF_operatingtime_1, en_US]

Figure 2.6/3 50LC/SOTF for 3-Phase, 1-Phase with Binary Output and Pulse Output

50N Instantaneous Earth Fault – Derived

This function derives the earth current internally from the 3-phase CT inputs to indicate an earth fault.

2 earth-fault stages are available.

50N INST/DTL elements provide earth-fault protection, each with independent settings for the pickup current.

51 Time-Delayed Overcurrent – Phase

51 IDMTL/DTL elements provide overcurrent protection, each with independent settings for pickup current, time multiplier (51), and time delays. The customer can select IEC or ANSI time-current characteristics. The IDMT has a user-selectable reset characteristic; either DTL or IEC/ANSI reset characteristic to improve the grading with electromechanical protection.

51N Time-Delayed Earth Fault – Derived

This function derives the earth current internally from the 3-phase CT inputs to indicate an earth fault.

51N IDMTL/DTL elements provide earth-fault protection, each with independent settings for pickup current, time multiplier, and time delays. The customer can select IEC or ANSI time-current characteristics. The IDMT has a user-selectable reset characteristic; either DTL or IEC/ANSI time reset characteristic to improve grading with electromechanical protection.

81HBL2 Inrush Current Detection

Where a 2nd harmonic current is detected (that is, during transformer energization), user-selectable protection-function elements can be blocked.

86 Lockout

Relay contacts can be configured to self-reset, or hand-reset operation.

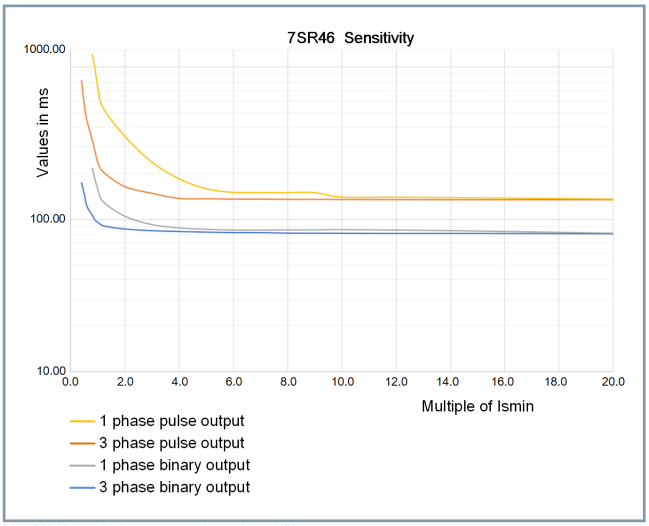
Relay contacts can be used to directly trip the circuit breaker. The operate break duty of relay contacts is limited so the circuit-breaker trip coil must be opened by a suitably rated contact, typically a circuit-breaker auxiliary switch.

Sensitivity

In absence of auxiliary voltage, the sensitivity of the relay is the minimum phase current required for the relay to energize, detect a fault, and trip as per the configuration.

The sensitivity of the 7SR46 Argus relay is 80 % of I_{smin} for 1-phase and 40 % of I_{smin} for 3-phase. The LED **HEALTHY** turns on when the relay is ready at the current levels mentioned.

The following graph shows the sensitivity of the relay and the corresponding operating time for different starting currents.



[dw_7SR46_sensitivity operating-time_1, en_US]

Figure 2.6/4 Operating Time for 3-phase, 1-phase with Binary Output and Pulse Output

Monitoring

The relay is designed with several monitoring features.

Self-Monitoring

The self-monitoring supervision includes monitoring of power-supply signals, code execution watchdog, memory checks by checksum, RTC check, and battery health checks.

The **Healthy** LED is illuminated when the power-supply signals are healthy. The **Internal relay failure** (**IRF**) feature monitors the healthiness of the relay, provides an error message indication on the LCD when an internal error is detected. The error messages and error codes are available in the instrument mode. The IRF can also be mapped to a binary output.

Battery Monitoring

The battery profile menu provides the consumption of the battery power for different applications, and in addition, a Low battery indication is provided.

Instruments & Meters

The following measured values and status information are monitored and displayed in the relay under the Instrument mode.

Primary current phases and earth
Binary input status and binary output status
Thermal capacity
External trip initiation input status
Fault records (trip log)
Battery Profile

Intelligent power management ensures a healthy shutdown below the operating ranges and fail-safe startup mode.

Data Acquisition and Recording

Sequence-of-Event Records (Event Log)

Up to 100 events can be stored and time tagged to 1-ms resolution. The events are stored on First-In-First-Out basis. The events are available through the communication interface.

Fault Records (Trip Log)

The last 10 fault records are displayed on the relay fascia and are also available through the communication interface. The records are displayed with time and date of trip, measured quantities, and type of fault.

Real-Time Clock

The time and date can be set and is maintained while the relay is de-energized. The real-time clock continues to operate on 3 V Lithium battery.

Communications

The relay offers a USB port as standard on the front of all units. All relay functions can be set on a PC using the Reydisp Evolution software via the USB port. The connection is made with a USB cable and operates with a "plug-and-play" connection, so no presetting of the relay is required.

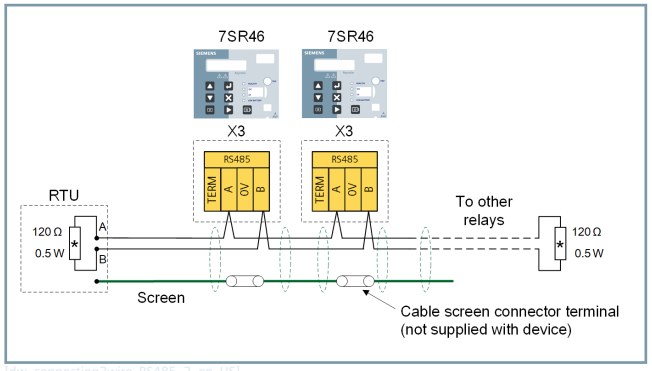
The front port can be switched off or set to use the protocols MODBUS-RTU or IEC 60870-5-103 for testing purposes. The default protocol is IEC 60870-5-103.

NOTE

The Reydisp Evolution software works with the relay only when the USB port is configured to the protocol IEC 60870-5-103.

A rear RS485 electrical connection is available on the relay for system-interface connections.

An internal terminating resistor is provided, which can be connected into the circuit by adding a wire loop between the relevant terminals.



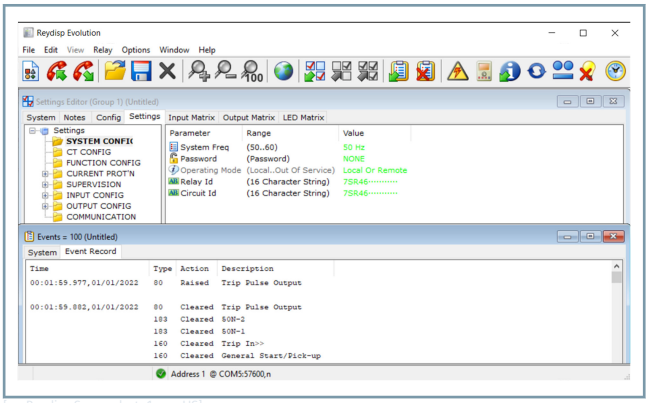
[dw_connection2wire_RS485, 2, en_US]

Figure 2.6/5 Typical RS485 Connection

The rear RS485 can be user-selected to be OFF, IEC 60870-5-103, or MODBUS-RTU.

Reydisp Evolution

Reydisp Evolution is a Microsoft Windows-based software tool. It allows you to apply settings, interrogate settings, and retrieve events and disturbance waveforms from the device. It is common to the entire range of Reyrolle protection relays.



[sc_Reydisp Screenshot, 1, en_US]

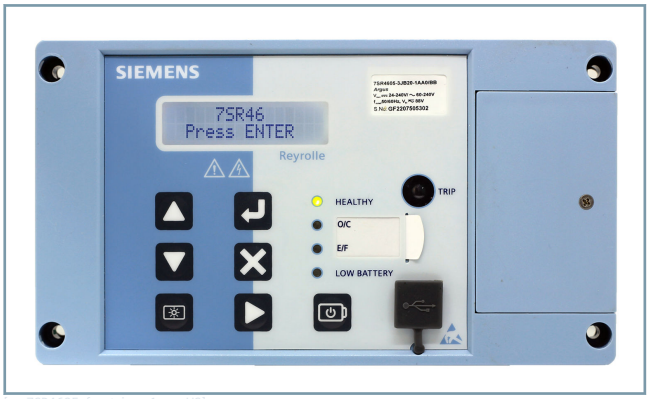
Figure 2.6/6 Example Reydisp Evolution

Hardware Construction

The relay is housed in a non-draw-out polycarbonate case.

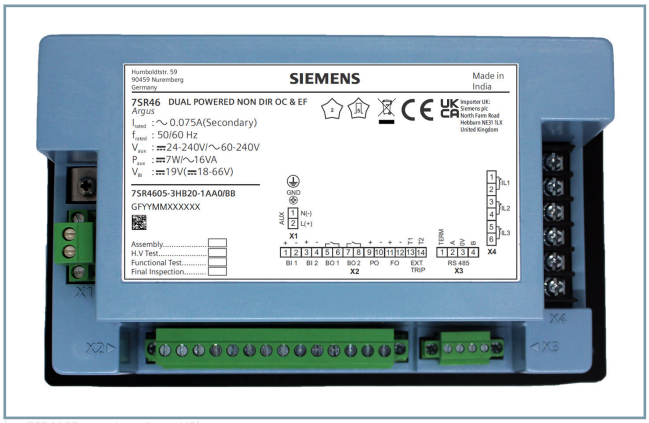
The rear connection comprises user-friendly pluggable type terminals for pulse and flag output, binary inputs, binary outputs, external trip initiation input, RS485 communication, and auxiliary input.

The CT terminals are suitable for a ring-type lug connection to provide a secure and reliable termination.



[sc_7SR4605_frontview, 1, en_US]

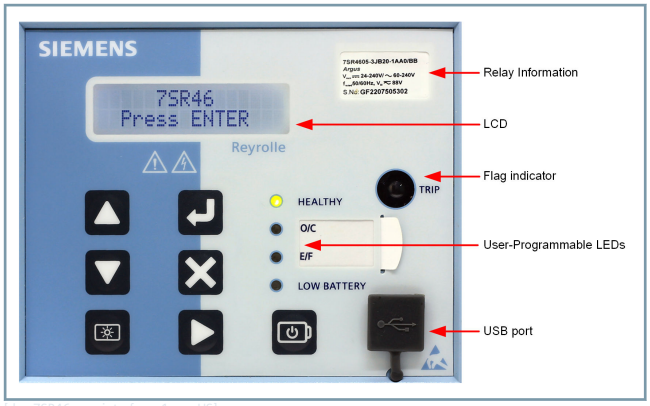
Figure 2.6/7 Front View



[sc_7SR4605_rearview, 1, en_US]

Figure 2.6/8 Rear View

User Interface



[dw_7SR46 user interface, 1, en_US]

Figure 2.6/9 User Interface

The user interface is designed to provide a user-friendly method of viewing menus, entering settings, and retrieving data from the relay. 5 buttons are provided for navigation around the menu structure. Also, 2 buttons are provided for the functionality battery ON/OFF and backlight ON/OFF.

LCD

A 2-line by 16-character-liquid crystal display with power save operation indicates the relay identifier, settings, instrumentation, and fault data. The relay also provides 3 alert screens – fault trip alert, alarm alert, and user information alert.

LEDs

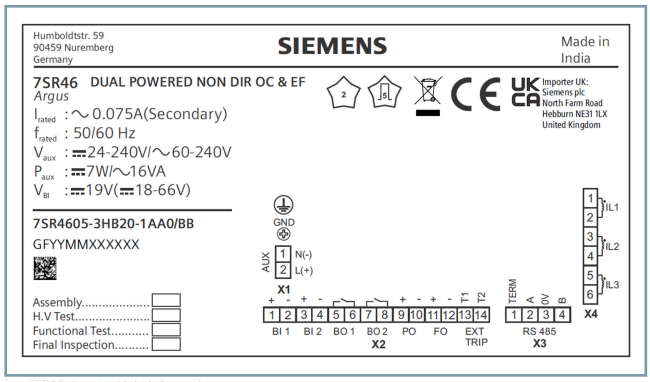
2 non-programmable LEDs and 2 user-programmable LEDs are provided on the front fascia. Each non-programmable LED shows clear indication of the associated functions state and has a label for identification.

The 2 user-programmable LEDs can be configured for protection and other relay functions. By default, the LED L2 is mapped to the function 50-1 and 51-1 respectively. LED L3 is mapped to the function 50N-1 and 51N-1 respectively. This default configuration is printed on one side of the paper label provided with the decal. If you prefer to change the configuration of user-programmable LEDs, then you must manually write the function name (to which the LED is mapped) on the paper label.

LED	Names	Color	Function
LED 1	Healthy	Green	Indicates the relay protection function in a healthy state
LED 2	User-defined function	Red	LEDs 2 and 3 are user-programmable LEDs. They indicate when the respective mapped function is triggered.
LED 3		Red	
LED 4	Low Battery	Amber	Indicates when the battery voltage is less than the operating level

Flag Indicator

1 local flag indicator is provided and configured for the trip indication. The color of the flag is BLACK during normal operation and turns TANGERINE during trip condition. The trip indication can be reset through HMI or via electrical reset (using binary input).



[sc_7SR46_terminal label, 1, –,–]

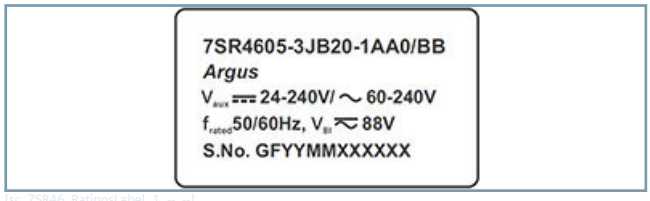
Figure 2.6/10 Terminal Label

The device terminal label displays the MLFB code, serial number, relay description, terminal contact details, and safety symbols.

	QR code that can be scanned using a QR-code reader application. This allows the device serial number to be quickly identified.
	2 kV dielectric test voltage
	5-kV impulse test voltage
	European CE marking
	Waste Electrical and Electronic Equipment Directive (WEEE)
	United Kingdom (UK) Conformity Assessed marking

Relay Information

The device is identified by the rating label on the front fascia. You can also give the device its own identity by editing the "Relay Identifier" displayed on the LCD.



[sc_7SR46_RatingsLabel, 1, –,–]

Figure 2.6/11 Fascia Relay Rating Label

Power

The 7SR46 dual-powered non-directional overcurrent and earth-fault relay can be powered in the following modes and their priority is as follows:

- Auxiliary power supply
- CT power
- USB power
- Battery power

Confirmation ID (Password Protection)

The relay allows you to set a 4-character confirmation ID (shown as Password in the relay LCD display). If a confirmation ID has already been set, then the user must enter the confirmation ID to gain access to the editing mode for setting parameters.

General Alarms

Up to 3 general alarms of 16 characters can be configured to display a text message on the LCD. The general alarms can be triggered from one or more inputs (binary inputs or external trip input).

External Trip Input

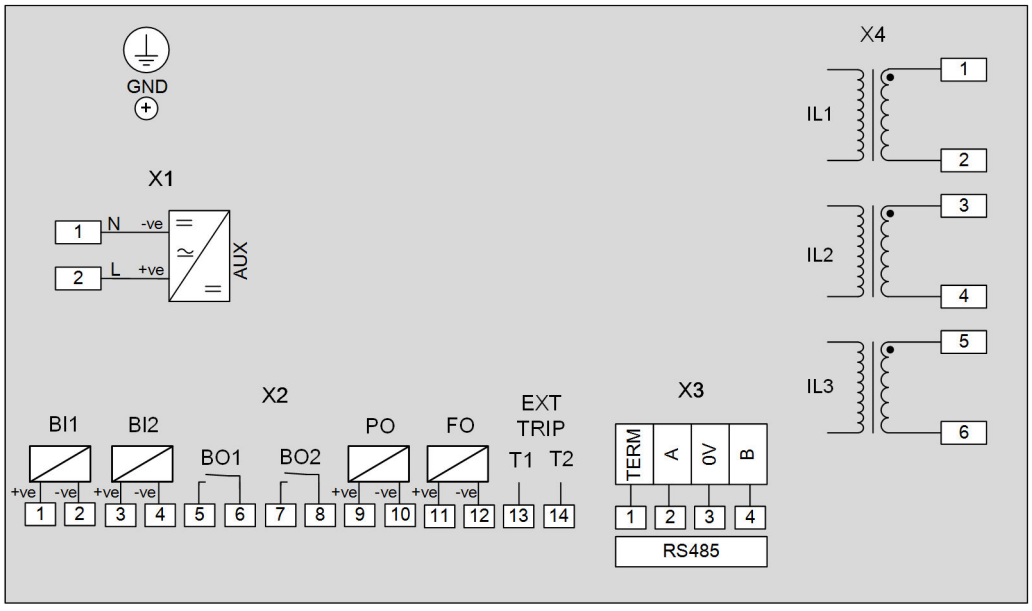
The device has an external trip input which is routed through an external potential-free contact. The external trip input senses the external potential-free contact status by sending a periodic low-voltage signal (approximately 5 V). The external trip input is available only with CT power and auxiliary power supply. This functionality is configured through HMI and Reydisp Evolution.

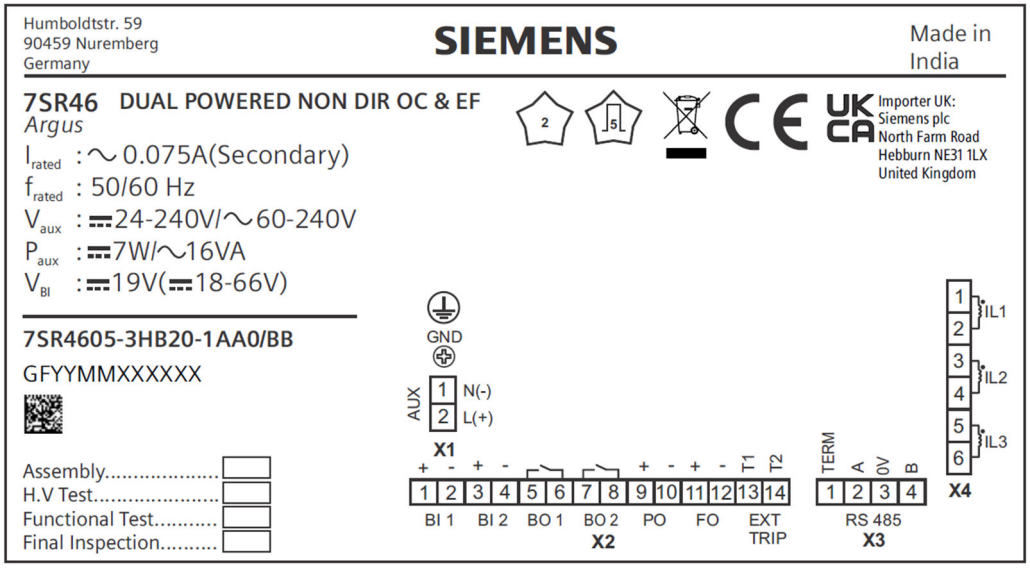
Battery

The 7SR46 Argus relay is provided with CR2/3AZ battery. The battery is used to energize the device when auxiliary power supply, phase current, and USB power-up are not available.

7SR46 in battery mode is used for operating binary input, binary output, LED, LCD backlight and resetting local flag.

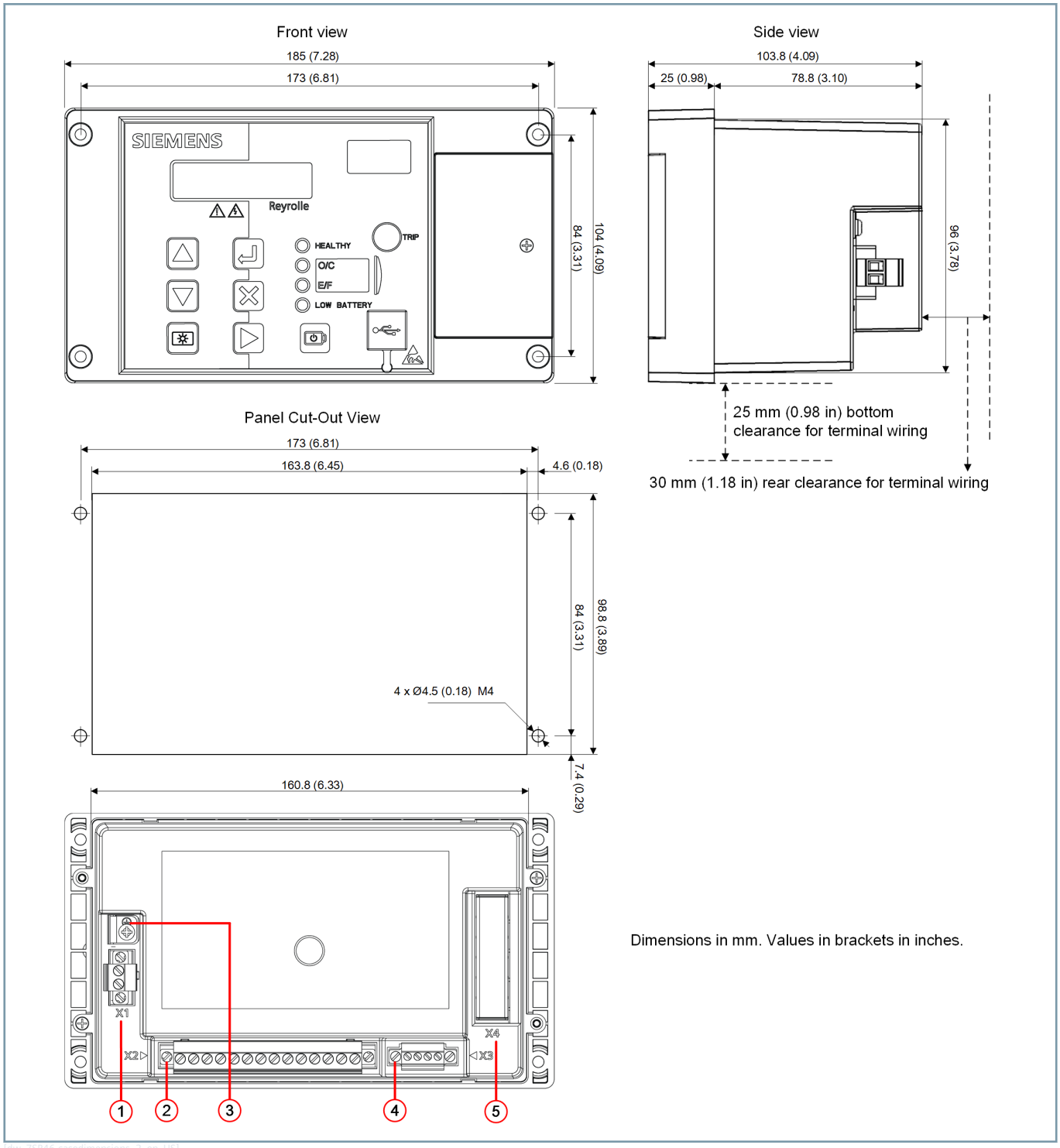
Connection Diagrams





[dw_7SR46_connection and terminal diagram, 1, en_US]

Figure 2.6/12 Connection Diagram and Terminal Label



[dw_7SR46-casedimensions, 2, en_US]

Figure 2.6/13 Front View, Side View, Panel Cut-Out View and Rear Terminal View

(1) 4.5 mm hole to have clearance in order to insert M4 screws

(2) Auxiliary power supply

(3) Binary inputs/binary outputs/pulse output/flag output/external trip input

(4) Protective grounding terminal

(5) Rear communication port

(6) Current inputs

Technical Data

For complete technical data, refer to the Technical Data chapter in the *7SR46 Device Manual* and in the *7SR46 Hardware Manual*.

Indication of Conformity

This product complies with the directive of the Council of the European Communities on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 2014/30/EU) and concerning electrical equipment for use within specified voltage limits (Low Voltage Directive 2014/35/EU) as well as restriction on usage of hazardous substances in electrical and electronic equipment (RoHS Directive 2011/65/EU).

This conformity has been proved by tests conducted by Siemens AG in accordance of the Council Directive in accordance with the product standard IEC/EN 60255-26 for the EMC directives, and with the standard IEC/EN 60255-27 for the low-voltage directive.

RoHS directive 2011/65/EU is met using the standard IEC/EN 63000. The device has been designed and produced for industrial use.

General Technical Data

Product family	Dual powered non-directional overcurrent and earth fault relay
Case and LEDs	Non draw-out polycarbonate case, 2 non-programmable LEDs & 2 programmable LEDs
Measuring inputs (current)	0.075 A (secondary) 50 Hz/60 Hz
Auxiliary voltage	AC 60 V to 240 V/DC 24 V to 240 V
Communication	Front communication port: USB (IEC 60870-5-103 or MODBUS RTU) Rear communication port: RS485 (IEC 60870-5-103 or MODBUS RTU)
Protection functions	49, 50, 50N, 51, 51N, 50LC/SOTF
Supervision functions	81HBL2 (Inrush-current detector)
Binary input and binary output	2 BI and 2 BO
External trip initiation input	1 external trip initiation input
Remote flag (FO)	24 V, 0.01 Ws
Local flag	Mechanical flag indicator • Normal – black color • Trip – tangerine color
Pulse output (PO)	24 V, 0.1 Ws pulse output
Altitude of operation	Maximum up to 2000 m

Sensitivity

Minimum phase current for relay operation	0.8 · I_{smin} in 1-phase 0.4 · I_{smin} in 3-phase
For more information on minimum current requirements for respective peripheral operations, refer to 7SR46 Operating Manual.	

Mechanical Specifications

Design	Panel mounting, non-draw-out polycarbonate molded case
Enclosure	IP 54 (front side) IP 20 (rear side with cover for current terminal)
For operator protection	IP 2x for other terminal and current terminal with cover
Weight	Approx. 0.9 kg
Dimensions	Width: 185 mm Height: 105 mm Depth behind panel: 78.8 mm. Additional 30 mm clearance distance to be considered for wiring.

Installation Category

Overvoltage category	Class III

Pollution

Degree of pollution	2

Recommended Terminal Lugs Specifications

Current inputs	Cable Specifications: Panduit ring terminal, nylon insulated M3 stud size, 4 mm^2 to 6.6 mm^2, 12 AWG Manufacturer/Part Number: TE Connectivity Mfr. Part No. 2-327960-1 or equivalent Torque required: 0.58 Nm
Auxiliary supply	Cable Specifications: Insulated tin-plated crimp pin connector, 2.6 mm^2 to 6.6 mm^2, 12 AWG to 10 AWG Manufacturer/Part Number: End sleeve, 3D-8011H or equivalent Torque required: 0.5 Nm to 0.6 Nm
Rear communication port	Cable Specifications: Pin type lug/1.5 mm^2 control cable Manufacturer/Part Number: End sleeve, 3D-8011H or equivalent Torque required: 0.5 Nm to 0.6 Nm
Front communication port	USB, type B Manufacturer/Part Number: Tyco/974329-1 or equivalent

Binary input/binary output/pulse output/ flag output/external trip input	Cable Specifications: Insulated tin-plated crimp pin connector, 2.6 mm^2 to 6.6 mm^2, 12 AWG to 10 AWG Manufacturer/Part Number: End sleeve, 3D-8011H or equivalent Torque required: 0.5 Nm to 0.6 Nm
Protective grounding terminal	Cable Specifications: Panduit ring terminal, nylon insulated M3 stud size, 4 mm^2 to 6.6 mm^2, 12 AWG to 10 AWG Manufacturer/Part Number: RS Stock No. 613-9334 or equivalent Mfr. Part no. RVY5-3.2 Torque required: 0.58 Nm

Inputs and Outputs

Auxiliary Supply

Rated auxiliary voltage	AC 60 V to 240 V/DC 24 V to 240 V Tolerance: -20 % to +10 %
Rated frequency	50 Hz 60 Hz
Allowable alternating component in DC (ripple)	15 % of DC voltage
Typical power consumption (DC)	< 7 W
Typical power consumption (AC)	< 16 VA
Inrush current	55 A for 200 µs maximum
Maximum interruption time (collapse to zero)	≤ 20 ms (DC 19.2 V) ≤ 20 ms (DC 48 V) ≤ 500 ms (AC 230 V)

Current Inputs

Quantity	3 x phase
Rated current I_{smin}	0.075 A (secondary) or 0.9 · I_{smin}
Measuring range	Phase current: 0.2 · I_{smin} to 20 · I_{smax}
Instrumentation[57]	±5 % or ±2 % ·I_s
Continuous thermal rating	2.5 · I_{smax}
Short time thermal rating	100 · I_{smax}
Rated frequency	50 Hz (range: 47.5 Hz to 52.5 Hz) 60 Hz (range: 57 Hz to 63 Hz)

Binary Inputs (BI)

Number	2	
BI threshold/operating range	**BI voltage rating**	**BI operating range**
	DC 19 V	DC 18 V to 66 V
	DC 88 V	DC 86 V to 265 V
	AC 88 V	AC 71 V to 265 V
Maximum AC/DC current for operation	3.5 mA	
Pickup delay	User-selectable 0 s to 600 s (up to 10 min)	
Drop off delay	User-selectable 0 s to 600 s (up to 10 min)	
Maximum cable length	< 10 m For larger cable length, always use a multi-core screened or twisted pair (screened or unscreened) cables.	

External Trip Input

Number	1
Current pulse	5 mA (±1 mA)
Scanning time	Every 5 s off, 1 s on
Maximum cable length	Up to 20 m
Maximum wire resistance	20 Ω

Binary Outputs (BO)

Number	2 (make contacts)	
Operating voltage	Potential-free	
Operating mode	User-selectable BO 1 and BO 2 self or hand/electrical reset	
Operating time from energizing binary input	< 20 ms	
Disengaging time	< 20 ms	
BO 1 and BO 2 Output Contact Details		
Switching voltage	AC 250 V and DC 125 V	
Contact current rating: Continuous Short time	 AC 5 A/DC 5 A AC 20 A/DC 20 A for 0.5 s AC 30 A/DC 30 A for 0.2 s	
Making capacity	1000 W at L/R ≤ 40 ms	
Breaking capacity: AC resistive AC inductive DC resistive DC inductive (L/R ≤ 40 ms)	 1250 VA 250 VA 75 W 30 W	 V/I = 250/5 V/I = 250/1@ PF ≤ 0.4 V/I = 48/1.5; 110/0.7 V/I = 48/0.7; 110/0.3
Mechanical/electrical endurance	10 000 operations	

Front Communication Port

Quantity	1
Electrical connection	USB, type B
Supported protocols	Modbus RTU, IEC 60870-5-103

Rear Communication Port

Quantity	1
Electrical connection	RS485, 2-wire electrical, twisted pair

57 The accuracy mentioned is for the device. An Additional CT error must be considered along with the specific CTs.

Supported protocols	Modbus RTU, IEC 60870-5-103
Rate	Transmission rate: 1200 Bit/s to 57 600 Bit/s

Data Storage

Fault record (trip log)	10 records
Events (event log)	100 events (1-ms resolution)

Mechanical Tests

Test	Standard
Degree of protection	IEC 60529 IP 54 front IP 20 (rear side with cover for current terminal)
Vibration	IEC 60255-21-1 Response and endurance Class I
Shock and bump	IEC 60255-21-2 Shock response and withstand Class I Bump, class I
Seismic	IEC 60255-21-3 Class I
Contact performance	IEC 60255-1 (Ref: Std IEC 61810-1)

Electrical Tests

Test	Standard
Insulation resistance	IEC 60255-27[58] Insulation resistance > 100 MΩ at DC 500 V Test duration: > 5 s (Between any terminal and earth, independent circuits)[59]
Impulse voltage withstand	IEC 60255-27[58] 5 kV, 1.2/50 µs, 0.5 J 5 +ve, -ve pulses (Between all terminals and earth and any 2 independent circuits)[59]
AC dielectric voltage	IEC 60255-27[58] AC 2 kV RMS for 1 min (Between any terminal and earth, independent circuits)[59] AC 1 kV RMS for 1 min (across normally open contacts)

Test	Standard
NOTE: Phase-current inputs, flag output, and pulse output are excluded between any terminals and earth for insulation resistance, impulse voltage withstand, AC dielectric voltage tests respectively.	
Slow damped oscillatory wave	IEC 60255-26 **Common-mode:** Test voltage: 2.5-kV peak voltage **Differential mode:** Test voltage: 1.0-kV peak voltage Test duration: 2 s Source impedance: 200 Ω Voltage oscillation frequency: 1 MHz Repetition frequency: 400 Hz
Electrostatic discharge	IEC 60255-26 8-kV air discharge 6-kV contact discharge
Electrical fast transient or burst	Zone A Test severity amplitude: ±4 kV Repetition frequency: 5 kHz
Surge immunity[60]	IEC 60255-26 Test level: zone A Line-to-line: 0.5 kV, 1 kV, 2 kV Line-to-earth: 0.5 kV, 1 kV, 2 kV, 4 kV Front time/time to half-value: 1.2/50 µs Source impedance: 2 Ω
Radiated immunity	IEC 60255-26 80 MHz to 1.0 GHz and 1.4 GHz to 2.7 GHz Field strength: 10 V/m (RMS) Amplitude modulated: 80 % AM
Conducted radio frequency interference	IEC 60255-26 150 kHz to 80 MHz, 10 V_{rms} , dwell time: 0.5 s
Power frequency-magnetic field	IEC 60255-26 30 A/m applied 1 min, 300 A/m applied for 3 s
Damped oscillatory magnetic field value	IEC 61000-4-10 0.1 MHz and 1.0 MHz, 100 A/m
Radiated emissions	IEC 60255-26
Conducted emissions	IEC 60255-26

58 All aspect of IEC 60255-5 have been covered under IEC 60255-27.

59 Phase current inputs, flag output, and pulse output are excluded between any terminals and earth.

60 Additional 90-ms DTL pickup delay applied to binary inputs.

Test	Standard
Thermal withstand	IEC 60255-27[58] Continuous withstand: 2.5 · I_{smax} Short-time withstand: Test duration 1 s 100 · I_{smax}
Functional performance	IEC 60255-151, IEC 60255-1, and IEC 60255-149
Maximum allowable temperature	IEC 60255-6 Max. temperature limit +100 °C
Gradual shutdown/startup test	IEC 60255-26 Shut down/start up ramp 60 s Power off 5 min
Power frequency immunity test[61]	IEC 60255-26 **Common-mode:** ● Test voltage: 300 V ● Coupling resistor: 220 Ω ● Coupling capacitor: 0.47 µF
Short circuit test[62]	20 kA for 3 s 25 kA for 1 s 62.5 kA for 10 ms dynamic withstand

Climatic Environmental Tests

Temperature

IEC 60068-2-1/IEC 60068-2-2/IEC 60255-1

Ambient operating temperature	-10 °C to +60 °C
Permissible temporary operating temperature (tested for 16 h)[63]	-40 °C to +70 °C
Storage temperature (non-operational)[64]	-25 °C to +70 °C

Humidity

IEC 60068-2-30/IEC 60068-2-78/IEC 60255-1

Damp heat test, cyclic	+25 °C to 55 °C, RH > 93 % RH (6 cycles) At lower temperature, 97 %, -2 % to +3 % RH At upper temperature, 93 %, ±3 % RH
Damp heat test, steady state	10 days at 93 ±3 % RH, +40 °C

Product Safety Test

Clearances and creepage distances	IEC/EN 60255-27: Edition 2 ≥ 4 mm
IP rating	IEC/EN 60255-27: Edition 2 IP54 (front side) IP20 (rear side)
Impulse voltage	IEC/EN 60255-27: Edition 2 5 kV, 5 +ve, -ve pulses
AC dielectric voltage	IEC/EN 60255-27: edition 2 AC 2 kV, 50 Hz, 1 min
Insulation resistance	IEC/EN 60255-27: Edition 2 DC 500 V, > 5 s, > 100 MΩ
Protective bonding resistance	IEC/EN 60255-27: Edition 2 < AC 12 V/DC 12 V, 1 min, < 0.1 Ω
Protective bonding continuity	IEC/EN 60255-27: Edition 2
Flammability	IEC/EN 60255-27: Edition 2
Single-fault condition	IEC/EN 60255-27: Edition 2

Performance

49 Thermal Overload Protection

Elements	Thermal Overload
Setting range I_{set} (49)	0.2 · I_s to 1.5 · I_s Δ 0.1 · I_s
Heating time constant (TauH)	1.0 min to 300.0 min Δ 0.5 m
Cooling time constant (TauC)	1.0 · TauH to 6.0 · TauH Δ 0.5 · TauH
Capacity alarm	50 % to 100 %, Δ 1 %
Initial thermal level	0 % to 40 %, Δ 5 %
Operate level	Thermal capacity: 100 %,±3 %
Reset level	≥ 95 % · θ
Overload trip operate time (t_{op})	$t = \tau \cdot \ln\left[\frac{I^2 - I_P^2}{I^2 - I_\theta^2}\right]$
Operating time tolerance[65]	± 5 % of t_{op} or ± 10 s
Operating time tolerance Frequency variation[65] (47.5 Hz to 52.5 Hz) (57 Hz to 63 Hz)	± 10 % of t_{op} or ± 50 s

61 DC binary input ports interfacing with cables whose total length is more than 10 m, must have a multi-core twisted screened cable for providing immunity against a high level of power-frequency interferences.

62 Applicable with auxiliary power supply.

63 Applicable for the relay with the rated auxiliary voltage of DC 48 V and above.

64 To retain the battery life during the transportation and storage, Siemens recommends maintaining the permissible temperature range from -20 °C to +45 °C.

65 Add current tolerance of ± 5 % of CT current measurement or ± 2 % · I_s (whichever is greater) to the operating time tolerance.

Operating time tolerance with Harmonics[65] 10 % of 3rd Harmonics 25 % of 5th Harmonics 15 % of 7th Harmonics	± 15 % of t_{op} or ± 50 s
Inhibited by	Binary input

50 Instantaneous Overcurrent – Phase

Operation	Non-directional
Elements	Phase fault
Setting range I_{set}	0.2 · I_s to 20.0 · I_s
Time delay	0 s to 600 s
Operate level I_{op}	100 % I_{set}, ± 5 % · I_s or ± 2% · I_s
Reset level	≥ 90 % I_{op} or I_{set}-4 % · I_s
Variation (-10 °C to +60 °C)	≤ 5%
Basic operate time (with auxiliary power/load current)	1.2 · I_{set}: 40 ms, ±15 ms, 2 · I_{set}: 35 ms, ±15 ms
Operate time following delay	t_{basic} + t_{delay}, ±1 % or ±10 ms
Inhibited by	Binary input or inrush current detector
Disengaging time	< 50 ms[66]

50LC Line Check/Switch onto Fault

Operate level	100 % I_{set}
Setting range	1· I_s to 20 · I_s
Operating time	Binary Output ● ≤165 ms for 1.2 · I_{smin} ● ≤130 ms for 2 · I_{smin} ● ≤100 ms for 5 · I_{smin} ● ≤90 ms for 10 · I_{smin} Pulse Output ● ≤660 ms for 1.2 · I_{smin} ● ≤430 ms for 2 · I_{smin} ● ≤175 ms for 5 · I_{smin} ● ≤150 ms for 10 · I_{smin} Refer to *Figure 2.6/3* for more information on operating time.
Inhibited by	Binary input or inrush current detector

50N Instantaneous Earth Fault – Derived

Operation	Non-directional
Elements	Earth fault, derived
Setting range I_{set}	0.2 · I_s to 20.0 · I_s
Time delay	0 s to 600 s
Operate level I_{op}	100 % I_{set}, ± 5% or ± 2 % · I_s
Reset level	≥ 90 % I_{op} or I_{set}-4 % · I_s
Variation (-10 °C to +60 °C)	≤ 5 %
Basic operate time (with auxiliary power/load current):	1.2 · I_{set}: 40 ms, ±15 ms, 2 · I_{set}: 35 ms, ±15 ms
Operate time following delay	t_{basic} + t_{delay}, ±1 % or ±10 ms
Inhibited by	Binary input or inrush current detector
Disengaging time	< 50 ms[66]

51 Time-Delayed Overcurrent – Phase

Operation	Non-directional
Elements	Phase fault
Setting range I_{set}	0.2 · I_s to 2.5 · I_s
Time multiplier	0.01 to 10
Time delay (DTL)	0.00 s to 15 s
Operate level	110 % I_{set}, ±5 % or ±2% · I_s
Reset level	≥ 90 % I_{op} or I_{set}-4 % · I_s
Variation (-10 °C to +60 °C)	≤ 5 %
Operate time (with auxiliary power/load current)	**IEC:** $t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1}\right] \cdot Tm$ **ANSI:** $t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^{P} - 1} + B\right] \cdot Tm$ ±5 % or ±50 ms[67]
Follower delay	0.00 s to 20 s
Reset	IEC/ANSI decaying, 0 s to 60 s
Inhibited by	Binary input or Inrush detector

51N Time-Delayed Earth Fault – Derived

Operation	Non-directional
Elements	Earth fault, derived
Setting range I_{set}	0.2 · I_s to 2.5 · I_s
Time multiplier	0.01 to 10
Time delay (DTL)	0.00 s to 15 s
Operate level	110 % I_{set}, ±5 % or ±2 % · I_s
Reset level	≥ 90 % I_{op} or I_{set}-4 % · I_s

66 With auxiliary power supply

67 Add current tolerance of ±5 % of CT current measurement or ±2 % · I_s (whichever is greater) to the operating time tolerance

Operate time (with auxiliary power/load current)	**IEC:** $t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1}\right] \cdot Tm$ **ANSI:** $t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^{P} - 1} + B\right] \cdot Tm$ ±5 % or ±50 ms[67]
Follower delay	0.00 s to 20 s
Reset	IEC/ANSI decaying, 0 s to 60 s
Inhibited by	Binary input or inrush current detector

81HBL2 Inrush Current Detection

Inrush setting (ratio of 2nd harmonic current to fundamental-component current)	0.10 to 0.50 · I Where, $I = I_2/I_1$
Inrush release block	0.30 · I_s to 20 · I_s
Element basic operate time (t_{basic})	Picks up before operation of any protection element due to magnetic inrush current
Reset time	Operates until drop-off of any protection element due to magnetic inrush current

Specific CT 5P80 Types

CT Type	CT Ratio	I_s Range	Relay Measurement	Relay Continuous Range ($2.5 \cdot I_{smax}$)
CT01	7.2/0.075	8 A to 28 A	1.6 A to 560 A	70 A
CT02	14.4/0.075	16 A to 56 A	3.2 A to 1120 A	140 A
CT03	28.8/0.075	32 A to 112 A	6.4 A to 2240 A	280 A
CT04	57.6/0.075	64 A to 224 A	12.8 A to 4480 A	560 A
CT05	115.2/0.075	128 A to 448 A	25.6 A to 8960 A	1120 A
CT06	230.4/0.075	256 A to 896 A	51.6 A to 17920 A	2240 A

Table 2.6/1 Specific CT Range

NOTE

7SR46 Argus relay is suitable with Specific CT (class 5P80) of the brand Eleq. All performance related claims are as per the testing conducted with Eleq specific CT (class 5P80).

Ordering Information – 7SR45 Argus

Product Description	Order Number																	
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Non-Directional Overcurrent and Earth Fault Relay	7	S	R	4	5	0	□	–	□	□	□	□	0	–	1	A	□	0
							|		|	|	|	|				|	|	
Case I/O and Fascia							|		|	|	|	|				|	|	
Size 4 moulded case (height reduced), 4 CT, 2 BI/2 BO, pulse output, 9 LEDs							3		|	G	A/B	|					|	|	
Size 4 moulded case (height reduced), 4 CT, 2 BI/2 BO, pulse output, 9 LEDs							3		|	H/J	A	|					|	|	
Size 4 moulded case (height reduced), 4 CT, 4 BI/4 BO, pulse output, 9 LEDs							4		|	H/J	B	|					|	|	
									|	|	|	|					|	|	
Measuring Input									|	|	|	|					|	|	
1 A, 50 Hz/60 Hz									1	|	|	|						|	|	
5 A, 50 Hz/60 Hz									2	|	|	|						|	|	
										|	|	|						|	|	
Auxiliary Voltage										|	|	|						|	|	
Self powered (CT powered : BI threshold DC 19 V)										G	|	1						|	|	
Dual powered (CT powered + Aux. powered : DC 24 V to 60 V, BI threshold: DC 19 V)										H	|	2						|	|	
Dual powered (CT powered + Aux. powered : AC 60 V to 240 V/DC 60 V to 240 V, BI threshold: AC 88 V/DC 88 V)										J	|	2						|	|	
											|	|						|	|	
Front Fascia											|	|						|	|	
Standard version											A	|						|	|	
Standard version – with trip flag indicator											B	|						|	|	
												|						|	|	
Communication Options												|						|	|	
Front port : USB												1						|	|	
Front port: USB and rear port: RS485 supporting IEC 60870-5-103 and Modbus RTU (user-selectable setting)												2						|	|	
																		|	|	
Protection and Supervision Function Packages																A		|	|	
49 Thermal overload																		|	|	
50 Instantaneous overcurrent – phase																		|	|	
50G Instantaneous earth fault – measured																		|	|	
50LC Line check/Switch onto fault																		|	|	
50N Instantaneous earth fault – calculated																		|	|	
51 Time-delayed overcurrent – phase																		|	|	
51G Time-delayed earth fault – measured																		|	|	
51N Time-delayed earth fault – calculated																		|	|	
81HBL2 Inrush detector																		|	|	
																		|	|	
Conformal coating																		|	|	
Standard version – No conformal coating on PCBA																		A		
Conformal coating on PCBA																		B		

7XG3120 Arc Fault Monitor Relay

2.7

Features

- Compact economic design
- Simple panel mounting for retrofit applications
- Two or three arc sensor inputs
- Two high-speed, tripping duty output contacts
- Push-button reset
- Continuous arc sensor supervision
- Integrated self supervision
- Fail alarm contact
- AC or DC operation
- options for auxiliary supply range, suitable for 24 to 250V supplies

Introduction

Medium voltage switchgear is a key element in the power supply chain. Existing protection systems operate effectively under most circumstances, but they are too slow to effectively clear arcing short circuits before significant damage is caused.

Arcing faults can occur as a result of insulation breakdown due to equipment age and/or poor maintenance.

The degree of damage caused by arcing depends principally on the duration of the arc. If an arc lasts only 100ms, the switchgear needs to be checked & the insulation resistance measured before power can be re-established. With a 200ms arc, the power supply will be interrupted; the switchgear must be checked; power is re-established only after minor repairs. In the event of a 500ms arc the supply is interrupted, metal parts of the switchgear are destroyed & poisonous gases are emitted. A 1-second arc destroys most of the switchgear & may cause a fire, injury to personnel & damage to property.

The over-current caused by an arc is, due to its resistance, lower than the over-current caused by a "metallic" short circuit. The over-current caused by the arc may also be lower than the protection start current when energising circuits or starting large motors. The consequence of these conditions is that a protection system based solely on over-current detection cannot effectively discriminate between normal system currents & an arc fault condition:

- For moderate arc fault currents the trip time of the over-current IDMT stage will be too slow;
- For very low arc fault currents the instantaneous trip stage of a standard over-current relay cannot be set low enough.

Arc Fault Protection

Arc fault protection is a technique employed for the fast clearance of arcing faults on bus bars & within metal clad switchgear & associated cable boxes. The arc is detected using an optical sensor & the signal input to a protection device which also monitors the load current on the system. A trip signal can be achieved in less than 10 ms using arc detection only or within 20 ms when using overcurrent check. This is considerably faster than a traditional IDMT overcurrent relay & provides additional protection from the onset of arcing faults with relatively low fault currents. Arguably the greatest risk of arc fault damage exists at the CB cable termination & in the CB chamber itself due to the slow clearance times of the IDMT feeder protection. The problem of arc faults is most prevalent in older metal-clad switchgear which already has operational protection systems. The RA20 (ReyARC 20) Arc Fault Monitor has therefore been designed for the following applications:

Existing Switchgear

Where a requirement exists to retrofit arc fault protection to metal clad switchgear utilizing the existing overcurrent protection relay.

New Switchgear

Where a requirement exists to install arc fault protection to new switchgear for integration with the customer-preferred overcurrent feeder protection relay, where a binary input and appropriate logic is available.

Reyrolle 7SR11/12/210/220 overcurrent & earth fault relays have the enhanced high-speed 50AFD protection function, specifically designed to interface with the ReyARC range for even further increased tripping performance.

Switchgear Applications

Switchgear Arc Protection

Risk of arc fault damage exists at the CB cable termination & in the CB chamber itself. The CB cable termination is particularly at risk to ingress of moisture & rodent damage. One, two or three arc sensors may be connected to the RA20 Arc Fault Monitors as depicted in the single line application diagrams.

The first two diagrams show the trip signals being used to trip the feeder circuit breaker in the event of an arc fault occurring at any sensor provided the overcurrent relay starter contact is picked up. In these applications the overcurrent check stage is optional as the consequence of a single feeder outage is less than the loss of an entire bus.

The final diagram shows an application where a single RA20 is applied for the protection of the Cable box, CT chamber & CB chamber using three sensors. In this configuration one arc trip output is used to trip the feeder circuit breaker in the event of an arc fault in the cable box / CT chamber. The second trip

output is set for independent operation to trip the bus breaker (bus overcurrent check not shown), in the event of an arc fault in the CB chamber.

Existing switchgear applications

The existing overcurrent relay protecting the feeder will normally provide an independent output contact associated with the start current setting of the relay. That is, an output contact that will close when a phase or earth fault current is detected above the threshold which starts the internal relay timers.

An Arc Fault Monitor relay RA20 is installed on the switchgear panel adjacent to the protection relay. The RA20 is specifically designed for simple retrofit to existing panels & requires only a single 31mm mounting hole to be drilled. The RA20 fits through this hole, the designation label supplied with the unit positioned & the retention shroud fitted.

RA30 optical arc sensors are fitted in the cable termination box & CT chamber.

The overcurrent relay starter contact may optionally be wired in series with the arc fault detection trip output contact. The resulting "AND" function trip output is wired to trip the breaker in ~15ms in the event that an arc fault is detected while the overcurrent start element is picked up.

The second arc trip & fail alarm contacts may be employed for interface to a SCADA system for fault reporting.

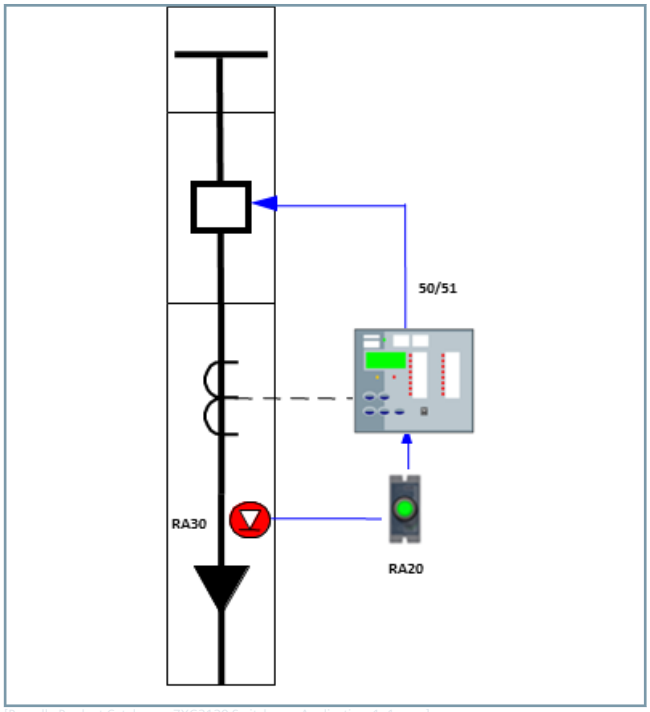
New switchgear applications

For new switchgear installations a modern numeric feeder protection relay is likely to be employed which will have numerous programming & configuration options.

The basic concept is the same as for the existing switchgear application described above except that the additional features & flexibility of modern feeder protection relay allows improved system integration.

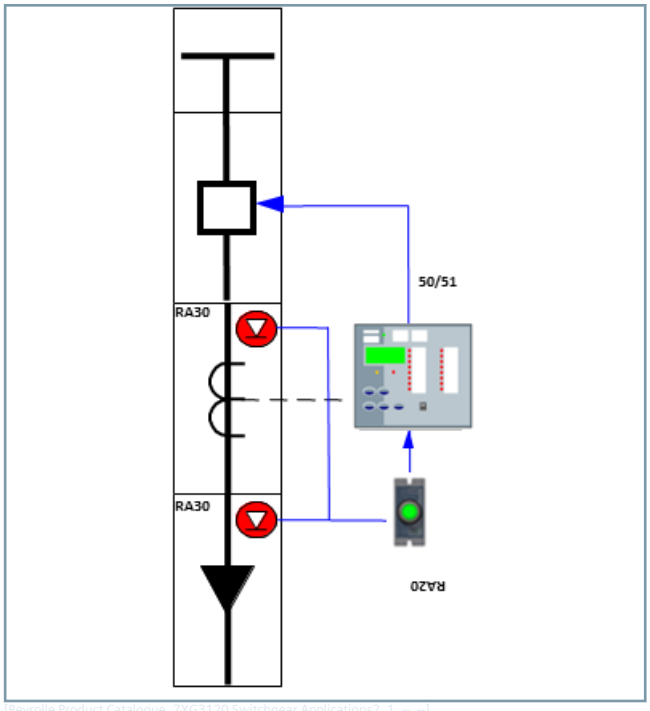
This may be achieved by using the second arc trip output contact to interface to a programmable status input on the feeder protection relay. Depending on the model of protection relay being used this input may be programmed to provide an alarm message on the HMI, time stamped event record available via its communications link.

Where this level of system integration is employed the RA20 does not need to be mounted on the front panel as the alarm indications are available on the feeder relay. Remote reset of the RA20 LED is achieved by momentary interruption of the power supply using a SCADA controlled series contact. The DIN rail mounting option is a convenient alternative in this situation.



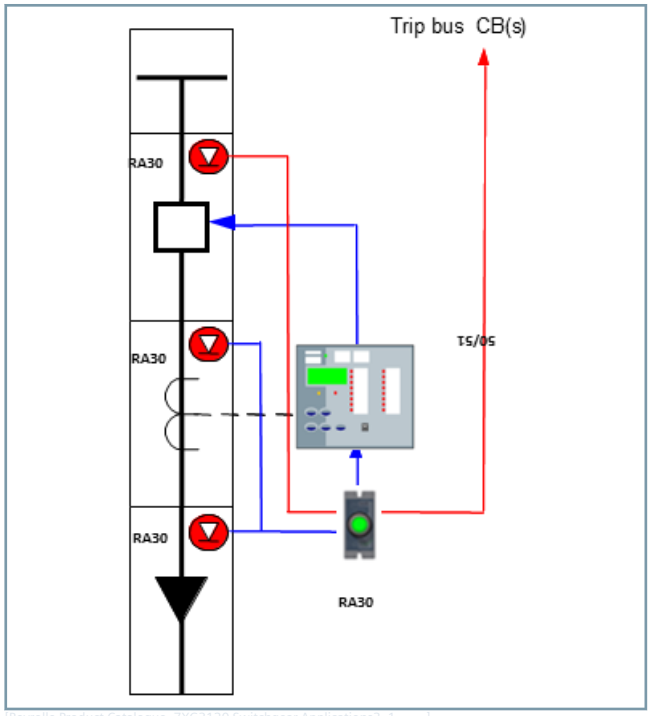
[Reyrolle Product Catalogue, 7XG3120 Switchgear Applications1, 1, ~_~]

Figure 2.7/1 Single arc sensor - Cable box only (Optional overcurrent check stage depicted)



[Reyrolle Product Catalogue, 7XG3120 Switchgear Applications2, 1, ~_~]

Figure 2.7/2 Two arc sensors - Cable box & CT chamber (Optional over-current check stage depicted)



[Reyrolle Product Catalogue, 7XG3120 Switchgear Applications3, 1, –_–]

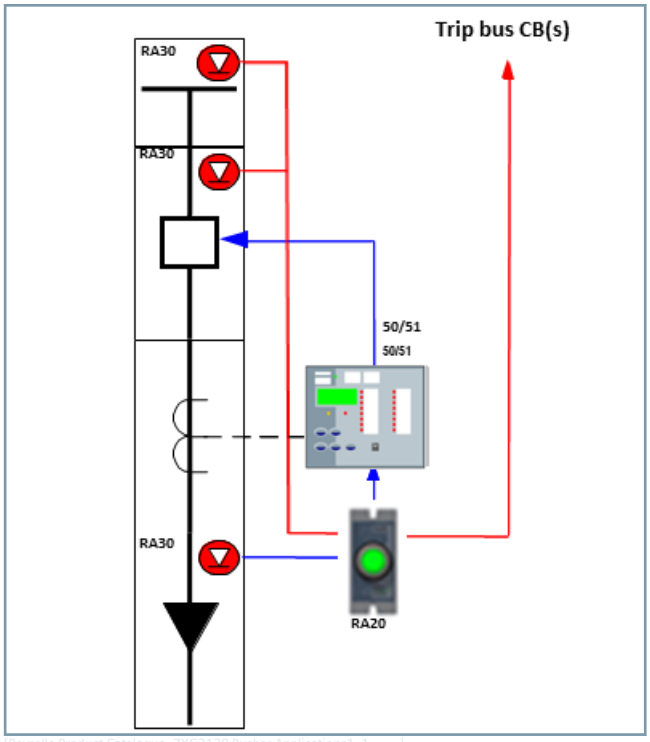
Figure 2.7/3 Two arc sensors - Cable box & CT chamber Independent trip to CB (Optional overcurrent check stage depicted) One arc sensor - CB chamber Independent trip to bus breaker (Bus overcurrent check stage not shown)

Busbar Applications

Combined Bus Bar & Switchgear Arc Protection

The following diagram shows an application where a single RA20 is applied for the protection of the Cable box & CT chamber plus the CB chamber & bus chamber using three sensors.

In this configuration one arc trip output is used to trip the feeder circuit breaker in the event of an arc fault in the cable box / CT chamber. The second trip output is set for independent operation to trip the bus breaker (bus overcurrent check stage not shown), in the event of an arc fault in the CB chamber or bus chamber.



[Reyrolle Product Catalogue, 7XG3120 Busbar Applications1, 1, –_–]

Figure 2.7/4 One arc sensor - Cable box / CT chamber Independent trip to CB Two arc sensors - CB chamber & bus chamber Independent trip to bus breaker (bus overcurrent check stage not shown)

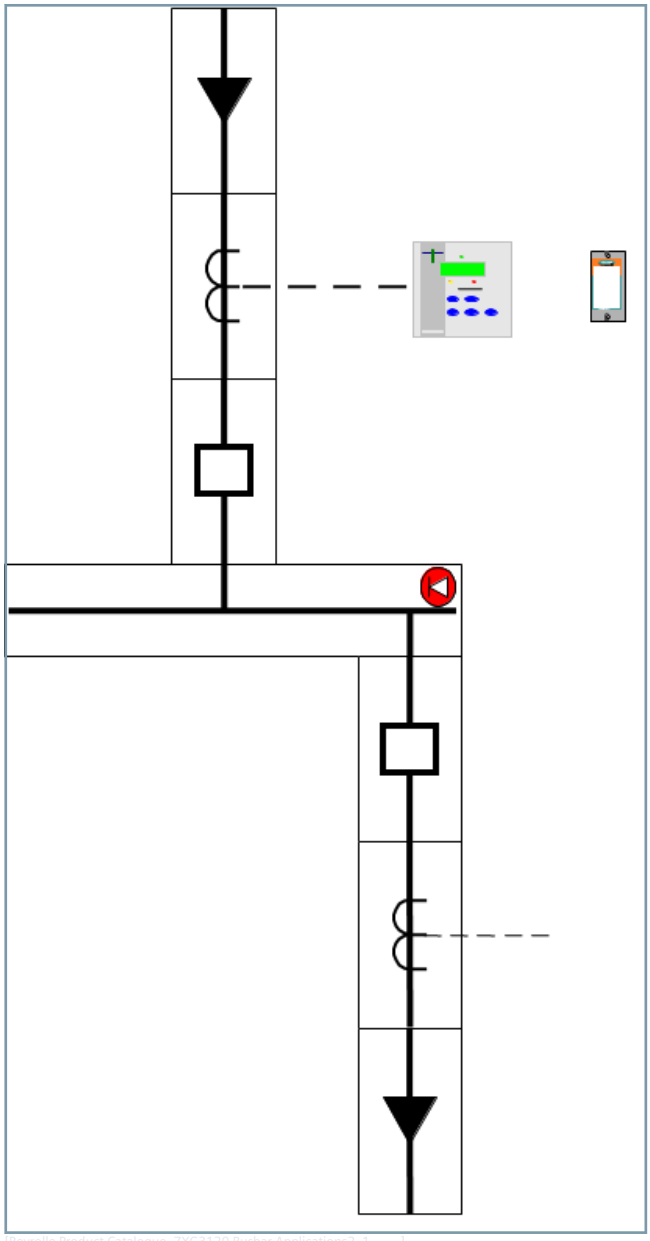
Bus Bar Arc Protection

The following diagram depicts how the RA30 may also be applied for the protection of bus bars. The number of sensors in the bus chamber is dictated by the switchgear design and the length of switchboard.

In most indoor metal clad switchgear the bus bar chamber is a continuous chamber between panels only broken into segregated sections at a bus section breaker & as such the strategic placement of one or two arc sensors in each bus bar chamber run is normally adequate.

Some indoor metal clad switchgear may segregate the bus chamber of each panel from the next via insulated bus chamber side barriers per panel, if this is the case then each bus chamber per panel would need to be monitored by at least one arc sensor.

In large enclosures the arc sensors should be placed at approximately 5m intervals.



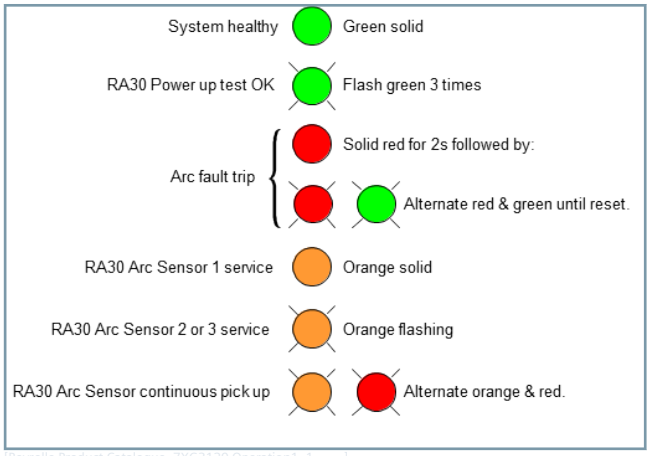
[Reyrolle Product Catalogue, 7XG3120 Busbar Applications2, 1, _ _]

Figure 2.7/5 One, two or three arc sensors located in the bus chamber

Operation

Operation Indicator

A single tri-colour LED is integrated into the front panel reset push button to provide the following status indications:



[Reyrolle Product Catalogue, 7XG3120 Operation1, 1, _ _]

Arc sensor circuit supervision

The RA30 Arc Sensor is the heart of the system & supervision of circuit continuity is critical for correct operation. To monitor the integrity of the wiring between the RA30 arc sensor & RA20 Arc Monitor, a continuous 2mA supervision current flows between the units. The RA20 alarm contact will drop out after a 1s time delay if it fails to detect this current.

Where a fault is detected on the Arc Sensor 1 circuit the front panel LED will give a solid orange indication.

Where a fault is detected on Arc Sensor 2 or 3 circuits the front panel LED will give a flashing orange indication.

Where a fault is detected on Arc Sensor 1 & 2 or 1& 3 circuits the front panel LED will give a solid orange indication.

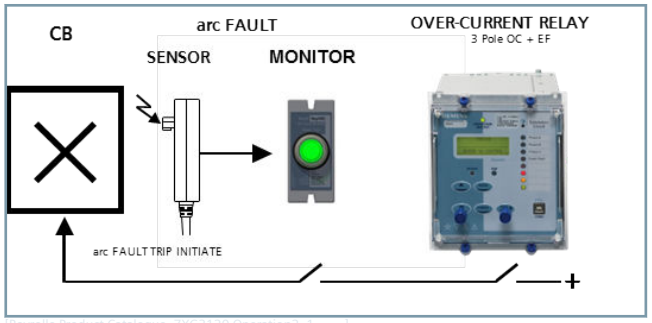
Arc Sensor Function

The RA30 is an optical sensor that responds to the flash of light emitted during the incidence of an arcing fault. Onset of the light flash & detection by the RA30 occurs in a few milliseconds.

When an arc is detected, the resistance presented by the RA30 drops to a level where the current flow increases to approximately 20mA. This increased current flow is instantaneously detected by the RA20 and its trip output contacts close. Refer to the RA30 Technical catalogue sheet for further details.

Arc fault tripping using current check

Fast operation of a tripping scheme usually results in reduced system security. The arc detection method can however, combine the RA20 optical detection technique with a traditional overcurrent method to maximize system security particularly for bus bar protection schemes. Both conditions must coexist for the trip condition to be met as depicted in the following diagram.



[Reyrolle Product Catalogue, 7XG3120 Operation2, 1, –_–]

Figure 2.7/6 Key components required to implement an Arc Fault Protection scheme with an overcurrent check stage to enhance system security

The application examples utilize this concept for enhanced system security in that both the RA20 AND the OC 50 starter contact must be picked up for a CB trip signal to be initiated. As the arc fault trip contact closes considerably faster than the overcurrent relay starter element picks up, the CB trip time will be dictated by the overcurrent relay performance.

Low current arcing faults

Arcing faults can occur at low current levels & it is possible for the over-current starter element to be set above this level. To avoid this problem & obtain very fast clearance (<10ms), of an arc fault, the RA20 arc fault trip contact may be wired directly to the breaker operate coil. It should be noted that this method may lead to reduced system security.

Arc detection reset time (effect of multiple arc trips)

A delay of 2s is required to reset the RA20 after an initial arc sensor trip. Subsequent arc detection will cause the trip output contacts to re-operate & reset the time delays described under Configuration Switch Settings.

Independent trip output contacts

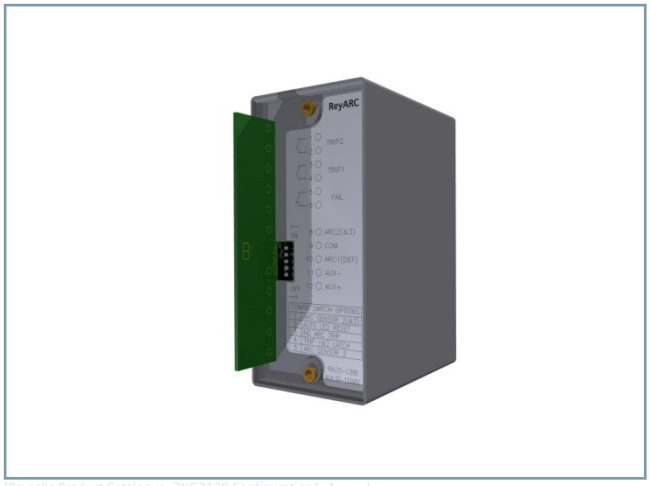
The RA20 may be set using configuration switch 3 for both trip output contacts to pick up when an arc is detected by any sensor input. Alternatively arc sensor 1 can be linked to trip contact 1 & arc sensor 2 (& 3 if fitted), to trip contact 2. This function may be applied where an arc fault detected in the cable box is directed to trip the feeder circuit breaker while an arc fault in the bus chamber is to be directed to trip the bus.

Arc sensor continuously picked up

High ambient light levels may cause a RA30 to be continuously picked up. This condition could occur for example if the CB cable box cover was left open in very high ambient light level conditions. A non arc fault over-current pick up would then result in an arc fault trip operation.

To avoid possible mal-operation due to this condition, the RA20 is designed to automatically disable the arc fault tripping function if the RA30 sensor is picked up for >10s. The RA20 alarm contact will be set & the front LED flash alternate orange & red until the ambient light level problem is corrected. The RA20 will then perform an arc sensor test function and automatically reset.

Configuration

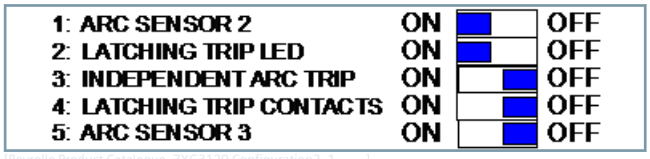


[Reyrolle Product Catalogue, 7XG3120 Configuration1, 1, –_–]

Figure 2.7/7 RA20 rear view showing configuration switches

Configuration switch

The configuration switches are accessible to the user by first unplugging the electronic module from the terminal base as shown below.



[Reyrolle Product Catalogue, 7XG3120 Configuration2, 1, –_–]

Configuration switch settings

The internal wiring label identifies the position of the following switch functions:

Switch 1:	Arc sensor 2
	ON - Arc Sensor 2 fitted
	OFF - Arc Sensor 2 not fitted
Switch 2:	Arc fault trip indication LED reset
	ON - Latching until manually reset
	OFF - Automatic self reset (Extinguish) after 4 hours will also reset contacts set for latching function
Switch 3:	Independent arc trip output contacts
	ON - Arc Sensor 1 activates trip output contact 1 & Arc sensor 2 or 3 activates trip output contact 2
	OFF - Arc Sensor 1, 2 or 3 activate both trip outputs
Switch 4:	Arc fault trip output contact reset
	ON - Latching – Reset with trip LED
	OFF - Self reset after 2s
Switch 5:	Arc sensor 3
	ON - Arc Sensor 3 fitted
	OFF - Arc Sensor 3 not fitted

Technical Data

Auxiliary Supply burden (at 110V DC)

Monitoring mode:	Less than 4W
Arc fault detected:	Less than 10W for 2s

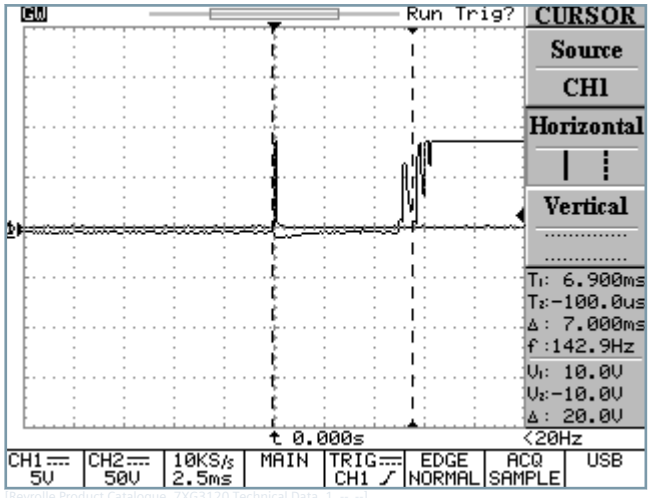
Auxiliary Supply

3 options are available for the auxiliary supply:

- 24/32/48V AC or DC nominal
- 110/125V AC or DC nominal
- 220/240/250V AC or DC nominal

Operate Time

Arc fault trip contacts guaranteed to pick up in less than 10ms including bounce. Typical operate time is 7ms.



CRO trace showing nominal operation time of the trip contacts at 7ms. First contact touch at 6.25ms and fully closed by 7.25ms. Operation in <10ms is considered acceptable as over-current relay operate time is ~25ms.

7SR11 / 12 / 210 / 220: 50 Instantaneous Overcurrent Element – Operate Time

Operate and Reset Time

	Attribute	Value
t_{basic}	Element basic operate time	0 to 2 x I_s: 30 ms, ± 10 ms
		0 to 5 x I_s: 20 ms, ± 10 ms

7SR11 / 12 / 210 / 220: 50AFD Arc Flash Detector Element – Operate Time

Operate and Reset Time

	Attribute	Value
t_{basic}	Element basic operate time	10 ms – 16 ms
t_{op}	AFD Zone operate time (Flash & 50AFD)	15 ms – 25 ms
	Repeatability	± 10 ms

Arc sensor inputs

Two or three independent arc sensor inputs for type RA30 arc sensors.

Minimum arc duration

The minimum arc flash duration required to guarantee operation of the output contacts is 1.25 ms.

Trip contact reset time

Once operated, the trip output contacts will reset in 2 seconds as per the configuration switch 4 setting.

Manual reset

Press front reset button or interrupt power supply to reset the unit.

Output contacts

Arc fault trip contacts:	2 N/O
Fail alarm:	1 N/C for the power supply / CPU fail Normally picked up & drops out to signal an alarm condition.

Output contact ratings IEC60255-0-2

Carry continuously	5A AC or DC
Make & carry L/R ≤ 40 ms & V ≤ 300 V	0.5 s 20A AC or DC 0.2 s 30A AC or DC
Break capacity I ≤ 5A & V ≤ 300 V	AC resistive 1,250VA AC inductive 250VA @ PF ≤ 0.4 75W DC resistive 30W @ L/R ≤ 40 ms DC inductive 50W @ L/R ≤ 10 ms
Minimum number of operations	10^6 at maximum load
Minimum recommended load	0.5W limit 10mA/5V

Transient overvoltage IEC60255-5

Between all terminals & earth	5kV 1.2/50us 0.5J
Between independent circuits without damage or flashover	5kV 1.2/50us 0.5J

Insulation coordination IEC60255-5

Between all terminals & earth	2.0kV_{RMS} for 1 minute
Between independent circuits	2.0kV_{RMS} for 1 minute
Across normally open contacts	1.0kV_{RMS} for 1 minute

Arc Fault Protection – 7XG3120 Arc Fault Monitor Relay

Auxiliary supply IEC60255-11

Allowable breaks / dips in supply	≤ 20 ms
Collapse to zero from nominal voltage	

High frequency disturbance - IEC60255-22-1 Class III

2.5kV 1MHz common mode	No mal operation
1.0kV 1MHz differential mode	

Electrostatic discharge - IEC60255-22-2 Class III

6kV contact discharge	No mal operation

Radio frequency interference IEC60255-22-3 Class III

10V/m, 80 TO 1,000MHz	No mal operation

Fast transient IEC60255-22-4 Class III

4kV, 5/50ns, 100KHz repetitive	No mal operation

Conducted RFI IEC60255-22-6 Class III

10V, 0.15 to 80MHz	No mal operation

Temperature range IEC68-2-1/2

Operating:	-5 to +55°C
Storage:	-25 to +75°C

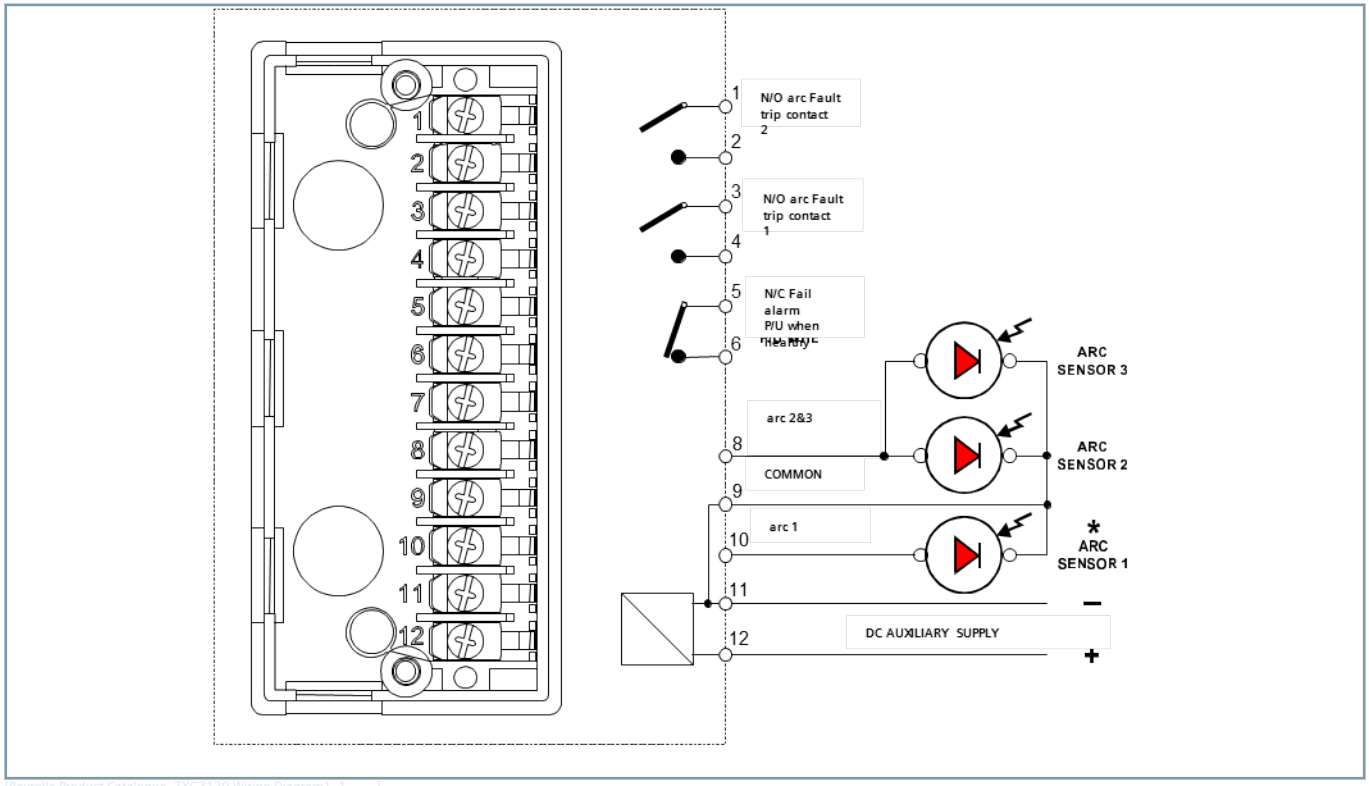
Humidity IEC68-2-78

40 °C & 93 % RH non-condensing

Case

ZA12 flush or DIN rail mount type, 12 M4 screw terminals, Plug-in module to facilitate easy wiring & fast change-over

Wiring Diagrams



[Reyrolle Product Catalogue, 7XG3120 Wiring Diagram1, 1, _ _]

Figure 2.7/8 RA20 Socket Terminal Layout viewed from the front when un-plugged from the main housing

Note: * Always wire Arc Sensor 1. Arc Sensors 2 & 3 are optional.

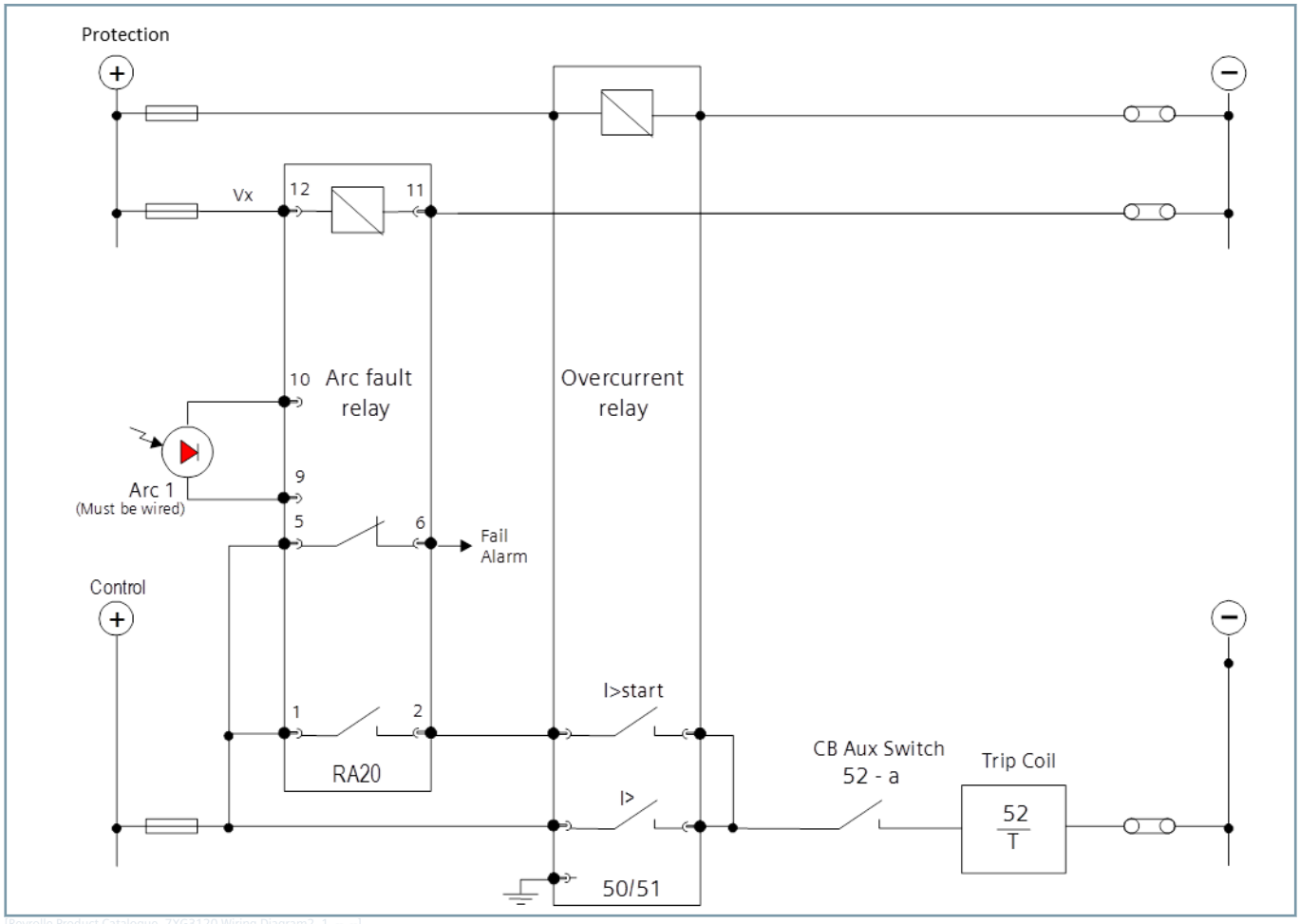
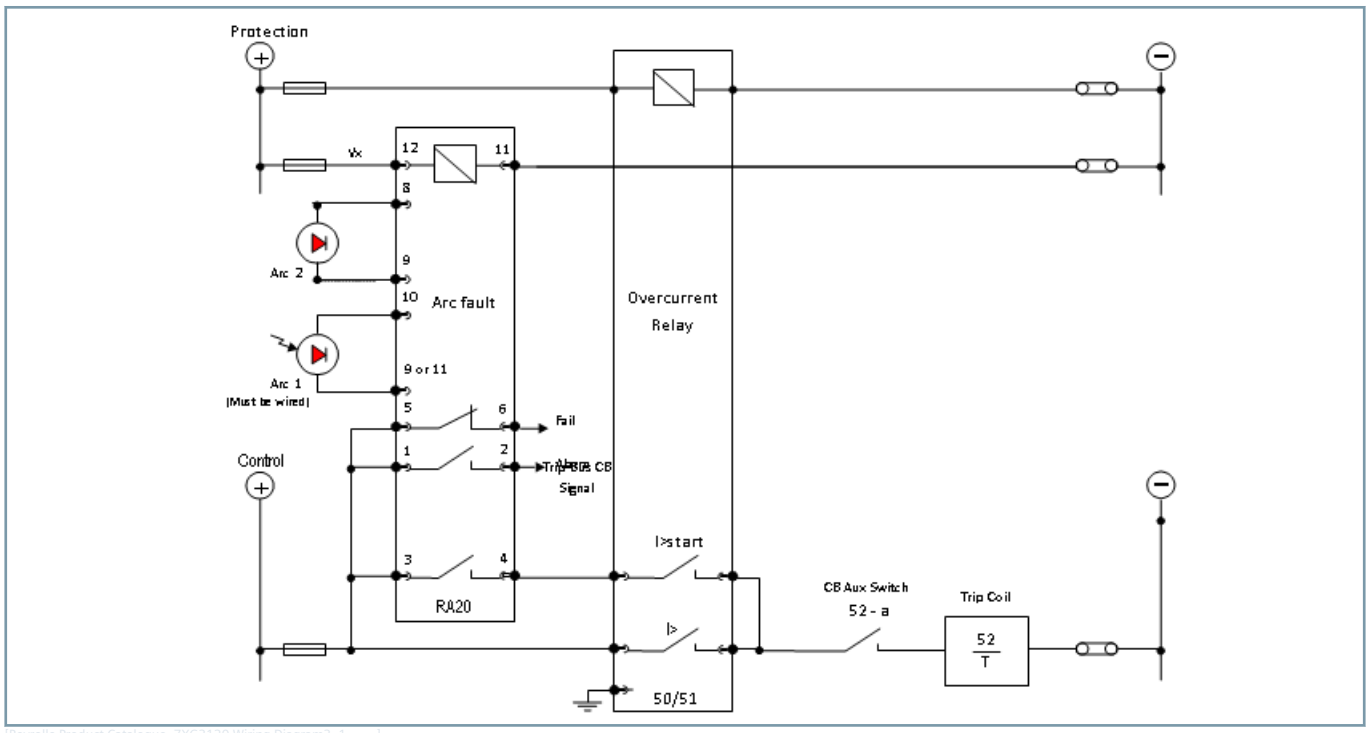
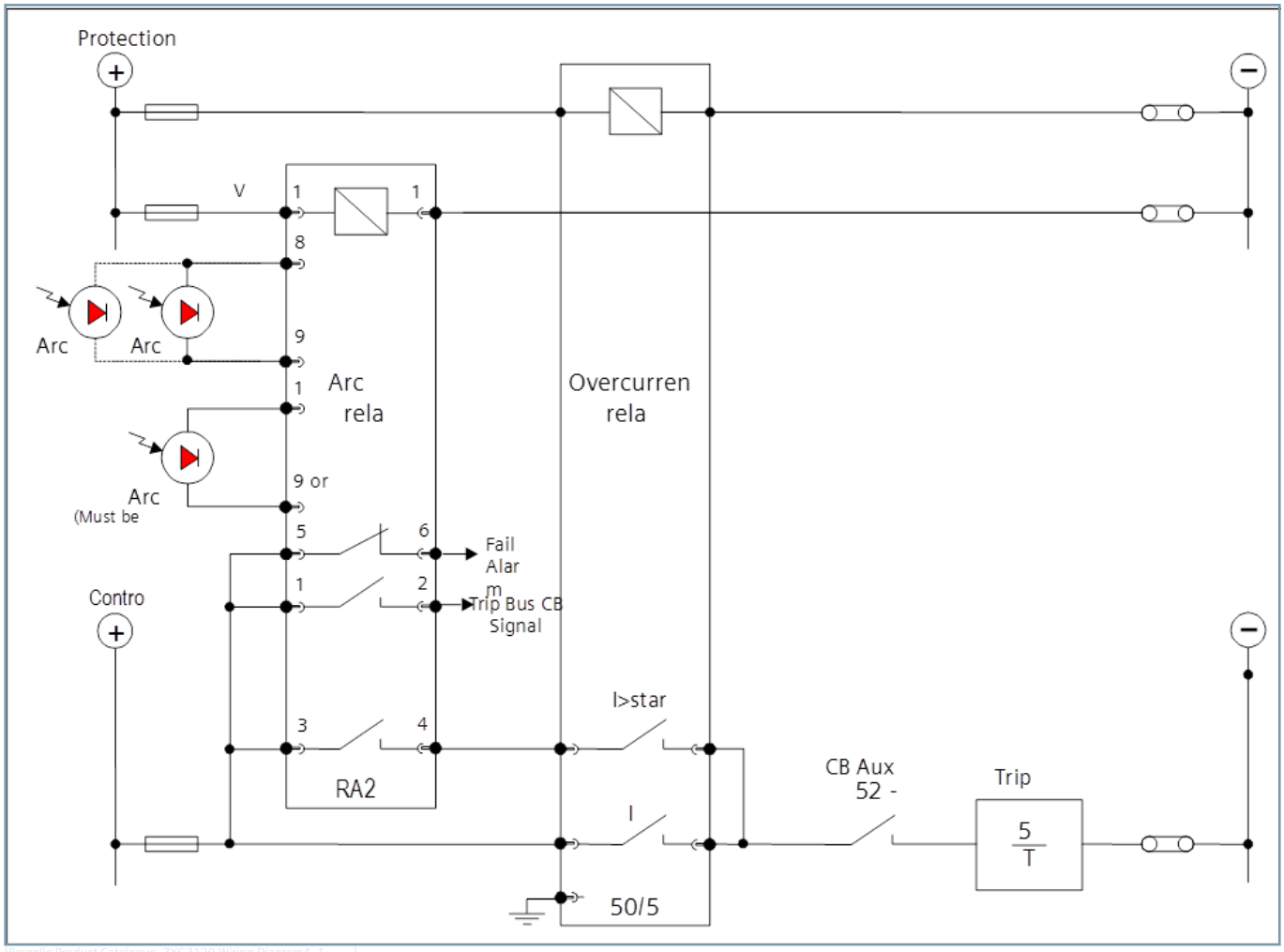


Figure 2.7/9 RA20 Wiring application diagram (Refers to Figure 1 Line Diagram)



[Reyrolle Product Catalogue, 7XG3120 Wiring Diagram3, 1, -_-]

Figure 2.7/10 RA20 Wiring application diagram (Refers to Figure 2 Line Diagram)



[Reyrolle Product Catalogue, 7XG3120 Wiring Diagram4, 1, –_–]

Figure 2.7/11 RA20 Wiring application diagram (Refers to Figure 3 Line Diagram)

Mounting Options

The RA20 is available in two versions:

1. A surface mount version which has a separate reset button & LED indicator on the front panel. The advantage of this version is the lower cost, and to offer a solution where front panel space is limited.

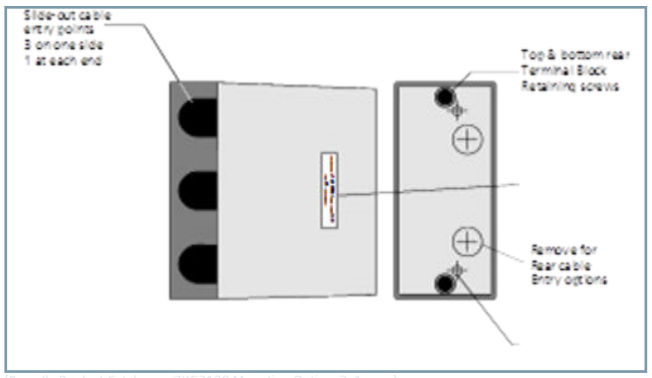
2. A panel mount version which has a combined reset button & LED indication. The advantage of this version is that it can be either panel or surface mounted, with a high-visibility indication from the large LED button.

Surface mount version

This version is suitable for location in the rear of a cubicle. It may be surface mounted or DIN rail mounting when the optional DIN Rail Mounting Kit is fitted.

[Reyrolle Product Catalogue, 7XG3120 Mounting Options1, 1, –_–]

Figure 2.7/12 RA20 surface mount version front view



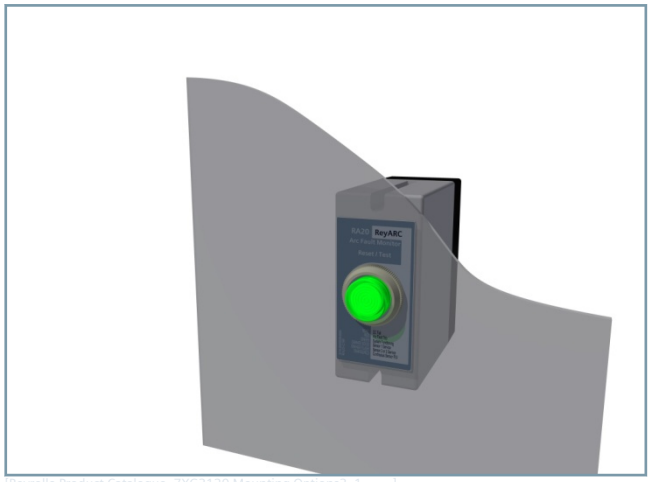
[Reyrolle Product Catalogue, 7XG3120 Mounting Options2, 1, --_--]

Figure 2.7/13 Surface mount version side view

Panel mount version

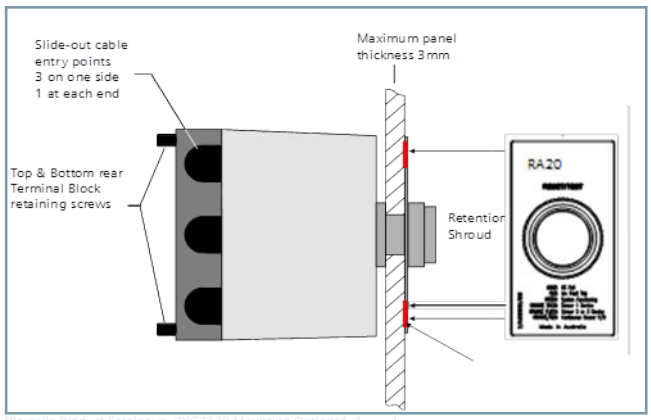
2.7

This version is suitable for mounting on the front panel of a cubicle or door. This is achieved using a 31mm diameter hole in the panel adjacent to the protection relay. This version may also be surface mounted by reversing the terminal block retaining screws. It may also be DIN rail mounting when the optional DIN Rail Mounting Kit is fitted.



[Reyrolle Product Catalogue, 7XG3120 Mounting Options3, 1, --_--]

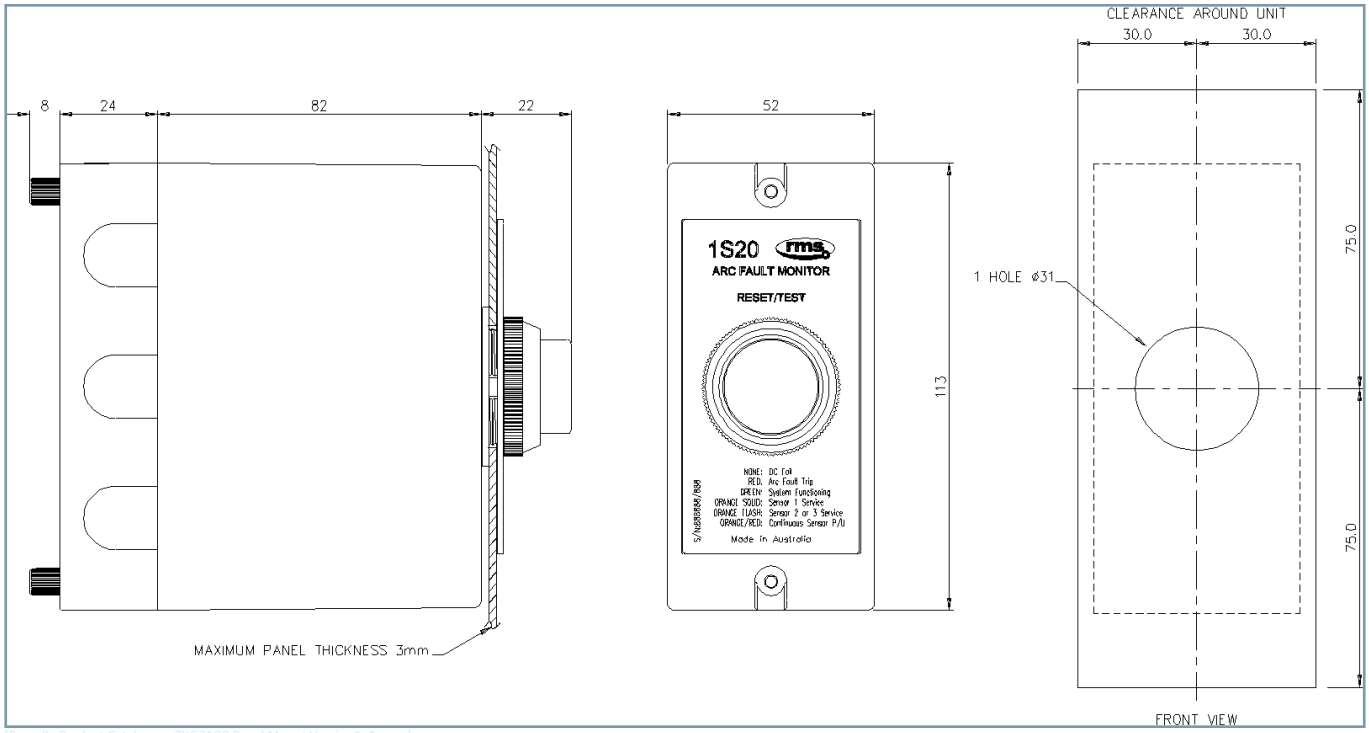
Figure 2.7/14 RA20 through-hole panel mount version



[Reyrolle Product Catalogue, 7XG3120 Mounting Options4, 1, --_--]

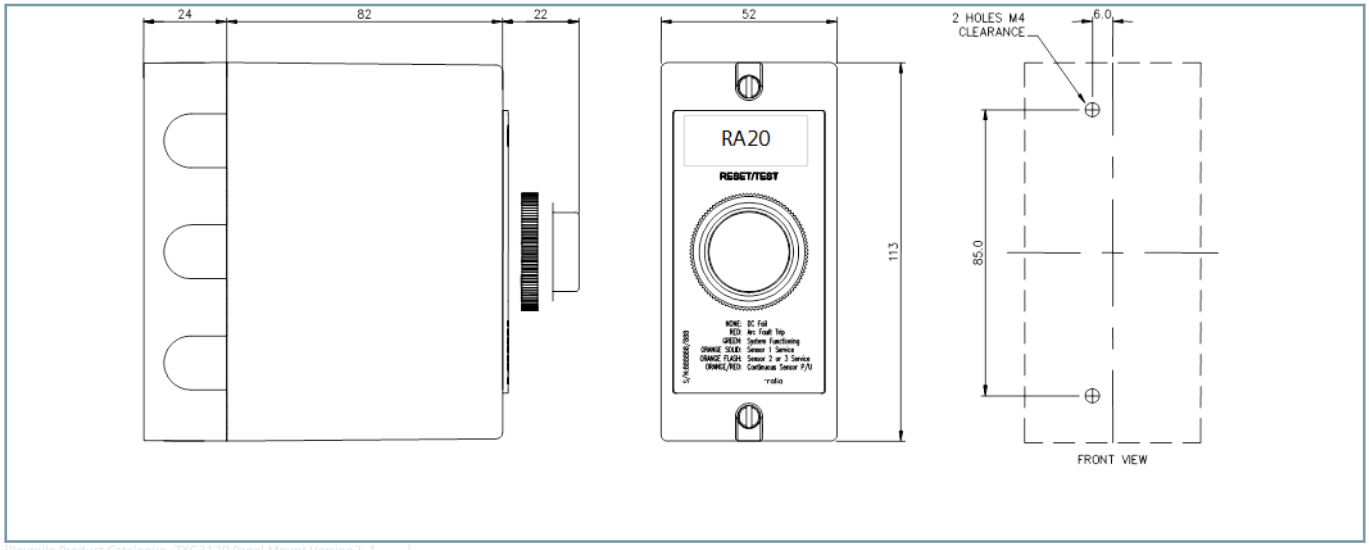
Figure 2.7/15 Panel mount version side view

Panel Mount Version



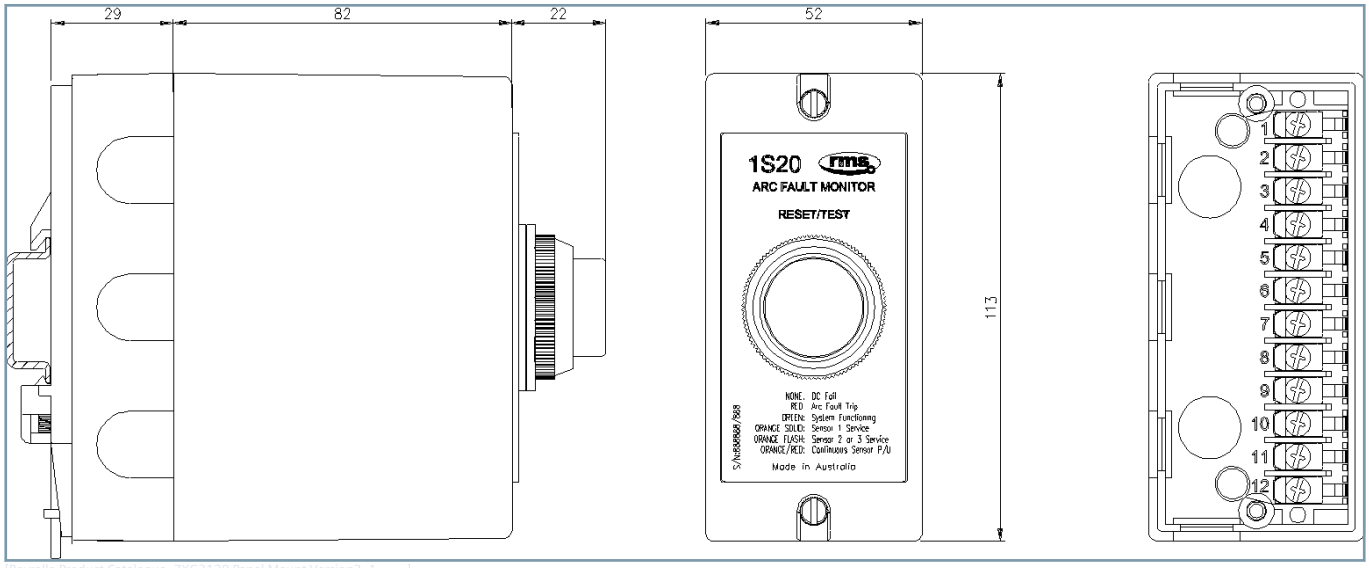
[Reyrolle Product Catalogue, 7XG3120 Panel Mount Version1, 1, ←_←]

Figure 2.7/16 Panel mounting cut out detail



[Reyrolle Product Catalogue, 7XG3120 Panel Mount Version2, 1, ←_←]

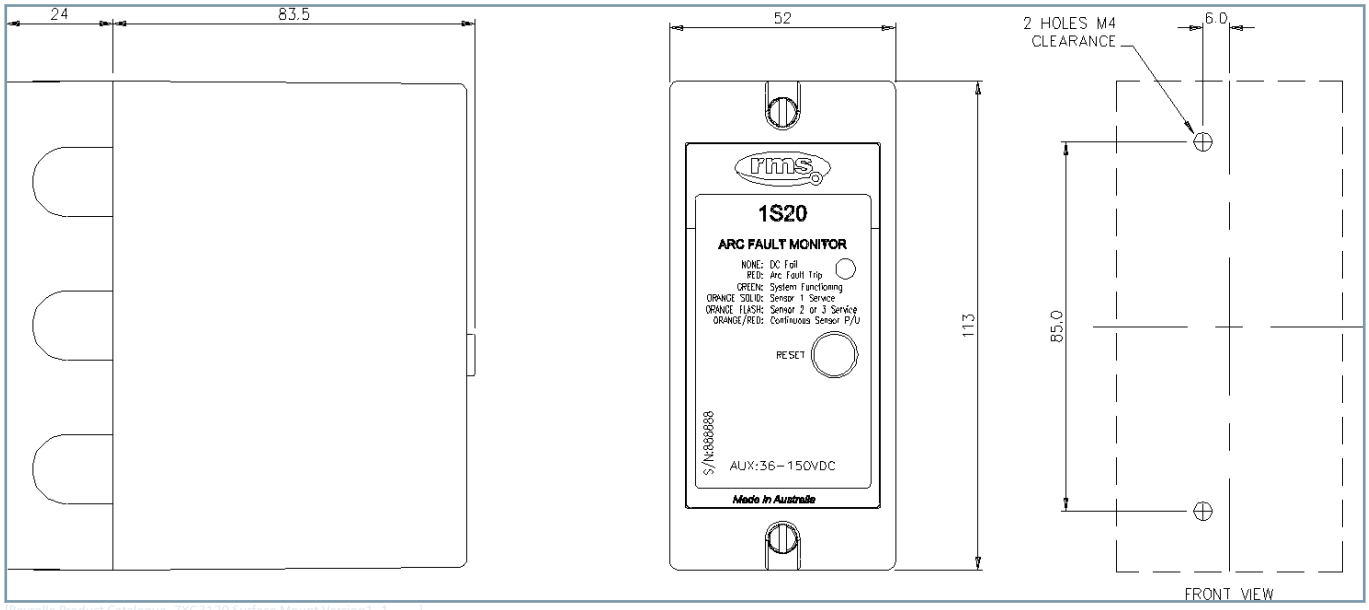
Figure 2.7/17 Surface mounting detail



[Reyrolle Product Catalogue, 7XG3120 Panel Mount Version3, 1, --_--]

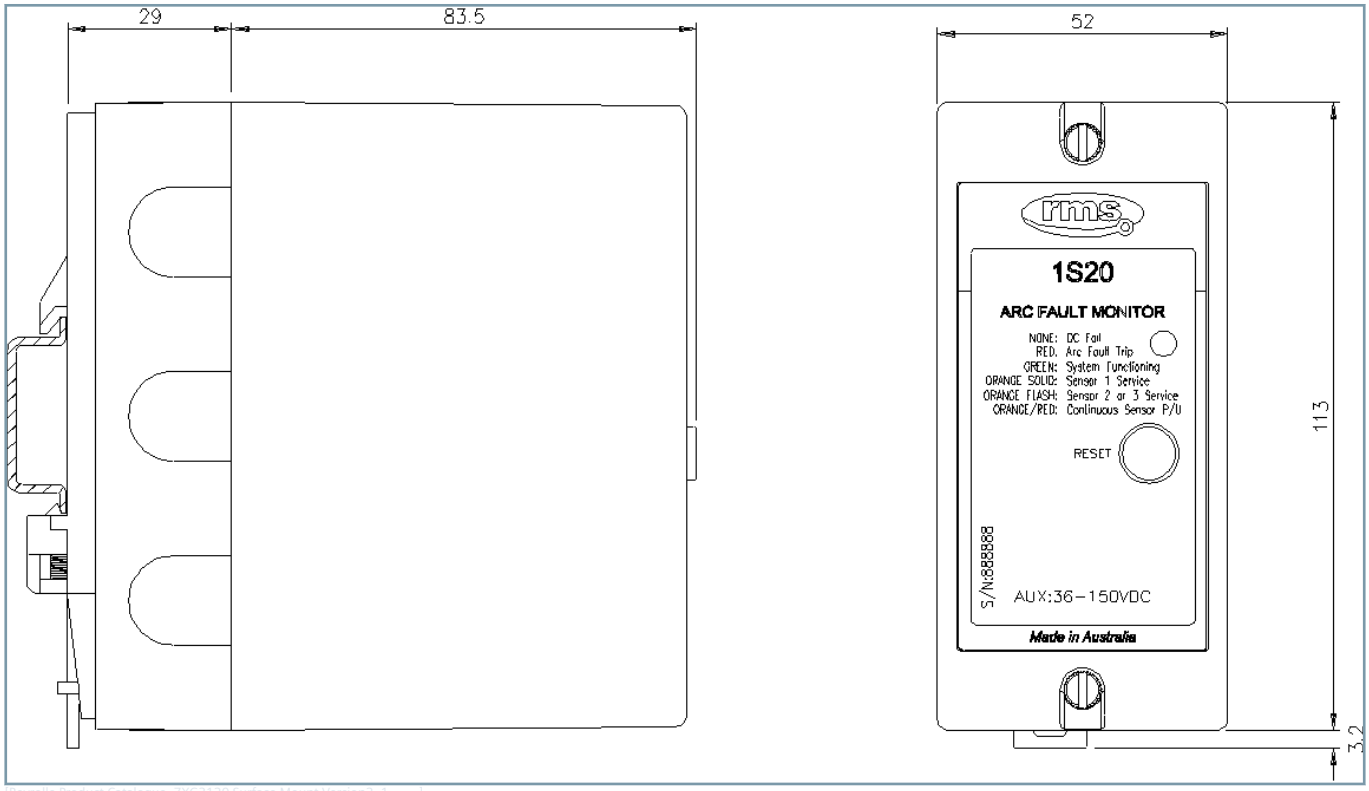
Figure 2.7/18 DIN rail mounting detail

Surface Mount Version



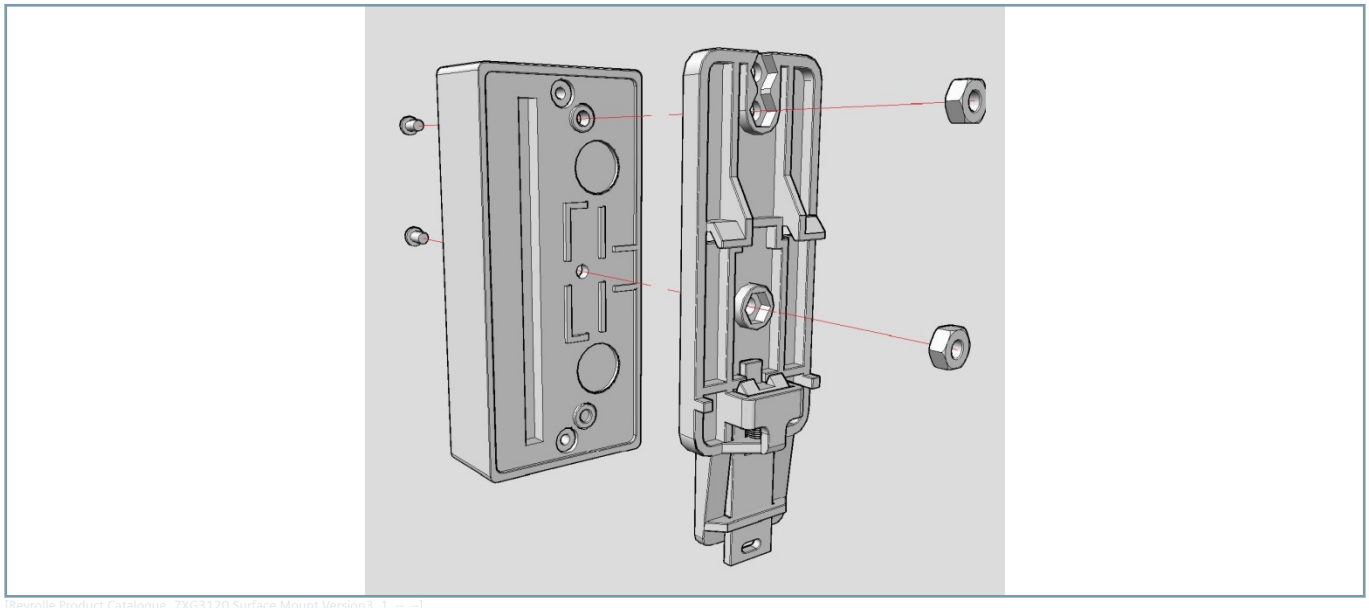
[Reyrolle Product Catalogue, 7XG3120 Surface Mount Version1, 1, --_--]

Figure 2.7/19 Surface mounting detail



[Reyrolle Product Catalogue, 7XG3120 Surface Mount Version2, 1, --_--]

Figure 2.7/20 DIN rail mounting detail



[Reyrolle Product Catalogue, 7XG3120 Surface Mount Version3, 1, --_--]

Figure 2.7/21 DIN rail clip fitting detail

Arc Fault Protection – 7XG3120 Arc Fault Monitor Relay

Ordering Information - 7XG3120 Arc Fault Monitor Relay

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Arc Fault Monitor Relay	7	X	G	3	1	2	0	-	□	□	□	0	0	-	0	A	A	0
				|	|	|	|		|	|	|								
Category				|	|	|	|		|	|	|								
Arc Protection				3	1	|	|		|	|	|								
						|	|		|	|	|								
Device						|	|		|	|	|								
RA20 Arc Fault Monitor Relay						2	0		|	|	|								
									|	|	|								
Sensor Inputs									|	|	|								
Two sensor inputs									2	|	|								
Three sensor inputs									3	|	|								
										|	|								
Operating Voltage										|	|								
24/32/48V AC or DC Nominal										F	|								
110/125V AC or DC Nominal										G	|								
220/240/250V AC or DC Nominal										H	|								
											|								
Mounting											|								
Panel or Surface Mount, No DIN Rail kit.											A								
Panel or Surface Mount, With DIN Rail kit.											B								
Surface Mount only, No DIN Rail kit.											C								
Surface Mount, With DIN Rail kit.											D								

7XG3123 Arc Fault Interface Module

[Reyrolle Product Catalogue, 7XG3123, 1, –_–]

Features

- Compact, simple, rugged and economic design
- Simple wiring and DIN rail mounting
- Interface for one or two RA30 arc fault sensors
- High speed arc fault tripping output to interface with protection relay status inputs
- Apply to initiate IEC 61850 GOOSE messaging of arc fault events
- Continuous arc fault sensor supervision
- Arc fault pick up and supervision healthy indication
- 24, 32, 48, 110, 125, 220, 240 and 250V DC auxiliary versions

Introduction

Medium voltage switchgear is a key element in the power supply chain. Existing protection systems operate effectively under most circumstances, but they are too slow to handle arcing short circuits.

Arcing faults can occur as a result of insulation breakdown due to equipment age & / or poor maintenance.

The degree of damage caused by arcing depends principally on the duration of the arc. If an arc lasts only 100ms, the switchgear needs to be checked & the insulation resistance measured before power can be re-established. With a 200ms arc, the power supply will be interrupted; the switchgear must be checked; power is re-established only after minor repairs. In the event of a 500ms arc the supply is interrupted, metal parts of the switchgear are destroyed & poisonous gases are emitted. A 1s arc destroys most of the switchgear & may cause a fire, injury to personnel & damage to property.

The over-current caused by an arc is, due to its resistance, lower than the over-current caused by a "metallic" short circuit. For moderate arc fault currents the trip time of the overcurrent IDMT stage will be too slow.

The consequence of these conditions is that a protection system based solely on over-current detection cannot effectively protect the switchgear against an internal arcing fault.

Arc Fault Protection

Arc fault protection is a technique employed for the fast clearance of arcing faults on Busbars & within metal clad switchgear & associated cable boxes. The arc is detected using an optical sensor & the signal input to a protection device which also monitors the load current on the system. A trip signal can be achieved in less than 10ms using arc detection only or within 20ms when using overcurrent check. This is considerably faster than a traditional IDMT overcurrent relay & provides additional protection from the onset of arcing faults with relatively low fault currents. Arguably the greatest risk of arc fault damage exists at the CB cable termination & in the CB chamber itself due to the slow clearance times of the IDMT feeder protection. The CB cable termination is particularly at risk to ingress of moisture & rodent damage.

The problem of arc faults is most prevalent in older metal clad switchgear which already has operational protection systems.

RA23 Arc Fault Interface Module

The RA23 (ReyArc23) Arc Fault Interface Module (Arc Module), described in this document is designed to connect one or two optical fault sensors to a protection relay status input.

Refer to the RA30 Catalogue Sheet for details on the arc fault sensor ordering options.

Switchgear Applications

Switchgear Arc Protection

Risk of arc fault damage exists at the CB cable termination & in the CB chamber itself. The CB cable termination is particularly at risk to ingress of moisture & rodent damage. RA30 Arc Sensors may be located as depicted in the single line application diagrams.

Modern numeric feeder protection relays provide internal logic functions that may be programmed to interface with the RA23 Module.

Depending on the model of protection relay being used this input may be programmed to provide not only a high speed arc fault trip output but also an alarm message on the HMI and time stamped event record via its communications link. This level of system integration allows the RA23 Module to be back of panel mounted with the alarm indications programmed to be displayed on the protection relay front panel.

Cable box protection

The following diagram shows the trip signal being used to trip the feeder circuit breaker in the event of an arc fault occurring in the cable box provided the overcurrent relay starter logic is picked up.

CT Chamber protection

In circuit breakers where the CT is screened from the cable box a second sensor and ARC Module may be deployed as shown below.

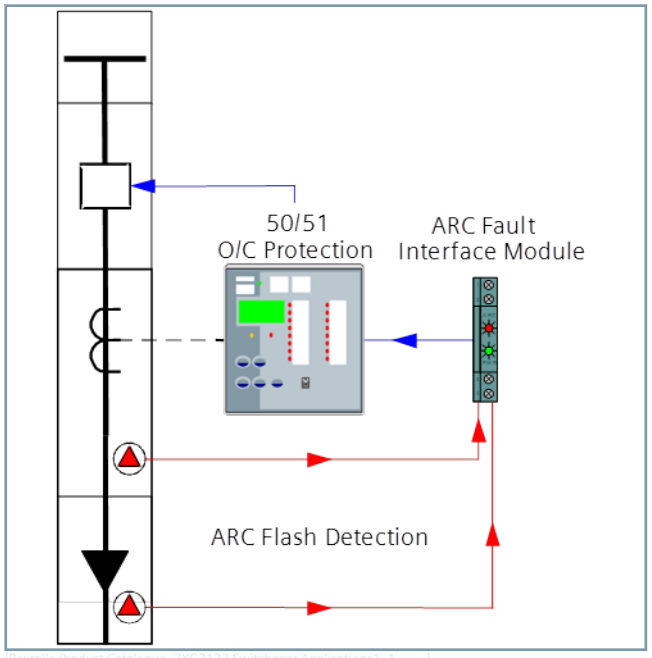


Figure 2.7/22 Cable box and CT chamber protection

Circuit Breaker Chamber Protection

Arc fault occurring within the CB chamber must be cleared by the upstream breaker. This may be achieved as depicted below. Note the optional use of GOOSE messaging over IEC61850 to communicate an arc fault condition to the incoming feeder protection relays. Programmable logic may then be applied in these relays to open the appropriate up-stream circuit breakers to clear the fault.

Where trip signalling is achieved using conventional wiring, the trip output connection should be terminated in close proximity to the ARC Module and screened cable employed to transfer the trip signal to the up-stream protection relay status input.

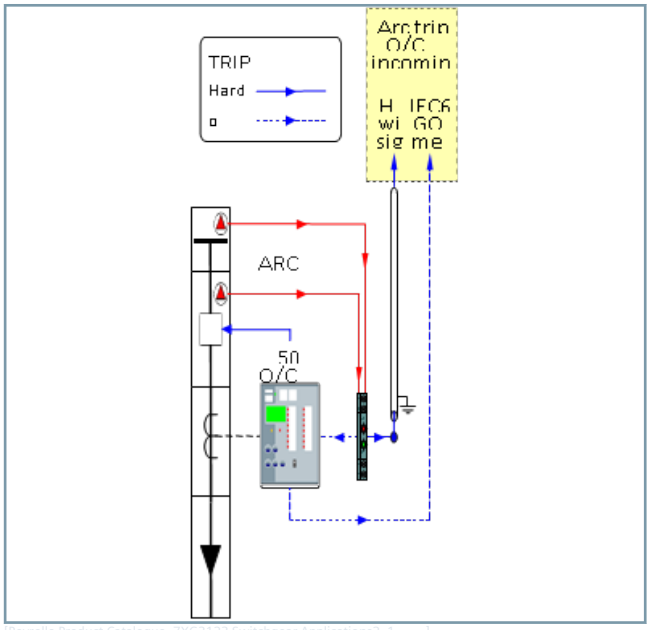


Figure 2.7/23 CB chamber protection Arc trip signal to BUS overcurrent check stage

Multiple RA23 Interface Modules

The diagram below depicts multiple RA23 Modules connected to a single status input. This scheme may be employed where more than one sensor is required to protect a single arc protection zone.

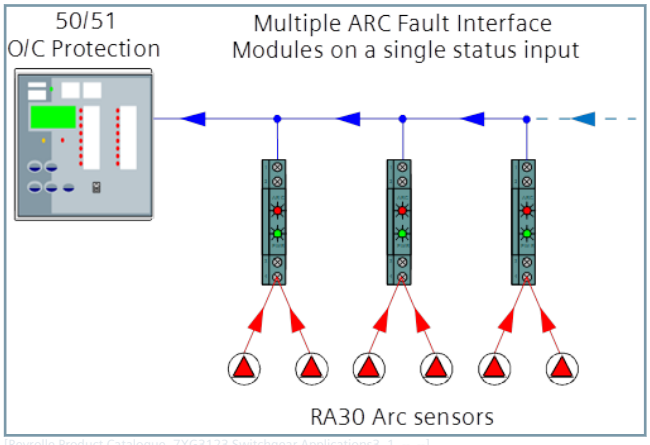
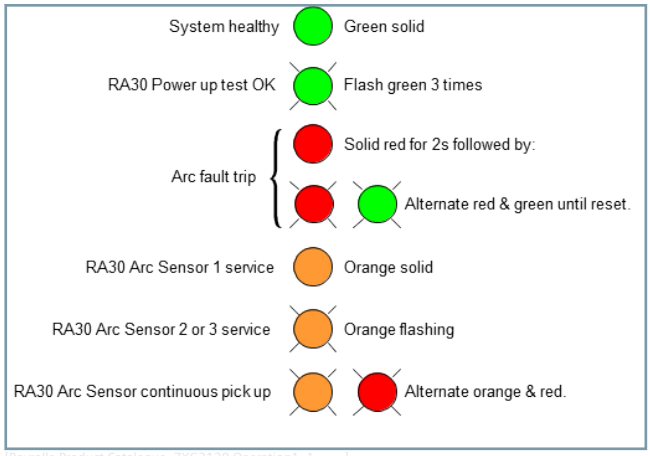


Figure 2.7/24 Multiple Arc Modules per status input

Operation

Operation Indicator

A single tri-colour LED is integrated into the front panel reset push button to provide the following status indications:



[Reyrolle Product Catalogue, 7XG3120 Operation1, 1, -, -]

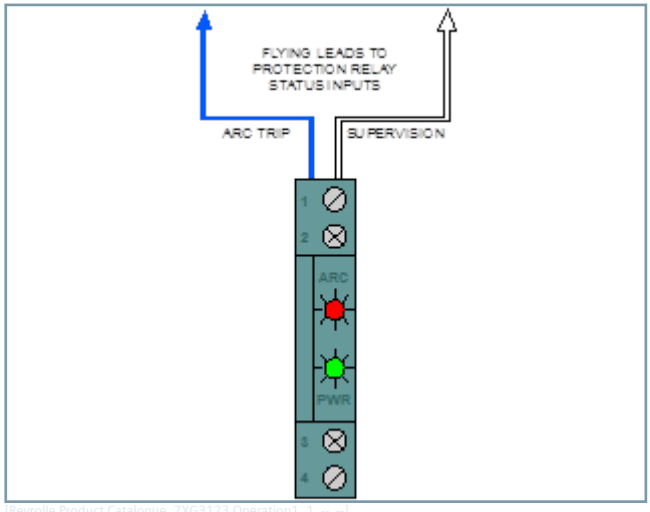
Front panel layout

Two LED's are integrated into the front panel to provide the following status indications:

GREEN Auxiliary supply indication - A green LED is continuously illuminated to indicate presence of the auxiliary supply and normal operation including supervision of the RA30 sensor(s).

RED Arc fault pick-up - A red LED is illuminated when an optical signal above the detection threshold is present. This LED will self reset when the optical signal falls below the detection threshold with a minimum dwell time of ~2s.

This feature is useful during commissioning and routine tests to verify correct operation of the system.



[Reyrolle Product Catalogue, 7XG3123 Operation1, 1, -, -]

Figure 2.7/25 RA23 Module front panel layout

Arc Sensor continuously picked up

High ambient light levels may cause a RA30 to be continuously picked up. This condition could occur for example if the CB cable box cover was left open in very high ambient light level conditions. A non arc fault over-current pick up would then result in an arc fault trip operation.

To avoid possible mal-operation due to this condition, the RA23 module is designed to automatically disable the arc fault tripping function, if the RA30 sensor is picked up for >500ms. The RA23 Module will then disable the healthy supervision signal and the front power LED will flash until the ambient light level problem is corrected. The ARC Module will then perform an arc sensor test function and automatically reset.

Arc Detection reset time (effect of multiple arc trips)

A delay of >500ms is required to reset the ARC Module after an initial arc sensor trip. Subsequent arc detection will cause the trip contact to re-operate.

Arc Sensor function

The RA30 is an optical sensor that responds to the flash of light emitted during the incidence of an arcing fault. Onset of the light flash and detection by the RA30 occurs in a few ms. When an arc is detected, the resistance presented by the RA30 drops to a level where the current flow increases to approximately 20mA. This increased current flow is detected by the RA23 Module which responds in <1ms to close a solid state contact to activate the arc fault input on the protection relay

Arc Sensor supervision

The RA30 Arc Sensor is the heart of the system and supervision of the circuit continuity is critical for correct operation. To monitor the integrity of the wiring between the RA30 arc sensor and the RA23 Module, a continuous 2mA supervision current flows between the units. A supervision healthy signal is output to the protection relay status input. This signal will be disabled after an ~1s time delay if the supervision current signal is lost.

An arc sensor fault will also be reported if an incorrect number of sensors are fitted to the RA23 Module as follows:

No arc sensor(s) connected

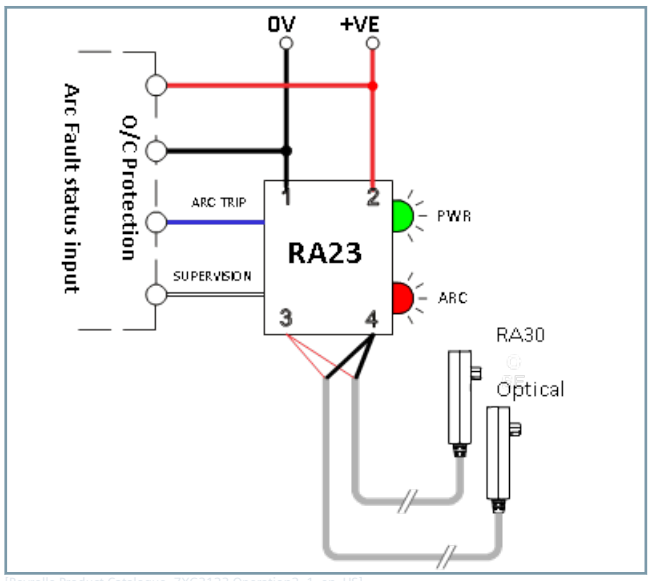
1 sensor connected to an RA23 Module specified for 2 sensors

Arc sensor fault indication

Where a fault is detected on the Arc Sensor circuit the front panel power LED will flash continuously until the fault is rectified.

Arc fault tripping using current check

Fast operation of a tripping scheme usually results in reduced system security. The arc detection method can however, combine the optical detection technique with a traditional over-current method to maximize system security. Both conditions must coexist for the trip condition to be met.



[Reyrolle Product Catalogue, 7XG3123 Operation2, 1, en_US]

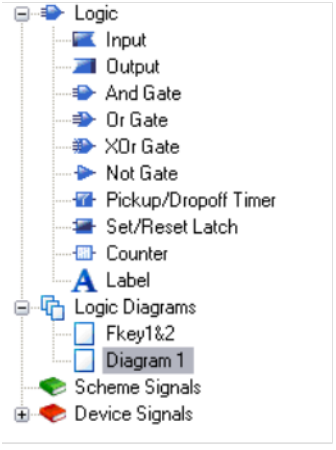
Figure 2.7/26 Key components required to implement an Arc fault Protection scheme with an overcurrent check stage to enhance system security

The application examples utilize this concept for enhanced system security in that both the RA23 Module AND the OC 50 starter logic must be picked up for a CB trip signal to be initiated. As the arc fault trip contact picks up considerably faster than the overcurrent relay starter element, the CB trip time will be dictated by the overcurrent relay performance.

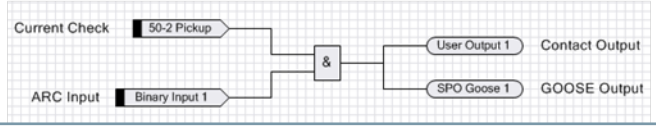
Relay Logic & Wiring

Protection relay logic

For the current check scheme to function correctly a protection relay with the following attributes is required:



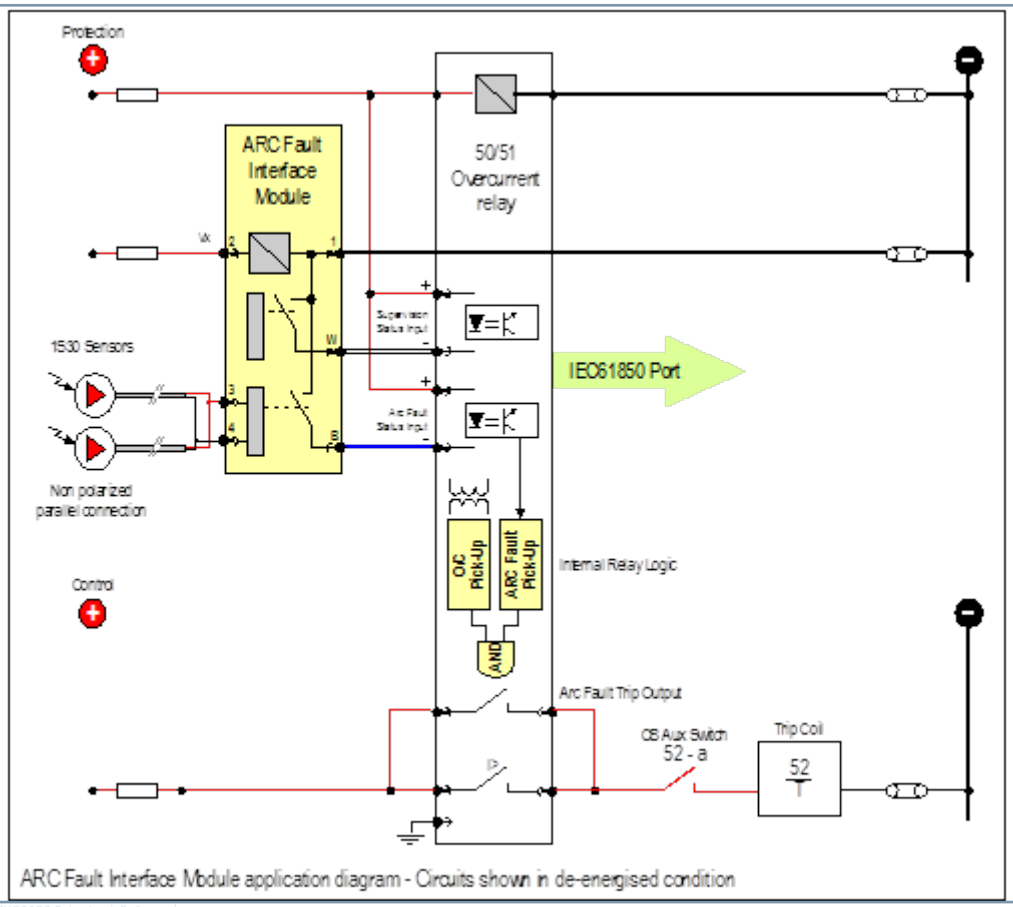
Attribute	Parameter	Necessity
Programmable relay logic	AND gates	Mandatory
High speed status input	<5ms pick up	Mandatory
High speed current check element	<15ms at 2x setting	Mandatory
Programmable front panel indication	Arc trip indication	Desirable
	Supervision status	Desirable
IEC61850 for trip signaling	GOOSE messaging	Optional



[Reyrolle Product Catalogue, 7XG3123 Relay Logic1, 1, --_--]

Figure 2.7/27 Reydisp manager logic programming

A suitable relay available with all of the above attributes is the Reyrolle 7SR21/22 platform multi-function feeder manager. A screen shot of the Reydisp Manager logic programming software is shown above.



[Reyrolle Product Catalogue, 7XG3123 Relay Logic2, 1, --_--]

Figure 2.7/28 RA23 Module application diagram

Enclosure dimensions

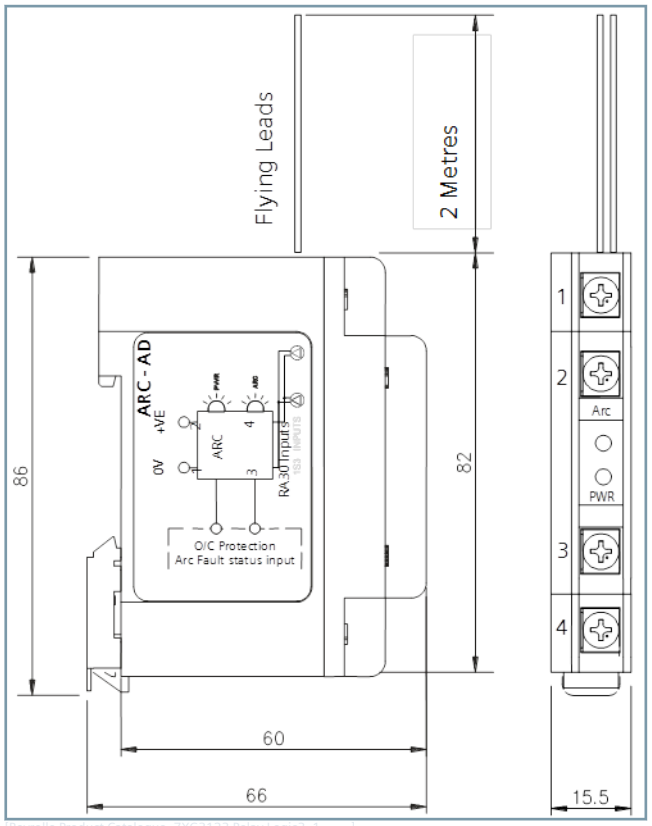


Figure 2.7/29 RA23 Module dimensional details

Arc Sensor inputs

One or two optical arc fault sensors type RA30 may be connected to the RA23 Module. Refer to the RA30 Catalogue Sheet for mounting options.

The number of sensors specified in the RA23 ordering code must be connected to ensure correct operation of the sensor supervision function.

If only one sensor is connected to the two sensor version the supervision output will indicate a sensor fail condition.

If two sensors are connected to the one sensor version the supervision output will indicate a sensor fail condition.

Figure 2.7/30 RA30 Arc Fault Sensor – front and back

DIN rain mount enclosure

The ARC Fault Interface Module is enclosed in a compact enclosure sealed with thermally conductive potting compound. The module is designed for DIN rail mounting.

Figure 2.7/31 RA23 Module depicting four (4) front screw terminals and two (2) top entry flying leads

Terminations

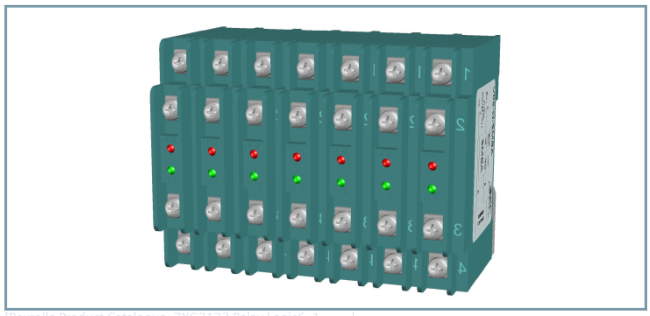
4x M4 screw terminals suitable for heavy duty ring lugs.	
Terminal 1:	DC negative
Terminal 2:	DC positive
Terminal 3:	RA30 arc fault in (Non polarized)
Terminal 4:	RA30 arc fault in (Non polarized)

2x 2 metre flying leads with 0.75 sq. mm conductor.	
Blue lead:	Arc fault trip output - negative
White lead:	Supervision status output - negative

Mounting

DIN rail mounting of multiple DIN rail modules allows for a compact installation close to the protection relay status inputs.

Wiring should be kept as short as practical to minimize the circuit resistance and possibility of noise on the protection relay status input.

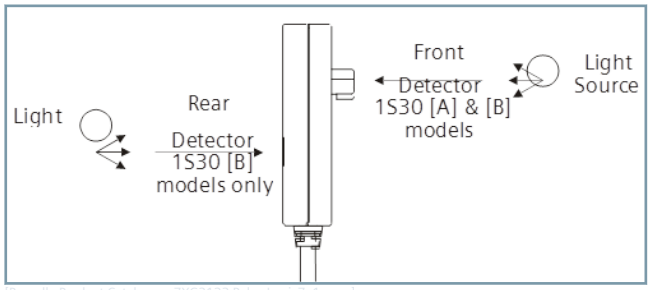


[Reyrolle Product Catalogue, 7XG3123 Relay Logic6, 1, _ _]

Figure 2.7/32 Array of 7 x RA23 modules

Optical sensitivity

~10,000 Lux* for white light at normal incidence to the detector window(s) as depicted below:

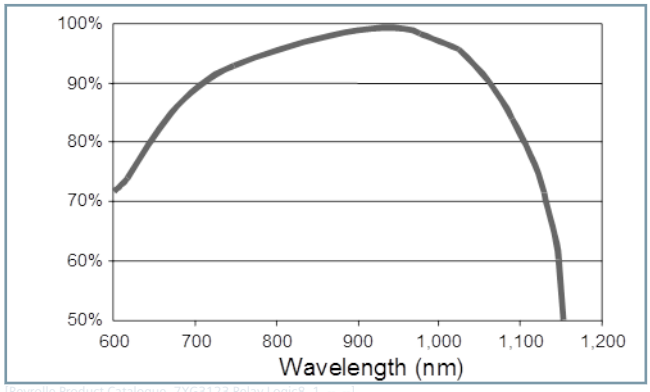


[Reyrolle Product Catalogue, 7XG3123 Relay Logic7, 1, _ _]

Figure 2.7/33 RA30 Arc Sensor

As the illuminace of diffuse ambient sunlight falls in the range 5,000 to 10,000 Lux, this will not normally be sufficient to trigger the RA23 Module. The luminous intensity from the sun at noon at the equator however is ~100,000 Lux which will be sufficient to trigger the RA23 Module so measures should be made to avoid this situation.

Detector spectral response



[Reyrolle Product Catalogue, 7XG3123 Relay Logic8, 1, _ _]

Figure 2.7/34 Arc detector spectral response

* Due to the relatively high sensitivity of the detector to IR wavelengths the type of light source employed for sensitivity testing will have a major effect on the results obtained. Sensitivity testing should therefore be conducted using a 50-75W halogen lamp with an integrated aluminum reflector.

System supervision

A CPU software watchdog monitors the system and in the event of an abnormal condition will automatically perform a soft restart.

Should this restart not clear the abnormal condition the system will revert to a safe mode with the outputs disabled. This will cause the self supervision healthy signal to be lost and the abnormal condition detected and reported by the protection relay via it's ARC supervision status input.

A front panel green LED is illuminated on the RA23 Module under normal conditions. This LED is switched off in safe mode.

Minimum Arc duration

The minimum arc "flash" duration required to guarantee operation of the output contacts is 0.5ms.

Trip signal reset time

Once operated the trip output signal is self reset with a minimum dwell time of 100 to 120ms.

Technical Data

Auxiliary supply burden (At 110V DC)

Monitoring mode:	Less than 0.75W
Arc fault detected:	Less than 1.5W for 2 s

Auxiliary supply

The Arc Module is suitable for use with the following nominal auxiliary supplies. A tolerance of -20 % to +20 % must be maintained to ensure correct operation and to avoid thermal damage.

Vx
24V DC
32V DC
48V DC
110V DC
125V DC
220V DC
240V DC
250V DC

Optical Arc fault detection operate time

An arc fault trip signal is output in less than 1ms.

Output circuit

Dedicated non-isolated outputs are provided to connect to overcurrent protection relay status inputs. Upon detection of light intensity greater than the pick–up threshold a solid state switch connects the 0V rail to the relay status input.

Arc Fault Protection – 7XG3123 Arc Fault Interface Module

Output ratings IEC60255-0-2

The Arc Module outputs are designed for connection to dedicated protection class binary status inputs only. They are not suitable for direct tripping applications of auxiliary relays or circuit breaker coils.

The following ratings are conservative and are suitable for application with status inputs employed on many modern protection relays such as the Reyrolle 7SR1 and 7SR2 platforms.

Supervision output

Open circuit voltage:	125 % of nominal
Maximum current:	15mA for 20 ms
	4mA continuous

Arc trip output

Open circuit voltage:	125 % of nominal
Maximum current:	15mA for 20 ms
	4mA continuous

Auxiliary supply IEC60255-11

Allowable breaks / dips in supply	≤ 20 ms
Collapse to zero from nominal voltage	

High Frequency disturbance IEC60255-22-1 Class III

2.5kV 1MHz common mode	No mal operation
1.0kV 1MHz differential mode	

Electrostatic discharge IEC60255-22-2 Class III

8kV air discharge	No mal operation

Radio frequency interference IEC60255-22-3

10V/m, 80 TO 1,000MHz	No mal operation

Fast transient IEC60255-22-4

4kV, 5/50ns, 100KHz repetitive	No mal operation

Insulation coordination IEC60255-5

Impulse voltage withstand test	5kV 1.2/50us 0.5J
Dielectric test	2.0kV$_{RMS}$ for 1 minute

Between all terminals and earth.

The earth point is defined as the DIN rail mounting bracket.

There is no isolation between any of the output terminals or flying leads.

They should be considered as the same group.

Conducted RFI IEC60255-22-6

10V, 0.15 to 80MHz	No mal operation

Temperature range IEC68-2-1/2

Operating:	-10 to +55°C
Storage:	-25 to +75°C

Humidity IEC68-2-78

40 °C and 93 % RH non condensing

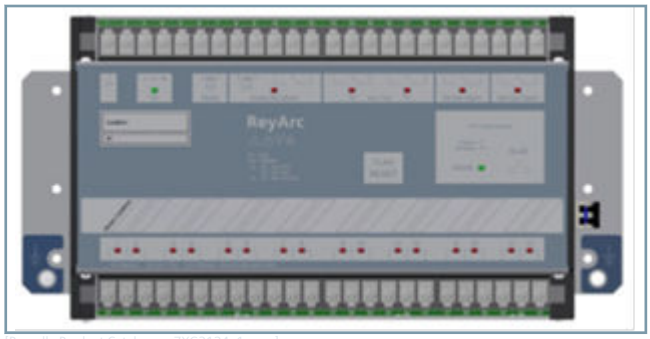
Fault Condition	RED LED	Trip Output	GREEN LED	Supervise Output
One (1) Sensor open circuit	OFF	OFF	FLASH	OFF
Two (2) Sensors open circuit	OFF	OFF	FLASH	OFF
One (1) Sensor short circuit on power up	OFF	OFF	FLASH	OFF
Two (2) Sensors short circuit on power up	OFF	OFF	FLASH	OFF
Arc trip >500ms (Continuous arc pick up)	ON	OFF	FLASH	OFF
Arc trip current limit exceeded	ON for 2 s	OFF for 100 ms	OFF for 2 s	OFF for 2 s
Supervise output current limit exceeded	OFF	OFF	FLASH - PAUSE - FLASH	OFF
Power supply fail	OFF	OFF	OFF	OFF
CPU fail	OFF	OFF	OFF	OFF
Single sensor software identification			Three (3) flashes at startup	
Dual sensor software identification			Four (4) flashes at startup	

Arc Module status table

Ordering Information - 7XG3123 Arc Fault Interface Module

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Arc Fault Interface Module	7	X	G	3	1	2	3	-	□	□	A	0	0	-	0	A	A	0
				|	|	|	|		|	|									
Category				|	|	|	|		|	|									
Arc Protection				3	1	|	|		|	|										
						|	|		|	|									
Device						|	|		|	|									
RA23 Arc Fault Interface Module						2	3		|	|										
									|	|										
Sensor Inputs									|	|										
One sensor input									1	|											
Two sensor inputs									2	|											
										|											
Operating Voltage										|											
24V DC										A											
32V DC										B											
48V DC										C											
110V DC										D											
125V DC										E											
220V DC										F											
240V DC										G											
250V DC										H											

7XG3124 Arc Fault Monitor Relay



[Reyrolle Product Catalogue, 7XG3124, 1, –_–]

Figure 2.7/35 RA24 Arc Fault Module

Features

- Up to 16 arc fault sensors
- 2 x High speed arc fault tripping duty contacts
- Trip indication LED for each arc fault sensor
- Arc sensor supervision with sensor fail LED for each zone
- 10Base-T / 100Base-TX port
- Optional 100Base-FX port
- System configuration via web browser
- IEC61850 GOOSE capable
- Up to 16 independent arc fault SARC logic nodes
- Self-supervision watchdog with healthy LED and alarm
- Wide range auxiliary supply

Introduction

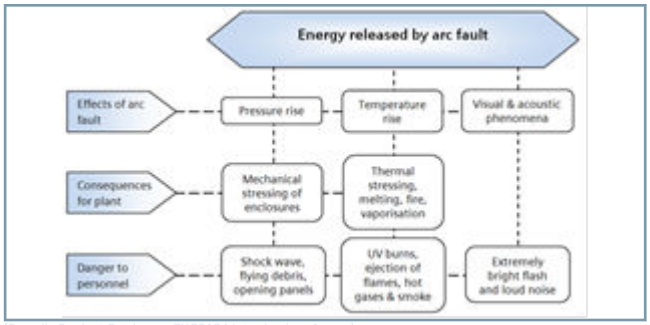
Arc fault protection is a technique employed for the clearance of arcing faults on low voltage panels, MCC's, BUS bars and within metal clad switchgear and associated cable boxes.

Conventional current based protection techniques are at times challenged by the nature of arcing faults, and can result in slow protection clearance times. Slow protection clearance times increase the risk to nearby personnel and increase the degree of damage to plant and equipment.

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

With the added benefit of IEC61850 Goose Messaging, the RA24 (ReyArc24) is a scalable solution capable of being employed in the most challenging applications with reduced engineering overhead.

With the flexibility of the IEC 61850 standard ARC tripping with current checking or ARC tripping with operational interlocks are able to be implemented with ease.



[Reyrolle Product Catalogue, 7XG3124 Introduction, 1, –_–]

Figure 2.7/36 Energy release due to electrical arcing faults

Arc Fault – Cause and Effect

Medium voltage switchgear and associated bus bars are a key element in the power supply chain. Existing protection systems operate effectively and quickly under most fault types but arcing faults may lead to slow operating times.

Due to the resistive nature of an arcing fault the associated fault current is likely to be lower than for a bolted short cir-cuit. Instantaneous overcurrent protection is set to operate above network energisation currents and motor starting currents, the fault current due to an arc may be lower than this.

The consequence of these conditions is that a protection system based solely on over-current detection cannot effectively discriminate between normal system currents and an arc fault condition:

- Moderate to low arc fault currents may not operate the instantaneous trip stage of a standard over-current relay
- For a Moderate to low arc fault current the trip time of the over-current IDMT stage will be too slow

Arcing faults in metal clad switchgear and associated Bus bars may occur for a number of reasons:

- defective or ageing insulating materials
- poor bus or cable connections
- poor maintenance
- human error
- ingress of moisture, dust or vermin
- abnormal service conditions

The degree of damage caused by arcing depends principally on the duration of the arc. If an arc lasts only 100ms, the switchgear needs to be checked and the insulation resistance measured before power can be re-established. With a 200ms arc, the power supply will be interrupted; the switchgear must be checked; power is re-established only after minor repairs. In the event of a 500ms arc the supply is interrupted, metal parts of the switchgear are destroyed and poisonous gases are emitted. A 1s arc destroys most of the switchgear and may cause a fire, injury to personnel and damage to property.

Arc Flash Detection Principle

An arcing fault results in an intense and rapid discharge of light from the arcing source. The light discharged from an arcing fault

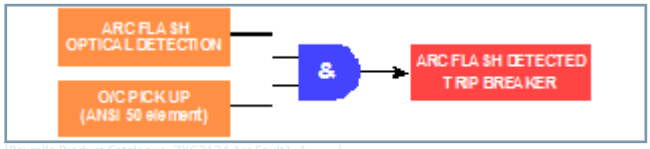
will typically be several thousand times normal ambient lighting levels.

The RA24 arc Fault Detection system optically senses the pres-ence of an arc by the means of RA30 optical sensors connect-ed to the RA24 monitor.

Very fast ARC detection is achieved using this technique, and protection operation times of <10ms are achievable.

Arc Fault Protection with Current Check

For system security purposes, the optical ARC detection may also be supervised by an external Instantaneous Current Check element to confirm fault detection.

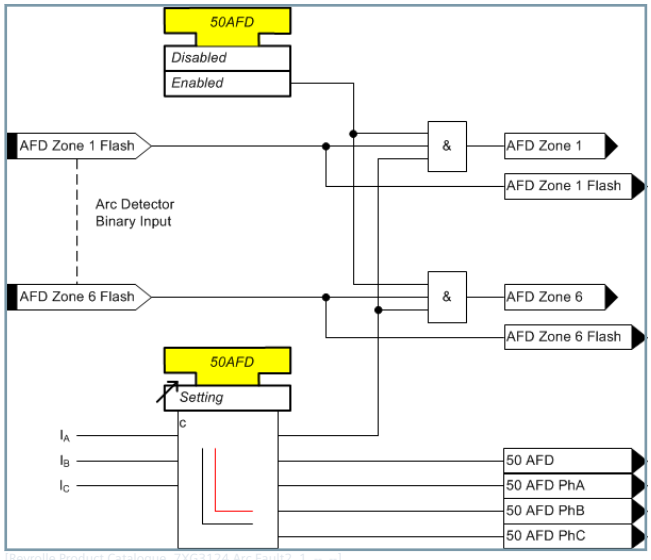


[Reyrolle Product Catalogue, 7XG3124 Arc Fault1, 1, – _ –]

Figure 2.7/37 High speed AND logic employed to discriminate an arc flash fault

Integration with Reyrolle Overcurrent Relays

The Reyrolle 7SR11, 7SR12, 7SR210 and 7SR220 overcurrent relays have a dedicated Arc Fault Detector protection function (50AFD). This function uses a time optimised algorithm to check an arc flash input against a current input for the fastest possible operation time in the event of an arc fault.



[Reyrolle Product Catalogue, 7XG3124 Arc Fault2, 1, – _ –]

Figure 2.7/38 50AFD arc flash protection function logic

Arc fault protection compliments existing conventional overcur-rent and differential protection schemes and is easily imple-mented into both new and existing installations.

[Reyrolle Product Catalogue, 7XG3124 Arc Fault3, 1, – _ –]

Figure 2.7/39 Consequences of arcing faults

Arc Sensor Location

The number and location of optical arc sensors is dictated by the switchgear and bus bar design and the length of the switch-board.

In most indoor metal clad switchgear the bus bar chamber is a continuous chamber between panels only broken into segre-gated sections at a bus section breaker and as such the strategic placement of one or two arc sensors in each bus bar chamber run is normally adequate.

Some indoor metal clad switchgear may segregate the bus chamber of each panel from the next via insulated bus chamber side barriers per panel, if this is the case then each bus chamber per panel would need to be monitored by at least one arc sensor.

Isolating switches between bus bar sections need to also be considered and appropriate tripping zones created to ensure isolation of the faulted section.

In large enclosures the arc sensors should be placed at approx-imately 5m intervals. RA30 arc sensors are also available with dual optical detectors to allow detection of an arc in both direc-tions.

The intense light produced by an arcing fault is strong enough to be picked up on by the sensors by its reflection off the switch-gear walls. Therefore, direct line of sight of the fault is not usually required, making exact sensor placement less critical.

IEC61850

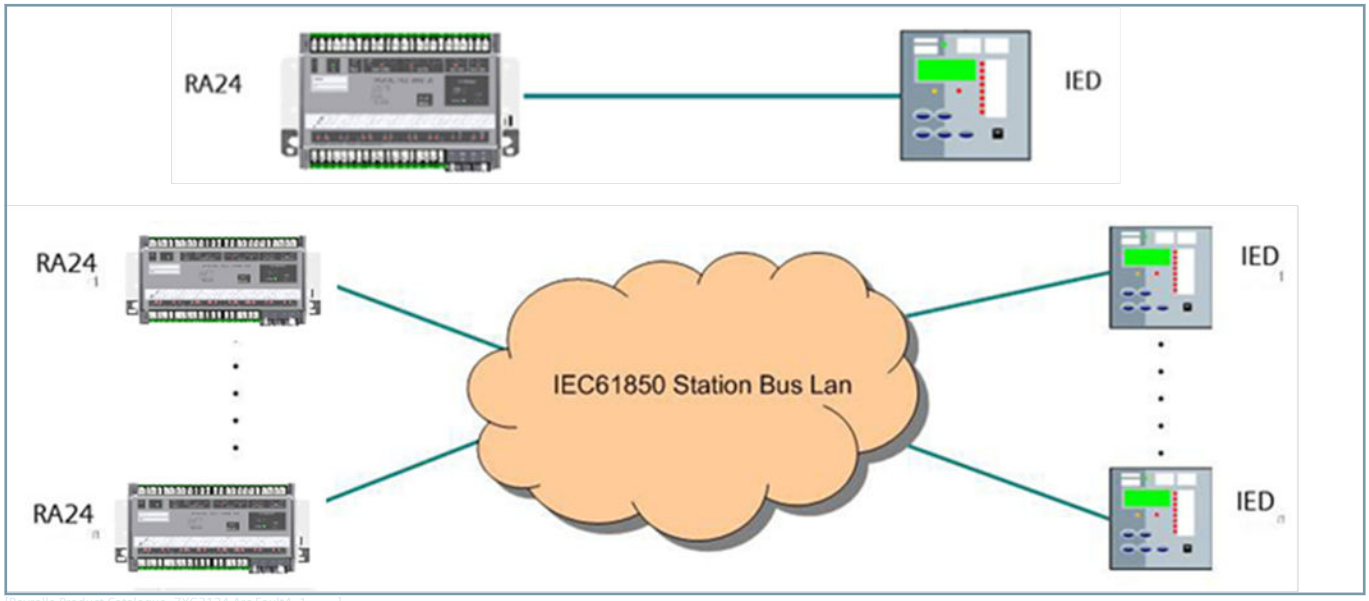
Substations, power plants and distributed energy resources all over the world are now implementing protection, control, auto-mation and condition monitoring functions in Power Automa-tion Systems (PAS) according to the IEC61850 Standard.

The open architecture and high speed GOOSE messaging avail-able through the implementation of IEC61850 make it an ideal

platform on which to base a scalable, selective and flexible arc fault protection scheme for any power system configuration. The RA24 system provides a comprehensive solution for the protection of arcing faults in metal clad air insulated switch-gear and bus bar systems based on the IEC61850 Standard.

The arc is detected using an optical sensor and the signal input to the RA24 arc monitoring system. The RA24 generates IEC61850 GOOSE messages which are broadcast via the station bus LAN. Intelligent IED's are employed to subscribe to the arc fault GOOSE messages and generate tripping signals to the appropriate circuit breakers based on tripping logic that takes into account pre-determined system configurations. The RA24 may be connected directly to an IED using a cross over cable or alternatively through a Station Bus Lan as per the typical IED topology shown below.

An IEC61850 based Arc Fault Solution will achieve reduced engineering overhead compared to a conventional hard wired alternative.



[Reyrolle Product Catalogue, 7XG3124 Arc Fault4, 1, --_--]

Figure 2.7/40 IEC 61850 based arc fault solution

Functional Description

Web Based Configuration

Configuration of the RA24 Arc Fault Monitor is carried out using a web browser interface. Connection is made between the RA24 and a PC using a standard Category 5 patch cable with RJ45 electrical plugs.

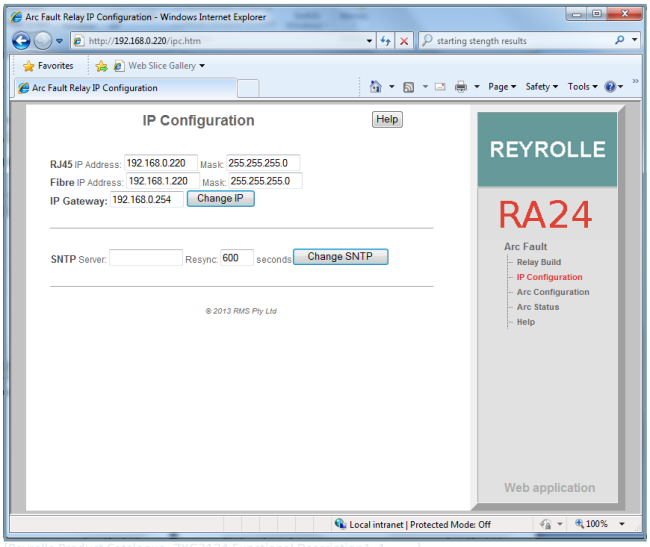
Connect the RA24 port P1 to the PC Ethernet LAN port. Open a PC browser using the default IP address 192.168.0.220

Ethernet Configuration

The current status of the device's communications configuration is shown in the browser interface.

SNTP Server	Change SNTP server name (SNTP server of the Station Bus Lan)
SNTP re-sync.	Changes re-sync. time in seconds
Password	Change administration password

Any changes are password protected and require entry of the username ("admin") and the password (default from the facto-ry is "RMS").



[Reyrolle Product Catalogue, 7XG3124 Functional Description1, 1, --_--]

Figure 2.7/41 RA24 IP Configuration screen

Arc Configuration Screen

The current status of each ARC detector is shown. To make the web page follow the ARC status in real time, tick the Automatic refresh button.

Arc Configuration:

Each individual ARC sensor can be configured as follows: 'Armed' or 'Disabled' by clicking on the state column (Affects both IEC61850 Goose outputs and the hardware trip contacts)

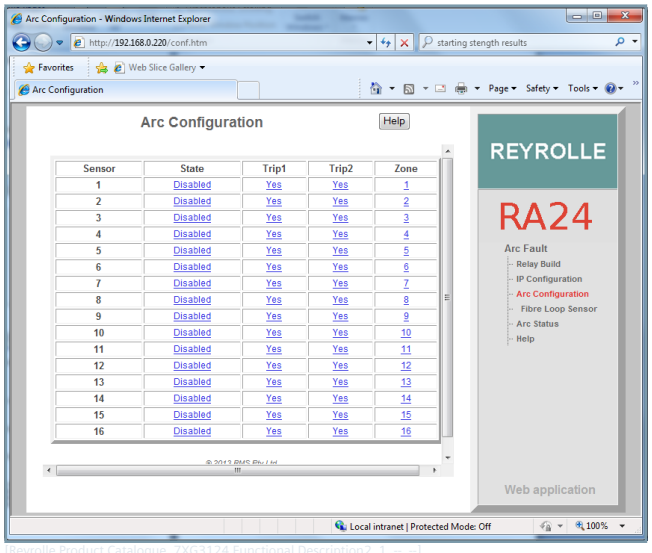
Arc States

The following list defines the possible ARC states:

- Disabled: Sensor not connected or disabled
- Armed: Ready to detect an arc fault
- Failed: Arc sensor supervision failure
- Tripped: Arc detected
- Initializing: Arc sensor initializing (transitory)
- Stuck: Arc sensor stuck on, i.e. continuously picked up
- Included: Determines whether a sensor is allocated to the relay
- Trip outputs (Yes or No)

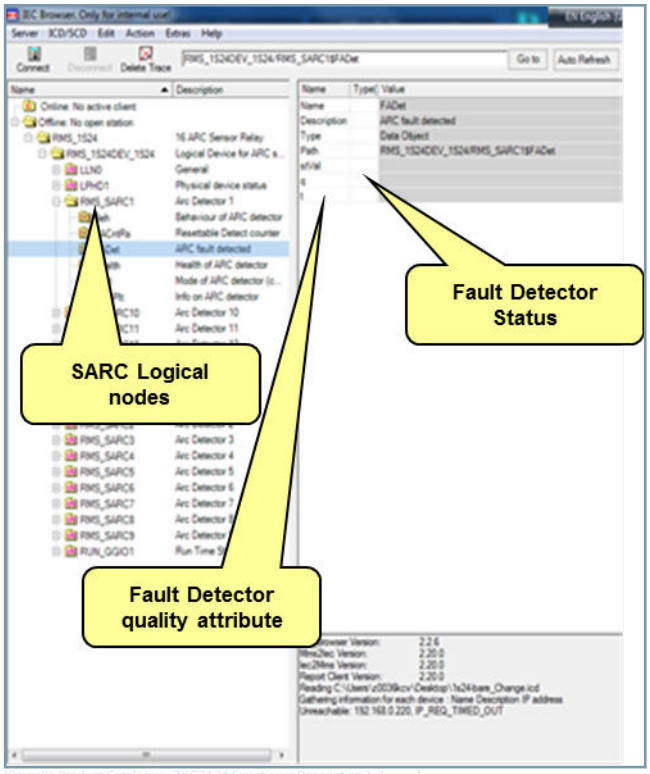
Each individual arc sensor provides the following status:

Trip:	Indicates when the arc sensor LED Flag is asserted (Yes or No)
Count:	Retains a count since power on of how many times arc sensor has been tripped. This count can be reset to 0 by clicking on the counter.



[Reyrolle Product Catalogue, 7XG3124 Functional Description2, 1, --_--]

Figure 2.7/42 RA24 Arc Sensor Configuration screen



[Reyrolle Product Catalogue, 7XG3124 Functional Description3, 1, --_--]

Figure 2.7/43 ICD editing screen

IED Capability Description (ICD)

The ICD is utilised in IEC61850 Substation Project Development. The RA24 ICD model contains the following logical nodes:

- A standard IEC61850-5 SARC (Monitoring and diagnostics for arcs), for each of the 16 Arc detectors. These cover an individual Arc fault detection, fault counter and detector health. Also, each Arc detector can be enabled or disabled using the SARC Mode.
- A configuration GGIO that can be used to configure the inclusion of each Arc detector in the single Alarm output relay of the RA24, as an alternative to the web page.
- A run-time GGIO that allows the front panel LED state for each Arc detector to be observed and cleared via IEC61850, as well as observing the state of the Alarm and Sensor Fail relays remotely.
- A Logical Node 0 (LLN0), that observes name plate in-formation about the device and overall device current behaviour. A global block can be set and unset via IEC61850 using the LLN0 Mode

The structure of the ICD file may be viewed using third party ICD browsers.

There are two .icd files that can be downloaded from the Reyrolle website. Descriptions of both files are provided below:

The 1S24.cid can be used as-is on the RA24 and has a default set of 16 separate Goose messages, one for each FADet point with stVal and Quality included in the Goose. However, The IP

address within this file, must match the IP Address configured on the RA24.

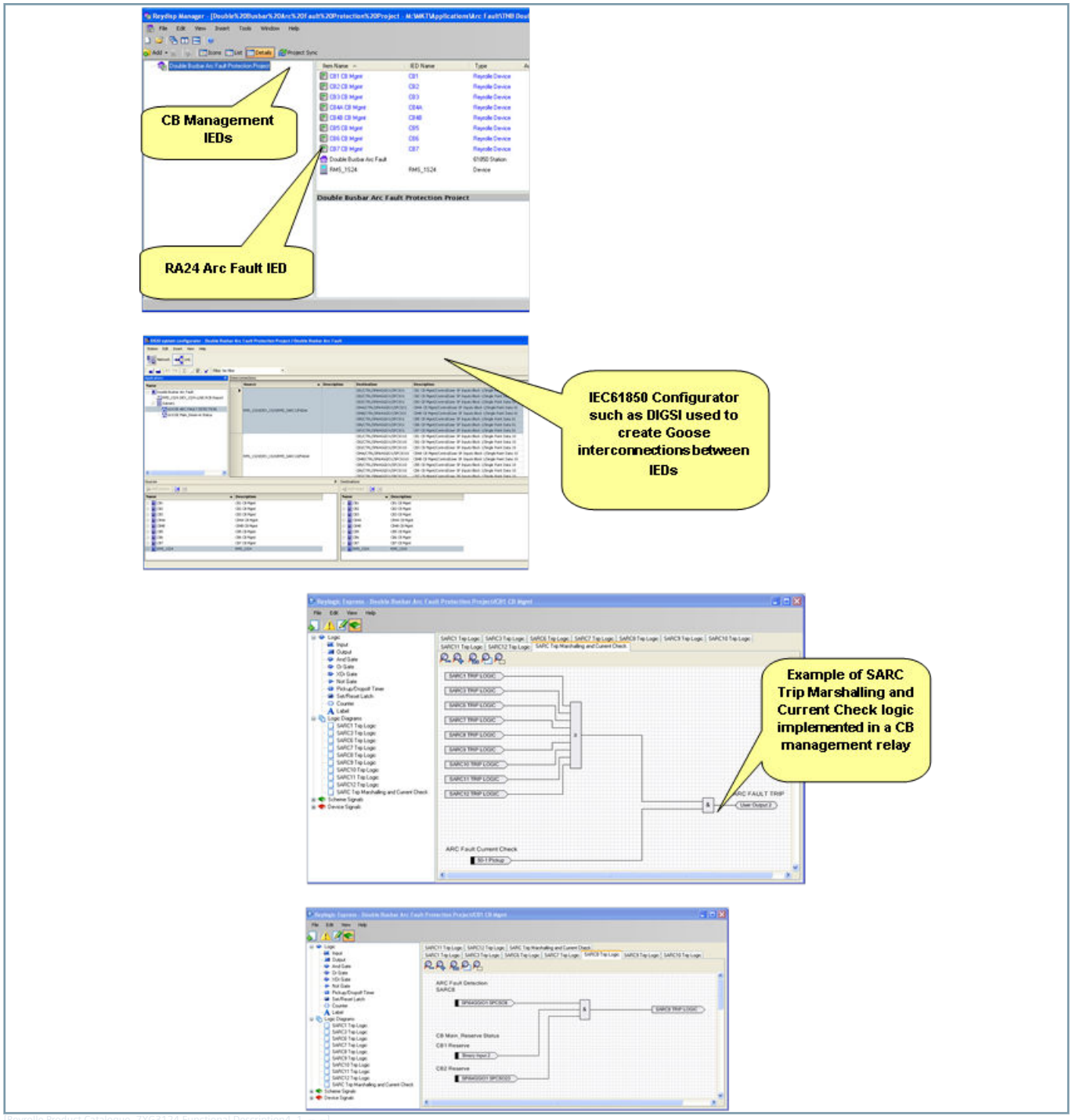
The 1S24-bare.icd has an ICD extension as it is intended for importing into site configuration tools which can add specific Goose to it (with whatever VLAN, Versioning etc. required). The Tool can then export a CID file for use on the RA24. Please Note: On the RA24 itself, it must be called 1S24.cid.

IEC61850 Project

The IEC61850 standard permits the integration of the RA24 into a substation project incorporating any third party CB management IED.

The RA24 is modelled under IEC61850 with a Logical node model defined by a IS24.icd file. This file can be imported into your IEC61850 system configurator and incorporated into an IEC61850 project.

Examples of an IEC61850 Substation project incorporating a RA24 into an ARC Fault Protection scheme and CB Management Logic utilising subscribed Goose messages from the RA24 are shown below.



[Reyrolle Product Catalogue, 7XG3124 Functional Description4, 1, =_=]

Figure 2.7/44 Reydisp Manager IEC61850 project editing and Reylogic screens

Arc Sensor Function

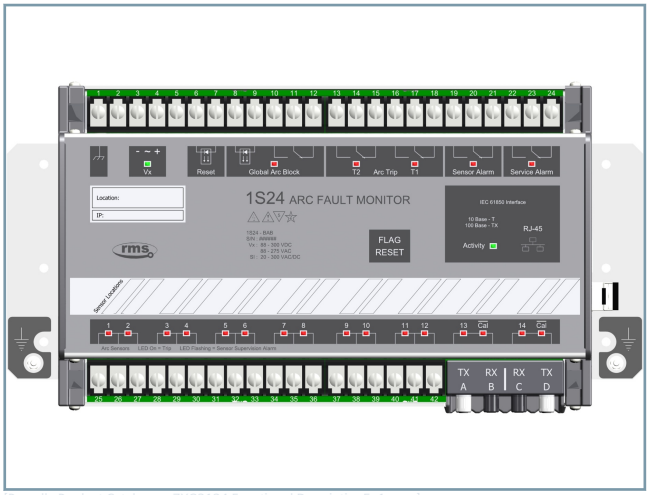
The RA30 is an optical sensor that responds to the flash of light emitted during the incidence of an arcing fault. Onset of the light flash and detection by the RA30 occurs in a few ms.

Refer to the RA30 Technical catalogue sheet for further details.

RA30 Point Sensor Inputs and Indicators

A red LED is provided for each arc sensor input to indicate:

Trip:	LED illuminates solid on detection of an arc fault. Resets when the front panel reset button is pressed or voltage pulse applied to remote reset status input. Individual flags can also be observed and cleared via IEC61850.
Fail:	LED Flashes to indicate failure of RA30 Arc Fault Sensor in zone.



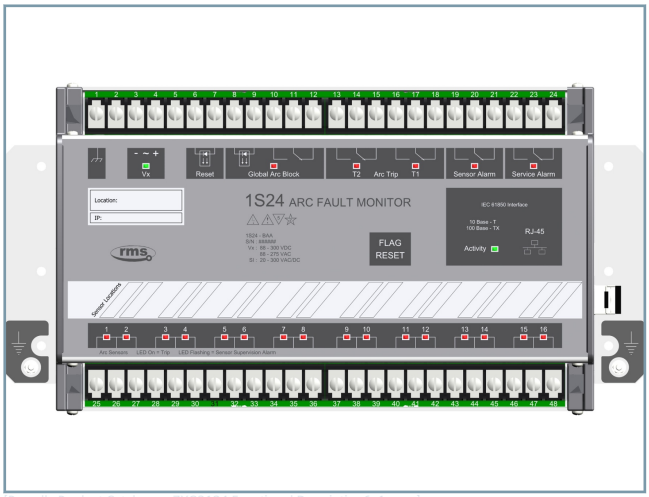
[Reyrolle Product Catalogue, 7XG3124 Functional Description5, 1, –_–]

Figure 2.7/45 Point arc sensor LED's and terminals

Arc Trip Output Contacts

The RA24 provides two (2) high speed tripping output contacts. These may be employed for local tripping functions and for system testing purposes. Each sensor input may be set to trip either of the output contacts.

The arc trip contacts will self-reset after a 2s delay. The trip indication LED is reset either by pressing the front panel reset button, via the remote reset status input or via IEC61850 control.

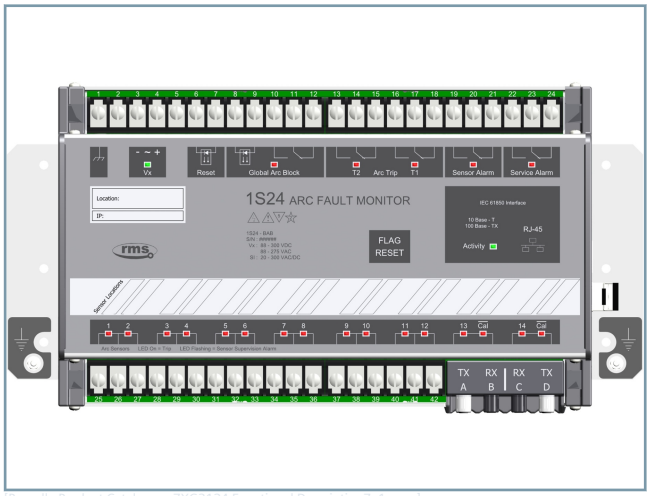


[Reyrolle Product Catalogue, 7XG3124 Functional Description6, 1, –_–]

Figure 2.7/46 Arc trip output contacts and trip LED

Arc Trip Blocking Input

The RA24 provides a status input to enable a global block of all arc fault detection sensors. Application of a control voltage within the specified range will activate this function and energize the Global Arc Block LED.



[Reyrolle Product Catalogue, 7XG3124 Functional Description7, 1, –_–]

Figure 2.7/47 Global arc block input and LED indication

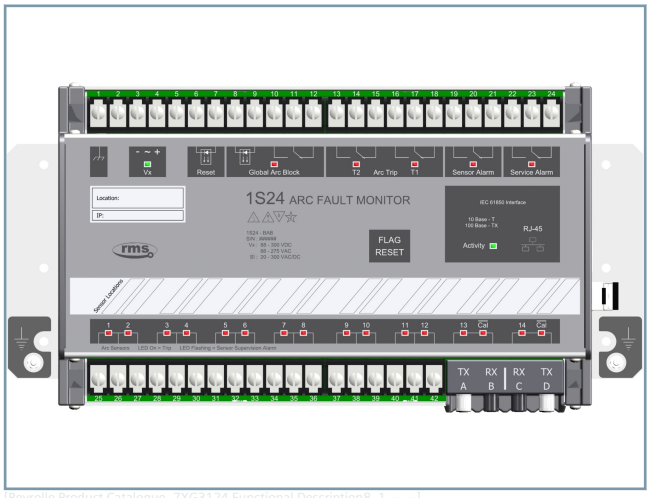
Arc Detection Reset Time

Effect of multiple arc trips.

A delay of 2s is required to reset the RA24 after an initial arc sensor trip. Subsequent arc detection will cause the trip out-puts to re-operate.

Remote Reset

A remote reset status input is provided to reset the arc trip LED's.



[Reyrolle Product Catalogue, 7XG3124 Functional Description8, 1, –_–]

Figure 2.7/48 Remote reset binary input - flag reset

Optical Arc Sensors

The RA30 optical arc sensors are the heart of the system and are available for application with the RA24.

Details on the function and sensitivity of these sensors may be found in the specific Technical catalogue sheet.

Point Sensor Supervision

To monitor the integrity of the wiring between the RA30 arc sensor and RA24 Arc Monitor, continuous 2mA supervision current flows between the units.

If the sensor supervision current is not detected for 1s the Sensor Alarm contact will operate and the Sensor Alarm LED will illuminate solid.

The affected sensor(s) will be indicated by the front panel sensor LED 1-16 flashing. The associated IEC61850 Arc Fault Quality will change to questionable.

Arc Sensor Continuously Picked Up

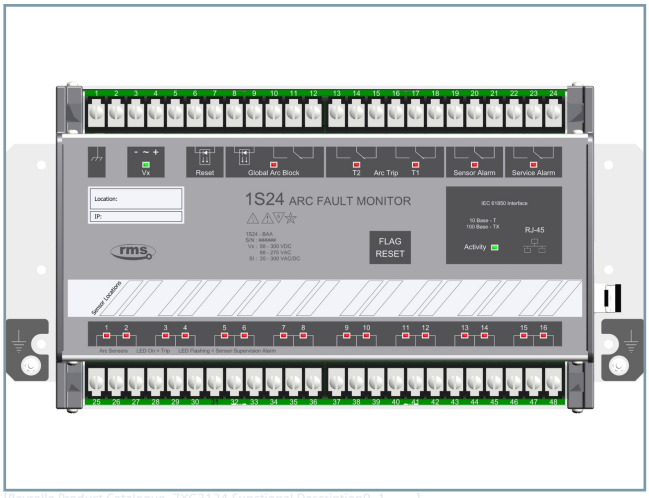
High ambient light levels may cause a RA30 to be continuously picked up. This condition could occur for example if the CB cable box cover was left open in very high ambient light level conditions. A non-arc fault over-current pick up would then result in an arc fault trip operation.

To avoid possible mal operation due to this condition, the RA24 is designed to automatically disable the arc fault tripping function if the RA30 sensor is picked up for >10s. The RA24 Sensor Alarm contact will operate and Sensor Alarm LED will illuminate solid until the ambient light level problem is corrected. The RA24 will then perform an arc sensor test function and automatically reset.

The affected sensor(s) will be indicated by the front panel sensor LED 1-16 flashing.

Sensor Fail Alarm

A common Sensor Fail Alarm contact is provided.



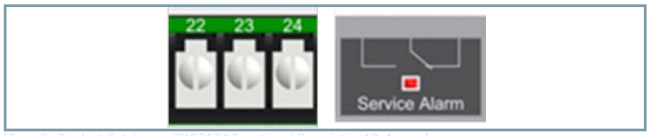
[Reyrolle Product Catalogue, 7XG3124 Functional Description9, 1, ~_~]

Figure 2.7/49 Sensor fail alarm LED and output contact

Self-Supervision Service Alarm

A change over alarm contact is maintained in the energized state when all of the following conditions are met:

- The auxiliary supply is applied
- The internal 5V DC rail is within acceptable limits
- The CPU hardware watchdog maintains a pulsing output
- The Service Alarm LED will be energized for a CPU fail condition.



[Reyrolle Product Catalogue, 7XG3124 Functional Description10, 1, ~_~]

Figure 2.7/50 Self-supervision service alarm

System Status

LED's are provided to indicate auxiliary supply and Ethernet activity.

[Reyrolle Product Catalogue, 7XG3124 Functional Description11, 1, ~_~]

Figure 2.7/51 System status LED's

Device Earth Terminal

The RA24 provides a device earthing terminal.

[Reyrolle Product Catalogue, 7XG3124 Functional Description12, 1, ~_~]

Figure 2.7/52 Device earth terminal

Rating Plate and Flag Reset

The rating plate is clearly identified on the front panel.

A reset button is provided to reset the arc trip LED's.

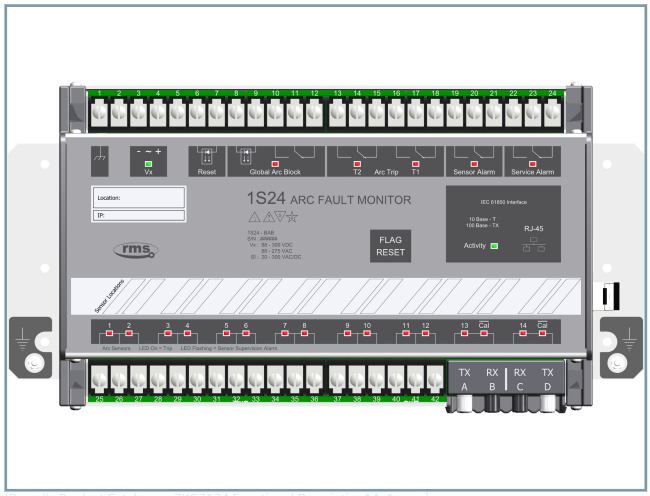
This button also has other functions to initiate warm boot and cold boot to restore factory default settings. Refer to the User Guide for details.

[Reyrolle Product Catalogue, 7XG3124 Functional Description13, 1, ~_~]

Figure 2.7/53 Relay rating plate and reset button

Customer Specific Labels

Provision for a slide-in customer specific label is provided on the front panel.



[Reyrolle Product Catalogue, 7XG3124 Functional Description14, 1, –_–]

Figure 2.7/54 Default slide in label

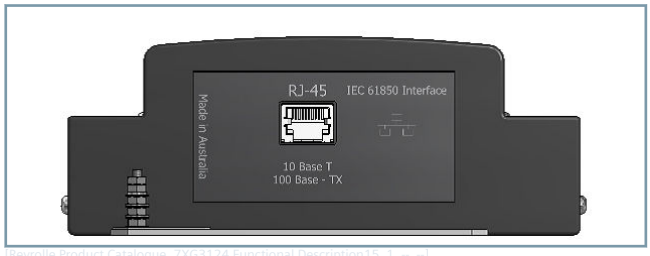
Ethernet Communication Ports

The RA24 provides the option of either one or two high speed Ethernet port options for connection to an IEC61850 compliant station bus local area network (LAN).

Standard Port: The standard port employs an electrical interface with an RJ45 connector and supports 10Base-T / 100Base-TX. The port may be utilised for either IEC61850 Goose messaging purposes or for device configuration.

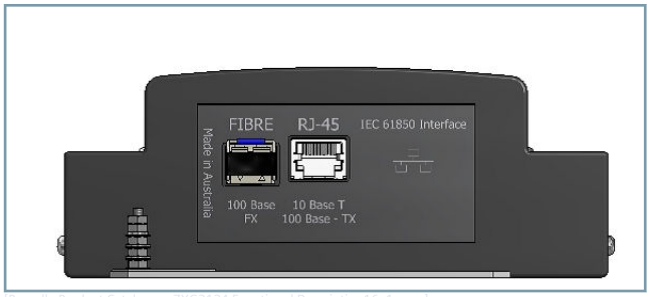
Optional Second Port: An optional second port employs a plug-in optical fibre port and supports 100Base-FX.

The two port option allows one of the ports to connect to an IEC61850 station bus LAN for Goose messaging purposes and either port may be utilised for device configuration.



[Reyrolle Product Catalogue, 7XG3124 Functional Description15, 1, –_–]

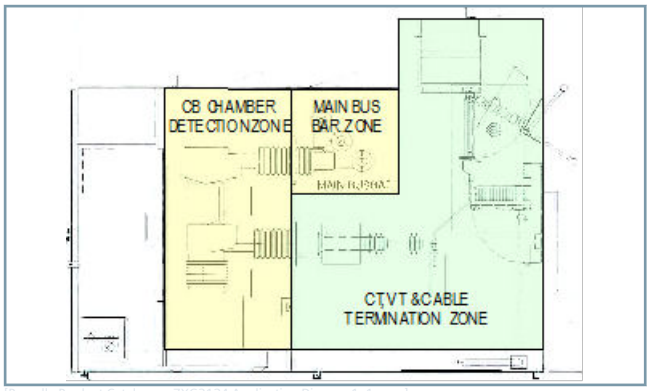
Figure 2.7/55 Standard single port 10Base-T / 100Base-TX



[Reyrolle Product Catalogue, 7XG3124 Functional Description16, 1, –_–]

Figure 2.7/56 Optional dual port 10Base-T / 100Base-TX + 100Base-FX

Application Diagram



[Reyrolle Product Catalogue, 7XG3124 Application Diagram1, 1, –_–]

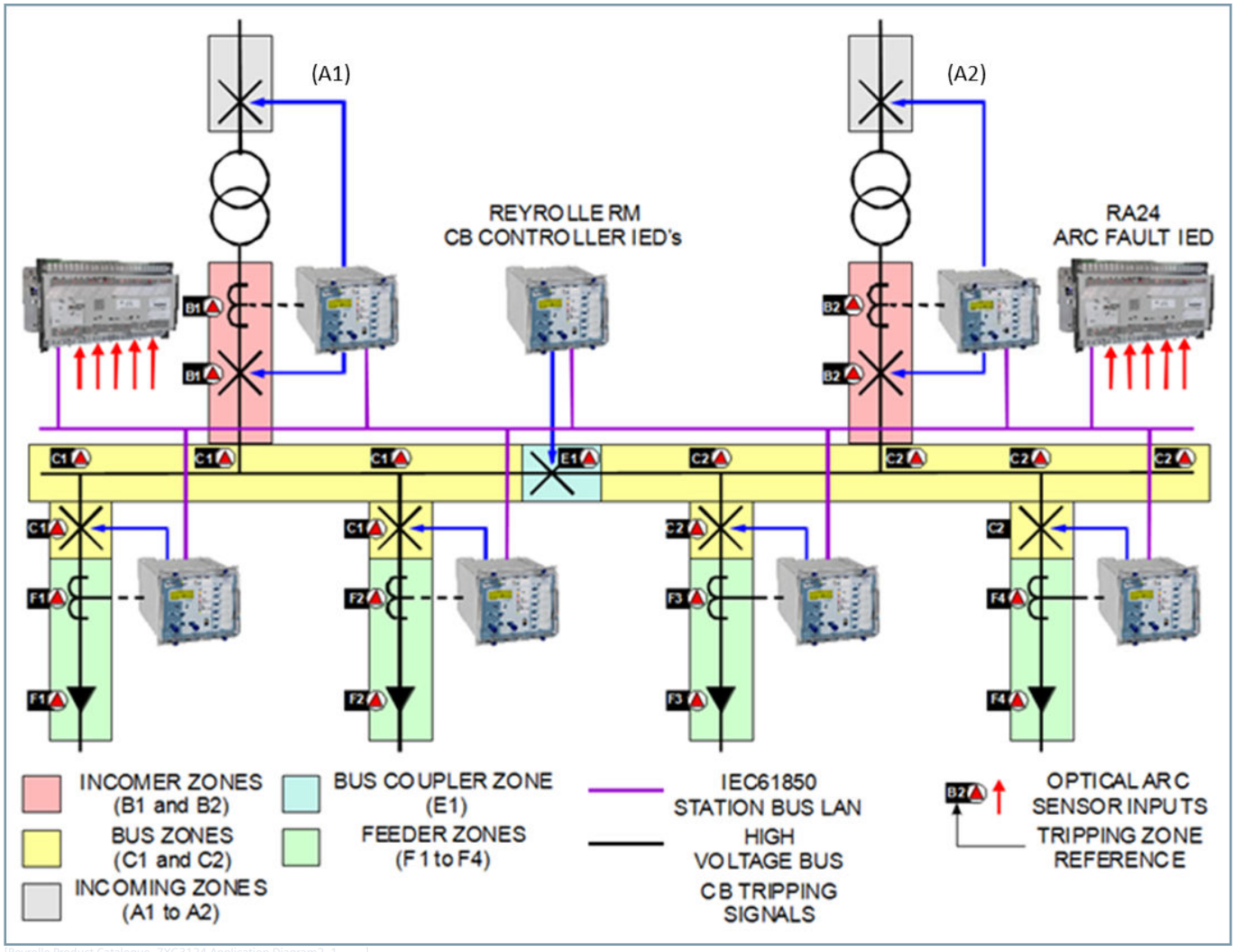
Figure 2.7/57 Single bus circuit breaker

Single Bus Switchgear

Single busbar switchgear systems are prevalent at medium voltage levels. The complexity on the protection required to mitigate arc flash faults is dependent on the Bus configuration. The diagram above depicts a typical circuit breaker arrangement in a single bus scheme.

Single Bus and Switchgear Arc Protection

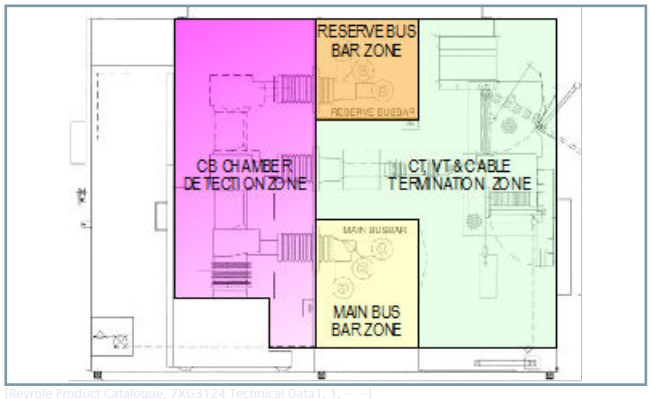
The diagram below depicts how the RA24 may be applied for arc fault protection on a single bus bar configuration.



[Reyrolle Product Catalogue, 7XG3124 Application Diagram2, 1, --_--]

Figure 2.7/58 Single bus scheme

Technical Data



[Reyrolle Product Catalogue, 7XG3124 Technical Data1, 1, --_--]

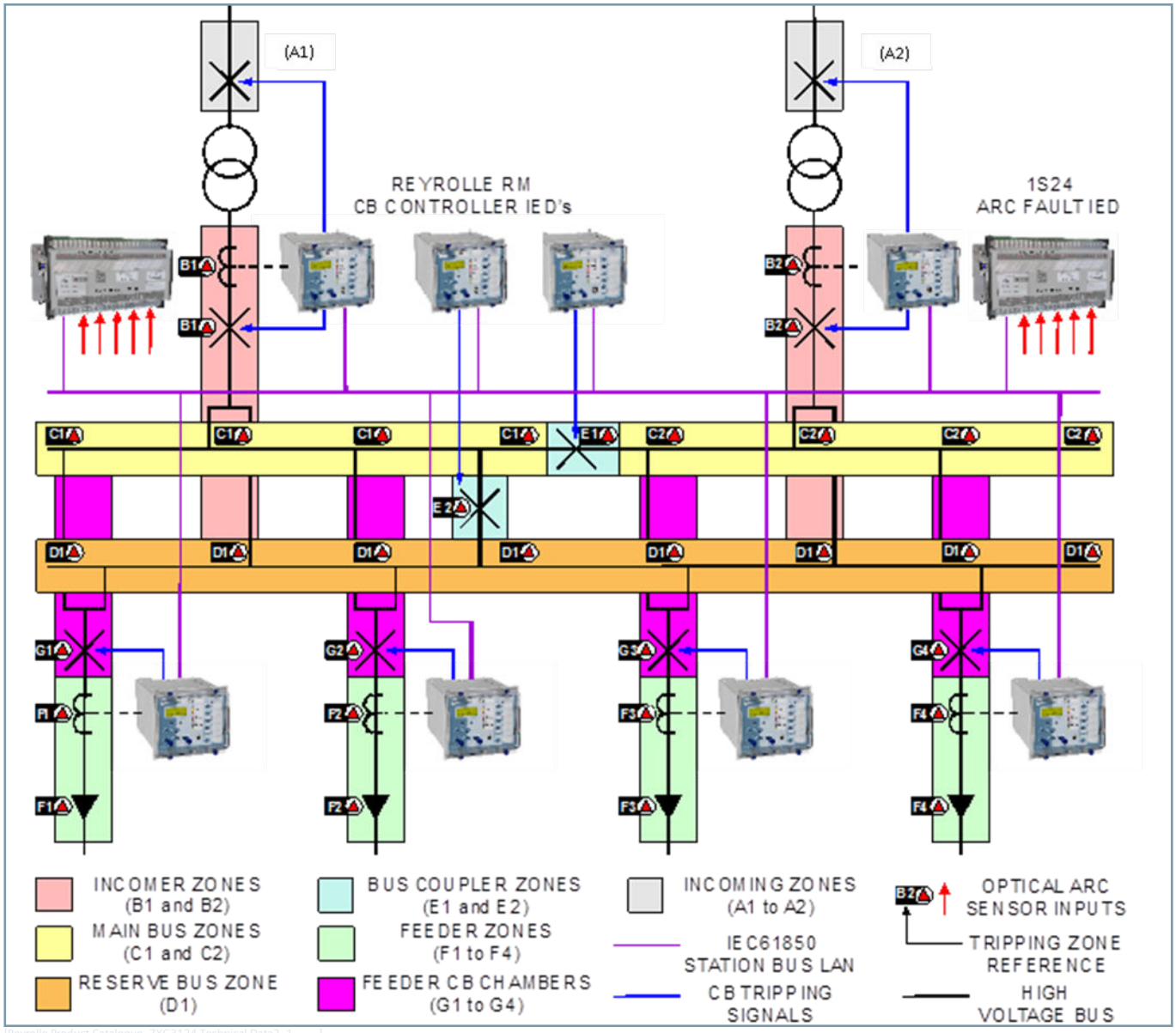
Figure 2.7/59 Single bus circuit breaker

Dual Bus Switchgear

Double busbar switchgear systems present additional challenges for protection against arc flash faults due to the number of arc fault protection zones and multiple operating configurations possible. The above diagram depicts a typical circuit breaker arrangement in a double bus scheme.

Double Bus and Switchgear Arc Protection

The diagram below depicts how the RA24 may be applied for arc fault protection on a double bus bar configuration.



[Reyrolle Product Catalogue, 7XG3124 Technical Data2, 1, ~_~]

Figure 2.7/60 Double bus scheme

Compliance Data

Auxiliary Supply

Nominal voltage	Operating Range
24 / 32 / 48	20-70V dc
b110 / 125 / 220 / 240 / 250	80-275V ac / 88-300V dc
Allowable breaks/dips in supply (Collapse to zero)	20 ms
Burden - Quiescent	8W at 110V dc
Burden - Maximum	15W at 110V dc

Binary Inputs

Voltage Range	18-275V ac / 18-300V dc 10mA pickup for 1 ms
Operating Current	Reducing to 1.5mA after 4 ms
DC Operate Time	<4 ms pickup <16 ms dropout
AC Operate Time	<23 ms pickup <33 ms dropout
Function	Enable on the application of a control voltage

Output Contacts

Operating Voltage	Voltage free
Operating Mode	Self-reset
Operate Time	7 ms
Release Time	3 ms
Making Capacity	8A ac or dc
Carry Continuously	20A ac or dc for 0.5 s
Make and Carry	30A ac or dc for 0.2 s
L/R ≤ 40 ms and ≤ 300V	
Breaking Capacity	L/R ≤ 40 ms and ≤ 300V
AC Resistive	2,000VA
AC Inductive	250W at p.f. ≤ 0.4 60W
DC Resistive	30W at L/R ≤ 40 ms
DC Inductive	50W at L/R ≤ 10 ms
Minimum Load	100mA ≥ 12V

Arc Fault Point Sensor Inputs

Number	16
Type	RA30 point sensors
Connection	Electrical termination
Zones	Up to 16
Supervision duration	Continuous
Trip Contact Operate Time	<10 ms (Typically <7 ms)
Reset Time	2 s

Goose Response

GOOSE Response	<3 ms to first publish

Insulation IEC 60255-5

Type	Level
Any Terminal and Earth	2.0kV ac rms for 1 min
	5.0kV 1.2/50us 0.5J
Between Independent Circuits	2.0kV ac rms for 1 min
	5.0kV 1.2/50us 0.5J
Across Normally Open Contacts	1.0kV ac rms for 1 min

High Frequency Disturbance IEC 60255-22-1

Type	Level	Variation
Common (Longitudinal)	2.5kV	No mal-op.
Differential (Transverse)	1.0kV	

Electrostatic Discharge IEC 60255-22-2 Class 3

Type	Level	Variation
Contact Discharge	6.0kV	No mal-op.

Fast Transients IEC 60255-22-2 Class A

Type	Level	Variation
5/50ns 100kHz	4.0kV	No mal-op.

Surge Immunity IEC 60255-22-5

Type	Level	Variation
Between all Terminals and Earth	4.0kV	No mal-op.
Between any Two Independent Circuits	2.0kV	

Conducted Radio Frequency Interference IEC 60255-22-6

Type	Level	Variation
0.15 to 80MHz	10V rms	No mal-op.

Radiated Immunity IEC 60255-22-3 Class III

Type	Level	Variation
80MHz to 2,760MHz	10V/m	No mal-op.

Temperature IEC 60068-2-1/2

Operating Range	-10 to +55 degrees Celsius
Storage Range	-25 to +70 degrees Celsius

Humidity IEC 680068-2-78

Operating Range	40 degrees Celsius and 93 % RH non condensing

IP Rating IEC 60529

Installed	IP4x

Vibration – Sinusoidal IEC 60255-21-1 Class I

Vibration Response	0.5gn	No mal-op
Vibration Endurance	1.0gn	

Shock and Bump IEC 60255-21-2 Class I

Shock Response	5gn, 11 ms	No mal-op
Shock Withstand	15gn, 11 ms	
Bump Test	10gn, 16 ms	

Seismic IEC 60255-21-3 Class I

Seismic Response	1gn	No mal-op

Mechanical Classification

Durability	>10^6 operations at no load

Arc Flash & Overcurrent Operation Time

The circuit breaker trip time will be dictated by the relays overcurrent element operation time. Please see the overcurrent element performance specification on relay used for more information.

Front Panel

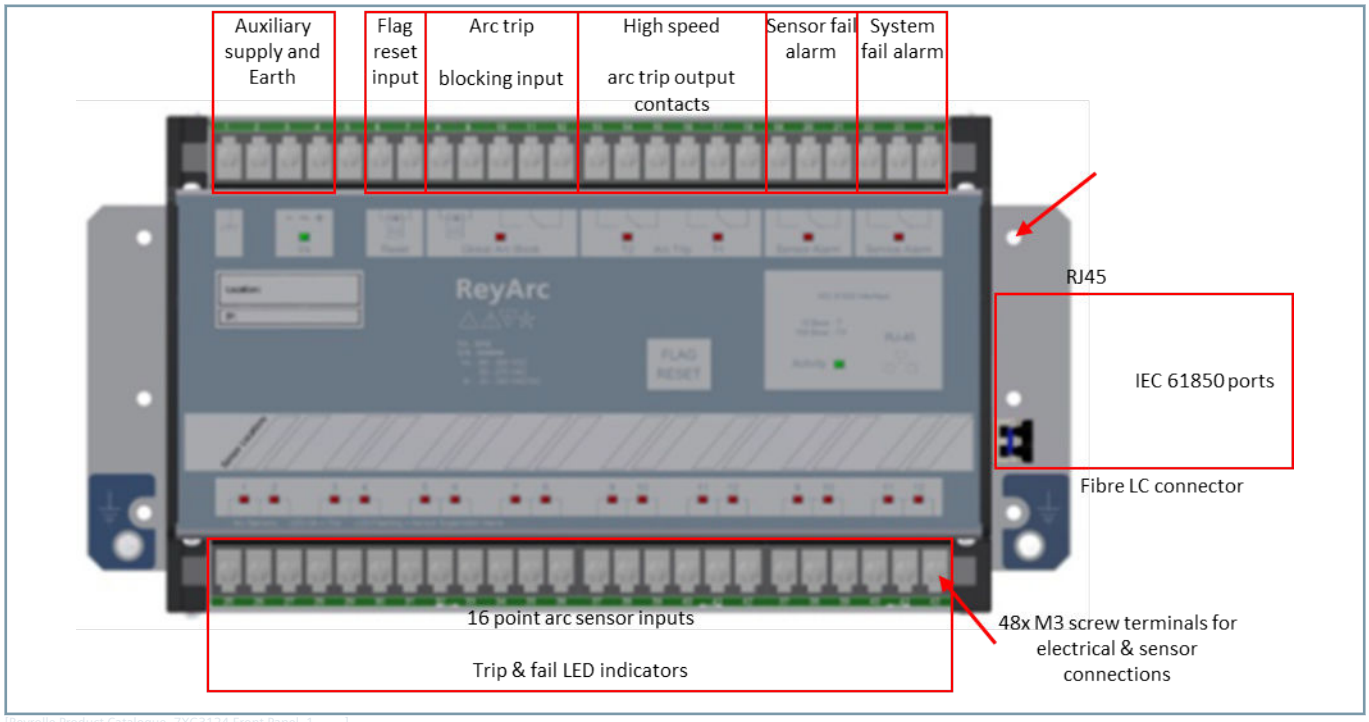
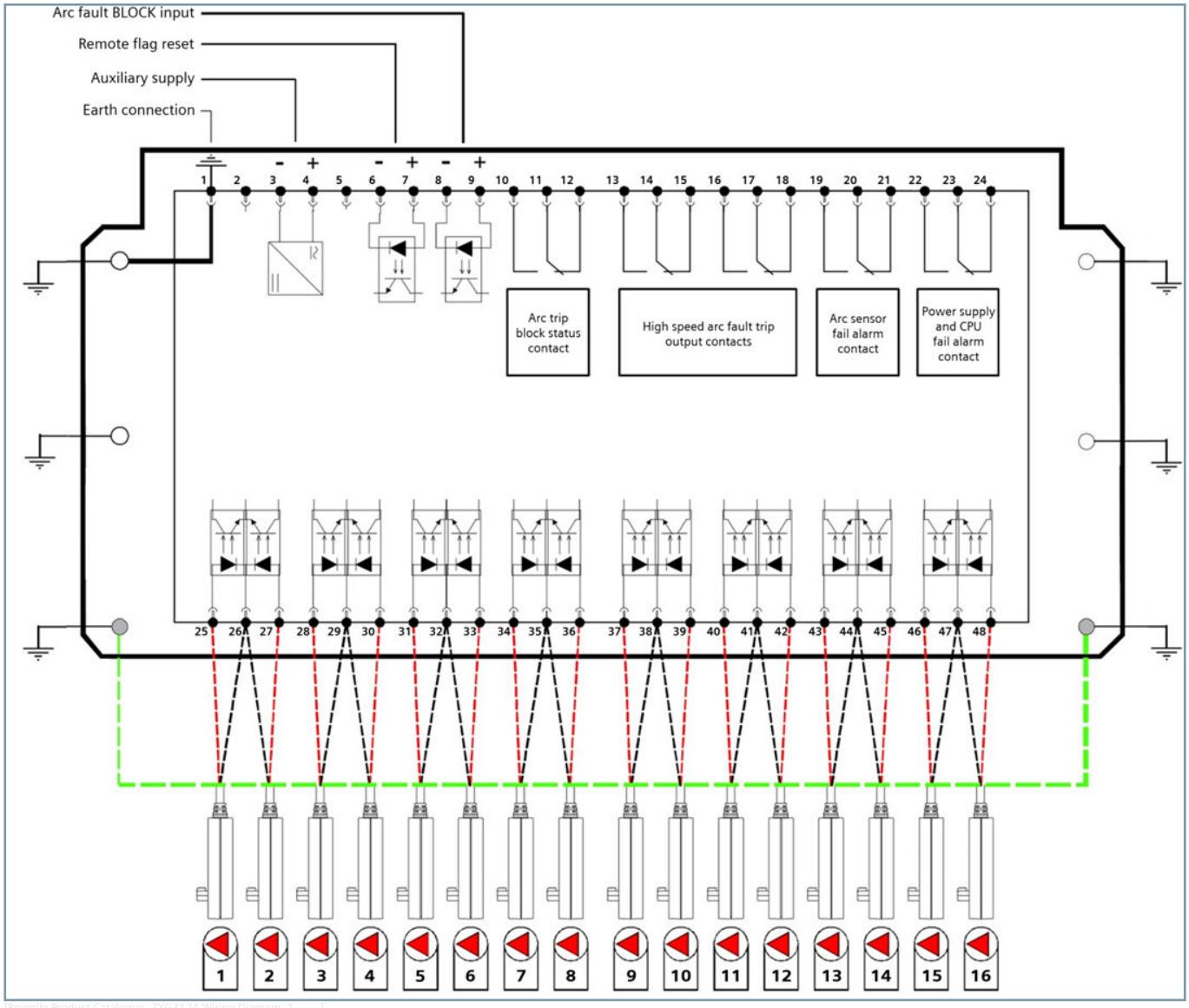


Figure 2.7/61 Front panel layout, 16 point sensor version with 100base-FX Ethernet port

Wiring Diagram

Wiring and Termination

Sturdy M3 screw terminals are provided suitable for one or two ring terminals. Multiple chassis earthing points are also provided. Terminal numbering is clearly identified and graphics are provided to visually represent the connection function.



[Reyrolle Product Catalogue, 7XG3124 Wiring Diagram, 1, _ _]

Figure 2.7/62 Wiring diagram

Arc Sensors

RA30 Point Sensor Connection

16x RA30 point arc sensor inputs are provided.

Each sensor operates independently with a common connection shared between each pair of sensors to reduce the total number of terminals required.

Each sensor pair is wired to 3 M3 terminal screws with the centre screw being common.

The RA30 sensor wires are colour coded but are not polarity sensitive.

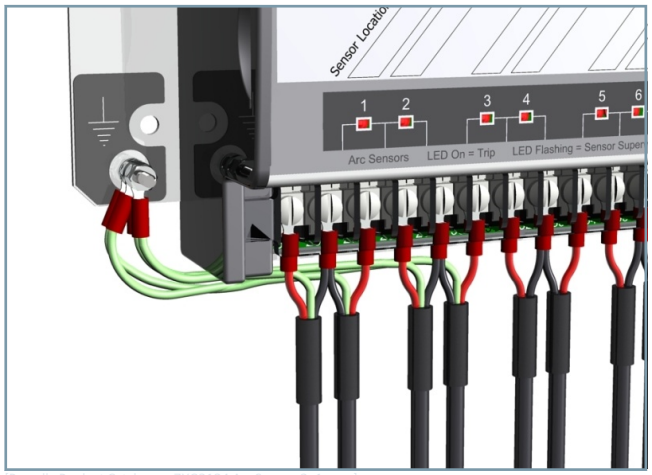
[Reyrolle Product Catalogue, 7XG3124 Arc Sensors1, 1, _ _]

Figure 2.7/63 RA30 sensors

RA30 Shielded Cables

Shielded cables are recommended when the length of the RA30 cable connections exceed 6m.

M3 earth studs with nuts and lock washers are provided on the RA24 chassis in two (2) positions - one to the left of terminal 1 and one to the right of terminal 24 - to allow connection of the optional RA30 sensor cable shields.

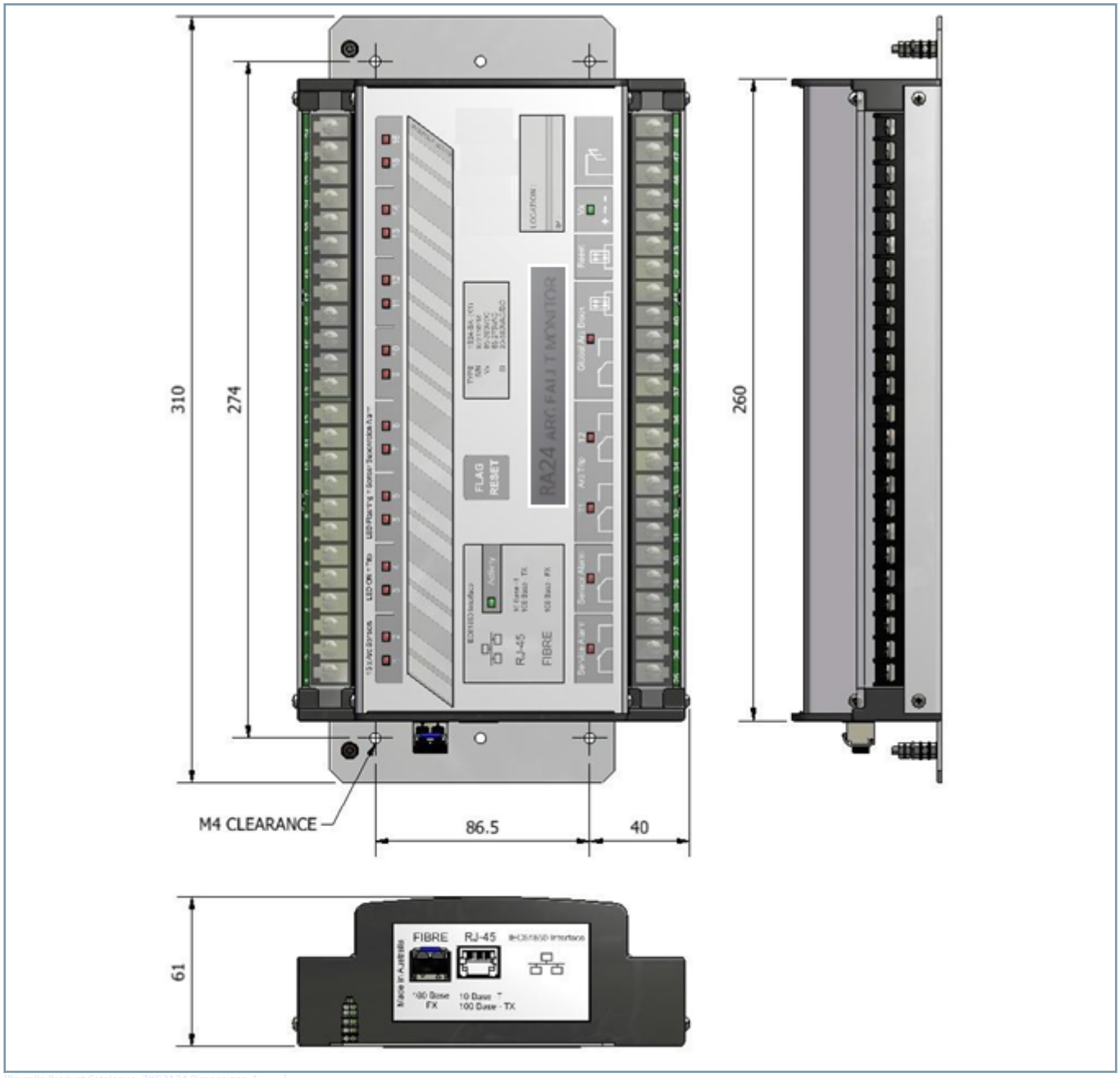


[Reyrolle Product Catalogue, 7XG3124 Arc Sensors2, 1, --_-]

Figure 2.7/64 RA30 sensor wiring using shielded cables

Dimensions

Surface or DIN Rail Mounting



[Reyrolle Product Catalogue, 7XG3124 Dimensions, 1, --_--]

Figure 2.7/65 RA24 dimensions and mounting points

Accessories

DIN Rail Mounting

The RA24 has provision to fit two (2) DIN rail mounting kits.
These "DIN Rail Mount" option must be specified at time of order
4 x M4 self-threading mounting screw kit

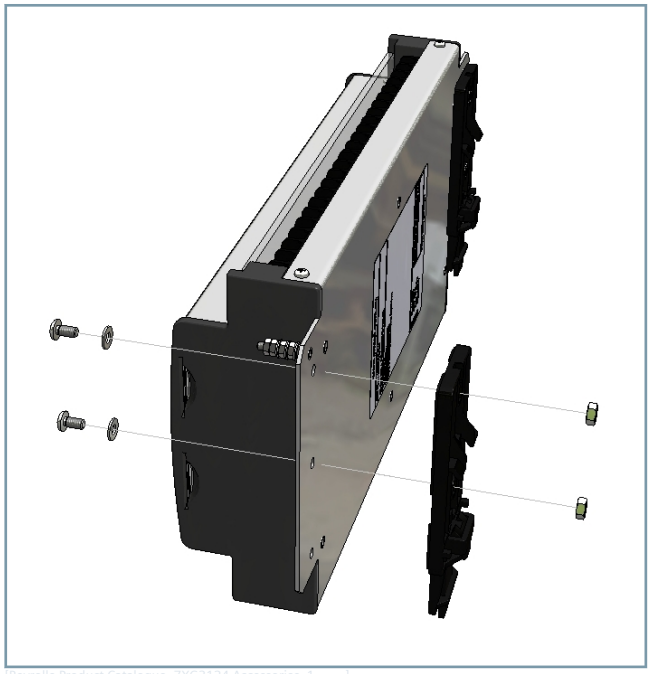
Accessories Supplied with Each Device

4 x M4 self-threading mounting screw kit

IS30 Arc Fault Point Sensor

The RA30 sensors are ordered separately.

Refer to the RA30 Technical catalogue sheet for details



[Reyrolle Product Catalogue, 7XG3124 Accessories, 1, –_–]

Ordering Information - 7XG3124 Arc Fault Monitor Relay

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Arc Fault Monitor Relay	7	X	G	3	1	2	4	-	□	□	□	0	0	-	0	A	A	0
				|	|	|	|		|	|	|								
Category				|	|	|	|		|	|	|								
Arc Protection				3	1	|	|		|	|	|								
						|	|		|	|	|								
Device						|	|		|	|	|								
RA24 Arc Fault Monitor						2	4		|	|	|								
									|	|	|								
Network Connection									|	|	|								
Single port 10Base-T/100Base-Tx									1	|	|								
Dual port 10Base-T/100Base-Tx + 100Base-Fx									2	|	|								
										|	|								
Operating Voltage										|	|								
20 – 70V DC										A	|								
88 - 300V DC / 88 – 275V AC										B	|								
											|								
Mounting											|								
Surface Mount											A									
DIN Rail mount (supplied with mounting hardware)											B									

Arc Fault Protection – 7XG3127 Arc Fault Monitor with Linear Sensor Support

7XG3127 Arc Fault Monitor Relay

[Reyrolle Product Catalogue, 7XG3127 Module, 1, --_--]

Figure 2.7/66 RA27 Arc Fault Module

2.7

Features

High speed arc fault detection for metal clad air insulated switchgear utilizing optical sensors.

- Less than 5 ms arc detection and tripping time
- Four (4) point sensor inputs
- Optional linear sensor input
- Compact case, size 2, 2U high
- Surface or rail mount
- Flush panel or rack mount
- Three high speed tripping zone outputs
- Front panel reset
- Continuous arc sensor supervision
- Integrated self-supervision with fail alarm contact
- Three (3) auxiliary supplies ranges available covering 24-125V ac or dc and 220 to 250 Volts dc nominal

Overview

Arc fault protection is employed for the clearance of arcing faults on low voltage panels, MCC's, Busbars and within metal clad switchgear and associated cable boxes.

Conventional current based protection techniques are at times challenged by the nature of arcing faults and can result in slow protection clearance times. Slow protection clearance times increase the risk of injury to nearby personnel and increase the degree of damage to plant and equipment.

By employing an optical detection technique, Arc Protection, results in fast clearance of arcing faults. When fitted in either new installations or as a simple retrofit in existing installations, the RA27 provides high speed detection and signalling of arc flash hazards.

Arc Fault protection schemes may be implemented on an Arc only basis, or alternatively a Current Check may be employed where additional security is warranted.

A current checked scheme may be implemented by making use of available protection relay logic and a fast acting instantaneous overcurrent element.

Description

The 7XG3127 Reyarc monitor device is packaged in a compact 2U high case that may be flush panel, rack or rail mounted.

The 7XG3127 device can use upto 4 point sensors (7XG3130) and a single optical linear sensor (7XG3140), with 3 high speed output tripping zones.

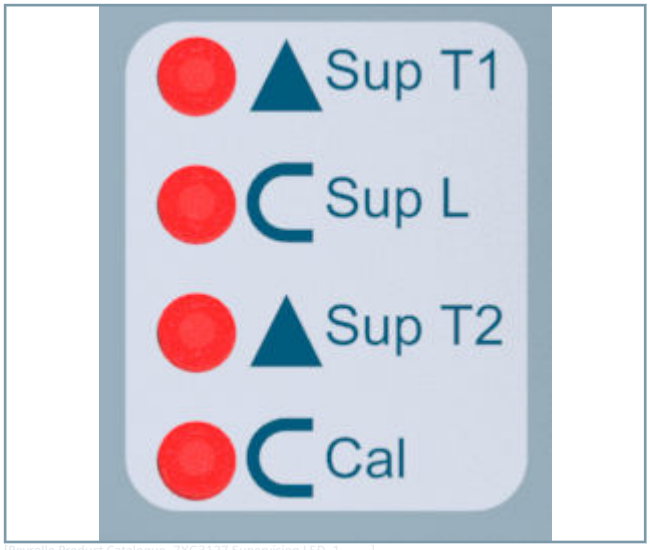
A plug in terminal block is provided to allow panel pre-wiring.

Healthy LED's

A front panel green LED is provided to indicate when the relay is powered up and all connected arc sensors are operating correctly. Should any of the sensors become disconnected the associated red supervision LED will be illuminated. Healthy sensors will continue to operate normally.

Supervision Alarm Contact

The supervision alarm contact is picked-up when all monitored circuits are in the HEALTHY condition. FAILURE of a supervision circuit will cause the alarm contact to drop out to signal an alarm condition.

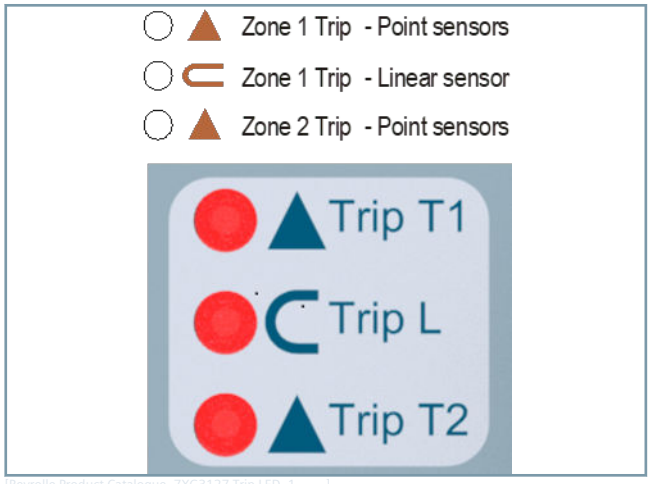


[Reyrolle Product Catalogue, 7XG3127 Supervision LED, 1, --_--]

Figure 2.7/67 Supervision LED Indication Arc Fault Monitor

Arc Trip Indication

A red LED is provided to indicate an arc trip event zone and the type of sensor to assist with fault location.



[Reyrolle Product Catalogue, 7XG3127 Trip LED, 1, –_–]

Figure 2.7/68 Trip LED Indication Arc Fault Monitor

This trip indication will remain latched until the front reset slide or the remote reset input is activated. The associated output trip contact(s) will also operate and self-reset in 1 s.

Reset Slide Switch

The reset slide switch is used for a number of functions:

- Reset trip LED's (Fast operate and release)
- Restart the device when held for > 2 s
- To gain access to the rotary configuration switch

Calibration Indication

The Cal LED will commence flashing if the linear sensor fails the automatic calibrate routine.

Display Relay Settings

To review the relay settings, lift and hold the reset slide switch until a combination of LED's commence flashing. 7XG3127-1 relay LED's for the trip and sensor configuration will be displayed in accordance with *Figure 2.7/76*. 7XG3127-2 relay LED's for the trip and sensor configuration will be displayed in accordance with *Figure 2.7/76* and alternating with the linear sensor transmission length in accordance with *Table 2.7/1*.

Components

The 7XG3127 is designed to monitor remote optical sensors that to respond to the flash of light emitted during the incidence of an arcing fault. Onset of the light flash & detection by the sensors occurs in a few ms.

Arc Sensors

7XG3130 Point Sensor RA30

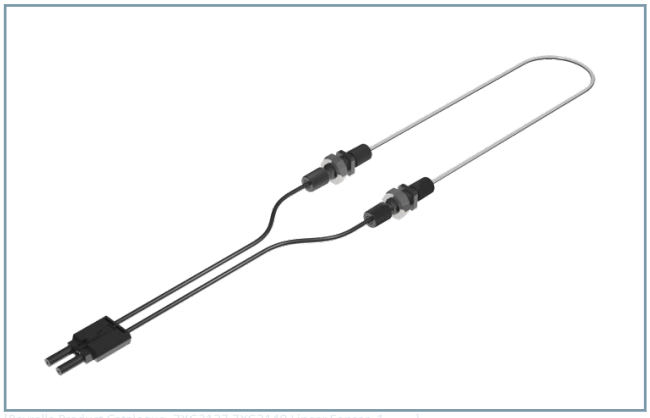
The RA30 is an electrically wired point sensor suitable for application in discrete compartments in metal clad switchgear and cable ducts. When an arc is detected, the resistance presented drops to a level where the current flow increases to approximately 20 mA. This increased current flow is instantaneously detected by the relay & its trip output contacts close. Refer to the 7XG3130 Technical Catalogue for further details.

[Reyrolle Product Catalogue, 7XG3127 7XG3130 Point Sensor, 1, –_–]

Figure 2.7/69 7XG3130 Point Sensor

7XG3140 Linear Sensor RA40

The linear sensor may be applied to protect large volumes where multiple point sensors would otherwise be required. A separate linear sensor is required for each segregated protection zone. Refer to the 7XG3140 Technical Catalogue for further details.



[Reyrolle Product Catalogue, 7XG3127 7XG3140 Linear Sensor, 1, –_–]

Figure 2.7/70 7XG3140 Linear Sensor

[Reyrolle Product Catalogue, 7XG3127 Linear Sensor Connection, 1, –_–]

Figure 2.7/71 Linear Sensor Connection to Arc Fault Monitor

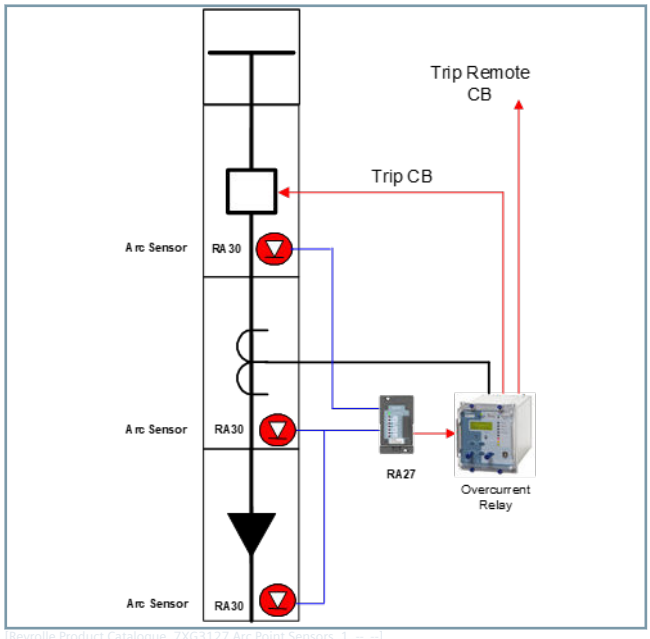
Application

Switchgear ARC Flash Protection

Risk of arc fault damage exists at the CB cable termination and in the CB chamber itself. The CB cable termination is particularly at risk to ingress of moisture and rodent damage.

Upto 4 point arc sensors may be connected to the Arc Fault Monitors.

Figure 2.7/72 shows an application where a single RA27 is applied for the protection of the Cable box, CT chamber and CB chamber using three sensors. In this configuration one arc trip output is used to trip the feeder circuit breaker in the event of an arc fault in the cable box / CT chamber. The second trip output is set for independent operation to trip the BUS breaker (BUS overcurrent check not shown), in the event of an arc fault in the CB chamber.

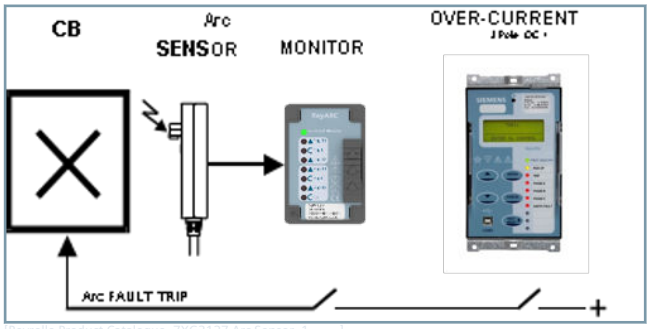


[Reyrolle Product Catalogue, 7XG3127 Arc Point Sensors, 1, –_–]

Figure 2.7/72 Arc Point Sensors with Current Check

Arc Fault Tripping Using Current Check

Fast operation of a tripping scheme usually results in reduced system security. The arc detection method can however, combine the RA27 optical detection technique with a traditional overcurrent method to maximize system security particularly for BUS bar protection schemes. Both conditions must coexist for the trip condition to be met as depicted in *Figure 2.7/73*.



[Reyrolle Product Catalogue, 7XG3127 Arc Sensor, 1, –_–]

Figure 2.7/73 Arc Sensor with Current Check

As the arc fault trip contact picks up considerably faster than the overcurrent relay element, the CB trip time will be dictated by the overcurrent relay performance.

Low Current Arcing Faults

Arcing faults can occur at low current levels & it is possible for the overcurrent starter element to be set above this level when an independent ARC OC element is not available. To avoid this problem & obtain very fast clearance (< 10 ms), of an arc fault, the RA27 arc fault trip contact may be wired directly to the breaker operate coil. It should be noted that this method may lead to reduced system security.

Existing Switchgear Applications

The existing overcurrent relay protecting the feeder will normally provide an independent output contact associated with the start current setting of the relay. This output contact will close when a phase or earth fault current is detected above the threshold which starts the internal relay timers. This starter element should be set for instantaneous operation so that it will pick up in the order of 10-15 ms.

An Arc Fault Monitor relay is installed on the switchgear panel adjacent to the protection relay. The RA27 is specifically designed for simple retrofit to existing panels or DIN rail mounted within the instrument chamber.

The overcurrent relay starter contact may optionally be wired in series with the arc fault detection trip output contact as depicted in *Figure 2.7/72*. The resulting "AND" function trip output is wired to initiate breaker trip in 10-15 ms in the event that an arc fault is detected while the overcurrent start element is picked up.

New Switchgear Applications

For new switchgear installations a modern numeric feeder protection relay is likely to be employed which will have numerous programming and configuration options.

The basic concept is the same as for the existing switchgear application described above except that the additional features and flexibility of modern feeder protection relay allows improved system integration.

Arc Detection Reset Time (Effect of multiple arc trips)

A delay of 2 s is required to reset the RA27 after an initial arc sensor trip. Subsequent arc detection will cause the trip output contacts to re-operate.

Arc Sensor Continuously Picked Up

High ambient light levels may cause a RA30 or RA40 to be continuously picked up. This condition could occur for example if the CB cable box cover was left open in very high ambient light level conditions.

To avoid possible mal operation due to this condition, the RA27 is designed to automatically disable the arc fault tripping function if any sensor input is picked up for > 10 s. The RA27 alarm contact will be set & the front LED flash alternate orange & red until the ambient light level problem is corrected. The RA27 will then perform an arc sensor test function & automatically reset.

Combined Bus Bar and Switchgear Arc Protection

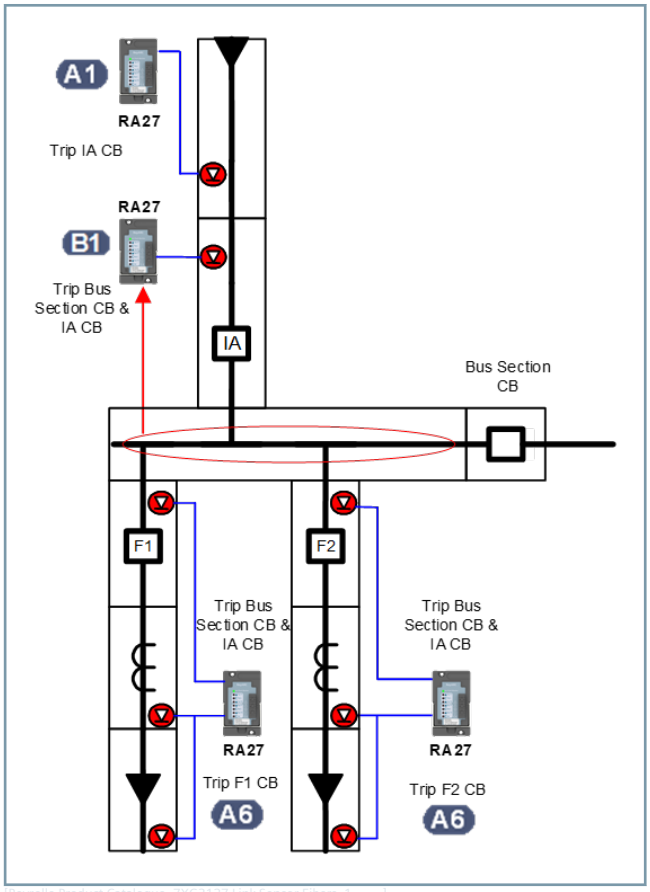
Figure 2.7/74 shows an application where a single RA27 is applied for the protection of the Cable box and CT chamber plus the CB chamber and BUS chamber using a linear sensor.

In this configuration one arc trip output is used to trip the feeder circuit breaker in the event of an arc fault in the cable box / CT chamber. The second trip output is set for independent operation to trip the BUS breaker (BUS overcurrent check stage not shown), in the event of an arc fault in the CB chamber or BUS chamber.

Hardware Code and Configuration Settings

For the scheme depicted in *Figure 2.7/74* to function correctly, the RA27 arc fault modules need to be specified and configured as follows:

Symbol	Model	Configuration
A1	7XG3127-1	1
A6	7XG3127-1	7
B1	7XG3127-2	1



[Reyrolle Product Catalogue, 7XG3127 Link Sensor Fibers, 1, '_...]

Figure 2.7/74 Link and Sensor Fibers Connected

Configuration

Arc sensor models

There are two models available:

- 7XG3127-1 Point sensor inputs only (Upto 4 x RA30)
- 7XG3127-2 Point Sensor inputs (Upto 4 x RA30) plus one Linear optic sensor (RA40)

Arc Sensor Operating Modes

The RA27 has three operating modes:

1. Normal Operating Mode: The device starts up in this mode when powered ON.

2. Setting Display Mode: With the slide switch held up for 2 s, the device enters the display setting mode. 7XG3127-1 LED's for trip and sensor configuration will be displayed in accordance with *Figure 2.7/76*. 7XG3127-2 is the same with alternating LED's for linear sensor transmission length in accordance with *Table 2.7/1*.

3. Configuration Mode: The configuration mode is entered when a setting change is made by the adjustment of the rotary selector switch. When this occurs the Green arc flash monitor LED will commence flashing, refer to configuration selection indication.

Arc Monitor Function Configuration Mode

The RA27 may be configured to suit a wide range of arc flash monitoring applications.

The configuration mode is set via a 10 position rotary switch accessible when the front panel slide switch is operated as shown in *Figure 2.7/75*. Positions 0-9 are employed for trip and sensor function configuration.

The single digit configuration code required to set the function mode is determined from matrix in *Figure 2.7/76*.

NOTE

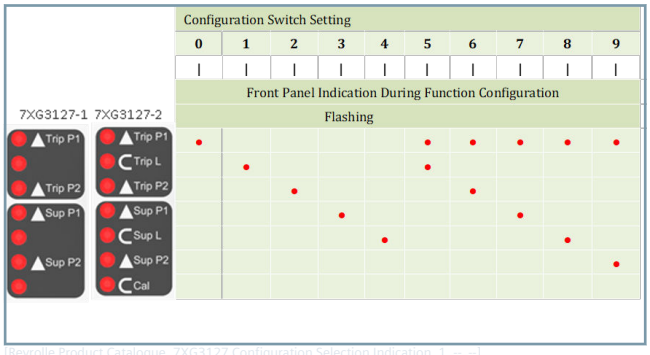
Note that the setting must be carried out with the device powered ON as the LED's provide feedback and to allow the configuration to be stored on completion of the setting process when the slide switch is released. The operating mode position can be changed using a small blade screwdriver, rotating the switch to the required position

[Reyrolle Product Catalogue, 7XG3127 Front Panel Slide Switch, 1, –_–]

Figure 2.7/75 Front Panel Slide Switch and Configuration Switch

Configuration Selection Indication

As the rotary switch is adjusted the front panel LED's respond by changing to a unique position to allow easy setting verification as per the following table.

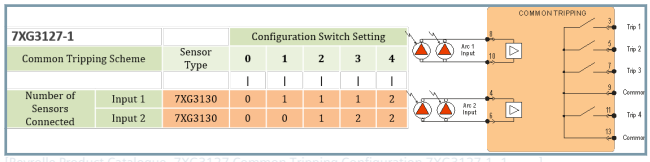


[Reyrolle Product Catalogue, 7XG3127 Configuration Selection Indication, 1, –_–]

Figure 2.7/76 Configuration Selection Indication

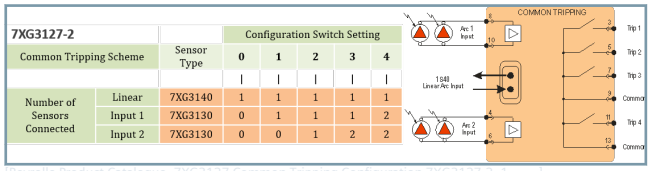
Common Tripping Configuration

Common Tripping – All connected sensors are mapped to trip contacts 1, 2, 3 and 4.



[Reyrolle Product Catalogue, 7XG3127 Common Tripping Configuration 7XG3127-1, 1, -_-]

Figure 2.7/77 Common Tripping Configuration 7XG3127-1



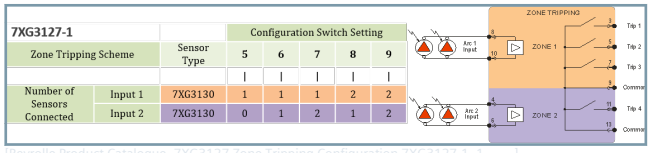
[Reyrolle Product Catalogue, 7XG3127 Common Tripping Configuration 7XG3127-2, 1, -_-]

Figure 2.7/78 Common Tripping Configuration 7XG3127-2

Zone Tripping Configuration

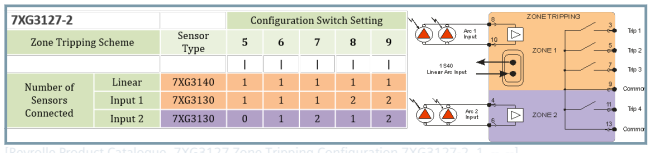
Zone Tripping – All sensors connected to INPUT 1 and LINEAR are mapped to trip contacts 1, 2 and 3 for ZONE 1.

Zone Tripping – All sensors connected to INPUT 2 are mapped to trip contact 4 for ZONE 2.



[Reyrolle Product Catalogue, 7XG3127 Zone Tripping Configuration 7XG3127-1, 1, -_-]

Figure 2.7/79 Zone Tripping Configuration 7XG3127-1



[Reyrolle Product Catalogue, 7XG3127 Zone Tripping Configuration 7XG3127-2, 1, -_-]

Figure 2.7/80 Zone Tripping Configuration 7XG3127-2

7XG3127 with Linear Sensor Option

This section relates to the version and the configuration required to operate with a 7XG3140 Linear Arc Sensor.

When connecting the linear sensor, the relay must be configured with the correct setting corresponding to the length of the optic fibre transmission section shown in *Figure 2.7/82* and listed in *Table 2.7/1*. The transmission section fibre must be cut to one of the set lengths as specified in *Table 2.7/1* within a tolerance of 10 %.

This step should only be undertaken after the relay Function Setting has been set as described under Function Configuration.

7XG3127 Linear Sensor Configuration

The linear sensor configuration is set via a rotary switch accessible when the front panel slide switch is operated as shown in *Figure 2.7/75*.

A 16-position rotary switch is employed for this version of relays. Positions A-F are used to select the Transmission Section Length setting in accordance with *Table 2.7/1*.

NOTE

Note that the setting must be carried out with the relay powered up so that the selected setting is stored at the completion of the setting process when the slide switch is released.

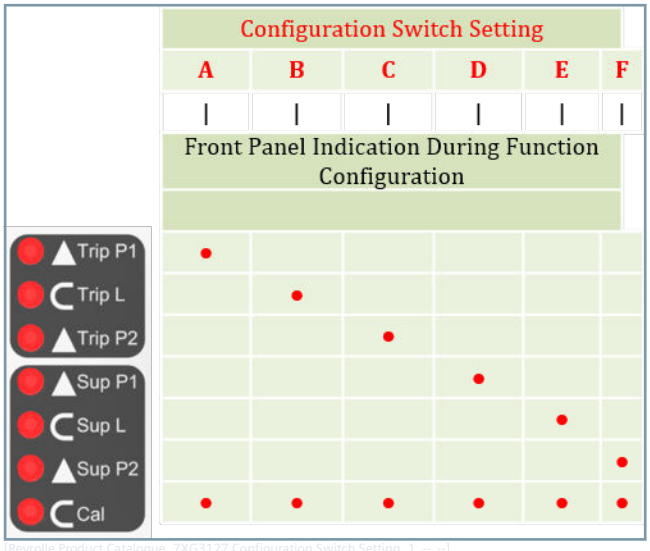
Arc Sensor Auto Calibration

When the arc monitor unit is powered up or a setting change confirmed, a calibration routine is automatically initiated to adjust the detection gain and threshold for the deployed sensor.

The output intensity of the supervision pulse used for the calibration is set based on the Transmission section length setting. If a suitable threshold cannot be set during calibration the calibration fail LED is illuminated to indicate that the 7XG3140 sensor connections and configuration setting should be checked.

Transmission Section Length	Setting
< 1 meter	A
1 meter	B
5 meters	C
10 meters	D
20 meters	E
30 meters	F

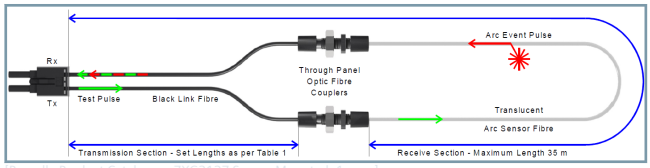
Table 2.7/1 Transmission Section Length Settings



[Reyrolle Product Catalogue, 7XG3127 Configuration Switch Setting, 1, -_-]

Figure 2.7/81 Configuration Switch Setting

Arc Fault Protection – 7XG3127 Arc Fault Monitor with Linear Sensor Support



[Reyrolle Product Catalogue, 7XG3127 Sensor Mounted, 1, --_--]

Figure 2.7/82 Example of Sensor Mounted Through a Panel and Looped Back Internally for Maximum Coverage

Technical Data

Auxiliary Supply

Low Range Version	Order Code F
Nominal Voltage Supply AC/DC (Shown on relay front panel label)	24 / 32 / 48
Standards Compliant Range	19-85V dc 19-65V ac
Absolute Range	18-100V dc 15-75V ac
Mid-Range Version	Order Code G
Nominal Voltage Supply AC/DC (Shown on relay front panel label)	110 / 125
Standards Compliant Range	45-165V dc 38-150V ac
Absolute Range	36-200V dc 30-175V ac
High Range Version	Order Code H
Nominal Voltage Supply AC/DC (Shown on relay front panel label)	220 / 240 / 250
Standards Compliant Range	125-250V dc 94-240V ac
Absolute Range	100-300V dc 75-275V ac
Allowable breaks/dips in supply (Collapse to zero)	As per IEC 60255-26 *7.2.11
Burden - Quiescent	8W at 110V dc
Burden - Maximum	15W at 110V dc

Trip Outputs

Operating Voltage	Voltage free
Operating Mode	Self-reset
Trip Contact Operate Time	< 7 ms (Flash to contact closure)
Reset Time	1 s
Making Capacity	
Carry Continuously	5A ac or dc
Make and Carry L/R ≤ 40ms and ≤ 300V	20A ac or dc for 0.5s 30A ac or dc for 0.2s
Breaking Capacity L/R ≤ 40ms and ≤ 300V	
AC Resistive	1,250VA
AC Inductive	250VA at p.f. ≤ 0.4
DC Resistive	75W
DC Inductive	30W at L/R ≤ 40ms 50W at L/R ≤ 10ms
Minimum Load	100mA ≥12V

Supervision Alarm Output

Contact material	Ag (Au Clad)
Operating Voltage	Voltage free
Isolation across open contacts	1 kV rms
Make and carry	0.5 A continuous at 125 V ac
Peak inrush current	2 A
Switching voltage:	
Maximum	220 V dc / 250 V ac
Minimum	10 mV dc
Minimum switching current	10uA

Arc Fault Sensor Point Inputs

Number	4
Type	7XG3130 point sensors
Connection	Electrical termination
Zones	1 or 2
Supervision duration	Continuous

Arc Fault Sensor Linear Sensor

Number	1
Type	7XG3140 linear sensors
Connection	Rx and Tx optic fibre ports
Zones	1
Supervision duration	< 1 ms
Supervision interval	2.5 minutes

Electrical Tests

AC and DC Voltage Dips (IEC 60255-26, #7.2.11)

Dip to 0% of residual voltage	DC: 20 ms
Acceptance criterion A	AC: 1 cycle 50/60 Hz
Dip to 40% of residual voltage	DC: 200 ms
Acceptance criterion C	AC: 10/12 cycles 50/60 Hz
Dip to 70% of residual voltage	DC: 500 ms
Acceptance criterion C	AC: 25/30 cycles 50/60 Hz

AC and DC Voltage Interruptions (IEC 60255-26, #7.2.11, Acceptance criterion C)

Drop to 0% of residual voltage	DC: 5 s
	AC: 250/300 cycles 50/60 Hz

AC component in DC (Ripple) (IEC 60255-26, #7.2.12, Acceptance criterion A)

15% of rated DC value	100/120 Hz, Sinusoidal

Gradual Shut-down/Start-up (DC Power Supply) (IEC 60255-26, #7.2.13, Acceptance criterion C)

Shut-down ramp	60 s
Power off	5 min
Start-up ramp	60 s

Clearance and Creepage Distances (IEC 60255-27, #10.6.3)

Pollution degree	2
Overvoltage category	III
Rated insulation voltage	300 V rms or dc
Clearances and Creepage Compliance	CAD drawings assessment

Insulation (IEC 60255-27 #10.6.4)

Type	Level 3
Between any terminal and earth	5 kV 1.2/50 µs 0.5 J 3 pulses of each polarity 2.0 kV ac rms for 1 minute
Between independent circuits	5 kV 1.2/50 µs 0.5 J 3 pulses of each polarity 2.0 kV ac rms for 1 minute
Across normally open contacts	1.0 kV AC RMS for 1 min
Protective Bonding Resistance	< 0.1 Ω at 20 A

Electrical Environment and Flammability (IEC 60255-27, #10.6.5)

Single-fault condition	Assessment
Maximum temperature of accessible parts at ambient temperature + 40 ° C	Metal parts: < 70 °C Non-metallic parts: < 80 °C
Flammability of insulating materials, components and fire enclosures	Assessment

Reverse Polarity and Slow Ramp Test (IEC 60255-27, #10.6.6)

Maximum voltage dc	V start-up + 20%
Minimum voltage dc	V shutdown - 20%
Ramp down/up gradient	1 V/min

Mechanical Environment

Vibration – Sinusoidal IEC 60255-21-1 Class I

Type	Level	Variance
Vibration response in each of 3 axes	0.5gn peak 1 sweep cycle 10-150Hz	≤ 5 %
Vibration endurance in each of 3 axes	1.0gn peak 1 sweep cycle 10-150Hz	≤ 5 %

Shock and Bump IEC 60255-21-2 Class I

Type	Level	Variance
Shock response in each of 3 axes	5gn, 11ms, 3 pulses in each direction	≤ 5 %
Shock withstand in each of 3 axes	5gn, 11ms, 3 pulses in each direction	≤ 5 %
Bump test in each of 3 axes	10gn, 16ms, 1,000 bumps in each direction10gn, 16 ms	≤ 5 %

Seismic IEC 60255-21-3 Class I

Type	Level	Variance
Seismic response, Horizontal on each axis	1gn 1 sweep cycle 1-35Hz	≤ 5 %
Seismic response, Vertical	0.5gn 1 sweep cycle 1-35Hz	

Atmospheric Environment

Temperature IEC 60068-2-1/2

Operating Range	-10 °C to +55 °C
Storage Range	-25 °C to +70 °C
Test Duration	16h at top and bottom temperatures

Humidity IEC 680068-2-78

Operational test	40 °C and 93% relative humidity non condensing
Test Duration	16h at top and bottom temperatures

IP Ratings IEC 60529

Type	Level
Installed	IP 5x

Mechanical Classification

Durability – 0.1Hz	> 10^5 operations at no load
maximum repetition rate	> 10^4 operations at full load

Electromagnetic Compatibility

Electrostatic Discharge IEC 60255-26 #7.2.3, Acceptance criterion B

Type	Level	Variation
Air Discharge	8 kV	≤ 5 %

Radiated Electromagnetic Field IEC 60255-26 #7.2.4, Acceptance criterion A

Port	Enclosure	
Test Identification	Test specification	Variation
Frequency sweep	10 V rms, 80 to 1000 MHz 1400 to 2700 MHz	No Mal-Op
Spot frequencies	10 V rms, 80, 160, 380, 450, 900, 1850 & 2150 MHz	No Mal-Op

Fast Transients IEC 60255-26 #7.2.5, Acceptance criterion B

Type	Level	Variation
Port	Aux Power Sup-ply, Inputs and Outputs, Functional Earth	
5/50 ns 5 kHz repetitive	4kV peak	≤ 5 %

Slow Damped Oscillatory Wave (HFD) IEC 60255-26 #7.2.6, Acceptance criterion B

Port	Auxiliary power supply, Input and Output	
Test Identification	Test specification	Variation
Common Mode	1 MHz 2.5 kV peak	No Mal-Op
Differential Mode	1 MHz 1.0 kV peak	No Mal-Op

Surge Immunity IEC 60255-26, #7.2.7, Acceptance criterion B

Type	Level	Variation
Port	Aux Power Supply, Inputs and Outputs	
Line to Earth	4.0 kV peak	≤ 10 %
Line to Line	2.0 kV peak	≤ 10 %

Conducted Disturbance Induced by RF Fields IEC 60255-26, #7.2.8, Acceptance criterion A

Port	Auxiliary power supply, Input and Out-put, Functional Earth	
Test Identification	Test specification	Variation
Frequency sweep	10 V rms, 0.15 to 80 MHz	No Mal-Op
Spot frequencies	10 V rms, 27 & 68 MHz	No Mal-Op

Power Frequency Magnetic Field IEC 60255-26, #7.2.10

Port	Enclosure only
Test Identification	Test specification
Continuous ≥ 60 s	30 A/m - Acceptance criterion A
Short time 1 s to 3 s	300 A/m - Acceptance criterion B

Emissions

Emission Enclosure IEC 60255-26 #5.1

Test Identification	Frequency range	Limits, dB (µV/m)
Radiated emission < 1 GHz	30 - 230 MHz	40, quasi peak at 10 m 50, quasi peak at 3 m
	230 - 1000 MHz	47, quasi peak at 10 m 57, quasi peak at 3 m
Radiated emission > 1 GHz	1 – 3 GHz	56, average 76, peak at 3 m
	3 – 6 GHz	60, average 80, peak at 3 m

Emission Auxiliary Power Supply Port IEC 60255-26 #5.2

Test Identification	Frequency range	Limits, dB (µV/m)
Conducted emission	0.15 – 0.50 MHz	79, quasi peak 66, average
	0.5 - 30 MHz	73, quasi peak 60, average

Dimensions

Surface Mount Rear connection (projecting – As shown in *Figure 2.7/91*).

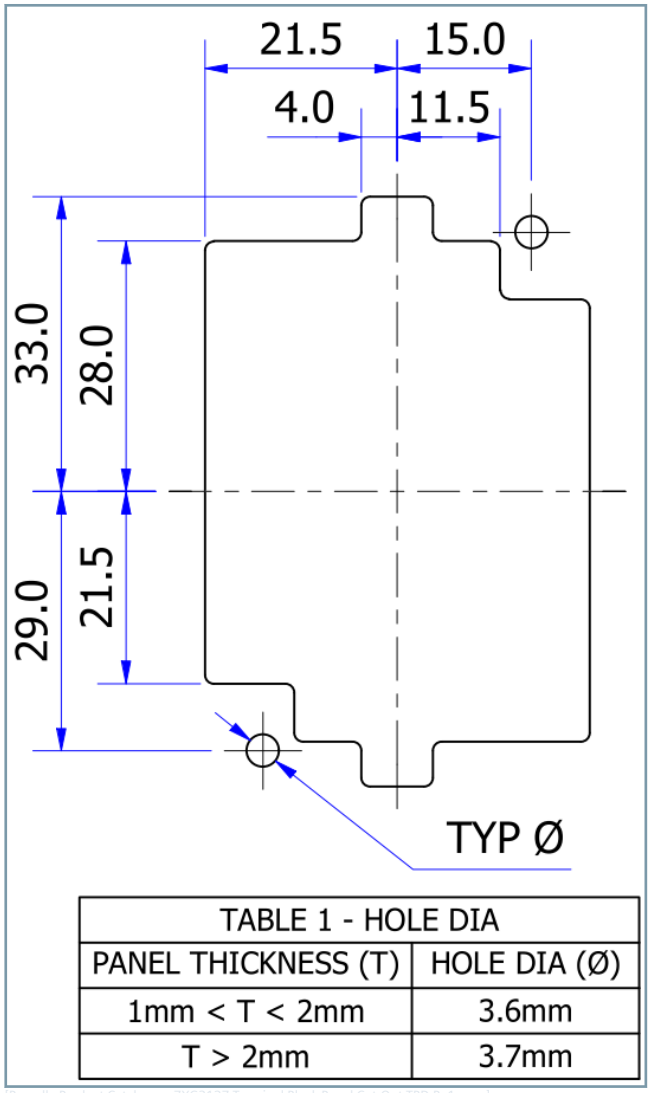


Figure 2.7/83 Terminal Block Panel Cut-Out Type TBD-R

Flush panel mount (As shown in *Figure 2.7/89*).

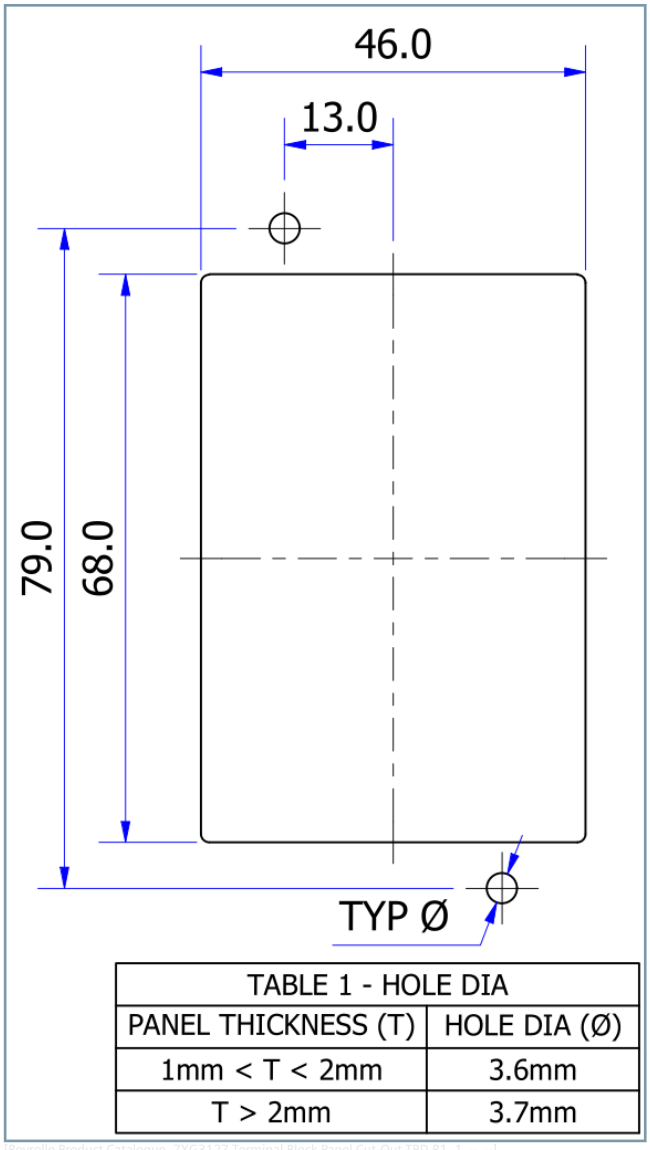
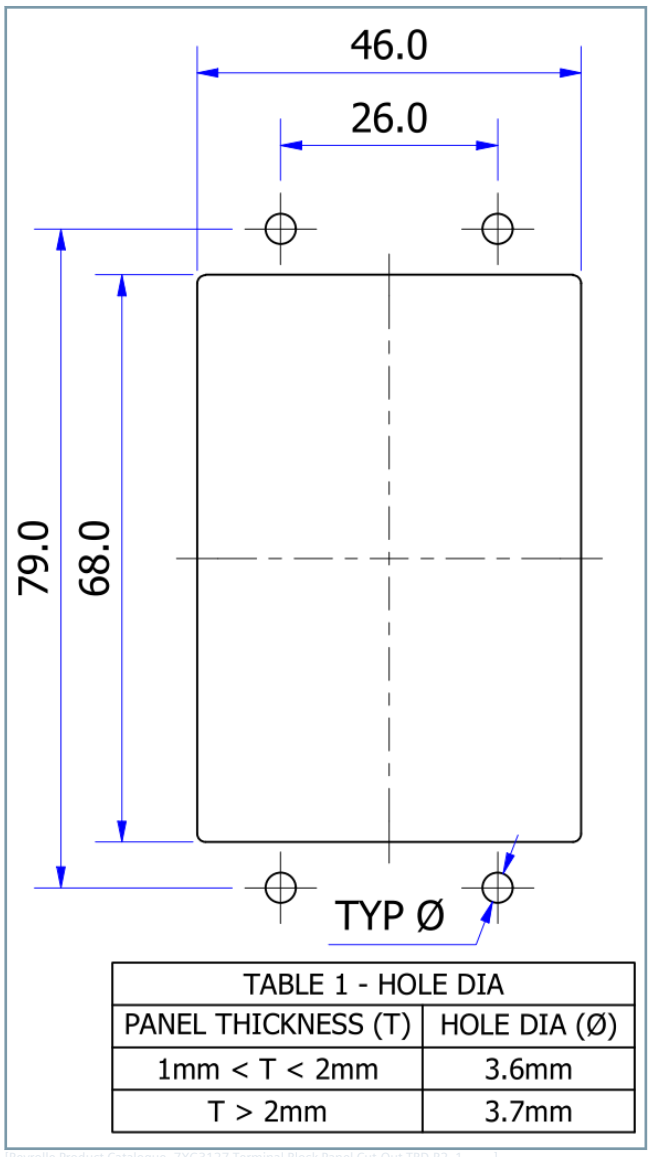


Figure 2.7/84 Panel Cut-Out For Flush Mounting Terminal Block Type TBD-R1 Base

Flush panel mount (As shown in *Figure 2.7/92*).



[Reyrolle Product Catalogue, 7XG3127 Terminal Block Panel Cut-Out TBD-R2, 1, —_–]

Figure 2.7/85 Panel Cut-Out For Flush Mounting Terminal Block Type TBD-R2 Base

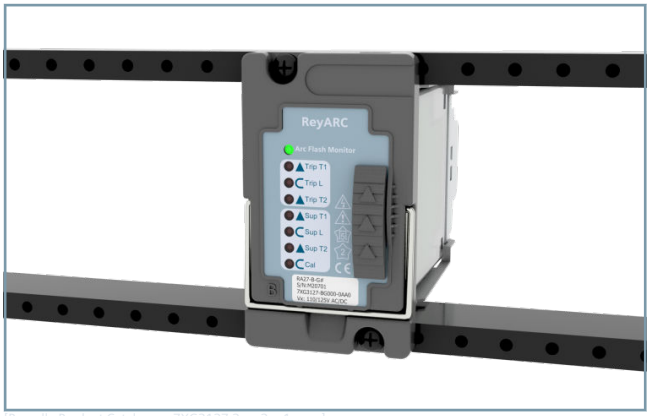
Mounting Recommendations

Terminal Block

TBD-R1 /R2 Rear connect terminal block suitable for flush mount relay version.

TBD-F Front connect terminal block suitable for rail mount relay version.

19 Inch Rack Mounted Rear Connection

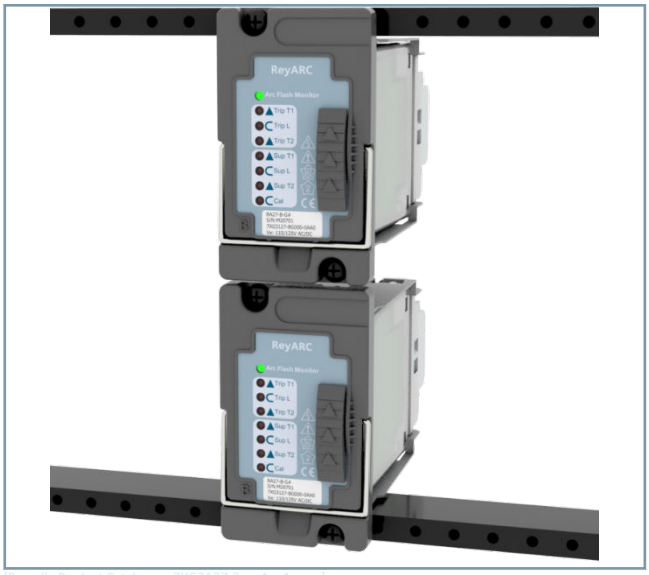


[Reyrolle Product Catalogue, 7XG3127 2u x 2u, 1, —_–]

Figure 2.7/86 19" Rack Mount 2U x 2U

[Reyrolle Product Catalogue, 7XG3127 4u x 4u, 1, —_–]

Figure 2.7/87 19" Rack Mount 4U x 4 U in Adapter Plate for 4 Units



[Reyrolle Product Catalogue, 7XG3127 2u x 4u, 1, –_–]

Figure 2.7/88 19" Rack Mount 2U x 4U in Adapter Plate for 2 Units

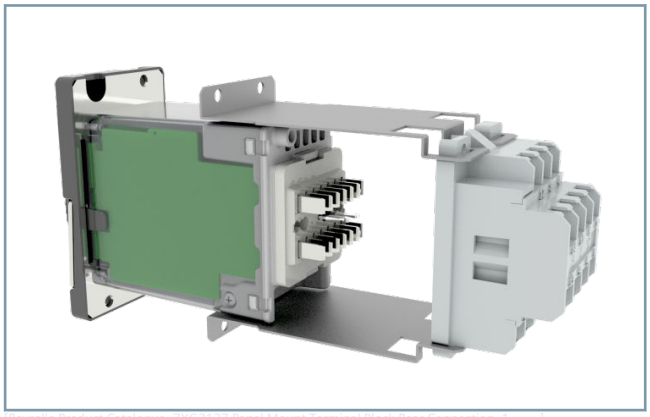
Panel Mounted Rear Connection

[Reyrolle Product Catalogue, 7XG3127 Front Panel Mount, 1, –_–]

Figure 2.7/89 Front Panel Mount

[Reyrolle Product Catalogue, 7XG3127 Rack Mount Terminal Block, 1, –_–]

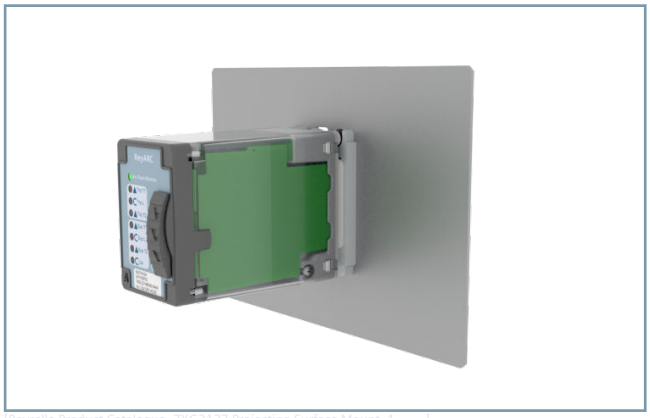
Figure 2.7/90 Rack Mount Terminal Block TBD-R1



[Reyrolle Product Catalogue, 7XG3127 Panel Mount Terminal Block Rear Connection, 1, –_–]

Figure 2.7/91 Panel Mount with Adapter Unit with Rear Connection Terminal Block TBD-R2 (Relay shown partially drawn out of panel.).

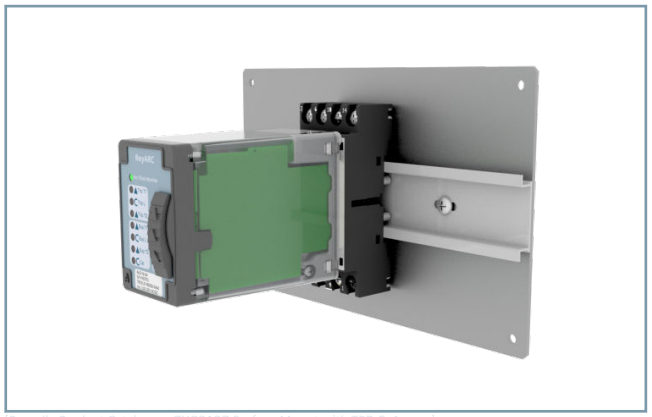
Surface Mount Rear Connection (Projecting)



[Reyrolle Product Catalogue, 7XG3127 Projecting Surface Mount, 1, –_–]

Figure 2.7/92 Projecting Surface Mount with TBD-R1

Surface Mount Front Connection



[Reyrolle Product Catalogue, 7XG3127 Surface Mount with TBD-F, 1, –_–]

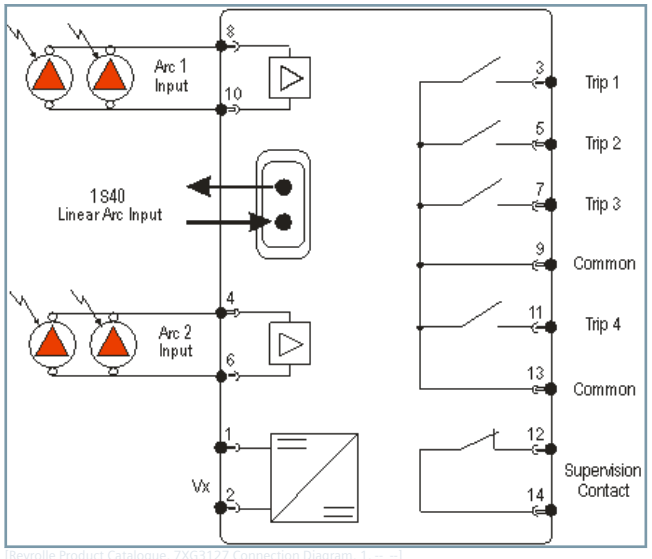
2.7

Figure 2.7/93 Surface Mount with TBD-F

[Reyrolle Product Catalogue, 7XG3127 Surface Mount Front Connection, 1, –_–]

Figure 2.7/94 Surface Mount Front Connection Terminal Block TBD-F

Connection Diagram



[Reyrolle Product Catalogue, 7XG3127 Connection Diagram, 1, –_–]

Figure 2.7/95 7XG3127 Connection Diagram

Ordering Information - 7XG3127 Arc Sensor Fault Monitor Relay

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Arc Sensor Fault Monitor Relay	7	X	G	3	1	2	7	-	□	□	□	0	0	-	0	A	A	0
				|	|	|	|		|	|	|								
Category				|	|	|	|		|	|	|								
Arc Protection				3	1	|	|		|	|	|								
						|	|		|	|	|								
Device						|	|		|	|	|								
RA27 Arc Sensor Fault Monitor						2	7		|	|	|								
									|	|	|								
Arc Detectors									|	|	|								
Point Sensor Inputs only									1	|	|								
Point Sensor & Linear Sensor Inputs									2	|	|								
									|	|	|								
Auxiliary Supply									|	|	|								
19-85V DC/19-65V AC									|	F	|								
40-165V DC/38-150V AC									|	G	|								
125-250V DC/95-240V AC									|	H	|								
									|		|								
Mounting Arrangement									|		|								
Surface/DIN Rail Mount +TBD-F Terminal Block									|		A								
Surface Mount +TBD-R1 Terminal Block									|		B								
Panel Mount +TBD-R1 Terminal Block									|		C								
Panel Mount +TBD-R2 Terminal Block									1		D								

Accessories	Variants	Order No.
Rack mounting frames	Dual – 4U x 2 frame for mounting 2 high x 1 wide RA27	VCE:TBD-AD
	Quad – 4U x 4 frame for mounting 2 high x 2 wide RA27	VCE:TBD-AQ

7XG3130 Optical Arc Fault Sensor

[Reyrolle Product Catalogue, 7XG3130, 1, –_–]

Features

- Compact rugged design
- One or two optical detectors
- High speed arc detection
- Heavy duty 6m termination cable
- Optional 20m & screened cables
- Simple flush cable panel mounting outside or inside switch-gear compartment
- Integrated sensor circuit supervision
- Very low sensitivity to ambient light levels to avoid nuisance tripping even in direct sunlight
- Sealed module for harsh environments
- Metal reinforced mounting shield comes as standard

Application

Arc fault protection is a technique employed for the fast clearance of arcing faults on busbars & within metal clad switch-gear & associated cable boxes. The arc is detected using an optical sensor & the signal input to a protection device which also monitors the load current on the system. A trip signal can be achieved in less than 10ms using arc detection.

While the high intensity flash caused by an electrical arc will be reflected within the metal clad switchgear, it is recommended that one or more sensors be mounted in each enclosed switch-gear compartment.

For busbar protection applications multiple sensors are required to achieve adequate coverage along the length of the bar. A sensor version with two optical detectors "looking" in opposite directions is available for this purpose.

Description

The RA30(ReyArc30) is an optical sensor that responds to the flash of light emitted during the incidence of an arcing fault. Onset of the light flash & detection by the RA30 occurs in a few ms.

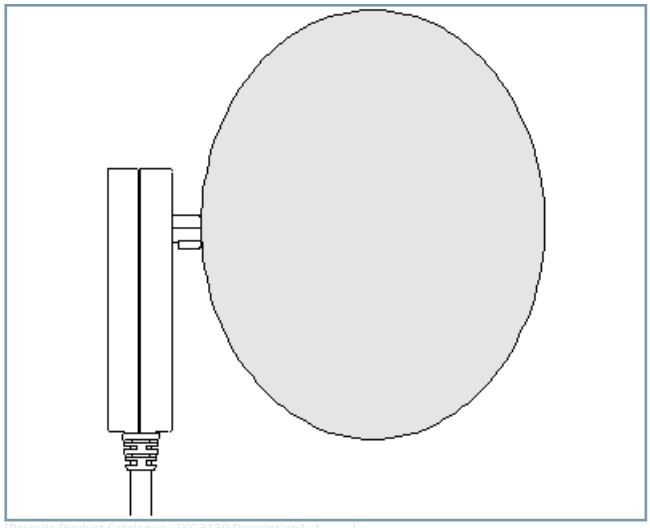
Each arc fault sensor consists of one or two silicon PIN photo diode light detectors mounted on a circuit board together with the associated detection circuit. The detector monitors a wide space angle. A broad spectral response in the visible region is provided.

Sensitivity of the arc sensor has been set to a low level to reduce the possibility of mal operation under high ambient lighting conditions. This is made possible due the high intensity of light emitted under arc fault conditions. Additional security can be incorporated by way of a current check stage.

In standby mode the RA30 sensor presents a high resistance to the 12V DC control signal provided by the Arc Fault Monitor. This allows a small circulating current to flow for continuous supervision of the RA30 connection circuit. When an arc is detected, the resistance presented by the RA30 drops to a level where the current flow increases to approximately 20mA. This increased current flow is instantaneously detected by the Arc Fault Monitor & its trip output contacts closed. Refer to the RA20 Arc Fault Monitor Catalogue sheet for further details.

Single detector package

The figure below depicts the RA30 with a single optical detector. Note the window where the active part of the detector is positioned to. This permits convenient mounting on the outside of the panel with the detector window protruding through a hole in the panel.

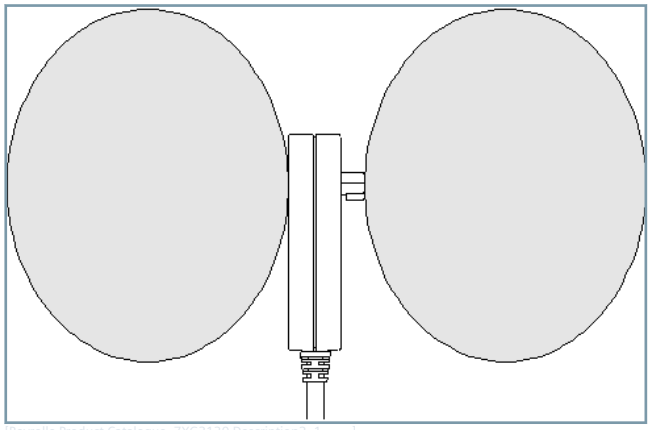


[Reyrolle Product Catalogue, 7XG3130 Description1, 1, --_--]

Figure 2.7/96 RA30 with single optical detector

Dual detector package

The figure below depicts the RA30 with dual optical detectors. The two optical detectors face in opposite directions to provide arc detection coverage in both directions. This version is particularly useful when mounted in a bus chamber or barrier between adjacent switchgear chambers. The main benefits are reduced cost compared to two separate sensors & use of only one input channel on the RA20 Arc Fault Monitor.



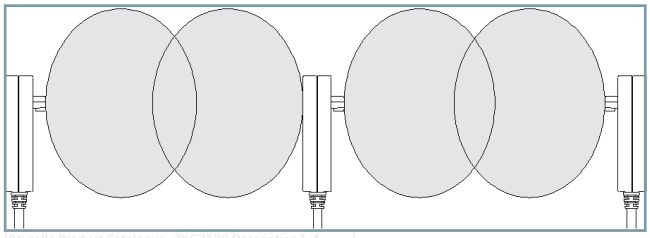
[Reyrolle Product Catalogue, 7XG3130 Description2, 1, --_--]

Figure 2.7/97 RA30 with dual optical detectors

Detector range

A detection range along the 100% relative sensitivity curve shown below is approximately 3m. Single detector versions therefore need to be placed at a maximum spacing of 5-6m. The dual detector versions may be placed at a maximum spacing of 8-10m to provide adequate detection overlap. In switchgear the light caused by the arc is reflected from the walls & therefore, the mounting of the sensor is not critical.

While the high intensity flash caused by an electrical arc will be reflected within the metal clad switchgear, it is recommended that one or more sensors be mounted in each enclosed switchgear compartment.



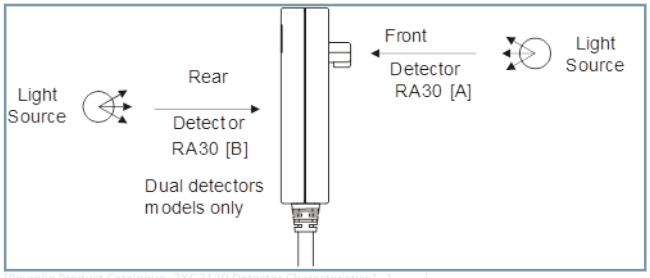
[Reyrolle Product Catalogue, 7XG3130 Description3, 1, --_--]

Figure 2.7/98 Detection range along 100% relative sensitivity curve

Detector Characteristics

Optical sensitivity

~10,000 Lux* for white light at normal incidence to the detector window(s) as depicted below:



[Reyrolle Product Catalogue, 7XG3130 Detector Characteristics1, 1, --_--]

Figure 2.7/99 ~10,000 Lux* for white light at normal incidence to the detector window(s)

For the RA30 single detector version the front detector only is fitted. In this configuration the RA30 will be insensitive to white light incident on the rear surface of the case up to a level of 200,000 Lux.

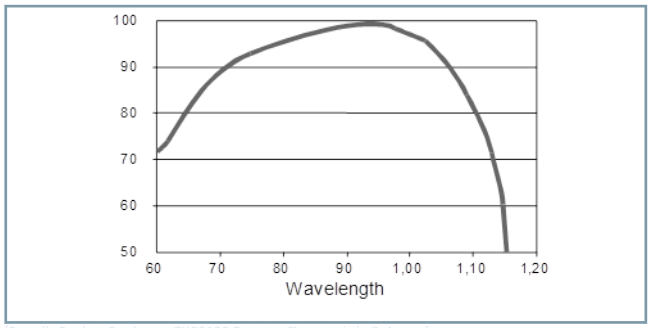
As the illuminace of diffuse ambient sunlight falls in the range 5,000 to 10,000 Lux, this will not normally be sufficient to trigger the RA30 sensor. The luminous intensity from the sun at noon at the equator however is ~100,000 Lux which will be sufficient to trigger the RA30 sensor so measures should be made to avoid this situation.

Direct sunlight incident on the rear of the RA30 single sensor model will not cause it to pick up. This attribute provides a significant safety margin to avoid nuisance tripping when the option of mounting the sensor externally on switchgear is employed.

Detector directional characteristics

Detector sensitivity falls to ~40% of the nominal level at inclination angles up to 70 degrees from the normal for white light.

Detector spectral response



[Reyrolle Product Catalogue, 7XG3130 Detector Characteristics2, 1, –_–]

Figure 2.7/100 Arc detector spectral response

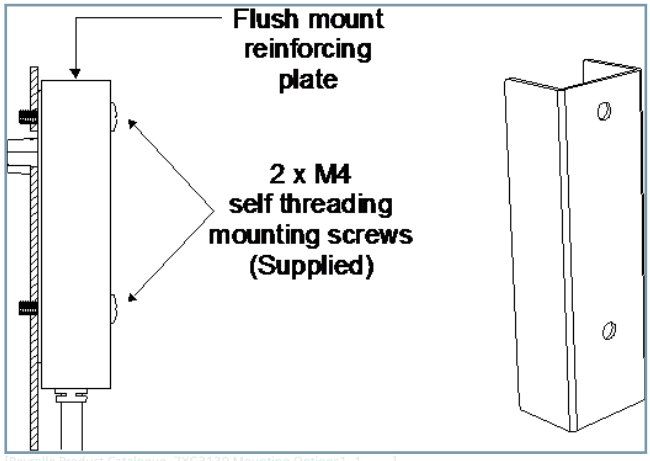
* Due to the relatively high sensitivity of the detector to IR wavelengths the type of light source employed for sensitivity testing will have a major effect on the results obtained. Sensitivity testing should therefore be conducted using a 50-75W halogen lamp with an integrated aluminum reflector.

2.7

Mounting Options

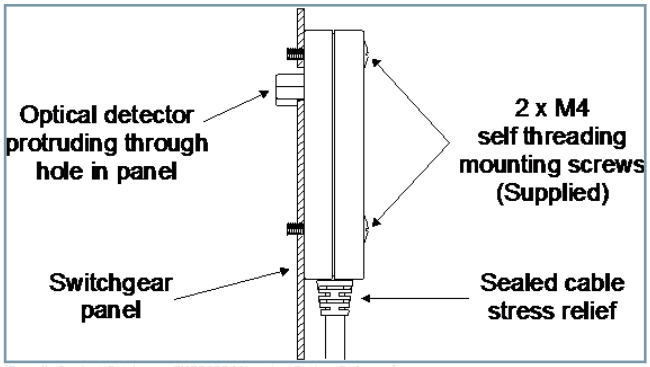
Flush panel mounting

The RA30 is suitable for flush panel mounting in a number of configurations.



[Reyrolle Product Catalogue, 7XG3130 Mounting Options1, 1, –_–]

Figure 2.7/101 RA30 shown mounted on the outside of a switchgear panel. Detector oriented to 'look' through a hole into the switchgear

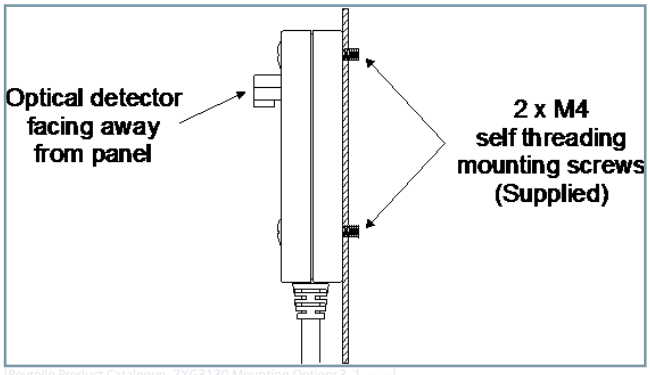


[Reyrolle Product Catalogue, 7XG3130 Mounting Options2, 1, –_–]

Figure 2.7/102 RA30 shown mounted on the inside of a switchgear panel Detector oriented to 'look' out into the switchgear compartment

Flush mounting reinforcing plate

When mounting the RA30 on the outside of a switchgear cubicle the hole required in the panel may degrade the short circuit rating. If this is considered to be an issue then a reinforcing plate may be fitted over the RA30 as depicted below. The Reinforcing plate comes as standard with the RA30.

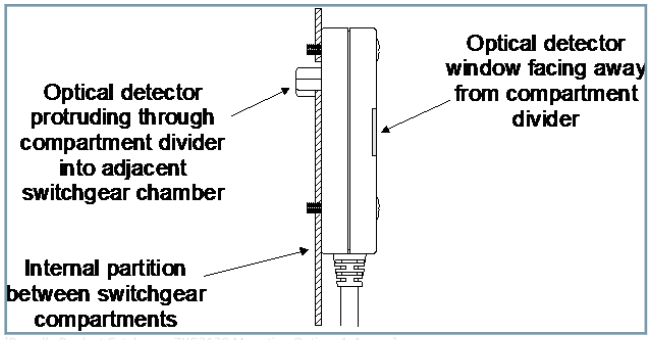


[Reyrolle Product Catalogue, 7XG3130 Mounting Options3, 1, –_–]

Figure 2.7/103 Flush mount reinforcing plate 1.2mm zinc plated mild steel

Dual detector version

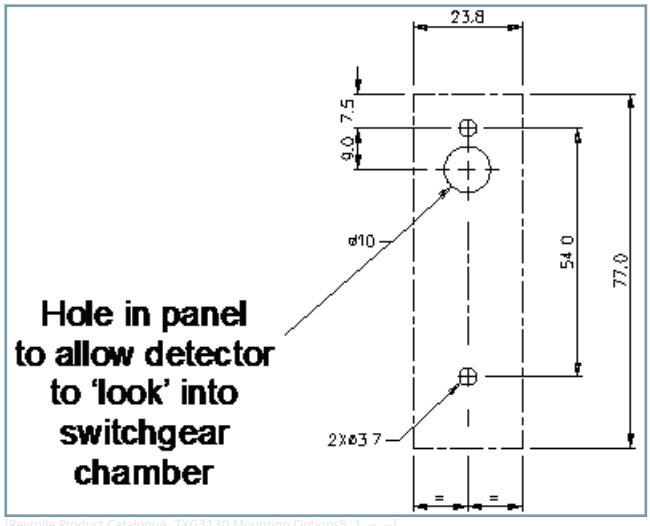
The dual detector version can be panel mounted to monitor two adjacent switchgear compartments simultaneously. This feature can be used to reduce the total cost for sensors or to increase the monitoring coverage for each RA20 Arc Fault Monitor unit.



[Reyrolle Product Catalogue, 7XG3130 Mounting Options4, 1, – –]

Figure 2.7/104 RA30 shown mounted on the inside of a switchgear panel.

Panel mount cut out detail

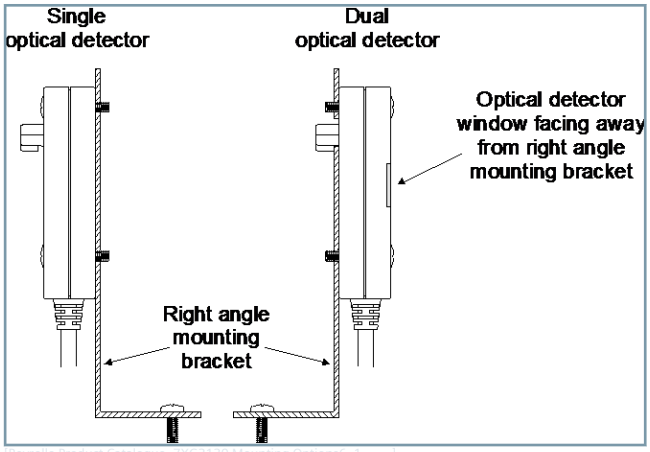


[Reyrolle Product Catalogue, 7XG3130 Mounting Options5, 1, – –]

Figure 2.7/105 Flush mounting detail

Right angle mounting off a surface

A right angle mounting bracket may be fabricated using the panel cut out detail above. Single & dual detector models may be mounted in this manner as depicted below.



[Reyrolle Product Catalogue, 7XG3130 Mounting Options6, 1, – –]

Figure 2.7/106 Right angle mounting off a surface mount off floor or walls within switchgear / busbar chamber

2.7

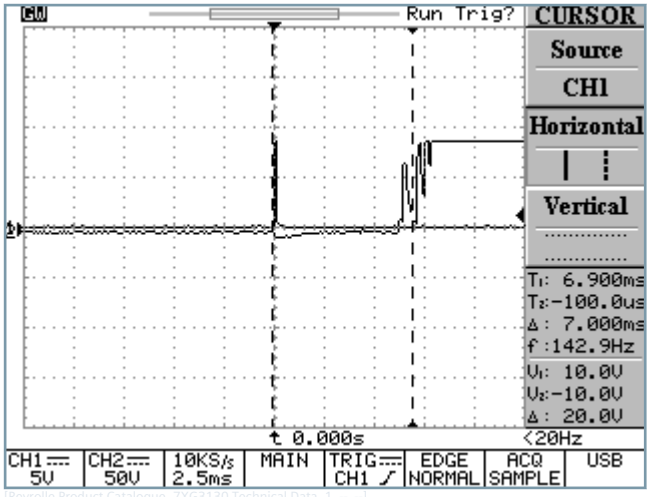
Technical Data

Arc fault protection scheme

Refer to the ReyArc20/23/24 Technical Catalogue sheets for further details.

Arc protection scheme operate time

Arc fault trip contacts guaranteed to pick up in less than 10ms including bounce. Typical operate time is 7ms.



[Reyrolle Product Catalogue, 7XG3130 Technical Data, 1, – –]

CRO trace showing nominal operation time of the trip contacts at 7ms. First contact touch at 6.25ms and fully closed by 7.25ms. Operation in <10ms is considered acceptable as current check relay operate time is ~25ms.

Minimum Arc duration

The minimum arc "flash" duration required to guarantee operation of the Arc Fault Monitors output contacts is 1.25ms.

Auxiliary supply

Voltage from RA20 Arc Fault Monitor:	12V DC
Power consumption:	≤2.5mA

Casing

Rugged moulded construction to IP51.

Temperature range

Operating:	-5 to +55°C
Storage:	-25 to +75°C

Sensor Connections

The RA30 is supplied with a 6m two core connection cable as standard. Two core multi strand wire (2x16/0.2mm), is supplied stripped & pre tinned at the RA20 connection end. The standard 6m cable may be cut down to the desired length & crimp ring lugs fitted for termination.

The RA30 connections are not polarity sensitive. Reversal of the wires on the arc monitor terminals has no effect on the performance of the RA30 or arc detection system.

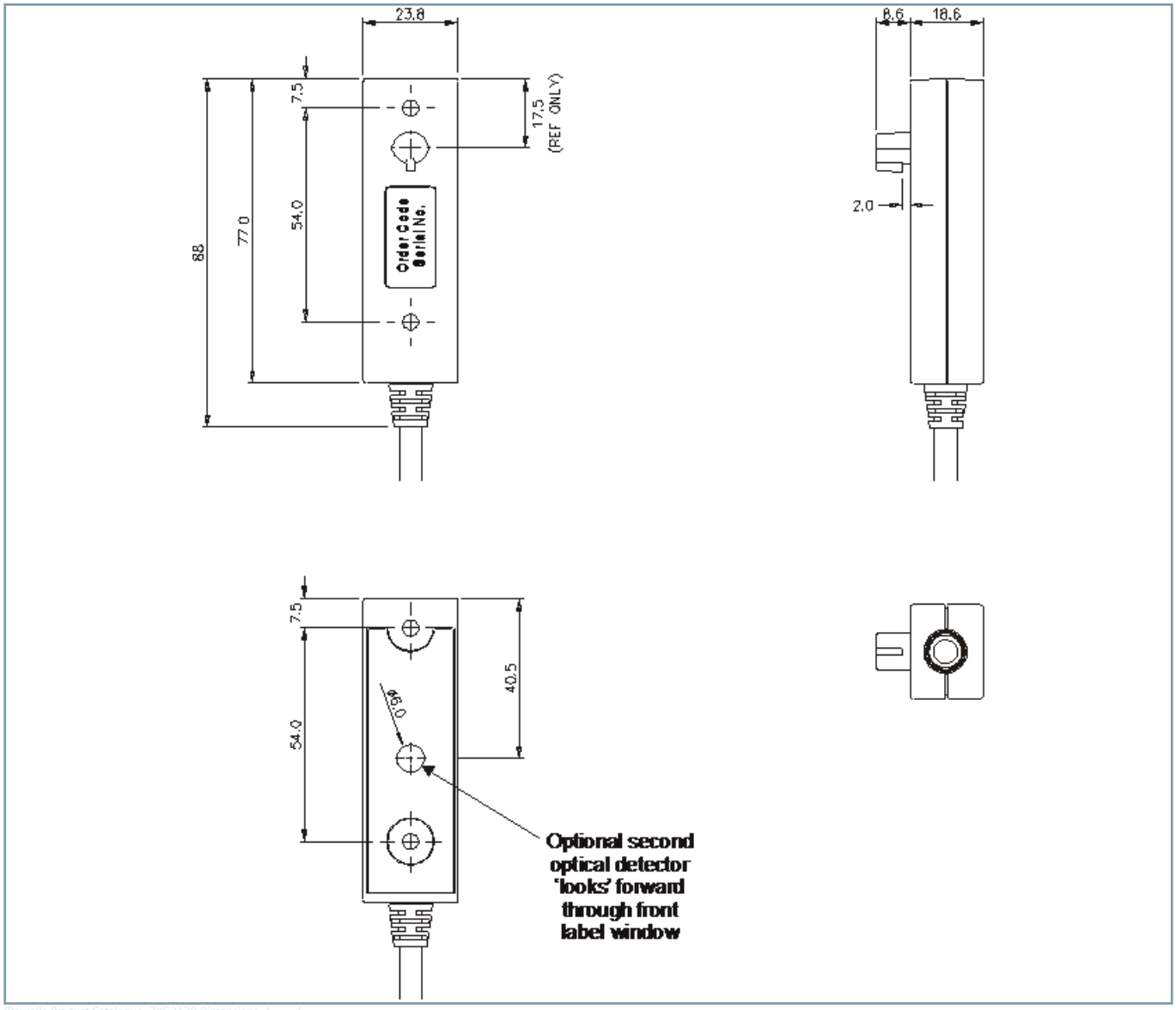
The cable is factory fitted to the RA30 Arc Fault Sensor using a stress relief molding to provide a sealed & durable connection interface. The cable employs thick inner & outer insulation layers to avoid damage during installation.

For connection over longer distances shielded cable is recommended. For distances over 20m, 24/0.2 mm cable should be employed.

Additional RA30 cable length

Screened arc sensor cables may be increased by wiring additional series twisted pair SCREENED cable provided it does not exceed 5 ohms and 30nF loop impedance.

Dimensions



[Reyrolle Product Catalogue, 7XG3130 Dimensions, 1, --_--]

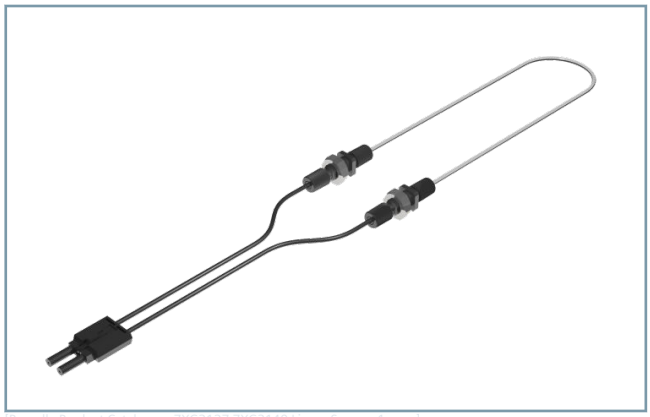
Figure 2.7/107 RA30 Arc fault Sensor dimensions

Arc Fault Protection – 7XG3130 Optical Arc Fault Sensor

Ordering Information - 7XG3130 Optical Arc Fault Sensor

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Optical Arc Fault Sensor	7	X	G	3	1	3	0	-	□	□	□	0	0	-	0	A	A	0
				|	|	|	|		|	|	|								
Category				|	|	|	|		|	|	|								
Arc Protection				3	1	|	|		|	|	|								
						|	|		|	|	|								
Device						|	|		|	|	|								
RA30 Arc Sensor						3	0		|	|	|								
									|	|	|								
Arc Detectors									|	|	|								
Single detector (Through Hole)									1	|	|								
Dual detector									2	|	B								
										|	|								
Cabling										|	|								
6m unshielded										A	|								
6m shielded										B	|								
20m shielded										C	|								
											|								
Reinforcing plate (single sensors only)											|								
Required											A								
Not Required											B								

7XG3140 Linear Fibre Optic Arc Fault Sensor



[Reyrolle Product Catalogue, 7XG3127 7XG3140 Linear Sensor, 1, –_–]

Figure 2.7/108 RA40 Arc Fault Sensor

Features

- Bare fibre optic type linear sensor for wide protection coverage for arcing faults
- Optional sensor length up to 30 metres
- Sensor link adds up to another 80 metres in length
- Loop topology allows sensor supervision
- Robust and durable 2mm plastic optical fibre
- No special tools required for installation
- Supplied with 2x fibre couplers
- Supplied with fibre cutter

Application

The RA40 is an optical sensor that is used to transmit the flash of light emitted during the incidence of an arcing fault back to an arc fault monitor such that detection of arcing faults can be achieved in as little as a few milliseconds.

The linear sensor may be applied to protect large volumes where multiple point sensors would otherwise be required. A separate RA40 linear sensor is required for each segregated protection zone.

The linear sensors kits provide both cladded and bare fibres. The bare fibres are located within the detection zone and cladded fibres allow routing of the linear sensor back to the relay.

Bare fibre and cladded fibres are joined through the use of optical fibre couplers. An optical fibre duplex connector is utilised for connection to the arc flash relay.

Description

The Linear Arc Sensor consists of four elements as depicted in *Figure 2.7/111*, *Figure 2.7/112*, and *Figure 2.7/113*:

1. Dual optic fibre connection plug to allow interface to a suitable arc flash monitor unit, i.e. ReyArc 7XG3127;

2. Sections of opaque (Black) link fibre to connect both ends of the sensor fibre to the arc flash monitor;

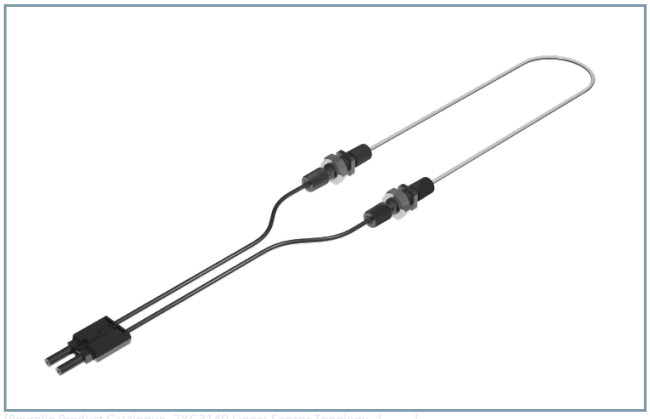
3. A section of translucent optical fibre that acts as the collector for the intense visible light emitted during an arc fault event;

4. Through-panel couplers for proper in-line connection of the sensor and link fibres.

Figure 2.7/110 depicts how the dual optic fibre connection is plugged into an arc fault monitor.

Figure 2.7/116 describes the function of each section and the practical limitations for installation.

Linear Sensor Topology



[Reyrolle Product Catalogue, 7XG3140 Linear Sensor Topology, 1, –_–]

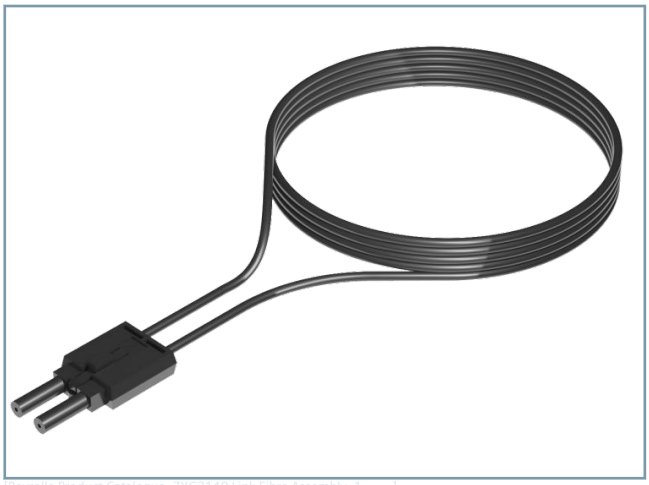
Figure 2.7/109 Linear Sensor Topology

[Reyrolle Product Catalogue, 7XG3140 Connection to 7XG3127, 1, –_–]

Figure 2.7/110 Connection to 7XG3127 Arc Fault Monitor

Components

Link Fibre Assembly



[Reyrolle Product Catalogue, 7XG3140 Link Fibre Assembly, 1, –_–]

Figure 2.7/111 Link Fibre Assembly

The black Link Fibre assembly is supplied pre-terminated to the dual fibre connector ready to plug into the RA27 Arc Fault Monitor. The link fibre is not sensitive to light and is used to make a connection between the optically sensitive fibre and the arc fault monitor. The length of link fibre required is specified in the Order Code section.

Sensor Fibre

[Reyrolle Product Catalogue, 7XG3140 Sensor Fibre, 1, –_–]

Figure 2.7/112 Sensor Fibre

The sensor fibre is a 2mm OD translucent plastic optical fibre which is both robust and durable for application in metal clad switchgear and bus duct environments. The length of sensor fibre required is specified in the Order Code section.

Optic Fibre Coupler

[Reyrolle Product Catalogue, 7XG3140 Optic Fibre Coupler, 1, –_–]

Figure 2.7/113 Optic Fibre Coupler

Two Optic Fibre Couplers are provided per RA40 kit and are used to connect the link fibre and sensor fibre together at an appropriate position such as a compartment interface.

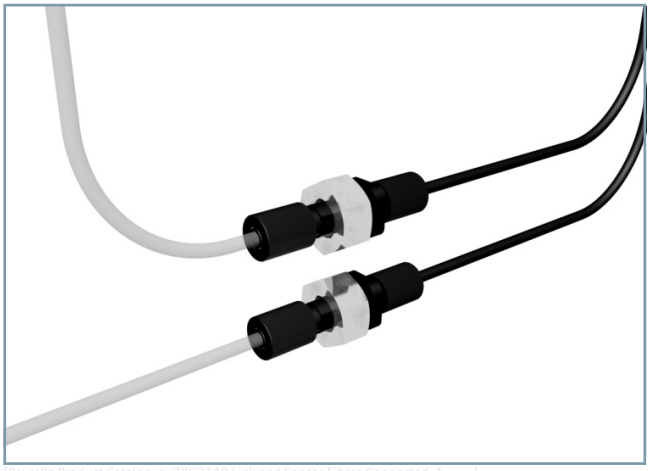
Optic Fibre Cutter

[Reyrolle Product Catalogue, 7XG3140 Optic Fibre Cutter, 1, –_–]

Figure 2.7/114 Optic Fibre Cutter

An optic fibre cutter tool is supplied to allow preparation of the Link Fibre and Sensor Fibre to the required length for installation.

Assembled Optic Fibre Sensor

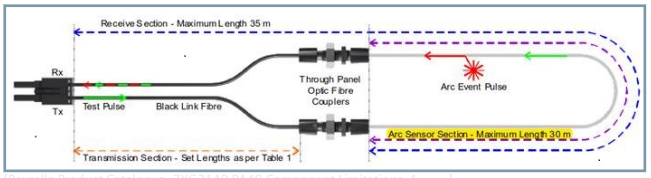


[Reyrolle Product Catalogue, 7XG3140 Link and Sensor Fibres Connected, 1, --_--]

Figure 2.7/115 Link and Sensor Fibres Connected

Once the optic fibre sections have been cut with the tool provided, no further special tools are required to achieve the in-line connection using the optic fibre couplers.

Functional Overview



[Reyrolle Product Catalogue, 7XG3140 RA40 Component Limitations, 1, --_--]

Figure 2.7/116 RA40 Component Function and Installation Limitations

Arc Sensor Detection Function

Figure 2.7/116 shows the transmit (Tx) and receive (Rx) ends of the sensor terminated at a duplex plug ready to plug in to an arc fault monitor. Visible light generated by an electrical arc event enters the translucent section of the sensor fibre and is guided along the fibre through the couplers and into the monitor Rx connection where an optical detector is employed to sense the arc flash.

While the arc light will travel down the fibre in both directions, only the Rx end will detect the arc flash. The optical detector threshold is set below the level below that would otherwise cause nuisance tripping under ambient lighting conditions. A light intensity of >7,500 Lux over a length of 300mm is required to cause an arc trip. Additional security against mal-operation is achieved by allowing only sharp increases in light level to be detected.

Arc Sensor Supervision Function

To monitor the integrity of the linear sensor, the arc fault monitor transmits a periodic optical test pulse. Provided this signal is received by the detector, the arc monitor front panel green LED will remain continuously lit to confirm correct sensor function and continuity. Refer to the appropriate arc flash monitor technical information for further details.

Arc Monitor Configuration Setting

The arc monitor must be configured with the correct setting corresponding to the length of the optic fibre transmission section shown in *Figure 2.7/116* and listed in *Table 2.7/2*. The transmission section fibre must be cut to one of the set lengths as specified in *Table 2.7/2* within a tolerance of 10%.

Transmission Section Length	Setting
< 1 metre	A
1 metre	B
5 metres	C
10 metres	D
20 metres	E
30 metres	F

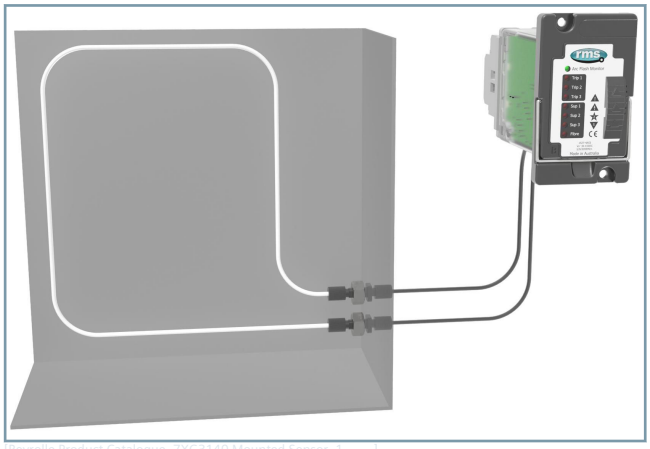
Table 2.7/2 Transmission Section Length Settings

Arc Sensor Auto Calibration

When the arc monitor unit is powered up a calibration routine is automatically initiated to adjust the supervision transmission level based on the configuration setting and to check that the supervision pulse is detected correctly.

Failure will cause an alarm LED to be illuminated to indicate that the RA40 connections and configuration setting should be checked.

Mounting Recommendations



[Reyrolle Product Catalogue, 7XG3140 Mounted Sensor, 1, --_--]

Figure 2.7/117 Example of a Sensor Mounted Through a Panel and Looped Back Internally for Maximum Coverage

Optic Fibre Sensor Location

The translucent optic fibre sensor must be located within the switchgear or bus chamber where arcing faults could occur during operation. Care should be taken to ensure a minimum length of 300mm of fibre is exposed within the chamber. For long bus chambers the fibre may be run the full length and then returned back to the starting point to provide maximum coverage as illustrated in *Figure 2.7/117*.

The sensor fibre should not extend beyond the chamber to be monitored and certainly not to an area that may be subject to high ambient light conditions or flash photography.

Link Fibre Location

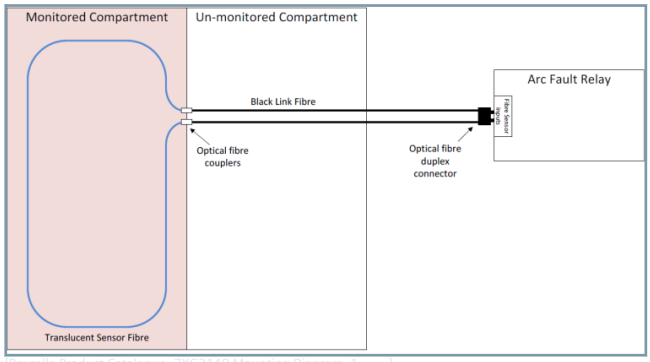
The opaque (black cladded) link fibre may extend inside the chamber to be protected or terminate at the chamber interface using the in-line couplers provided.

Optic Fibre Retention

Both the translucent and opaque optic fibres may be retained using cable ties or silicon adhesive provided not more than 10% of the sensor fibre is masked by the silicon or other fasteners.

Optic Fibre Bend Radius

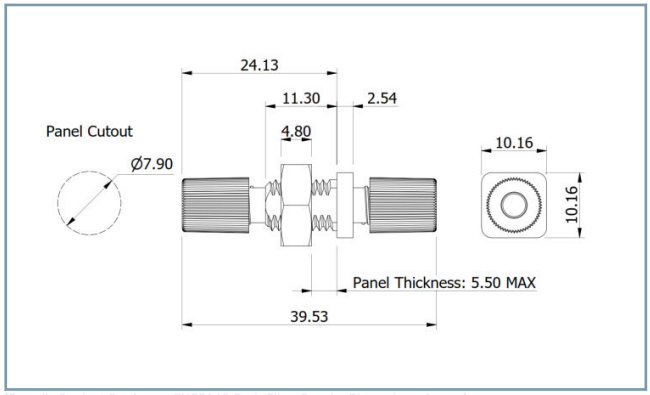
The minimum bend radius for both the bare sensor and opaque cladded link sections of the optic fibres is 75mm.



[Reyrolle Product Catalogue, 7XG3140 Mounting Diagram, 1, –_–]

Figure 2.7/118 Diagram Illustrating How Neighboring Compartments can be Selectively Monitored by Passing the Black Cladded Link Fibre Through the Compartment Not to be Monitored

Dimensions



[Reyrolle Product Catalogue, 7XG3140 Optic Fibre Coupler Dimensions, 1, –_–]

Figure 2.7/119 Optic Fibre Coupler Dimensions

The optic fibre coupler allows easy in-line connection of the link and sensor fibres as per *Figure 2.7/116* and *Figure 2.7/117*. The clean cut fibre ends are simply inserted into either end of the coupler and the clamp screws finger tightened. The coupler may be mounted through a panel or left to be supported by the optic fibres.

Technical Data

Temperature IEC 60068-2-1/2

Operating Range	-40 °C to +85 °C
Storage Range	-40 °C to +85 °C

Humidity IEC 680068-2-78

Operational test	56 days at 40 °C and 95% relative humidity

IP Ratings IEC 60529

Type	Level
Installed	IP 5x

Vibration – Sinusoidal IEC 60255-21-1 Class I

Type	Level	Variance
Vibration response	0.5gn	≤ 5 %
Vibration endurance	1.0gn	≤ 5 %

Shock and Bump IEC 60255-21-2 Class I

Type	Level	Variance
Shock response	5gn, 11ms	≤ 5 %
Shock withstand	15gn, 11ms	≤ 5 %
Bump test	10gn, 16ms	≤ 5 %

Seismic IEC 60255-21-3 Class I

Type	Level	Variance
Seismic response	1gn	≤ 5 %

Material

Category	Remarks
Chemical	All components of the RA40 are RoHS compliant.
Flammability	The components of the RA40 which are directly in contact to the monitoring system are made from flame retardant material. Duplex connector plug: SABIC ULTEM flame retardant plastic (UL file E121562) Opaque plastic optic fibre: fire-resistant polyethylene (FRPE) – meets UL VW-1 flame retardant specification (UL file E116331, style 5538)

Mechanical

Parameter	Value
Duplex connector plug	
Insertion force, connector to trans-ceiver	20 N

Parameter	Value
Retention force, connector to transceiver (Latched)	24 N
Retention force, connector to transceiver (Unlatched)	20 N
Tensile force, Connector to POF cable	90 N
Black opaque plastic optical fibre (POF)	
Absolute minimum bend radius	35mm
Short term tensile force (30 minutes)	50 N
Long term tensile force	1 N
Typical outer diameter	2.20 mm
Maximum outer diameter	2.27 mm
POF coupler	
Retention force, POF cable to coupler	10 N [68]

68 May vary depending on tightness of plastic clamping nut

Ordering Information - 7XG3140 Linear Fibre Optic Arc Fault Sensor

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Linear Fibre Optic Arc Fault Sensor	7	X	G	3	1	4	0	-	0	□	□	0	0	-	0	A	A	0
				|	|	|	|			|	|								
Category				|	|	|	|			|	|								
Arc Protection				3	1	|	|			|	|									
						|	|			|	|								
Device						|	|			|	|								
RA40 Arc Sensor						4	0			|	|									
										|	|									
Arc Sensor Fibre Length (m)										|	|									
5m										A	|									
10m										B	|									
20m										C	|									
30m										D	|									
											|									
Black Link Fibre Length (m)											|									
5m											A										
10m											B										
20m											C										
30m											D										
40m											E										
80m											J										

7PG11 Auxiliary Relay

[Reyrolle Product Catalogue, 7PG11, 1, _ _]

Description

The 7PG111 & 7PG112 AR range of electromechanical relays are available with up to eight self, hand or electrically reset contacts. They can be supplied in most combinations of contact, flag and reset arrangements. Fixed time delay models are also available.

AR relays are voltage operated from either AC or DC supplies.

Features

- Consistent positive action
- Robust design for a long, reliable, service life

Type AR relays are a range of electro-mechanical relays with up to 8 contacts and complying to BS142. They can be supplied in most combinations of contact, flag and reset arrangements and with a fixed time delay. The relays are identified by a series of numbers and letters which define important relay features.

The following comments are provided as a guide to the various features of type AR relays.

AR - 1	Up to 8 self reset contacts, in any combination of normally open or normally closed as required.
AR - 2	Up to 8 self reset contacts, in any combination of normally open or normally closed as required.
AR - 3	Electrical and hand set contacts supplied with a contact reset mechanism in the relay case cover.
AR - 4	Hand and self reset contacts, can be supplied with 2 hand reset contacts and a maximum of 4 self reset contacts. All the contacts may be either normally open or normally closed.
AR - 6	Electrical reset contacts with optional self reset flag.
AR - 3 & 6	Reset coils are short time rated, we recommend that reset circuits include a normally open (cut-off) contact

First Digit	Second Digit - Type of flag		Third Digit - Type of contact reset	
Number of identical elements	0	No flag	1	Self
	1	Hand reset	2	Hand
	2	Hand reset reverse acting	3	Electrical & hand
	3	Self reset	4	Hand & self
	4	Self reset reverse acting	6	Electrical

Suffix letters are used to identify further features:

Suffix D	Indicates a relay fitted with a suppression diode across the coil to reduce the effects of back emf on switch-off.
Suffix SB	Identifies a relay with a series break contact to cut-off the operating coil, thus the relay burden becomes zero after operation of this contact. Only available with AR relays which have hand reset contacts.

Type	Number of Contacts	Flag Reset	Contact Reset
AR101	2,4,6 or 8	N.A.	Self
AR103	4,6 or 8	N.A.	Elec & Hand
AR106	2, 4, or 6	N.A.	Elec
AR111	2,4,6 or 8	Hand	Self
AR112	2,4,6 or 8	Hand	Hand
AR113	4, 6 or 8	Hand	Elec & Hand
AR114	4 or 6	Hand	Hand & Self
AR121	2,4,6 or 8	Hand*	Self
AR124	4,or 6	Hand*	Hand & Self
AR131	2,4,or 6	Self	Self
AR133	2,4,6 or 8	Self	Elec & Hand
AR136	2,4,or 6	Self	Elec
AR141	2,4,or 6	Self*	Self

NOTE

* Indicates a reverse acting flag indicating on de-energisation.

Technical Data

Inputs and Outputs

Rated Voltage (Vn)	
A.C.	63.5, 110, 220, 240V
D.C.	12, 24, 30, 50, 125, 240V

Operating Range	
A.C.	80 % to 110 % of rated voltage
D.C.	70 % to 115 % of rated voltage

Burden	
3 to 5W/VA depending upon rating	Dependent on rating. Rectified a.c. relays nominal power factor = 0.96

Output Contacts

Make and carry continuously	1250VAa.c. or 1250Wd.c. within the limits of 660V and 5A
Make and carry for 3 seconds	7500VAa.c. or 7500Wd.c. within the limits of 660Vand 30A
Breaking Capacity (≤ 5 A and ≤ 250 V): AC Resistive DC Resistive DC Inductive	1250 VA 100 W 50 W L/R = 40 ms
Minimum number of operations	1000 at maximum load
Minimum recommended load	0.5 W att limits 10mA or 5V

Electrical Tests

Insulation

IEC 60255-5 RMS levels for 1 minute

Between contacts to earth and to the coil	2.0 kV
Between any case terminal and earth	2.0 kV
Between case terminals of independent circuits	2.0 kV
Across normally open contacts	1.0 kV

Transient Overvoltage

IEC 60255-5

Between all terminals and earth or between any two independent circuits without damage or flash-over	5 kV 1.2/50 µs 0.5 J

Mechanical

Vibration (Sinusoidal)

IEC 255-21-1	The relays meet the requirements of Class 1 for vibration response and endurance
BS142 section 2.1 category S2	Relays will withstand a 20G shock or impact on the panel without operating

Shock Bump

IEC 255-21-2	Class 1 severity
BS142, sub-section 1.5.2. (1989)	Class 1 severity

Mechanical Life

Durability	In excess of 10,000 operations with the contact rating at a rate of 600 operations per hour

Environmental

Temperature

IEC 68-2-1/2

Operating	-10°C to +55°C
Storage	-25°C to +70°C

Humidity

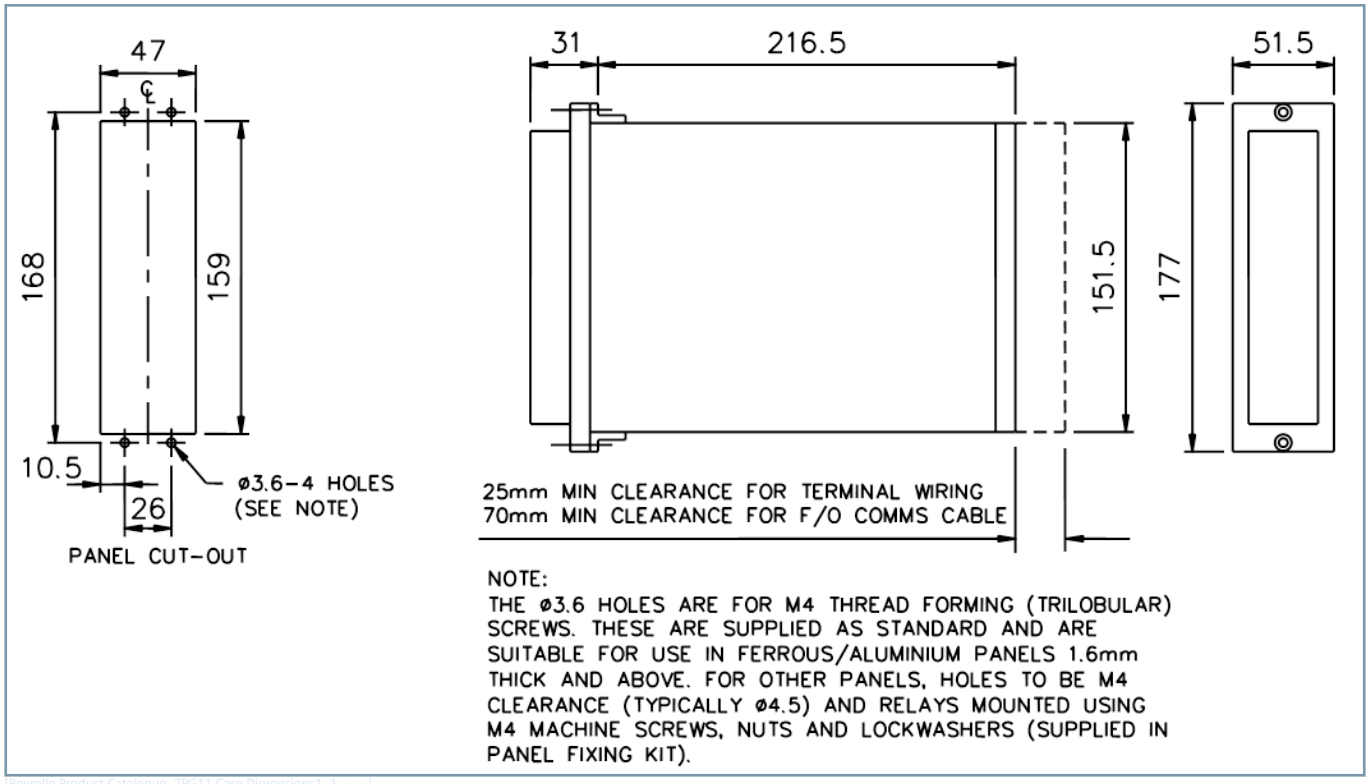
IEC 68-2-3

Operational test	56 days at 40°C and 95 % RH

Performance

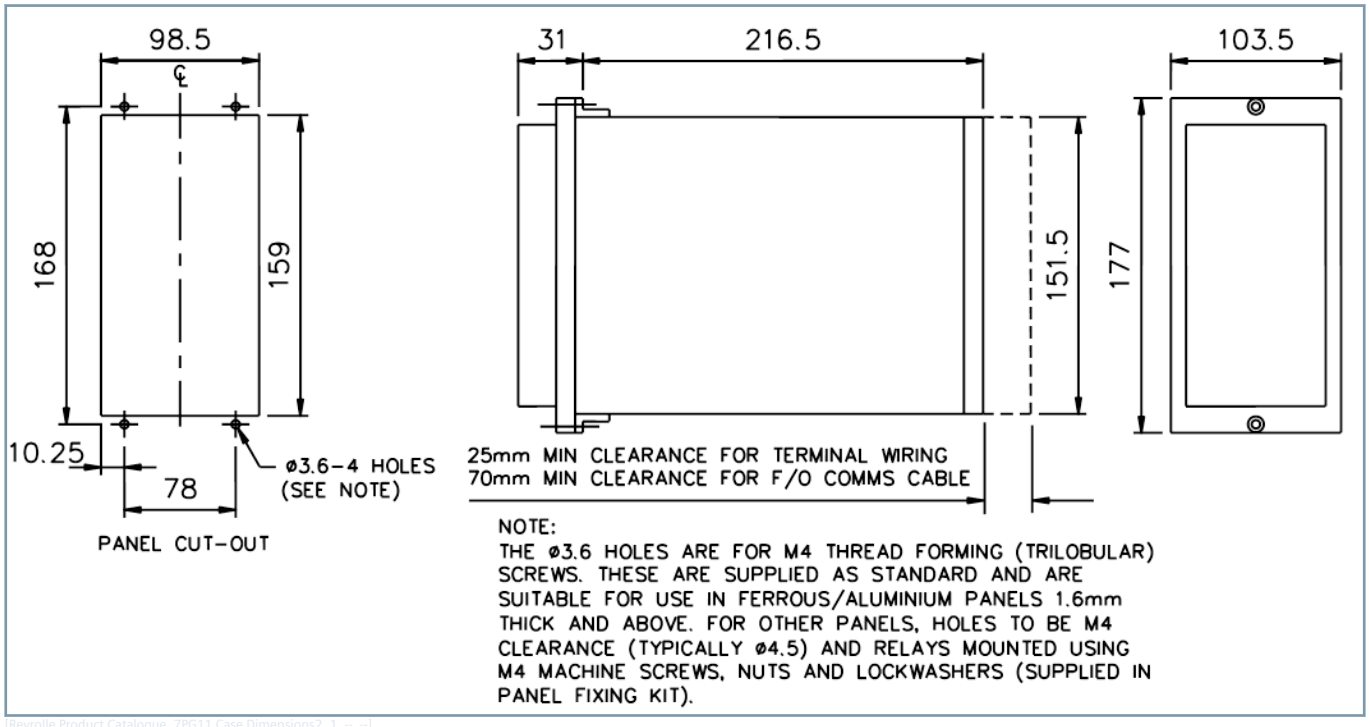
Instantaneous Operating time	
Typically	25 ms
Range	10 ms to 50 ms

Case Dimensions



[Reyrolle Product Catalogue, 7PG11 Case Dimensions1, 1, --_-]

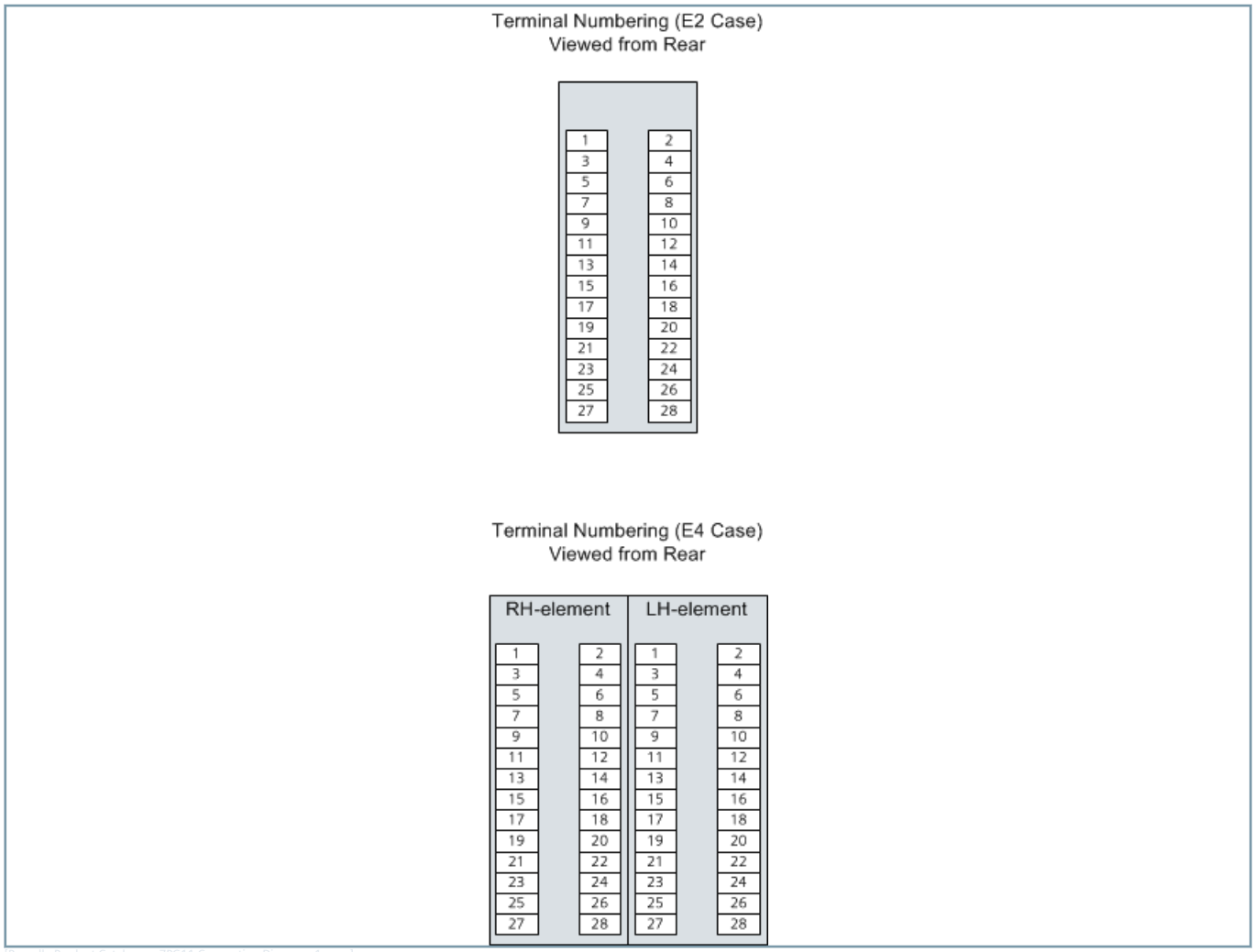
Figure 3.1/1 E2 Case Dimensions



[Reyrolle Product Catalogue, 7PG11 Case Dimensions2, 1, --_-]

Figure 3.1/2 E4 Case Dimensions

Connection Diagram 7PG11 AR



[Reyrolle Product Catalogue, 7PG11 Connection Diagram, 1, —_—]

Figure 3.1/3 Connection Diagrams

Ordering Information - 7PG111 Auxiliary Relay (AR101, AR103)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR101, AR103)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|		|	|	|	|
A.C. or D.C. voltage operated relay.						|	|		|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|		|	|	|	|
Single element						1	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|		|	|	|	|
No flag							0		|	|	|	|		|	|	|	|
									|	|	|	|		|	|	|	|
Contact operation									|	|	|	|		|	|	|	|
Self reset contacts									1	|	|	|	|		|	|	|	|
Hand and electrical reset contacts									3	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
5 NO										F	|	|	|		|	|	|	|
6 NO										G	|	|	|		|	|	|	|
7 NO										H	|	|	|		|	|	|	|
8 NO										J	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
7 NC											H	|	|		|	|	|	|
8 NC											J	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts [1)]												|	|		|	|	|	|
Two												0	|		|	|	|	|
Four												1	|		|	|	|	|
Six												3	|		|	|	|	|
Eight												5	|		|	|	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
																	|	|

7PG11 Auxiliary Relay

Product Description	Order No.		
Voltage rating		|	|
12V DC		A	|
24V DC		B	|
30V DC		C	|
50V DC		D	|
60V DC		E	|
125V DC		F	|
220V DC		G	|
240V DC		H	|
63.5V AC		J	0
110V AC		K	0
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG111 Auxiliary Relay (AR901)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR901)	7	P	G	1	1	1	0	-	7	A	E	1	0	-	0	A	□	0
						|	|		|	|	|	|	|		|	|	|	|
D.C. voltage operated relay.						|	|		|	|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|	|		|	|	|	|
Single element						1	|		|	|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|	|	|		|	|	|	|
No flag							0		|	|	|	|	|	|		|	|	|	|
									|	|	|	|	|	|		|	|	|	|
Contact operation									|	|	|	|	|	|		|	|	|	|
CT shorting contacts									7	|	|	|	|	|	|	|	|	|	|
										|	|	|	|	|	|	|	|	|	|
Contact arrangement – NO										|	|	|	|	|	|	|	|	|	|
0 NO										A	|	|	|	|	|	|	|	|	|
											|	|	|	|	|	|	|	|	|
Contact arrangement NC											|	|	|	|	|	|	|	|	|
4 NC											E	|	|	|	|	|	|	|	|
												|	|	|	|	|	|	|	|
Number of contacts												|	|	|	|	|	|	|	|
Four												1	|	|	|	|	|	|	|
													|	|	|	|	|	|	|
Contact type													|	|	|	|	|	|	|
NO (Standard) / NC (Standard)													0	|	|	|	|	|	|	|
															|	|	|	|	|	|
Time delay															|	|	|	|	|	|
No additional time delay															0	|	|	|	|	|
																|	|	|	|	|
Housing size																|	|	|	|	|
Case size E2 (4U high)																A	|	|	|	|
																	|	|	|	|
Voltage rating																	|	|	|	|
30V DC																	C	|	|	|
50V DC																	D	|	|	|
125V DC																	F	|	|	|
240V DC																	H	|	|	|
																		|	|	|
Back emf suppression diode																		|	|	|
Not Fitted																		0	|	|

Ordering Information - 7PG111 Auxiliary Relay (AR106)

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR106)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|	|		|	|	|	|
A.C. or D.C. voltage operated relay.						|	|		|	|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|	|		|	|	|	|
Single element						1	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|	|		|	|	|	|
No flag							0		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Contact operation									|	|	|	|	|		|	|	|	|
Electrical reset contacts									6	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
5 NO										F	|	|	|		|	|	|	|
6 NO										G	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts [1)]												|	|		|	|	|	|
Two												0	|		|	|	|	|
Four												1	|		|	|	|	|
Six												3	|		|	|	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
																	|	|
Voltage rating																	|	|
12V DC																	A	|
24V DC																	B	|
30V DC																	C	|
50V DC																	D	|
60V DC																	E	|
125V DC																	F	|

Product Description	Order No.		
220V DC		G	|
240V DC		H	|
63.5V AC		J	0
110V AC		K	0
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG111 Auxiliary Relay (AR201)

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR201)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|	|		|	|	|	|
A.C. or D.C. voltage operated relay.						|	|		|	|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|	|		|	|	|	|
Two element						2	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|	|		|	|	|	|
No flag							0		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Contact operation									|	|	|	|	|		|	|	|	|
Self reset contacts									1	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
5 NO										F	|	|	|		|	|	|	|
6 NO										G	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts/element [1)]												|	|		|	|	|	|
Two												0	|		|	A	|	|
Four												1	|		|	C	|	|
Six												3	|		|	C	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
Case size E4 (4U high)																C	|	|
																	|	|
Voltage rating																	|	|
12V DC																	A	|
24V DC																	B	|
30V DC																	C	|
50V DC																	D	|
60V DC																	E	|

Product Description	Order No.		
125V DC		F	|
220V DC		G	|
240V DC		H	|
63.5V AC		J	0
110V AC		K	0
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG111 Auxiliary Relay (AR111, AR112)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR111, AR112)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|		|	|	|	|
A.C. or D.C. voltage operated relay.						|	|		|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|		|	|	|	|
Single element						1	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|		|	|	|	|
Hand reset flag							1		|	|	|	|		|	|	|	|
									|	|	|	|		|	|	|	|
Contact operation									|	|	|	|		|	|	|	|
Self reset contacts									1	|	|	|	|		|	|	|	|
Hand reset contacts									2	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
5 NO										F	|	|	|		|	|	|	|
6 NO										G	|	|	|		|	|	|	|
7 NO										H	|	|	|		|	|	|	|
8 NO										J	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
7 NC											H	|	|		|	|	|	|
8 NC											J	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts [1)]												|	|		|	|	|	|
Two												0	|		|	|	|	|
Four												1	|		|	|	|	|
Six												3	|		|	|	|	|
Eight												5	|		|	|	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
																	|	|

Product Description	Order No.		
Voltage rating		|	|
12V DC		A	|
24V DC		B	|
30V DC		C	|
50V DC		D	|
60V DC		E	|
125V DC		F	|
220V DC		G	|
240V DC		H	|
63.5V AC		J	0
110V AC		K	0
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG111 Auxiliary Relay (AR112SB)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR112SB)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|	|		|	|	|	|
D.C. voltage operated relay with series break contact to reduce relay burden to zero after operation.						|	|		|	|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|	|		|	|	|	|
Single element						1	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|	|		|	|	|	|
Hand reset flag							1		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Contact operation									|	|	|	|	|		|	|	|	|
Hand reset contacts									2	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
5 NO										F	|	|	|		|	|	|	|
6 NO										G	|	|	|		|	|	|	|
7 NO										H	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
7 NC											H	|	|		|	|	|	|
8 NC											J	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts [2)]												|	|		|	|	|	|
Two												0	|		|	|	|	|
Four												1	|		|	|	|	|
Six												3	|		|	|	|	|
Eight												5	|		|	|	|	|
													|		|	|	|	|
Contact type [1)]													|		|	|	|	|
NO (Standard) / NC (Standard / 1 SB)													4		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
																	|	|
Voltage rating																	|	|
12V DC																	A	|

3.1

Product Description	Order No.		
24V DC		B	|
30V DC		C	|
50V DC		D	|
60V DC		E	|
125V DC		F	|
220V DC		G	|
240V DC		H	|
63.5V AC		J	0
110V AC		K	0
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) One NO contact allocated for series break

2) Number of contacts must match selected contact arrangement

Ordering Information - 7PG111 Auxiliary Relay (AR113)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR113)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|	|		|	|	|	|
A.C. or D.C. voltage operated relay.						|	|		|	|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|	|		|	|	|	|
Single element						1	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|	|		|	|	|	|
Hand reset flag							1		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Contact operation									|	|	|	|	|		|	|	|	|
Hand and electrical reset contacts									3	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
5 NO										F	|	|	|		|	|	|	|
6 NO										G	|	|	|		|	|	|	|
7 NO										H	|	|	|		|	|	|	|
8 NO										J	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
7 NC											H	|	|		|	|	|	|
8 NC											J	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts [1)]												|	|		|	|	|	|
Four												1	|		|	|	|	|
Six												3	|		|	|	|	|
Eight												5	|		|	|	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
																	|	|
Voltage rating																	|	|
12V DC																	A	|
24V DC																	B	|

Product Description	Order No.		
30V DC		C	|
50V DC		D	|
60V DC		E	|
125V DC		F	|
220V DC		G	|
240V DC		H	|
63.5V AC		J	0
110V AC		K	0
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG111 Auxiliary Relay (AR114)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR114)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|	|		|	|	|	|
A.C. or D.C. voltage operated relay.						|	|		|	|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|	|		|	|	|	|
Single element						1	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|	|		|	|	|	|
Hand reset flag							1		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Contact operation									|	|	|	|	|		|	|	|	|
Hand and self reset contacts									4	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
5 NO										F	|	|	|		|	|	|	|
6 NO										G	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts [2)]												|	|		|	|	|	|
Four												1	|		|	|	|	|
Six												3	|		|	|	|	|
													|		|	|	|	|
Contact type [1)]													|		|	|	|	|
NO (Self Reset) / NC (Self Reset / 2 Hand Reset)													1		|	|	|	|
NO (Self Reset / 2 Hand Reset) / NC (Self Reset)													2		|	|	|	|
NO (Self Reset / 1 Hand Reset) / NC (Self Reset / 1 Hand Reset)													3		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
																	|	|
Voltage rating																	|	|
12V DC																	A	|
24V DC																	B	|
30V DC																	C	|
50V DC																	D	|
60V DC																	E	|

Product Description	Order No.		
125V DC		F	|
220V DC		G	|
240V DC		H	|
63.5V AC		J	0
110V AC		K	0
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) Hand reset contacts are fitted as 2NO, 2NC or 1NO/1NC, remaining contacts are self reset in any combination

2) Number of contacts must match selected contact arrangement

Ordering Information - 7PG111 Auxiliary Relay (AR211, AR212)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR211, AR212)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|		|	|	|	|
A.C. or D.C. voltage operated relay.						|	|		|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|		|	|	|	|
Two element						2	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|		|	|	|	|
Hand reset flag							1		|	|	|	|		|	|	|	|
									|	|	|	|		|	|	|	|
Contact operation									|	|	|	|		|	|	|	|
Self reset contacts									1	|	|	|	|		|	|	|	|
Hand reset contacts									2	|	|	|	|		|	C	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
5 NO										F	|	|	|		|	|	|	|
6 NO										G	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts/element [1)]												|	|		|	|	|	|
Two												0	|		|	A	|	|
Four												1	|		|	C	|	|
Six												3	|		|	C	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
Case size E4 (4U high)																C	|	|
																	|	|
Voltage rating																	|	|
12V DC																	A	|
24V DC																	B	|
30V DC																	C	|

Product Description	Order No.		
50V DC		D	|
60V DC		E	|
125V DC		F	|
220V DC		G	|
240V DC		H	|
63.5V AC		J	0
110V AC		K	0
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG111 Auxiliary Relay (AR212SB)

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR212SB)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|	|		|	|	|	|
D.C. voltage operated relay with series break contact to reduce relay burden to zero after operation						|	|		|	|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|	|		|	|	|	|
Two element						2	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|	|		|	|	|	|
Hand reset flag							1		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Contact operation									|	|	|	|	|		|	|	|	|
Hand reset contacts									2	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
5 NO										F	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts [2)]												|	|		|	|	|	|
Two												0	|		|	|	|	|
Four												1	|		|	|	|	|
Six												3	|		|	|	|	|
													|		|	|	|	|
Contact type [1)]													|		|	|	|	|
NO (Standard) / NC (Standard / 1 SB)													4		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E4 (4U high)																C	|	|
																	|	|
Voltage rating																	|	|
12V DC																	A	|
24V DC																	B	|
30V DC																	C	|
50V DC																	D	|
60V DC																	E	|
125V DC																	F	|

Product Description	Order No.		
220V DC		G	|
240V DC		H	|
63.5V AC		J	0
110V AC		K	0
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) One NO contact allocated for series break

2) Number of contacts must match selected contact arrangement

Ordering Information - 7PG111 Auxiliary Relay (AR121)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR121)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|	|		|	|	|	|
A.C. or D.C. voltage operated relay.						|	|		|	|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|	|		|	|	|	|
Single element						1	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|	|		|	|	|	|
Hand reset reverse acting flag							2		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Contact operation									|	|	|	|	|		|	|	|	|
Self reset contacts									1	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
5 NO										F	|	|	|		|	|	|	|
6 NO										G	|	|	|		|	|	|	|
7 NO										H	|	|	|		|	|	|	|
8 NO										J	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
7 NC											H	|	|		|	|	|	|
8 NC											J	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts [1)]												|	|		|	|	|	|
Two												0	|		|	|	|	|
Four												1	|		|	|	|	|
Six												3	|		|	|	|	|
Eight												5	|		|	|	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
																	|	|
Voltage rating																	|	|
12V DC																	A	|

Product Description	Order No.		
24V DC		B	|
30V DC		C	|
50V DC		D	|
60V DC		E	|
125V DC		F	|
220V DC		G	|
240V DC		H	|
63.5V AC		J	0
110V AC		K	0
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG111 Auxiliary Relay (AR124)

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR124)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|	|		|	|	|	|
A.C. or D.C. voltage operated relay.						|	|		|	|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|	|		|	|	|	|
Single element						1	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|	|		|	|	|	|
Hand reset reverse acting flag							2		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Contact operation									|	|	|	|	|		|	|	|	|
Hand and self reset contacts									4	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
5 NO										F	|	|	|		|	|	|	|
6 NO										G	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts [1)]												|	|		|	|	|	|
Four												1	|		|	|	|	|
Six												3	|		|	|	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Self Reset) / NC (Self Reset / 2 Hand Reset)													1		|	|	|	|
NO (Self Reset / 2 Hand Reset) / NC (Self Reset)													2		|	|	|	|
NO (Self Reset / 1 Hand Reset) / NC (Self Reset / 1 Hand Reset)													3		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
																	|	|
Voltage rating																	|	|
12V DC																	A	|
24V DC																	B	|
30V DC																	C	|
50V DC																	D	|
60V DC																	E	|

Product Description	Order No.		
125V DC		F	|
220V DC		G	|
240V DC		H	|
63.5V AC		J	0
110V AC		K	0
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG111 Auxiliary Relay (AR221)

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR221)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|	|		|	|	|	|
A.C. or D.C. voltage operated relay.						|	|		|	|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|	|		|	|	|	|
Two element						2	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|	|		|	|	|	|
Hand reset reverse acting flag							2		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Contact operation									|	|	|	|	|		|	|	|	|
Self reset contacts									1	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
5 NO										F	|	|	|		|	|	|	|
6 NO										G	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts [1)]												|	|		|	|	|	|
Two												0	|		|	A	|	|
Four												1	|		|	C	|	|
Six												3	|		|	C	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
Case size E4 (4U high)																C	|	|
																	|	|
Voltage rating																	|	|
12V DC																	A	|
24V DC																	B	|
30V DC																	C	|
50V DC																	D	|
60V DC																	E	|

Product Description	Order No.		
125V DC		F	|
220V DC		G	|
240V DC		H	|
63.5V AC		J	0
110V AC		K	0
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG111 Auxiliary Relay (AR131, AR136)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR131, AR136)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|		|	|	|	|
A.C. or D.C. voltage operated relay.						|	|		|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|		|	|	|	|
Single element						1	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|		|	|	|	|
Self reset flag							3		|	|	|	|		|	|	|	|
									|	|	|	|		|	|	|	|
Contact operation									|	|	|	|		|	|	|	|
Self reset contacts									1	|	|	|	|		|	|	|	|
Electrical reset contacts									6	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
5 NO										F	|	|	|		|	|	|	|
6 NO										G	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts [1)]												|	|		|	|	|	|
Two												0	|		|	|	|	|
Four												1	|		|	|	|	|
Six												3	|		|	|	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
																	|	|
Voltage rating																	|	|
12V DC																	A	|
24V DC																	B	|
30V DC																	C	|
50V DC																	D	|

Product Description	Order No.		
60V DC		E	|
125V DC		F	|
220V DC		G	|
240V DC		H	|
63.5V AC		J	0
110V AC		K	0
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG111 Auxiliary Relay (AR133)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR133)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|	|		|	|	|	|
A.C. or D.C. voltage operated relay.						|	|		|	|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|	|		|	|	|	|
Single element						1	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|	|		|	|	|	|
Self reset flag							3		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Contact operation									|	|	|	|	|		|	|	|	|
Hand and electrical reset contacts									3	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
5 NO										F	|	|	|		|	|	|	|
6 NO										G	|	|	|		|	|	|	|
7 NO										H	|	|	|		|	|	|	|
8 NO										J	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
7 NC											H	|	|		|	|	|	|
8 NC											J	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts [1)]												|	|		|	|	|	|
Two												0	|		|	|	|	|
Four												1	|		|	|	|	|
Six												3	|		|	|	|	|
Eight												5	|		|	|	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
																	|	|
Voltage rating																	|	|
12V DC																	A	|

Product Description	Order No.		
24V DC		B	|
30V DC		C	|
50V DC		D	|
60V DC		E	|
125V DC		F	|
220V DC		G	|
240V DC		H	|
63.5V AC		J	0
110V AC		K	0
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG111 Auxiliary Relay (AR231)

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR231)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|	|		|	|	|	|
A.C. or D.C. voltage operated relay.						|	|		|	|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|	|		|	|	|	|
Two element						2	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|	|		|	|	|	|
Self reset flag							3		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Contact operation									|	|	|	|	|		|	|	|	|
Self reset contacts									1	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts/element [1)]												|	|		|	|	|	|
Two												0	|		|	A	|	|
Four												1	|		|	C	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
Case size E4 (4U high)																C	|	|
																	|	|
Voltage rating																	|	|
12V DC																	A	|
24V DC																	B	|
30V DC																	C	|
50V DC																	D	|
60V DC																	E	|
125V DC																	F	|
220V DC																	G	|
240V DC																	H	|
63.5V AC																	J	0
110V AC																	K	0

Product Description	Order No.		
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG111 Auxiliary Relay (AR141)

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR141)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|	|		|	|	|	|
A.C. or D.C. voltage operated relay.						|	|		|	|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|	|		|	|	|	|
Single element						1	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|	|		|	|	|	|
Self reset reverse acting flag							4		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Contact operation									|	|	|	|	|		|	|	|	|
Self reset contacts									1	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
5 NO										F	|	|	|		|	|	|	|
6 NO										G	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts [1)]												|	|		|	|	|	|
Two												0	|		|	|	|	|
Four												1	|		|	|	|	|
Six												3	|		|	|	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
																	|	|
Voltage rating																	|	|
12V DC																	A	|
24V DC																	B	|
30V DC																	C	|
50V DC																	D	|
60V DC																	E	|
125V DC																	F	|

Product Description	Order No.		
220V DC		G	|
240V DC		H	|
63.5V AC		J	0
110V AC		K	0
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG111 Auxiliary Relay (AR241)

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Auxiliary relay (AR241)	7	P	G	1	1	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|	|		|	|	|	|
A.C. or D.C. voltage operated relay.						|	|		|	|	|	|	|		|	|	|	|
Number of elements						|	|		|	|	|	|	|		|	|	|	|
Two element						2	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Type of flag							|		|	|	|	|	|		|	|	|	|
Self reset reverse acting flag							4		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Contact operation									|	|	|	|	|		|	|	|	|
Self reset contacts									1	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts [1)]												|	|		|	|	|	|
Two												0	|		|	A	|	|
Four												1	|		|	C	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Time delay															|	|	|	|
No additional time delay															0	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
Case size E4 (4U high)																C	|	|
																	|	|
Voltage rating																	|	|
12V DC																	A	|
24V DC																	B	|
30V DC																	C	|
50V DC																	D	|
60V DC																	E	|
125V DC																	F	|
220V DC																	G	|
240V DC																	H	|
63.5V AC																	J	0
110V AC																	K	0

Product Description	Order No.		
220V AC		L	0
240V AC		M	0
			|
Back emf suppression diode			|
Not Fitted			0
Fitted			1

NOTE

1) Number of contacts must match selected contact arrangement

7PG15 High Speed Trip Relay – Devices and Application

[sc_7PG15_profile, 1, --_--]

Description

The 7PG15 TR relay has a range of multi-contact attracted armature relays designed to both IEC 255-5 and BS142 standards. A wide range of models are available to meet the requirements of the electric supply industry.

- Low burden, TR series
  Type TR1 relays are suitable for application for tripping and auxiliary duties where immunity to capacitance discharge is not required. These relays are not intended for use with current operated series follower relays.
- High burden, TR2 series
  High burden relays with immunity to capacitance discharge currents. They are also suitable for certain applications where they are remote from the initiation signal.
  A high burden also permits reliable operation of current operated series repeat relays. TR relays can be provided with an instantaneous or time-delayed cut-off.
- Low burden relay, TR312
  Designed to meet the requirements of NGC specification P15, this is an electrically reset relay (no flag indicator) with additional terminals in the economy circuit to enable a direct connection to the DC supply.
  This arrangement allows a reduction in the break duty of the initiating contact.
- Switching relay, TR431
  Designed to meet the requirements of NGC TDM 5/11, this is an electrically reset relay with a flag indicator which follows the contact operation. These relays are intended to switch protection and auto reclose equipment in and out of service when controlled over pilot wires from a remote point. They are intended to operate from a remote DC 50 V battery with a pilot loop resistance of up to 200 Ω.
- Protection unstabilizing relay, TR512
  Designed to meet the requirements of NGC specification P11, this is a self reset relay without a flag indicator.
- Special purpose relays, TR9 series
  This designation identifies TR relays designed to meet a special purpose e.g. TR901 is a high burden repeat relay, a type TR231 with a 2 position flag indicator used as a plant follower relay for circuit breakers and disconnectors.

Benefits

The benefits of the High Speed Trip Relay are:

- High speed, high burden, positive action, and instantaneous cutoff.
- The 7PG15 trip relay can be used with the Trip Circuit Supervision relay (7PG17, XR250 to XR351) to monitor and supervise the integrity of the trip circuit with coil supervision terminal.
- It is supplied in a draw-out type case.
- The relay has a robust design for a long, reliable service life.
- The trip relay coil may be supervised using a trip relay supervision relay (7PG17, XR151).

Standard Variants

Standard Variants for 7PG15		
TR112	7 or 11 contacts	
	Modular case size – E4	
	Contact reset arrangement – Self	
	Operating coil cut-off – Economy	
	Specification – EB1	
	Burden level – Low	
TR121	7 or 11 contacts	
	Modular case size – E2	
	Contact reset arrangement – Hand	
	Operating coil cut-off – Instantaneous	
	Specification – EB1	
	Burden level – Low	
TR131	6 or 10 contacts	
	Modular case size – E2	
	Contact reset arrangement – Electrical	
	Operating coil cut-off – Instantaneous	
	Specification – EB1	
	Burden level – Low	
TR141	6 or 10 contacts	
	Modular case size – E2	
	Contact reset arrangement – Hand and electrical	
	Operating coil cut-off – Instantaneous	
	Specification – EB1	
	Burden level – Low	
TR212	6, 10 or 20 contacts	
	Modular case size – E2 or E4	
	Contact reset arrangement – Self	
	Operating coil cut-off – Economy	
	Specification – EB2	
	Burden level – High	
TR214	5 or 10 contacts	
	Modular case size – E4	
	Contact reset arrangement – Self	
	Operating coil cut-off – Economy 2 s delayed reset	
	Specification – EB2	
	Burden level – High	
TR221	7 or 11 contacts	
	Modular case size – E2	
	Contact reset arrangement – Hand	
	Operating coil cut-off – Instantaneous	
	Specification – EB2	
	Burden level – High	

7PG15 High Speed Trip Relay – Devices and Application

TR223	7 or 11 contacts	
	Modular case size – E4	
	Contact reset arrangement – Hand	
	Operating coil cut-off – 40 ms/60 ms delay	
	Specification – EB2	
	Burden level – High	
TR231	6 or 10 contacts	
	Modular case size – E2	
	Contact reset arrangement – Electrical	
	Operating coil cut-off – Instantaneous	
	Specification – EB2	
	Burden level – High	
TR233	6 or 10 contacts	
	Modular case size – E4	
	Contact reset arrangement – Electrical	
	Operating coil cut-off – 40 ms/60 ms delay	
	Specification – EB2	
	Burden level – High	
TR241	6, 10 or 20 contacts	
	Modular case size – E2 or E4	
	Contact reset arrangement – Hand and electrical	
	Operating coil cut-off – Instantaneous	
	Specification – EB2	
	Burden level – High	
TR243	6 or 10 contacts	
	Modular case size – E4	
	Contact reset arrangement – Hand and electrical	
	Operating coil cut-off – 40 ms/60 ms delay	
	Specification – EB2	
	Burden level – High	
TR312	5 contacts	
	Modular case size – E4	
	Contact reset arrangement – Self	
	Operating coil cut-off – Economy	
	Specification – NGC P15	
	Burden level – Low	
TR431	7 contacts	
	Modular case size – E4	
	Contact reset arrangement – Electrical	
	Operating coil cut-off – Instantaneous	
	Specification – NGC TDM.5/11	
	Burden level – Low	
TR512	6 contacts	
	Modular case size – E4	
	Contact reset arrangement – Self	
	Operating coil cut-off – Economy	
	Specification – NGC P11	
	Burden level – High	

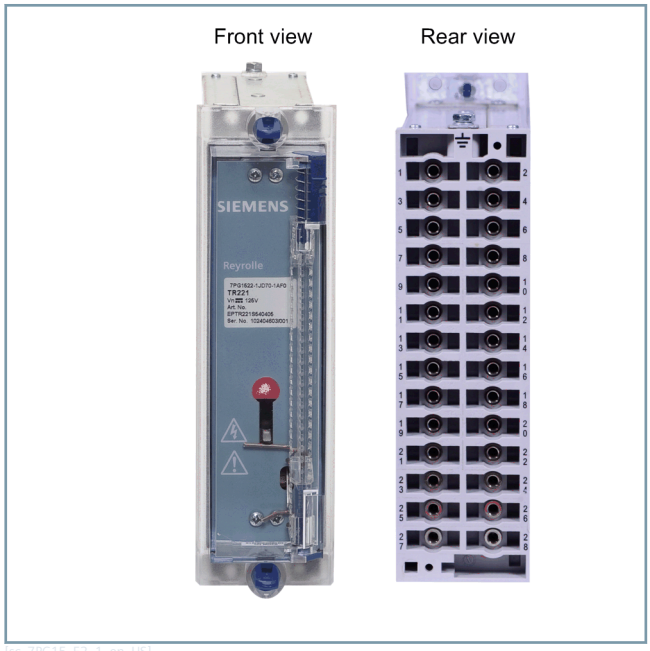
TR901	10 contacts	
	Modular case size – E2	
	Contact reset arrangement – Electrical	
	Operating coil cut-off – Instantaneous	
	Specification – EB2	
	Burden level – High	

Table 3.2/1 Standard Variants for 7PG15

Hardware Construction

The device is housed in a draw-out case designed for panel mounting.

The rear connection comprises of M4 screw terminals suitable for ring type crimps.



[sc_7PG15_E2, 1, en_US]

Figure 3.2/1 Size E2

[sc_7PG15_E4, 1, en_US]

Figure 3.2/2 Size E4

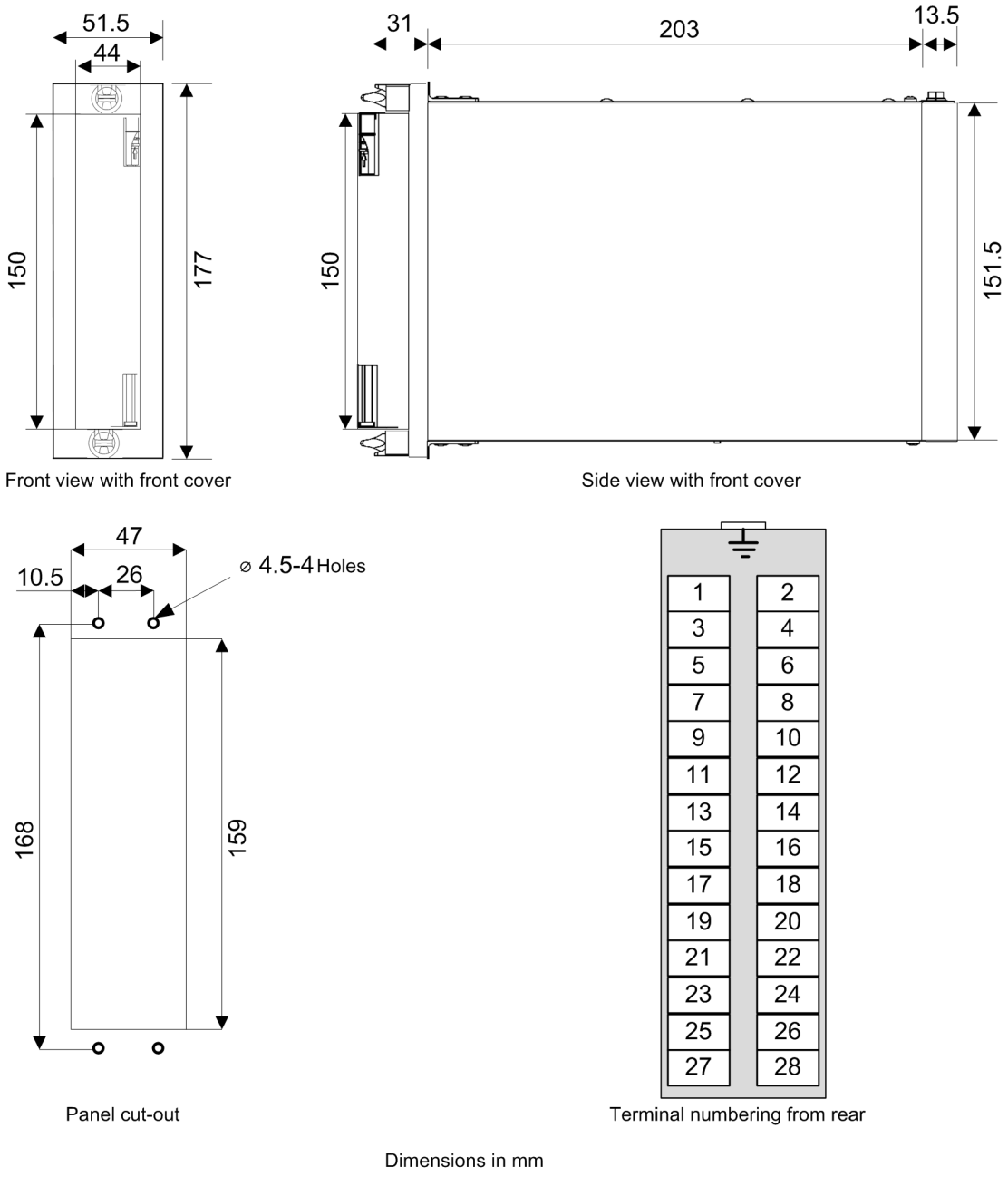
Relay Information

The device fascia displays the MLFB order code, serial number, and device identification reference.

	Electrical Hazard
CE	European CE marking
	Refer to device documentation
	Waste Electrical and Electronic Equipment Directive (WEEE)
EAC	Guideline for the Eurasian Market

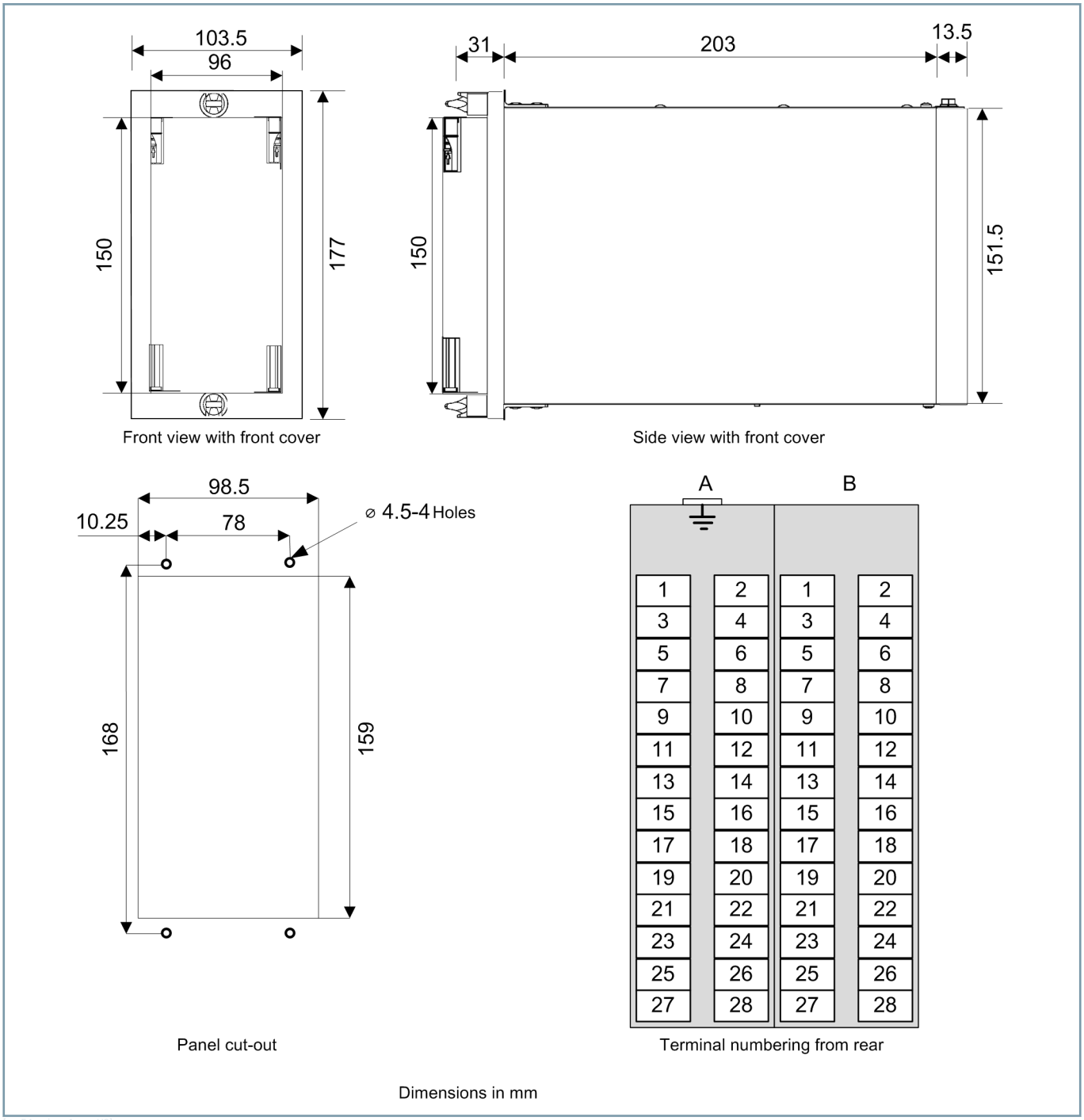
Dimension Drawings

This section displays the different dimensional views of a High Speed Trip Relay.



[sc_E2casing, 1, en_US]

Figure 3.2/3 E2 Case



[sc_E4casing, 1, en_US]

Figure 3.2/4 E4 Case

Connection Diagrams

Please refer to the Siemens website for the connection diagrams.

Technical Data

Indication of Conformity

This product complies with the directive of the Council of the European Communities on the harmonization of the laws of the Member States relating to electrical equipment for use within specified voltage limits (Low Voltage Directive 2014/35/EU) as well as restriction on usage of hazardous substances in electrical and electronic equipment (RoHS Directive 2011/65/EU).

This conformity has been proved by tests conducted by Siemens AG in accordance of the Council Directive in accordance with the product standard IEC/EN 60255-27 for the low-voltage directive.

RoHS directive 2011/65/EU is met using the standard EN 50581. The device has been designed and produced for industrial use.

General Technical Data

Parameter	Value
Operate time	10 ms at rated voltage
Rated voltage V_{rated}	DC 24 V, DC 30 V, DC 48 V, DC 125 V, DC 240 V [69]
Operating range	50 % to 120 % of rated voltage [70] [71]

Nominal Burdens

	Burden (W)	
Rated voltage	TR1	TR2
DC 30 V	43	43
DC 48 V	46	52
DC 125 V	47	127
Reset coil	50	50

NOTE

Relays with economy circuits reduce to approximately 7 W after operation.

Contact Ratings

Make and carry continuously	AC 1250 VA or DC 1250 W within limits of 660 V and 5 A
Make and carry for 3 s	AC 7500 VA or DC 7500 W within limits of 660 V and 30 A
Break	AC 1250 VA or DC 100 W (resistive) or DC 50 W (inductive) within limits of 250 V and 5 A
Indication	TR1 and TR2 relays have a hand reset mechanical flag indicator. TR4 and TR9 relays have a self reset flag indicator.

Mechanical Tests

Test	Reference	Requirement
Vibration	IEC 60255-21-1	Class I
Shock and bump	IEC 60255-21-2 and BS142, 1.5.2 (1989)	Class I

Electrical Tests

Test	Standard
Insulation resistance	IEC 60255-4, 5 kV 1.2/50 µs waveform 2 kV RMS 50 Hz for 1 min (2.5 kV for 1 s) between all terminals and earth. IEC 60255-5 and BS142, 1 kV RMS 50 Hz for 1 min across make contacts.

Climatic Environmental Tests

Temperature

IEC 60068-2-1/IEC 60068-2-2 and BS2011 (1977)

Ambient operating temperature	-10 °C to +55 °C
Storage temperature (non-operational)	-25 °C to +70 °C

Humidity

IEC 60068-2-30

Damp heat test, cyclic	56 days at 40 °C and 95 % relative humidity

69 DC 24 V and DC 240 V ratings are not part of ESI 48-4.

70 Operating coils of self-reset and economy cut-off relays are rated at 120 % of rated voltage. All other operate and reset coils are short time rated well in excess of the operating time of their cut-off contacts. Self-reset relays will reset at not less than 5 % rated voltage.

71 The operating range for the 20 contact TR212 device is 70 % to 110 % of rated voltage (Starting with product code 7PG1521-2XX80).

Ordering Information – 7PG15

Product Description	Order Number																
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR112)	7	P	G	1	5	1	1	–	2	□	□	□	0	–	1	C	□	0
Self reset, low burden, tripping relay						|	|		|	|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|	|		|	|	|	
TR1: Low burden, EB1						1	|		|	|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|	|		|	|	|	
Self reset contacts							1		|	|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|	|		|	|	|	
Economy									2	|	|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|	|		|	|	|	
1 Make contact										B	G	|	|	|		|	|	|	
2 Make contact										C	|	|	|	|		|	|	|	
3 Make contact										D	|	|	|	|		|	|	|	
4 Make contact										E	|	|	|	|		|	|	|	
5 Make contact										F	|	|	|	|		|	|	|	
6 Make contact										G	|	|	|	|		|	|	|	
7 Make contact										H	|	|	|	|		|	|	|	
8 Make contact										J	D	|	|	|		|	|	|	
9 Make contact										K	C	|	|	|		|	|	|	
10 Make contact										L	B	|	|	|		|	|	|	
11 Make contact										M	A	|	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|	|		|	|	|	
0 Break contact											A	|	|	|		|	|	|	
1 Break contact											B	|	|	|		|	|	|	
2 Break contact											C	|	|	|		|	|	|	
3 Break contact											D	|	|	|		|	|	|	
4 Break contact											E	|	|	|		|	|	|	
5 Break contact											F	|	|	|		|	|	|	
6 Break contact											G	|	|	|		|	|	|	
7 Break contact											H	|	|	|		|	|	|	
8 Break contact											J	|	|	|		|	|	|	
9 Break contact											K	|	|	|		|	|	|	
Number of Contacts [72]												|	|	|		|	|	|	
7												4	|	|		|	|	|	
11												7	|	|		|	|	|	
Contact Type													|	|		|	|	|	
Make contact (standard) / Break contact (standard)													0	|		|	|	|	
Type of Flag															|	|	|	
Hand reset flag															1	|	|	
Housing Size																|	|	
Case size E4 (4U high)																C	|	
Voltage Rating																	|	
DC 24 V																	B	
DC 30 V																	C	
DC 50 V																	D	
DC 125 V																	F	
DC 240 V																	H	

3.2

72 The number of contacts must match the selected contact arrangement.

Ordering Information – 7PG15

Product Description	Order Number																
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR121)	7	P	G	1	5	1	2	–	1	□	□	□	0	–	1	A	□	0
Hand reset, low burden, tripping relay						|	|		|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|		|	|	|	
TR1: Low burden, EB1						1	|		|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|		|	|	|	
Hand reset contacts							2		|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|		|	|	|	
Instantaneous									1	|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|		|	|	|	
2 Make contact										C	|	|	|		|	|	|	
3 Make contact										D	|	|	|		|	|	|	
4 Make contact										E	|	|	|		|	|	|	
5 Make contact										F	|	|	|		|	|	|	
6 Make contact										G	|	|	|		|	|	|	
7 Make contact										H	|	|	|		|	|	|	
8 Make contact										J	D	|	|		|	|	|	
9 Make contact										K	C	|	|		|	|	|	
10 Make contact										L	B	|	|		|	|	|	
11 Make contact										M	A	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|		|	|	|	
0 Break contact											A	|	|		|	|	|	
1 Break contact											B	|	|		|	|	|	
2 Break contact											C	|	|		|	|	|	
3 Break contact											D	|	|		|	|	|	
4 Break contact											E	|	|		|	|	|	
5 Break contact											F	|	|		|	|	|	
6 Break contact											G	|	|		|	|	|	
7 Break contact											H	|	|		|	|	|	
8 Break contact											J	|	|		|	|	|	
9 Break contact											K	|	|		|	|	|	
Number of Contacts [73]												|	|		|	|	|	
7												4	|		|	|	|	
11												7	|		|	|	|	
Contact Type													|		|	|	|	
Make contact (standard) / Break contact (standard)													0		|	|	|	
Type of Flag															|	|	|	
Hand reset flag															1	|	|	
Housing Size																|	|	
Case size E2 (4U high)																A	|	
Voltage Rating																	|	
DC 24 V																	B	
DC 30 V																	C	
DC 50 V																	D	
DC 125 V																	F	
DC 240 V																	H	

3.2

73 The number of contacts must match the selected contact arrangement.

Ordering Information – 7PG15

Product Description	Order Number																	
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR131)	7	P	G	1	5	1	3	–	1	□	□	□	0	–	1	A	□	0
Electrical reset, low burden, tripping relay						|	|		|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|		|	|	|	
TR1: Low burden, EB1						1	|		|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|		|	|	|	
Electrical reset contacts							3		|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|		|	|	|	
Instantaneous									1	|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|		|	|	|	
1 Make contact										B	F	|	|		|	|	|	
2 Make contact										C	|	|	|		|	|	|	
3 Make contact										D	|	|	|		|	|	|	
4 Make contact										E	|	|	|		|	|	|	
5 Make contact										F	|	|	|		|	|	|	
6 Make contact										G	|	|	|		|	|	|	
7 Make contact										H	D	|	|		|	|	|	
8 Make contact										J	C	|	|		|	|	|	
9 Make contact										K	B	|	|		|	|	|	
10 Make contact										L	A	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|		|	|	|	
0 Break contact											A	|	|		|	|	|	
1 Break contact											B	|	|		|	|	|	
2 Break contact											C	|	|		|	|	|	
3 Break contact											D	|	|		|	|	|	
4 Break contact											E	|	|		|	|	|	
5 Break contact											F	|	|		|	|	|	
6 Break contact											G	|	|		|	|	|	
7 Break contact											H	|	|		|	|	|	
8 Break contact											J	|	|		|	|	|	
Number of Contacts [74]												|	|		|	|	|	
6												3	|		|	|	|	
10												6	|		|	|	|	
Contact Type													|		|	|	|	
Make contact (standard) / Break contact (standard)													0		|	|	|	
Type of Flag															|	|	|	
Hand reset flag															1	|	|	
Housing Size																|	|	
Case size E2 (4U high)																A	|	
Voltage Rating																	|	
DC 24 V																	B	
DC 30 V																	C	
DC 50 V																	D	
DC 125 V																	F	
DC 240 V																	H	

3.2

74 The number of contacts must match the selected contact arrangement.

Ordering Information – 7PG15

Product Description	Order Number																
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR141)	7	P	G	1	5	1	4	–	1	□	□	□	0	–	1	A	□	0
Hand and electrical reset, low burden, tripping relay						|	|		|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|		|	|	|	
TR1: Low burden, EB1						1	|		|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|		|	|	|	
Hand and electrical reset contacts							4		|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|		|	|	|	
Instantaneous									1	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|		|	|	|	
1 Make contact										B	F	|		|	|	|	
2 Make contact										C	|	|		|	|	|	
3 Make contact										D	|	|		|	|	|	
4 Make contact										E	|	|		|	|	|	
5 Make contact										F	|	|		|	|	|	
6 Make contact										G	|	|		|	|	|	
7 Make contact										H	D	|		|	|	|	
8 Make contact										J	C	|		|	|	|	
9 Make contact										K	B	|		|	|	|	
10 Make contact										L	A	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|		|	|	|	
0 Break contact											A	|	|		|	|	|	
1 Break contact											B	|	|		|	|	|	
2 Break contact											C	|	|		|	|	|	
3 Break contact											D	|	|		|	|	|	
4 Break contact											E	|	|		|	|	|	
5 Break contact											F	|	|		|	|	|	
6 Break contact											G	|	|		|	|	|	
7 Break contact											H	|	|		|	|	|	
8 Break contact											J	|	|		|	|	|	
Number of Contacts [75]												|	|		|	|	|	
6												3	|		|	|	|	
10												6	|		|	|	|	
Contact Type													|		|	|	|	
Make contact (standard) / Break contact (standard)													0		|	|	|	
Type of Flag															|	|	|	
Hand reset flag															1	|	|	
Housing Size																|	|	
Case size E2 (4U high)																A	|	
Voltage Rating																	|	
DC 24 V																	B	
DC 30 V																	C	
DC 50 V																	D	
DC 125 V																	F	
DC 240 V																	H	

75 The number of contacts must match the selected contact arrangement.

Ordering Information – 7PG15

Product Description	Order Number																	
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR212, TR214 (6 and 10 Contact))	7	P	G	1	5	2	1	–	□	□	□	□	0	–	1	□	□	0
Self reset, high burden, tripping relay						|	|		|	|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|	|		|	|	|	
TR2: High burden, EB2						2	|		|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|		|	|	|	
Self reset contacts							1		|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|		|	|	|	
Economy									2	|	|	|	|		|	|	|	
Economy and 2 s delay on reset									4	|	|	|	|		|	C	|	
Contact Arrangement – Make Contact										|	|	|	|		|	|	|	
1 Make contact										B	F	|	|		|	|	|	
2 Make contact										C	|	|	|		|	|	|	
3 Make contact										D	|	|	|		|	|	|	
4 Make contact										E	|	|	|		|	|	|	
5 Make contact										F	|	|	|		|	|	|	
6 Make contact										G	|	|	|		|	|	|	
7 Make contact										H	D	|	|		|	|	|	
8 Make contact										J	C	|	|		|	|	|	
9 Make contact										K	B	|	|		|	|	|	
10 Make contact										L	A	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|		|	|	|	
0 Break contact											A	|	|		|	|	|	
1 Break contact											B	|	|		|	|	|	
2 Break contact											C	|	|		|	|	|	
3 Break contact											D	|	|		|	|	|	
4 Break contact											E	|	|		|	|	|	
5 Break contact											F	|	|		|	|	|	
6 Break contact											G	|	|		|	|	|	
7 Break contact											H	|	|		|	|	|	
8 Break contact											J	|	|		|	|	|	
Number of Contacts [76]												|	|		|	|	|	
6												3	|		|	|	|	
10												6	|		|	|	|	
Contact Type													|		|	|	|	
Make contact (standard) / Break contact (standard)													0		|	|	|	
Type of Flag															|	|	|	
Hand reset flag															1	|	|	
Housing Size																|	|	
Case size E2 (4U high)																A	|	
Case size E4 (4U high)																C	|	
Voltage Rating																	|	
DC 24 V																	B	
DC 30 V																	C	
DC 50 V																	D	
DC 125 V																	F	
DC 240 V																	H	

3.2

76 The number of contacts must match the selected contact arrangement.

Ordering Information – 7PG15

Product Description	Order Number																
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR212 (20 Contact))	7	P	G	1	5	2	1	–	2	□	□	8	0	–	1	C	□	0
Self reset, high burden, tripping relay						|	|		|	|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|	|		|	|	|	
TR2: High burden, EB2						2	|		|	|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|	|		|	|	|	
Self reset contacts							1		|	|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|	|		|	|	|	
Economy									2	|	|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|	|		|	|	|	
10 Make contact										L	|	|	|	|		|	|	|	
11 Make contact										M	|	|	|	|		|	|	|	
12 Make contact										N	|	|	|	|		|	|	|	
13 Make contact										P	|	|	|	|		|	|	|	
14 Make contact										Q	|	|	|	|		|	|	|	
15 Make contact										R	|	|	|	|		|	|	|	
16 Make contact										S	|	|	|	|		|	|	|	
17 Make contact										T	|	|	|	|		|	|	|	
18 Make contact										U	|	|	|	|		|	|	|	
19 Make contact										V	|	|	|	|		|	|	|	
20 Make contact										W	|	|	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|	|		|	|	|	
0 Break contact											A	|	|	|		|	|	|	
1 Break contact											B	|	|	|		|	|	|	
2 Break contact											C	|	|	|		|	|	|	
3 Break contact											D	|	|	|		|	|	|	
4 Break contact											E	|	|	|		|	|	|	
5 Break contact											F	|	|	|		|	|	|	
6 Break contact											G	|	|	|		|	|	|	
7 Break contact											H	|	|	|		|	|	|	
8 Break contact											J	|	|	|		|	|	|	
9 Break contact											K	|	|	|		|	|	|	
10 Break contact											L	|	|	|		|	|	|	
Number of Contacts [77]												|	|	|	|	|	|	
20												8	|	|	|	|	|	
Contact Type													|	|	|	|	|	
Make contact (standard) / Break contact (standard)													0	|	|	|	|	
Type of Flag															|	|	|	
Hand reset flag															1	|	|	
Housing Size																|	|	
Case size E4 (4U high)																C	|	
Voltage Rating																	|	
DC 125 V																	F	

3.2

77 The number of contacts must match the selected contact arrangement.

Ordering Information – 7PG15

Product Description	Order Number																
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR221)	7	P	G	1	5	2	2	–	1	□	□	□	0	–	1	A	□	0
Hand reset, high burden, tripping relay						|	|		|	|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|	|		|	|	|	
TR2: High burden, EB2						2	|		|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|		|	|	|	
Hand reset contacts							2		|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|		|	|	|	
Instantaneous									1	|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|		|	|	|	
3 Make contact										D	|	|	|		|	|	|	
4 Make contact										E	|	|	|		|	|	|	
5 Make contact										F	|	|	|		|	|	|	
6 Make contact										G	|	|	|		|	|	|	
7 Make contact										H	|	|	|		|	|	|	
8 Make contact										J	D	|	|		|	|	|	
9 Make contact										K	C	|	|		|	|	|	
10 Make contact										L	B	|	|		|	|	|	
11 Make contact										M	A	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|		|	|	|	
0 Break contact											A	|	|		|	|	|	
1 Break contact											B	|	|		|	|	|	
2 Break contact											C	|	|		|	|	|	
3 Break contact											D	|	|		|	|	|	
4 Break contact											E	|	|		|	|	|	
5 Break contact											F	|	|		|	|	|	
6 Break contact											G	|	|		|	|	|	
7 Break contact											H	|	|		|	|	|	
8 Break contact											J	|	|		|	|	|	
Number of Contacts [78]												|	|		|	|	|	
7												4	|		|	|	|	
11												7	|		|	|	|	
Contact Type													|		|	|	|	
Make contact (standard) / Break contact (standard)													0		|	|	|	
Type of Flag															|	|	|	
Hand reset flag															1	|	|	
Housing Size																|	|	
Case size E2 (4U high)																A	|	
Voltage Rating																	|	
DC 24 V																	B	
DC 30 V																	C	
DC 50 V																	D	
DC 125 V																	F	
DC 240 V																	H	

3.2

78 The number of contacts must match the selected contact arrangement.

Ordering Information – 7PG15

Product Description	Order Number																
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR223)	7	P	G	1	5	2	2	–	3	□	□	□	0	–	1	C	□	0
Hand reset, high burden, tripping relay						|	|		|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|		|	|	|	
TR2: High burden, EB2						2	|		|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|		|	|	|	
Hand reset contacts							2		|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|		|	|	|	
40 ms/60 ms delay									3	|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|		|	|	|	
3 Make contact										D	|	|	|		|	|	|	
4 Make contact										E	|	|	|		|	|	|	
5 Make contact										F	|	|	|		|	|	|	
6 Make contact										G	|	|	|		|	|	|	
7 Make contact										H	|	|	|		|	|	|	
8 Make contact										J	D	|	|		|	|	|	
9 Make contact										K	C	|	|		|	|	|	
10 Make contact										L	B	|	|		|	|	|	
11 Make contact										M	A	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|		|	|	|	
0 Break contact											A	|	|		|	|	|	
1 Break contact											B	|	|		|	|	|	
2 Break contact											C	|	|		|	|	|	
3 Break contact											D	|	|		|	|	|	
4 Break contact											E	|	|		|	|	|	
5 Break contact											F	|	|		|	|	|	
6 Break contact											G	|	|		|	|	|	
7 Break contact											H	|	|		|	|	|	
8 Break contact											J	|	|		|	|	|	
Number of Contacts [79]												|	|		|	|	|	
7												4	|		|	|	|	
11												7	|		|	|	|	
Contact Type													|		|	|	|	
Make contact (standard) / Break contact (standard)													0		|	|	|	
Type of Flag															|	|	|	
Hand reset flag															1	|	|	
Housing Size																|	|	
Case size E4 (4U high)																C	|	
Voltage Rating																	|	
DC 24 V																	B	
DC 30 V																	C	
DC 50 V																	D	
DC 125 V																	F	
DC 240 V																	H	

3.2

79 The number of contacts must match the selected contact arrangement.

Ordering Information – 7PG15

Product Description	Order Number																	
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR231)	7	P	G	1	5	2	3	–	1	□	□	□	0	–	1	A	□	0
Electrical reset, high burden, tripping relay						|	|		|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|		|	|	|	
TR2: High burden, EB2						2	|		|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|		|	|	|	
Electrical reset contacts							3		|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|		|	|	|	
Instantaneous									1	|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|		|	|	|	
0 Make contact										A	|	|	|		|	|	|	
1 Make contact										B	|	|	|		|	|	|	
2 Make contact										C	|	|	|		|	|	|	
3 Make contact										D	|	|	|		|	|	|	
4 Make contact										E	|	|	|		|	|	|	
5 Make contact										F	|	|	|		|	|	|	
6 Make contact										G	|	|	|		|	|	|	
7 Make contact										H	D	|	|		|	|	|	
8 Make contact										J	C	|	|		|	|	|	
9 Make contact										K	B	|	|		|	|	|	
10 Make contact										L	A	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|		|	|	|	
0 Break contact											A	|	|		|	|	|	
1 Break contact											B	|	|		|	|	|	
2 Break contact											C	|	|		|	|	|	
3 Break contact											D	|	|		|	|	|	
4 Break contact											E	|	|		|	|	|	
5 Break contact											F	|	|		|	|	|	
6 Break contact											G	|	|		|	|	|	
7 Break contact											H	|	|		|	|	|	
8 Break contact											J	|	|		|	|	|	
Number of Contacts [80]												|	|		|	|	|	
6												3	|		|	|	|	
10												6	|		|	|	|	
Contact Type													|		|	|	|	
Make contact (standard) / Break contact (standard)													0		|	|	|	
Type of Flag															|	|	|	
Hand reset flag															1	|	|	
Housing Size																|	|	
Case size E2 (4U high)																A	|	
Voltage Rating																	|	
DC 24 V																	B	
DC 30 V																	C	
DC 50 V																	D	
DC 125 V																	F	
DC 240 V																	H	

3.2

80 The number of contacts must match the selected contact arrangement.

Ordering Information – 7PG15

Product Description	Order Number																
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR233)	7	P	G	1	5	2	3	–	3	□	□	□	0	–	1	C	F	0
Electrical reset, high burden, tripping relay						|	|		|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|		|	|	|	
TR2: High burden, EB2						2	|		|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|		|	|	|	
Electrical reset contacts							3		|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|		|	|	|	
40 ms/60 ms delay									3	|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|		|	|	|	
2 Make contact										C	|	|	|		|	|	|	
3 Make contact										D	|	|	|		|	|	|	
4 Make contact										E	|	|	|		|	|	|	
5 Make contact										F	|	|	|		|	|	|	
6 Make contact										G	|	|	|		|	|	|	
7 Make contact										H	D	|	|		|	|	|	
8 Make contact										J	C	|	|		|	|	|	
9 Make contact										K	B	|	|		|	|	|	
10 Make contact										L	A	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|		|	|	|	
0 Break contact											A	|	|		|	|	|	
1 Break contact											B	|	|		|	|	|	
2 Break contact											C	|	|		|	|	|	
3 Break contact											D	|	|		|	|	|	
4 Break contact											E	|	|		|	|	|	
5 Break contact											F	|	|		|	|	|	
6 Break contact											G	|	|		|	|	|	
7 Break contact											H	|	|		|	|	|	
8 Break contact											J	|	|		|	|	|	
Number of Contacts [81]												|	|		|	|	|	
6												3	|		|	|	|	
10												6	|		|	|	|	
Contact Type													|		|	|	|	
Make contact (standard) / Break contact (standard)													0		|	|	|	
Type of Flag															|	|	|	
Hand reset flag															1	|	|	
Housing Size																|	|	
Case size E4 (4U high)																C	|	
Voltage Rating																	|	
DC 125 V																	F	

3.2

81 The number of contacts must match the selected contact arrangement.

Ordering Information – 7PG15

Product Description	Order Number																	
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR241 (6 and 10 Contact))	7	P	G	1	5	2	4	–	1	□	□	□	0	–	1	□	□	0
Hand and electrical reset, high burden, tripping relay						|	|		|	|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|	|		|	|	|	
TR2: High burden, EB2						2	|		|	|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|	|		|	|	|	
Hand and electrical reset contacts							4		|	|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|	|		|	|	|	
Instantaneous									1	|	|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|	|		|	|	|	
2 Make contact										C	|	|	|	|		|	|	|	
3 Make contact										D	|	|	|	|		|	|	|	
4 Make contact										E	|	|	|	|		|	|	|	
5 Make contact										F	|	|	|	|		|	|	|	
6 Make contact										G	|	|	|	|		|	|	|	
7 Make contact										H	D	|	|	|		|	|	|	
8 Make contact										J	C	|	|	|		|	|	|	
9 Make contact										K	B	|	|	|		|	|	|	
10 Make contact										L	A	|	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|	|		|	|	|	
0 Break contact											A	|	|	|		|	|	|	
1 Break contact											B	|	|	|		|	|	|	
2 Break contact											C	|	|	|		|	|	|	
3 Break contact											D	|	|	|		|	|	|	
4 Break contact											E	|	|	|		|	|	|	
5 Break contact											F	|	|	|		|	|	|	
6 Break contact											G	|	|	|		|	|	|	
7 Break contact											H	|	|	|		|	|	|	
8 Break contact											J	|	|	|		|	|	|	
Number of Contacts [82]												|	|	|		|	|	|	
6												3	|	|		|	|	|	
10												6	|	|		|	|	|	
Contact Type													|	|		|	|	|	
Make contact (standard) / Break contact (standard)													0	|		|	|	|	
Type of Flag															|	|	|	
Hand reset flag															1	|	|	
Housing Size																|	|	
Case size E2 (4U high)																A	|	
Case size E4 (4U high)																C	|	
Voltage Rating																	|	
DC 24 V																	B	
DC 30 V																	C	
DC 50 V																	D	
DC 125 V																	F	
DC 240 V																	H	

3.2

82 The number of contacts must match the selected contact arrangement.

Ordering Information – 7PG15

Product Description	Order Number																
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR241 (20 Contact))	7	P	G	1	5	2	4	–	1	□	□	8	0	–	1	C	□	0
Hand and electrical reset, high burden, tripping relay						|	|		|	|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|	|		|	|	|	
TR2: High burden, EB2						2	|		|	|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|	|		|	|	|	
Hand and electrical reset contacts							4		|	|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|	|		|	|	|	
Instantaneous									1	|	|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|	|		|	|	|	
10 Make contact										L	|	|	|	|		|	|	|	
11 Make contact										M	|	|	|	|		|	|	|	
12 Make contact										N	|	|	|	|		|	|	|	
13 Make contact										P	|	|	|	|		|	|	|	
14 Make contact										Q	|	|	|	|		|	|	|	
15 Make contact										R	|	|	|	|		|	|	|	
16 Make contact										S	|	|	|	|		|	|	|	
17 Make contact										T	|	|	|	|		|	|	|	
18 Make contact										U	|	|	|	|		|	|	|	
19 Make contact										V	|	|	|	|		|	|	|	
20 Make contact										W	|	|	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|	|		|	|	|	
0 Break contact											A	|	|	|		|	|	|	
1 Break contact											B	|	|	|		|	|	|	
2 Break contact											C	|	|	|		|	|	|	
3 Break contact											D	|	|	|		|	|	|	
4 Break contact											E	|	|	|		|	|	|	
5 Break contact											F	|	|	|		|	|	|	
6 Break contact											G	|	|	|		|	|	|	
7 Break contact											H	|	|	|		|	|	|	
8 Break contact											J	|	|	|		|	|	|	
9 Break contact											K	|	|	|		|	|	|	
10 Break contact											L	|	|	|		|	|	|	
Number of Contacts [83]												|	|	|		|	|	|	
20												8	|	|		|	|	|	
Contact Type													|	|		|	|	|	
Make contact (standard) / Break contact (standard)													0	|		|	|	|	
Type of Flag															|	|	|	
Hand reset flag															1	|	|	
Housing Size																|	|	
Case size E4 (4U high)																C	|	
Voltage Rating																	|	
DC 50 V																	D	
DC 125 V																	F	

3.2

83 The number of contacts must match the selected contact arrangement.

Ordering Information – 7PG15

Product Description	Order Number																	
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR243)	7	P	G	1	5	2	4	–	3	□	□	□	0	–	1	C	F	0
Hand and electrical reset, high burden, tripping relay						|	|		|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|		|	|	|	
TR2: High burden, EB2						2	|		|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|		|	|	|	
Hand and electrical reset contacts							4		|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|		|	|	|	
40 ms/60 ms delay									3	|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|		|	|	|	
2 Make contact										C	|	|	|		|	|	|	
3 Make contact										D	|	|	|		|	|	|	
4 Make contact										E	|	|	|		|	|	|	
5 Make contact										F	|	|	|		|	|	|	
6 Make contact										G	|	|	|		|	|	|	
7 Make contact										H	D	|	|		|	|	|	
8 Make contact										J	C	|	|		|	|	|	
9 Make contact										K	B	|	|		|	|	|	
10 Make contact										L	A	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|		|	|	|	
0 Break contact											A	|	|		|	|	|	
1 Break contact											B	|	|		|	|	|	
2 Break contact											C	|	|		|	|	|	
3 Break contact											D	|	|		|	|	|	
4 Break contact											E	|	|		|	|	|	
5 Break contact											F	|	|		|	|	|	
6 Break contact											G	|	|		|	|	|	
7 Break contact											H	|	|		|	|	|	
8 Break contact											J	|	|		|	|	|	
Number of Contacts [84]												|	|		|	|	|	
6												3	|		|	|	|	
10												6	|		|	|	|	
Contact Type													|		|	|	|	
Make contact (standard) / Break contact (standard)													0		|	|	|	
Type of Flag															|	|	|	
Hand reset flag															1	|	|	
Housing Size																|	|	
Case size E4 (4U high)																C	|	
Voltage Rating																	|	
DC 125 V																	F	

84 The number of contacts must match the selected contact arrangement.

Ordering Information – 7PG15

Product Description	Order Number																
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR312)	7	P	G	1	5	3	1	–	2	□	□	2	0	–	□	C	F	0
Self reset, low burden, tripping relay						|	|		|	|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|		|	|	|	
TR3: Low burden, CEGB spec. P15						3	|		|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|		|	|	|	
Self reset contacts							1		|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|		|	|	|	
Economy									2	|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|		|	|	|	
0 Make contact										A	|	|	|		|	|	|	
1 Make contact										B	|	|	|		|	|	|	
2 Make contact										C	|	|	|		|	|	|	
3 Make contact										D	|	|	|		|	|	|	
4 Make contact										E	|	|	|		|	|	|	
5 Make contact										F	|	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|		|	|	|	
0 Break contact											A	|	|		|	|	|	
1 Break contact											B	|	|		|	|	|	
2 Break contact											C	|	|		|	|	|	
3 Break contact											D	|	|		|	|	|	
4 Break contact											E	|	|		|	|	|	
5 Break contact											F	|	|		|	|	|	
Number of Contacts												|	|		|	|	|	
5												2	|		|	|	|	
Contact Type													|		|	|	|	
Make contact (standard) / Break contact (standard)													0		|	|	|	
Type of Flag															|	|	|	
No flag															0	|	|	
Hand reset flag															1	|	|	
Housing Size																|	|	
Case size E4 (4U high)																C	|	
Voltage Rating																	|	
DC 125 V																	F	

Ordering Information – 7PG15

Product Description	Order Number																
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR431)	7	P	G	1	5	4	3	–	1	□	□	□	0	–	3	C	N	0
Electrical reset, low burden, tripping relay						|	|		|	|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|		|	|	|	
TR4: Low burden, CEGB spec. TDM 5/11						4	|		|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|		|	|	|	
Electrical reset contacts							3		|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|		|	|	|	
Instantaneous									1	|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|		|	|	|	
0 Make contact										A	|	|	|		|	|	|	
1 Make contact										B	|	|	|		|	|	|	
2 Make contact										C	|	|	|		|	|	|	
3 Make contact										D	|	|	|		|	|	|	
4 Make contact										E	|	|	|		|	|	|	
5 Make contact										F	|	|	|		|	|	|	
6 Make contact										G	|	|	|		|	|	|	
7 Make contact										H	|	|	|		|	|	|	
8 Make contact										J	A	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|		|	|	|	
0 Break contact											A	|	|		|	|	|	
1 Break contact											B	|	|		|	|	|	
2 Break contact											C	|	|		|	|	|	
3 Break contact											D	|	|		|	|	|	
4 Break contact											E	|	|		|	|	|	
5 Break contact											F	|	|		|	|	|	
6 Break contact											G	|	|		|	|	|	
7 Break contact											H	|	|		|	|	|	
8 Break contact											J	|	|		|	|	|	
Number of Contacts [85]												|	|		|	|	|	
7												4	|		|	|	|	
8												5	|		|	|	|	
Contact Type													|		|	|	|	
Make contact (standard) / Break contact (standard)													0		|	|	|	
Type of Flag															|	|	|	
Self reset flag [86]															3	|	|	
Housing Size																|	|	
Case size E4 (4U high)																C	|	
Voltage Rating																	|	
DC 50 V/DC 125 V																	N	

85 The number of contacts must match the selected contact arrangement.

86 Flag indication "IN" and "OUT"

Ordering Information – 7PG15

Product Description	Order Number																
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR512)	7	P	G	1	5	5	1	–	2	□	□	3	0	–	0	C	□	0
Self reset, high burden, unstabilizing relay						|	|		|	|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|		|	|	|	
TR5: High burden, CEGB spec. P11						5	|		|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|		|	|	|	
Self reset contacts							1		|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|		|	|	|	
Economy									2	|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|		|	|	|	
2 Make contact										C	|	|	|		|	|	|	
3 Make contact										D	|	|	|		|	|	|	
4 Make contact										E	|	|	|		|	|	|	
5 Make contact										F	|	|	|		|	|	|	
6 Make contact										G	|	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|		|	|	|	
0 Break contact											A	|	|		|	|	|	
1 Break contact											B	|	|		|	|	|	
2 Break contact											C	|	|		|	|	|	
3 Break contact											D	|	|		|	|	|	
4 Break contact											E	|	|		|	|	|	
Number of Contacts												|	|		|	|	|	
6												3	|		|	|	|	
Contact Type													|		|	|	|	
Make contact (standard) / Break contact (standard)													0		|	|	|	
Type of Flag															|	|	|	
No flag															0	|	|	
Housing Size																|	|	
Case size E4 (4U high)																C	|	
Voltage Rating																	|	
DC 50 V																	D	
DC 125 V																	F	

Ordering Information – 7PG15

Product Description	Order Number																	
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Trip Relay (TR901)	7	P	G	1	5	6	3	–	1	□	□	6	0	–	3	A	□	0
Electrical reset, high burden, repeat relay						|	|		|	|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|	|		|	|	|	
TR9: High burden, EB2						6	|		|	|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|	|		|	|	|	
Electrical reset contacts							3		|	|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|	|		|	|	|	
Instantaneous									1	|	|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|	|		|	|	|	
2 Make contact										C	J	|	|	|		|	|	|	
3 Make contact										D	H	|	|	|		|	|	|	
4 Make contact										E	G	|	|	|		|	|	|	
5 Make contact										F	F	|	|	|		|	|	|	
6 Make contact										G	E	|	|	|		|	|	|	
7 Make contact										H	D	|	|	|		|	|	|	
8 Make contact										J	C	|	|	|		|	|	|	
9 Make contact										K	B	|	|	|		|	|	|	
10 Make contact										L	A	|	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|	|		|	|	|	
0 Break contact											A	|	|	|		|	|	|	
1 Break contact											B	|	|	|		|	|	|	
2 Break contact											C	|	|	|		|	|	|	
3 Break contact											D	|	|	|		|	|	|	
4 Break contact											E	|	|	|		|	|	|	
5 Break contact											F	|	|	|		|	|	|	
6 Break contact											G	|	|	|		|	|	|	
7 Break contact											H	|	|	|		|	|	|	
8 Break contact											J	|	|	|		|	|	|	
Number of Contacts												|	|	|		|	|	|	
10												6	|	|		|	|	|	
Contact Type													|	|		|	|	|	
Make contact (standard) / Break contact (standard)													0			|	|	|	
Type of Flag																|	|	|	
Self reset flag [87]															3	|	|	|	
Housing Size																|	|	|	
Case size E2 (4U high)																A	|	|	
Voltage Rating																	|	|	
DC 50 V																	D	|	
DC 125 V																	F	|	

3.2

87 Flag indication "OPEN" and "CLOSED"

7PG17 XR105, XR106, XR107, XR205 and XR206 Interposing Relays

[Reyrolle Product Catalogue, 7PG17 Interposing Relay, 1, -_-]

Description

Type XR205 and XR206 are two element versions of the XR105 and XR106 respectively with the same performance. Type XR relays are developments for specific applications from the type AR relay range. They are electro-mechanical relays with a consistent positive action, a long service life and complying with BS142. Type XR105 has no flag indicator, XR106 & XR107 have a hand reset flag. Both types are available with a suppression diode across the coil to reduce the effects of the back emf which occurs on switch-off.

Application

Types XR105/XR106/XR107 are intended for the remote control of switchgear and associated equipment over pilot wires with a maximum resistance of 200 ohms. These relays are designed so that they are not susceptible to certain a.c. voltage levels which may be induced onto the pilots wires.

Technical information

External resistor required for 125Vd.c. operation. Operating range: With zero pilot resistance 78 to 125 % of nominal rated voltage

With a maximum pilot loop resistance of 200ohm 92 to 125 % of nominal rated voltage. Burden: Typically 3.7W for a relay with 4 normally open contacts.

A.C. Rejection

For a 48Vd.c. rated relay, typically 110V 50Hz a.c. Operating time: For a relay rated 48Vd.c. with 4 normally open contacts at rated voltage typically 30 ms. With 200ohms pilot resistance less than 80 ms. Reset time is less than 35 ms

Contacts

2 normally open, 4 normally open or 2 normally open and 2 normally closed, self reset on XR105 & XR106.

Hand reset on XR107. Normal duty, contact ratings. Make and carry continuously 1250VAa.c. or 1250Wd.c. within the limits of 660V and 5A.

Make and carry for 3 seconds: 7500VAa.c. or 7500Wd.c. within the limits of 660V and 30A

Break: 1250VAa.c. or 100W (resistive) d.c. or 50W (inductive). L/R = 0.04, d.c. within the limits of 250V and 5A

Temperature

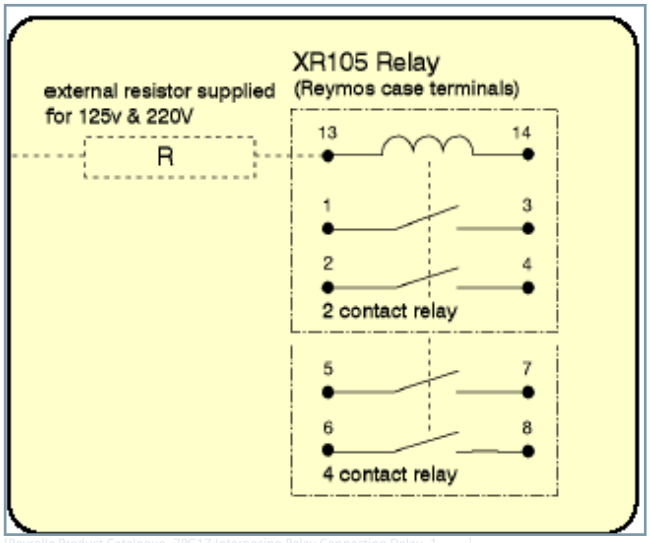
In service:	-10°C to 55°C
Storage	-25°C to 70°C

Mechanical durability

Vibration, relays comply with BS142, Section 2.1 Category S2.

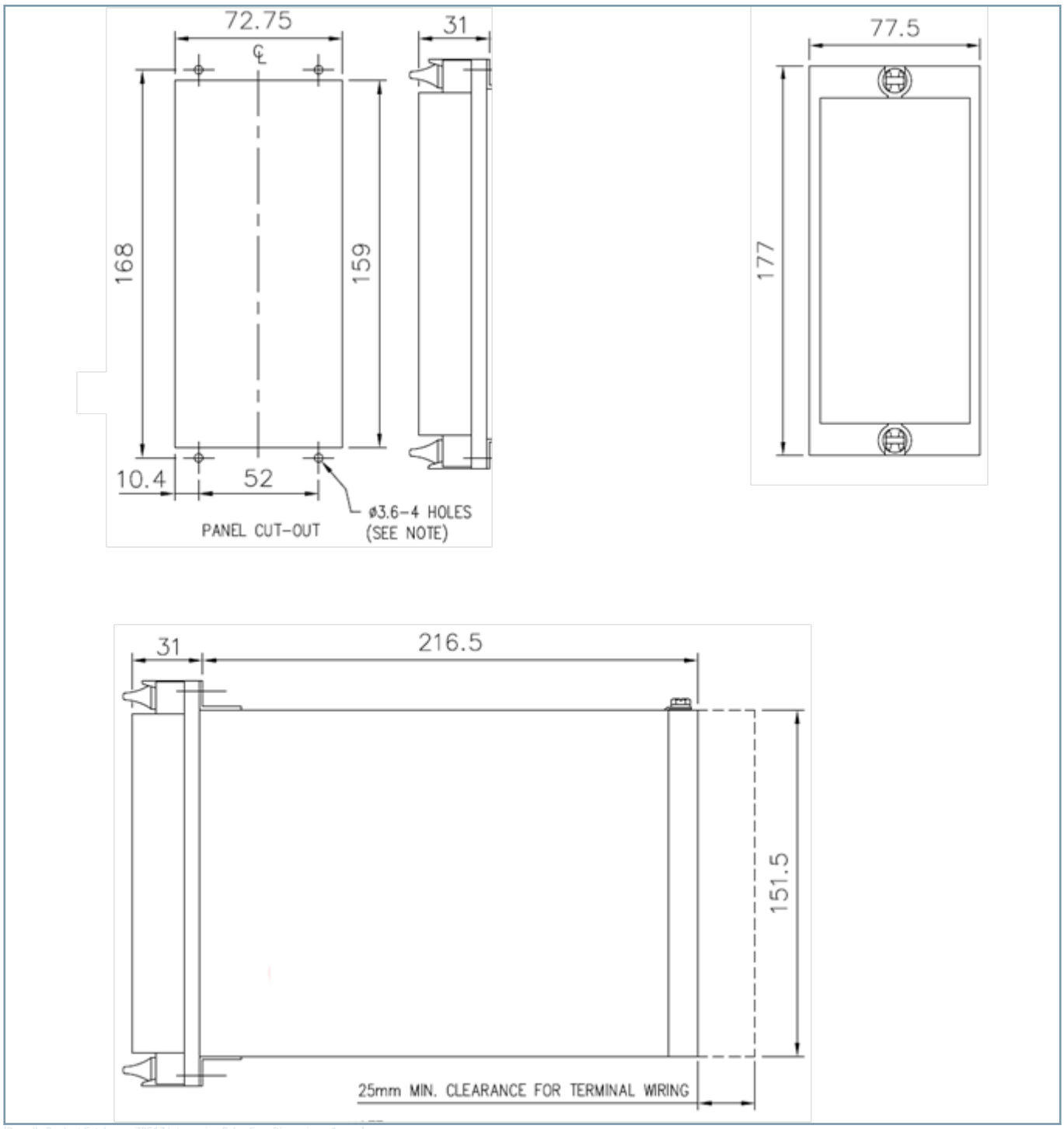
Shock, relays will withstand a 20G shock or impact on the panel without operating. Operational/mechanical life, relays will withstand in excess of 10,000 operations with the contact rating stated.

Normally closed contact location (Epsilon case terminal numbers)				
	1-3	2-4	5-7	6-8
1 NC		NC		
2 NC	NC	NC		
3 NC	NC	NC		NC
4 NC	NC	NC	NC	NC



[Reyrolle Product Catalogue, 7PG17 Interposing Relay Connection Delay, 1, -_-]

Figure 3.3/1 Connection details for Epsilon Case



[Reyrolle Product Catalogue, 7PG17 Interposing Relay Case Dimensions, 1, _ _]

Figure 3.3/2 E3 Case Dimensions

NOTE

The ∅3.6 holes are for M4 thread forming (trilobular) screws. These are supplied as standard and are suitable for use in ferrous/aluminum panels 1.6mm thick and above. For other panels, holes to be M4 clearance (typically ∅4.5) and relays mounted using M4 machine screws, nuts and lockwashers (supplied in panel fixing kit).

Ordering Information - 7PG17 XR105, XR106 and XR107
Interposing Relays

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
7PG17 XR105, XR106 and XR107	7	P	G	1	7	□	□	-	□	□	□	□	□	-	□	□	□	0
						|	|		|	|	|	|	|		|	|	|	|
Interposing control relay (XR105, XR106, XR107)						|	|		|	|	|	|	|		|	|	|	|
XR relay type						|	|		|	|	|	|	|		|	|	|	|
Interposing control						3	|		|	|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|	|		|	|	|	|
Number of elements							|		|	|	|	|	|	|		|	|	|	|
Single element, self reset contacts							1		|	|	|	|	|	|		|	|	|	|
Single element, hand reset contacts							3		|	|	|	|	|	|		|	|	|	|
									|	|	|	|	|	|		|	|	|	|
Type of flag									|	|	|	|	|	|		|	|	|	|
No flag									0	|	|	|	|	|		|	|	|	|
Hand reset flag									1	|	|	|	|	|		|	|	|	|
										|	|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|	|		|	|	|	|
0 NO										A	|	|	|	|		|	|	|	|
1 NO										B	|	|	|	|		|	|	|	|
2 NO										C	|	|	|	|		|	|	|	|
3 NO										D	|	|	|	|		|	|	|	|
4 NO										E	|	|	|	|		|	|	|	|
											|	|	|	|		|	|	|	|
Contact arrangement NC											|	|	|	|		|	|	|	|
0 NC											A	|	|	|		|	|	|	|
1 NC											B	|	|	|		|	|	|	|
2 NC											C	|	|	|		|	|	|	|
3 NC											D	|	|	|		|	|	|	|
4 NC											E	|	|	|		|	|	|	|
												|	|	|		|	|	|	|
Number of contacts [2)]												|	|	|		|	|	|	|
Two												0	|	|		|	|	|	|
Four												1	|	|		|	|	|	|
													|	|		|	|	|	|
Contact type													|	|		|	|	|	|
NO (Standard) / NC (Standard)													0	|		|	|	|	|
															|	|	|	|
Voltage rating															|	|	|	|
24V DC															1	|	|	|
30V DC															2	|	|	|
50V DC															3	|	|	|
125V DC [1)]															4	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
																	|	|
Voltage rating (alarm)																	|	|
Not Applicable																	A	|
																		|
Back emf suppression diode																		|
Not Fitted																		0
Fitted																		1

NOTE

1) Supplied with resistor VCE:2101H10152 (1500 Ohm) for wiring in series with the coil.

2) Number of contacts must match selected contact arrangement

Ordering Information - 7PG17 Interposing Relays (XR205, XR206)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Interposing Relay (XR205, XR206)	7	P	G	1	7	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|		|	|	|	|
Interposing control relay						|	|		|	|	|	|		|	|	|	|
XR relay type						|	|		|	|	|	|		|	|	|	|
Interposing control						3	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Number of elements							|		|	|	|	|	|		|	|	|	|
Two element, self reset contacts							2		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Type of flag									|	|	|	|	|		|	|	|	|
No flag									0	|	|	|	|		|	|	|	|
Hand reset flag									1	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts [2]												|	|		|	|	|	|
Two												0	|		|	|	|	|
Four												1	|		|	C	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Voltage rating															|	|	|	|
24V DC															1	|	|	|
30V DC															2	|	|	|
50V DC															3	|	|	|
125V DC [1]															4	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
Case size E4 (4U high)																C	|	|
																	|	|
Voltage rating (alarm)																	|	|
Not Applicable																	A	|
																		|
Back emf suppression diode																		|
Not Fitted																		0
Fitted																		1

NOTE

1) Supplied with resistor VCE:2101H10152 (1500 Ohm) for wiring in series with the coil.

2) Number of contacts must match selected contact arrangement

7PG17 XR151 Trip Relay Supervision Relay

[Reyrolle Product Catalogue, 7PG17 Supervision Relay, 1, -__-]

Description

Type XR relays are developments for specific applications of the type AR relay range. They are electro-mechanical relays with long service life and complying with the appropriate requirements of IEC 255 and BS 142. These relays have a low operating current, specific settings and time delayed drop-off. This latter feature is to keep the relay in the operated condition during temporary reductions in the battery voltage, such as those which occur just prior to a fuse blowing or during a busbar fault when many trip relays operate simultaneously.

Application

Type XR151 relays are designed to allow the supervision of a trip relay operating coil, supply & associated wiring. This application requires relays with low operating current, visual indication and the ability to initiate a remote alarm. Both these relays have mechanical flag indicators which show on de-energisation, either self reset or hand reset.

Low burden & consistent, positive action. Suitable for high burden trip relays (EB2) only.

Exact burden & operating current dependent upon application.

Technical information

Rated voltage V_n	125V
Settings	Pick-up: 70 % of V_n Drop-off: not less than 26 % of V_n
Reset time	No less than 100 ms when supply is switched from 100 % to 26 % of V_n.

Operating current	Less than 20mA.
Burden	Less than 2.5W
Thermal Withstand	1.15 V_n continuously
Indication	A self or hand reset flag indicator shows when the relay is de-energised.

Contact arrangements

4 contacts in any combination of normally open or normally closed.

Contact rating

Make and carry continuously: 1250VA a.c. or 1250Wd.c. with limits of 660V and 5A

Make and carry for 3 seconds: 7500VA a.c. or 7500Wd.c with limits of 660V and 30A

Break

1250VA a.c. or 100Wd.c. resistive, or 50W inductive (L/R = 0.04) d.c. with limits of 250V

Environmental Information

Temperature

IEC 68-2-1 & 2

Storage	25°C to +70°C
Operating	10°C to +55°C

Humidity

IEC 68-2-3

56 days at 95 % RH and 40°C

Vibration

IEC 255-21-1

The relays meet the requirements of Class 1 for vibration response and endurance

Shock and bump

IEC 255-21-2

The relays meet the requirements of IEC 255-21-2 and BS142, sub-section 1.5.2. (1989) with respect to shock and bump testing for class 1 severity

Mechanical life

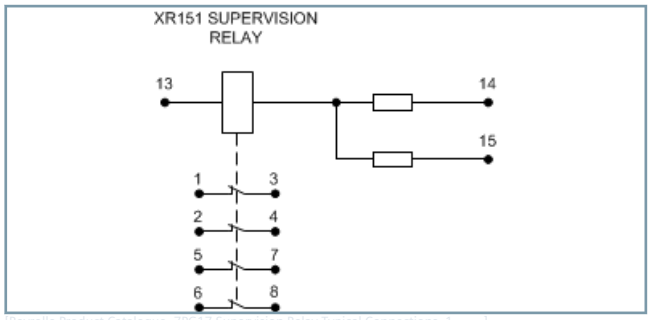
The relays will withstand in excess of 10,000 operations with the contact rating at a rate of 600 operations per hour

Insulation

IEC 255-5

Relays will withstand: 5kV peak, 1.2/50µs, 0.5J between all terminals and case earth and between adjacent terminals. $2kV_{RMS}$ 50Hz for 1 minute between all case terminals connected together and the case earth and between independent circuits. $1kV_{RMS}$ 50Hz for 1 minute between normally open contacts.

Typical connections



[Reyrolle Product Catalogue, 7PG17 Supervision Relay Typical Connections, 1, –_–]

Case Dimensions

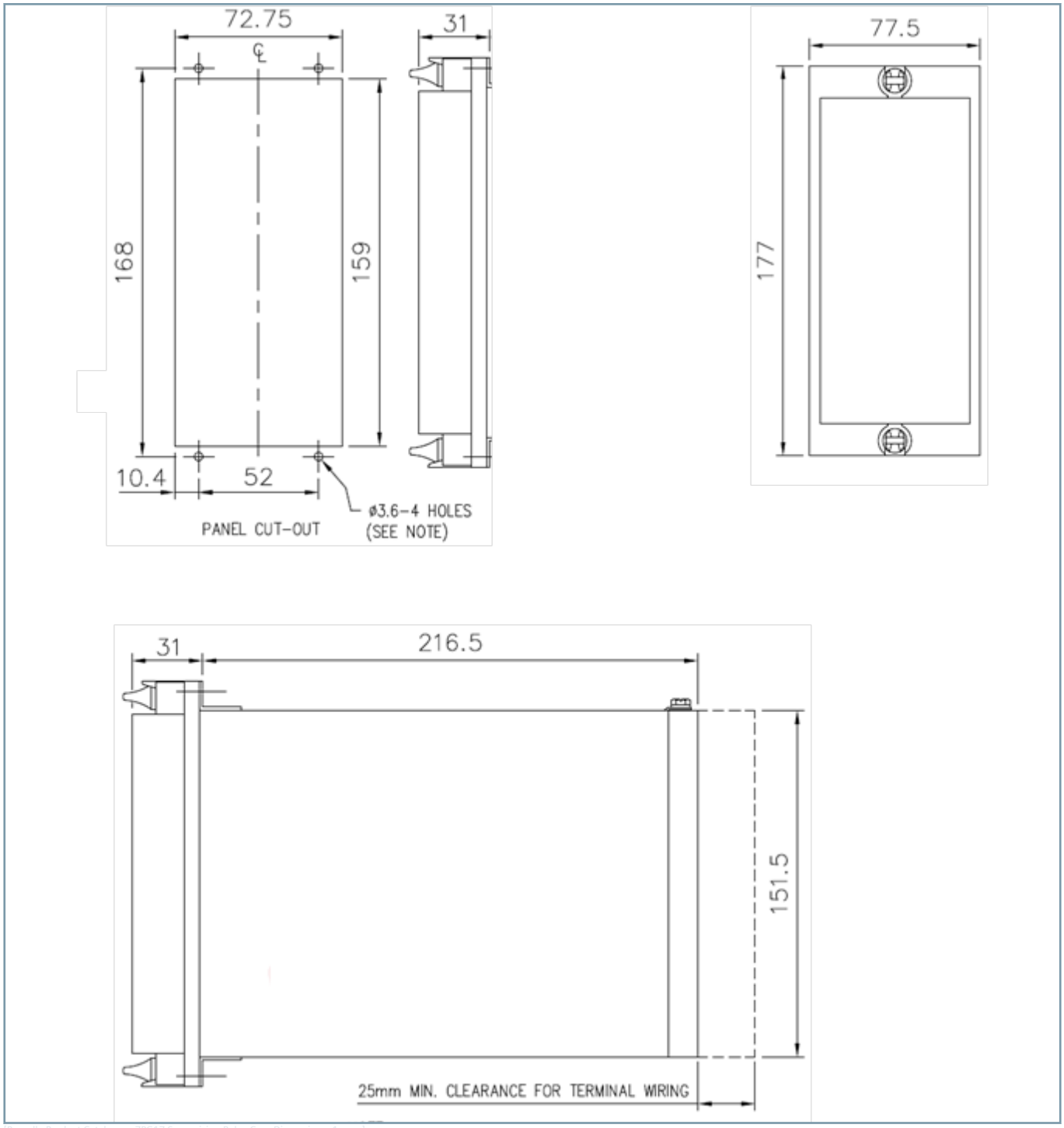


Figure 3.3/3 E3 Case Dimensions

Note: The Ø3.6 holes are for M4 thread forming (trilobular) screws. These are supplied as standard and are suitable for use in ferrous/aluminum panels 1.6mm thick and above. For other panels, holes to be M4 clearance (typically Ø4.5) and relays mounted using M4 machine screws, nuts and lockwashers (supplied in panel fixing kit).

Ordering Information - 7PG17 Trip Relay Supervision Relay (XR151)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Trip Relay Supervision Relay (XR151)	7	P	G	1	7	□	□	-	□	□	□	□	□	-	□	□	□	0
						|	|		|	|	|	|		|	|	|	|
Trip supervision relay						|	|		|	|	|	|		|	|	|	|
XR relay type						|	|		|	|	|	|		|	|	|	|
Trip Relay supervision						5	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Number of elements							|		|	|	|	|	|		|	|	|	|
Single element, self reset contacts							1		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Type of flag									|	|	|	|	|		|	|	|	|
Hand reset flag									1	|	|	|	|		|	|	|	|
Self reset flag									3	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts												|	|		|	|	|	|
Four												1	|		|	|	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Voltage rating															|	|	|	|
125V DC															4	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
																	|	|
Voltage rating (alarm)																	|	|
Not Applicable																	A	|
																		|
Back emf suppression diode																		|
Not Fitted																		0

7PG17 XR152 and XR153 Supply Supervision Relays

[Reyrolle Product Catalogue, 7PG17 Supply Supervision Relay, 1, —_—]

Description

Type XR relays are developments for specific applications of the type AR relay range. They are electro-mechanical relays with long service life and complying with the appropriate requirements of IEC 255 and BS 142. These relays have a low operating current, specific settings and time delayed drop-off. This latter feature is to keep the relay in the operated condition during temporary reductions in the battery voltage, such as those which occur just prior to a fuse blowing or during a busbar fault when many trip relays operate simultaneously. Healthy circuits therefore do not give spurious alarms and the relay effected by the fuse failure provides the alarm and indication necessary for accurate maintenance attention.

Application

Types XR152 and XR153 relays are designed to comply with CEGB and other specification for protection supervision requirements and the monitoring of d.c. voltage supplies. These applications require relays with low operating current, visual indication and the ability to initiate a remote alarm. Both these relays have mechanical flag indicators which show on de-energisation, self reset on the XR152 and hand reset on the XR153.

- Low burden
- Versatile design, can provide pre-close supervision
- Consistent positive action

Technical information

Rated voltage V_n	24V, 30V, 50V, 60V, 125V and 220Vdc
Settings	Pick-up 70 % of rated voltage Drop-off not less than 26 % of V_n
Reset time	No less than 100 ms when supply is switched from 100 % to 26 % of V_n.
Operating current	10mA nominal. (17mA for 24V & 30V ratings)
Burden	0.4W at 24Vd.c. 1.25W at 125Vd.c
Thermal Withstand	1.15 V_n continuously
Indication	A flag indicator shows when the relay is de-energised XR152 self reset flag XR153 hand reset flag

Contact arrangements

2 or 4 contacts in any combination of normally open and normally closed.

Contact rating - Make and carry continuously: 1250VA a.c. or 1250Wd.c. with limits of 660V and 5A. Make and carry for 3 seconds: 7500VA a.c. or 7500Wd.c with limits of 660V and 30A.

Break

1250VA a.c. or 100Wd.c. resistive, or 50W inductive (L/R = 0.04) d.c. with limits of 250V

Environmental Information

Temperature

IEC 68-2-1 & 2

Storage	25°C to +70°C
Operating	10°C to +55°C

Humidity

IEC 68-2-3

56 days at 95 % RH and 40°C

Vibration

IEC 255-21-1

The relays meet the requirements of Class 1 for vibration response and endurance.

Shock and bump

IEC 255-21-2

The relays meet the requirements of IEC 255-21-2 and BS142, sub-section 1.5.2.

(1989) with respect to shock and bump testing for class 1 severity.

Mechanical life

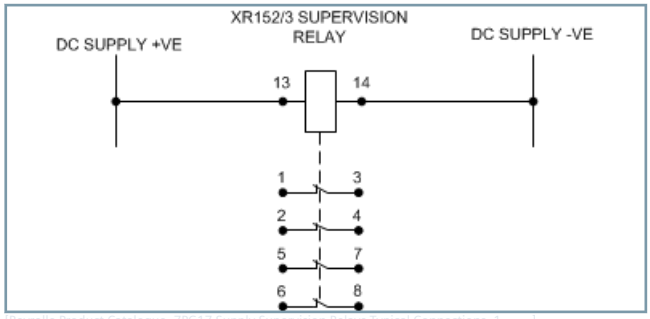
The relays will withstand in excess of 10,000 operations with the contact rating at a rate of 600 operations per hour.

Insulation

IEC 255-5

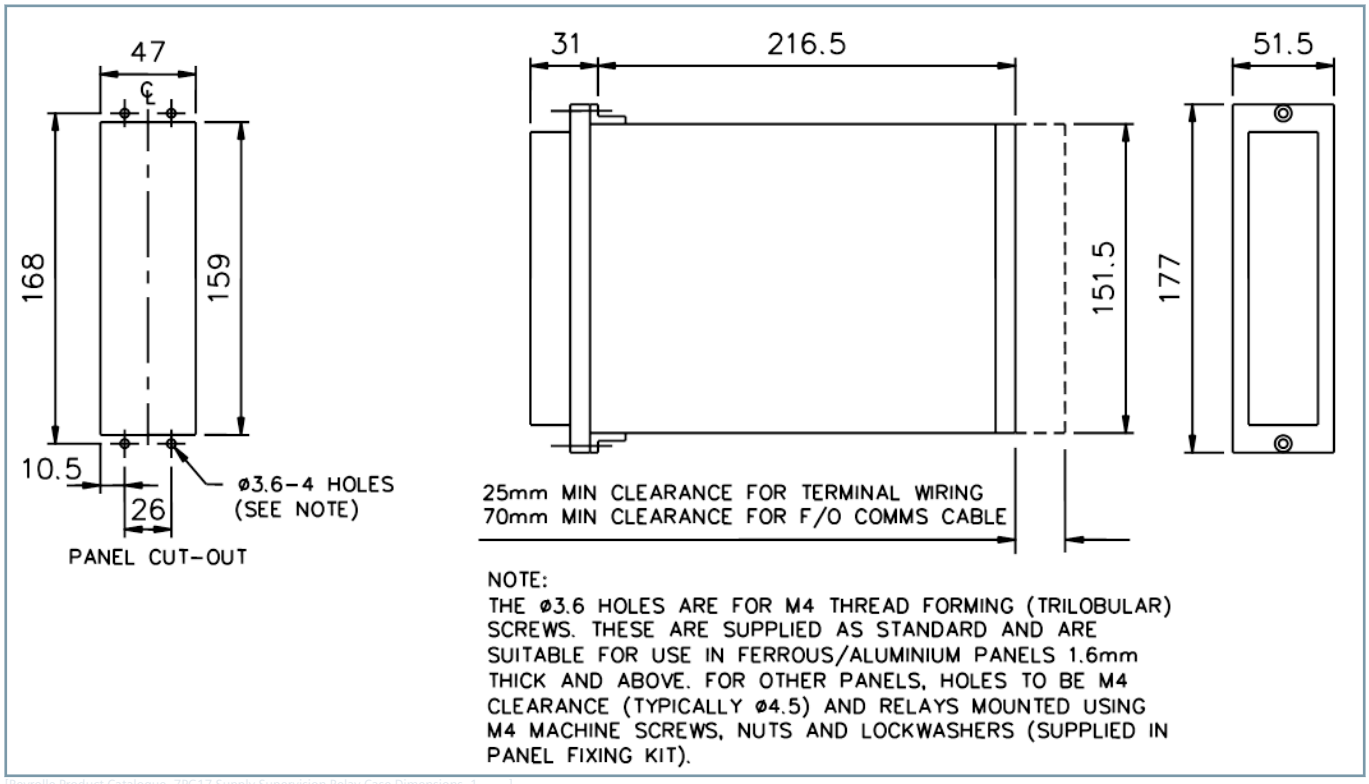
Relays will withstand: 5kV peak, 1.2/50µs, 0.5J between all terminals and case earth and between adjacent terminals. $2kV_{RMS}$ 50Hz for 1 minute between all case terminals connected together and the case earth and between independent circuits. $1kV_{RMS}$ 50Hz for 1 minute between normally open contacts.

Typical connections



[Reyrolle Product Catalogue, 7PG17 Supply Supervision Relays Typical Connections, 1, _ _]

Case Dimensions



[Reyrolle Product Catalogue, 7PG17 Supply Supervision Relay Case Dimensions, 1, _ _]

Figure 3.3/4 E2 Case Dimensions

Ordering Information - 7PG17 Supply Supervision Relays (XR152, XR153)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Supply Supervision Relays (XR152, XR153)	7	P	G	1	7	□	□	-	□	□	□	□	□	-	□	□	□	0
						|	|		|	|	|	|		|	|	|	|
D.C. supply supervision relay						|	|		|	|	|	|		|	|	|	|
XR relay type						|	|		|	|	|	|		|	|	|	|
D.C. supply supervision						4	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Number of elements							|		|	|	|	|	|		|	|	|	|
Single element, self reset contacts							1		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Type of flag									|	|	|	|	|		|	|	|	|
Hand reset flag									1	|	|	|	|		|	|	|	|
Self reset flag									3	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts												|	|		|	|	|	|
Four												1	|		|	|	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Voltage rating															|	|	|	|
24V DC															1	|	|	|
30V DC															2	|	|	|
50V DC															3	|	|	|
125V DC															4	|	|	|
240V DC															5	|	|	|
																|	|	|
Housing size																|	|	|
Case size E2 (4U high)																A	|	|
																	|	|
Voltage rating (alarm)																	|	|
Not Applicable																	A	|
																		|
Back emf suppression diode																		|
Not Fitted																		0

7PG17 XR250 to XR351 Trip Circuit Supervision Relays

[Reyrolle Product Catalogue, 7PG17 Trip Circuit Supervision Relay, 1, -_-]

Description

Type XR relays are developments for specific applications of the type AR relay range. They are electro-mechanical relays with a consistent positive action, a long service life and complying with the appropriate requirements of IEC 255 and BS142. Models XR250/251 have two attracted armature elements, XR350/351 have three. These relays incorporate a time delay on de-energisation to keep the relay in an operated condition during temporary reductions in the battery voltage.

- Low burden
- Versatile design, can provide pre-close supervision
- Consistent positive action

Supervision of the trip circuit breaker is desirable as a means of ensuring the integrity to the trip circuit.

There are differing requirements for monitoring a trip circuit, supervision of the trip with the circuit breaker closed, supervision with the circuit breaker open and closed and pre-closing supervision. These XR relays are designed to meet all of these requirements and in particular the requirements of BEBS S15 schemes H4 and H7.

XR250 and XR251 Circuit breaker closed supervision will initiate an alarm and provide indication with the circuit closed for : Failure of the trip supply, open circuit trip coil, an open circuit in the trip circuit wiring and if the trip coil should fail to respond to a trip command.

XR350 and XR351 Continuous supervision with the circuit breaker in the open and closed positions and in compliance with the scheme requirements of BEBS S15 scheme H7.

XR350 and XR351 relays also have a contact for pre-closing supervision, where a circuit breaker is prevented from being closed if trip relays have not been reset. BEBS S15 scheme H7 is applicable to trip circuit voltages of 125Vd.c. and 240Vd.c.

Technical information

Rated voltage V_n	30V, 50V, 125V & 220Vdc
Operating range	80 % to 120 % of V_n
Reset time	400 ms when supply is switched from V_n to off

Burden

H7 scheme relay burdens are typically:

Rated voltage	Trip circuit condition		Alarm circuit
	C.B. open	C.B. closed	
50Vd.c	- -	- -	2W
125Vd.c	1W	2W	4W
240Vd.c	2W	4W	9W

Thermal Withstand 1.15V_n continuous

Indication

A flag indicator shows when the relay is de- energised

Self reset flag XR250 and XR350

Hand reset flag XR251 and XR351

Contact arrangements

Alarm output - 4 contacts in any combination of normally open and normally closed. Pre-closing supervision, XR350 & XR351, 1 normally open contact.

Contact rating

Make and carry continuously: 1250VAa.c. or 1250Wd.c. with limits of 660V and 5A

Make and carry for 3 seconds: 7500VAa.c. or 7500Wd.c with limits of 660V and 30A

Break: 1250VAa.c. or 7500Wd.c. resistive, or 50W inductive (L/R = 0.04) d.c. with limits of 250V and 5A

Environmental

Temperature

IEC 68-2-1 & 2

Storage	-25°C to +70°C
Operating	-10°C to +55°C

Humidity

IEC 68-2-3

56 days at 95 % RH and 40°C

Vibration

IEC 255-21-1

The relays meet the requirements of Class 1 for vibration response and endurance

Shock and bump

IEC 255-21-2

The relays meet the requirements of IEC 255-21-2 and BS142, sub-section 1.5.2. (1989) with respect to shock and bump testing for class 1 severity

Operational/mechanical life

The relays will withstand in excess of 10,000 operations with the contact rating at a rate of 600 operations per hour.

Insulation IEC 255-5

Relays will withstand: 5kV peak, 1.2/50µs, 0.5J between all terminals and case earth and between adjacent terminals $2kV_{RMS}$ 50Hz for 1 minute between all case terminals connected together, the case earth and between independent circuits $1kV_{RMS}$ 50Hz for 1 minute between normally open contacts.

Coil and Resistor Data

Voltage	R1	R2	R3	R4
30V DC	-	-	100	100
50V DC	-	-	350	350
125V DC	2000	-	3300	3300
240V DC	7000	-	10300	10300

R1 and R2 are fitted in the 'C' coil circuit.

R3 and R4 are fitted in the 'A' and 'B' coil circuits respectively.

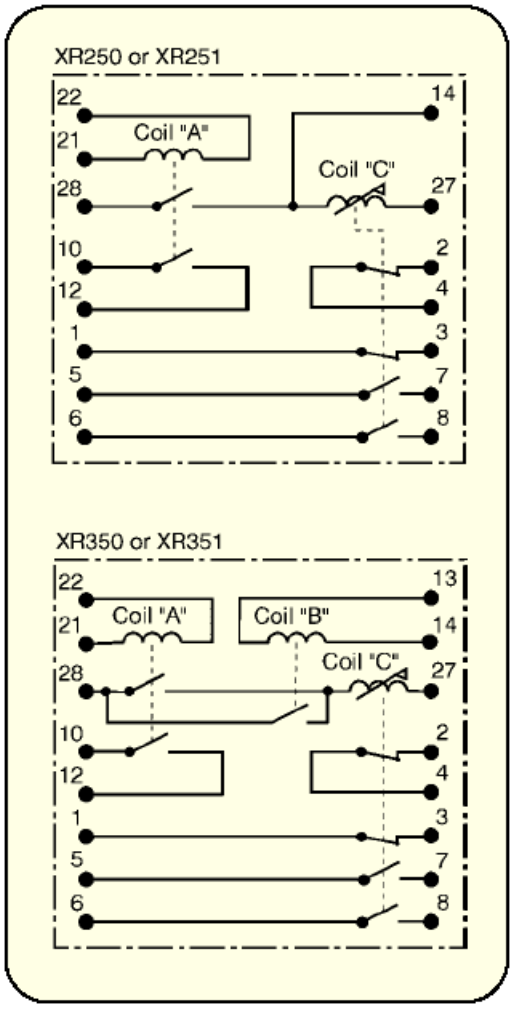
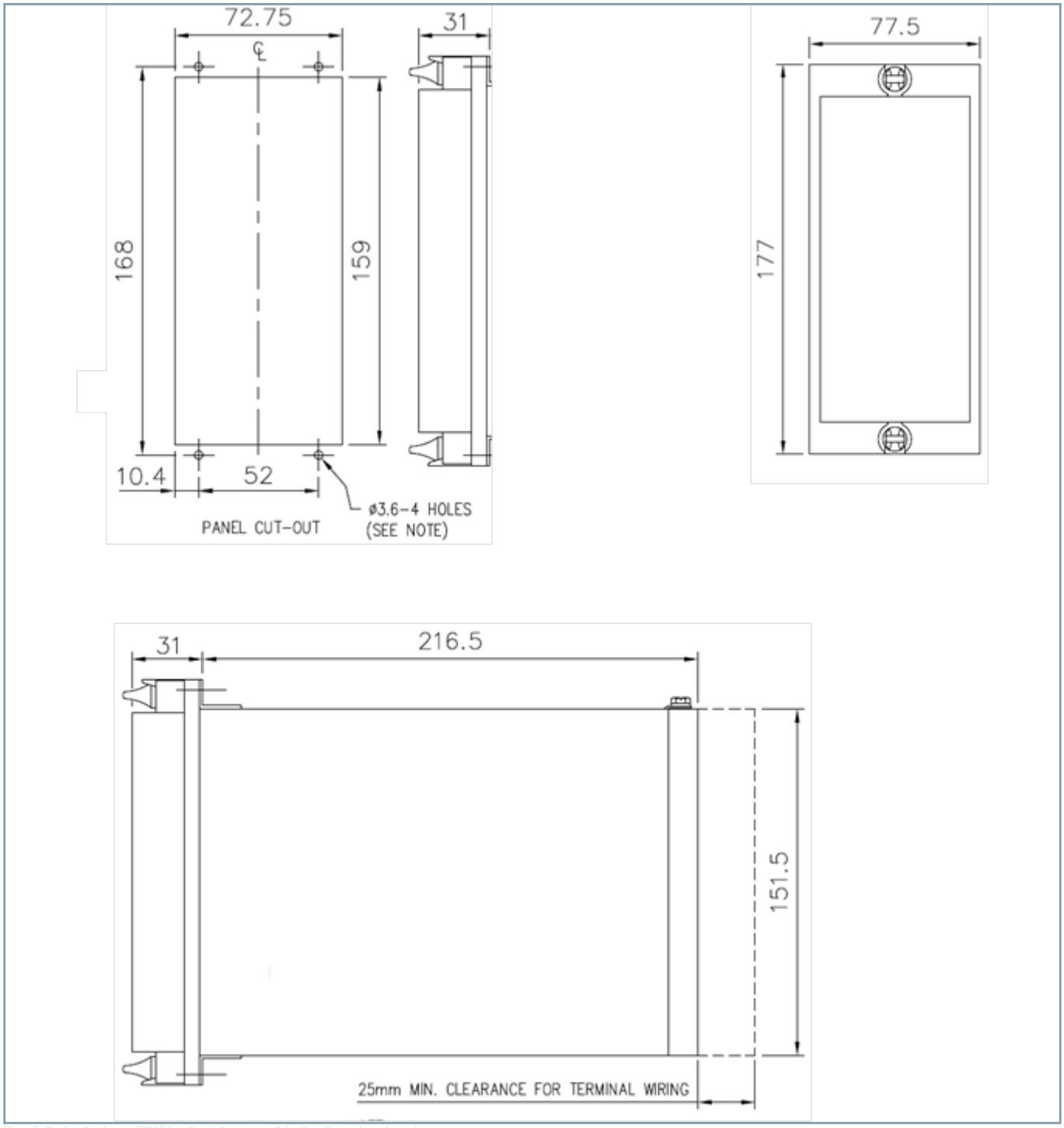


Fig. 1. Typical relay wiring, modular case terminal numbers shown

[Reyrolle Product Catalogue, 7PG17 Trip Circuit Supervision Relay Connection Diagram, 1, -, -]

Figure 3.3/5 Typical relay wiring, modular case terminal numbers shown

Case Dimensions



[Reyrolle Product Catalogue, 7PG17 Trip Circuit Supervision Relay Case Dimensions, 1, _ _]

Figure 3.3/6 E3 Case Dimensions

Note: The ∅3.6 holes are for M4 thread forming (trilobular) screws. These are supplied as standard and are suitable for use in ferrous/aluminum panels 1.6mm thick and above. For other panels, holes to be M4 clearance (typically ∅4.5) and relays mounted using M4 machine screws, nuts and lockwashers (supplied in panel fixing kit).

Ordering Information - 7PG17 Trip Circuit Supervision Relay (XR250, XR251)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Trip Circuit Supervision Relay (XR250, XR251)	7	P	G	1	7	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|		|	|	|	|
Trip circuit supervision relay						|	|		|	|	|	|		|	|	|	|
XR relay type						|	|		|	|	|	|		|	|	|	|
Trip circuit supervision						5	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|		|	|	|	|
Number of elements							|		|	|	|	|		|	|	|	|
Two element, self reset contacts							2		|	|	|	|		|	|	|	|
									|	|	|	|		|	|	|	|
Type of flag									|	|	|	|		|	|	|	|
Hand reset flag									1	|	|	|	|		|	|	|	|
Self reset flag									3	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts/element												|	|		|	|	|	|
Four												1	|		|	|	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Voltage rating															|	|	|	|
30V DC [1)]															2	|	|	|
50V DC [1)]															3	|	|	|
125V DC [1)]															4	|	|	|
240V DC [1)]															5	|	|	|
																|	|	|
Housing size																|	|	|
Case size E3 (4U high)																B	|	|
																	|	|
Voltage rating (alarm)																	|	|
30V DC																	C	|
50V DC																	D	|
125V DC [1)]																	E	|
240V DC [1)]																	F	|
																		|

Product Description	Order No.
Back emf suppression diode	|
Not Fitted	0

NOTE

1) Supplied with external resistors

Ordering Information - 7PG17 Trip Circuit Supervision Relay (XR350, XR351)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Trip Circuit Supervision Relay (XR350, XR351)	7	P	G	1	7	□	□	-	□	□	□	□	□	-	□	□	□	□
						|	|		|	|	|	|		|	|	|	|
Trip circuit supervision relay						|	|		|	|	|	|		|	|	|	|
XR relay type						|	|		|	|	|	|		|	|	|	|
Trip circuit supervision						5	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|		|	|	|	|
Number of elements							|		|	|	|	|		|	|	|	|
Three element, self reset contacts							3		|	|	|	|		|	|	|	|
									|	|	|	|		|	|	|	|
Type of flag									|	|	|	|		|	|	|	|
Hand reset flag									1	|	|	|	|		|	|	|	|
Self reset flag									3	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										|	|	|	|		|	|	|	|
0 NO										A	|	|	|		|	|	|	|
1 NO										B	|	|	|		|	|	|	|
2 NO										C	|	|	|		|	|	|	|
3 NO										D	|	|	|		|	|	|	|
4 NO										E	|	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											|	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
												|	|		|	|	|	|
Number of contacts/element												|	|		|	|	|	|
Four												1	|		|	|	|	|
													|		|	|	|	|
Contact type													|		|	|	|	|
NO (Standard) / NC (Standard)													0		|	|	|	|
															|	|	|	|
Voltage rating[2)]															|	|	|	|
30V DC [1)]															2	|	|	|
50V DC [1)]															3	|	|	|
125V DC [1)]															4	|	|	|
240V DC [1)]															5	|	|	|
																|	|	|
Housing size																|	|	|
Case size E3 (4U high)																B	|	|
																	|	|
Voltage rating (alarm)																	|	|
30V DC																	C	|
50V DC																	D	|
125V DC [1)]																	E	|
240V DC [1)]																	F	|
																		|

Product Description	Order No.
Back emf suppression diode	|
Not Fitted	0

NOTE

1) Supplied with external resistors

2) Voltage rating for both trip coils

7PG18 Tripping Relay-A

[Reyrolle Product Catalogue, 7PG18, 1, -_-]

Features

- High speed, positive action
- Can be supplied in modular and drawout type case
- Robust design for a long, reliable, service life

Description

Type TR-A relays are a range of volt age operated multi-contact attracted armature relays designed to both IEC 255-5 and to BS142. A wide range of models is available to meet the requirements of the electric supply industry.

TR-A2 – High burden to ESI 48-4 EB2 & NGTS 3.6.15, ESI 2.

High burden, TR-A2 series

High burden relays with immunity to capacitance discharge currents. They are also suitable for certain applications where they are remote from the initiation signal.

A high burden also permits reliable operation of current operated series repeat relays. TR relays can be provided with a time delayed economy feature, either instantaneous or time delayed.

Technical Information

TR-A2 series relays

Operating time	10 ms at rated voltage
Rated voltage	V_n 24V, 30V, 48V, 125V, 240Vd.c Note. 24V and 240V ratings are not part of ESI 48-4
Operating range	50 % to 120 % of rated voltage

Operating coils of self-reset and economy cut-off relays are rated at 120 % of rated voltage. All other operate and reset coils are short time rated well in excess of the operating time of their cut-off contacts. Self-reset relays will reset at not less than 5 % rated voltage.

Nominal burdens

Rated Voltage V.d.c	TR2 -
30	43
48	52
125	<150
Reset coil	50

Relays with economy circuits reduce to approximately 14W

Relay Type	Number of Contacts	Contact Reset Arrangement	Operating Coil Cut-off	Specification	Burden Level	Modular Case Size
TR-A212	20	Self	Economy	EB2	High	E4
TR-A214	20	Self	Economy 2s delay	EB2	High	E4
TR-A221	20	Hand	Instantaneous	EB2	High	E4
TR-A223	20	Hand	40/60 ms delay	EB2	High	E4
TR-A231	20	Electrical	Instantaneous	EB2	High	E4
TR-A233	20	Electrical	40/60 ms delay	EB2	High	E4
TR-A241	20	Hand & electrical	Instantaneous	EB2	High	E4
TR-A243	20	Hand & electrical	40/60 ms delay	EB2	High	E4

Ratings

Make and carry continuously:	1250VAa.c. or 1250Wd.c. within limits of 660V and 5A
Make and carry for 3 seconds:	7500VAa.c. or 7500Wd.c. within limits of 660V and 30A

Break;

1250VAa.c. or 100W (resistive) d.c. or 50W (inductive) d.c. within limits of 250V and 5A

Maximum rate of operation, 600 per hour Indication

TR-A2 relays have a hand reset mechanical flag indicator

Environmental

Temperature

IEC68-2-1/2 and BS2011 (1977)

Operating	-10°C to +55°C
Storage	-25°C to +70°C

Humidity

IEC 68-2-3

56 days at 95 % RH and 40°C

Shock and bump

IEC 255-21-2 and BS142, 1.5.2 (1989)

Relays meet the requirements with respect to shock and bump testing for Class 1 severity.

Operational/Mechanical life

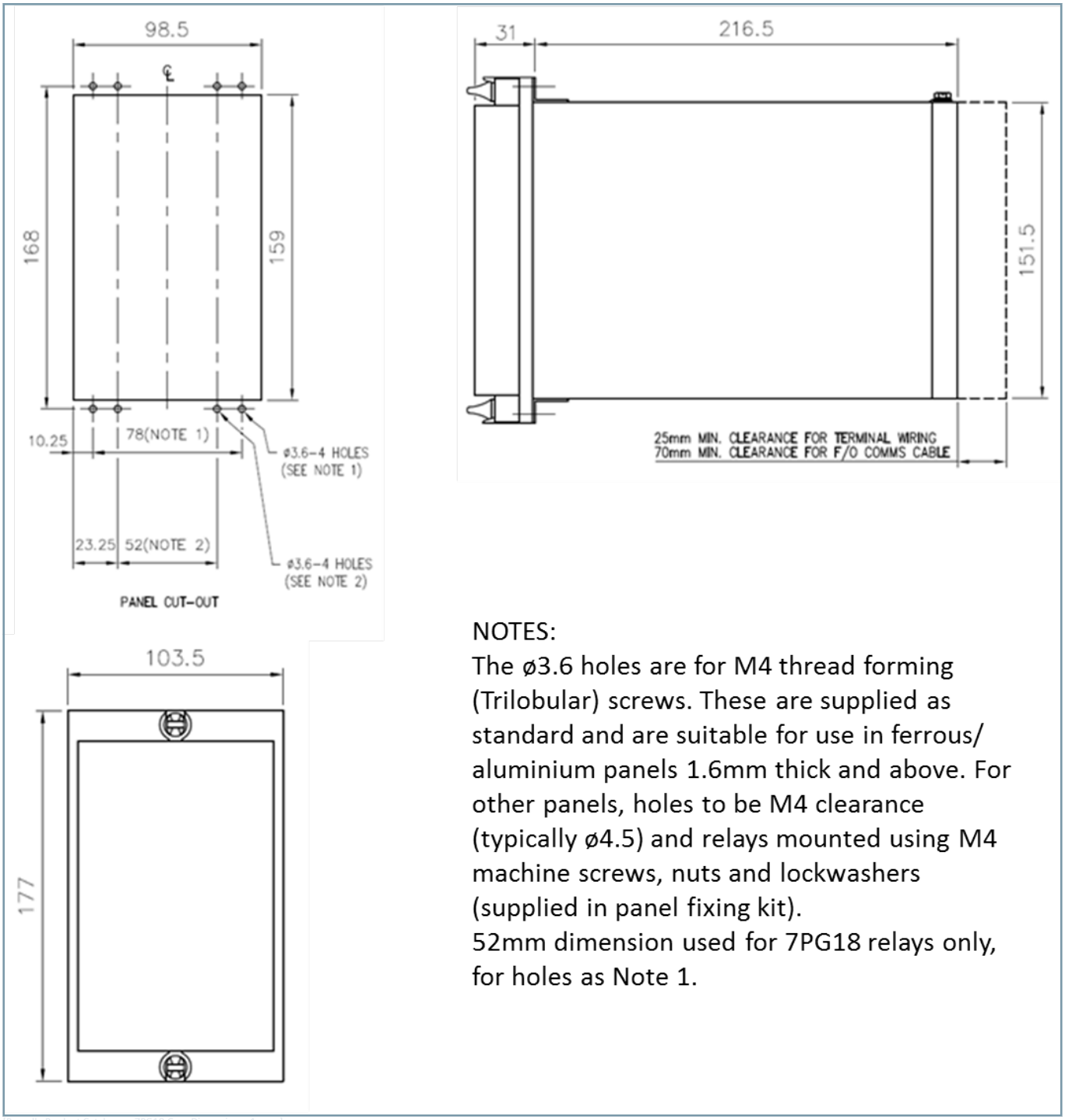
Relays will withstand in excess of 10,000 operations, within the maximum contact loading specified, at a rate of 600 operations per hour.

Insulation

Relays will withstand:

- 5kV 1.2/50µs waveform as IEC 255-4
- $2kV_{RMS}$ 50Hz for 1 minute (2.5kV for 1 s) between all terminals and earth
- $1kV_{RMS}$ 50Hz for 1 minute across normally open contacts to IEC 255-5 and BS142

Case Dimensions



[Reyrolle Product Catalogue, 7PG18 Case Dimensions, 1, -_-]

Figure 3.4/1 E4 Case Dimensions

Ordering Information - 7PG18 Tripping Relay (TR-A212, TR-A214 (20 CONTACT))

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Tripping Relay (TR-A212, TR-A214 (20 CONTACT))	7	P	G	1	8	2	1	-	2	□	□	8	0	-	1	C	□	0
					|	|	|		|	|	|	|	|		|	|	|	|
EPSILON tripping relay					|	|	|		|	|	|	|	|		|	|	|	|
Alpha range					5	|	|		|	|	|	|	|		|	|	|	|
TR-A Tripping					8	|	|		|	|	|	|	|		|	|	|	|
						|	|		|	|	|	|	|		|	|	|	|
TR-A Tripping						6	|		|	|	|	|	|		|	|	|	|
TR-A2-- : high burden, EB2						2	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Contact operation							7		|	|	|	|	|		|	|	|	|
Self reset contacts							1		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Operating coil cut-off									8	|	|	|	|		|	|	|	|
Economy									2	|	|	|	|		|	|	|	|
Economy and 2 second delay on reset									4	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										9	|	|	|		|	|	|	|
0 NO										A	W	|	|		|	|	|	|
1 NO										B	V	|	|		|	|	|	|
2 NO										C	U	|	|		|	|	|	|
3 NO										D	T	|	|		|	|	|	|
4 NO										E	S	|	|		|	|	|	|
5 NO										F	R	|	|		|	|	|	|
6 NO										G	Q	|	|		|	|	|	|
7 NO										H	P	|	|		|	|	|	|
8 NO										J	N	|	|		|	|	|	|
9 NO										K	M	|	|		|	|	|	|
10 NO										L	L	|	|		|	|	|	|
11 NO										M	K	|	|		|	|	|	|
12 NO										N	J	|	|		|	|	|	|
13 NO										P	H	|	|		|	|	|	|
14 NO										Q	G	|	|		|	|	|	|
15 NO										R	F	|	|		|	|	|	|
16 NO										S	E	|	|		|	|	|	|
17 NO										T	D	|	|		|	|	|	|
18 NO										U	C	|	|		|	|	|	|
19 NO										V	B	|	|		|	|	|	|
20 NO										W	A	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											10	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
7 NC											H	|	|		|	|	|	|
8 NC											J	|	|		|	|	|	|
9 NC											K	|	|		|	|	|	|

7PG18 Tripping Relay-A

Product Description	Order No.								
10 NC		L	|	|		|	|	|	|
11 NC		M	|	|		|	|	|	|
12 NC		N	|	|		|	|	|	|
13 NC		P	|	|		|	|	|	|
14 NC		Q	|	|		|	|	|	|
15 NC		R	|	|		|	|	|	|
16 NC		S	|	|		|	|	|	|
17 NC		T	|	|		|	|	|	|
18 NC		U	|	|		|	|	|	|
19 NC		V	|	|		|	|	|	|
20 NC		W	|	|		|	|	|	|
			|	|		|	|	|	|
Number of contacts			11	|		|	|	|	|
Twenty			8	|		|	|	|	|
				|		|	|	|	|
Contact type				12		|	|	|	|
NO (Standard) / NC (Standard)				0		|	|	|	|
						|	|	|	|
Type of flag						13	|	|	|
Hand reset flag						1	|	|	|
							|	|	|
Housing size							14	|	|
Case size E4 (4U high)							C	|	|
								|	|
Voltage rating								15	|
24V DC								B	|
30V DC								C	|
50V DC								D	|
125V DC								F	|
240V DC								H	|
									|
Back emf suppression diode									16
Not Fitted									0

Ordering Information - 7PG18 Tripping Relay (TR-A221 (20 CONTACT))

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Tripping Relay (TR-A221 (20 CONTACT))	7	P	G	1	8	2	2	-	1	□	□	8	0	-	1	C	□	0
					|	|	|		|	|	|	|	|		|	|	|	|
EPSILON tripping relay					|	|	|		|	|	|	|	|		|	|	|	|
Alpha range					5	|	|		|	|	|	|	|		|	|	|	|
TR-A Tripping					8	|	|		|	|	|	|	|		|	|	|	|
						|	|		|	|	|	|	|		|	|	|	|
TR-A Tripping						6	|		|	|	|	|	|		|	|	|	|
TR-A2-- : high burden, EB2						2	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Contact operation							7		|	|	|	|	|		|	|	|	|
Hand reset contacts							2		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Operating coil cut-off									8	|	|	|	|		|	|	|	|
Instantaneous									1	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										9	|	|	|		|	|	|	|
0 NO										A	W	|	|		|	|	|	|
1 NO										B	V	|	|		|	|	|	|
2 NO										C	U	|	|		|	|	|	|
3 NO										D	T	|	|		|	|	|	|
4 NO										E	S	|	|		|	|	|	|
5 NO										F	R	|	|		|	|	|	|
6 NO										G	Q	|	|		|	|	|	|
7 NO										H	P	|	|		|	|	|	|
8 NO										J	N	|	|		|	|	|	|
9 NO										K	M	|	|		|	|	|	|
10 NO										L	L	|	|		|	|	|	|
11 NO										M	K	|	|		|	|	|	|
12 NO										N	J	|	|		|	|	|	|
13 NO										P	H	|	|		|	|	|	|
14 NO										Q	G	|	|		|	|	|	|
15 NO										R	F	|	|		|	|	|	|
16 NO										S	E	|	|		|	|	|	|
17 NO										T	D	|	|		|	|	|	|
18 NO										U	C	|	|		|	|	|	|
19 NO										V	B	|	|		|	|	|	|
20 NO										W	A	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											10	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
7 NC											H	|	|		|	|	|	|
8 NC											J	|	|		|	|	|	|
9 NC											K	|	|		|	|	|	|
10 NC											L	|	|		|	|	|	|

3.4

7PG18 Tripping Relay-A

Product Description	Order No.							
11 NC	M	|	|		|	|	|	|
12 NC	N	|	|		|	|	|	|
13 NC	P	|	|		|	|	|	|
14 NC	Q	|	|		|	|	|	|
15 NC	R	|	|		|	|	|	|
16 NC	S	|	|		|	|	|	|
17 NC	T	|	|		|	|	|	|
18 NC	U	|	|		|	|	|	|
19 NC	V	|	|		|	|	|	|
20 NC	W	|	|		|	|	|	|
		|	|		|	|	|	|
Number of contacts		11	|		|	|	|	|
Twenty		8	|		|	|	|	|
			|		|	|	|	|
Contact type			12		|	|	|	|
NO (Standard) / NC (Standard)			0		|	|	|	|
					|	|	|	|
Type of flag					13	|	|	|
Hand reset flag					1	|	|	|
						|	|	|
Housing size						14	|	|
Case size E4 (4U high)						C	|	|
							|	|
Voltage rating							15	|
24V DC							B	|
30V DC							C	|
50V DC							D	|
125V DC							F	|
240V DC							H	|
								|
Back emf suppression diode								16
Not Fitted								0

Ordering Information - 7PG18 Tripping Relay (TR-A231 (20 CONTACT))

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Tripping Relay (TR-A231 (20 CONTACT))	7	P	G	1	8	2	3	-	1	□	□	8	0	-	1	C	□	0
					|	|	|		|	|	|	|	|		|	|	|	|
EPSILON tripping relay					|	|	|		|	|	|	|	|		|	|	|	|
Alpha range					5	|	|		|	|	|	|	|		|	|	|	|
TR-A Tripping					8	|	|		|	|	|	|	|		|	|	|	|
						|	|		|	|	|	|	|		|	|	|	|
TR-A Tripping						6	|		|	|	|	|	|		|	|	|	|
TR-A2-- : high burden, EB2						2	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Contact operation							7		|	|	|	|	|		|	|	|	|
Electrical reset contacts							3		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Operating coil cut-off									8	|	|	|	|		|	|	|	|
Instantaneous									1	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										9	|	|	|		|	|	|	|
0 NO										A	W	|	|		|	|	|	|
1 NO										B	V	|	|		|	|	|	|
2 NO										C	U	|	|		|	|	|	|
3 NO										D	T	|	|		|	|	|	|
4 NO										E	S	|	|		|	|	|	|
5 NO										F	R	|	|		|	|	|	|
6 NO										G	Q	|	|		|	|	|	|
7 NO										H	P	|	|		|	|	|	|
8 NO										J	N	|	|		|	|	|	|
9 NO										K	M	|	|		|	|	|	|
10 NO										L	L	|	|		|	|	|	|
11 NO										M	K	|	|		|	|	|	|
12 NO										N	J	|	|		|	|	|	|
13 NO										P	H	|	|		|	|	|	|
14 NO										Q	G	|	|		|	|	|	|
15 NO										R	F	|	|		|	|	|	|
16 NO										S	E	|	|		|	|	|	|
17 NO										T	D	|	|		|	|	|	|
18 NO										U	C	|	|		|	|	|	|
19 NO										V	B	|	|		|	|	|	|
20 NO										W	A	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											10	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
7 NC											H	|	|		|	|	|	|
8 NC											J	|	|		|	|	|	|
9 NC											K	|	|		|	|	|	|
10 NC											L	|	|		|	|	|	|

7PG18 Tripping Relay-A

Product Description	Order No.							
11 NC	M	|	|		|	|	|	|
12 NC	N	|	|		|	|	|	|
13 NC	P	|	|		|	|	|	|
14 NC	Q	|	|		|	|	|	|
15 NC	R	|	|		|	|	|	|
16 NC	S	|	|		|	|	|	|
17 NC	T	|	|		|	|	|	|
18 NC	U	|	|		|	|	|	|
19 NC	V	|	|		|	|	|	|
20 NC	W	|	|		|	|	|	|
		|	|		|	|	|	|
Number of contacts		11	|		|	|	|	|
Twenty		8	|		|	|	|	|
			|		|	|	|	|
Contact type			12		|	|	|	|
NO (Standard) / NC (Standard)			0		|	|	|	|
					|	|	|	|
Type of flag					13	|	|	|
Hand reset flag					1	|	|	|
						|	|	|
Housing size						14	|	|
Case size E4 (4U high)						C	|	|
							|	|
Voltage rating							15	|
24V DC							B	|
30V DC							C	|
50V DC							D	|
125V DC							F	|
240V DC							H	|
								|
Back emf suppression diode								16
Not Fitted								0

Ordering Information - 7PG18 Tripping Relay (TR-A241 (20 CONTACT))

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Tripping Relay (TR-A241 (20 CONTACT))	7	P	G	1	8	2	4	-	1	□	□	8	0	-	1	C	□	0
					|	|	|		|	|	|	|	|		|	|	|	|
EPSILON tripping relay					|	|	|		|	|	|	|	|		|	|	|	|
Alpha range					5	|	|		|	|	|	|	|		|	|	|	|
TR-A Tripping					8	|	|		|	|	|	|	|		|	|	|	|
						|	|		|	|	|	|	|		|	|	|	|
TR-A Tripping						6	|		|	|	|	|	|		|	|	|	|
TR-A2-- : high burden, EB2						2	|		|	|	|	|	|		|	|	|	|
							|		|	|	|	|	|		|	|	|	|
Contact operation							7		|	|	|	|	|		|	|	|	|
Hand and electrical reset contacts							4		|	|	|	|	|		|	|	|	|
									|	|	|	|	|		|	|	|	|
Operating coil cut-off									8	|	|	|	|		|	|	|	|
Instantaneous									1	|	|	|	|		|	|	|	|
										|	|	|	|		|	|	|	|
Contact arrangement – NO										9	|	|	|		|	|	|	|
0 NO										A	W	|	|		|	|	|	|
1 NO										B	V	|	|		|	|	|	|
2 NO										C	U	|	|		|	|	|	|
3 NO										D	T	|	|		|	|	|	|
4 NO										E	S	|	|		|	|	|	|
5 NO										F	R	|	|		|	|	|	|
6 NO										G	Q	|	|		|	|	|	|
7 NO										H	P	|	|		|	|	|	|
8 NO										J	N	|	|		|	|	|	|
9 NO										K	M	|	|		|	|	|	|
10 NO										L	L	|	|		|	|	|	|
11 NO										M	K	|	|		|	|	|	|
12 NO										N	J	|	|		|	|	|	|
13 NO										P	H	|	|		|	|	|	|
14 NO										Q	G	|	|		|	|	|	|
15 NO										R	F	|	|		|	|	|	|
16 NO										S	E	|	|		|	|	|	|
17 NO										T	D	|	|		|	|	|	|
18 NO										U	C	|	|		|	|	|	|
19 NO										V	B	|	|		|	|	|	|
20 NO										W	A	|	|		|	|	|	|
											|	|	|		|	|	|	|
Contact arrangement NC											10	|	|		|	|	|	|
0 NC											A	|	|		|	|	|	|
1 NC											B	|	|		|	|	|	|
2 NC											C	|	|		|	|	|	|
3 NC											D	|	|		|	|	|	|
4 NC											E	|	|		|	|	|	|
5 NC											F	|	|		|	|	|	|
6 NC											G	|	|		|	|	|	|
7 NC											H	|	|		|	|	|	|
8 NC											J	|	|		|	|	|	|
9 NC											K	|	|		|	|	|	|

7PG18 Tripping Relay-A

Product Description	Order No.							
10 NC	L	|	|		|	|	|	|
11 NC	M	|	|		|	|	|	|
12 NC	N	|	|		|	|	|	|
13 NC	P	|	|		|	|	|	|
14 NC	Q	|	|		|	|	|	|
15 NC	R	|	|		|	|	|	|
16 NC	S	|	|		|	|	|	|
17 NC	T	|	|		|	|	|	|
18 NC	U	|	|		|	|	|	|
19 NC	V	|	|		|	|	|	|
20 NC	W	|	|		|	|	|	|
		|	|		|	|	|	|
Number of contacts		11	|		|	|	|	|
Twenty		8	|		|	|	|	|
			|		|	|	|	|
Contact type			12		|	|	|	|
NO (Standard) / NC (Standard)			0		|	|	|	|
					|	|	|	|
Type of flag					13	|	|	|
Hand reset flag					1	|	|	|
						|	|	|
Housing size						14	|	|
Case size E4 (4U high)						C	|	|
							|	|
Voltage rating							15	|
24V DC							B	|
30V DC							C	|
50V DC							D	|
125V DC							F	|
240V DC							H	|
								|
Back emf suppression diode								16
Not Fitted								0

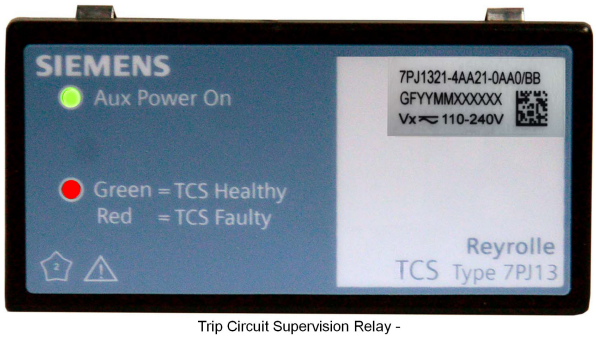
Description

The 7PJ13 Trip Circuit Supervision Relay is an electronic-circuit based relay. The relay is a member of Siemens Reyrolle protection devices product family. It is used to monitor and supervise the integrity of a circuit-breaker's trip coil and other wiring circuits.

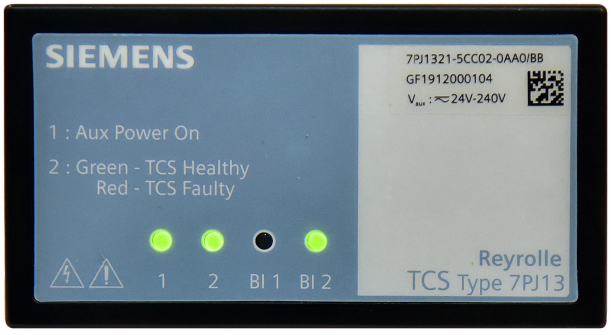
The 7PJ13 is connected with a circuit-breaker to monitor the trip circuit positions (make or break). The 7PJ13 generates a trip circuit failure alarm, either if the trip circuit supply is disconnected or if the trip circuit connection is changed to an open circuit. Trip circuit continuity is measured by supplying the supervision current of 0.7 mA to 1.5 mA and sensing the flow of current with two opto-couplers. The circuit-breaker contact indicates the status of the relay whether the circuit-breaker is in a make position or a break position.

The 7PJ13 is available in 2 variants depending on the auxiliary voltage range. The front panel of the 7PJ13 comprises of a dual colored LED to indicate the status of process.

Outputs	2 Changeover
Housing	Size 106 mm x 58 mm x 118 mm (Width x Height x Depth), panel mounting, non draw-out
Indication	Auxiliary Power On LED • Green = Aux Power On Trip circuit supervision LED • Green = TCS Healthy • Red = TCS Faulty For **MLFB 7PJ1321-5CC02-0AA0** only Binary Input 1 LED and Binary Input 2 LED • Green = ON • No indication = OFF
Universal Auxiliary Voltage Range	MLFB 7PJ1321-5AA21-0AA0 • AC 24 V to 240 V/DC 24 V to 240 V MLFB 7PJ1321-4AA21-0AA0 • AC 110 V to 240 V/ DC 110 V to 240 V MLFB 7PJ1321-5CC02-0AA0 • AC 24 V to 240 V/DC 24 V to 240 V
Burden	Maximum burden upto 4 W or 9 VA
Universal Supervision Voltage Range	MLFB 7PJ1321-5AA21-0AA0 • DC 18 V to 265 V MLFB 7PJ1321-4AA21-0AA0 • DC 18 V to 265 V MLFB 7PJ1321-5CC02-0AA0 • AC 40 V to 240 V/DC 40 V to 240 V



Trip Circuit Supervision Relay -
(MLFB 7PJ1321-5AA21-0AA0/7PJ1321-4AA21-0AA0)



Trip Circuit Supervision Relay -
(MLFB 7PJ1321-5CC02-0AA0)

[dw_7PJ13v1-v2_FrontViews, 1, --_--]

Benefits

- A compact design 108 mm x 56 mm (Width x Height)
- Flush mounting moulded case.
- Continuous supervision of trip circuit in pre-closed condition, post-closed condition, and latched trip condition.
- Detect and indicate auxiliary voltage loss and circuit failure in supervised circuits.
- Indicates operational status by a single LED with dual color.
- The relay with MLFB 7PJ1321-5CC02-0AA0 displays status of binary inputs with LED indication.
- Depending on relay selection, the contacts available are 2 contacts or 2 make contact + 2 break contact.
- The relay complies with IEC 60255 standards.

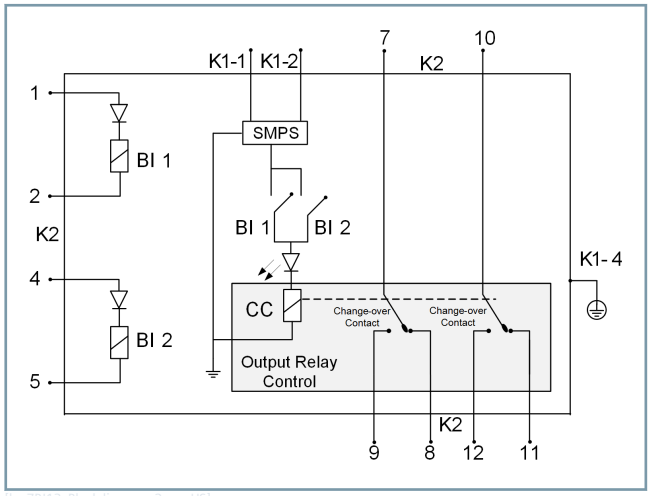
Applications

The 7PJ13 Trip Circuit Supervision Relay is used in the following field applications:

- The relay is used for supervising and monitoring activities. The trip circuit wiring is supervised from the positive supply to the negative supply when the circuit-breaker is in a make position or a break position.
- The relay is used for detecting and generating a circuit-breaker alarm, if the trip circuit supply has failed.

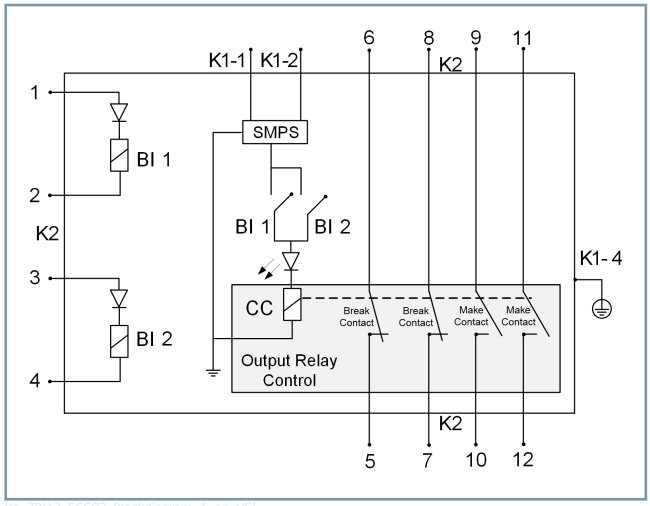
- The relay is used to generate an alarm if the trip signal is received but the circuit-breaker fails to operate.
- The binary outputs can be wired on to a numerical protection relay to indicate the faulted circuit to remote SCADA.

Supervision Operation



[lo_7PJ13_Blockdiagram, 2, en_US]

Figure 3.5/1 7PJ13 Trip Circuit Supervision Block Diagram [MLFB 7PJ1321-5AA21-0AA0/MLFB 7PJ1321-4AA21-0AA0]



[lo_7PJ13_5CC02_Blockdiagram, 1, en_US]

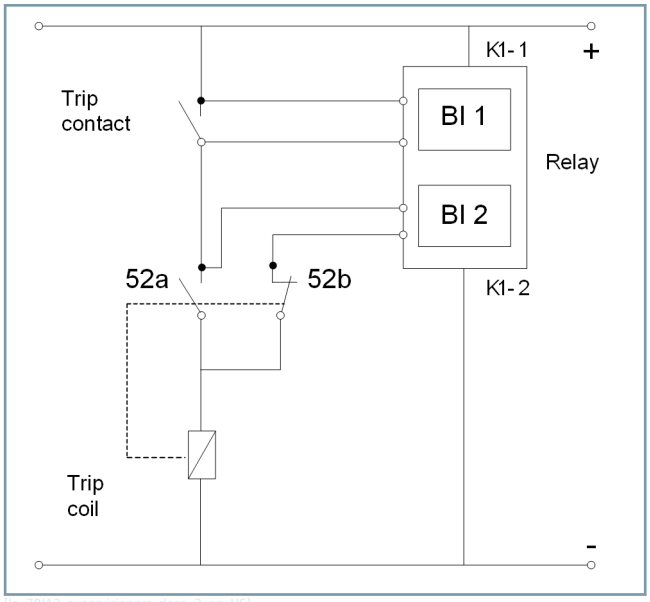
Figure 3.5/2 7PJ13 Trip Circuit Supervision Block Diagram [MLFB 7PJ1321-5CC02-0AA0]

A Trip Circuit Supervision Relay contact operates in the following 3 supervision conditions:

Supervision in pre-close condition

After the tripping circuit is completed, a small amount of sensing current flows through BI 1, BI 2, circuit-breaker auxiliary contacts (52b), and the tripping coil. The Trip Circuit Supervision Relay indicates a healthy condition by displaying the green LED.

If the tripping circuit becomes open circuit or has a loss of supply voltage, the Trip Circuit Supervision relay indicates this by displaying the red LED and the break contact (which is a make contact in healthy condition) provides remote indication.



[lo_7PJ13_supervisionpre-close, 2, en_US]

Figure 3.5/3 Supervision in a Pre-Close Condition

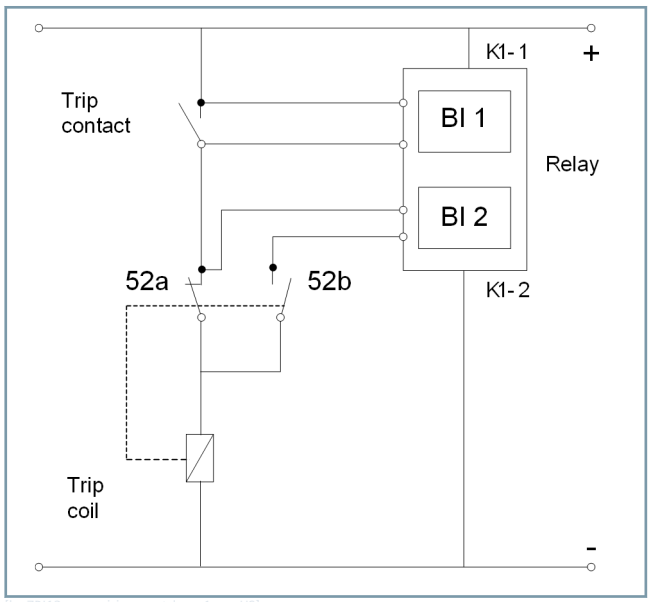
NOTE

For a low voltage system (DC 24 V to DC 48 V) trip circuit supervision operation shorting between pin number K2-1 and K2-4 is required.

Supervision in post-close condition

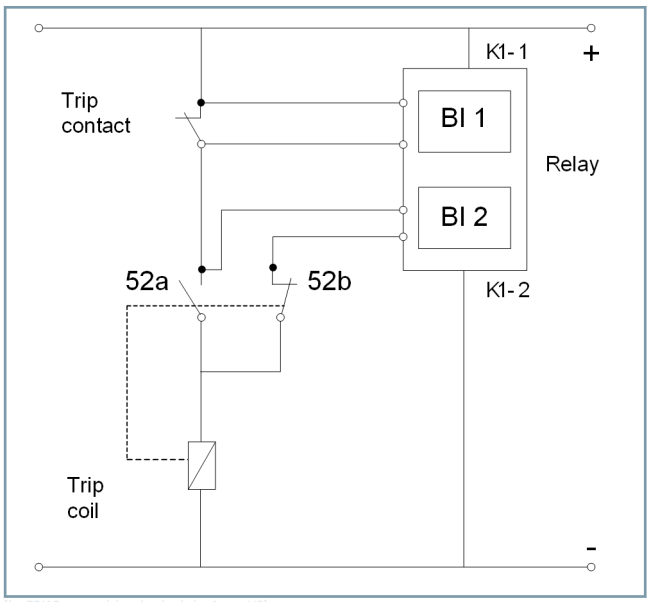
After the tripping circuit is completed, a small amount of sensing current flows through TS1, circuit-breaker auxiliary contacts (52a), and the tripping coil. The Trip Circuit Supervision Relay indicates a healthy condition by flashing the green LED.

If the tripping circuit becomes open circuit or has a loss of supply voltage, the Trip Circuit Supervision relay indicates this by flashing the red LED and the break contact (which is a make contact in healthy condition) provides remote indication.



[Io_7PJ13_supervision_postclose, 1, en_US]

Figure 3.5/4 Supervision in a Post-Close Condition



[Io_7PJ13_supervision_latchedtrip, 1, en_US]

Figure 3.5/5 Supervision in a Latched Trip Condition

NOTE

For low voltage system (DC 24 V to DC 48 V) trip circuit supervision operation shorting between pin number K2-1 and K2-4 is required.

NOTE

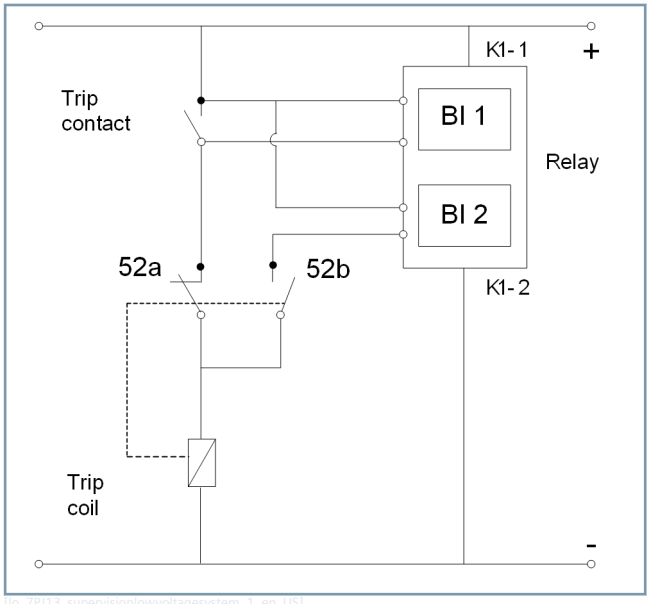
For low voltage system (DC 24 V to DC 48 V) trip circuit supervision operation shorting between pin number K2-1 and K2-4 is required.

3.5

Supervision in latched trip condition

After the tripping circuit is completed, a small amount of sensing current flows through TS2, circuit-breaker auxiliary contacts (52b), and the tripping coil. The Trip Circuit Supervision Relay indicates a healthy condition by displaying the green LED.

If the tripping circuit becomes open circuit or has a loss of supply voltage, the Trip Circuit Supervision relay indicates this by flashing the red LED and the break contact (which is a make contact in healthy condition) provides remote indication.



[Io_7PJ13_supervisionlowvoltagesystem, 1, en_US]

Figure 3.5/6 Supervision Trip Low Voltage System

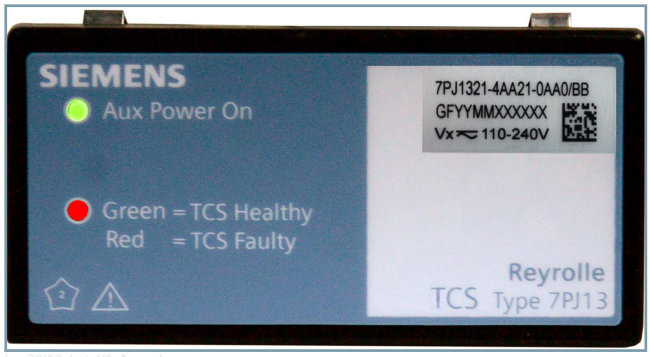
Monitoring

In a healthy condition, the green LED flashes and the output relay operates. For a trip circuit fault or trip supply loss the red LED flashes and the output relays de-energize after a delay of 500 ms.

Hardware Construction

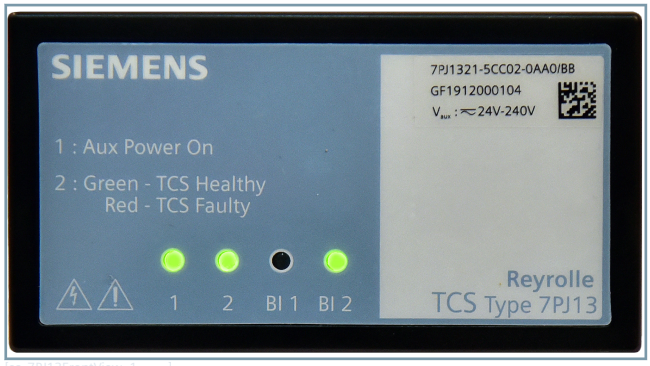
The device is housed in a non draw-out case designed for panel mounting.

The rear connection comprises of user friendly pluggable type terminals.



[sc_7PJ13photoV1, 1, --_--]

Figure 3.5/7 Front View [MLFBs 7PJ1321-5AA21-0AA0/7PJ1321-4AA21-0AA0]

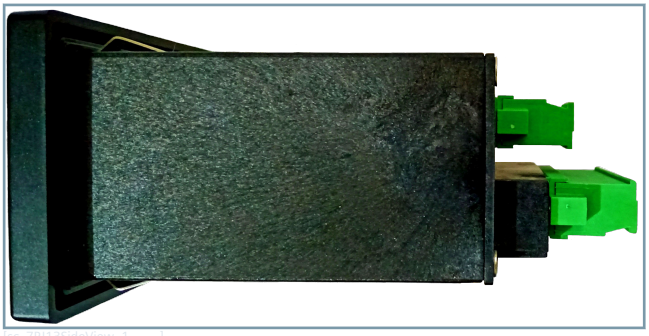


[sc_7PJ13FrontView, 1, --_--]

Figure 3.5/8 Front View [MLFB 7PJ1321-5CC02-0AA0]

[sc_7PJ13_rearview, 1, --_--]

Figure 3.5/9 Rear View



[sc_7PJ13SideView, 1, --_--]

Figure 3.5/10 Side View

Relay Information

The device fascia displays the MLFB order code, serial number, and device identification reference.

The device terminal label displays the MLFB order code, serial number, relay description, terminal contact details, and safety symbols.

	QR code (displays device serial number)
2	AC 2 kV insulation test of the aux inputs, binary inputs, and binary outputs
5	5 kV impulse voltage test (type test) in compliance with Class III
	Electrical Hazard
CE	European CE marking
	Caution, risk of danger. Refer to device documentation before operation.
	Waste Electrical and Electronic Equipment Directive (WEEE)

Connection Diagrams

The terminal diagram is located on top of the 7PJ13 Trip Circuit Supervision Relay housing and displays the terminal numbers and terminals.

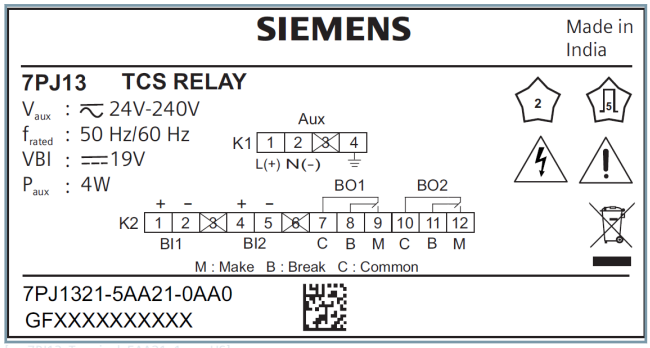


Figure 3.5/11 Terminal Details (for MLFB 7PJ1321-5AA21-0AA0) of 7PJ13 Trip Circuit Supervision Relay

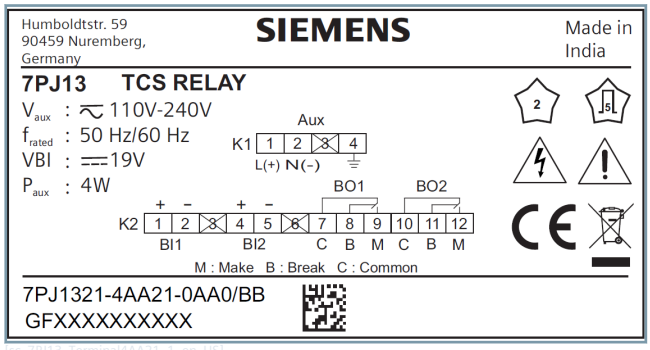


Figure 3.5/12 Terminal Details (for MLFB 7PJ1321-4AA21-0AA0) of 7PJ13 Trip Circuit Supervision Relay

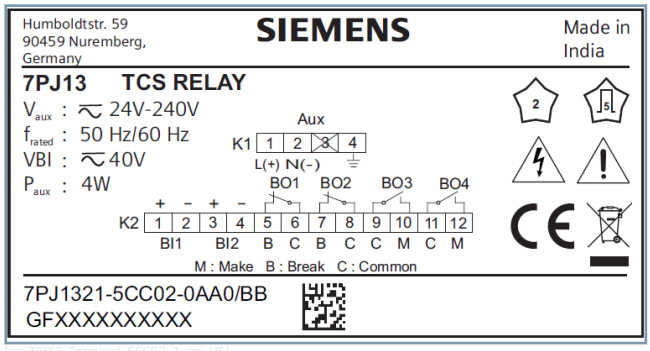


Figure 3.5/13 Terminal Details (for MLFB 7PJ1321-5CC02-0AA0) of 7PJ13 Trip Circuit Supervision Relay

Terminal Number	Terminal Name	Description
K1-1	L (+)	Auxiliary voltage positive
K1-2	N (-)	Auxiliary voltage negative
K1-3	–	Not connected
K1-4	⏚	Earth

Table 3.5/1 Auxiliary Terminals Specification

Terminal Number	Terminal Name	Description
K2-1	BI 1 +	Binary input 1 positive
K2-2	BI 1 -	Binary input 1 negative
K2-3	–	Not connected
K2-4	BI 2 +	Binary input 2 positive
K2-5	BI 2 -	Binary input 2 negative
K2-6	–	Not connected
K2-7	BO 1-COM	Common
K2-8	BO 1-B	Binary output 1 break contact
K2-9	BO 1-M	Binary output 1 make contact
K2-10	BO 2-COM	Common
K2-11	BO 2-B	Binary output 2 break contact
K2-12	BO 2-M	Binary output 2 make contact

Table 3.5/2 Binary Terminals Specification [MLFB 7PJ1321-5AA21-0AA0/MLFB 7PJ1321-4AA21-0AA0]

Terminal Number	Terminal Name	Description
K2-1	BI 1 +	Binary input 1 positive
K2-2	BI 1 -	Binary input 1 negative
K2-3	BI 2 +	Binary input 2 positive
K2-4	BI 2 -	Binary input 2 negative
K2-5	BO 1-B	Binary output 1 break contact
K2-6	BO 1-COM	Common
K2-7	BO 2-B	Binary output 2 break contact
K2-8	BO 2-COM	Common
K2-9	BO 3-COM	Common
K2-10	BO 3-M	Binary output 3 make contact
K2-11	BO 4-COM	Common
K2-12	BO 4-M	Binary output 4 make contact

Table 3.5/3 Binary Terminals Specification [MLFB 7PJ1321-5CC02-0AA0]

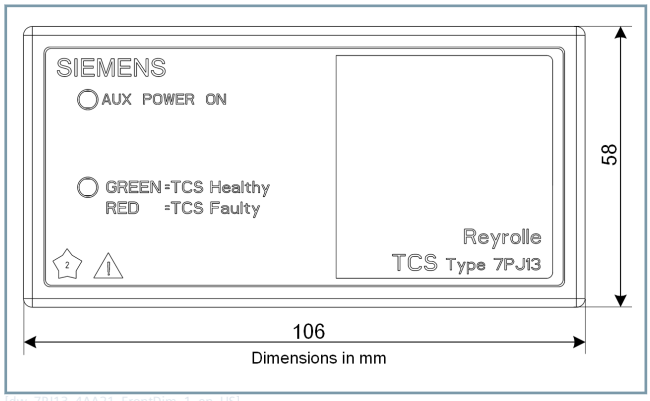
Mounting Instructions

A Trip Circuit Supervision Relay comprises of spring type mounting clamps, which enables easy installation. To mount the Trip Circuit Supervision Relay, the following requirements should be satisfied:

- Cut a hole in the panel with a measurement of 92 mm x 45 mm (Width x Height).
- Carry out all of the required internal wiring connections.
- Install the Trip Circuit Supervision Relay into the panel and lock with the clamps.

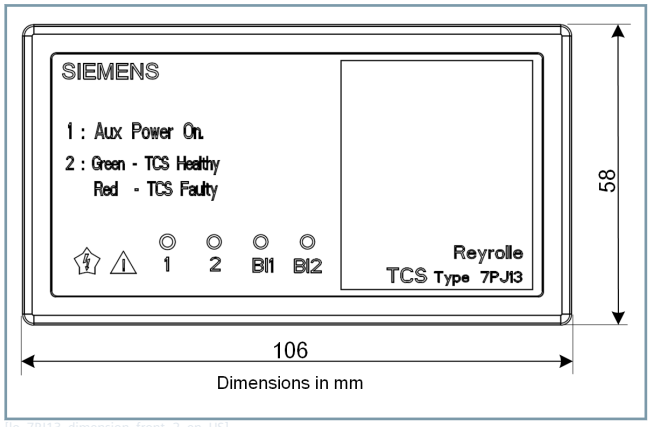
Dimension Drawings

This section displays the different dimensional views of a Trip Circuit Supervision Relay.



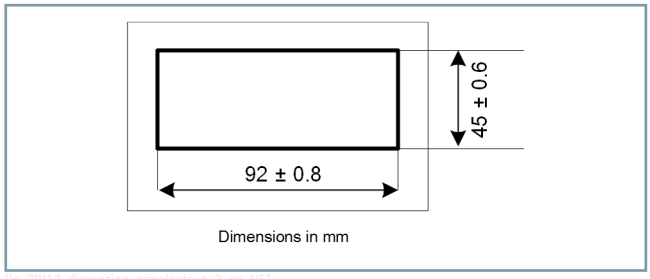
[dw_7PJ13_4AA21_FrontDim, 1, en_US]

Figure 3.5/14 Front View [MLFB 7PJ1321-5AA21-0AA0 and MLFB 7PJ1321-4AA21-0AA0]



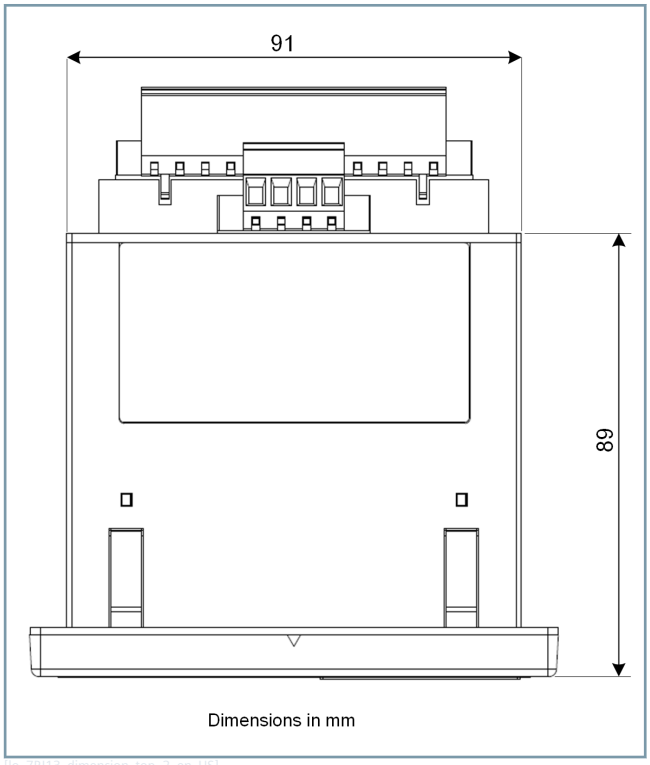
[lo_7PJ13_dimension_front, 2, en_US]

Figure 3.5/15 Front View [MLFB 7PJ1321-5CC02-0AA0]



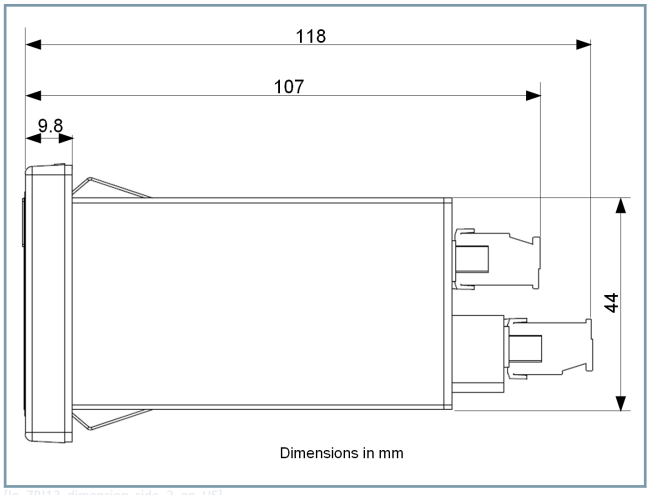
[lo_7PJ13_dimension_panelcutout, 2, en_US]

Figure 3.5/16 Panel Cut-out View



[lo_7PJ13_dimension_top, 2, en_US]

Figure 3.5/17 Top View



[lo_7PJ13_dimension_side, 2, en_US]

Figure 3.5/18 Side View

Technical Data

Indication of Conformity

This product complies with the directive of the Council of the European Communities on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 2014/30/EU) and concerning electrical equipment for use within specified voltage limits (Low Voltage Directive 2014/35/EU) as well as restriction on usage of hazardous substances in electrical and electronic equipment (RoHS Directive 2011/65/EU).

This conformity has been proved by tests conducted by Siemens AG in accordance of the Council Directive in accordance with the product standard IEC/EN 60255-26 for the EMC directives, and with the standard IEC/EN 60255-27 for the low-voltage directive.

RoHS directive 2011/65/EU is met using the standard EN 50581. The device has been designed and produced for industrial use.

NOTE

Product CE certified for MLFBs:
7PJ1321-4AA21-0AA0 and 7PJ1321-5CC02-0AA0

General Technical Data

Power Supply

Parameter	Value
Auxiliary voltage range V_{rated}	DC 24 V to 240 V/AC 24 V to 240 V [88] DC 110 V to 240 V/ AC 110 V to 240 V [88]
Auxiliary voltage operating range	80 % to 110 %
Input power consumption	< 4 W/ 9 VA

Binary Inputs

Parameter	Value	
BI threshold/operating voltage	**BI voltage rating**	**BI operating range**
	DC 19 V	DC 18 V to 265 V
	AC 40 V/DC 40 V	AC 40 V to 265 V/DC 40 V to 265 V
Input power consumption	< 1 W/VA	
Current for operation	0.9 mA to 3 mA	
Isolation	AC 2 kV	

Binary Outputs

Parameter	Value	
Operate time	> 500 ms and < 800 ms	
Reset time	< 100 ms	
Mechanical life (loaded)	10 000 operations (at rated current of resistive load)	
Number of contacts	2 change-over contacts, Selectable 2 make contacts + 2 break contacts (As per MLFB selection)	
Contact details	Rated voltage	AC 250 V DC 250 V
	Contact current rating: Continuous Short time	 AC 5 A/DC 5 A AC 30 A/DC 30 A for 0.2 s
	Make and carry for 0.5 s	AC 10 A
	Make and carry for 3 s	AC 8 A
	Break	Breaking capacity for DC with circuit time-constant L/R < 40 ms, at 48 V/110 V/ 220 V 0.7 A/ 0.25 A/0.15 A
Limiting making capacity: (L/R ≤ 40 ms)	1000 W	

Installation Category

Parameter	Value
Installation category (overvoltage category)	Class III

Pollution

Parameter	Value
Pollution degree	2

External Interfaces

Parameter	Value
Power supply (1 make contact)	Header: 4 Pin Cabling-type: standard wire, unshielded, max. 2.5 mm²
Binary inputs (2 make contacts) and contact outputs (2 make contacts)	Header: 12 Pin Cabling-type: standard wire, unshielded, max. 2.5 mm²

88 Based on ordering option

Mechanical Tests

Test	Standard
Degree of protection	IEC 60529, IP54 front IP20 rear
Vibration	IEC 60255-21-1, Response and endurance, Class I
Shock and bump	IEC 60255-21-2, Shock response and withstand, Class I Bump, class I
Seismic	IEC 60255-21-3, Class I
Contact performance	IEC 60255-1, (Ref: Std IEC 61810-1)

Electrical Tests

Test	Standard
Insulation resistance	IEC 60255-27 [89] Insulation resistance > 100 MΩ at DC 500 V Test duration: > 5 s (Between any terminal and earth, independent circuits)
Impulse voltage withstand	IEC 60255-27 [89] 5 kV, 1.2/50 µs, 0.5 J 5 +ve, -ve pulses (Between all terminals and case earth and any 2 independent circuits)
AC dielectric voltage	IEC 60255-27 [89] AC 2 kV RMS for 1 min (Between any terminal and earth, independent circuits) AC 1 kV RMS for 1 min (across make contacts)
Slow damped oscillatory wave	IEC 60255-26 **Common-mode:** Test voltage: 2.5 kV peak voltage **Differential mode:** Test voltage: 1.0 kV peak voltage Test duration: 2 s Source impedance: 200 Ω Voltage oscillation frequency: 1 MHz Repetition frequency: 400 Hz
Electrostatic discharge	IEC 60255-26 8 kV air discharge 6 kV contact discharge
Electrical fast transient or burst	IEC 60255-26 Test level: zone A Test severity amplitude: ± 4 kV Repetition frequency: 5 kHz
Surge immunity	IEC 60255-26 Test level: zone B Line to line: 0.5 kV, 1 kV Line to earth: 0.5 kV, 1 kV, 2 kV Front time/time to half-value: 1.2/50 µs Source impedance: 2 Ω
Radiated immunity	IEC 60255-26 80 MHz to 1.0 GHz and 1.4 GHz to 2.7 GHz Field strength: 10 V/m (RMS) Amplitude modulated: 80 % AM (1 kHz)
Conducted radio frequency interference	IEC 60255-26 150 kHz to 80 MHz, 10 V_{RMS} , dwell time: 0.5 s
Power frequency magnetic field	IEC 60255-26 30 A/m applied 1 min, 300 A/m applied for 3 s
Radiated emissions	IEC 60255-26 and CISPR 11
Conducted emissions	IEC 60255-26 and CISPR 32
Functional performance	IEC 60255-1
Gradual shutdown/start-up test	IEC 60255-26 Shut down/start up ramp 60 s Power off 5 min
Power frequency immunity test [90]	IEC 60255-26 Test level: zone B

89 All aspects of IEC 60255-5 have been covered under IEC 60255-27.

90 DC binary input ports interfacing with cables whose total length is more than 10 m, need to have a multi core twisted screened cable for providing immunity against high level of power frequency interferences.

Test	Standard
Pulse magnetic field test	IEC 61000-4-9 1000 A/m, 5 +ve and 5 -ve
Damped oscillatory magnetic field value	IEC 61000-4-10 0.1 and 1.0 MHz, 100 A/m

Product Safety Test

Test	Reference
Clearances and creepage distances	IEC/EN 60255-27: Edition 2 ≥ 4 mm
IP rating	IEC/EN 60255-27: Edition 2 IP54 (front side) IP20 (rear side)
Impulse voltage	IEC/EN 60255-27: Edition 2 5 kV, 5 +ve, 5 -ve pulses
AC dielectric voltage	IEC/EN 60255-27: Edition 2 AC 2 kV, 50 Hz, 1 min
Insulation resistance	IEC/EN 60255-27: Edition 2 DC 500 V, > 5 s, > 100 MΩ
Protective bonding resistance	IEC/EN 60255-27: Edition 2 < AC 12 V/DC 12 V, 1 min, < 0.1 Ω
Protective bonding continuity	IEC/EN 60255-27: Edition 2
Flammability	IEC/EN 60255-27: Edition 2
Single fault condition	IEC/EN 60255-27: Edition 2
Mechanical resistance to shock and impact	IEC 61010-1: Edition 3 Clause number 8

Test	Reference
Protection against electric shock	IEC 61010-1: Edition 3 Clause number 6
Protection against the spread of fire	IEC 61010-1: Edition 3 Clause number 9
Equipment temperature limits and resistance to heat	IEC 61010-1: Edition 3 Clause number 10

Climatic Environmental Tests

Temperature

IEC 60068-2-1/IEC 60068-2-2/IEC 60255-1/IEC 60068-2-14

Ambient operating temperature	-10 °C to +55 °C
Storage temperature (non-operational)	-25 °C to +70 °C
Change of temperature test	-10 °C to +55 °C

Humidity

IEC 60068-2-30/IEC 60068-2-78/IEC 60255-1

Damp heat test, cyclic	+25 to 55 °C, RH > 93 % RH (6 cycles) At lower temperature, 93 %, ± 3 % RH At upper temperature, 93 %, ± 3 % RH
Damp heat test, steady state	10 days at 93 ± 3 % RH, +40 °C

Ordering Information – 7PJ13

Product Description	Order Number	Order Description
Trip Circuit Supervision Relay (Global Region)	7PJ1321-4AA21-0AA0	• Number of Binary Inputs: Element 2 • Contact Reset Type: Self reset • Auxiliary Voltage Range: AC 110 V to 240 V/ DC 110 V to 240 V • Contact Arrangement: 0 make contact, 0 break contact and 2 change-over contact • Binary Input Range: DC 18 V to 265 V, Threshold DC 19 V
Trip Circuit Supervision Relay (Global Region)	7PJ1321-5CC02-0AA0	• Number of Binary Inputs: Element 2 • Contact Reset Type: Self reset • Auxiliary Voltage Range: AC 24 V to 240 V/DC 24 V to 240 V • Contact Arrangement: 2 Make contact, 2 Break contact and 0 change-over contact • Binary Input Range: AC 40 V to 240 V/DC 40 V to 240 V, Threshold AC/DC 40 V
Trip Circuit Supervision Relay (India Region)	7PJ1321-5AA21-0AA0	• Number of Binary Inputs: Element 2 • Contact Reset Type: Self reset • Auxiliary Voltage Range: AC 24 V to 240 V/DC 24 V to 240 V • Contact Arrangement: 0 make contact, 0 break contact and 2 change-over contact • Binary Input Range: DC 18 V to 265 V, Threshold DC 19 V

7PJ14 Supervision Relay – Devices and Application

Description

The 7PJ14 AC/DC Supervision Relay is a relay used for detecting the loss of the alternating or direct current supply. The relay is a member of the Siemens Reyrolle protection devices product family and is an electronic device.

The supply supervision schemes typically require a low operating current, and the ability to initiate a time-delayed output for remote monitoring along with local visual flag indication to indicate if the supply is lost.

Under normal operating condition, the 7PJ14 relay is energised and the normally closed contacts are held open. If the supply is disconnected, the 7PJ14 relay provides a visual flag indication and the normally closed binary output contacts are de-energised and can be used for remote monitoring.

The 7PJ14 requires minimal operating current and includes a drop-off delay. These features keep the relay in the operating condition during a temporary decrease in the battery voltage. For example, during a busbar fault when the trip relays operate simultaneously, this avoids any spurious alarms being generated.

The 7PJ14 is available in 4 variants with different threshold values based on the supply voltage that needs to be monitored. The front panel of the 7PJ14 comprises 2 dual-colored LEDs and a flag indicator.

The status LED and flag indicator provide visual indication of the supervision state. If the auxiliary supply is available, the flag indicator can be reset manually with the reset button.

Type of device	Electronic circuit relay
Housing	Size 106 mm x 58 mm x 118 mm (Width x Height x Depth), surface/flush mounting, non-draw–out
LED indications	**Auxiliary power On LED** • Green = Auxiliary power On **Supply supervision status LED** • Green = Healthy status • Red = Faulty status
Flag indication	Black = Healthy status Red = Faulty status
Auxiliary voltage range	AC 24 V to 240 V DC 24 V to 240 V
Burden	< 4 W or 9 VA

Outputs	2 (NO) make contacts and 2 (NC) break contacts
BI supervision voltage based selection range	7PJ1411-5CC01-0AA0 • Threshold DC 24 V 7PJ1411-5CC02-0AA0 • Threshold DC 48 V 7PJ1411-5CC03-0AA0 • Threshold AC/DC 110 V 7PJ1411-5CC04-0AA0 • Threshold AC/DC 220 V

Benefits

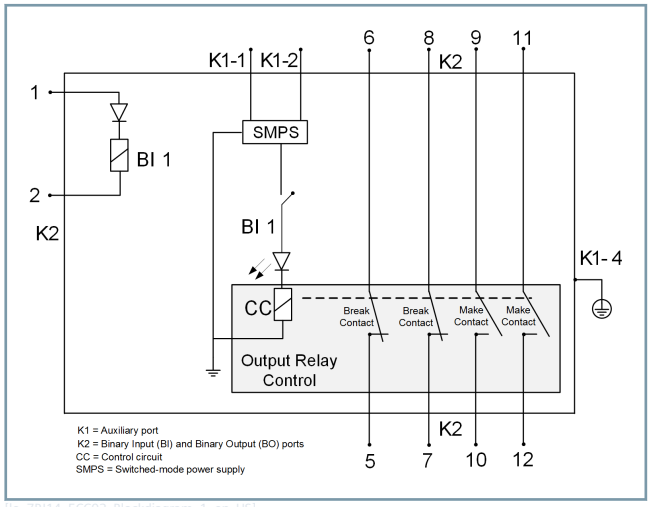
- A compact design 106 mm x 58 mm (Width x Height).
- Surface/flush mounting molded case.
- Continuous supervision of supervised supply by keeping the output contacts in a pickup condition.
- Able to detect and indicate auxiliary supply failures in supervised circuits.
- Indicates operating state by a single LED with dual color and flag indicator.
- LED indications for auxiliary voltage and supervision voltage.
- The relay complies with IEC 60255 standards.

Applications

The 7PJ14 AC/DC Supervision Relay is used in the following field applications:

- The relay is used for supervising and monitoring the voltage of a station battery in protection systems.
- If the alternating or direct current supply fails then the relay generates an alarm.
- The binary outputs can be wired to a digital protection device or RTU to indicate the faulty circuit to remote SCADA.

Supply Supervision Operation



[fo_7PJ14_5CC02_Blockdiagram, 1, en_US]

Figure 3.6/1 7PJ14 AC/DC Supervision Block Diagram

The AC/DC supply supervision relay contacts operate as follows:

When the auxiliary power supply is connected to the device, after the supply to be supervised is connected, a small amount of current flows through the binary input (BI). If the supply voltage at BI is above the threshold level, then device indicates the presence of the supervision supply by illuminating a status LED in Green color as healthy condition. The output contacts are in pickup condition after a pickup delay of 100 ms (operated condition). Flag indication can be resetted by pressing a reset key, color black shown as healthy condition.

If the supervised supply voltage at BI falls below the threshold level during the continuous monitoring, then the device indicates a faulty status by illuminating the status LED in red color. The output contacts are de-energised after a delay of around 200 ms to 400 ms (non-operated condition), then the device flag indicates a red color.

Once the supervised supply at BI is restored the relay returns to a healthy condition and the status LED turns green color. The output contacts are in pickup condition after a pickup delay of 100 ms (operated condition). Flag indication can be resetted by pressing a reset key, color black shown as healthy condition.

NOTE

The BO reset time is guaranteed only when BI voltage is maintained at respective drop-off voltage for > 400 ms.

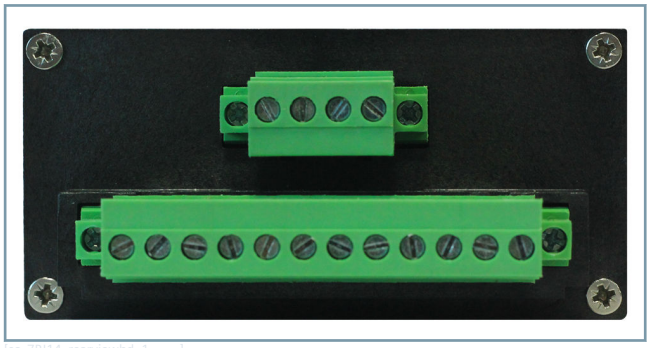
Hardware Construction

The device is housed in a non-draw–out case designed for surface mounting or flush mounting.

The rear connection comprises of user-friendly pluggable type terminals.

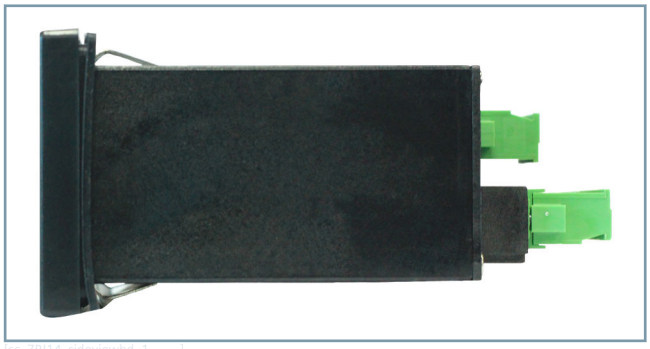
[ph_7PJ14_frontview, 1, --_--]

Figure 3.6/2 Front View



[sc_7PJ14_rearviewhd, 1, --_--]

Figure 3.6/3 Rear View



[sc_7PJ14_sideviewhd, 1, --_--]

Figure 3.6/4 Side View

Relay Information

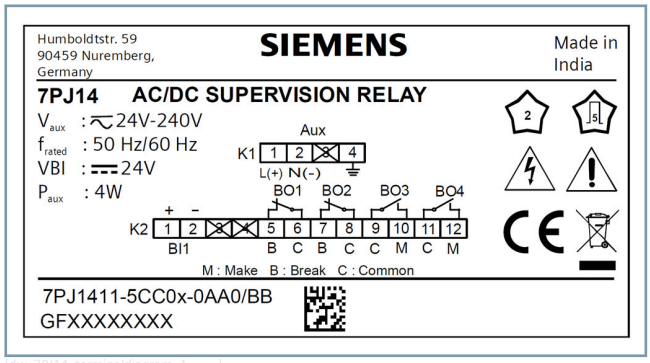
The device front fascia displays the MLFB order code, serial number, and device identification reference details.

The device terminal label displays the MLFB order code, serial number, relay description, terminal contacts details, and safety symbols.

	QR code (displays device serial number)
	AC 2-kV insulation test of the aux inputs, binary inputs, and binary outputs
	5-kV impulse voltage test (type test) in compliance with Class III
	Electrical hazard
	European CE marking
	Caution, risk of danger. Refer to device documentation before operation.
	Waste Electrical and Electronic Equipment Directive (WEEE)

Connection Diagrams

The terminal diagram is on top of the 7PJ14 AC/DC Supervision Relay housing and displays the terminal numbers and terminals.



[dw_7PJ14_terminaldiagram, 1, –, –]

Figure 3.6/5 Terminal Details for AC/DC Supervision Relay

Terminal Number	Terminal Name	Description
K1-1	L (+)	Auxiliary voltage positive
K1-2	N (-)	Auxiliary voltage negative
K1-3	–	Not connected
K1-4	⏚	Ground

Table 3.6/1 Binary Input and Binary Output Specifications

Terminal Number	Terminal Name	Description
K2-1	BI 1 +	Binary input 1 positive
K2-2	BI 2 -	Binary input 1 negative
K2-3	–	Not connected
K2-4	–	Not connected
K2-5	BO 1-B	Binary output 1 break contact
K2-6	BO 1-C	Common
K2-7	BO 2-B	Binary output 2 break contact
K2-8	BO 2-C	Common
K2-9	BO 3-C	Common
K2-10	BO 3-M	Binary output 3 make contact
K2-11	BO 4-C	Common
K2-12	BO 4-M	Binary output 4 make contact

Table 3.6/2 Binary Input and Binary Output Specifications

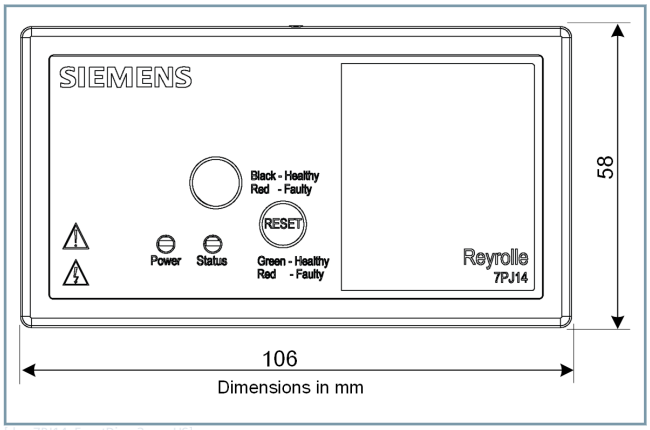
Assembly Instructions

The AC/DC Supervision Relay comprises of spring type assembly clamps, which enables easy installation. To mount the relay, the following requirements must be satisfied:

- Carry panel cut out with a measurement of 92 mm x 45 mm (Width x Height).
- Carry out all of the required internal wiring connections.
- Install the relay into the panel and lock with the clamps.

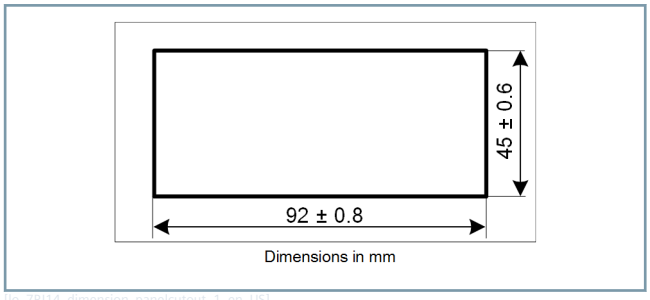
Dimension Drawings

This section displays the different dimensional views of a AC/DC Supervision Relay.



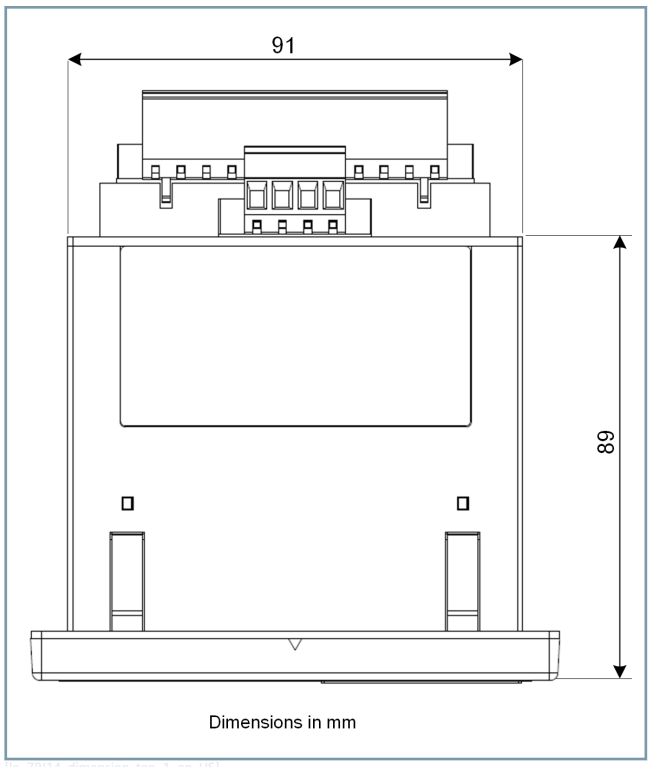
[dw_7PJ14_FrontDim, 2, en_US]

Figure 3.6/6 Front View



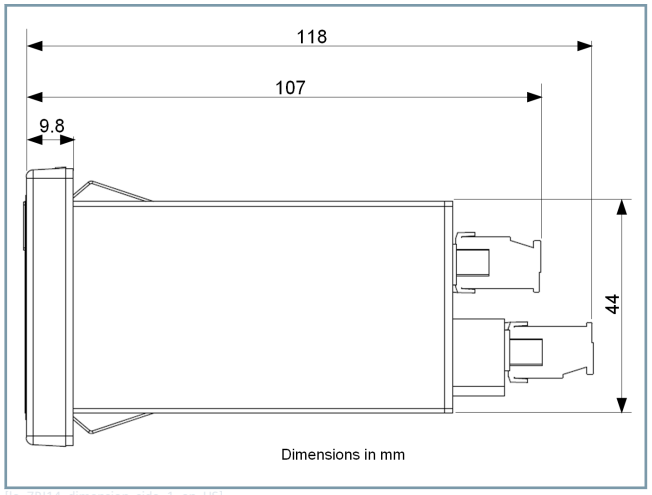
[io_7PJ14_dimension_panelcutout, 1, en_US]

Figure 3.6/7 Panel Cut out View



[io_7PJ14_dimension_top, 1, en_US]

Figure 3.6/8 Top View



[io_7PJ14_dimension_side, 1, en_US]

Figure 3.6/9 Side View

Technical Data

Indication of Conformity

This product complies with the directive of the Council of the European Communities on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 2014/30/EU) and concerning electrical equipment for use within specified voltage limits (Low Voltage Directive 2014/35/EU) as well as restriction on usage of hazardous substances in electrical and electronic equipment (RoHS Directive 2011/65/EU).

This conformity has been proved by tests conducted by Siemens AG in accordance of the Council Directive in accordance with the product standard IEC/EN 60255-26 for the EMC directives, and with the standard IEC/EN 60255-27 for the low-voltage directive.

RoHS directive 2011/65/EU is met using the standard EN 63000. The device has been designed and produced for industrial use.

General Technical Data

Power supply

Parameter	Value
Auxiliary-voltage range V_{rated}	DC 24 V to 240 V/AC 24 V to 240 V
Auxiliary-voltage operating range	80% to 110%
Input power consumption	< 4 W/ 9 VA
Allowable super imposed AC component	15% of direct voltage
Max interruption time (collapse to zero)	≤ 20 ms (AC/DC 19.2 V)

Binary Inputs

Parameter	Value
BI operating voltage	DC 24 V, DC 48 V, AC/DC 110 V, AC/DC 220 V
Input power consumption	< 1 W/VA
Current for operation	2 mA to 4 mA (typical) 5 mA maximum
Isolation	AC 2 kV

Operating Voltage	Value
DC 24 V, DC 48 V, DC 110 V, DC 220 V AC 110 V, AC 220 V	Pickup voltage: < 70% of V_{BI}
DC 110 V, DC 220 V	Drop-off voltage: > 50% of V_{BI}
DC 24 V, DC 48 V	Drop-off voltage: > 45% of V_{BI}
AC 110 V, AC 220 V	Drop-off voltage: > 40% of V_{BI}

Parameter	Value
Reset time	> 200 ms and < 400 ms DC 24 V, DC 48 V, DC 110 V, DC 220 V, AC 110 V, AC 220 V
Operate time	< 100 ms DC 24 V, DC 48 V, DC 110 V, DC 220 V
Operate time	< 110 ms AC 110 V, AC 220 V

LED Indications

Indicator	Status
Power LED – ON	Green color – Auxiliary supply is available
Power LED – OFF	No color – Auxiliary supply is not available
Status LED	Green color – AC/DC Healthy (supervision status is healthy)
	Red color – AC/DC Faulty (supervision status is faulty)
Bi-stabel flag indicator	Black color – AC/DC Healthy (supervision status is healthy)
	Red color – AC/DC Faulty (supervision status is faulty)

Binary Outputs

Parameter	Value	
Mechanical life (loaded)	10 000 operations	
Number of contacts	2 make contacts + 2 break contacts	
Reset type	Self reset	
Contact details	Contact voltage	AC 250 V DC 250 V
	Contact current rating: Continuous Short time for 0.2 s	 AC 5 A/DC 5 A AC 30 A/DC 30 A
	Make and carry for 0.5 s	AC 10 A
	Make and carry for 3 s	AC 8 A
	Limiting making capacity: (L/R ≤ 40 ms)	1000 W

Installation Category

Parameter	Value
Installation category (overvoltage category)	Class III

Pollution

Parameter	Value
Degree of pollution	2

External Interfaces

Parameter	Value
Power supply	Header: 4 Pin Cabling type: standard wire, unshielded, max. 2.5 mm^2
Binary inputs and binary outputs	Header: 12 Pin Cabling type: standard wire, unshielded, max. 2.5 mm^2

Recommended Terminal Lugs Specifications

Terminal lugs	Type/Cable Specifications
Auxiliary supply	Insulated tin plated crimp pin connector, 2.6 mm^2 to 6.6 mm^2, 12 AWG to 10 AWG, Torque required is 0.5 Nm to 0.6 Nm Manufacturer/part number: End sleeve 3D-8011H or equivalent
Binary input/binary output	Insulated tin plated crimp pin connector, 2.6 mm^2 to 6.6 mm^2, 12 AWG to 10 AWG, Torque required is 0.5 Nm to 0.6 Nm Manufacturer/part number: End sleeve 3D-8011H or equivalent

Mechanical Tests

Test	Standard
Degree of protection	IEC 60529, IP54 front IP20 rear
Vibration	IEC 60255-21-1, Response and endurance, Class I
Shock and bump	IEC 60255-21-2, Shock response and withstand, Class I Bump, class I
Seismic	IEC 60255-21-3, Class I
Contact performance	IEC 60255-1, (Reference standard: IEC 61810-1)

Electrical Tests

Test	Standard
Insulation resistance	IEC 60255-27 [91] Insulation resistance > 100 MΩ at DC 500 V Test duration: > 5 s (Between any terminal and ground, independent circuits)
Impulse voltage withstand	IEC 60255-27 [91] 5 kV, 1.2/50 µs, 0.5 J 5 +ve pulses, 5 -ve pulses (Between all terminals and case ground and any 2 independent circuits)
AC dielectric voltage	IEC 60255-27 [91] AC 2 kV RMS for 1 min (Between any terminal and ground, independent circuits) AC 1 kV RMS for 1 min (across make contacts)
Slow damped oscillatory wave	IEC 60255-26 **Common-mode:** Test voltage: 2.5-kV peak voltage **Differential mode:** Test voltage: 1.0-kV peak voltage Test duration: 2 s Source impedance: 200 Ω Voltage oscillation frequency: 1 MHz Repetition frequency: 400 Hz
Electrostatic discharge	IEC 60255-26 8-kV air discharge 6-kV contact discharge
Electrical fast transient or burst	IEC 60255-26 Test level: zone A Test severity amplitude: ± 4 kV Repetition frequency: 5 kHz

91 All aspects of IEC 60255-5 have been covered under IEC 60255-27.

Test	Standard
Surge immunity	IEC 60255-26 Test level: zone A Phase-to-phase: 0.5 kV, 1 kV, 2 kV Phase-to-ground: 0.5 kV, 1 kV, 2 kV, 4 kV Front time/time to half-value: 1.2/50 µs Source impedance: 2 Ω
Radiated immunity	IEC 60255-26 80 MHz to 1.0 GHz and 1.4 GHz to 2.7 GHz Field strength: 10 V/m (RMS) Amplitude modulated: 80% AM (1 kHz)
Conducted high frequency interference	IEC 60255-26 150 kHz to 80 MHz, 10 V_{rms}, dwell time: 1.0 s
Power frequency magnetic field	IEC 60255-26 30 A/m applied 1 min, 300 A/m applied for 3 s
Radiated emissions	IEC 60255-26 and CISPR 11
Conducted emissions	IEC 60255-26 and CISPR 32
Functional performance	IEC 60255-1
Gradual shutdown/start-up test	IEC 60255-26 Shut down/start up ramp 60 s Power off 5 min
Power frequency immunity test [92]	IEC 60255-26 Test level: zone A
Pulse magnetic field test	IEC 61000-4-9 1000 A/m, 5 +ve and 5 -ve
Damped oscillatory magnetic field value	IEC 61000-4-10 0.1 MHz and 1.0 MHz, 100 A/m

Product Safety Test

Test	Reference
Clearances and creepage distances	IEC/EN 60255-27: Edition 2 ≥ 4 mm
IP rating	IEC/EN 60255-27: Edition 2 IP54 (front side) IP20 (rear side)
Impulse voltage	IEC/EN 60255-27: Edition 2 5 kV, 5 +ve, 5 -ve pulses
AC dielectric voltage	IEC/EN 60255-27: Edition 2 AC 2 kV, 50 Hz, 1 min
Insulation resistance	IEC/EN 60255-27: Edition 2 DC 500 V, > 5 s, > 100 MΩ
Protective bonding resistance	IEC/EN 60255-27: Edition 2 < AC 12 V/DC 12 V, 1 min, < 0.1 Ω
Protective bonding continuity	IEC/EN 60255-27: Edition 2
Flammability	IEC/EN 60255-27: Edition 2
Single fault condition	IEC/EN 60255-27: Edition 2
Mechanical resistance to shock and impact	IEC 61010-1: Edition 3 Clause number 8
Protection against electric shock	IEC 61010-1: Edition 3 Clause number 6
Protection against the spread of fire	IEC 61010-1: Edition 3 Clause number 9
Equipment temperature limits and resistance to heat	IEC 61010-1: Edition 3 Clause number 10

Climatic Environmental Tests

Temperature

IEC 60068-2-1/IEC 60068-2-2/IEC 60255-1/IEC 60068-2-14

Ambient operating temperature	-10 °C to +55 °C
Storage temperature (non-operational)	-25 °C to +70 °C
Change of temperature test	-10 °C to +55 °C

Humidity

IEC 60068-2-30/IEC 60068-2-78/IEC 60255-1

Damp heat test, cyclic	+25 °C to 55 °C, Relative Humidity (RH) > 93 % RH (6 cycles) At lower temperature, 93 %, ± 3 % RH At upper temperature, 93 %, ± 3 % RH
Damp heat test, steady state	10 days at 93 ± 3 % RH, +40 °C

92 The DC binary input ports interfacing with cables whose total length is more than 10 m, must have a multi-core twisted shielded cable for providing immunity against high level of power frequency interferences.

Ordering Information – 7PJ14

Product Description	Order Number	Order Description
AC/DC Supervision Relay	7PJ1411-5CC01-0AA0	• Auxiliary-voltage range: AC 24 V to 240 V/DC 24 V to 240 V • Binary input threshold: DC 24 V • Number of binary inputs: Element 1 • Contact arrangement: 2 (NO) make contacts and 2 (NC) break contacts • Contact reset type: Self reset • Flag indicator: Hand reset type • Number of LEDs: 2 • Size: 106 mm x 58 mm x 118 mm (Width x Height x Depth)
	7PJ1411-5CC02-0AA0	• Auxiliary-voltage range: AC 24 V to 240 V/DC 24 V to 240 V • Binary input threshold: DC 48 V • Number of binary inputs: Element 1 • Contact arrangement: 2 (NO) make contacts and 2 (NC) break contacts • Contact reset type: Self reset • Flag indicator: Hand reset type • Number of LEDs: 2 • Size: 106 mm x 58 mm x 118 mm (Width x Height x Depth)
	7PJ1411-5CC03-0AA0	• Auxiliary-voltage range: AC 24 V to 240 V/DC 24 V to 240 V • Binary input threshold: AC/DC 110 V • Number of binary inputs: Element 1 • Contact arrangement: 2 (NO) make contacts and 2 (NC) break contacts • Contact reset type: Self reset • Flag indicator: Hand reset type • Number of LEDs: 2 • Size: 106 mm x 58 mm x 118 mm (Width x Height x Depth)
	7PJ1411-5CC04-0AA0	• Auxiliary voltage range: AC 24 V to 240 V/DC 24 V to 240 V • Binary input threshold: AC/DC 220 V • Number of binary inputs: Element 1 • Contact arrangement: 2 (NO) make contacts and 2 (NC) break contacts • Contact reset type: Self reset • Flag indicator: Hand reset type • Number of LEDs: 2 • Size: 106 mm x 58 mm x 118 mm (Width x Height x Depth)

Description

The 7PJ1521 and 7PJ1524 High Speed Trip relay is a multi-contact attracted armature relay designed to IEC 60255.

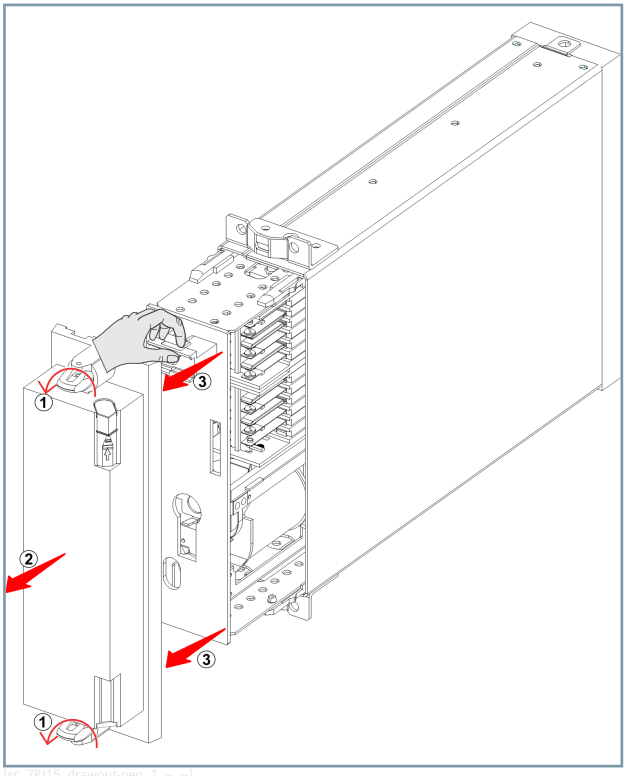
High burden relays with immunity to capacitance discharge currents. They are also suitable for certain applications where they are remote from the initiation signal.

A high burden also permits reliable operation of current operated series repeat relays. TR relays can be provided with an instantaneous or time-delayed cut-off.

Benefits

The features of the High Speed Trip Relay are:

- High speed, high burden, positive action, and instantaneous cutoff.
- The 7PJ15 series High Burden Trip Relay can be used with Trip Circuit supervision relay (Siemens Reyrolle 7PJ13) having a supervision current of ≤ 3 mA to monitor and supervise the integrity of the Trip circuit with coil supervision terminal.
- It is supplied in a draw-out type case.



[sc_7PJ15_drawout-gen, 1, –_–]

- The relay has a robust design for a long, reliable service life.

Applications

The high speed trip relay type 7PJ15 is mainly used for all types of control and protection circuits in power stations and industrial applications, where a higher grade of reliability and high contact rating is stipulated. The 7PJ15 relay acts as a high speed

[7PJ15_FrontView, 1, –_–]

element and contact multiplication in tripping and signaling circuits of protective relays.

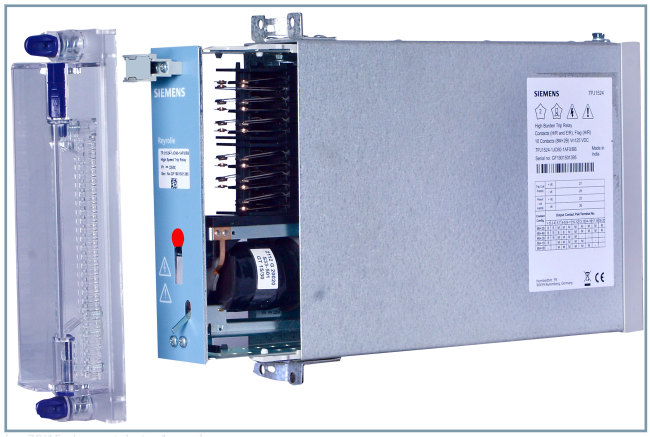
The high speed trip relay is used in the following applications:

- Tripping of multiple circuit-breakers
- Tripping and lock out application of feeder and transformer circuit-breakers
- Control signaling and interlocking
- Inter tripping and remote tripping interface for SCADA

Hardware Construction

The device is housed in a draw-out case designed for panel mounting.

The rear connection comprises of screw type, fixed terminals.

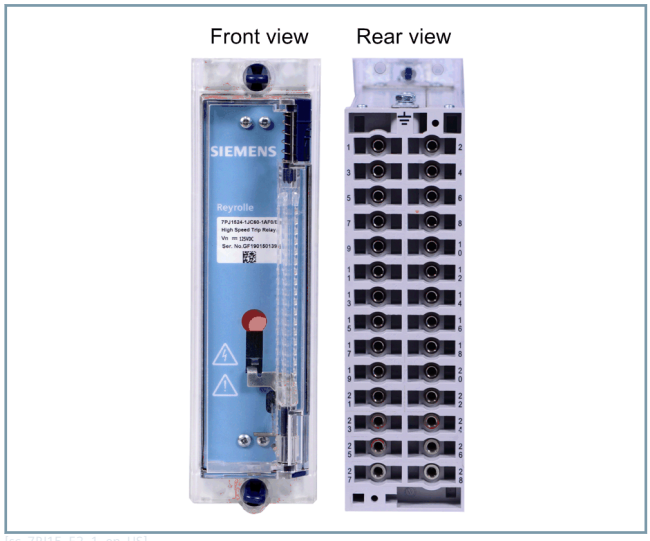


[sc_7PJ15_drawoutphoto, 1, --_--]

Figure 3.7/1 7PJ15 Including Handles

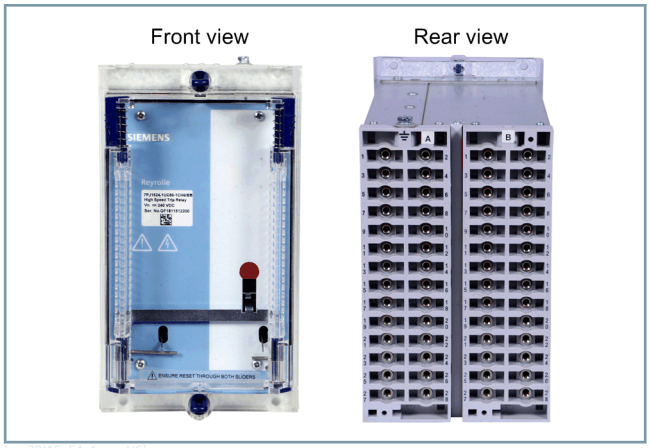
NOTE

All other photographs in this document show the device with handles removed for uninterrupted views.



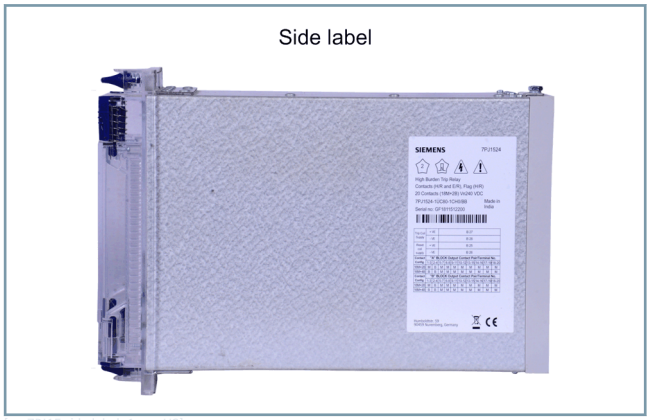
[sc_7PJ15_E2, 1, en_US]

Figure 3.7/2 Size E2



[sc_7PJ15_E4, 1, en_US]

Figure 3.7/3 Size E4



[sc_7PJ15 side label, 1, en_US]

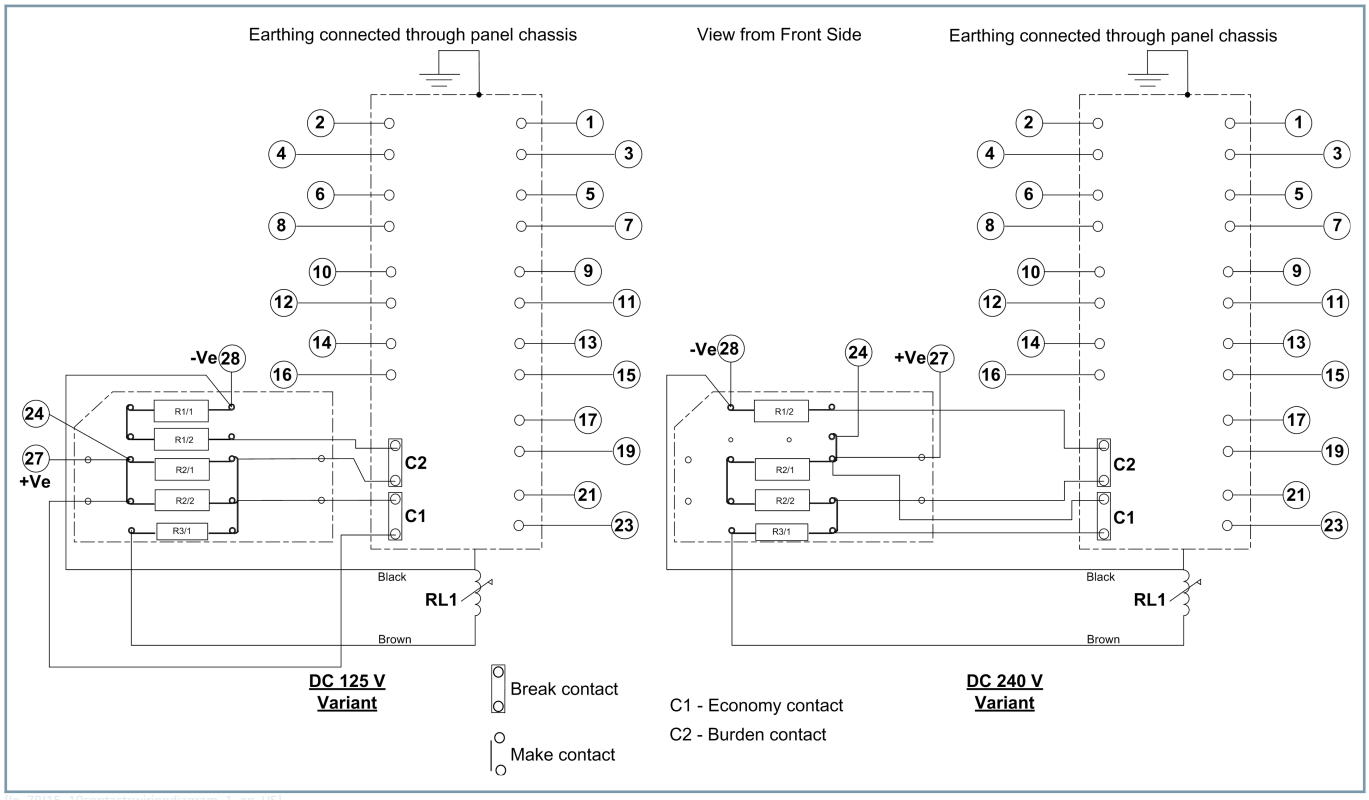
Figure 3.7/4 Side Label

Relay Information

The device fascia displays the MLFB order code, serial number, and device identification reference.

The device terminal label displays the MLFB code, serial number, relay description, terminal contact details, and safety symbols.

	QR code
	AC 2 kV insulation test of reset coil, trip coil, and output contacts
	5 kV impulse voltage test (type test) in compliance with Class III
	Electrical Hazard
CE	European CE marking
	Refer to device documentation
	Waste Electrical and Electronic Equipment Directive (WEEE)



[io_7PJ15_10contactswiringdiagram, 1, en_US]

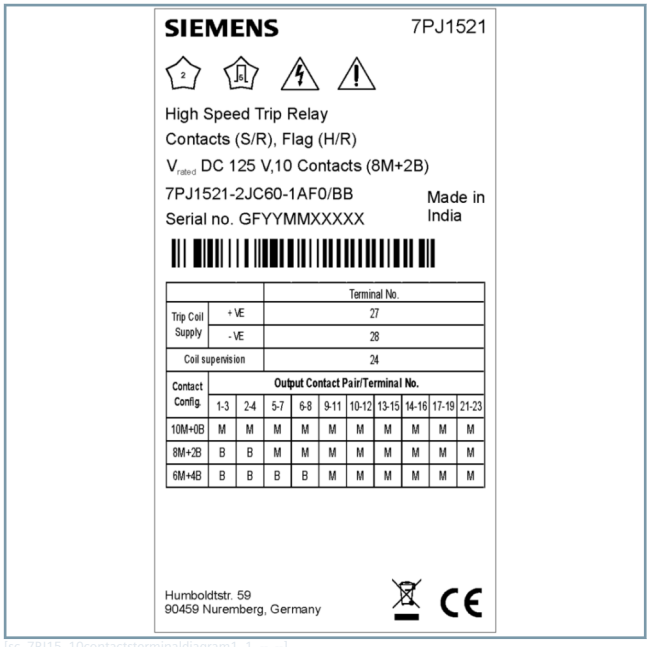
Figure 3.7/5 7PJ1521 (10 Contacts Self Reset Trip Relay) Wiring Diagram

Trip coil supply	+ ve	27									
	- ve	28									
Coil supervision		24									
Contact configuration		Output Contact Pair / Terminal Number									
		1–3	2–4	5–7	6–8	9–11	10–12	13–15	14–16	17–19	21–23
10M + 0B		M	M	M	M	M	M	M	M	M	M
8M + 2B		B	B	M	M	M	M	M	M	M	M
6M + 4B		B	B	B	B	M	M	M	M	M	M

Table 3.7/1 7PJ1521 (10 Contacts Self Reset Trip Relay) Terminal Details

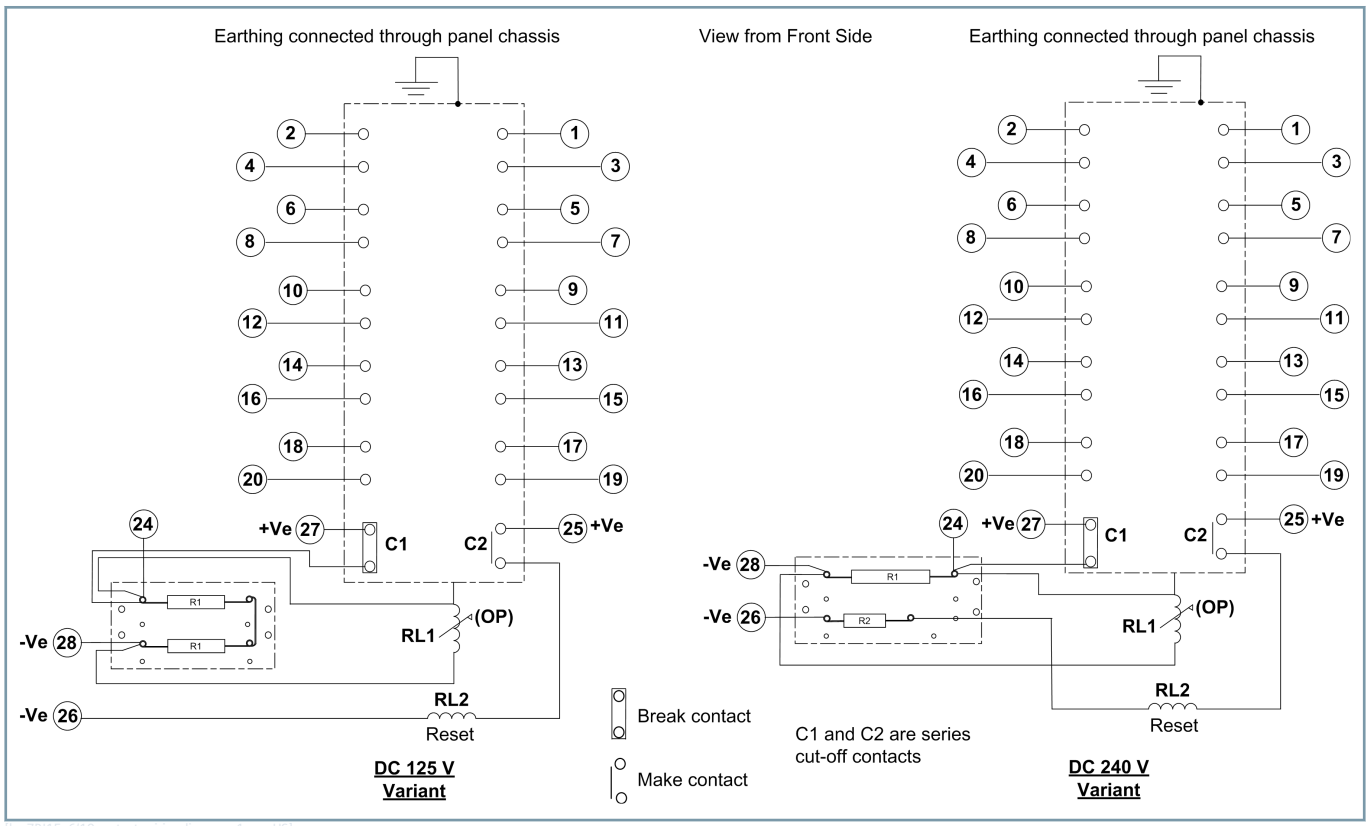
DC 125 V Relay	R1-2X 100R, 12 W R2-2X 3.9K, 12 W R3-1X 270R, 6 W
DC 240 V Relay	R1-1X 470R, 12 W R2-1X 2.2K, 12 W R2-1X 4.7K, 12 W R3-1X 270R, 6 W

Table 3.7/2 7PJ1521 (10 Contacts Self Reset Trip Relay) Resistor Details



[sc_7PJ15_10contactsterminaldiagram1, 1, _en_]

Figure 3.7/6 7PJ1521 (10 Contacts Self Reset Trip Relay) Terminal Diagram



[io_7PJ15_6r10contactswiringdiagram, 1, en_US]

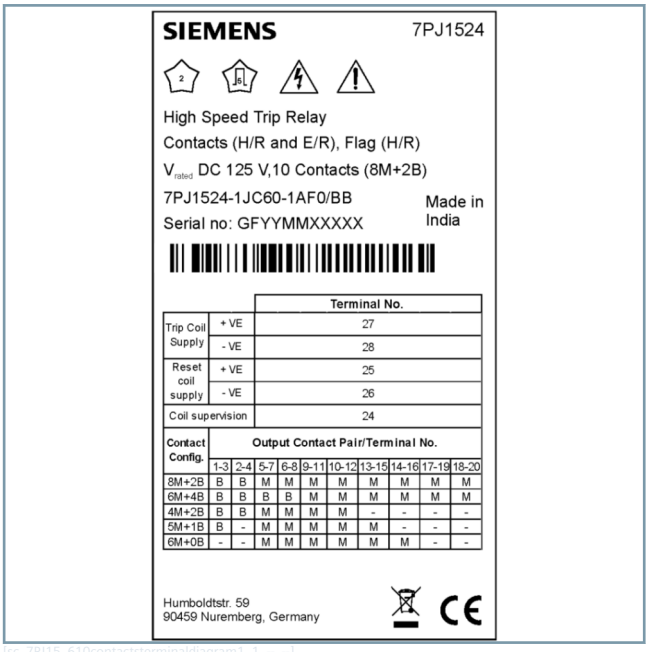
Figure 3.7/7 7PJ1524 (6/10 Contacts Hand Reset and Electrical Reset Trip Relay) Wiring Diagram

Trip coil supply	+ ve	27									
	- ve	28									
Reset coil supply	+ ve	25									
	- ve	26									
Coil supervision		24									
Contact configuration		Output Contact Pair / Terminal Number									
		1–3	2–4	5–7	6–8	9–11	10–12	13–15	14–16	17–19	18–20
8M + 2B		B	B	M	M	M	M	M	M	M	M
6M + 4B		B	B	B	B	M	M	M	M	M	M
4M + 2B		B	B	M	M	M	M	–	–	–	–
5M + 1B		B	–	M	M	M	M	M	–	–	–
6M + 0B		–	–	M	M	M	M	M	M	–	–

Table 3.7/3 7PJ1524 (6/10 Contacts Hand Reset and Electrical Reset Trip Relay) Terminal Details

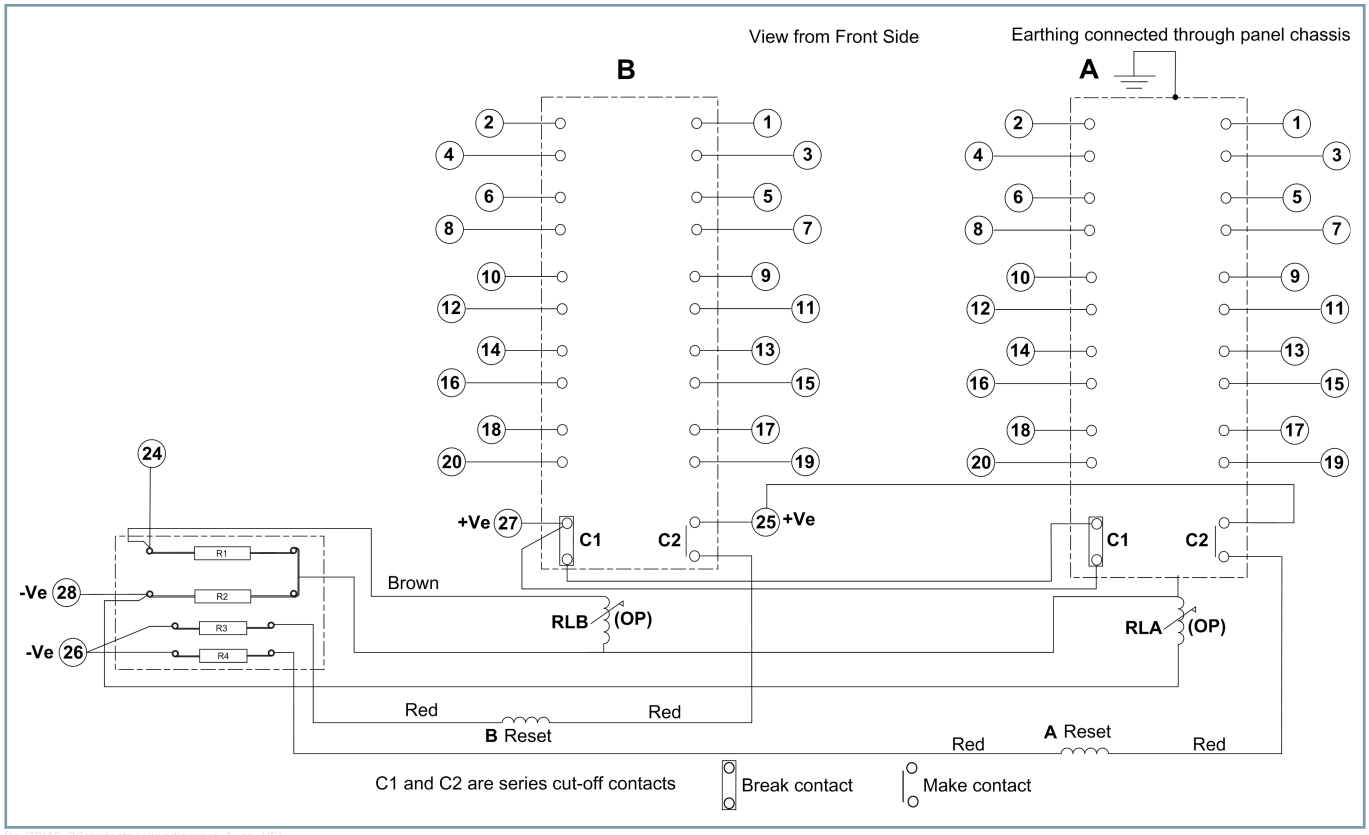
DC 125 V Relay	R1-2X 100R
DC 240 V Relay	R1-1X 470R, 14 W R2-1X 470R, 3 W

Table 3.7/4 7PJ1524 (6/10 Contacts Hand Reset and Electrical Reset Trip Relay) Resistor Details



[sc_7PJ15_610contactsterminaldiagram1, 1, –_–]

Figure 3.7/8 7PJ1524 (6/10 Contacts Hand Reset and Electrical Reset Trip Relay) Terminal Diagram



{io_7PJ15_20contactswiringdiagram, 1, en_US}

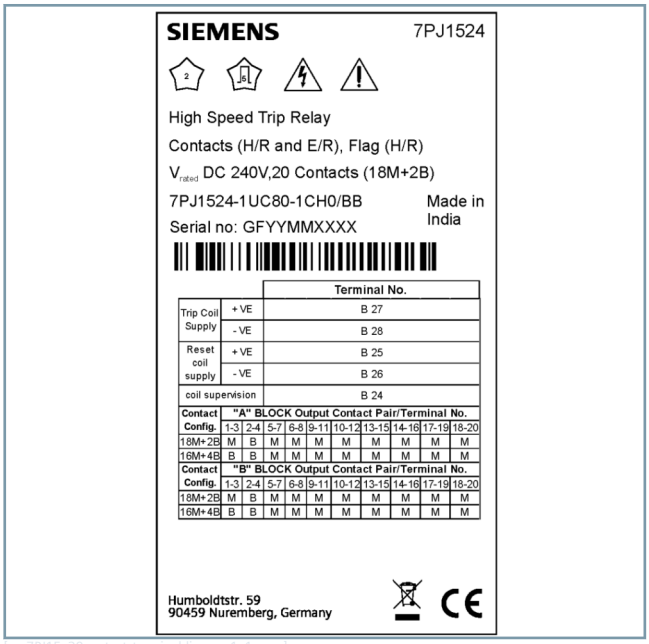
Figure 3.7/9 7PJ1524 (20 Contacts hand Reset and electrical reset Trip Relay) Wiring Diagram

Trip coil supply	+ ve	B 27									
	- ve	B 28									
Reset coil supply	+ ve	B 25									
	- ve	B 26									
Coil supervision		B 24									
Contact configuration		"A" Block Output Contact Pair / Terminal Number									
		1–3	2–4	5–7	6–8	9–11	10–12	13–15	14–16	17–19	18–20
18M + 2B		M	B	M	M	M	M	M	M	M	M
16M + 4B		B	B	M	M	M	M	M	M	M	M
Contact configuration		"B" Block Output Contact Pair / Terminal Number									
		1–3	2–4	5–7	6–8	9–11	10–12	13–15	14–16	17–19	18–20
18M + 2B		M	B	M	M	M	M	M	M	M	M
16M + 4B		B	B	M	M	M	M	M	M	M	M

Table 3.7/5 7PJ1524 (20 Contacts Hand Reset and Electrical Reset Trip Relay) Terminal Details

DC 125 V Relay	No resistor
DC 240 V Relay	R1&R2 – 470R, 14 W R3&R4 – 470R, 3 W

Table 3.7/6 7PJ1524 (20 Contacts Hand Reset and Electrical Reset Trip Relay) Resistor Details

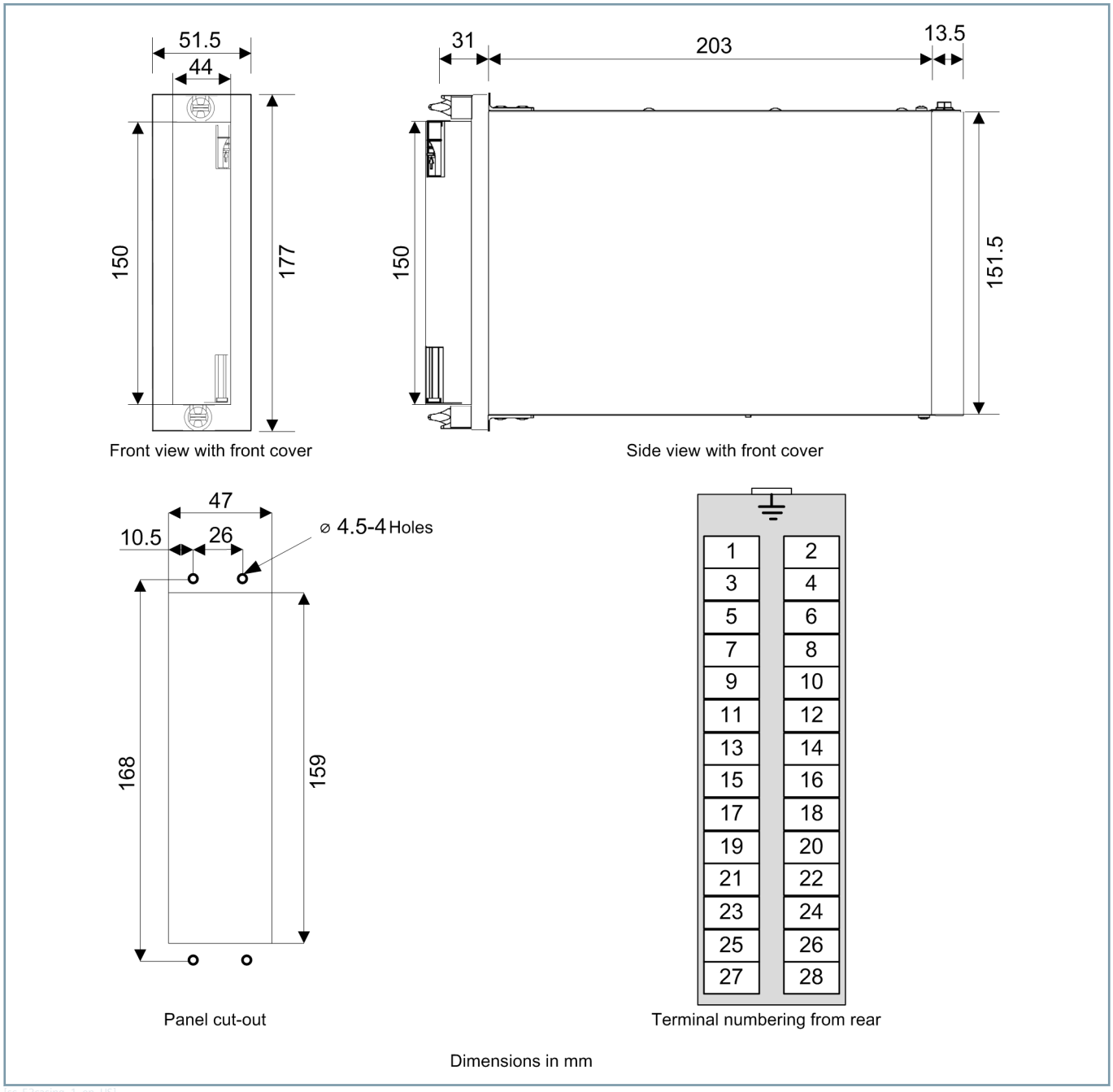


[sc_7PJ15_20contactsterminaldiagram1, 1, --_--]

Figure 3.7/10 7PJ1524 (20 Contacts Hand Reset and Electrical Reset Trip Relay) Terminal Diagram

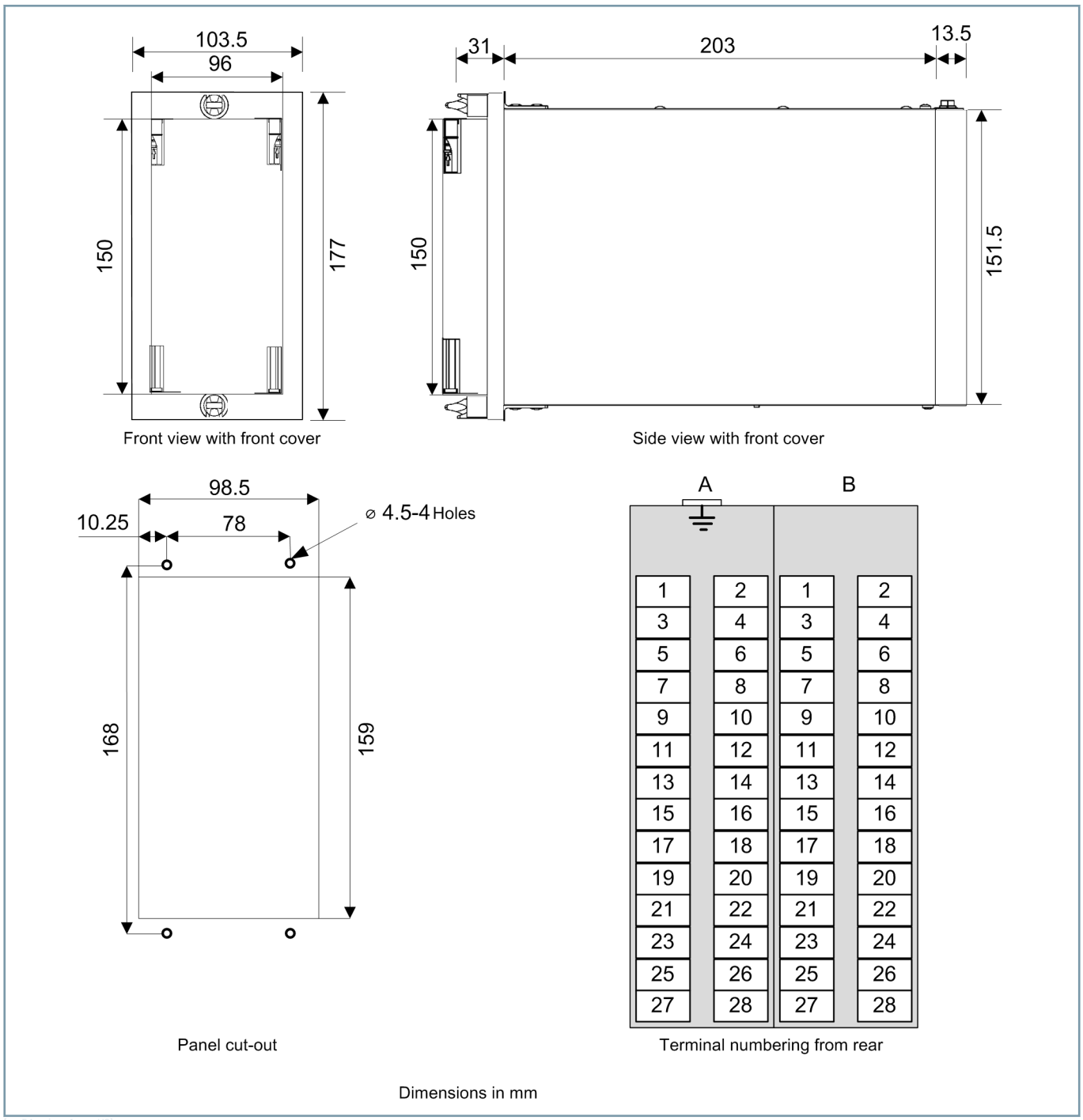
Dimension Drawings

This section displays the different dimensional views of a High Speed Trip Relay.



[sc_E2casing, 1, en_US]

Figure 3.7/11 E2 Case



[sc_E4casing, 1, en_US]

Figure 3.7/12 E4 Case

Technical Data

For full technical data refer to the Performance Specification Chapter of the Technical Manual.

Indication of Conformity

This product complies with the directive of the Council of the European Communities on the harmonization of the laws of the Member States relating to concerning electrical equipment for use within specified voltage limits (Low Voltage Directive 2014/35/EU) as well as restriction on usage of hazardous substances in electrical and electronic equipment (RoHS Directive 2011/65/EU).

This conformity has been proved by tests conducted by Siemens AG in accordance of the Council Directive in accordance with the product standard IEC/EN 60255-27 for the low-voltage directive.

RoHS directive 2011/65/EU is met using the standard IEC/EN 63000. The device has been designed and produced for industrial use.

General Technical Data

Parameter	Value
Operating time	10 ms at rated voltage V_{rated}
Reset time	< 20 ms at rated voltage V_{rated} (electrical reset)
Drop-off time	< 20 ms (self reset)
Rated voltage V_{rated}	DC 125 V, DC 240 V [93]
Operating range	50 % to 120 % of rated voltage V_{rated} [94]
Permissible current for coil supervision	3 mA maximum
Contact reset arrangement (7PJ1521)	Self
Contact reset arrangement (7PJ1524)	Hand and Electrical
Flag reset arrangement	Hand

7PJ1521 Nominal Burden (Self Reset)

	Operate Coil Burden (W)	
Rated voltage	Nominal burden (W) to operate	Burden (W) after operation of economy circuit
DC 125 V	≤ 150	≤ 10
DC 240 V	≤ 180	≤ 10

7PJ1524 Nominal Burden (Hand and Electrical Reset)

	Operate Coil Burden (W)	
Rated voltage	10 Contacts	20 Contacts
DC 125 V	≤ 150	≤ 180
DC 240 V	≤ 180	≤ 180
	Reset Coil Burden (W)	
Rated voltage	10 Contacts	20 Contacts
DC 125 V	≤ 50	≤ 70
DC 240 V	≤ 70	≤ 150

Contact Ratings

Make and carry continuously	AC 1250 VA or DC 1250 W within limits of 660 V and 5 A	
Short time	AC 30 A or DC 30 A for 0.5 s	
Make and carry for 3 s	AC 7500 VA or DC 7500 W within limits of 660 V and 30 A	
Limiting making capacity (L/R ≤ 40 ms)	1000 W within limits of 250 V	
Limiting breaking capacity		
AC resistive	1250 VA	V/I = 250/5
DC resistive	100 W	V/I = 48/2.09; 110/0.91;
DC inductive (L/R ≤ 40 ms)	50 W	250/0.4 V/I = 48/1.042; 110/0.454; 250/0.2
Electrical endurance	10,000 operations	
Switching rate	600 operations per hour	

Mechanical Tests

Test	Reference	Requirement
Vibration	IEC 60255-21-1	Response and endurance Class I
Shock and bump	IEC 60255-21-2	Shock response and withstand Class I Bump Class I
Seismic	IEC 60255-21-3	Class I
Degree of protection	IEC 60529	IP50 – Front IP10 – Rear

93 10 contacts - DC 240 V, 20 contacts - DC 125 V and DC 240 V, product variants are not part of the ENA TS 48-4.

94 Operating coils of self-reset and economy cut-off relays are rated at 120 % of rated voltage. All other operate and rest coils are short time rated well in excess of the operating time of their cut-off contacts. Self-reset relays will reset at not less than 5 % rated voltage.

Electrical Tests

Test	Standard
Insulation resistance	IEC 60255-27 [95] Insulation resistance > 100 MΩ at DC 500 V Between all terminals and earth Between coil terminals and contacts
Impulse voltage withstand	IEC 60255-27 [95] 5 kV, 1.2/50 µs, 0.5 J 5 +ve, -ve pulses Between all terminals and earth Between coil terminals and contacts
High voltage (Dielectric)	IEC 60255-27 [95] 2 kV, 50 Hz@1 min Between all terminals and earth Between coil terminals and contacts AC 1 kV, 50 Hz @ 1 min across make contacts
Thermal withstand continuous [96]	IEC 60255-6 1.2 V_{rated}
Functional performance	IEC 60255-1
Maximum allowable temperature	IEC 60255-6 Maximum temperature limit + 100 °C
AC ripple on DC supply	IEC 61000-4-17 Withstand 15 % AC ripple on DC
Power frequency magnetic field	IEC 61000-4-8 Level 4, 30 A/m applied continuously 300 A/m applied for 3 s
Damped oscillatory magnetic field value	IEC 61000-4-10, Level 5 0.1 and 1.0 MHz,100 A/m
Impulse magnetic field immunity test	IEC 61000-4-9, Level 5 1000 A/m, +/- 5 pulses
Immunity to capacitance discharge	ENA TS 48-4 Issue 4 2010 Refer to General Technical Data[93].

Product Safety Test

Test	Standard
Clearances and creepage distances	IEC 60255-27
IP rating	
Impulse voltage	
AC or DC dielectric voltage	
Insulation resistance	
Protective bonding continuity	
Protective bonding resistance	
Flammability of insulating materials, components and fire enclosures	
Single fault condition	

Test	Standard
Mechanical resistance to shock and impact	IEC 61010-1
Protection against electric shock	
Protection against the spread of fire	
Equipment temperature limits and resistance to heat	

Climatic Environmental Tests

Temperature

IEC 60068-2-1/IEC 60068-2-2/IEC 60068-2-14/IEC 60255-1

Ambient operating temperature	-10 °C to +55 °C
Storage temperature (non-operational)	-25 °C to +70 °C
Change of temperature	Cyclic: 3 h at -10 °C to 3 h at +55°C Number of cycles: 5

Humidity

IEC 60068-2-30/IEC 60068-2-78/IEC 60255-1

Damp heat test, cyclic	6 days at +25 °C to +55 °C (12 h + 12 h cycle) and 93 % relative humidity
Damp heat steady state test	10 days at +40 °C and 95 % humidity
Maximum altitude of operation	Up to 2000 m

Installation Category

Installation category (overvoltage category)	Class III

Pollution

Pollution degree	2

95 All aspect of IEC 60255-5 have been covered under IEC 60255-27.

96 Applicable for self reset type trip relays

Ordering Information – 7PJ1524

Product Description	Order Number																
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
High Speed Trip Relay	7	P	J	1	5	2	4	–	1	□	□	□	0	–	1	□	□	0
High speed trip, high burden with contact type (hand reset and electrical reset) and hand reset flag						|	|		|	|	|	|		|	|	|	
						|	|		|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|		|	|	|	
TR2: High burden						2	|		|	|	|	|	|		|	|	|	
							|		|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|		|	|	|	
Hand and electrical reset contacts							4		|	|	|	|	|		|	|	|	
									|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|		|	|	|	
Instantaneous									1	|	|	|	|		|	|	|	
										|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|		|	|	|	
4 Make contact										E	C	6	|		|	|	|	
5 Make contact										F	B	6	|		|	|	|	
6 Make contact										G	A	6	|		|	|	|	
6 Make contact										G	E	6	|		|	|	|	
8 Make contact										J	C	6	|		|	|	|	
16 Make contact										S	E	8	|		|	|	|	
18 Make contact										U	C	8	|		|	|	|	
											|	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|		|	|	|	
0 Break contact											A	|	|		|	|	|	
1 Break contact											B	|	|		|	|	|	
2 Break contact											C	|	|		|	|	|	
4 Break contact											E	|	|		|	|	|	
												|	|		|	|	|	
Number of Contacts [97]												|	|		|	|	|	
6/10												6	|		|	A	|	
20												8	|		|	C	|	
													|		|	|	|	
Contact Type													|		|	|	|	
Make contact (standard) / Break contact (standard)													0		|	|	|	
															|	|	|	
Type of Flag															|	|	|	
Hand reset flag															1	|	|	
																|	|	
Housing Size																|	|	
Case size E2 (4U high)																A	|	
Case size E4 (4U high)																C	|	
																	|	
Voltage Rating																	|	
DC 125 V																	F	
DC 240 V																	H	

97 The number of contacts must match the selected contact arrangement.

Ordering Information – 7PJ1521

Product Description	Order Number																
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
High Speed Trip Relay	7	P	J	1	5	2	1	–	2	□	□	6	0	–	1	A	□	0
High speed trip, high burden with contact type (self reset) and hand reset flag						|	|		|	|	|	|		|	|	|	
						|	|		|	|	|	|		|	|	|	
TR – Tripping						|	|		|	|	|	|		|	|	|	
TR2: High burden, EB2						2	|		|	|	|	|	|		|	|	|	
							|		|	|	|	|	|		|	|	|	
Contact Operation							|		|	|	|	|	|		|	|	|	
Self reset contacts							1		|	|	|	|	|		|	|	|	
									|	|	|	|	|		|	|	|	
Operating Coil Cut-Off									|	|	|	|	|		|	|	|	
Economy									2	|	|	|	|		|	|	|	
										|	|	|	|		|	|	|	
Contact Arrangement – Make Contact										|	|	|	|		|	|	|	
6 Make contact										G	E	|	|		|	|	|	
8 Make contact										J	C	|	|		|	|	|	
10 Make contact										L	A	|	|		|	|	|	
											|	|	|		|	|	|	
Contact Arrangement – Break Contact											|	|	|		|	|	|	
0 Break contact											A	|	|		|	|	|	
1 Break contact											B	|	|		|	|	|	
2 Break contact											C	|	|		|	|	|	
4 Break contact											E	|	|		|	|	|	
												|	|		|	|	|	
Number of Contacts [98]												|	|		|	|	|	
6/10												6	|		|	|	|	
													|		|	|	|	
Contact Type													|		|	|	|	
Make contact (standard) / Break contact (standard)													0		|	|	|	
															|	|	|	
Type of Flag															|	|	|	
Hand reset flag															1	|	|	
																|	|	
Housing Size																|	|	
Case size E2 (4U high)																A	|	
																	|	
Voltage Rating																	|	
DC 125 V																	F	
DC 240 V																	H	

98 The number of contacts must match the selected contact arrangement.

7PG23 Restricted Earth Fault

[Reyrolle Product Catalogue, 7PG23, 1, -_-]

Description

The relay uses a type B61 attracted armature element energized via a low pass filter circuit and a full wave rectifier. The relay has a minimum setting of I5V. Other resistors are introduced into the circuit to provide the voltage setting range up to 270V in increments of 5V using heavy duty DIL switches. Included within the relays are the essential non-linear resistors to limit the peak voltage output from saturated CTs, these resistors protect the CT insulation and secondary wiring.

Functional Overview

Low settings can be achieved.

Stability based upon plant capacity.

4.1

Application

The 5B3 relay is ideal for restricted earth fault protection of transformer windings or phase and earth fault protection of reactors and the stator windings of large machines.

This relay may also be used for high impedance busbar protection. High impedance schemes have the advantages over low impedance schemes that a more sensitive setting can be obtained without any loss of stability and the primary fault setting calculation is simpler.

Current operated schemes are more susceptible to mal-operations from through faults unless greater care is taken with the selection of the current transformers. For some restricted earth fault applications the primary fault setting needs to be greater at harmonic frequencies than the setting at the fundamental frequency. The 5B3 relay uses a low pass filter circuit to achieve this. No adverse reduction in fault setting can occur with the high frequency currents which may be produced during switching.

CT Requirements

Experience has shown that most protection CTs are suitable for use with the high impedance relays and that where the CTs are specifically designed for this protection their overall size may be smaller than that required for an alternative current balance protection. The basic requirements are:

a) All CTs should, if possible, have identical turns ratios.

b) The knee point voltage of each CT should be at least 2x Vs. The knee point voltage is expressed as the voltage applied to the secondary circuit with the primary open circuit which when increased by 10 % causes the magnetizing current to increase by 50 %.

c) CTs should be of the low leakage reactance type. Most modern CTs are of this type and there is no difficulty in meeting this requirement. A low leakage reactance CT has a jointless ring type core, the secondary winding evenly distributed along the whole length of the magnetic circuit and the primary conductor passes through the approximate centre of the core.

Technical Information

Frequency f_n:	50 or 60 Hz
Current I_s:	Fixed at 20mA
Voltage V_s:	I5V to 270V in 5V steps
Thermal withstand:	Continuous 1.25 x V_s
Accuracy:	V_s ± 5 %
Burden:	V_s x 20mA
Operating time:	45 ms maximum at 3 x V

Indication:	Hand reset flag
Contact arrangement:	3 normally open self reset
Contact rating:	Contacts are capable of making and carrying 6.6kVA for 0.2 seconds with a maximum of 30A. Contacts are intended for use in circuits where a circuit breaker auxiliary switch breaks the trip coil current.

Environmental

Temperature

IEC 68-2-1 & 2

Operating	-10°C to +55°C
Storage	-25°C to +70°C

Humidity

IEC 68-2-3

56 days at 95 % RH and +40°C

Vibration

IEC 255-21-2

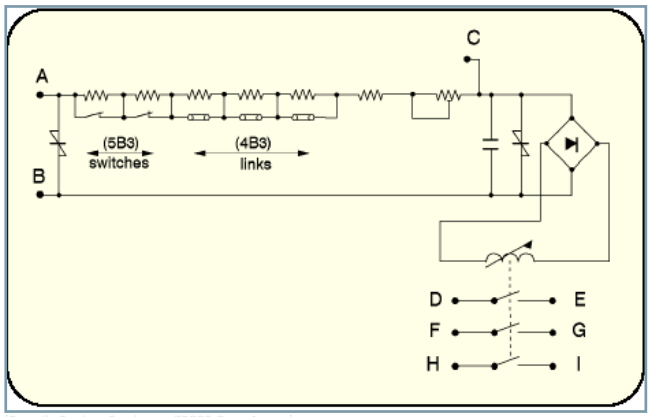
The relay complies with the requirements of BS142, section 2.2, category S2 over the frequency range 10 to 800Hz impact. The relay will withstand panel impact shocks of 20g. Operational/mechanical life in excess of 10,000 operations.

Insulation IEC 255-5

Relay will withstand: 5kV 1.2/50,µs 0.5j between all terminals and case earth and between adjacent terminals. 2kV rms 50HZ for I minute between all case terminals connected together and the case earth and between independent circuits. IkV_{RMS} 50HZ for I minute across normally open contacts.

Case

Single element Epsilon E3 case.

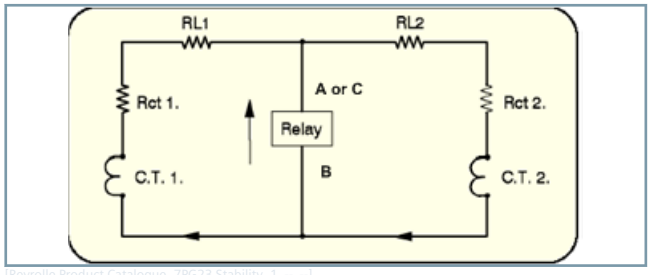


[Reyrolle Product Catalogue, 7PG23 Case, 1, _ _]

Figure 4.1/1 Modular relay case terminal numbers

	A	B	C	D	E	F	G	H	I
5B3 (size 3 case)	28	27	22	1	3	2	4	5	7

Stability



[Reyrolle Product Catalogue, 7PG23 Stability, 1, _ _]

Figure 4.1/2 High Impedance Scheme

For stability the voltage setting of the relay must be made equal to or exceed the highest value of V calculated below:

V=I (Rct+RI)

Where:

RI = The largest value of pilot-loop resistance between the CTs and the relay.

Rct = The secondary winding resistance of the CT.

I = The CT secondary current corresponding to the maximum steady state through fault current of the protected equipment.

Fault Setting

It should, however, be noted that because the operating voltage of the relay circuit is relatively high, the excitation currents of the CT's in parallel with the relay may comprise a large proportion of the fault setting.

Primary fault setting = N (I0 + I1 + I2 + I3)

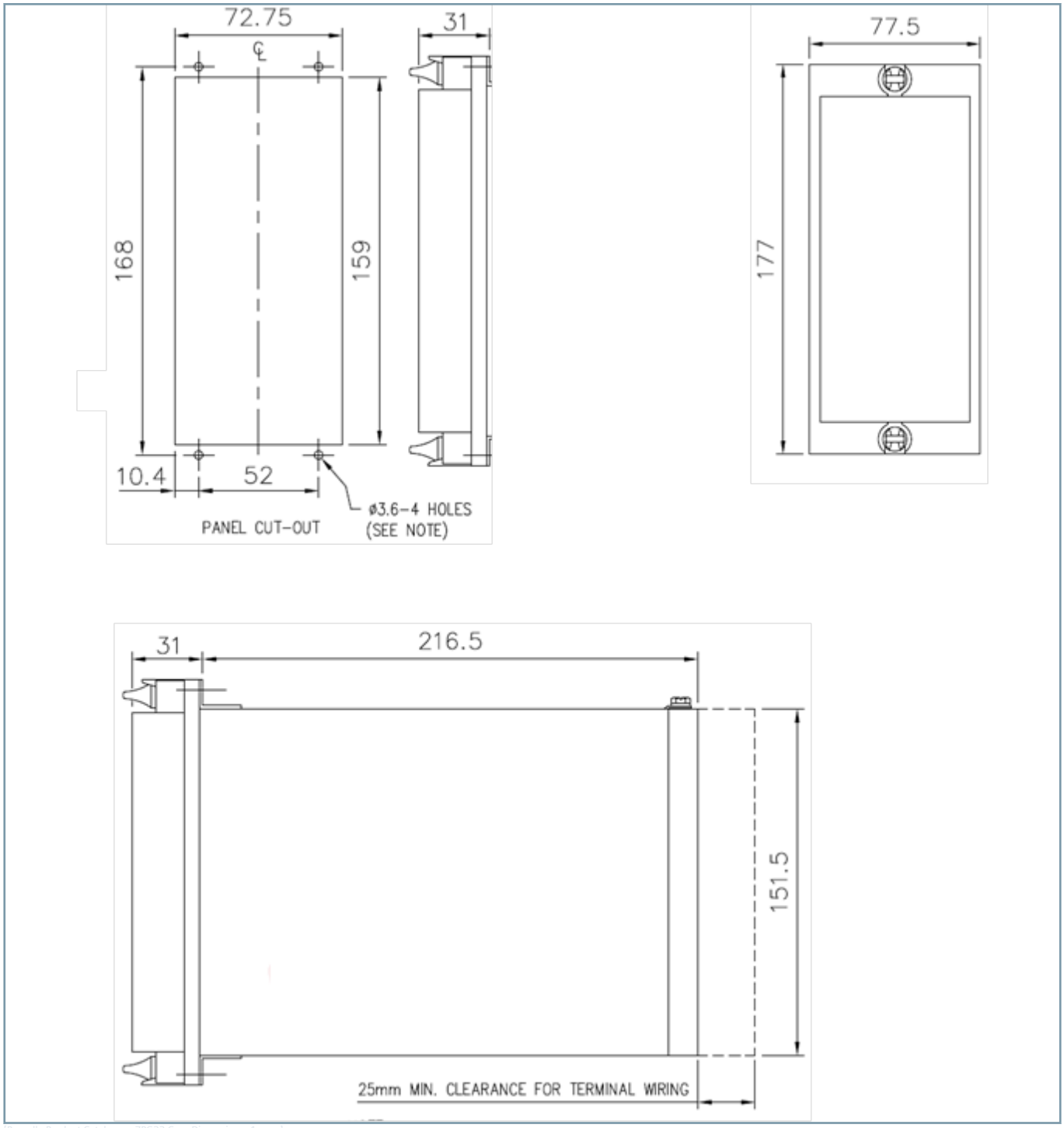
Where:

I0 = Relay operating current

I1 etc = Excitation current of each CT. at the relay setting voltage.

N = C.T. turns ratio

Case Dimensions



[Reyrolle Product Catalogue, 7PG23 Case Dimensions, 1, _ _]

Figure 4.1/3 E3 Case Dimensions

NOTE

Note: The ∅3.6 holes are for M4 thread forming (trilobular) screws. These are supplied as standard and are suitable for use in ferrous/aluminum panels 1.6mm thick and above. For other panels, holes to be M4 clearance (typically ∅4.5) and relays mounted using M4 machine screws, nuts and lockwashers (supplied in panel fixing kit).

Ordering Information - 7PG23 Restricted Earth Fault (5B3)

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
5B3	7	P	G	2	3	□	□	-	□	□	□	□	□	-	□	□	A	0
						|	|		|	|	|	|	|		|	|		
Single element high impedance relay, ideal for REF applications.						|	|		|	|	|	|	|		|	|		
Relay type						|	|		|	|	|	|	|		|	|		
5B3 - High impedance, 50Hz						1	|		|	|	|	|	|		|	|		
5B3 - High impedance, 60Hz						2	|		|	|	|	|	|		|	|		
							|		|	|	|	|	|		|	|		
Type of flag							|		|	|	|	|	|		|	|		
Hand reset flag							1		|	|	|	|	|		|	|		
									|	|	|	|	|		|	|		
Contact operation									|	|	|	|	|		|	|		
Self reset contacts									1	|	|	|	|		|	|		
										|	|	|	|		|	|		
Contact arrangement – NO										|	|	|	|		|	|		
3 NO										D	|	|	|		|	|		
											|	|	|		|	|		
Contact arrangement NC											|	|	|		|	|		
0 NC											A	|	|		|	|		
												|	|		|	|		
Number of contacts [1]												|	|		|	|		
Three												3	|		|	|		
													|		|	|		
Contact type													|		|	|		
NO (Standard) / NC (Standard)													0		|	|		
															|	|		
Setting range [1]															|	|		
15V AC to 270V AC															1	|		
																|		
Housing size																|		
Case size E3 (4U high)																B		

4.1

NOTE

1) Relay is pre-set to 15VAC, customer adjustable settings up to 270VAC in increments of 5V provided by heavy duty DIL switches

7PG21 Pilot Wire Current Differential Protection

[Reyrolle Product Catalogue, 7PG21, 1, -_-]

Description

Solkor R & Solkor Rf are well established pilot wire feeder differential protections operating on the current balance principle. The R/Rf relay is primarily intended for use in the Rf mode which has the advantage of increased operating speed but can be simply changed to R mode for compatibility with pre-installed remote end relays which are older 5kV Solkor R type relays.

The relay is suitable for application on a single pair of privately owned pilots with loop resistance up to 2000ohms to protect 2 ended feeder circuits up to 20km in length. Two compatible relays are used as a pair with one relay connected to current transformers at each end of the feeder respectively. The Solkor R/Rf relays do not require an auxiliary DC supply.

Function Overview

High transient stability.

High speed operation.

Low phase and earth fault settings.

Little or no setting variation with pilot length

Test points at relay fascia

Bleed-off up to 20 % of rated current

Easily reconnected as R or Rf mode

Option of 15kV pilot isolation

Option of pilot supervision

Additional Options

15kV Isolation

The Solkor R/Rf relay has an insulation level of 5kV between pilot connections and the local ground to withstand voltages induced on the pilot cable due to coupling with the fault current and to withstand differential ground voltages caused by the flow of fault current. Experience has shown that 5kV insulation is usually adequate for most distribution feeders.

For higher voltage systems where feeders may be longer and fault levels higher, an additional external isolation transformer is available for use with the relay in Rf mode to increase the voltage withstand to 15kV.

5kV systems may be suitable for higher voltage systems where fault levels are low or feeder lengths are short. One isolation transformer is fitted at each end of the pilot circuit. Tappings at the transformers can be utilised to allow pilots with inter-core capacitance up to 4µF can be used compared to the 0.8µF limit imposed by the 5kV standard arrangement.

Pilot supervision

Communication via the pilots between the relay pair is essential for correct operation of the Current Differential protection system.

Additional external Pilot Supervision equipment can be supplied to detect pilot cable open circuit which can lead to protection operation or short circuit pilots which will greatly reduce the sensitivity of the relays under subsequent fault conditions.

Pilot supervision will not block relay operation but will provide an alarm. Pilot Supervision is available to suit the 5kV or 15kV insulation level of the scheme.

Overcurrent Guard

Solkor relay trip contacts can be connected in series with those of an Overcurrent Guard relay driven from the same current transformers to avoid operation for damaged pilots during normal load levels.

The electromechanical B69 can be used for this which will provide variable settings without an auxiliary supply.

Alternatively, a numeric relay from the Argus range can be used which will have negligible additional AC burden on the current transformer and can be used to add the waveform recording functionality to the traditional Solkor scheme.

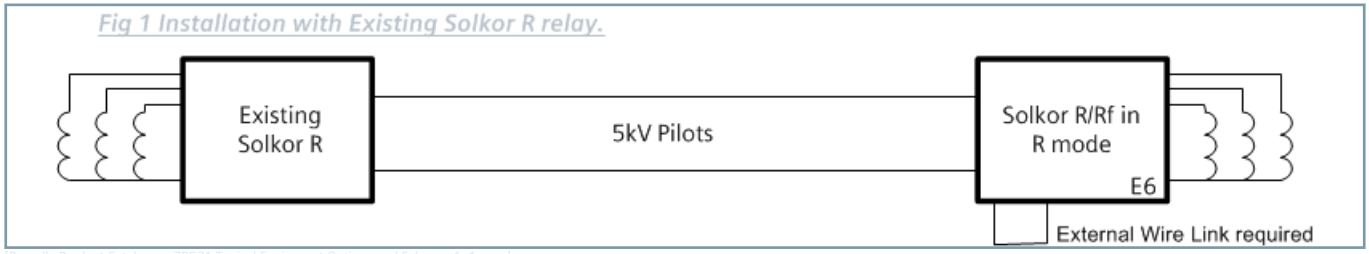
Intertripping

The current differential system will naturally issue a trip at both ends for an in zone fault. Additional connections can also be made which utilise the pilot connection to initiate a protection operation at the remote end. This is generally used to cause a trip for an out of zone fault which has been detected by a different protection relay. There are 2 different methods to achieve this and their application depends on the fault current available for the out of zone fault.

Firstly the pilot loop can be open circuited to allow the remote end to operate on its measured current. To ensure positive operation of the remote end relay, the current should be at least twice the normal fault setting. Switching relays must provide suitable 5/15kV isolation.

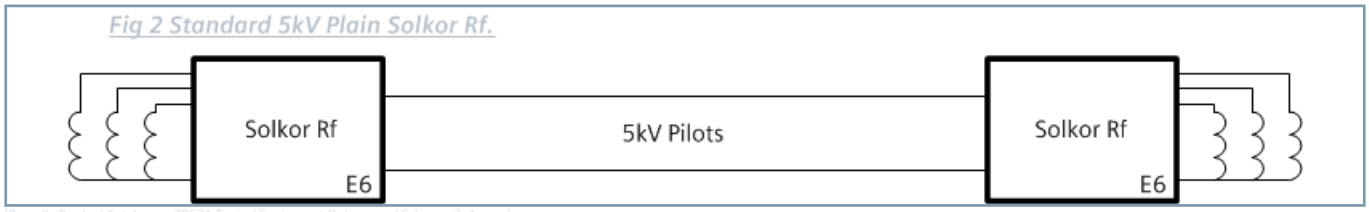
Secondly, the local end summation transformer can be short circuited to allow the remote end to operate on its measured current but with the local end connected in shunt. This can be successful with R mode where settings are raised to 4x normal settings but with Rf mode this can be up to 10x normal settings and this current is often not available.

Typical Equipment Options and Schemes



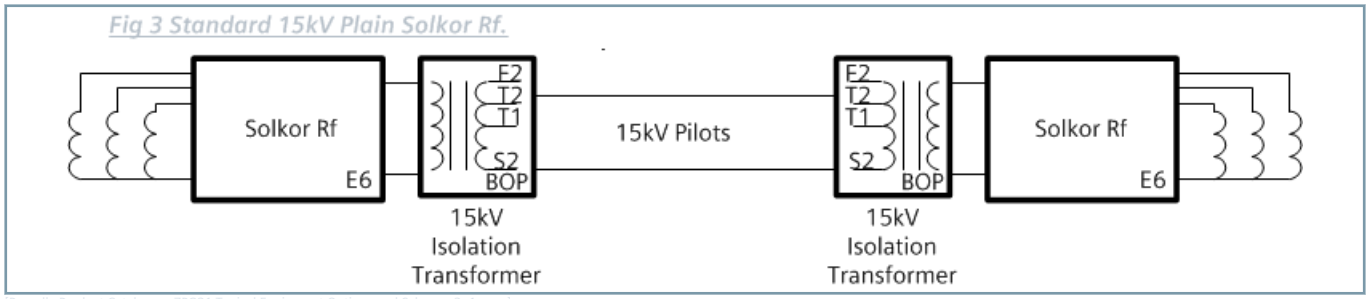
[Reyrolle Product Catalogue, 7PG21 Typical Equipment Options and Schemes1, 1, --_-]

Figure 4.2/1 Installation with existing Solkor R Relay



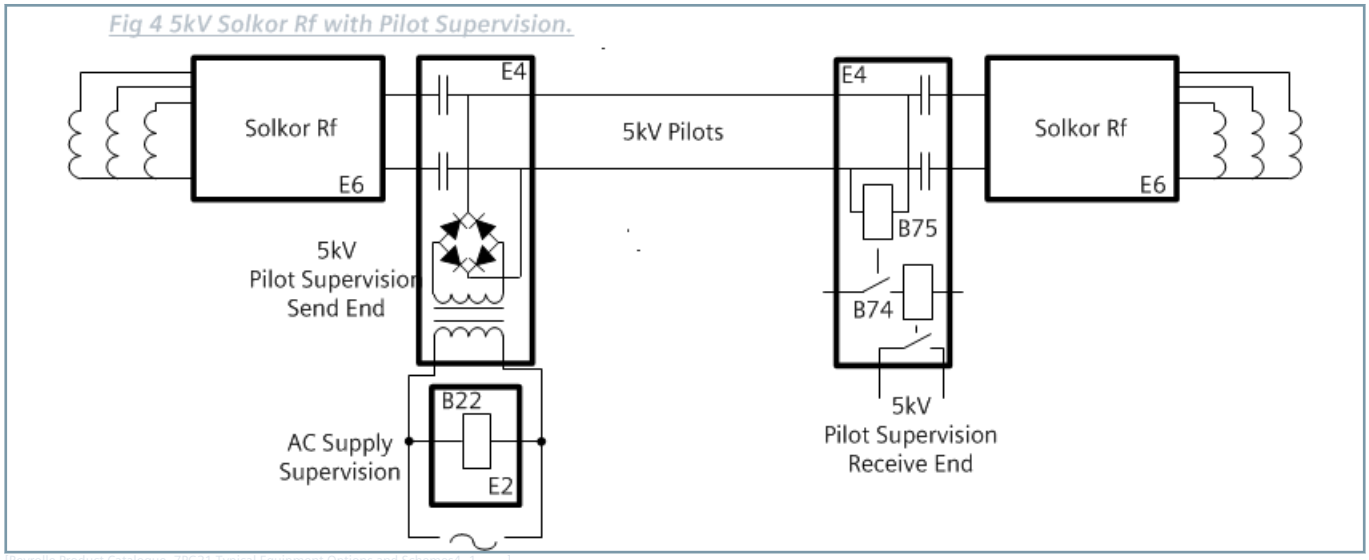
[Reyrolle Product Catalogue, 7PG21 Typical Equipment Options and Schemes2, 1, --_-]

Figure 4.2/2 Standard 5kV Plain Solkor Rf



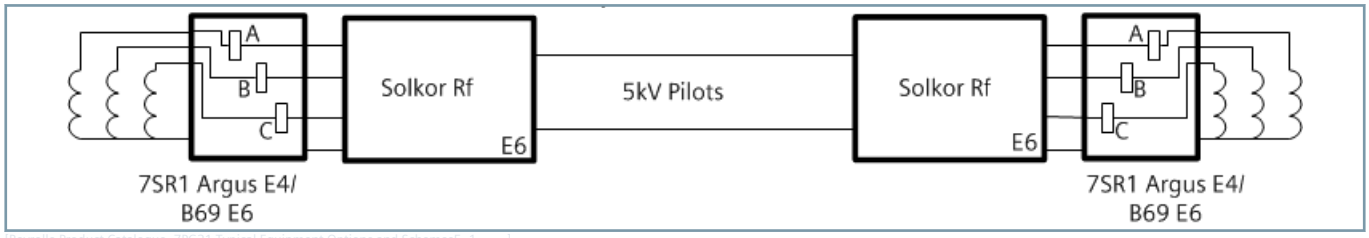
[Reyrolle Product Catalogue, 7PG21 Typical Equipment Options and Schemes3, 1, --_-]

Figure 4.2/3 Standard 15kV Plain Solkor Rf



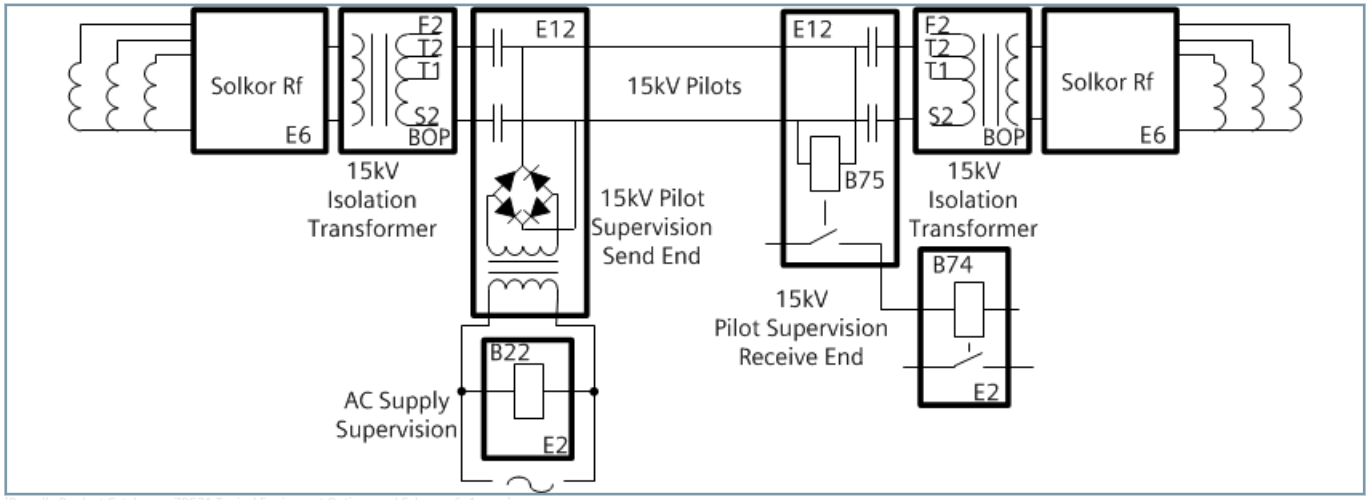
[Reyrolle Product Catalogue, 7PG21 Typical Equipment Options and Schemes4, 1, –_–]

Figure 4.2/4 5kV Solkor Rf with pilot Supervision



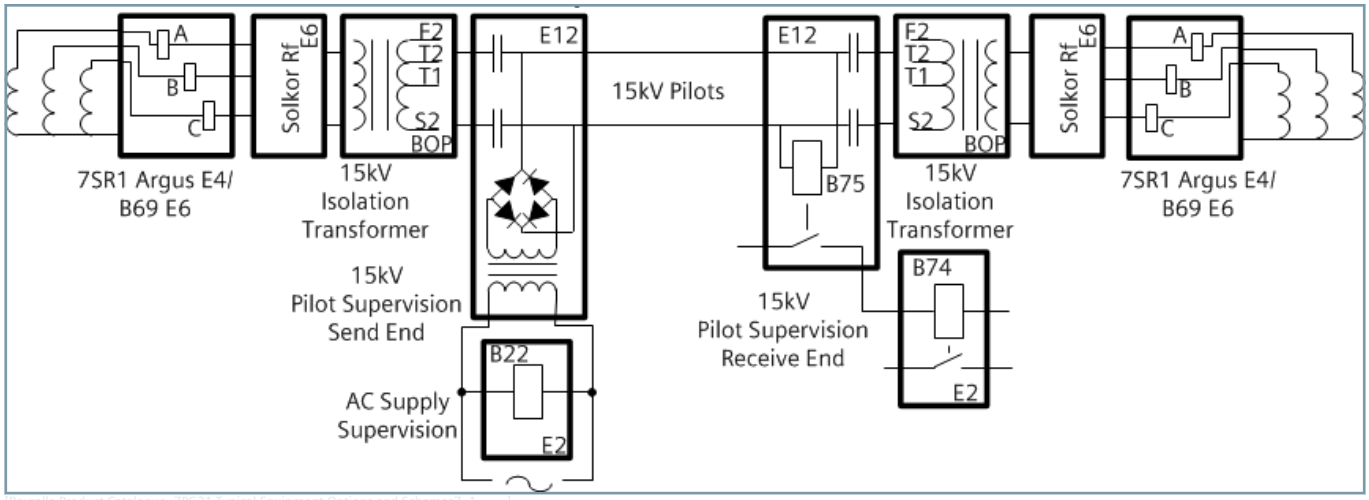
[Reyrolle Product Catalogue, 7PG21 Typical Equipment Options and Schemes5, 1, –_–]

Figure 4.2/5 5kV Plain Solkor Rf with Overcurrent Guard



[Reyrolle Product Catalogue, 7PG21 Typical Equipment Options and Schemes6, 1, –_–]

Figure 4.2/6 15kV Solkor Rf with Pilot Supervision



[Reyrolle Product Catalogue, 7PG21 Typical Equipment Options and Schemes7, 1, _]

Figure 4.2/7 15kV Solkor Rf with Pilot Supervision and Overcurrent Guard

Service Conditions and performance data

Application Requirements

Number of Pilot cores required 2

	R Mode	Rf Mode	Rf mode with 15kV Transf.		
			Tap 1	Tap 0.5	Tap 0.25
Max. Loop Resistance	1000 Ω	2000 Ω	1780 Ω	880 Ω	440 Ω
Max. Inter core Capaci-tance	2.5µF	0.8µF	1 µF	2µF	4µF

Table 4.2/1 Pilot Requirements

	R Mode	Rf Mode	Rf mode with 15kV Transf.		
			Tap 1	Tap 0.5	Tap 0.25
Peak Voltage applied to pilots under fault conditions	300v	450v	450v	330v	225v
Maximum current carried by pilots under fault conditions	200mA	250mA	250mA	380mA	500mA

Table 4.2/2 Pilot Current and Voltage

Maximum Primary Line Capacitive Charging Current.

Solidly Earthed System, 1/3 times the most sensitive earth fault setting

Resistance Earthed System, 1/9 times the most sensitive earth fault setting

Mechanical Durability

Vibration, relays comply with BS142 section 2.1 Category S2. Shock, relays withstand 20G shock or impact on the panel without operating.

Operation/mechanical life, relays will withstand in excess of 10,000 operations.

Electrical Performance

Characteristic Energising Quantities

Rated Current (I_n)	0.5A
	1A
	2A
	5A
	6.67A

Rated Frequency (fN)	Operating Range
50 Hz	47Hz to 52Hz
60 Hz	57Hz to 62Hz

Insulation

Between pilot circuit and all other independent circuits and earth	$5kV_{RMS}$
Between all external terminal and earth	$2kV_{RMS}$
Between terminals of independent circuits	$2kV_{RMS}$
Across normally open contacts	$1kV_{RMS}$

Isolation Transformer

Between pilot circuit terminals and all other terminals and earth	$15kV_{RMS}$

Current Withstand

Maximum through fault condition for differential protection stability	50x rated current

AC current Thermal Withstand	Multiple of rated current
Continuous	2x
20 minutes	2.8x
10 minutes	3.5x
5 minutes	4.7x
3 minutes	6.0x
2 minutes	7.3x
3 seconds	60x
1 second	100x limited to 400A

Operating Time	R Mode	5kV Rf Mode	15kV Rf Mode
3x fault setting	60 ms	50 ms	45 ms
5x fault setting	55 ms	45 ms	40 ms
10x fault setting	50 ms	45 ms	40 ms
Indication		Hand Reset Flag	
Contact Arrangement		3 N/O	
Contact Rating		Make and carry for 0.2 s a burden of 6600VA with a maximum of 30A	

Environmental

Temperature

IEC 60068-2-1/2

Type	Level
Operating Range	-10 °C to +55 °C
Storage range	-25 °C to +70 °C

Humidity

IEC 60068-2-3

Type	Level
Operational test	56 days at 40 °C and 95 % relative humidity

IP Ratings

Type	Level
Installed with cover	IP 51

Pilot Supervision Equipment

Auxiliary Supply	
Send End	110/220/240V ac 50/60Hz
Receive End	30V dc 50V dc 125V dc 240V dc

Burdens

AC Supervision Supply	10VA approx.
AC supply fail relay	3 to 5VA
Receive Repeat Relay	1W

Contact Arrangements

Pilot Supervision Relay(B75)	1NO self reset
Repeat relay B74	2NO & 2NC
Supervision supply fail relay	2NO & 2NC

Contact Ratings

Type B22, B74 and B75

Make & Carry Continuously	1500VA ac or 1500W dc within limits of 660V and 3A. Make and carry 8A for 3 seconds or 16A for 1 second.
Break	300VA ac or 75W dc (inductive L/R -0.04) within limits of 250V and 5A
Indication	Flag indicators shown on de-energisation
Supervision supply fail relay (B22)	Hand Reset Flag
Receive Repeat Relay	Self Rest Flag

Settings

Primary fault settings with insulation between pilot circuits and other terminals and earth 15kV; typical current transformers and zero pilot capacitance are given below. Values are expressed as percentages of the current transformer rating.

Fault Type	Fault Setting							
	5kV scheme				15kV scheme (Rf mode only)			
	R Mode		Rf Mode		R Mode		Rf Mode	
	N1	N	N1	N	N1	N	N1	N
A-E	16	22	18	25	22	31	25	35
B-E	18	27.5	21	32	26	39	30	44
C-E	22	37	25	42	31	52	35	59
A-B	110		125		155		177	
B-C	110		125		155		177	
C-A	55		62		77.5		88.5	
3P	63		72		89		101	

The addition of Pilot Supervision will increase the settings by 20-50 %.

Current Transformer Requirements

	R mode	Rf mode
Maximum output of CT required to operate relay	1.2VA	3VA

The main requisite is that the saturation voltage of the current transformers should not be less than that given by the formula:

$$V_k = \frac{50}{I_n} + \frac{I_F}{N}(R_{CT} + 2R_L)$$

Where I_n = Rated current of Solkor Rf relay.
I_F = Primary current under maximum steady state THROUGH FAULT conditions.
N = Current Transformer ratio.
R_{CT} = Secondary resistance of the current transformer
R_L = Lead resistance between the current transformers and the Solkor R/Rf, per phase.

[Reyrolle Product Catalogue, 7PG21 Current Transformer Requirements, 1, --_-]

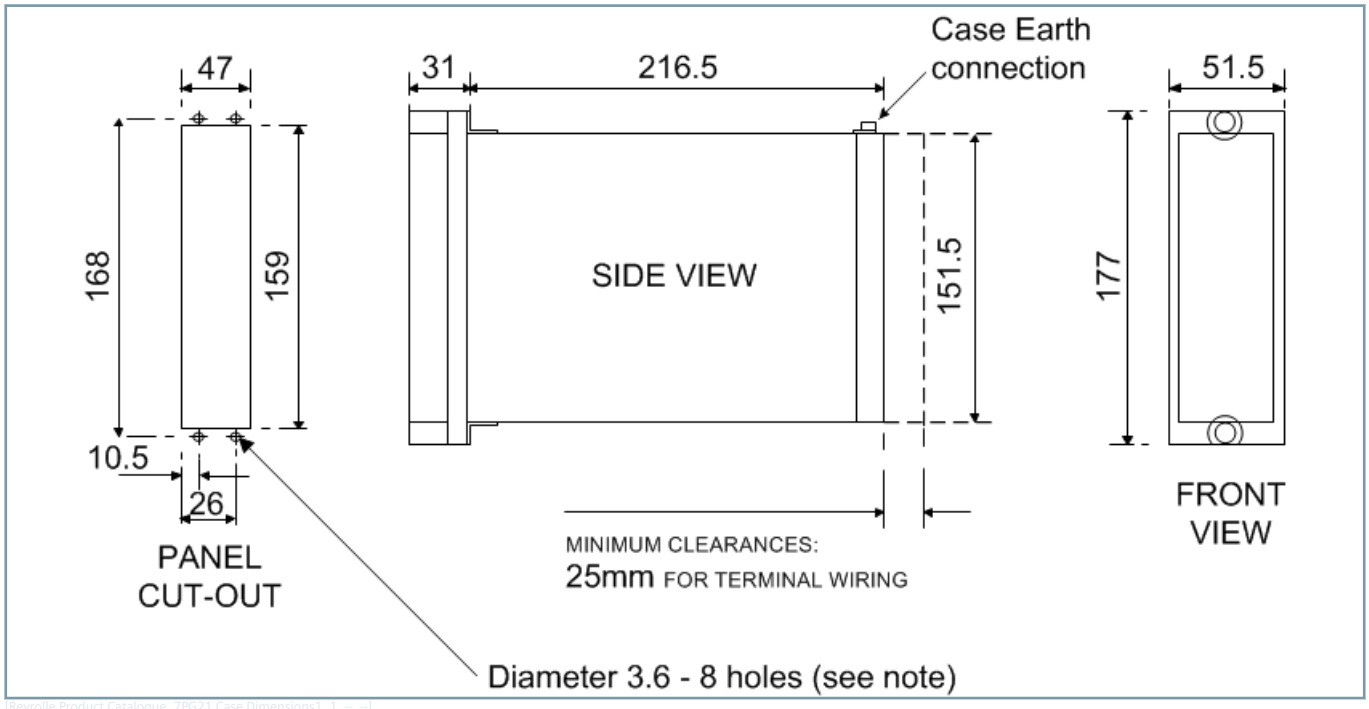
For the above purpose the saturation voltage i.e. the knee point of the magnetising curve, may be taken as that point on the curve at which a 10 % increase in output voltage requires 50 % increase in magnetising current.

To ensure good balance of the protection the current transformers at the two ends should have identical turns ratios. Close balance of the ratio is provided by current transformers to IEC60044: pt1, class px, whose ratio error is limited to ±0.25 % and these CTs are recommended to meet the above requirements.

It is recommended that no other burdens should be included in the current transformer circuit, but where this cannot be avoided the additional burden should be added to those listed when determining the current transformer output voltage required.

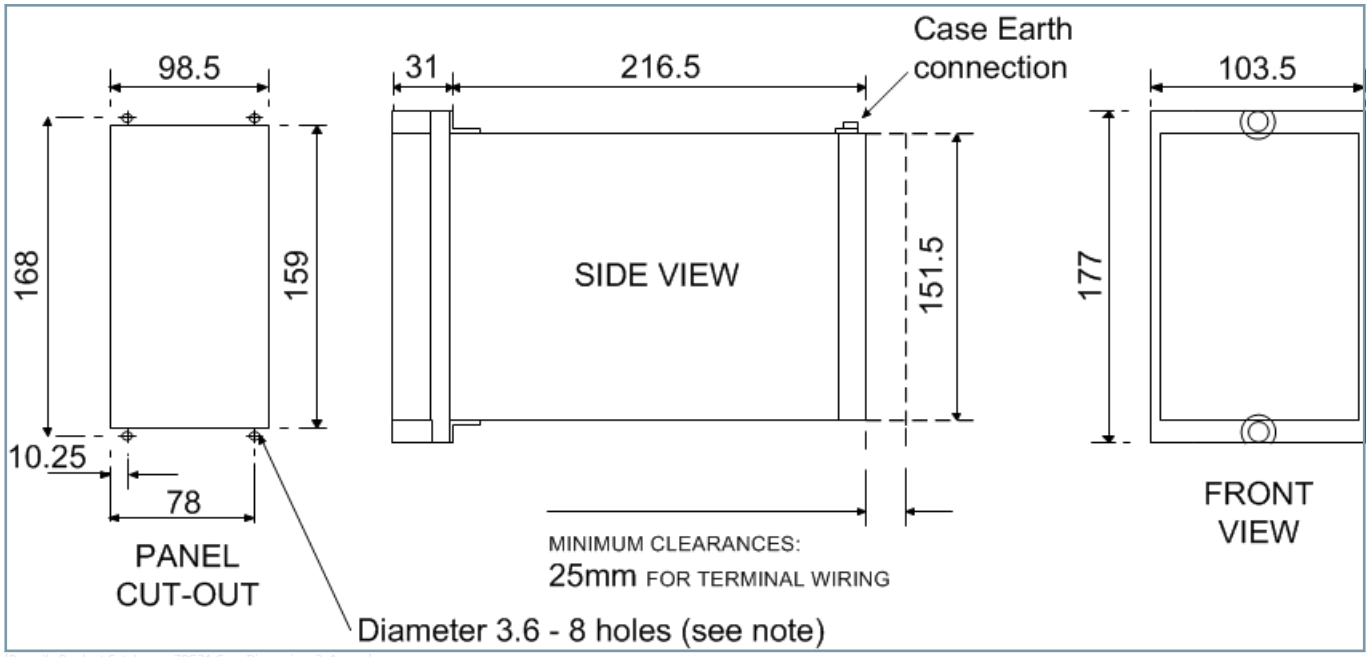
In addition to the above, the secondary magnetising currents of the current transformers at different ends of the feeder should normally not differ by more than $I_n/20$ amperes for output voltages up to $50/I_n$ volts where I_n = rated current of Solkor Rf relay. This criterion is applied to quantify matching of the transient response of the two CTs so that relay operations do not occur due to differing responses of the CTs to normal load switching or the incidence and clearance of out of zone faults. This condition is usually easily satisfied by modern CTs of similar size since the magnetising current is usually a lower value. Care should be taken when applying a new CT to be paired with existing CT and also when interposing CTs are required to match CT ratios.

Case Dimensions



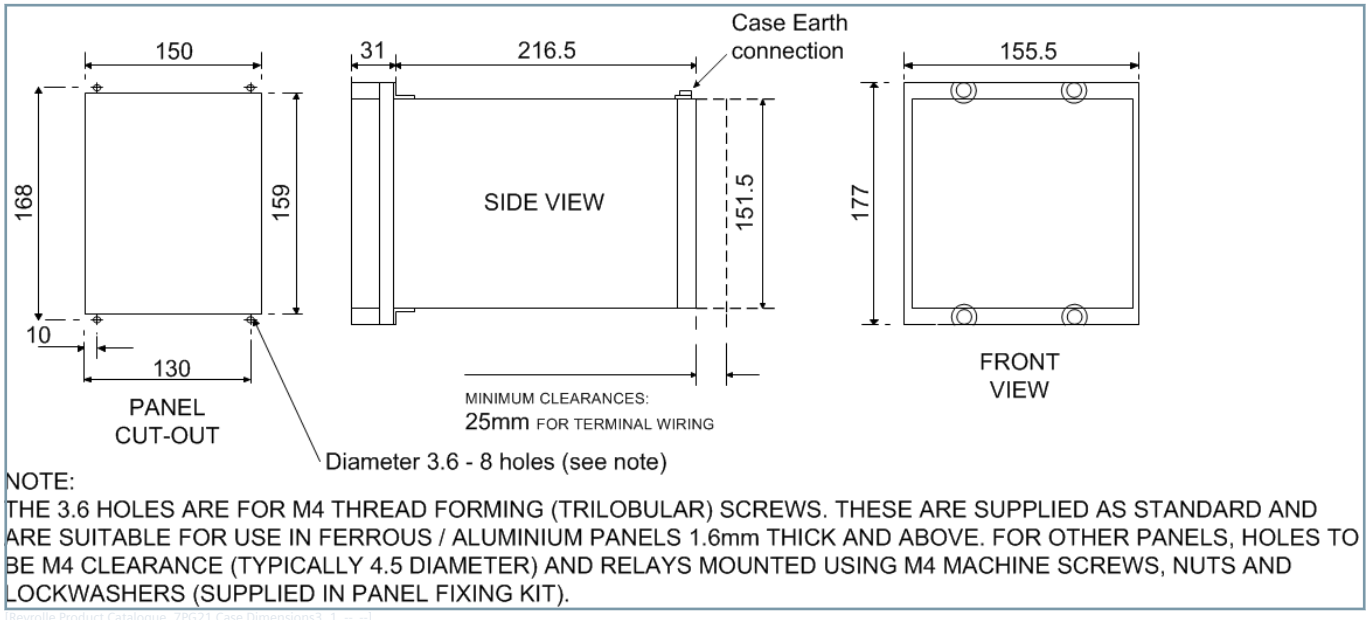
[Reyrolle Product Catalogue, 7PG21 Case Dimensions1, 1, --_-]

Figure 4.2/8 E2 Case



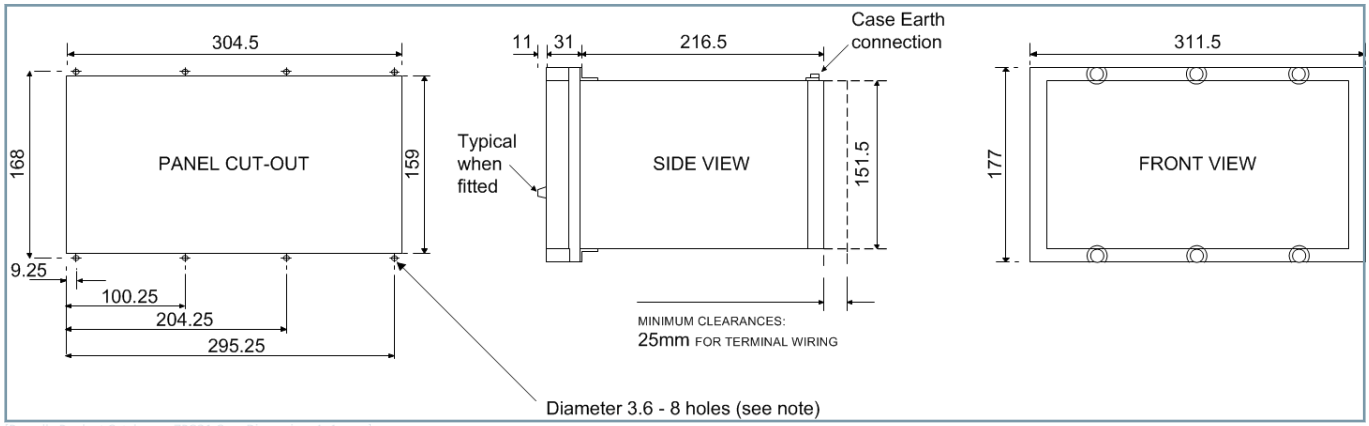
[Reyrolle Product Catalogue, 7PG21 Case Dimensions2, 1, --_-]

Figure 4.2/9 E4 Case



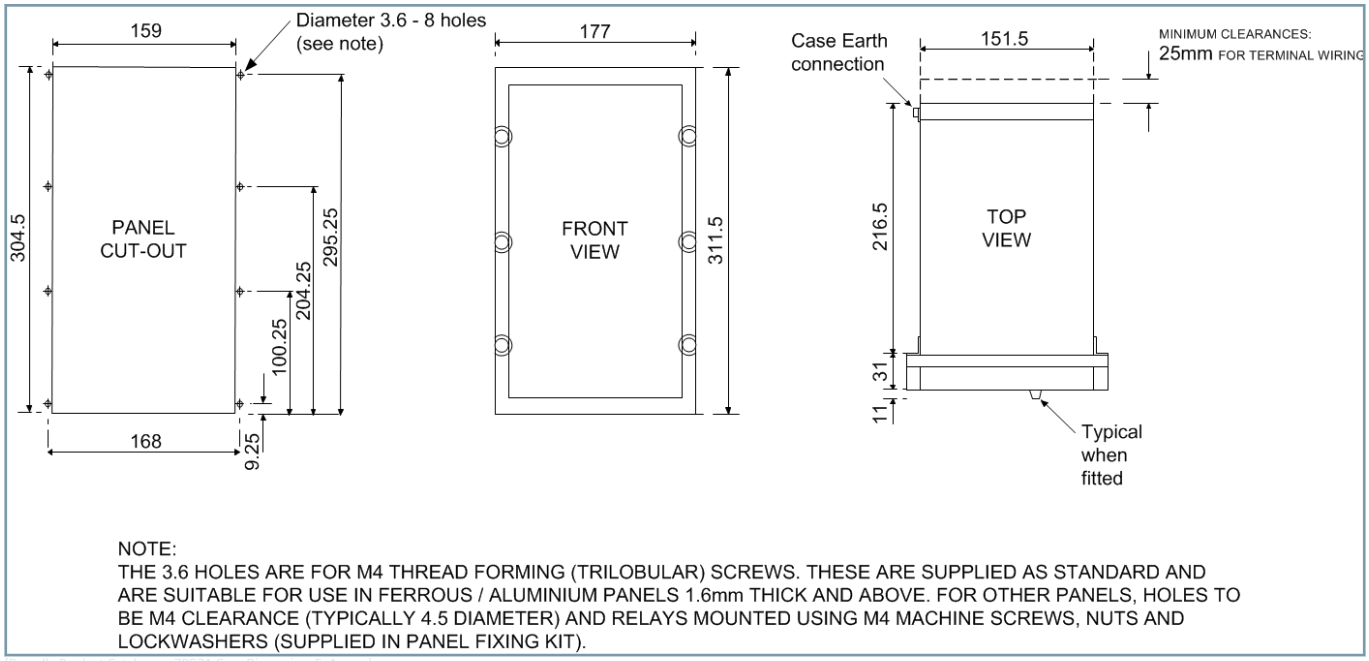
[Reyrolle Product Catalogue, 7PG21 Case Dimensions3, 1, --_-]

Figure 4.2/10 E6 Case



[Reyrolle Product Catalogue, 7PG21 Case Dimensions4, 1, - _ -]

Figure 4.2/11 E12 Case (4U high)

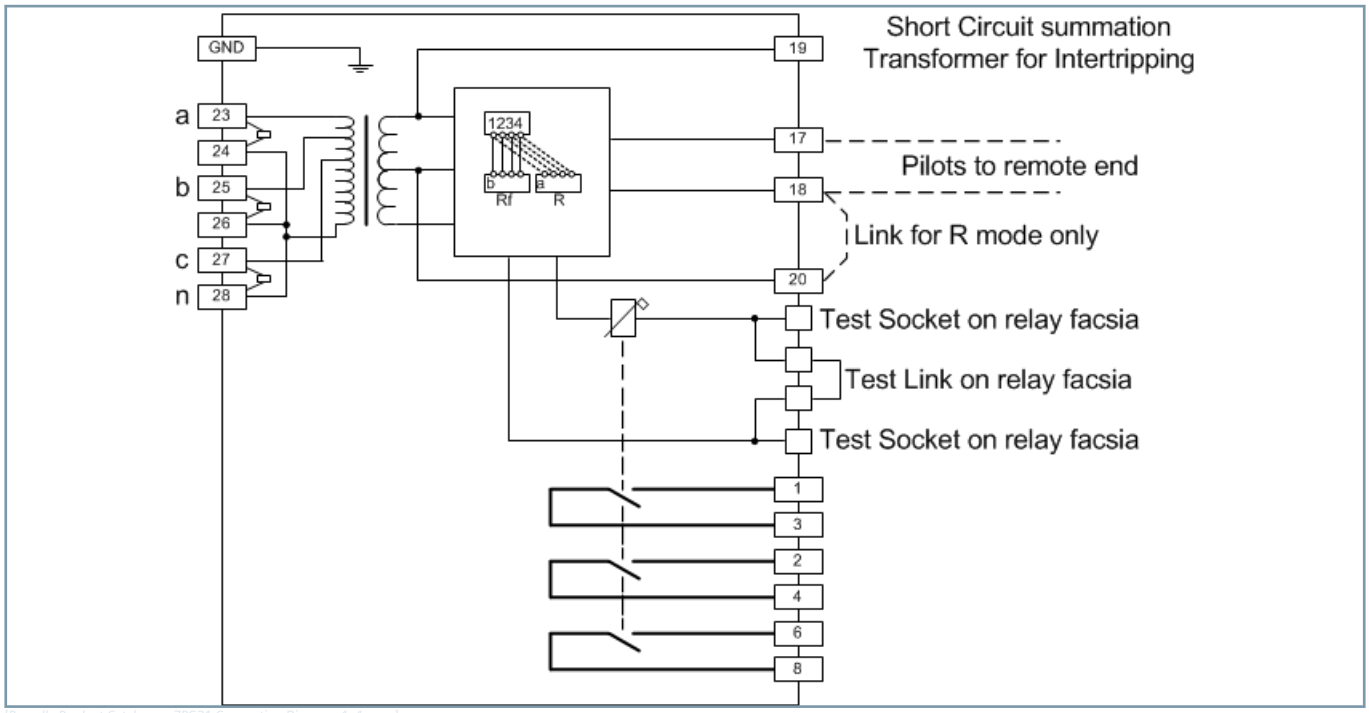


[Reyrolle Product Catalogue, 7PG21 Case Dimensions5, 1, - _ -]

4.2

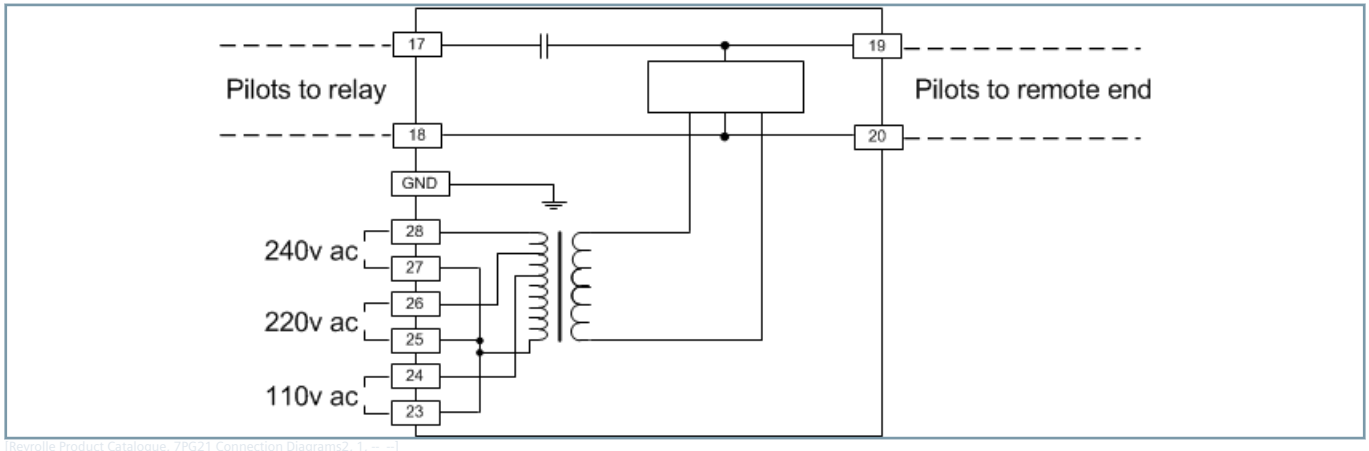
Figure 4.2/12 E12 Vertical Case (4U wide)

Connection Diagrams



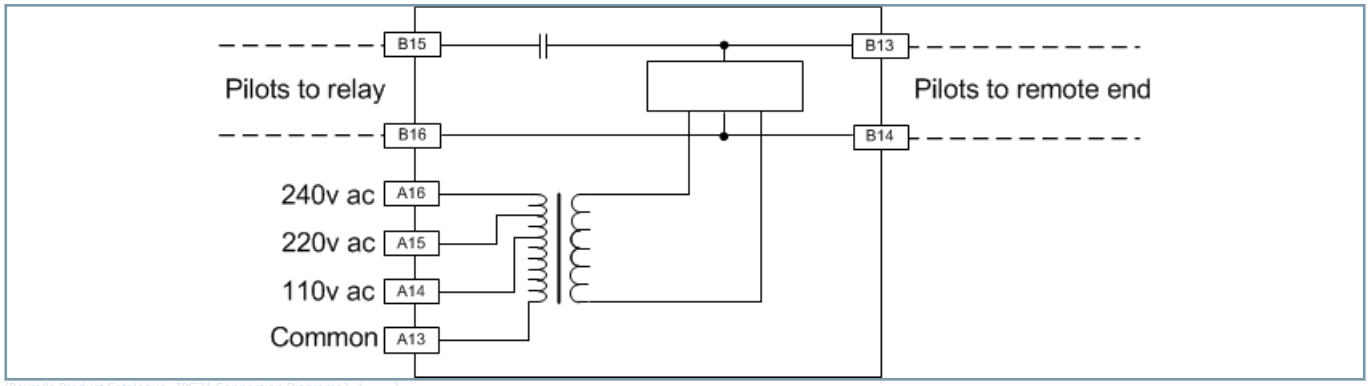
[Reyrolle Product Catalogue, 7PG21 Connection Diagrams1, 1, --_-]

Figure 4.2/13 7PG2111 Solkor R/Rf Connections (E6 case)



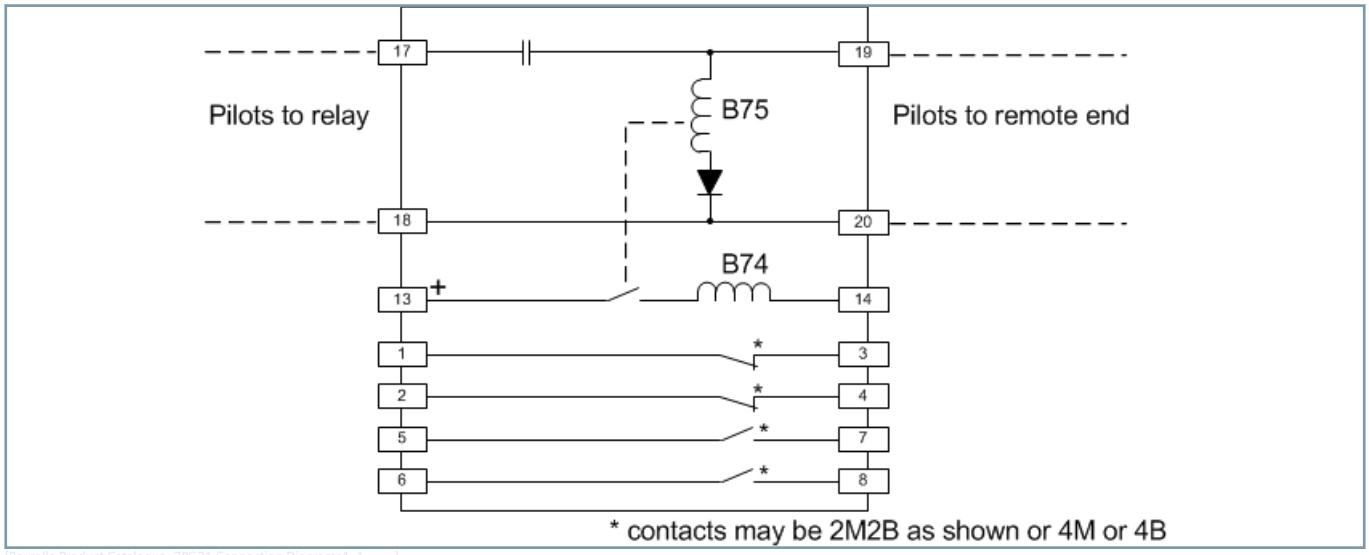
[Reyrolle Product Catalogue, 7PG21 Connection Diagrams2, 1, --_-]

Figure 4.2/14 7PG212 5kV Pilot Supervision Send End connections (E4 case)



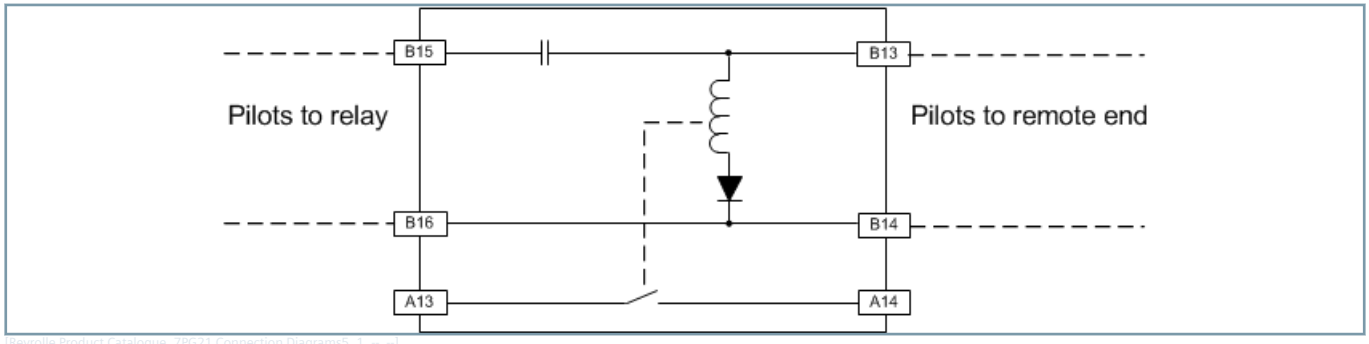
[Reyrolle Product Catalogue, 7PG21 Connection Diagrams3, 1, –_–]

Figure 4.2/15 7PG212 15kV Pilot Supervision Send End connections (E12 case)



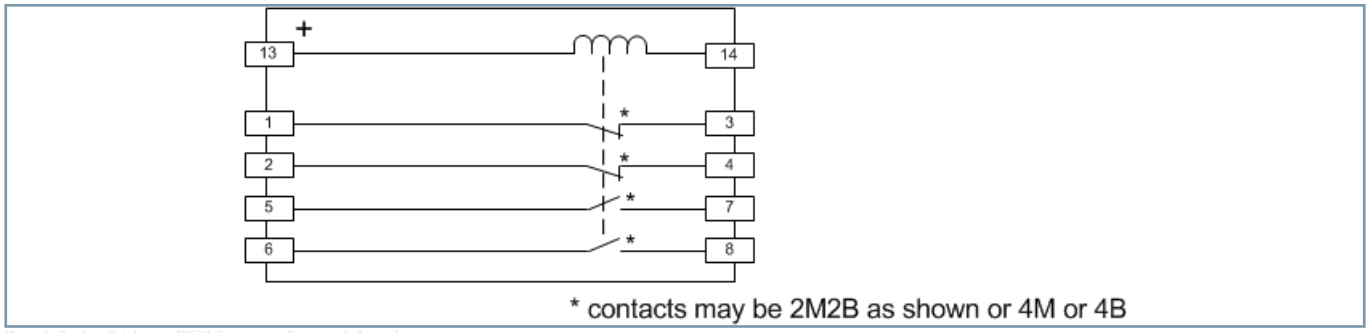
[Reyrolle Product Catalogue, 7PG21 Connection Diagrams4, 1, –_–]

Figure 4.2/16 7PG214 5kV Pilot Supervision Receive End connections (E4 case)



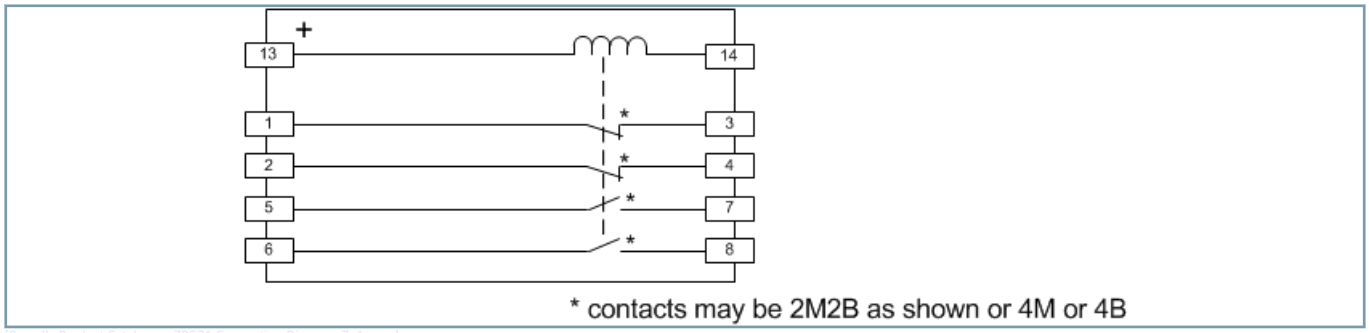
[Reyrolle Product Catalogue, 7PG21 Connection Diagrams5, 1, –_–]

Figure 4.2/17 7PG215 15kV B75 Pilot Supervision Receive End connections (E12 case)



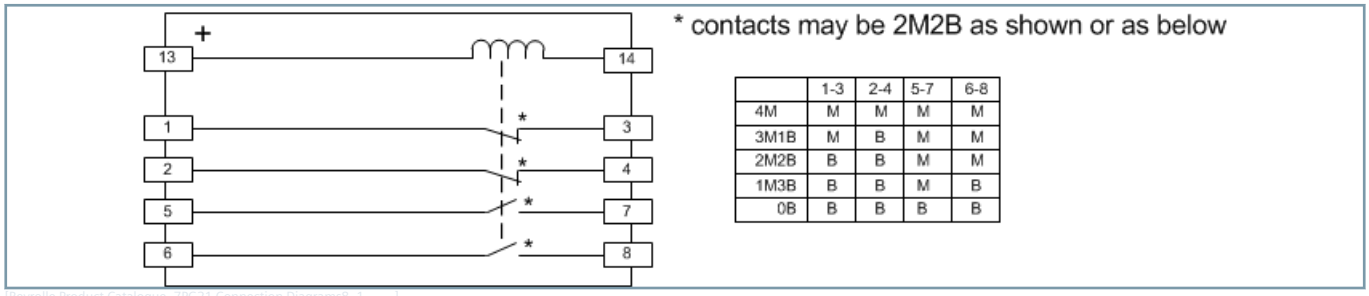
[Reyrolle Product Catalogue, 7PG21 Connection Diagrams6, 1, --_--]

Figure 4.2/18 7PG216 B74 Pilot Supervision Receive End Repeat relay for 15kV scheme (E2 case)



[Reyrolle Product Catalogue, 7PG21 Connection Diagrams7, 1, --_--]

Figure 4.2/19 7PG213 B22 Power Supply Supervision relay for Pilot Supervision (E2 case)



	1-3	2-4	5-7	6-8
4M	M	M	M	M
3M1B	M	B	M	M
2M2B	B	B	M	M
1M3B	B	B	M	B
0B	B	B	B	B

[Reyrolle Product Catalogue, 7PG21 Connection Diagrams8, 1, --_--]

Figure 4.2/20 7PG2183 B34 Delayed Pickup delay relay for Rf Mode Intertripping (E2 case)

Ordering Information - 7PG21 Pilot Wire Current Differential Protection (Solkor R/Rf)

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Solkor R/Rf	7	P	G	2	1	□	□	-	□	□	□	□	□	-	□	□	□	0
						|	|		|	|	|	|	|		|	|	|	
Pilot wire current differential feeder protection.						|	|		|	|	|	|	|		|	|	|	
Relay Type						|	|		|	|	|	|	|		|	|	|	
Solkor R/Rf relay						1	|		|	|	|	|	|	|		|	|	|	
							|		|	|	|	|	|	|		|	|	|	
Solkor R/Rf equipment							|		|	|	|	|	|	|		|	|	|	
Solkor R/Rf - Circulating current feeder protection							1		|	|	|	|	|	|		|	|	|	
									|	|	|	|	|	|		|	|	|	
Contact operation									|	|	|	|	|	|		|	|	|	
Self reset contacts									1	|	|	|	|	|		|	|	|	
										|	|	|	|	|		|	|	|	
Contact arrangement – NO										|	|	|	|	|		|	|	|	
3 NO										D	|	|	|	|		|	|	|	
											|	|	|	|		|	|	|	
Contact arrangement NC											|	|	|	|		|	|	|	
0 NC											A	|	|	|		|	|	|	
												|	|	|		|	|	|	
Number of contacts [1]												|	|	|		|	|	|	
Three												3	|	|		|	|	|	
													|	|		|	|	|	
Contact type													|	|		|	|	|	
NO (Standard) / NC (Standard)													0	|		|	|	|	
															|	|	|	
Solkor mode															|	|	|	
Solkor Rf [2]															0	|	|	
Solkor R															1	|	|	
																|	|	
Housing size																|	|	
Case size E6 (4U high)																D	|	
																	|	
Rating																	|	
0.5A AC																	A	
1A AC																	B	
2A AC																	C	
5A AC																	D	
6.67A AC																	E	

NOTE

1) For pilot insulation of between 5kV and 15kV, SOLKOR Rf mode only, order 7PG2112-0AA00-0AA0 isolating transformer with the relay at each feeder-end

2) Relay is set in Solkor Rf mode as default

Ordering Information - 7PG21 Pilot Wire Current Differential Protection (Solkor R/Rf Isolation Transformer)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Solkor R/Rf	7	P	G	2	1	□	□	-	0	A	A	0	0	-	0	□	A	0
						|	|								|		
15kV isolation transformer for use with Solkor Rf.						|	|									|		
Relay Type						|	|									|		
Solkor R/Rf - Circulating current feeder protection scheme						1	|									|		
							|									|		
Solkor R/Rf equipment							|									|		
Solkor Rf – 15kV isolation transformer							2									|		
																|		
Housing size																|		
Special																A		

4.2

Ordering Information - 7PG21 Pilot Wire Current Differential Protection (Solkor Pilot Supervision)

Product Description	Order No.																	
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Supply transformer rectifier unit	7	P	G	2	1	□	0	-	0	A	A	0	0	-	□	□	□	0
						|	|			|	|	|	|		|	|	|	
For use with Solkor R/Rf relay, pilot supervision send end.						|	|			|	|	|	|		|	|	|	
Relay Type						|	|			|	|	|	|		|	|	|	
Supply Transformer/Rectifier unit (send end) [1]						2	|			|	|	|	|		|	|	|	
							|			|	|	|	|		|	|	|	
Type of Flag							|			|	|	|	|		|	|	|	
No flag							0			|	|	|	|		|	|	|	
										|	|	|	|		|	|	|	
Contact arrangement – NO										|	|	|	|		|	|	|	
0 NO										A	|	|	|		|	|	|	
											|	|	|		|	|	|	
Contact arrangement NC											|	|	|		|	|	|	
0 NC											A	|	|		|	|	|	
												|	|		|	|	|	
Number of contacts [1]												|	|		|	|	|	
None												0	|		|	|	|	
													|		|	|	|	
Contact type													|		|	|	|	
None													0		|	|	|	
															|	|	|	
Insulation level															|	|	|	
5kV															1	C	|	
15kV															2	G/H	|	
																|	|	
Housing size																|	|	
Case size E4 (4U high)																C	|	
Case size E12 (4U high)																G	|	
Case size E12 Vertical (4U wide)																H	|	
																	|	
Rating [2]																	|	
110/220/240V AC, 50/60Hz																	A	

NOTE

1) Supply Transformer/Rectifier unit (send end), ratings 110/220/240V ac, 50/60Hz.

2) For required supply supervision relay B22, see 7PG213*.

Ordering Information - 7PG21 Pilot Wire Current Differential Protection (Solkor Pilot Supervision B22-AC)

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
B22-AC	7	P	G	2	1	□	□	-	□	□	□	□	□	-	□	□	□	0
						|	|		|	|	|	|	|		|	|	|	
For use with Solkor R/Rf relay, pilot supervision send end.						|	|		|	|	|	|	|		|	|	|	
Relay Type						|	|		|	|	|	|	|		|	|	|	
Supply supervision (B22-AC)						3	|		|	|	|	|	|		|	|	|	
							|		|	|	|	|	|		|	|	|	
Type of Flag							|		|	|	|	|	|		|	|	|	
Hand reset reverse acting flag							2		|	|	|	|	|		|	|	|	
									|	|	|	|	|		|	|	|	
Contact operation									|	|	|	|	|		|	|	|	
Self reset contacts									1	|	|	|	|		|	|	|	
										|	|	|	|		|	|	|	
Contact arrangement – NO										|	|	|	|		|	|	|	
2 NO										C	|	|	|		|	|	|	
											|	|	|		|	|	|	
Contact arrangement NC											|	|	|		|	|	|	
2 NC											C	|	|		|	|	|	
												|	|		|	|	|	
Number of contacts												|	|		|	|	|	
Four												4	|		|	|	|	
													|		|	|	|	
Contact type													|		|	|	|	
NO (Standard) / NC (Standard)													0		|	|	|	
															|	|	|	
Frequency															|	|	|	
50Hz															1	|	|	
60Hz															2	|	|	
																|	|	
Housing size																|	|	
Case size E2 (4U high)																A	|	
																	|	
Voltage rating																	|	
110V AC																	A	
220V AC																	B	
240V AC																	C	

Ordering Information - 7PG21 Pilot Wire Current Differential Protection (Solkor Pilot Supervision B75/74)

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
B75/74	7	P	G	2	1	□	□	-	□	□	□	□	□	-	□	□	□	0
						|	|		|	|	|	|		|	|	|	
For use with Solkor R/Rf relay, pilot supervision receive end (5kV).						|	|		|	|	|	|	|		|	|	|	
Relay type [1)]						|	|		|	|	|	|	|		|	|	|	
Receive and repeat (B75/B74)						4	|		|	|	|	|	|		|	|	|	
							|		|	|	|	|	|		|	|	|	
Type of Flag							|		|	|	|	|	|		|	|	|	
Self reset reverse acting flag							4		|	|	|	|	|		|	|	|	
									|	|	|	|	|		|	|	|	
Contact operation									|	|	|	|	|		|	|	|	
Self reset contacts									1	|	|	|	|		|	|	|	
										|	|	|	|		|	|	|	
Contact arrangement – NO										|	|	|	|		|	|	|	
0 NO										A	E	|	|		|	|	|	
2 NO										C	C	|	|		|	|	|	
4 NO										E	A	|	|		|	|	|	
											|	|	|		|	|	|	
Contact arrangement NC											|	|	|		|	|	|	
0 NC											A	|	|		|	|	|	
2 NC											C	|	|		|	|	|	
4 NC											E	|	|		|	|	|	
												|	|		|	|	|	
Number of contacts												|	|		|	|	|	
Four												4	|		|	|	|	
													|		|	|	|	
Contact type													|		|	|	|	
NO (Standard) / NC (Standard)													0		|	|	|	
															|	|	|	
Insulation level															|	|	|	
5kV															1	|	|	
																|	|	
Housing size																|	|	
Case size E4 (4U high)																C	|	
																	|	
Voltage rating																	|	
24V DC																	A	
30V DC																	B	
50V DC																	C	
125V DC																	E	
240V DC																	F	

NOTE

1) Option selection for B74 element, B75 (3mA, 1NO/0NC) element included as standard

4.2

Ordering Information - 7PG21 Pilot Wire Current Differential Protection (Solkor Pilot Supervision B75)

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
B75	7	P	G	2	1	□	□	-	□	□	□	□	□	-	□	□	□	0
						|	|		|	|	|	|		|	|	|	
For use with Solkor R/Rf relay, pilot supervision receive end (15kV).						|	|		|	|	|	|	|		|	|	|	
Relay Type						|	|		|	|	|	|	|		|	|	|	
Receive (B75)						5	|		|	|	|	|	|		|	|	|	
							|		|	|	|	|	|		|	|	|	
Type of Flag							|		|	|	|	|	|		|	|	|	
Self reset reverse acting flag							4		|	|	|	|	|		|	|	|	
									|	|	|	|	|		|	|	|	
Contact operation									|	|	|	|	|		|	|	|	
Self reset contacts									1	|	|	|	|		|	|	|	
										|	|	|	|		|	|	|	
Contact arrangement – NO										|	|	|	|		|	|	|	
1 NO										B	|	|	|		|	|	|	
											|	|	|		|	|	|	
Contact arrangement NC											|	|	|		|	|	|	
0 NC											A	|	|		|	|	|	
												|	|		|	|	|	
Number of contacts												|	|		|	|	|	
One												1	|		|	|	|	
													|		|	|	|	
Contact type													|		|	|	|	
NO (Standard) / NC (Standard)													0		|	|	|	
															|	|	|	
Insulation level															|	|	|	
15kV															2	|	|	
																|	|	
Housing size																|	|	
Case size E12 (4U high)																G	|	
Case size E12 Vertical (4U wide)																H	|	
																	|	
Current setting																	|	
3mA																	A	

Ordering Information - 7PG21 Pilot Wire Current Differential Protection (Solkor Pilot Supervision B74)

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
B74	7	P	G	2	1	□	□	-	□	□	□	□	□	-	□	□	□	0
						|	|		|	|	|	|	|		|	|	|	
For use with Solkor R/Rf relay, pilot supervision receive end (15kV).						|	|		|	|	|	|	|		|	|	|	
Relay Type						|	|		|	|	|	|	|		|	|	|	
Receive repeat (B74)						6	|		|	|	|	|	|		|	|	|	
							|		|	|	|	|	|		|	|	|	
Type of Flag							|		|	|	|	|	|		|	|	|	
Self reset reverse acting flag							4		|	|	|	|	|		|	|	|	
									|	|	|	|	|		|	|	|	
Contact operation									|	|	|	|	|		|	|	|	
Self reset contacts									1	|	|	|	|		|	|	|	
										|	|	|	|		|	|	|	
Contact arrangement – NO										|	|	|	|		|	|	|	
2 NO										C	|	|	|		|	|	|	
											|	|	|		|	|	|	
Contact arrangement NC											|	|	|		|	|	|	
2 NC											C	|	|		|	|	|	
												|	|		|	|	|	
Number of contacts												|	|		|	|	|	
Four												4	|		|	|	|	
													|		|	|	|	
Contact type													|		|	|	|	
NO (Standard) / NC (Standard)													0		|	|	|	
															|	|	|	
Insulation level															|	|	|	
15kV															2	|	|	
																|	|	
Housing size																|	|	
Case size E2 (4U high)																A	|	
																	|	
Voltage rating																	|	
24V DC																	A	
30V DC																	B	
50V DC																	C	
125V DC																	E	
240V DC																	F	

7SG21 Multi Range Digital Setting Time Delay Relay

[Reyrolle Product Catalogue, 7SG21, 1, -_-]

Features

- Four time ranges 0-0.99s, 0-9.9s, 0-99s, 0-990s
- High accuracy & repeatability – timing compensated for output relay delay
- Time settings easily selected by digital thumb wheel switches
- Selectable delay operate or delay release
- Optional reset functions
- Instantaneous (Fast), definite time, count down
- 4 C/O output contacts
- Wide auxiliary supply range with fail alarm contact
- Timing in progress LED
- Non-volatile trip indication
- Multi voltage timer initiate input
- Multi voltage flag reset input
- Size 2M draw out case

Application

The 7SG21 - DDB20 time delay relay is particularly suitable for use in protection & control schemes where precision time delays are required.

CB Fail

A typical use is for providing a definite time delay in circuit breaker failure protection. For example: The transformer multi-trip relays energize the 7SG21 - DDB20 timer & if the circuit breaker (CB) fails to clear the fault within the pre-set (0.6s) the timer times out & operates a multi-trip relay. This in turn trips all CB's on the section of the busbar connected to the CB, which has failed to trip.

Induction disc reset emulation

Replacement of induction disc timing elements with solid-state relays can result in a loss of grading & reduced functionality due to the different reset characteristics. For example, the inherent slow reset time of induction disc relays provide an advantage in sensitive overcurrent schemes where pecking faults could go undetected due to the timer being instantaneously reset each time the current momentarily falls below the start setting. The 7SG21 - DDB20 may be specified with a number of reset functions to avoid this problem & to suit specific protection applications.

Operation

A crystal oscillator & embedded micro controller based timing circuit are employed to provide accurate timing & flexible functionality. When a control signal is applied to the timer initiate input, a counter begins counting down from the thumb wheel switch setting. When the zero is detected, the output relay contacts & flag operate.

Three time ranges are selected via a front panel switch. An internal configuration switch can be used to select a x10 range multiplier to provide up to 990s of precision time delay. Two timing modes are available:

- Time delay ON mode (Relay starts timing after the initiate control signal is applied & output contact picks up after the pre-set time delay has elapsed) or;
- Time delay OFF mode (Relay output contact picks up instantaneously when the initiate control signal is applied, starts timing after the initiate control signal is removed & drops out after the pre-set time delay has elapsed).

An amber LED on the front panel indicates when the relay has been initiated & flashes during timing.

The DDB20 timer may be specified with a number of different reset functions to provide instantaneous reset, definite time reset or induction dist reset emulation. These functions are specified at time of order.

A switchmode power supply provides a very wide auxiliary operating range. A relay fail alarm is provided in the form of a C/O contact which is picked up when the auxiliary supply rail & CPU watchdog status is healthy.

Timing Functions

Timing Function / Initiate Signal input (Status input)

For accurate timing functions the 7SG21 - DDB20 detects application or removal of an external voltage control signal. This mode is set using internal configuration switch 2 (Refer order code details).

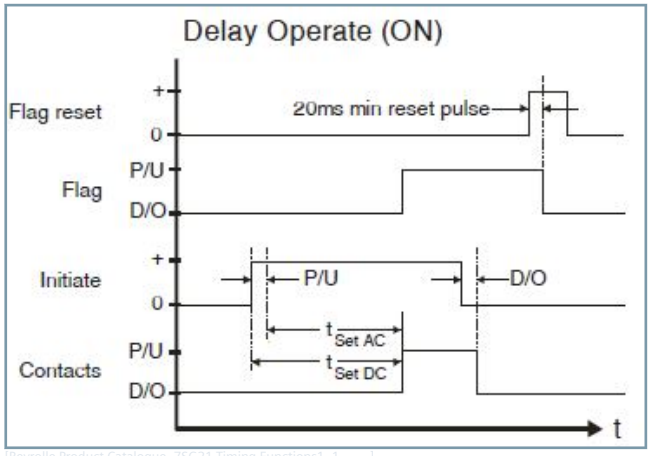
Delay Operate Timing Function

This timing mode is selected using internal configuration switch 3.

The relay is permanently connected to the auxiliary supply & is initiated by the application of a control signal. Application of the initiate signal starts the pre set timing cycle. During timing the front panel initiate LED will flash & then go on solid once the thumbwheel time setting has elapsed, this sets the output relay

& visual indicator. The initiate LED is extinguished & the output contacts reset when the initiate signal is removed. After system reset the visual indicator may be reset locally using the front panel push button or remotely via the flag reset input.

To achieve a simple but less accurate delay ON function, the initiate signal may be connected directly to the auxiliary supply. Timing will then commence when power is applied to the relay while removal of power will reset the time delay & output relay. This mode is only suitable for longer time delay settings as the switch mode power supply takes 100 – 500ms (Depending on Vx), to start which adds to the inherent time delay.



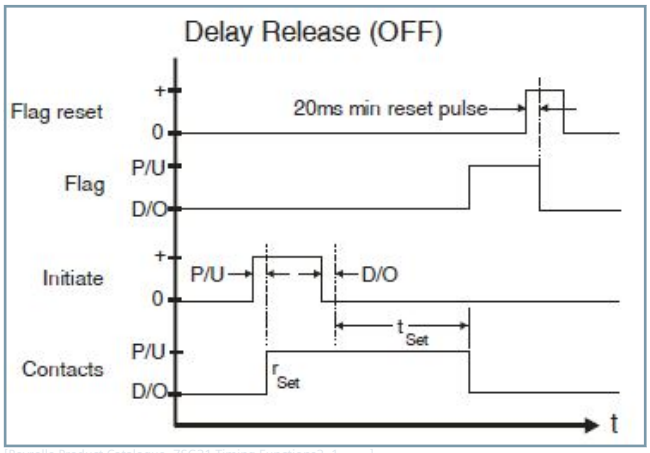
[Reyrolle Product Catalogue, 7SG21 Timing Functions1, 1, ~_~]

Removal of the initiate signal during timing will reset the time delay (Refer timing reset options). After time out the contacts are reset to the D/O condition upon removal of the initiate signal. The flag can be reset provided the timer initiate signal is removed.

Delay Release Timing Function

This timing mode is selected using internal configuration switch 3.

The relay is permanently connected to the auxiliary supply. Application of the initiate control signal, causes the output relay to set instantaneously (Rset). It will remain in this state until the control signal is removed; this starts the timing cycle & resets the output relay when the preset time delay is reached.



[Reyrolle Product Catalogue, 7SG21 Timing Functions2, 1, ~_~]

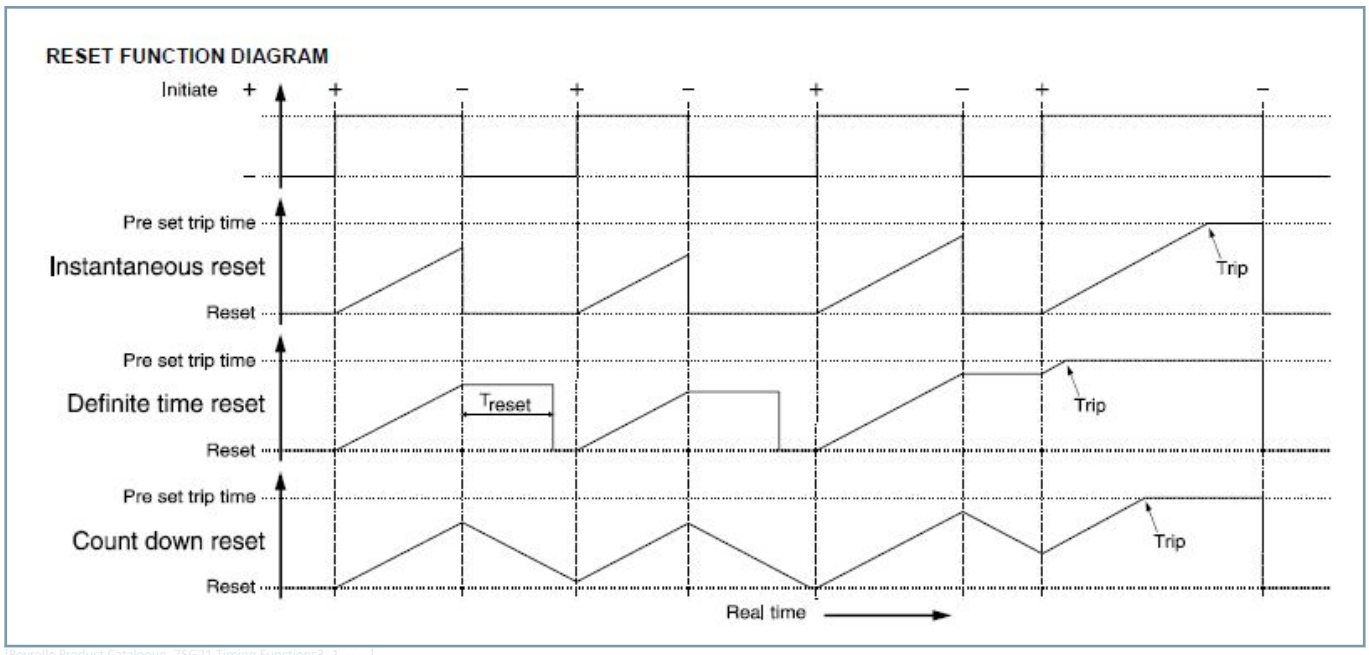
Re-application of the initiate signal during timing will reset the time delay (Refer timing reset options). After time out the contacts are reset to the P/U condition. The flag can be reset at any time, except during timing.

Timing Reset options

Instantaneous - If reset before the preset time delay is reached the timing element will reset (D/O).

Definite Time Reset (Treset) - If reset before the preset time delay is reached the delay timer will pause until the reset time has elapsed before resetting. If the timer is re-initiated before the reset time has elapsed, the delay timer will restart the timing sequence from the paused timing point.

Count Down Reset - If reset before the preset time delay is reached, the timer will count down toward reset. If the timer is re-initiated before reset is reached the timer will start counting back up towards the time delay pre set.



[Reyrolle Product Catalogue, 7SG21 Timing Functions3, 1, ~_~]

Technical Data

Auxiliary Supply

40-300V DC & 40-275V AC or 20-70V DC switchmode supply.

Burden (110V DC nominal supply)

Less than 2 watts during idle & timing.

Less than 4 watts when output relays are energized.

Relay Fail Alarm

A C/O alarm contact is maintained in the energized state when all of the following conditions are met:

- The auxiliary supply is applied
- The internal 24V DC rail is within acceptable limits
- The CPU hardware watchdog maintains a pulsing output

A CPU software watchdog records "suspect" events to an assert register & if necessary performs a soft restart.

Time Setting ranges

The 7SG21 - DDB20 relay allows for precision time settings of between zero (Minimum operate time) & 990 seconds. This is achieved by the use of two decimal thumb wheel switches & a range multiplication switch on the front panel. A 10x setting multiplier is activated when configuration switch 5 is set to OFF to extend mer range 3 up to 990s.

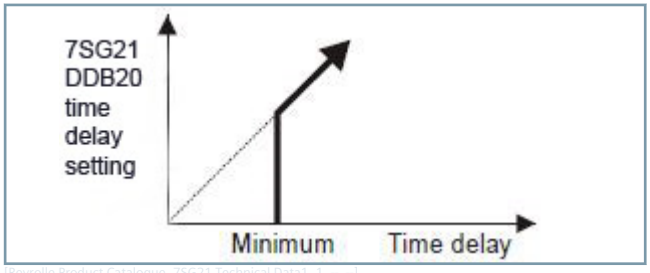
Range Selector Setting	Achievable Time Setting Range	Resolution of Time Setting
Range 1	Zero to 0.99 Sec	0.01 Sec
Range 2	Zero to 9.9 Sec	0.1 Sec
Range 3	Zero to 99 Sec	1 Sec
Range setting x10	Zero to 990 Sec	10 Sec

Time Delay setting changes

The time delay & function settings should only be changed when the timing initiate LED is extinguished. Time delay settings are read at the beginning of each timing sequence.

		AC Rejection Filter	
Initiate input	Minimum	ON	OFF
DC	P/U	< 16 ms	< 4 ms
	D/O	< 4 ms	< 16 ms
AC	P/U	N/A	< 23 ms
	D/O		< 33 ms

Minimum Output Contact Operate Time



[Reyrolle Product Catalogue, 7SG21 Technical Data1, 1, ~_~]

The minimum output contact operate time is equal to the timer initiate status input delays in Table 2 + 6 ms. Time delay settings ≤ to this figure will result in a relay contact operate time equal to the minimum.

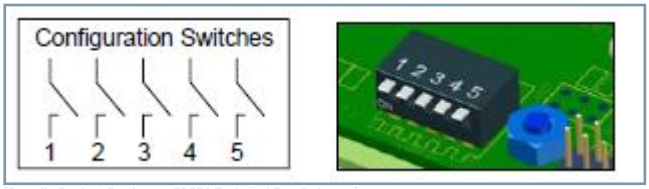
Timing Accuracy

Maximum timing error as a % of setting + uncertainty in ms.

AC Rejection Filter		
Initiate input	ON	OFF
DC	-0.19 % +0.2 ms	
AC	N/A	-0.19 % +10 ms

Configuration Switches

Configuration switches are accessible to the user & can be set by withdrawing the relay module & following the instructions on the side plate label. A bank of 5 switches are provided as depicted below & are read each time the DDB20 is powered up: Configuration Switches 2 1 3 4 5.



[Reyrolle Product Catalogue, 7SG21 Technical Data2, 1, —_–]

Status Input Operating Voltage (AC rejection filter)

The operating range of the status inputs are set using internal configuration switch 1. This setting may be pre defined when ordering.

18 - 300V DC	Set Configuration Switch to ON

In this mode the universal status input will reject AC signals that may be induced on the control wiring. Suitable for high security applications where a DC battery supply is available.

18 - 300V DC & 18 – 275V AC	Set Configuration Switch to OFF

In this mode the universal status input is designed to operate on both AC & DC input voltages. Suitable for applications where an AC auxiliary voltage is available such as transformer or generator control panels.

Status Input minimum operating current

10mA P/U for 1 ms then reducing to 1.5mA after 4 ms.

While the function of the configuration switches may vary for special custom models, the standard functions & default settings are described in the Ordering Information section.

Front Panel Indicators

Four LED indicators are provided on the front panel:

Power	On solid when auxiliary supply healthy	Green
Timing	Flashing during timing	Amber
Trip	On solid when output relay operated	Red
Range x10	On when the x10 time range selected	Green

The trip LED status is stored in non volatile memory & will be restored when the 7SG21 - DDB20 is powered up after loss of the auxiliary supply. The preserved trip LED state is reset using the front panel flag reset button or status input.

A hand & remote reset magnetic disc flag (permanent memory) indicator may be specified as an option. Note that an auxiliary supply is required to reset the flag circuits.

Transient Overvoltage

IEC60255-5 Class III

Between all terminals & earth	5kV 1.2/50us 0.5J
Between independent circuits without damage or flashover	5kV 1.2/50us 0.5J

Insulation Coordination

IEC60255-5 Class III

Between all terminals & earth	2.0kV$_{RMS}$ for 1 minute
Between independent circuits	2.0kV$_{RMS}$ for 1 minute
Across normally open contacts	1.0kV$_{RMS}$ for 1 minute

Auxiliary Supply

IEC60255-11

Allowable breaks / dips in supply	≤ 20 ms
Collapse to zero from normal voltage	

High Frequency Disturbance

IEC60255-22-1 Class III

2.5kV 1MHz common mode	≤ 3 % variation
1.0kV 1MHz differential mode	

Electrostatic Discharge

IEC60255-22-2 Class III

6kV contact discharge	≤ 5 % variation

Radio Frequency Interference

IEC60255-22-3

10V/m, 80 TO 1,000MHz	≤ 5 % variation

Fast Transient

IEC60255-22-4

4kV/m, 5/50ns, 100KHz repetitive	≤ 3 % variation

Conducted RFI

IEC60255-22-6

10V, 0.15 TO 80MHz repetitive	≤ 5 % variation

Temperature Range

IEC68-2-1/2

Operating	-10 to 55°C
Storage	-25 to +75°C

Humidity

IEC68-2-78

40°C & 95 % RH non condensing

Wiring Diagram

Output Relay Contact Configuration

4 C/O contacts

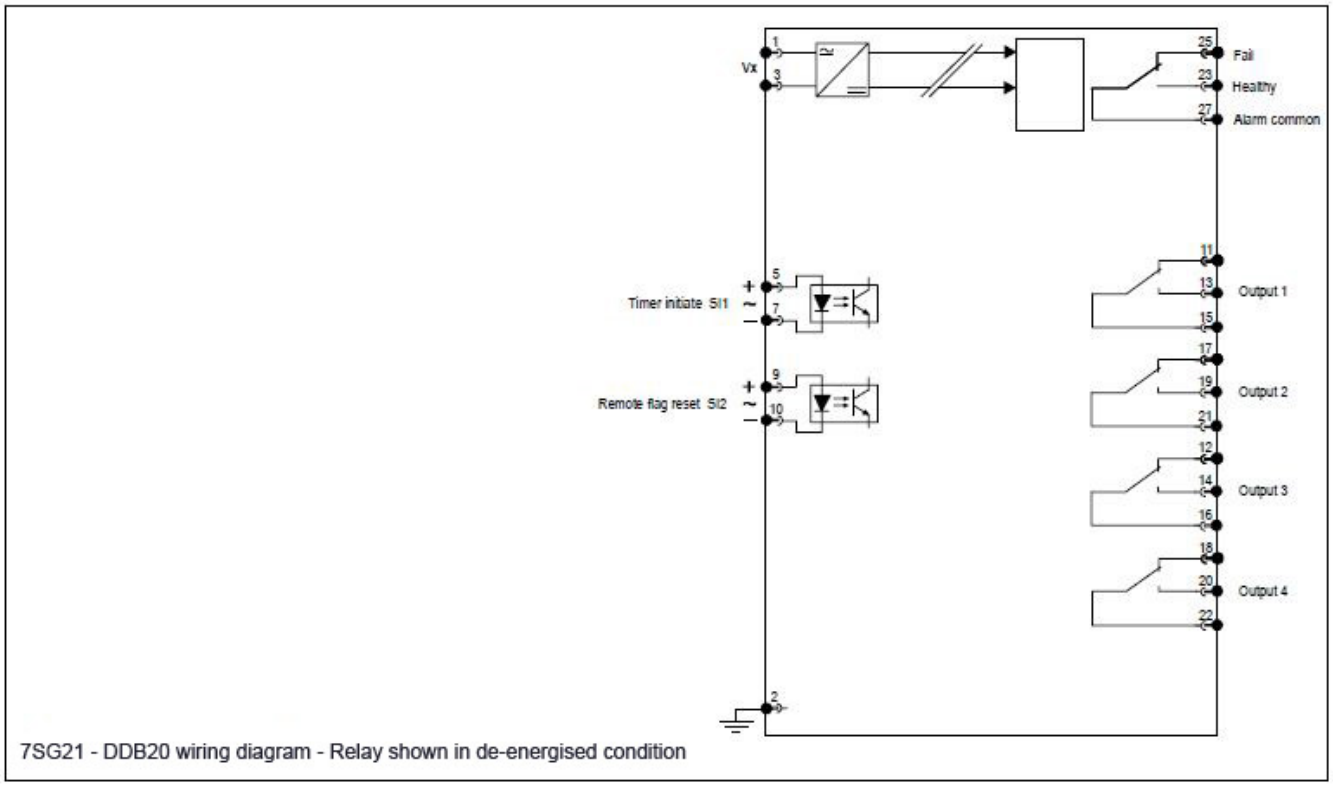
Output Contact dwell time

Once operated all tme delayed output contacts have a minimum dwell time of 100 ms

Output contact ratings

IEC60255-0-2

Carry continuously	5A AC or DC	
Make & carry	0.5 s 20A AC or DC	
L/R ≤40 ms & V ≤300V	AC resistive	1,250VA
	AC inductive	250VA @PF ≤ 0.4
	DC resistive	75W
	DC inductive	30W @ L/R ≤ 40 ms
		50W @ L/R ≤ 10 ms
Minimum numbers of operations		10^6 at maximum load
Minimum recommended load		0.5W limit 10mA/ 5V

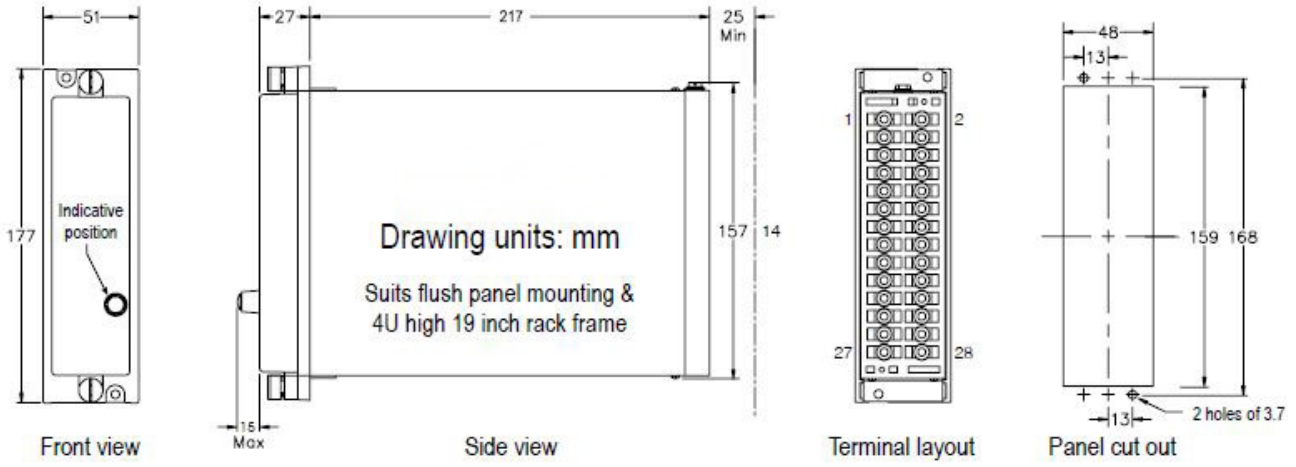


7SG21 - DDB20 wiring diagram - Relay shown in de-energised condition

[Reyrolle Product Catalogue, 7SG21 Wiring Diagram, 1, _ _]

5.1

Case Dimensions



[Reyrolle Product Catalogue, 7SG21 Case Dimensions, 1, _ --]

Ordering Information - 7SG21 Multi Range Digital Setting Time Delay Relay (DDB20)

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
DDB20	7	S	G	2	1	1	1	-	0	□	□	□	1	-	0	A	A	0
						|	|			|	|	|	|			|		
Multi range digital time delay relay.						|	|			|	|	|	|			|		
Relay type						|	|			|	|	|	|			|		
Line differential						1	|			|	|	|	|			|		
							|			|	|	|	|			|		
Timing Range							|			|	|	|	|			|		
0 th 0.99s, 0 to 9.9s, 0 to 99s and 0 to 990s							1			|	|	|	|			|		
										|	|	|	|			|		
Auxiliary supply										|	|	|	|			|		
AC/DC 20-70V										A	|	|	|			|		
AC 40-275V and DC 40-300V										B	|	|	|			|		
											|	|	|			|		
Timing reset function											|	|	|			|		
Instantaneous reset											A	|	|			|		
Definite time reset											B	|	|			|		
Count down reset											C	|	|			|		
												|	|			|		
Trip flag												|	|			|		
Red LED non volatile indication (standard)												1	|			|		
Magnetic disc trip flag												2	|			|		
													|			|		
Contact type													|			|		
4 C/O													1			|		
																|		
Housing size																|		
Housing size E2 (4U high)																A		

7XG15 High Impedance Component Box

[Reyrolle Product Catalogue, 7XG15, 1, –]

High impedance protection operates on the differential current-balance principle. In each zone, the current transformers of the incoming and outgoing circuits are connected together and form a current balance group. A relay is connected at a convenient point to form a spill circuit. An internal fault upsets the current balance and causes the relay to operate. The system employs one or more relay elements with sensitive current setting and low operating burden.

An external series resistor is used to give the each relay element the voltage setting required to ensure stability under through fault conditions. This is the setting or stabilizing resistor.

The resistance of the setting resistor should be sufficient to ensure the effective setting voltage exceeds the voltage developed by a through fault with one CT fully saturated.

The current setting of the 7SR23 may be adjusted to achieve the desired primary operating current.

Non-linear resistors (e.g. Metrosils) are used to protect the relay components, the insulation of secondary wiring and current transformers, by suppressing high voltage peaks which may otherwise be developed by the current transformer secondary winding under internal fault conditions.

Resistors and non-linear resistors are fitted on a per phase basis.

The resistors and non-linear resistors may be fitted as discrete components; however the High Impedance Component Box 7XG15 contains these items within a 4U high, size E6 relay enclosure.

7PG1110-7AE10 CT Shorting Relay

C.T. Supervision and Shorting: Unbalance in any current-balance group due to an open-circuited current transformer, the primary of which is carrying load current, produces a voltage across the relay circuit. This causes a spill current to flow and leads to instability of the protection. This condition is monitored using a sensitive element, either within the main protection relay or as a stand alone device.

CT supervision is especially recommended for protections applied to High Voltage switchgear and for schemes at all voltages where current transformers are switched to accommodate different busbar arrangements.

When an unbalance is detected, the alarm element is used to operate a suitably rated CT shorting relay, which will prevent any protection maloperation. The relay is arranged to short circuit the CT secondary wiring, diverting current from the protection relay and preventing its operation.

The 7PG1110-7AE10 (AR901) CT shorting relay is such a device, its contacts are rated to carry in excess of 50A for three seconds, which is suitable for the majority of installations. This relay is supplied in a 4U, size E2 relay enclosure.

Application

Auxiliary units for High impedance Busbar and Auto transformer protection.

Used in conjunction with the 7SR23 High Impedance Protection Relay, the High Impedance Component Box 7XG15 and its associated CT Shorting Relay 7PG1110-7AE10 provides a complete, panel mounted solution for the provision of High Impedance Protection.

Features of the system include:

- CT supervision using elements within the 7SR23.
- Provision of test points on the front panel of the Component Box.
- CT shorting on the detection of a CT fault, and whenever a protection operation occurs. This limits the dissipation of the resistor and metrosil networks within the protection panel.

Technical Information

Stabilising Resistor values:	2000, 1000 or 500 Ohms
Non-Linear Resistor:	C = 1000, B = 0.22 – 0.25
Pressure tests:	2kV for 1 minute between phases, and all circuits to Earth.
Shock, Bump, Vibration and Seismic tests:	IEC 60255-21-1,2,3

Cases

Modular case:

7XG15 High Impedance Component Box: E6

Determination of Stability

The stability of a current balance scheme using a high impedance relay circuit depends upon the relay voltage setting being greater than the maximum voltage which can appear across

the relay under a given through fault condition. This maximum voltage can be determined by means of a simple calculation which makes the following assumptions:-

- One current transformer is fully saturated making its excitation impedance negligible.
- The resistance of the secondary winding of the saturated CT together with the leads connecting it to the relay circuit terminals constitutes the only burden in parallel with the relay.
- The remaining current transformers maintain their ratio.

Thus the required relay operating voltage is given by:

$$V_S \geq I_F(R_{CT} + R_L) \times T$$

[Reyrolle Product Catalogue, 7XG15 Determination of Stability1, 1, –_–]

Where

V_s = Relay circuit setting voltage

R_L = The largest value of pilot loop resistance between the CT and the relay circuit terminals.

R_{CT} = The secondary winding resistance of the CT.

IF = The CT secondary current corresponding to the maximum steady-state through-fault current of the protected equipment.

T = Turns ratio of all current transformers (Primary turns / Secondary turns)

Method of establishing the value of relay setting resistors.

To give the required voltage setting the relay operating level is adjusted by means of an external series resistor as follows:

$$R_{STAB} = \frac{V_S}{I_S}$$

[Reyrolle Product Catalogue, 7XG15 Determination of Stability2, 1, –_–]

Where

Rstab = Resistance of the stabilising resistor

V_s = Relay circuit setting voltage

I_s = Relay setting current

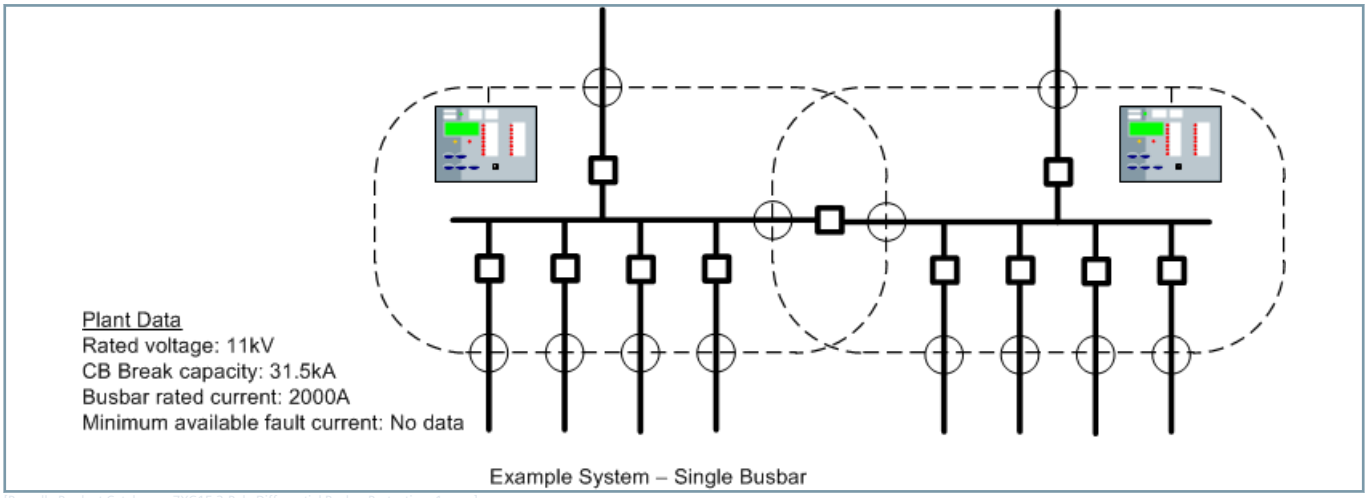
Fault Setting

The fault setting of a current –balance protection using a high impedance relay circuit can be calculated in the usual manner. It should, however, be noted that because the operating voltage of the relay circuit is relatively high, the excitation currents of the CTs in parallel with the relay may comprise a large portion of the fault setting.

Thus, if Is = the relay setting current, and I1, I2, I3 etc are the excitation currents of the CTs at the setting voltage, and T is the CT turns ratio then

Primary Operating Current = (I_s +I1+I2+I3)xT

Example: 3-Pole Differential Busbar Protection



Example System – Single Busbar

[Reyrolle Product Catalogue, 7XG15 3-Pole Differential Busbar Protection, 1, –_–]

Setting Requirements

Assigned through fault current (rated stability limit) = 31.5kA (CB break capacity)

Required Fault Setting (Primary Operate Current): Approximately 50 % of busbar rating, or 10 – 30 % of minimum fault current available, or As specified by the user

From the supplied plant data a primary operate current (POC) of 1000A is chosen.

CT and Connection Details

Turns ratio (T)	1/2000
Voltage Knee Point (VK)	600V
Magnetising Current (I_{mag}) @ V_K	100mA
CT secondary resistance (R_{CT})	10 Ohms
CT lead loop resistance (R_L)	0.15 Ohms max.

Using the data in the 7SR23 settings tool software, we are given the following settings:

7XG15 High Impedance Component Box

7SR23 Relay

87/50-1 Element	Enabled
87/50-1 Current Setting	0.365A
87/50-1 Delay setting	0s
CT50 Element	Enabled
CT50 Setting	0.02A
CT50 Delay	3 s

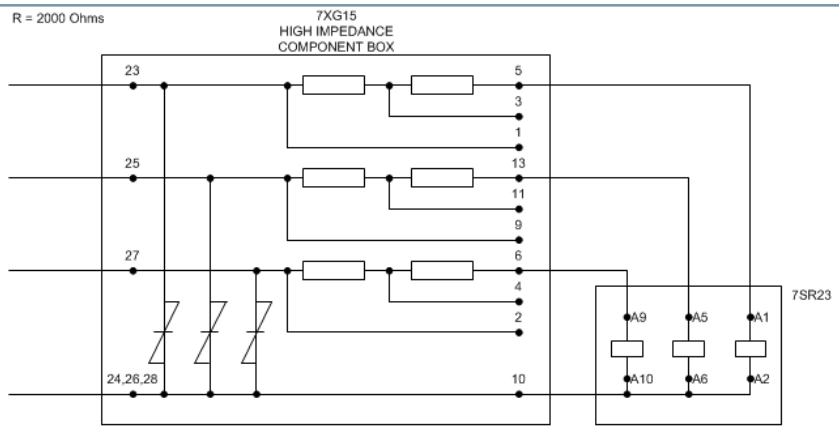
Auxiliary Component Box

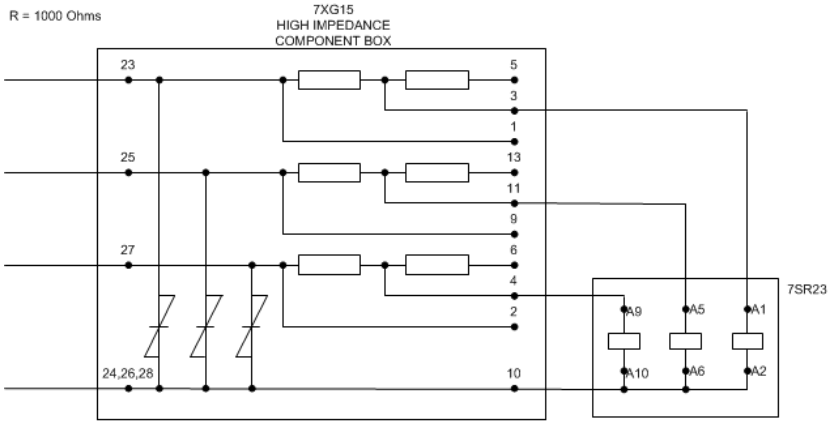
Rstab	500 Ohms
Metrosil	75 mm, c = 1000

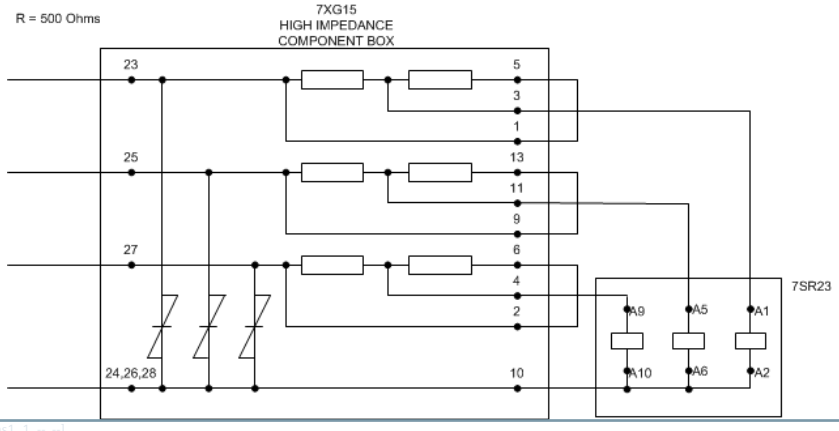
Control Scheme settings for 7SR23 (see connections diagram)

Protection Healthy	BO2
87/50-1 Operated	BO3
CT50 Operated	BO3
Zone Switch Out	BO3
BI 1 Operated	L8
Self Reset LED	L8 (L8 to be marked as " CT Shorting Relay Operated ")
BO3 Minimum Operate Time	5 s

Diagrams – Selection of stabilising resistance

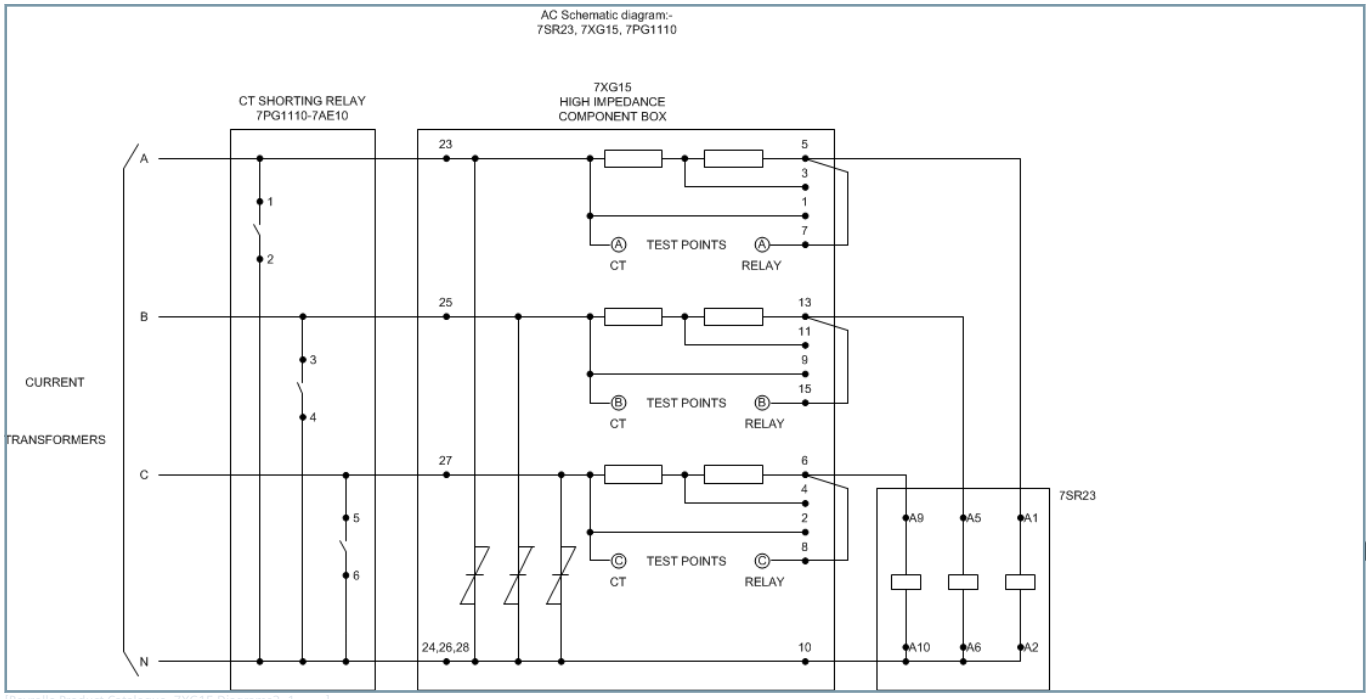






[Reyrolle Product Catalogue, 7XG15 Diagrams1, 1, _ _]

7XG15 High Impedance Component Box



[Reyrolle Product Catalogue, 7XG15 Diagrams2, 1, --_--]

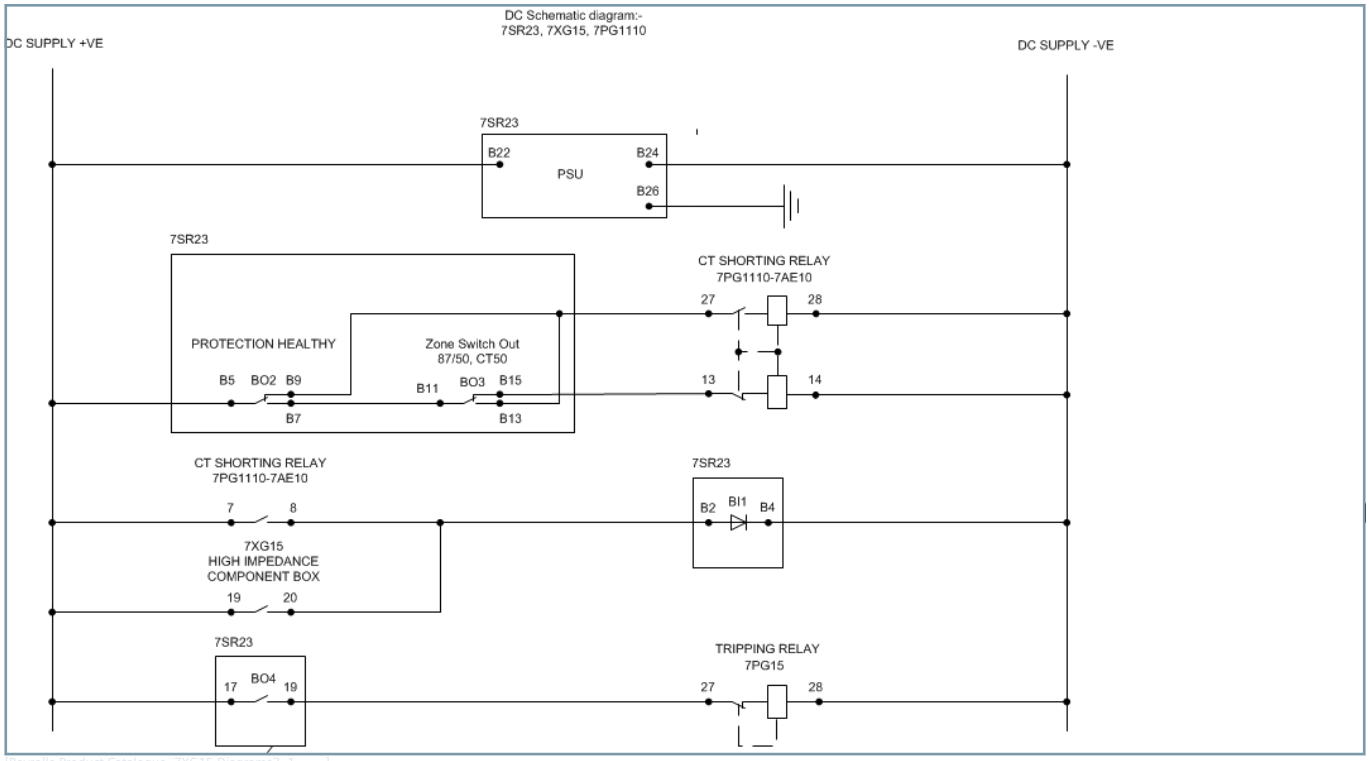
NOTE

NOTES:

1. 7SR23 DAD connections to the 7XG15 unit are correct for a setting resistance of 2000 Ohms. These connections must be varied on the 7XG15 unit where the alternative values of 1000 or 500 Ohms are required for a given application.

2. The CT Shorting Relay and the 7XG15 unit are both fitted with case shorting contacts. In the event that either device is withdrawn, the Current Transformers are automatically short circuited and indication is given by the 7SR23.

3. The 7XG15 unit is designed to be used in conjunction with the 7PG11 CT Shorting Relay. Do not use the 7XG15 unit without a CT shorting relay, or with alternative scheme connections.



[Reyrolle Product Catalogue, 7XG15 Diagrams3, 1, --_--]

NOTE

NOTES:

1. The rated DC voltage of the CT Shorting Relay and the 7SR23 DAD (Power Supply and Binary Inputs) must be com-patible with the available auxiliary supply.

2. On the 7SR23, Binary Input 1 must be suitably mapped to provide a self –reset LED indication that the CT Shorting Relay is operated, and the protection is temporarily out of service (until the CT Shorting Relay Resets).

3. The CT Shorting Relay and the 7XG15 unit are both fitted with case shorting contacts. In the event that either device is withdrawn, the Current Transformers are automatically short circuited and indication is given by the 7SR23.

4. Binary Outputs on the 7SR23 are to be mapped as indicated above. This is to allow automatic operation of the CT Shorting Relay as required by the scheme.

5. BO3 must be configured as hand reset. The protection is reset from the keypad on the 7SR23, this will also reset the CT shorting relay and indi-cation.

6. CB Trip is to be via a latched Trip Relay.

Ordering Information - 7XG15 High Impedance Component Box

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Component Box	7	X	G	1	5	2	0	-	3	A	A	0	0	-	0	D	A	0
						|	|		|	|						|		
Setting resistor and metrosil unit for 7SR23 High Impedance Protection.						|	|		|	|						|		
Disc size, number of phases						|	|		|	|						|		
Three inch, single phase						2	|		|	|							|		
							|		|	|							|		
B value							|		|	|							|		
0.22 to 0.25							0		|	|								|		
									|	|							|		
C value									|	|							|		
1000									3	|								|		
										|								|		
Resistors										|								|		
2000/1000/500 Ohm										A								|		
Case size E6 (4U high)																		D		

Description

The 7XG222 range of test blocks, housed within an Epsilon enclosure, offers facilities for monitoring and secondary injection testing of power system protection schemes in conjunction with the appropriate multi-fingered test plug.

The 2RMLG Test Block has 14 pairs of spring loaded contacts which are linked to a terminal block positioned at the rear of the enclosure.

The 2RMLG07 is coded to only accept the 2RMLB-R7 Test Plug which has connection terminals 21, 23, 25, and 27, internally.

The 2RMLG08 is coded to only accept the 2RMLB-R8 Test Plug which has internal pairs 1 and 3, 5 and 7, 9 and 11, and 15 and 17, shorted together internally.

The 2RMLG09 is coded to only accept the 2RMLB-R9 Test Plug which has terminals 1-3-5-7, 9-11, 17-19 & 21-23-25-27 shorted together internally..

Each pair of contacts is normally closed completing the circuit through the test block when the associated protection equipment is in use.

For testing purposes the test block can be accessed by removing the front cover. The 2RMLG01 has a metallic probe attached to the front cover assembly which when withdrawn open circuits the 2 contacts at position 13 and 14.

The main DC auxiliary supply to the protection scheme or relay can be wired to this circuit to prevent inadvertent tripping of the protection circuit after removal of the cover and during the test procedure.

The 2RMLG02/07/08/09 do not include the above facility and contacts 13 and 14 are normally closed. These contacts must not be used for current circuits, as the relevant contact finger on the 2RMLB-R test plug is shorter in this position.

The short test finger in position 13 and 14 on the 2RMLB-R will open contacts 13 and 14 in the test block after the other fingers have made contact in all other positions.

It is important that the sockets in the test plug which correspond to the current transformer secondary windings are linked prior to the test plug being inserted into the test block.

This will ensure that the current transformer secondary windings are short circuited prior to disconnection from the protection scheme or relay. If the DC auxiliary supply is to be used during testing it can be linked using the sockets in the test plug.

Operation of the contacts can be monitored by connecting the test equipment to the protection scheme or relay with the even numbered sockets of the test plug. If a number of 2RMLG test blocks are connected to a relay it is recommended that the DC supply be routed through each of them to safeguard against inadvertent operation.

Benefits

The features of the Test Block are:

- Finger safe design
- Finger safe test leads

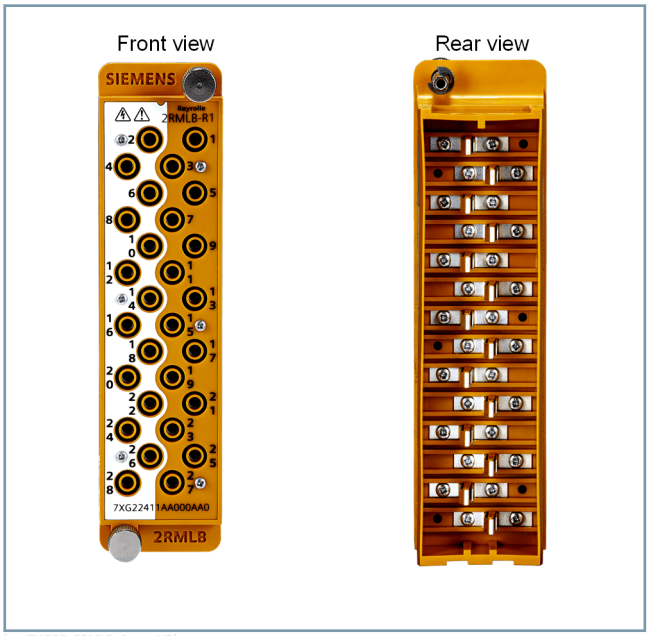
- Various scheme configurations
- Retention fixings on test plugs
- 7XG222 Suitable for vertical or horizontal mounting
- Standard 4U case design
- Coded test plugs prevent incorrect insertion

Hardware Construction

The 2RMLG is a size E2 unit in the Epsilon range of enclosures. The rear terminal block has 28 terminals each with an M4 screw outlet for the attachment of external wiring, fitted with 'L' shaped pre-insulated ring tongue terminations.

[sc_7XG22_2RMLG, 1, en_US]

Figure 5.3/1 2RMLG



[sc_7XG22_2RMLB, 1, en_US]

Figure 5.3/2 2RMLB

2RMLB-R Series Multi-Fingered Test Plugs

The 2RMLB-R series is inserted into the 2RMLG test socket and is securely retained by means of two knurled screws. The 2RMLB-RI test plug incorporates 28 test sockets, each socket accepting a shrouded or plain 4 mm diameter plug.

2RMLB-R7 with Shorting Contacts

The 2RMLB-R7 is similar to the 2RMLB-R1 with shorted contact pairs 21-23-25-27 and is coded to be used with the MMLG07 Test Socket only.

2RMLB-R8 with Shorting Contacts

The 2RMLB-R8 is similar to the 2RMLB-R1 with shorted contact pairs 1-3, 5-7, 9-11, 15-17 and is coded to be used with the 2RMLG08 Test Socket only.

2RMLB-R9 with Shorting Contacts

The 2RMLB-R9 is similar to the 2RMLB-R1 with shorted contact pairs 1-3-5-7, 9-11, 17-19, 21-23-25-27 and is coded to be used with the 2RMLG09 Test Socket only.

NOTE

BEFORE inserting a Test Plug into a Test Socket carrying current transformer secondary circuits ensure that the test plugs corresponding to the current transformer circuits are short-circuited.

This is to ensure the current transformer secondary circuits are not inadvertently open-circuited during insertion of the last plug.

NOTE

BEFORE inserting a Test Plug to measure current ensure that the ammeter is on the correct range and that it is connected to its test leads.

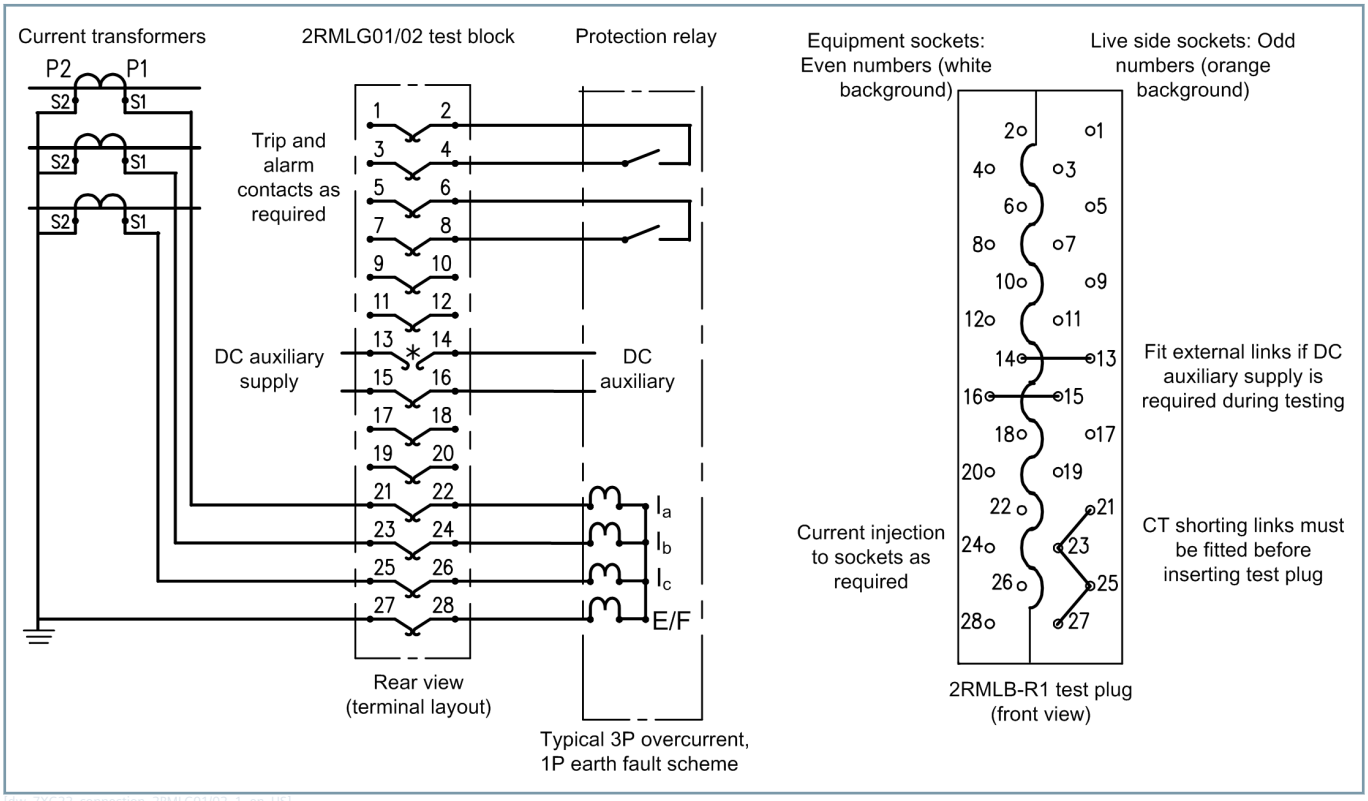
The connections will depend upon the scheme and details must be obtained from the appropriate diagrams. If it is necessary to use the DC auxiliary supply during testing, then a test link may be fitted across the sockets in the Test Plug.

Test Block Information

The device terminal label displays the MLFB code, serial number, relay description, terminal contact details, and safety symbols.

CE	European CE marking
⚠	Refer to device documentation
⚠	Electrical Hazard
	Waste Electrical and Electronic Equipment Directive (WEEE)
EAC	Guideline for the Eurasian Market

Connection Diagrams



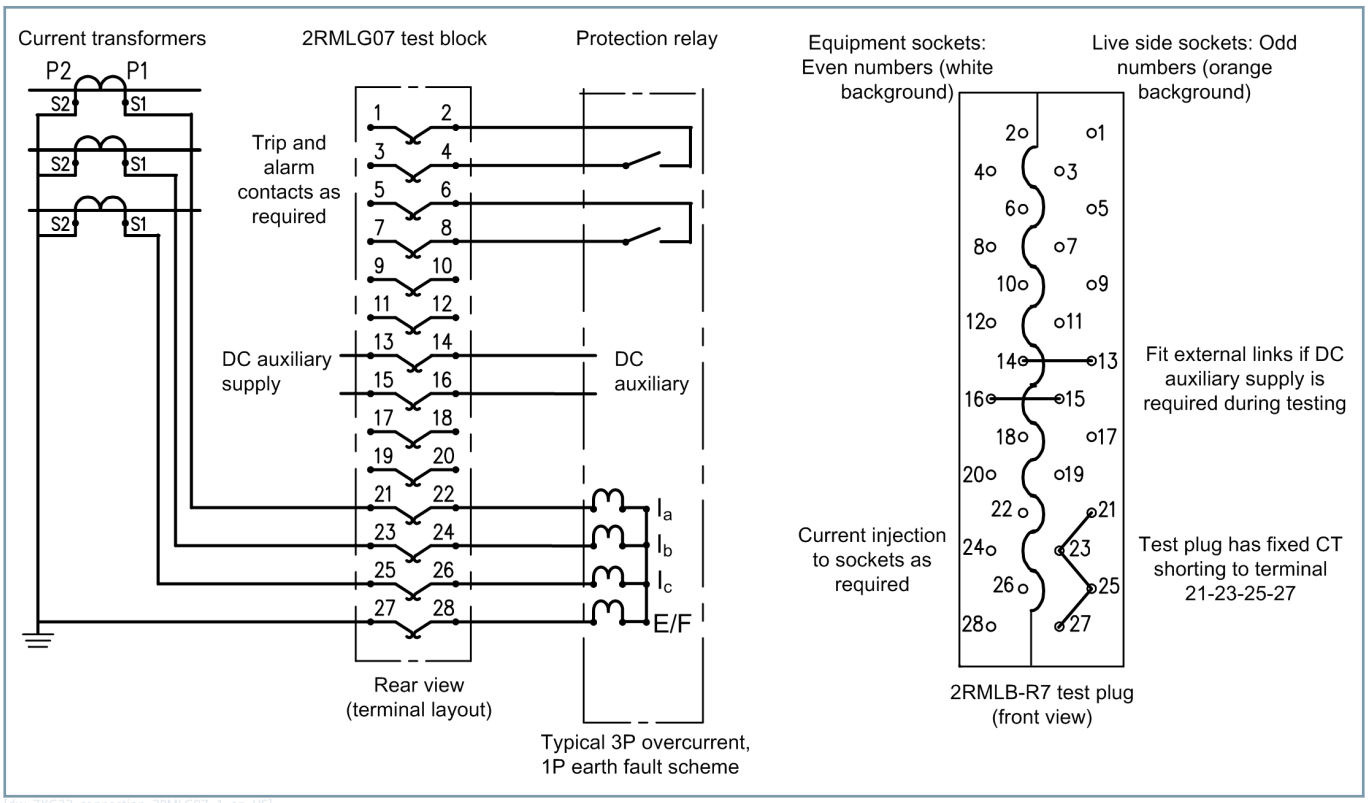
[dw_7XG22_connection_2RMLG01/02, 1, en_US]

Figure 5.3/3 Typical Application of the 2RMLG01 / 2RMLG02 Test Block and 2RMLB-R1 Test Plug

NOTE

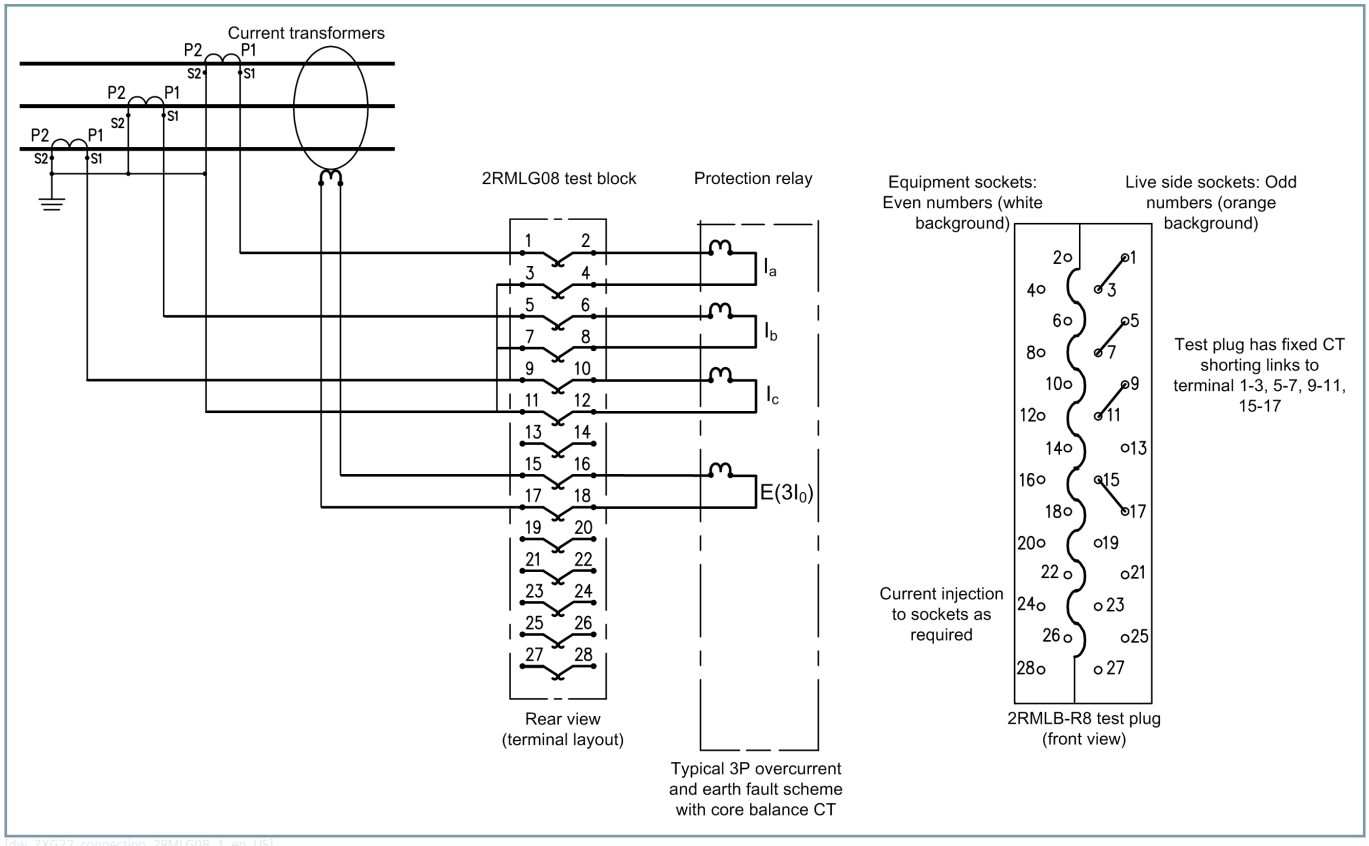
2RMLG01 13/14 open cct when cover is removed and all other positions are connected.

2RMLG02 13/14 connected as in the same way as other positions.



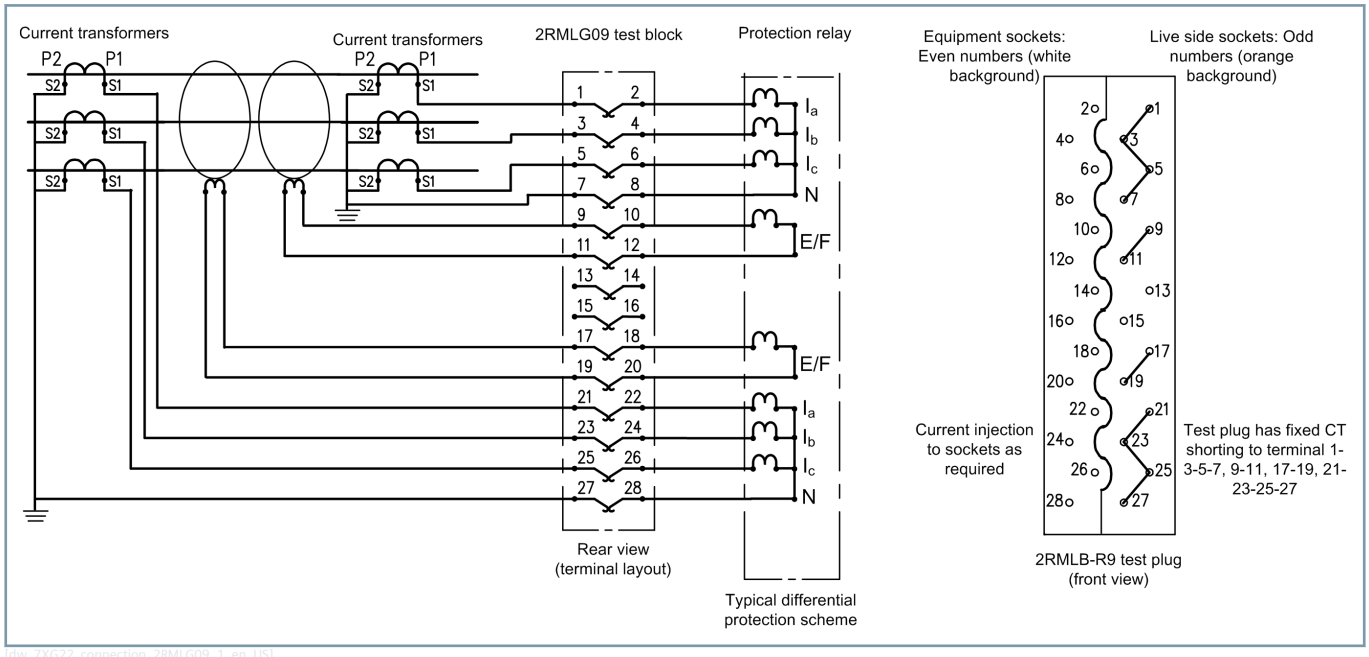
[dw_7XG22_connection_2RMLG07, 1, en_US]

Figure 5.3/4 Typical Application of the 2RMLG07 Test Block and 2RMLB-R7 Test Plug



[dw_7XG22_connection_2RMLG08, 1, en_US]

Figure 5.3/5 Typical Application of the 2RMLG08 Test Block and 2RMLB-R8 Test Plug

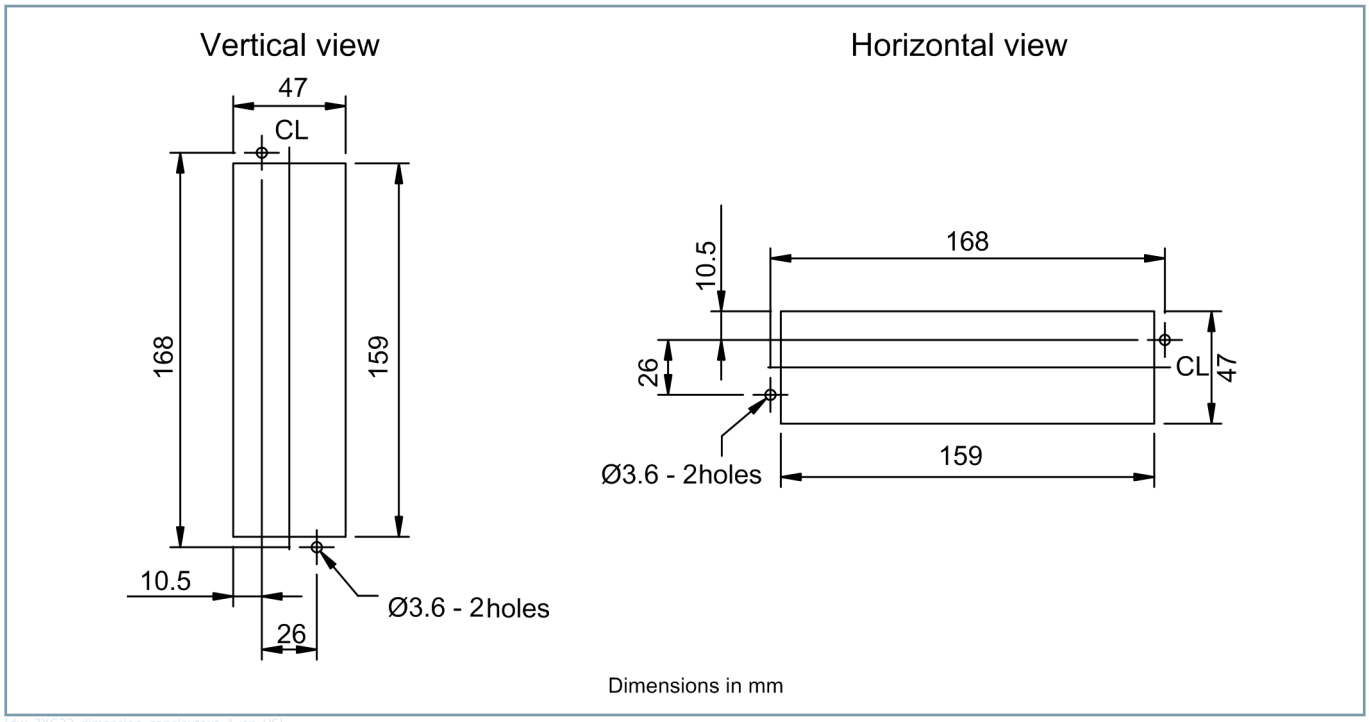


[dw_7XG22_connection_2RMLG09, 1, en_US]

Figure 5.3/6 Typical Application of the 2RMLG09 Test Block and 2RMLB-R9 Test Plug

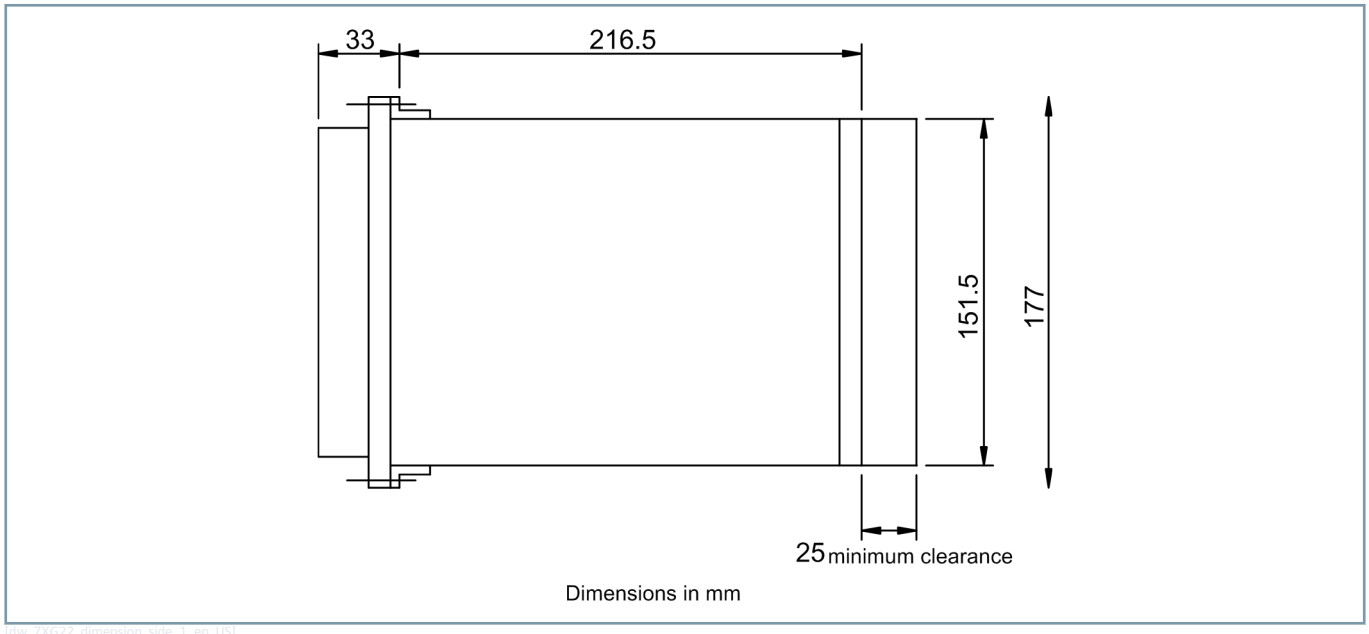
Dimension Drawings

This section displays the different dimensional views of a Test Block.



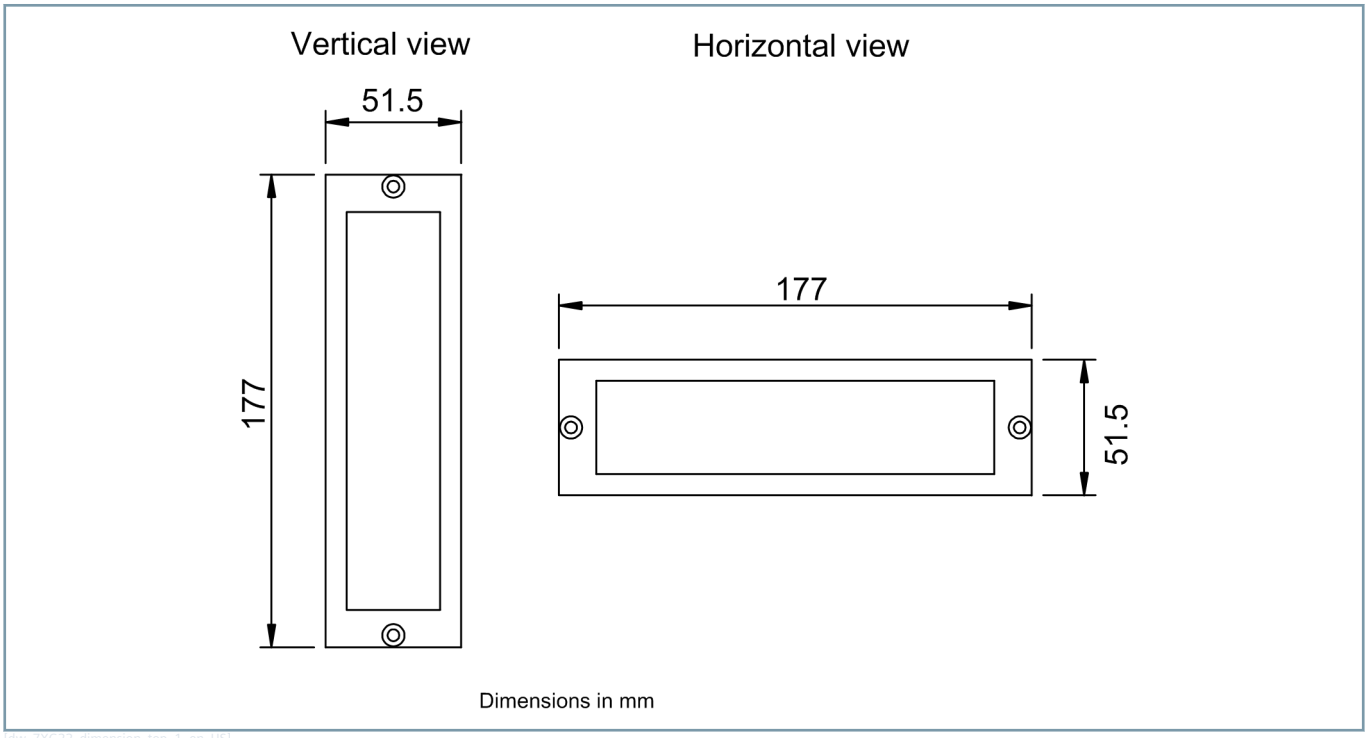
[dw_7XG22_dimension_panelcutout, 1, en_US]

Figure 5.3/7 Panel Cut-out View



[dw_7XG22_dimension_side, 1, en_US]

Figure 5.3/8 Side View (Vertical) Top View (Horizontal)



[dw_7XG22_dimension_top, 1, en_US]

Figure 5.3/9 Front View

NOTE

The Ø3.6 holes are for M4 thread forming (trilobular) screws. These are supplied as standard and are suitable for use in ferrous/aluminum panels 1.6 mm thick and above. For other panels, holes to be M4 clearance (typically Ø4.5) and relays mounted using M4 machine screws, nuts and lockwashers (supplied in panel fixing kit).

Technical Data

Indication of Conformity

CE	This product complies with the directive of the Council of the European Communities on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 2014/30/EU) and concerning electrical equipment for use within specified voltage limits (Low Voltage Directive 2014/35/EU) as well as restriction on usage of hazardous substances in electrical and electronic equipment (RoHS Directive 2011/65/EU). This conformity has been proved by tests conducted by Siemens AG in accordance of the Council Directive in accordance with the product standard IEC/EN 60255-26 for the EMC directives, and with the standard IEC/EN 60255-27 for the low-voltage directive. RoHS directive 2011/65/EU is met using the standard EN 50581. The device has been designed and produced for industrial use.

EMC Compliance

89/336/EEC	These products have been classified as electromagnetically benign and are therefore excluded from the European Community EMC Directive. (89/336/EEC)

General Technical Data

High Voltage Withstand

IEC 60255-5

2RMLG 01/02/07/08/09	5 kV_{RMS} for 1 minute between all case terminals connected together and the case earth terminal.
	5 kV_{RMS} for 1 minute between any contact pair and either adjacent alternate contact pair, provided the intermediate contact pair is not used.
	2 kV_{RMS} for 1 minute between any contact pair and either adjacent contact pair.
2RMLG 01 only	1 kV_{RMS} for 1 minute between terminals 13 and 14 when the cover is removed (e.g. opening the auxiliary supply or trip circuit).
2RMLB-R1	As 2RMLG 01 plus 2 kV_{RMS} for 1 minute between incoming and outgoing contacts when inserted.
2RMLB-R7	As above with the exception of terminals 21, 23, 25, and 27 which are permanently shorted together.
2RMLB-R8	As above with the exception of terminal pairs 1-3, 5-7, 9-11, and 15-17 which are permanently shorted together as pairs.
2RMLB-R9	As above with the exception of terminal pairs 1-3-5-7, 9-11, 17-19, and 21-23-25-27 which are permanently shorted together in groups.

Transient Overvoltage

IEC 60255-27

2RMLG 01/02/07/08/09	5 kV impulse between all case terminals connected together and the case earth terminal.
	5 kV impulse between any contact pair and either adjacent alternate contact pair, provided the intermediate contact pair is not used.
	2 kV impulse between any contact pair and either adjacent contact pair.
2RMLG 01 only	2 kV impulse between terminals 13 and 14 when the cover is removed (e.g. opening the auxiliary supply or trip circuit).
2RMLB-R1	As 2RMLG 01 plus 2 kV impulse between incoming and outgoing contacts when inserted.
2RMLB-R7	As above with the exception of terminals 21, 23, 25, and 27 which are permanently shorted together.
2RMLB-R8	As above with the exception of terminal pairs 1-3, 5-7, 9-11, and 15-17 which are permanently shorted together as pairs.
2RMLB-R9	As above with the exception of terminal pairs 1-3-5-7, 9-11, 17-19, and 21-23-25-27 which are permanently shorted together in groups.

Current and Voltage Withstand

2RMLG 01/02/07/08 2RMLBR1-R9	All contact circuits rated at 20 A continuously or 400 A for 1 s, AC or DC.
	AC 300 V/DC 300 V maximum service voltage.

Mechanical Tests

Test	Standard
Vibration	IEC 60255-21-1, Response and endurance, Class 2

Climatic Environmental Tests

Temperature

IEC 60068-2-1/IEC 60068-2-2/IEC 60255-6

Ambient operating temperature	-10 °C to +55 °C
Storage temperature (non-operational)	-25 °C to +70 °C

Humidity

IEC 60068-2-3

Damp heat test, steady state	56 days at 93 % RH and +40 °C

Enclosure Protection (2RMLG only)

IEC 60529

IP50 (dust protected)

Ordering Information – 7XG222

Product Description	Order Number																
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Test Modules (2RMLG)	7	X	G	2	2	2	0	–	□	□	A	0	0	–	0	A	A	0
				|	|	|			|	|								
Category				|	|	|			|	|								
Ancillary equipment				2	|	|			|	|								
					|	|			|	|								
Ancillary Equipment					|	|			|	|								
Modular case test components					2	|			|	|								
						|			|	|								
Test Component Type						|			|	|								
Test modules (2RMLG)						2			|	|									
									|	|									
Component Type									|	|									
Test module (2RMLG01)									1	|									
Test module without open circuit facility between terminals 13 and 14 when cover removed (2RMLG02)									2	|									
Test module with automatic CT shorting (2RMLG07)									3	|									
Test module with automatic CT shorting (2RMLG08)									4	|									
Test module with automatic CT shorting (2RMLG09)									5	|									
										|									
Mounting										|									
E2 case vertical										A									
E2 case horizontal										B									

Ordering Information – 7XG2241

Product Description	Order Number																
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Test Plugs (2RMLB-R)	7	X	G	2	2	4	1	–	□	A	A	0	0	–	0	A	A	0
				|	|	|	|		|									
Category				|	|	|	|		|									
Ancillary equipment				2	|	|	|		|									
					|	|	|		|									
Ancillary Equipment					|	|	|		|									
Modular case test components					2	|	|		|									
						|	|		|									
Test Component Type						|	|		|									
Test plugs (2RMLB-R)						4	1		|										
									|										
Component Type									|										
Multi finger test plug complete with leads (2RMLB-R1)									1										
Multi finger test plug complete with leads and internal shorting links (2RMLB-R7)									3										
Multi finger test plug complete with leads and internal shorting links (2RMLB-R8)									4										
Multi finger test plug complete with leads and internal shorting links (2RMLB-R9)									5										

7XG225 – 3RMLG Test Block System

[Reyrolle Product Catalogue, 7XG225, 1, _ _]

7XG225 is a flexible and high performance test block system with a focus on operator safety. Suitable for application on a wide range of protection relay panels.

- Finger safe test sockets
- Automatic CT shorting
- 14 or 28 independent test groups

3RMLB-S Test Plug

- 14 or 28 test circuits
- 'Finger safe' test sockets
- One test plug for all 14 way 3RMLG blocks
- One test plug for all 28 way 3RMLG blocks

Features

- Automatic shorting of CT circuits completed in the test block - No test links or operator intervention required
- Isolation plug provides sequential circuit isolation timing in three (3) stages
- 'Finger safe' test sockets suit standard or shrouded type 4 mm banana plugs for direct access to the protection or measurement scheme
- Clear and concise front panel circuit identification
- Test plug fitted with insertion handle and thumb screw retention system to enhance operator safety and system security
- Side label instructions on test plug for changing from normal service to the test condition
- High current / voltage rating

Application

Test blocks enable test technicians to quickly and safely isolate protection relays so that test signals may be injected and system performance verified.

There are a number of advantages in performing injection tests at the protection relay panel:

- Reduction in down time of the equipment under test
- Testing does not cause disturbance to wiring, terminals or equipment settings
- Existing auxiliary supply to the equipment under test may be isolated

The 3RMLG Test Block system is designed as a general-purpose isolation and test signal injection point. 'Finger safe' sockets are employed to improve operator safety and suit 4mm shrouded type banana plugs.

Equipment under test need only be removed for servicing if problems are detected or for routine maintenance. Where more than 14 test circuits are required, refer to the 3RMLG models that provide 28 test circuits.

Test Circuit Access

Access to the circuits for testing purposes is achieved in a three stage process.

STAGE ONE	Test Block Cover Extraction
Isolation:	Isolation of Stage 1 circuits
STAGE TWO	Isolation Plug Extraction
CT Shorting:	Automatic shorting of all CT circuits
Isolation:	Isolation of Stage 2 Isolation of CT circuits
STAGE THREE	Test Plug Insertion
Insertion:	4 mm test points available

The above procedure should be completed in the reverse order to place the protection system back in service. Insertion of the Test Plug type 3RMLB connects the live side circuits to the 4mm yellow test sockets. The equipment side circuits are connected to the 4mm black test sockets. Each test socket is identified by a number, which corresponds to the numbered terminal on the rear of the case when the Test Plug is inserted.

The internal vertical CT shorting bar shorts the CT terminals on the live side only, on removal of the isolation plug. Therefore it is vital that CTs are connected to the live side terminals to avoid the CT wiring being open-circuited.

Inserting the 3RMLB test plug allows changeover in 3 stages as shown in the timing diagram.

Description

The fourteen (14) test groups are specified to provide automatic CT shorting and sequential circuit to suit specific protection schemes:

- Stage 1 isolation
- CT shorting
- Stage 2 isolation

The main advantage of this approach is the improved level of safety and security afforded to the CT circuits. This is because the CT shorting function takes place within the 3RMLG Test Block irrespective of the CT circuit position. In many test block systems the CT shorting is only accomplished when the Test Plug is inserted which leaves open the possibility of a CT circuit becoming open circuit due to the CT shorting links being omitted or in the wrong position. This potential problem is

avoided in the 3RMLG and allows a single Test Plug to be employed for all 14 way Test Block configurations.

Each test circuit is connected to a separate pair of terminals at the rear of the case. During normal operation of the associated protection equipment, each terminal pair is connected via a circuit-shorting link.

Where more than 14 test circuits are required such as in EHV transmission protection panels, the 3RMLG Test Block with 28 test circuits may be employed.

Safety Overview

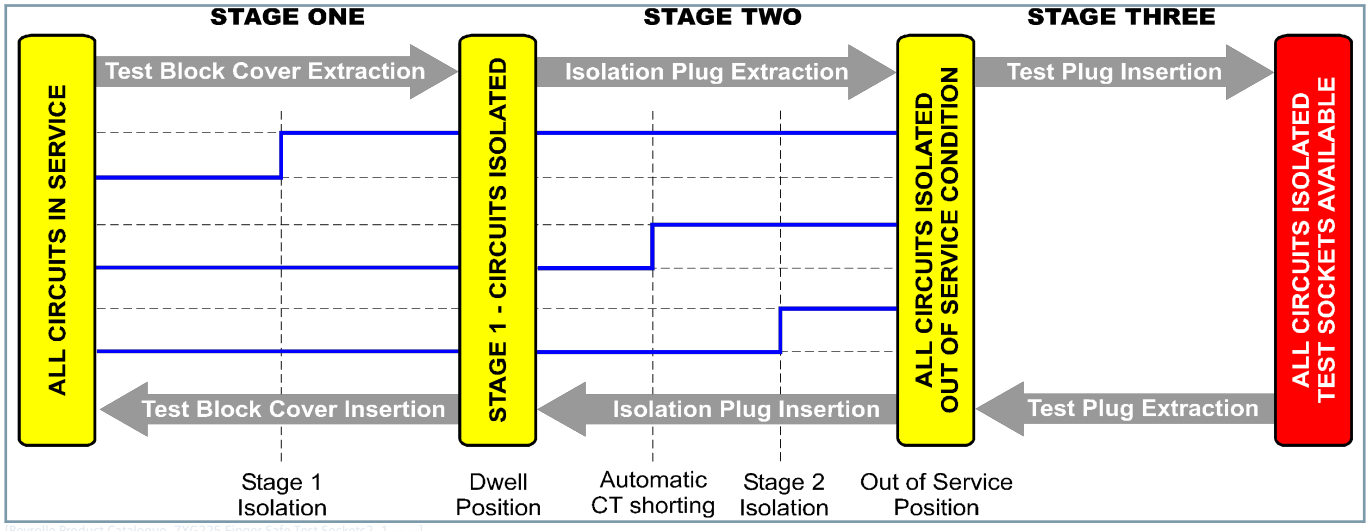
While providing maximum convenience and efficiency to system testing, test block systems must also provide a high degree of safety. This section describes the key design features employed in the 3RMLG test block system to enhance operator safety.

Finger Safe Test Sockets

BLACK	even numbered equipment side sockets
YELLOW	odd numbered live side sockets

[Reyrolle Product Catalogue, 7XG225 Finger Safe Test Sockets1, 1, --_--]

The 3RMLG Test Plug employs 'finger safe' test sockets. This allows the use of shrouded banana plugs to greatly reduce the possibility of an operator coming into contact with any part of the test circuit.



[Reyrolle Product Catalogue, 7XG225 Finger Safe Test Sockets2, 1, --_--]

Figure 5.4/1 Timing diagram

Test Plug Handles

The 3RMLG employs handles at the top and bottom of the plug assembly to ensure the operator's hand is well separated from the test sockets during insertion. Retention thumb screws are provided at the top and bottom of the test plug to avoid inadvertent removal of the plug during testing.

[Reyrolle Product Catalogue, 7XG225 Test Plug Handles1, 1, --_--]

Figure 5.4/2 VT Connections

[Reyrolle Product Catalogue, 7XG225 Test Plug Handles2, 1, –_–]

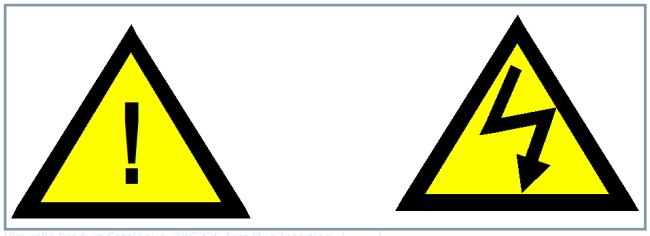
Figure 5.4/3 28 Test circuit versions

Test Lead Insertion

Before use the insulation of the flying leads should be visibly checked for damage.

Flexible banana test leads with shrouded plugs are recommended for operator safety. 2.5 mm^2 multi-strand wire with PVC insulation is recommended for adequate current rating and flexibility.

Test Plug Insertion

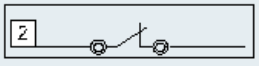


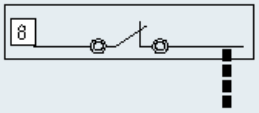
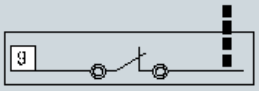
[Reyrolle Product Catalogue, 7XG225 Test Plug Insertion, 1, –_–]

To avoid high voltage shock hazard, external CT circuits must NOT be open circuited.

Insertion of the 3RMLB-S connects the live side circuits to the YELLOW test sockets on the front panel. The equipment side circuits are connected to the BLACK test sockets on the front panel. Each test socket is identified by a number, which corresponds to the numbered terminal on the rear of the case when the Test Plug is inserted.

Automatic CT Shorting

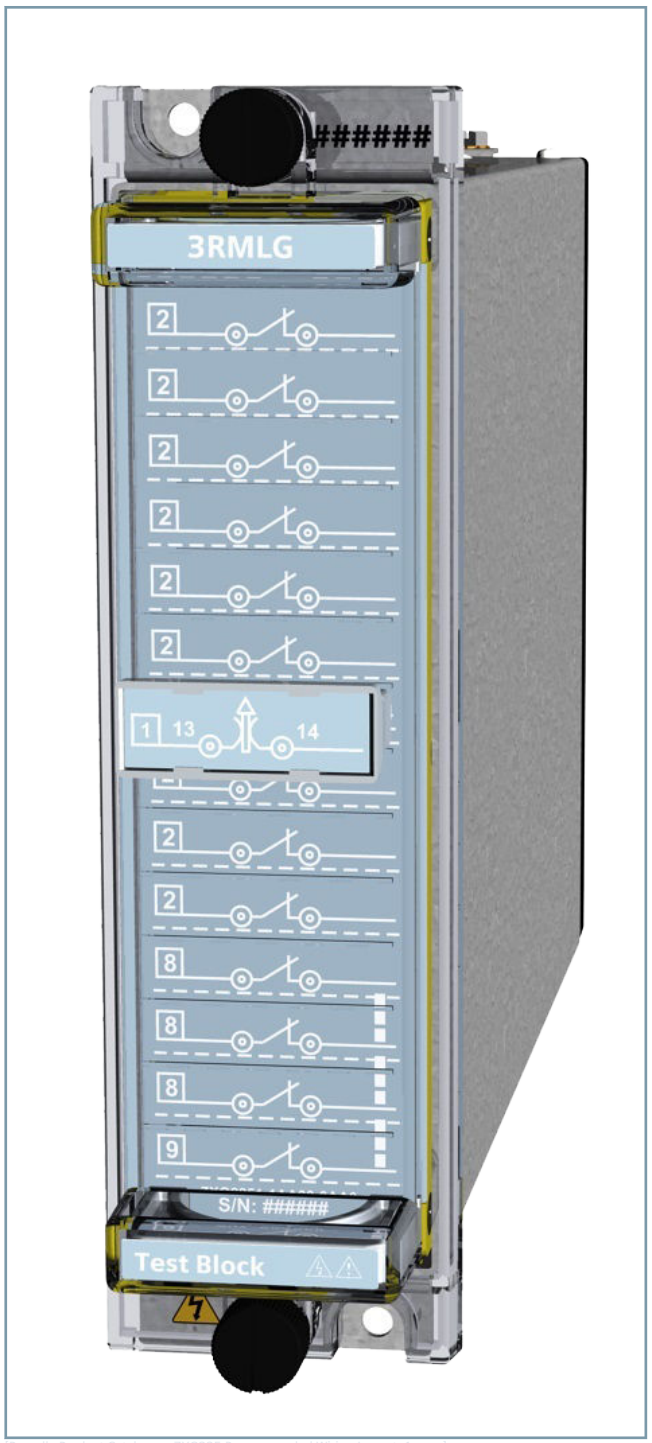
Type	Description	Function	Timing Stage	Front Panel Labeling
1	Stage 1 isolation cassette	This circuit type is isolated at Stage 1 as the front cover is removed from the Test Block. Use to provide: • Isolation of auxiliary supply Isolation of trip circuits	1	
2	Stage 2 isolation cassette (General Purpose)	This circuit type is isolated later during Stage 2 as the Isolation Plug is removed from the Test Block. Use to provide: • Isolation of trip circuits • Remote 'Out of Service' indication • Isolation of inter-tripping circuits • Isolation of watchdog alarms • Isolation of VT circuits • Isolation of I/O circuits	2b	
3	Stage 2 isolation cassette (Early Break)	This circuit type is isolated early during Stage 2 as the Isolation Plug is removed from the Test Block. Use to provide: • Isolation of trip circuits • Isolation of inter-tripping circuits • Isolation of watchdog alarms	2a	

Type	Description	Function	Timing Stage	Front Panel Labeling
8	CT cassette with shorting bar to the adjacent circuit below	Use for CT connections so that they will be automatically shorted to the adjacent CT circuit below. After shorting, this circuit is isolated at Stage 2.		
9	Last CT cassette on a CT group	Use for the last CT connection in a group so that it will be automatically shorted to the adjacent CT circuit above. After shorting, this circuit is isolated at Stage 2.		

Recommended Wiring Layout

It is recommended that the Test Block is always wired with connections to the protective relay or scheme made to the EVEN numbered equipment side terminals. Connections to other equipment, e.g. CT's, VT's and DC supplies, should be made to the ODD numbered live side terminals on the Test Block. This ensures that when the Test Plug is inserted, the black sockets are connected to the isolated relay circuits and the yellow sockets are connected to the potentially live supplies. This is vital as the automatic CT shorting is only applied to the live side.

- This image shows the 3RMLG with the front cover removed to isolate the Stage 1 circuits.
- The Isolation Plug is in place so the CTs and Stage 2 circuits are still connected.
- The front label identifies each cassette type.

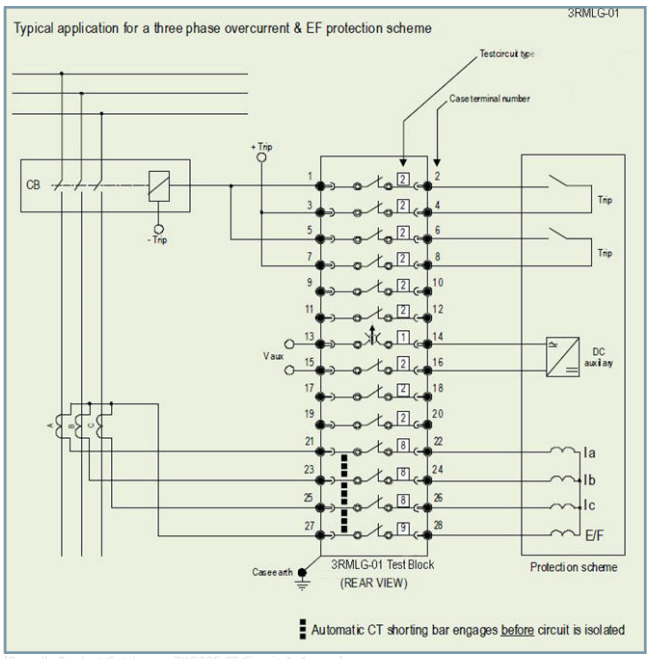


[Reyrolle Product Catalogue, 7XG225 Recommended Wiring Layout, 1, –_–]

Figure 5.4/4 Front Panel Layout

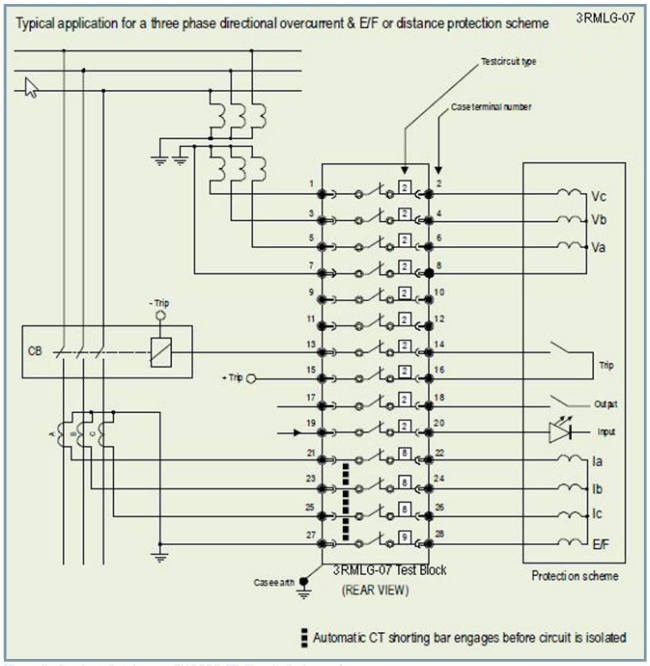
CT Circuits

CT circuits must only be wired to cassette type 8 or 9. CT circuits must not be wired to cassette types 1, 2 or 3 as this will result in open circuit CT's as the isolation plug is re-moved.



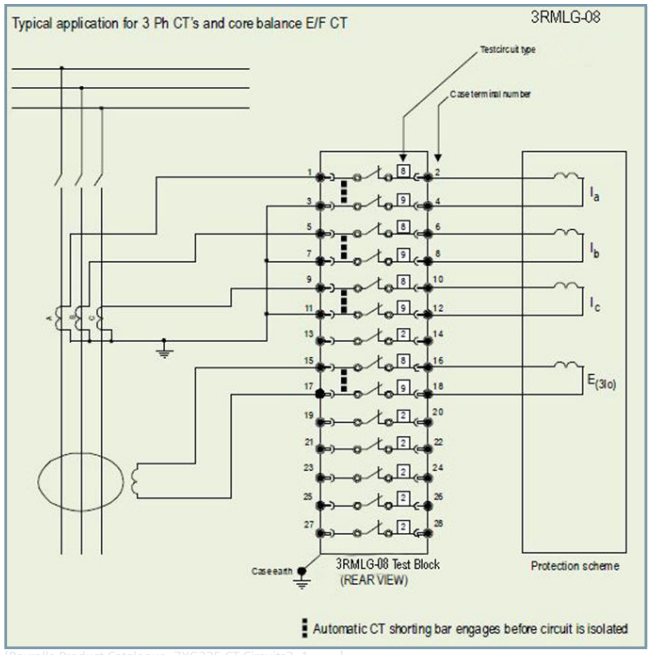
[Reyrolle Product Catalogue, 7XG225 CT Circuits1, 1, –_–]

Figure 5.4/5 Application wiring example for a three phase overcurrent and EF protection scheme with auto CT shorting. Order Code – 3RMLG01



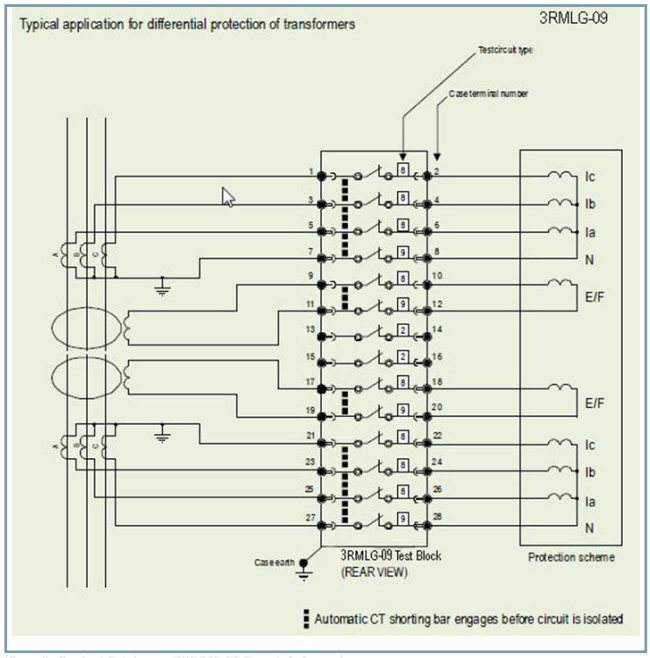
[Reyrolle Product Catalogue, 7XG225 CT Circuits2, 1, –_–]

Figure 5.4/6 Application wiring example for a three phase directional O/C and E/F or distance protection scheme with auto CT shorting. Order Code – 3RMLG07



[Reyrolle Product Catalogue, 7XG225 CT Circuits3, 1, --_--]

Figure 5.4/7 Application wiring example for three phase CT's and core balance E/F CT with auto CT shorting. Order Code – 3RMLG08

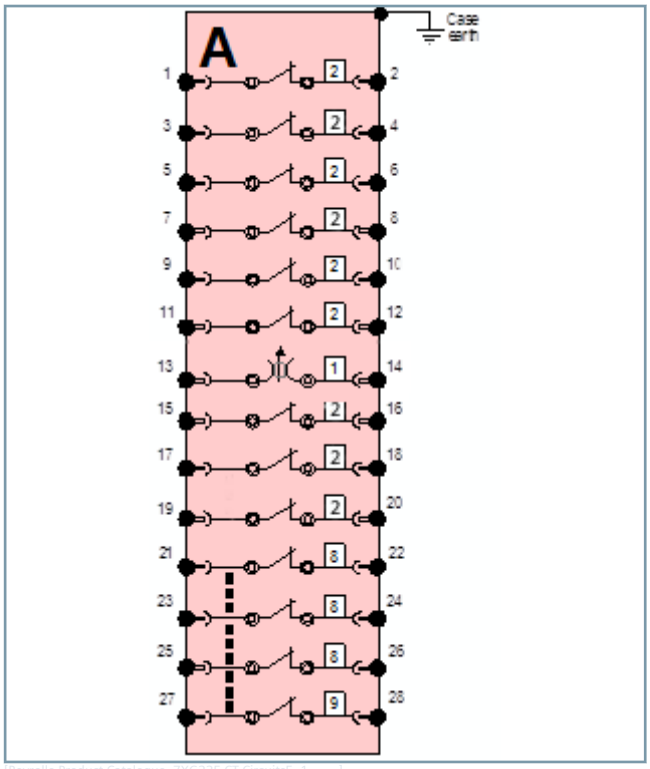


[Reyrolle Product Catalogue, 7XG225 CT Circuits4, 1, --_--]

Figure 5.4/8 Application wiring example for differential protection of transformers with auto CT shorting Order Code – 3RMLG09

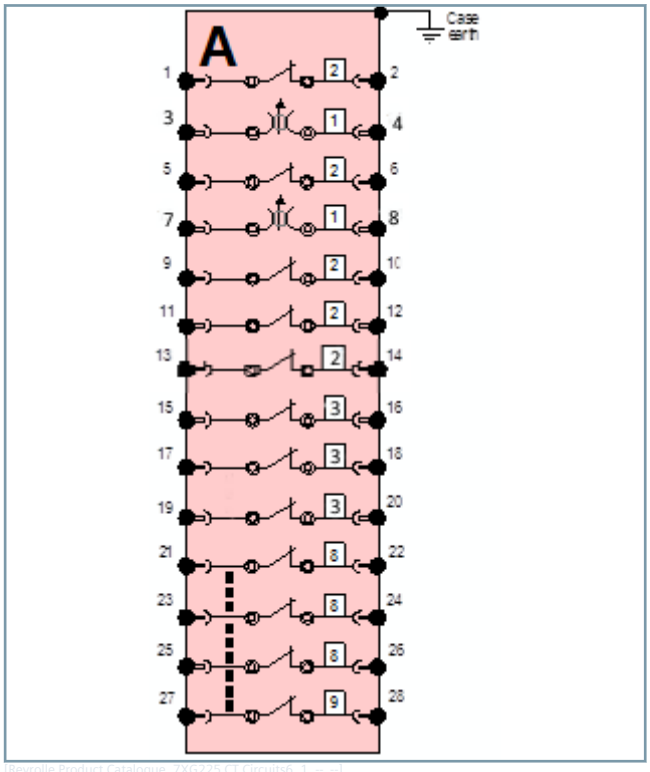
14 WAY TEST BLOCKS

3RMLG – 01



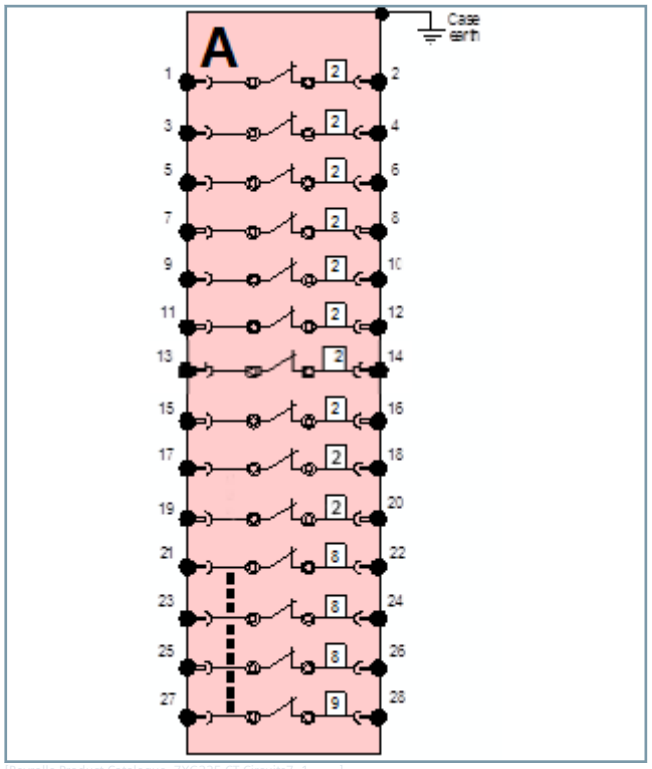
[Reyrolle Product Catalogue, 7XG225 CT Circuits5, 1, --_--]

3RMLG - 02



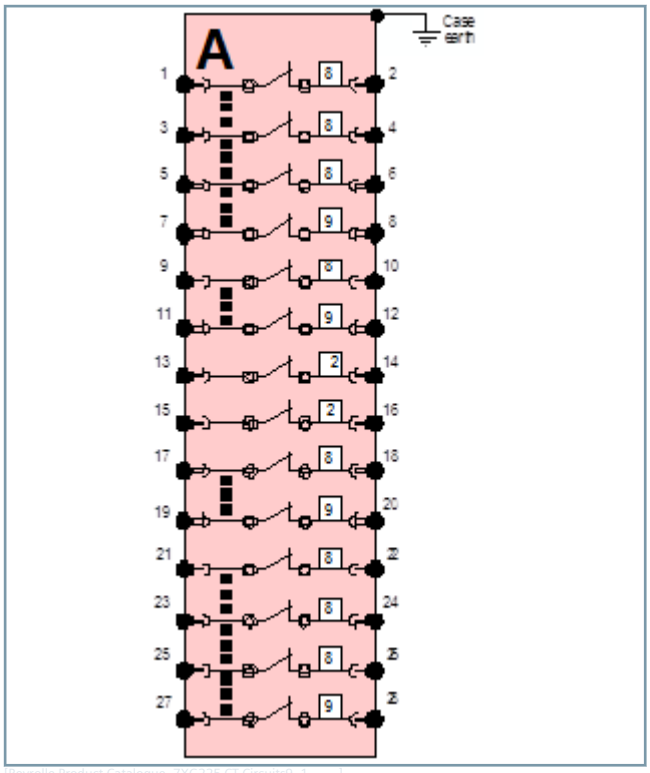
[Reyrolle Product Catalogue, 7XG225 CT Circuits6, 1, --_--]

3RMLG - 07



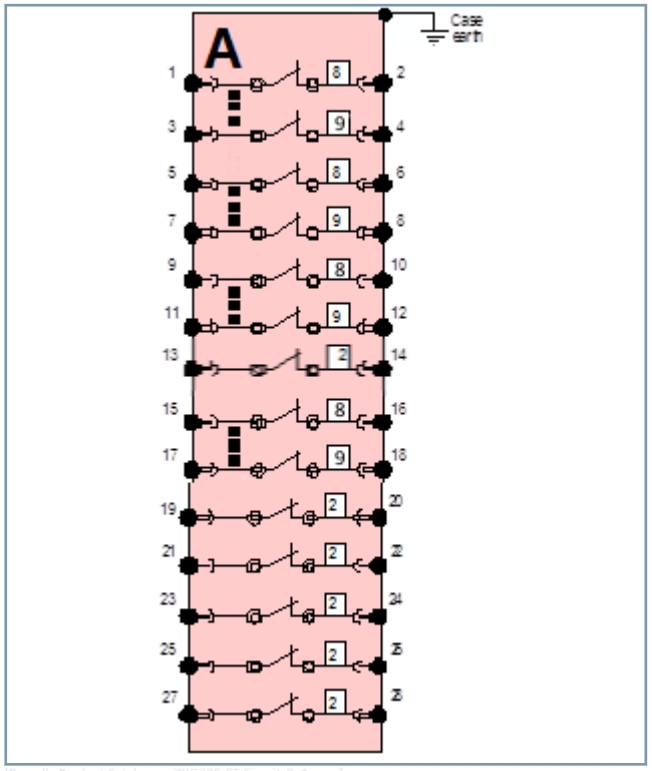
[Reyrolle Product Catalogue, 7XG225 CT Circuits7, 1, –_–]

3RMLG - 09



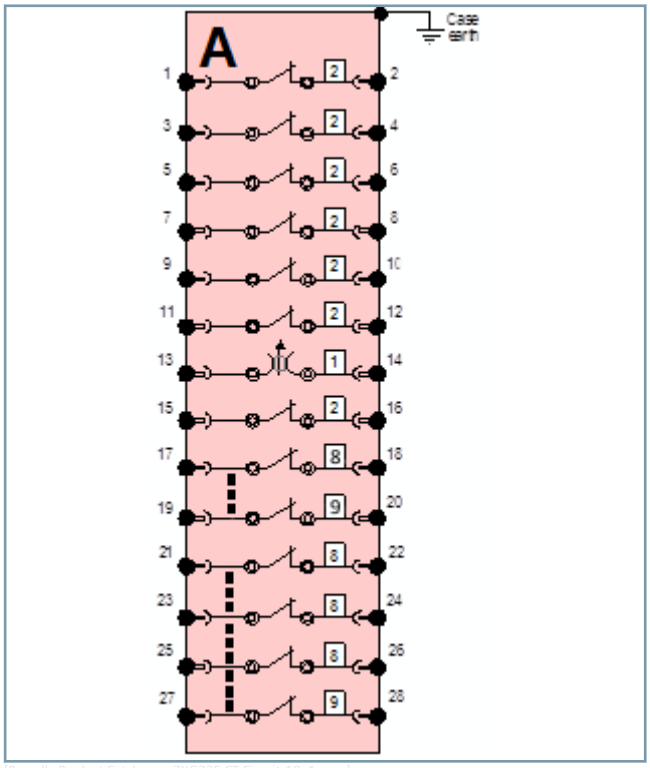
[Reyrolle Product Catalogue, 7XG225 CT Circuits9, 1, –_–]

3RMLG - 08



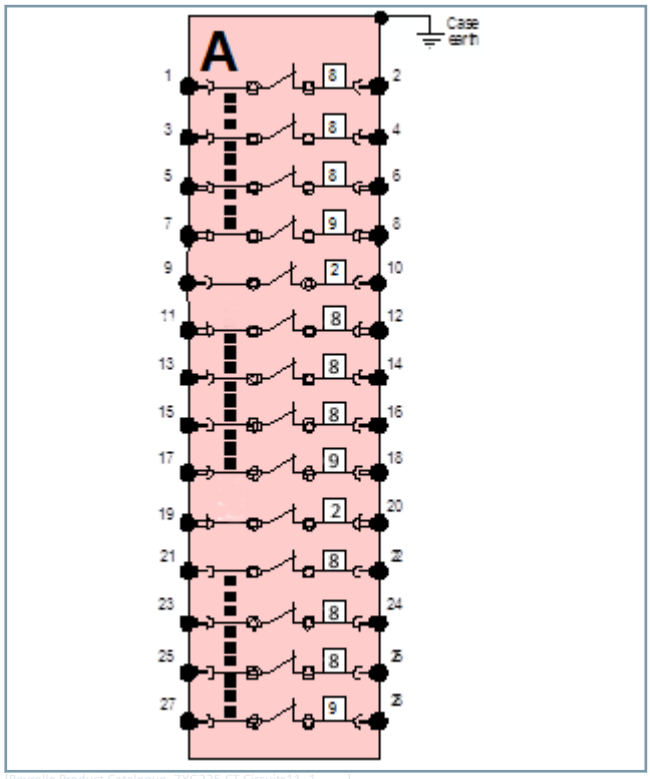
[Reyrolle Product Catalogue, 7XG225 CT Circuits8, 1, –_–]

3RMLG - 20



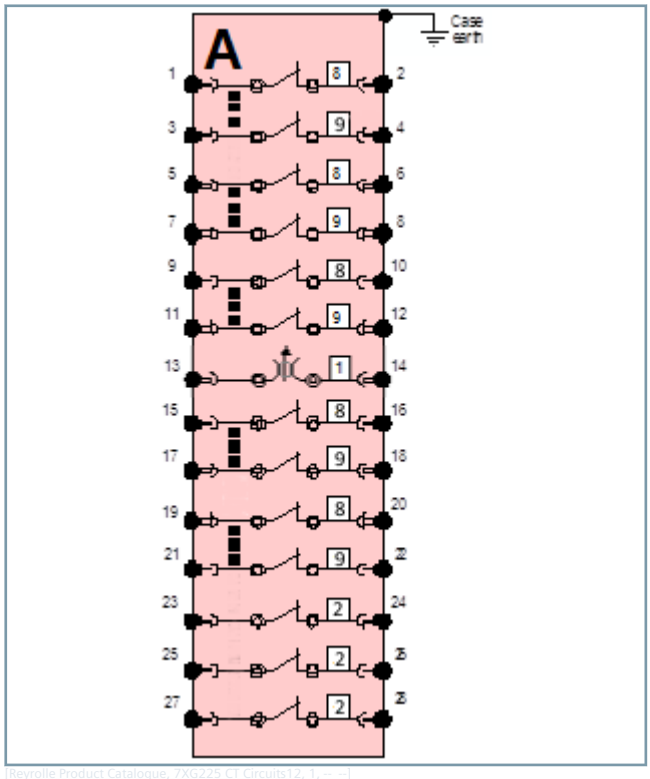
[Reyrolle Product Catalogue, 7XG225 CT Circuits10, 1, –_–]

3RMLG - 21



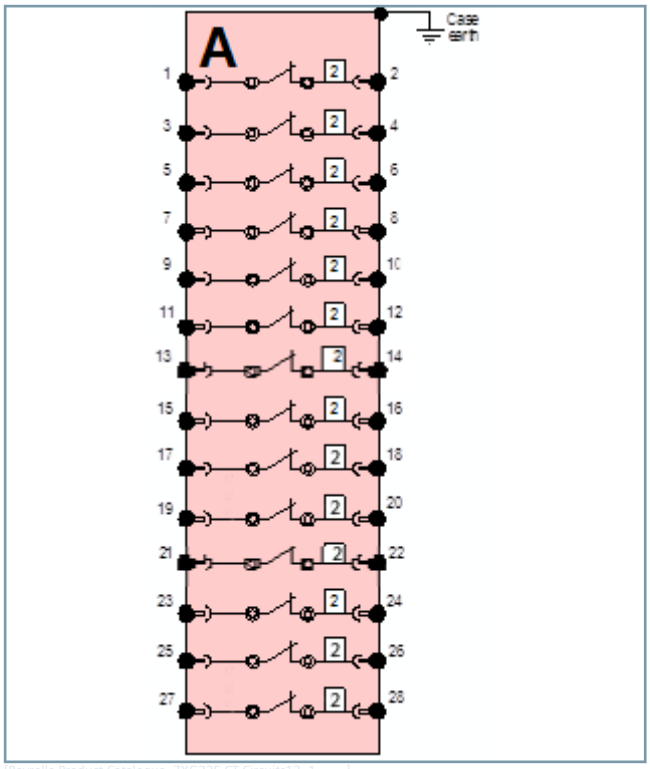
[Reyrolle Product Catalogue, 7XG225 CT Circuits11, 1, _ _]

3RMLG - 22



[Reyrolle Product Catalogue, 7XG225 CT Circuits12, 1, _ _]

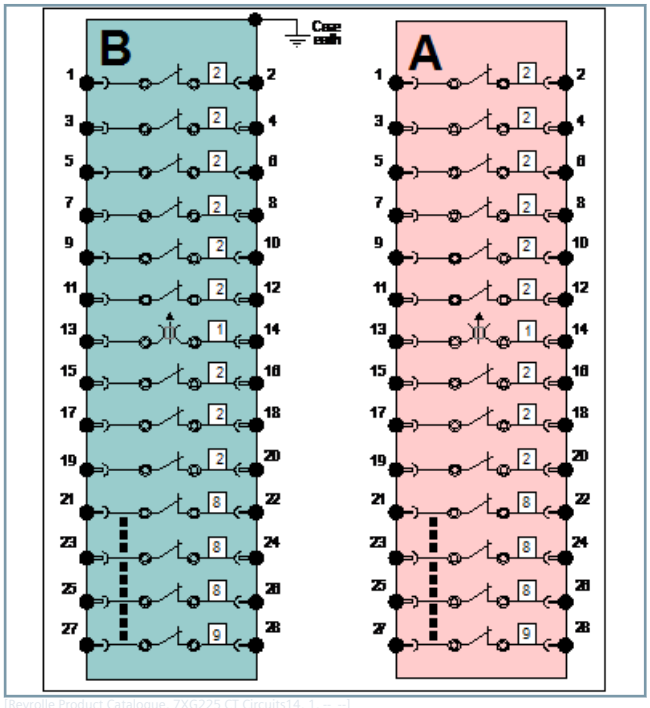
3RMLG - 23



[Reyrolle Product Catalogue, 7XG225 CT Circuits13, 1, _ _]

28 WAY TEST BLOCKS

3RMLG - 11

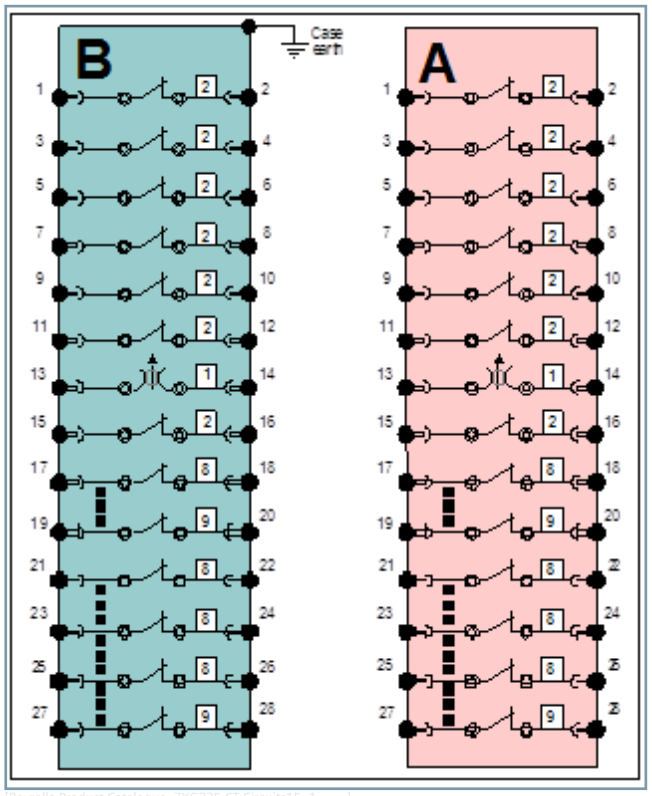


[Reyrolle Product Catalogue, 7XG225 CT Circuits14, 1, _ _]

5.4

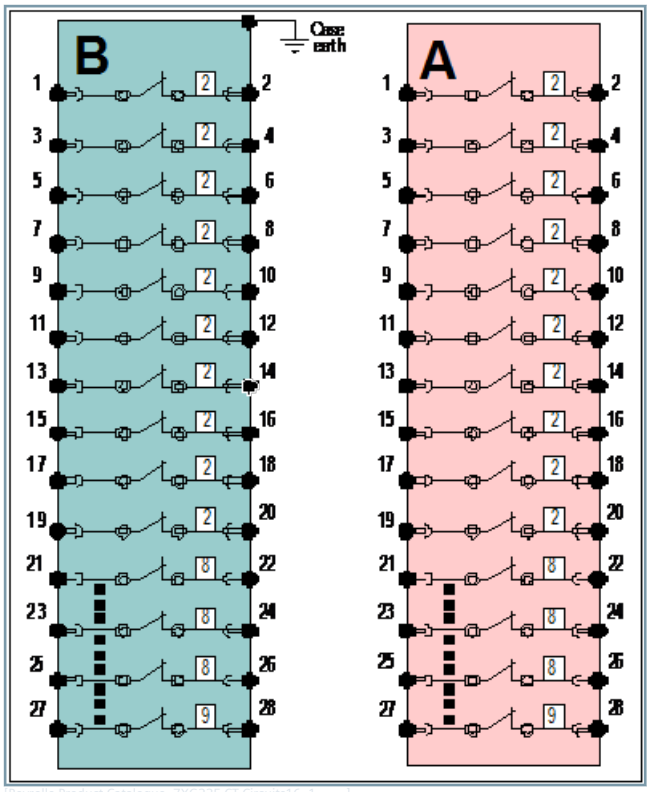
7XG225 – 3RMLG Test Block System

3RMLG - 12



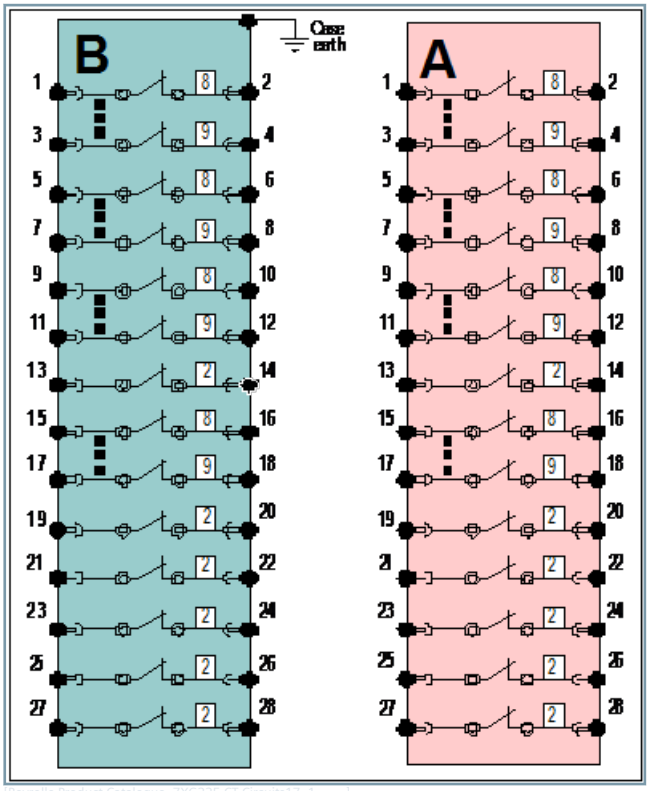
[Reyrolle Product Catalogue, 7XG225 CT Circuits15; 1; ~_~]

3RMLG - 17



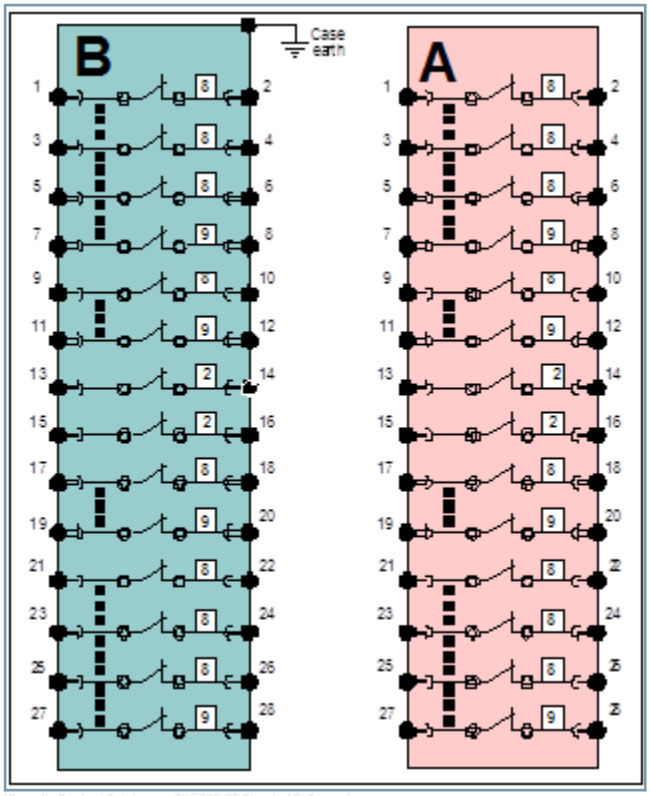
[Reyrolle Product Catalogue, 7XG225 CT Circuits16; 1; ~_~]

3RMLG - 18



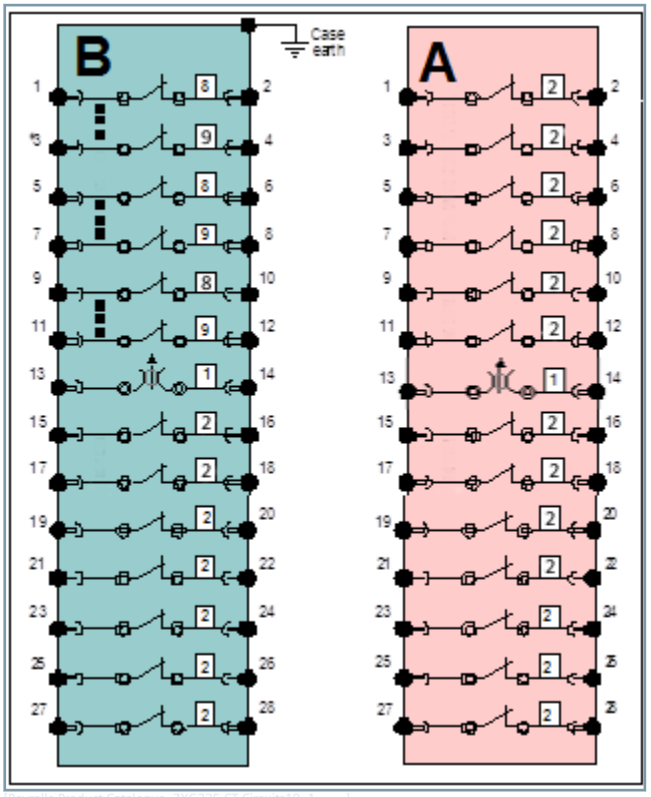
[Reyrolle Product Catalogue, 7XG225 CT Circuits17, 1, _ _]

3RMLG - 19



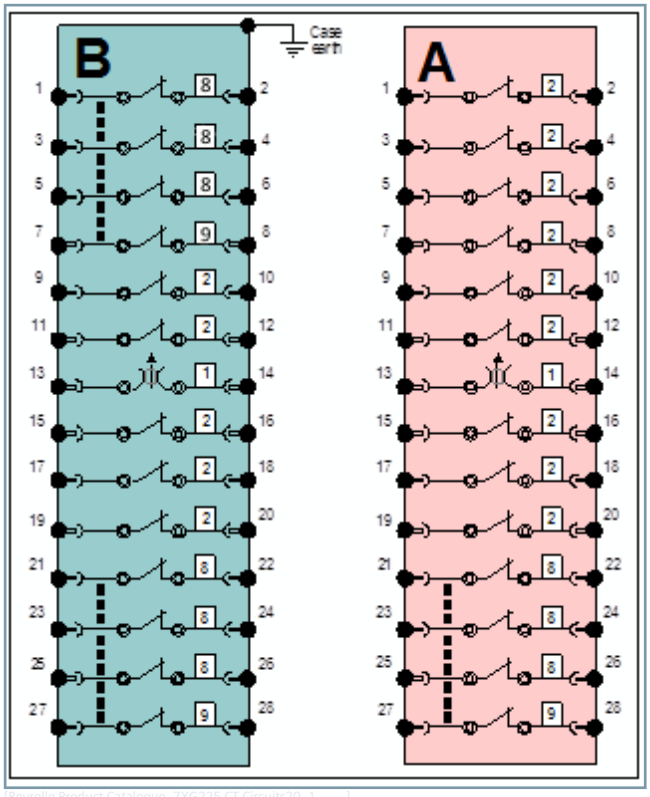
[Reyrolle Product Catalogue, 7XG225 CT Circuits18, 1, _ _]

3RMLG - 520



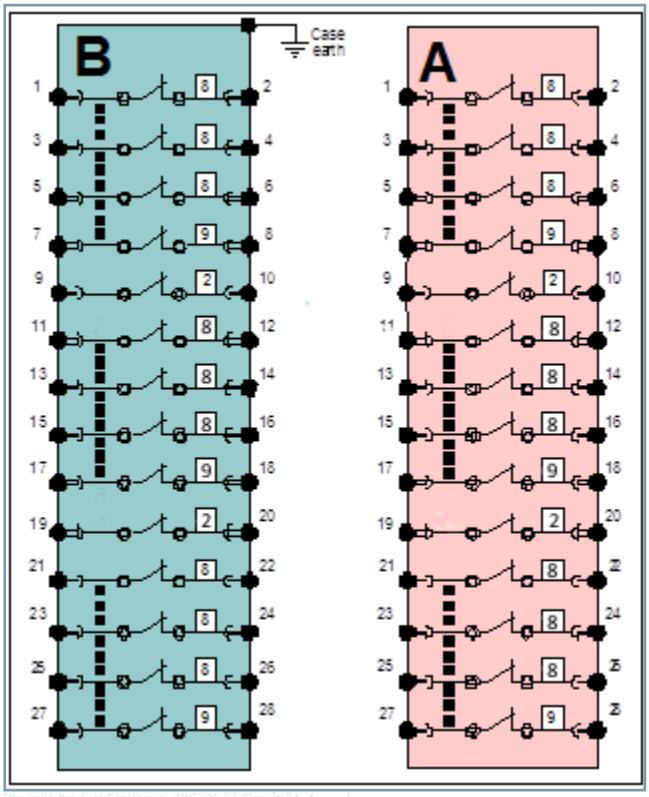
[Reyrolle Product Catalogue, 7XG225 CT Circuits19, 1, -_-]

3RMLG - 521



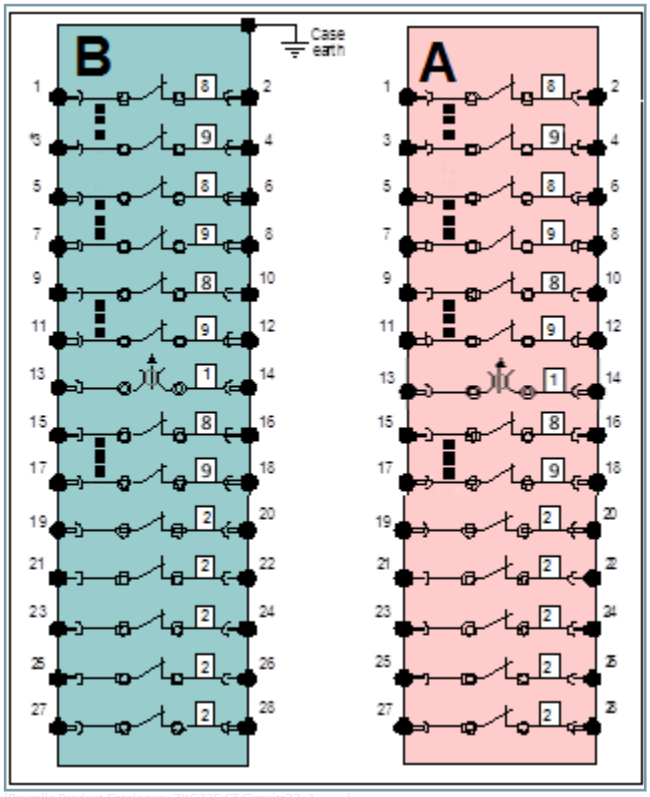
[Reyrolle Product Catalogue, 7XG225 CT Circuits20, 1, -_-]

3RMLG - 522



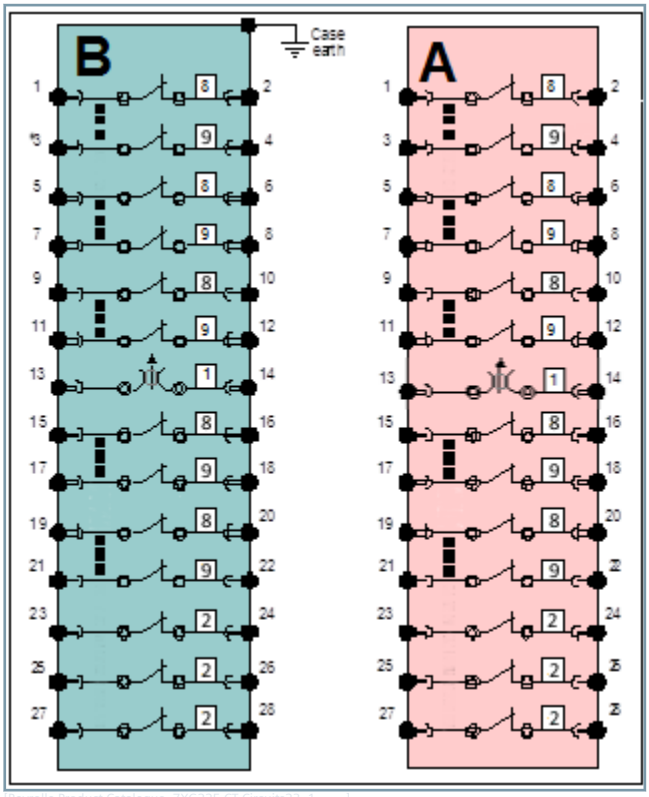
[Reyrolle Product Catalogue, 7XG225 CT Circuits21, 1, -_-]

3RMLG - 523



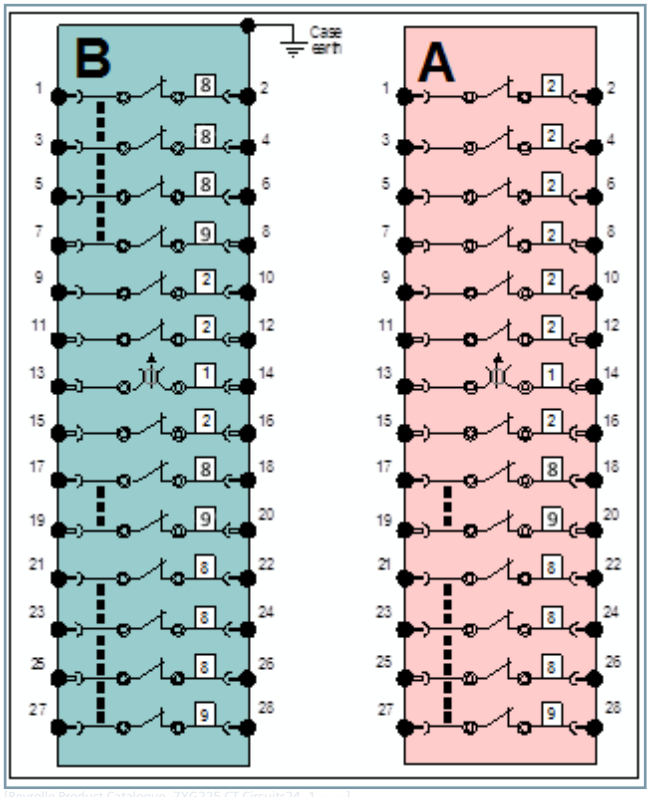
[Reyrolle Product Catalogue, 7XG225 CT Circuits22, 1, -_-]

3RMLG - 524



[Reyrolle Product Catalogue, 7XG225 CT Circuits23, 1, –_–]

3RLMG - 525



[Reyrolle Product Catalogue, 7XG225 CT Circuits24, 1, –_–]

Shrouded Test Leads

Two types of shrouded 'finger safe' test leads are available:

Description

Two-ended test lead short - 75 mm

Two-ended test lead long - 180 mm

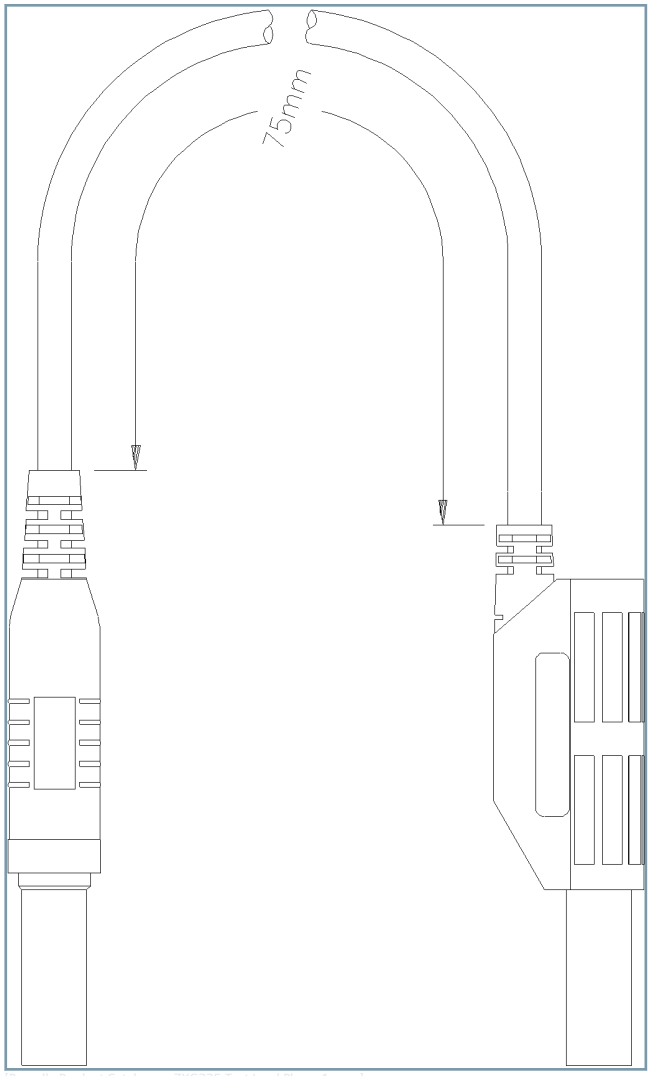
Test Lead Plugs

Single Plug

The single plug is the most compact and may be plugged into any test socket.

Dual Plug

The dual or 'piggy back' plug is larger and should be plugged into the test sockets on the outside edge of the 3RMLG.



[Reyrolle Product Catalogue, 7XG225 Test Lead Plugs, 1, ~_~]

Figure 5.4/9 Two-ended test lead - short 75mm wire length version depicted

3RMLG Test Block

14/28 Equipment side terminals (Even terminal numbers).

14/28 Live side terminals (Odd terminal numbers).

14/28 Live sides to equipment side shorting links.

This arrangement provides for up to 14/28 independent circuits to be connected.

3RMLB Multi-Finger Test Plug

28/56 test sockets suitable for 4mm shrouded or standard banana plugs.

Securing screws are built-in to retain the Test Plug during testing operations.

Ratings

Current: CT circuits and terminals	20A continuous 400A 1 s
Current: Other circuits	10A continuous 200A 1 s
Voltage: All circuits	600V AC continuous 320V DC continuous

Case Type

E2	Size 2 28 terminals
E4	Size 2 56 terminals
Mounting	Flush 4U high rack mount

Insulation – 3RMLG – In Service

Standard	IEC 60255-5
Type	Level
Between any contact pair & either adjacent contact pair.	2.0kV ac rms for 1 minute
Between all case terminals & the case earth	5.0kV ac rms for 1 minute
Between any alternate contact pair, provided that the inter-mediate pair is not used.	5.0kV ac rms for 1 minute

Insulation – 3RMLG with 3RMLB

Standard	IEC 60255-5
Type	Level
Between incoming & outgoing contacts.	2.0kV ac rms for 1 minute
Between all case terminals & the case earth	5.0kV ac rms for 1 minute

Temperature

Standard	IEC 60068-2-1/2
Operating Range	-10 to +55 degrees Celsius
Storage Range	-25 to +70 degrees Celsius

Humidity

Standard	IEC 680068-2-78
Operating Range	40 degrees Celsius and 93 % RH non condensing

IP Rating

Standard	IEC 60529
Installed	IP5x

Vibration - Sinusoidal

Standard	IEC 60255-21-1 Class I	
Vibration Response	0.5gn	≤5 %
Vibration Endurance	1.0gn	≤5 %

Shock and Bump

Standard	IEC 60255-21-2 Class I	
Shock Response	5gn, 11 ms	≤5 %
Shock Withstand	15gn, 11 ms	≤5 %
Bump Test	10gn, 16 ms	≤5 %

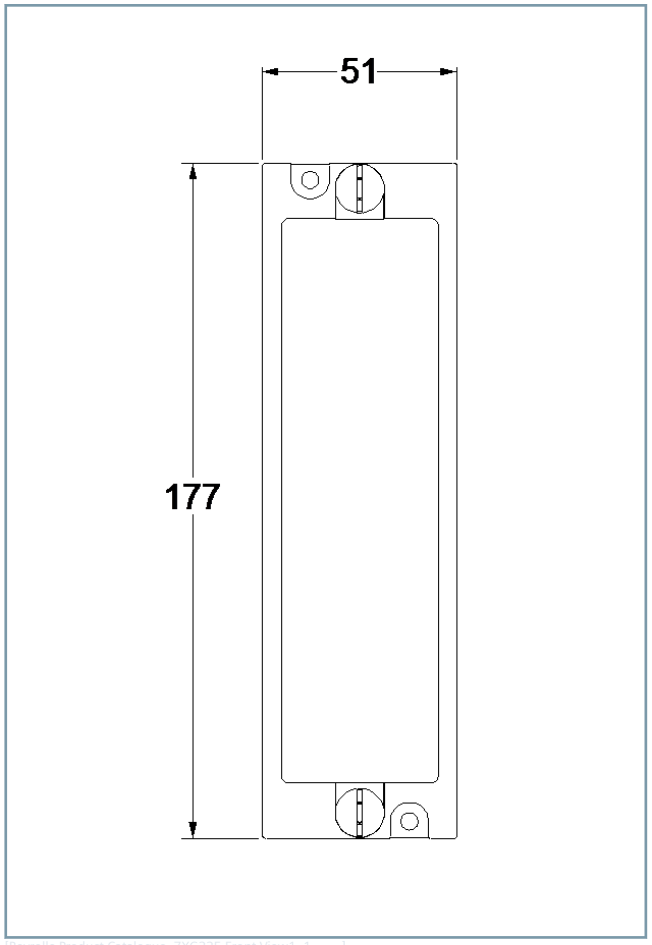
Seismic

Standard	IEC 60255-21-3 Class I	
Seismic Response	1gn	≤5 %

Mechanical Classification

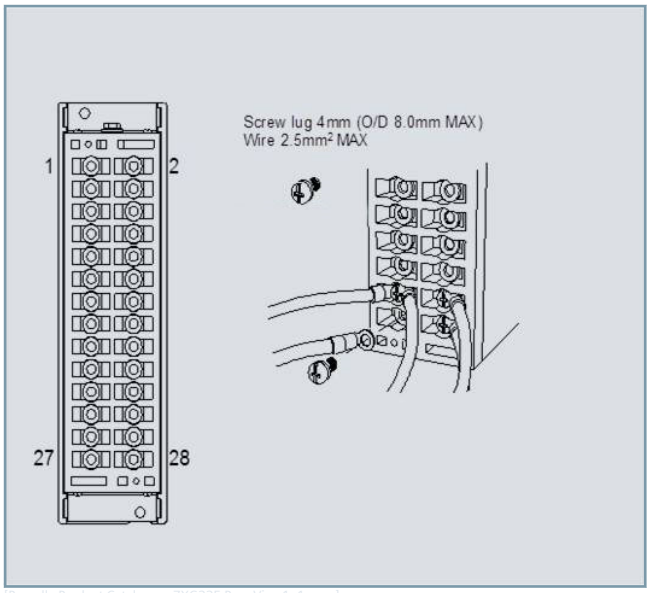
Durability	>10^5 operations at no load

Front View



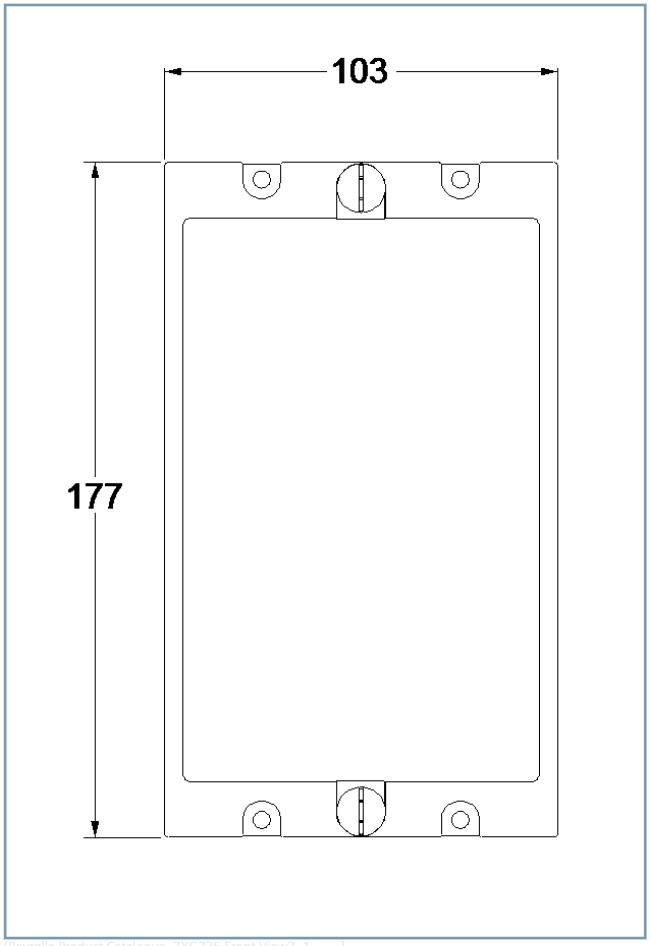
[Reyrolle Product Catalogue, 7XG225 Front View1, 1, -_-]

Rear View



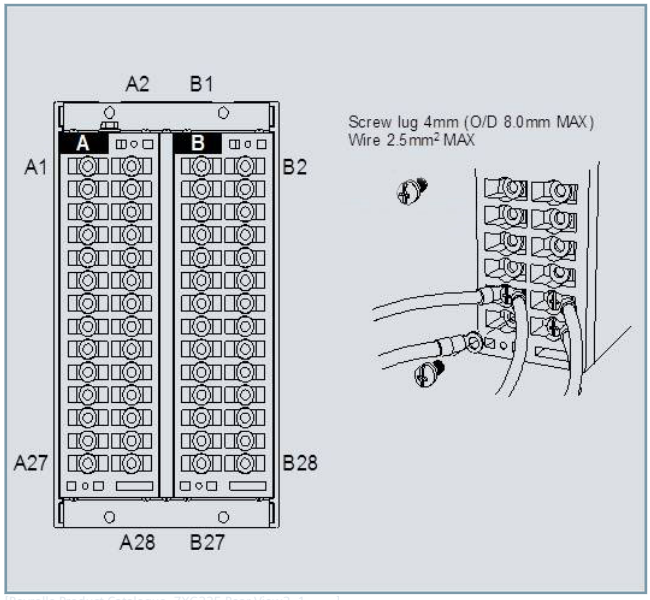
[Reyrolle Product Catalogue, 7XG225 Rear View1, 1, -_-]

Front View



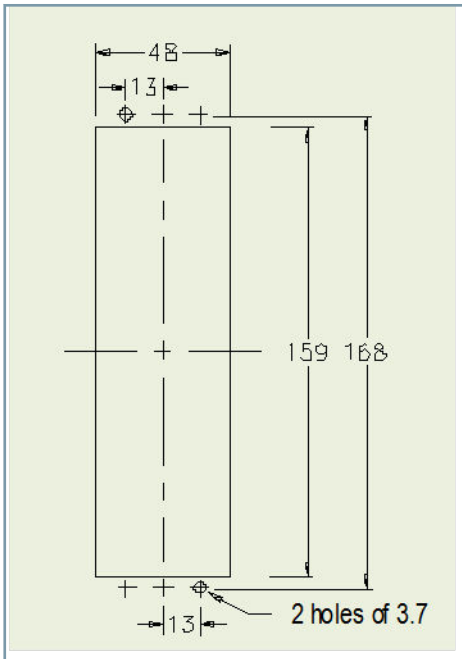
[Reyrolle Product Catalogue, 7XG225 Front View2, 1, -_-]

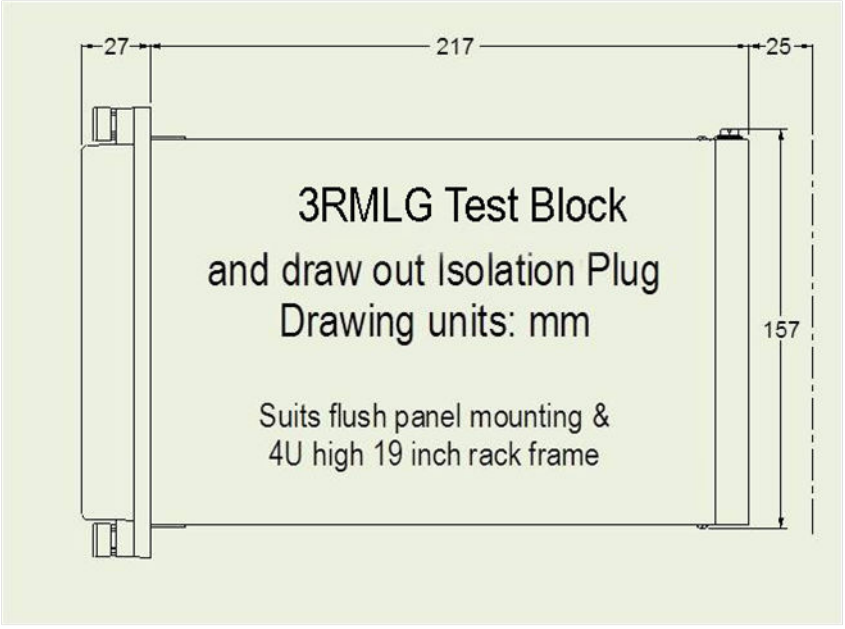
Rear View

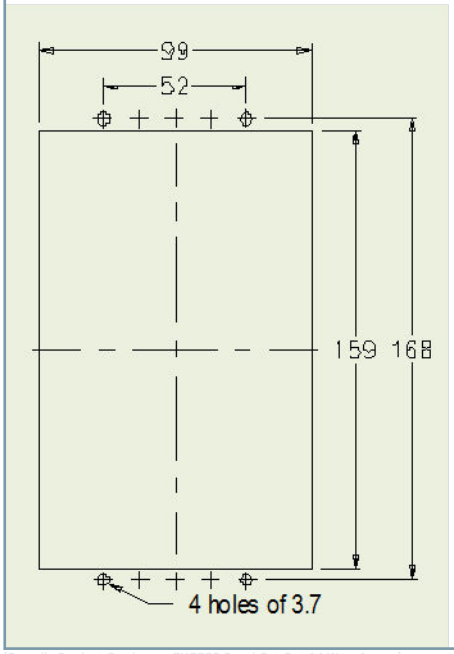


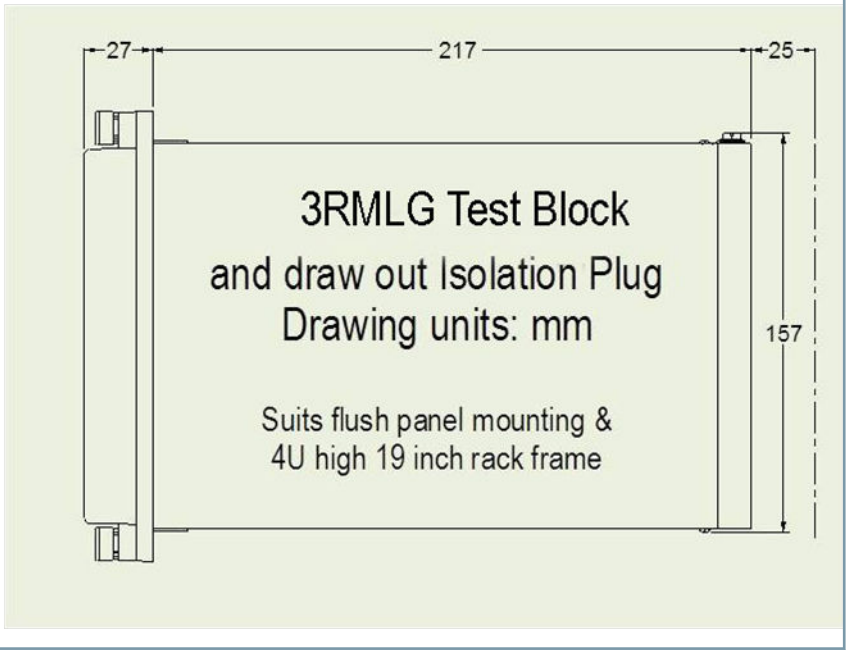
[Reyrolle Product Catalogue, 7XG225 Rear View2, 1, --_--]

Panel Cut-Out 14 Way









[Reyrolle Product Catalogue, 7XG225 Panel Cut-Out 14 Way, 1, -, -]

Ordering Information - 7XG225 3RMLG Test Block System

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Test Modules	7	X	G	2	2	5	1	-	□	□	□	0	0	-	0	A	A	0
				|	|	|	|		|	|	|								
14 way Test Blocks				|	|	|	|		|	|	|								
Category				|	|	|	|		|	|	|								
Ancillary equipment				2	|	|	|		|	|	|								
					|	|	|		|	|	|								
Ancillary equipment					|	|	|		|	|	|								
Modular case test components					2	|	|		|	|	|								
						|	|		|	|	|								
Test component type						|	|		|	|	|								
Test Modules 3RMLG						5	|		|	|	|								
							|		|	|	|								
14 way test block							1		|	|	|								
									|	|	|								
Standard Arrangements									|	|	|								
3RMLG01. For 3 CTs.									1	A	A									
3RMLG02. For 3 CTs.									2	A	A									
3RMLG07. For 3 CTs.									3	A	A									
3RMLG08. For 4 CTs.									4	A	A									
3RMLG09. For 8 CTs.									5	A	A									
									|	|	|								
Custom Arrangements									6	|	|								
3RMLG20									6	A	A									
3RMLG21									6	A	B									
3RMLG22									6	A	C									
3RMLG23									6	A	D									

Ancillary Equipment

7XG225 – 3RMLG Test Block System

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Test Modules	7	X	G	2	2	5	2	-	□	□	□	0	0	-	0	A	A	0
				|	|	|	|		|	|	|								
28 way Test Blocks				|	|	|	|		|	|	|								
Category				|	|	|	|		|	|	|								
Ancillary equipment				2	|	|	|		|	|	|								
					|	|	|		|	|	|								
Ancillary equipment					|	|	|		|	|	|								
Modular case test components					2	|	|		|	|	|								
						|	|		|	|	|								
Test component type						|	|		|	|	|								
Test Modules 3RMLG						5	|		|	|	|								
							|		|	|	|								
28 way test block							2		|	|	|								
									|	|	|								
Standard Arrangements									|	|	|								
3RMLG11. For 6 CTs.									1	A	A									
3RMLG12. For 8 CTs.									2	A	A									
3RMLG17. For 6 CTs.									3	A	A									
3RMLG18. For 8 CTs.									4	A	A									
3RMLG19. For 16 CTs.									5	A	A									
									|	|	|								
Custom Arrangements									6	|	|								
3RMLG520									6	A	A									
3RMLG521									6	A	B									
3RMLG522									6	A	C									
3RMLG523									6	A	D									
3RMLG524									6	A	E									
3RMLG525									6	A	F									

5.4

Product Description	Order No.																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
Test Modules	7	X	G	2	2	6	□	-	0	A	A	0	0	-	0	A	A	0
				|	|	|	|												
14 & 28 Way Test Plugs				|	|	|	|												
Category				|	|	|	|												
Ancillary equipment				2	|	|	|												
					|	|	|												
Ancillary equipment					|	|	|												
Modular case test components					2	|	|												
						|	|												
Test component type						|	|												
Test modules (3RMLB-S)						6	|													
							|													
14 way (3RMLB – S14)							1														
28 way (3RMLB – S28)							2														

Indication of conformity

CE This product is CE compliant to relevant EU directives.

Disclaimer of liability

This document has been subjected to rigorous technical review before being published. It is revised at regular intervals, and any modifications and amendments are included in the subsequent issues. The content of this document has been compiled for information purposes only. Although Siemens AG has made best efforts to keep the document as precise and up-to-date as possible, Siemens AG shall not assume any liability for defects and damage which result through use of the information contained herein. This content does not form part of a contract or of business relations; nor does it change these. All obligations of Siemens AG are stated in the relevant contractual agreements. Siemens AG reserves the right to revise this documentation time to time.

Document Edition: 4.0

Release Status: 04.2023

Copyright

Published by Siemens

Smart Infrastructure
Electrification & Automation
Mozartstr. 31 C
91052 Erlangen
Germany

Customer Support Center

Our Customer Support Center provides a 24-hour service.

Siemens AG
Smart Infrastructure - Protection Automation Customer Support Center

Phone: +49 9112155 4466
Email: energy.automation@siemens.com

Article No: C53000-X7040-C022-1

Subject to changes and errors.

The information given in this document only contains general descriptions and / or performance features which may not always specifically reflect those described or which may undergo modification in the course of further development of the products.

The requested performance features are binding only when they are expressly agreed upon in the concluded contract.