Reyrolle
Protection
Devices

7SG22 - Iota

Input/Output Units with Logic Programming

Answers for energy

SIEMENS

7SG22 - Iota

Input/Output Units with Logic Programming

Fig 1. 7SG22

Introduction

The Iota range of Common Services Modules are programmable logic controllers designed for general application within the substation environment. Typical applications include direct replacement for hardwired relay logic schemes. PLCs developed for the industrial market typically require additional external protection to ensure reliable operation in the electrically hostile substation environment. Siemens Protection Devices Ltd has a long history of designing modular protection and control relays which can withstand the environmental extremes that an electricity substation must endure and this unit is constructed using modules already proven in this environment.

The relay consists of a combination of status inputs, output relays, current and voltage level detector modules which can be interconnected using logical elements such as AND, OR, NOT gates, pickup/drop-off timers, counters and latches to fulfil many operational interlocking requirements.

The Iota can accommodate a total of 59 input and 61 output points consisting of a combination of status inputs together with output relays. The basic models have 3 status inputs and 5 output relays on the power supply module. Additional Input and output modules can be added to the relay. The maximum number is only limited by available empty module slots in the case.

16/32 user defined LEDs are also available to the logic schemes for local indication of functions.

The voltage modules and current modules have 4 analogue channels. Each channel has a settable pick up level & time delay and its output is fed into the logic as an input. The measured values can be displayed in the instruments and are available via the IEC communications in a measurand.

Features

- Fully programmable scheme logic using Reylogic
- Programmable alarm/indication LEDs with text legend
- Analogue measurements
- Flexible number of inputs and outputs
- Fault, event and waveform recorder
- IEC60870-5-103/MODBUS fibre optic communications
- Front RS232 communication port
- IRIG-B time synchronisation input
- Continuous self monitoring

Description

Reylogic

Reylogic is a Windows based schematic capture program used for creating configuration logic diagrams for use in Iota. The inputs and outputs may be interconnected with up to 64 timers, 64 counters and 64 latches along with combinational logic consisting of AND, OR and NOT gates limited only by the choice of scan rate for the logic. The default scan rate is 2.5 milliseconds but this may be adjusted to accommodate more complex logic schemes.

The logical elements are simply dragged and dropped onto the drawing page and interconnections formed by dragging a connection wire from the output of an element to the input of another. This greatly simplifies scheme configuration over other techniques such as ladder logic used in industrial grade PLCs.

All timers and counters, drawn on a logic diagram and set to be visible, appear in the setting lists accessible via the front fascia to allow on-site modifications without having to use a PC to modify the logic diagrams. All Boolean points marked as external inputs on the schematic package appear in the settings list with a matrix setting which allows any combination of output relays and fascia flags to be selected.
Latches and counters can be configured to retain their state if the power supply is interrupted.

Fascia unit

The Iota has a user friendly HMI interface which allows simple modifications to timer and counter settings as well as simple reconfiguration of the allocation of inputs and outputs.

The input and output points are fully programmable to allow easy modification. In addition all Boolean outputs are available in the menus and can be configured to give indications on the LED front panel. LEDs can be selected to be hand or self reset.

Measurement and Trending

Analogue values can be displayed in primary or secondary quantities on the LCD screen via the Instruments Menu. In addition the values can be obtained via the IEC60870-5-103 communications.

The IEC events can be edited to report any output Boolean state as an event.

The IEC command files can also be edited to allow remote operation of the input Booleans in the logic diagram.

Real time measurements

- Primary and Secondary currents
- Primary and Secondary voltages
- Status inputs
- Output contacts

System Data

Sequence of Event records

Up to 500 events are stored and time tagged to 1ms resolution. These are available via the communications.

Fault records

The last 10 fault records are available from the Iota fascia along with time and date of operation.

Disturbance recorder

The Waveform Recorder may be triggered from a logic Boolean or an external input and has a configurable pre-fault trigger. Up to 10 seconds of fault waveforms may be stored with associated analogue and digital values. This is user configurable as ten 1-second records, five 2-second records, two 5-second records or one 10-second record.

The IEC60870-5-103 protocol allows remote operators to control plant and receive indication and metering information.

Fibre-optic communications ports are provided on the rear of the relay and will be optimised for 62.5/125μmm glass-fibre using BFOC/2.5 (ST®) bayonet-style connectors as standard.

In addition users may interrogate the Iota locally with a laptop PC via the RS232 port on the front of the relay. The Reydisp Evolution software described as follows allows the user to do this.

Support Software

Reydisp Evolution

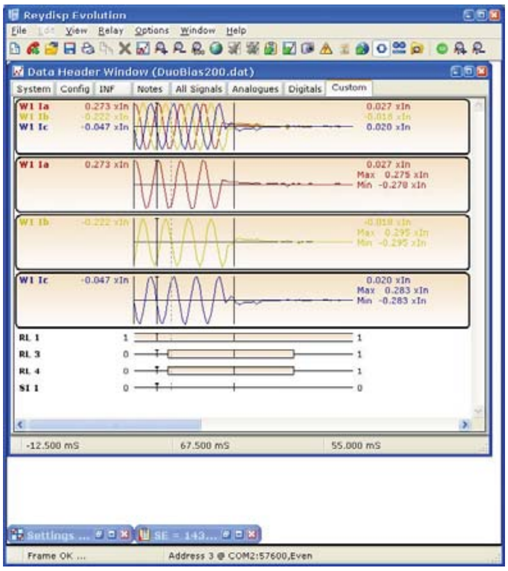


Fig 2. Typical Reydisp Evolution screenshot

Reydisp Evolution provides the means for the user to apply setting to the Iota, interrogate settings and retrieve disturbance waveforms from the relay.

Reylogic toolbox

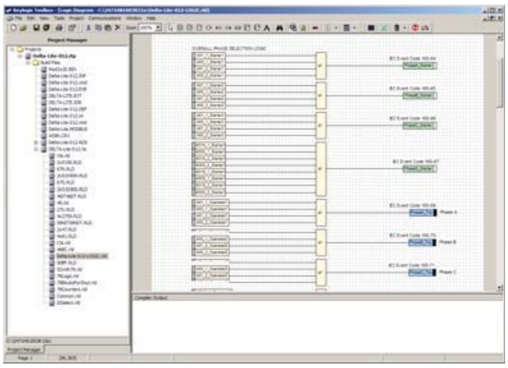


Fig 3. Example Reylogic screenshot

Reylogic allows users to design their own logic schemes and apply them to the relay. The design is built from simple building blocks of combinational logic (and, or, exclusive or) and sequential logic (timers, counters and latches). These are dropped onto the page and wired to form the scheme.

When the design is complete it can be tested offline by simulation in the Reylogic package. The test files and results can be stored as a record of the tests and for future repeatability.

The logic diagram along with IEC event and command configuration files are built into a project which can be downloaded to the Iota. The logical inputs and outputs of the scheme can then be assigned to physical inputs and outputs in the Iota in the settings file via Reydisp or fascia.

Technical Information

Performance data to IEC 60255-3

Characteristic energising quantities

AC Current	1, 5A
AC Voltage	63.5V line-neutral 110V line-line 50Hz

Auxiliary Energising Quantity DC power supply

Nominal Voltage	Operating range VDC
48, 110V	37.5 to 137.5
220V	176.0 to 280.0

DC status inputs

Nominal Voltage	Operating range VDC
30, 34V	18.0 to 37.5
48, 54V	37.5 to 60.0
110, 125V	87.5 to 137.5
220, 1250V	175.0 to 280.0

The status voltage need not be the same as the main energising voltage.

Electricity Association ESI48-4

The 30/34V and 48/54V inputs meet the requirements of ESI48-4 ESI 1. However, the 110/125V and 220/250V inputs will operate with a DC current of less than 10mA. If 110/125V or 220/250V inputs compliant with ESI48-4 ESI 1 are required, an Iota with 48/54V status can be supplied with external dropper resistors as follows:

Nominal Voltage	Resistor Value	Wattage
110, 125V	2k7 ± 5%	2.5W
220, 250V	8k2 ± 5%	6.0W

Status Input Performance

Parameter	Value
Minimum DC current for operation (30/34V and 48/54V inputs only)	10mA
Reset/Operate Voltage Ratio	≥ 90%
Typical response time	< 5ms
Typical response time when used to energise an output relay contact	<15ms
Minimum pulse duration	40ms

Each status input has an associated timer that can be programmed to give time delayed pick-up. When a 20ms pick-up setting value is applied the status inputs will not respond to the following:

- 250V RMS 50/60 Hz applied for two seconds through a 0.1μF capacitor.
- 500V RMS 50/60 Hz applied between each terminal and earth.
- Discharge of a 10μF capacitor charged to maximum DC auxiliary supply voltage.

Indication

Relay Healthy	
Method	Green LED
Healthy	Steady
Failure	Flashing or extinguished
Indication	
Method	16/32 Programmable RED LEDs
Settings and Instrumentation	
Method	Backlit LCD

Sub-station Communications

Protocol	**IEC 60870-5-103/MODBUS**
RS-232 interface	
Location	**Fascia**
Form	**25-pin female D-type connector**
Fibre interface	
Location	**Rear**
Quantity	**2 x Rx, 2 x Tx**
Form	**BFOC/2.5 (ST®) bayonet connector**
COM1	
Baud rate	**75-115200 baud**
Interface	**Fibre-optic port**
COM2	
Baud rate	**75-115200 baud**
Interface	**Auto-switches between Fibre-optic and RS-232 ports**

General Accuracy

Reference conditions

General	IEC 60255
Current Settings	100% of In
Auxiliary supply	Nominal
Frequency	50Hz
Ambient temperature	20 °C

General settings

Parameter	**Value**
Transient Overreach of Disengaging Time (1)	< 42ms
Overshoot Time	< 40ms

(1)Output contacts have a minimum dwell time of 100ms, after which the disengage time is as above.

Accuracy Influencing Factors Temperature

-10 °C to +55 °C	≤ 5% variation

Thermal Withstand

AC Current Inputs		
continuous	Phase	3.0 xIn
10 minutes		3.5 xIn
5 minutes		4.0 xIn
2 minutes		6.0 xIn
1 second	5A Phase/Earth	400 A
	1A Phase/Earth	100 A
	5A Phase/Earth	2500 A
1 cycle	1A Phase/Earth	700 A
AC Voltage Inputs		
continuous	3.5 xVn	

Burdens

Measuring Inputs	
AC Current Inputs	
5A Phase/Earth	≤0.2 VA ≤0.01 Ω
1A Phase/Earth	≤0.05 VA ≤0.05 Ω
AC Voltage Inputs	≤0.01 VA

Auxiliary supply

Quiescent (Typical)	13W
Maximum	25W

Burdens are measured at nominal rating.

Output Contacts

Contact rating IEC 60255-23

Carry Continuously	5A AC or DC
Make and Carry	(L/R ≤40ms and V≤300 volts)
0.5 seconds	20A AC or DC
0.2 seconds	30A AC or DC
Break	(I≤5A and V≤300 volts)
ac resistive	1250VA
ac inductive	250VA @ PF ≤0.4
dc resistive	75W
dc inductive	30W @ L/R ≤40ms
	50W @ L/R ≤10ms

Number of Operations

Minimum number of operations	1000 at maximum load

Recommended load

Minimum recommended load	0.5W, limits 10mA or 5V

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

Transient Over voltage IEC 60255-5

Between all terminals and earth or between any two independent circuits without damage or flashover	5kV
	1.2/50µs
	0.5J

Insulation IEC 60255-5

RMS levels for 1 minute

Between all terminals and earth	2.0 kV
Between independent circuits	2.0 kV
Across normally open contacts	1.0 kV

Immunity

Auxiliary DC Supply IEC 60255-11	
Allowable superimposed ac component	≤ 12% of dc voltage
Allowable breaks/dips in supply (collapse to zero from nominal voltage)	≤ 20ms
High Frequency Disturbance IEC 60255-22-1 Class III	
2.5kV, Longitudinal mode	≤ 3% variation
1.0kV, Transverse mode	
Electrostatic Discharge IEC 60255-22-2 Class III	
8kV, Contact discharge	≤ 5% variation
Radio Frequency Interference IEC 60255-22-3	
10 V/m, 80 to 1000 MHz	≤ 5% variation
Fast Transient IEC 60255-22-4 Class IV	
4kV, 5/50ns, 2.5 kHz, repetitive	≤ 3% variation
Conducted RFI IEC 60255-22-6	
10V, 0.15 to 80 MHz	≤ 5% variation

Emissions

Conducted limits IEC 60255-25		
Frequency Range	Limits dB(mV)	
	Quasi-peak	Average
0.15 to 0.MHz	79	66
0.5 to 30 MHz	73	60

Radiated limits IEC 60255-25	
Frequency Range	Limits at 10m
	Quasi-peak, dB(µV/m)
30 to 230 MHz	40
230 to 10000 MHz	47

Mechanical

Vibration (Sinusoidal) IEC 60255-21-1 Class 1	
0.5 gn, Vibration response	≤ 5% variation
1.0 gn, Vibration endurance	
Shock and Bump IEC 60255-21-2 Class 1	
5 gn, Shock response, 11ms	≤ 5% variation
15 gn, Shock withstand, 11ms	
10 gn, Bump test, 16ms	
Seismic IEC 60255-21-3 Class 1	
1 gn, Seismic Response	≤ 5% variation
Mechanical Classification	
Durability	In excess of 10^6 operations

Case Dimensions

The Iota is supplied in either a size E8, size E12 or size E16 case depending on the number of analogue input sets and the status input and output requirement

All dimensions are in Millimetres

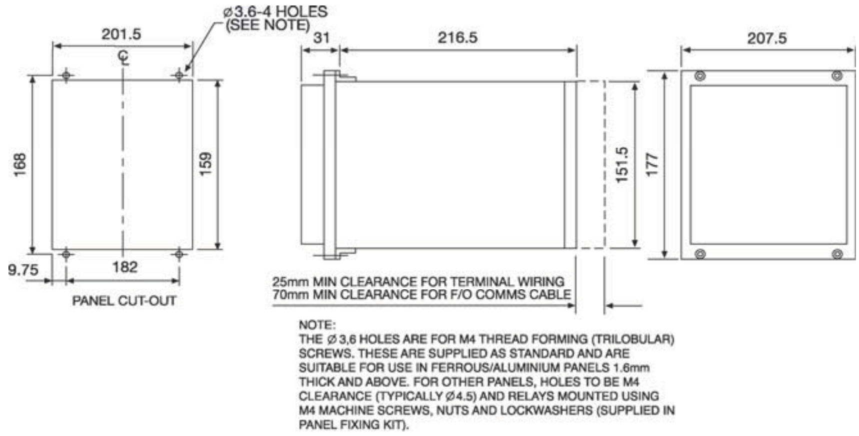


Fig 4. Epsilon E8 Case

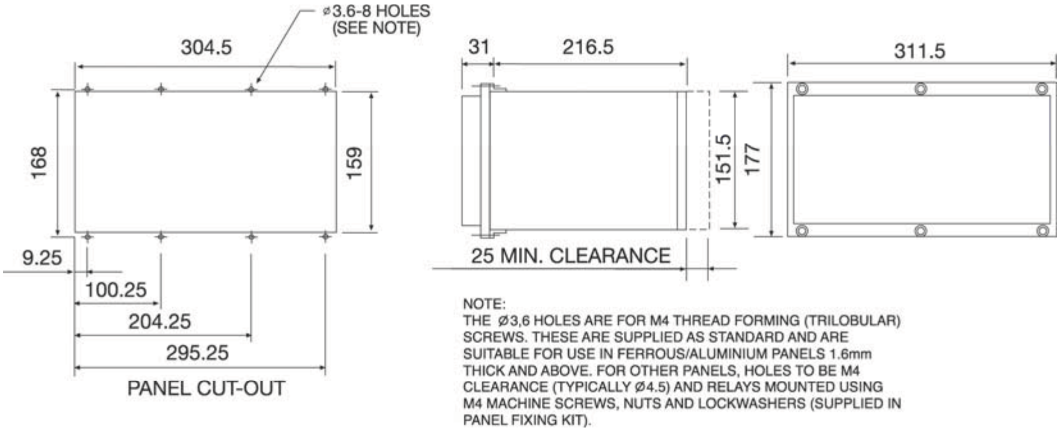


Fig 5. Epsilon E12 Case

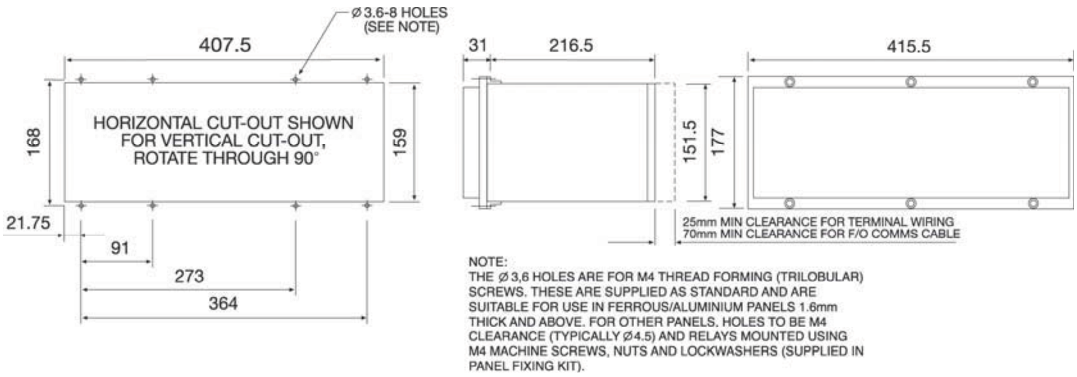


Fig 6. Epsilon E16 case

Typical Connection Diagram

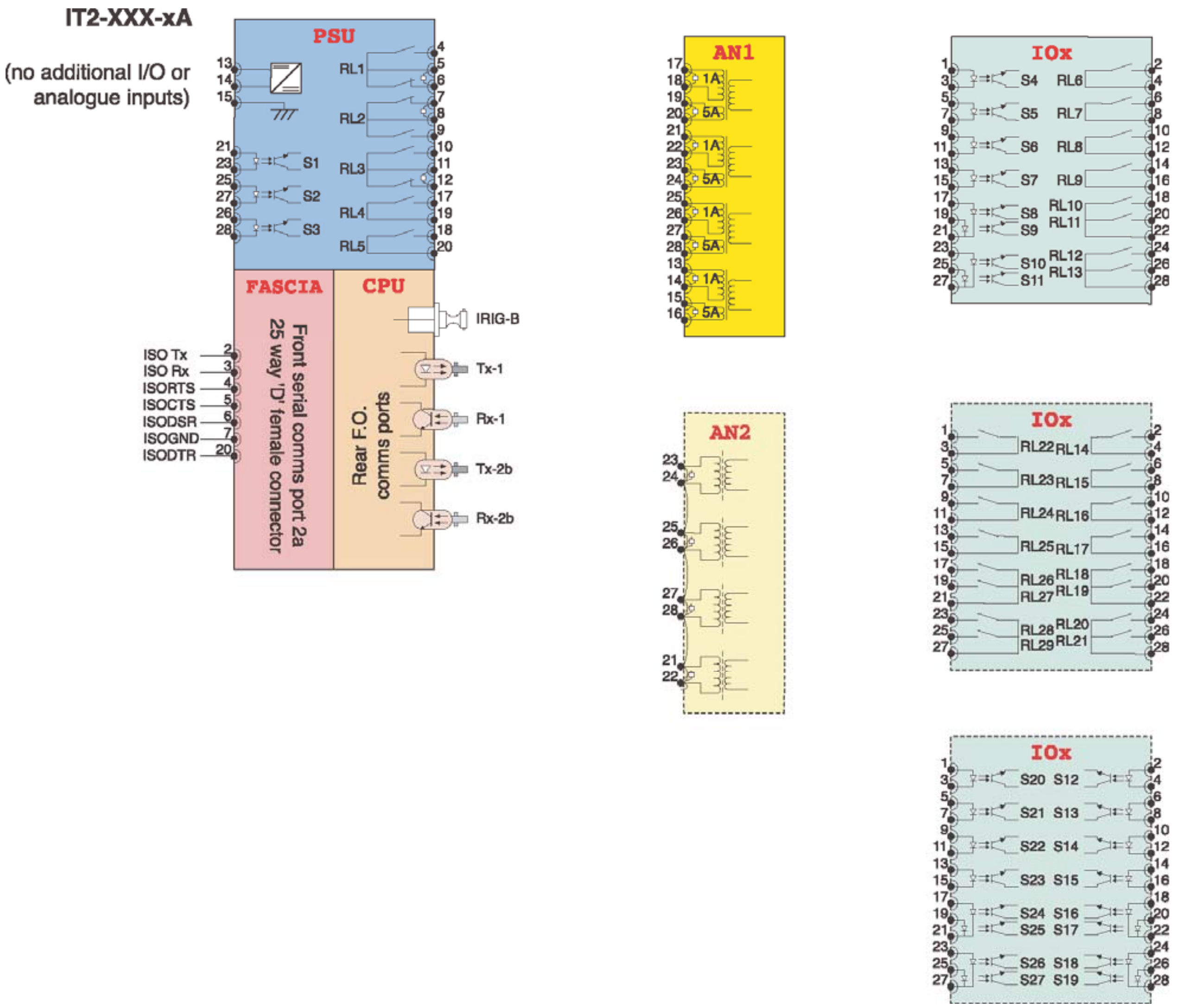


Fig 7. Typical connection diagram

Ordering Information - Iota 7SG22

Product description	Variants	Order No.
IOTA (100 series)		**7 S G 2 2 □ □ - 0 □ □ □ □ - □ □ □ 0**
Input/output units.		
	Relay type	
	100 series – Input/Output Units	1
	Functionality	
	Binary Inputs and Binary Outputs, 2 module positions for additional I/O	0 … 0 … 0
	Binary Inputs, Binary Outputs and 4 Voltage Inputs, 1 module positions for additional I/O	1 … 1
	Binary Inputs, Binary Outputs and 4 Current Inputs, 1 module positions for additional I/O	2 … 0
	Auxiliary supply /binary input voltage	
	30 V DC auxiliary, 30 V DC binary input	A
	30 V DC auxiliary, 48 V DC binary input	B
	48/110 V DC auxiliary, 30 V DC binary input	C
	48/110 V DC auxiliary, 48 V DC binary input 1)	D
	48/110 V DC auxiliary, 110 V DC binary input	E
	220 V DC auxiliary, 110 V DC binary input	F
	220 V DC auxiliary, 220 V DC binary input	G
	Additional I/O Modules 2)	
	3 Binary Inputs / 5 Binary Outputs (incl. 3 changeover), basic I/O	A
	11 Binary Inputs / 13 Binary Outputs (incl. 3 changeover), 1 module	B
	19 Binary Inputs / 21 Binary Outputs (incl. 3 changeover), 2 modules	C
	27 Binary Inputs / 13 Binary Outputs (incl. 3 changeover), 2 modules	H
	Frequency	
	Not applicable	0
	50Hz	1
	60Hz	2
	Nominal current	
	1/ 5 A	0
	Voltage inputs	
	Not applicable	0
	63.5/110 V AC	1
	Housing size	
	Case size E8 (4U high)	E
	Communication interface	
	Fibre optic (ST-connector) / IEC 60870-5-103 or Modbus RTU	B

1) These binary inputs may be used from 110/125V & 220/250V via external dropper resistors, order combination of the following resistor boxes to suit number of binary inputs.
2512H10064 (9 inputs, 110/125V)
2512H10065 (5 inputs, 110/125V)
2512H10066 (1 inputs, 110/125V)
2512H10067 (5 inputs, 220/250V)
2512H10068 (1 inputs, 220/250V)

2) Additional input/output modules must not exceed available module positions.

Ordering Information - Iota 7SG22

Product description	Variants	Order No.
IOTA (200 series)		**7 S G 2 2 □ □ - 0 □ □ □ □ - □ □ □ 0**
Input/output units.		
	<u>Relay type</u>	
	200 series – Input/Output Units	2
	<u>Functionality</u>	
	Binary Inputs and Binary Outputs, 4 module positions for additional I/O	0 … 0 … 0
	Binary Inputs, Binary Outputs and 4 Current Inputs, 3 module positions for additional I/O	1 … 1
	Binary Inputs, Binary Outputs and 4 Current Inputs, 3 module positions for additional I/O	2 … 0 … 0
	Binary Inputs, Binary Outputs, 4 Current and 4 Voltage Inputs, 2 module positions for additional I/O	3 … 1
	<u>Auxiliary supply /binary input voltage</u>	
	30 V DC auxiliary, 30 V DC binary input	A
	30 V DC auxiliary, 48 V DC binary input	B
	48/110 V DC auxiliary, 30 V DC binary input	C
	48/110 V DC auxiliary, 48 V DC binary input 1)	D
	48/110 V DC auxiliary, 110 V DC low burden binary input	E
	220 V DC auxiliary, 110 V DC low burden binary input	F
	220 V DC auxiliary, 220 V DC low burden binary input	G
	<u>Additional I/O Modules</u> 2)	
	3 Binary Inputs / 5 Binary Outputs (incl. 3 changeover), basic I/O	A
	11 Binary Inputs / 13 Binary Outputs (incl. 3 changeover), 1 module	B
	19 Binary Inputs / 21 Binary Outputs (incl. 3 changeover), 2 modules	C
	27 Binary Inputs / 29 Binary Outputs (incl. 3 changeover), 3 modules	D
		G
	27 Binary Inputs / 29 Binary Outputs (incl. 3 changeover and 4 N/C), 3 modules	
	27 Binary Inputs / 13 Binary Outputs (incl. 3 changeover), 2 modules	H
	35 Binary Inputs / 37 Binary Outputs (incl. 3 changeover), 4 modules	L
	35 Binary Inputs / 37 Binary Outputs (incl. 3 changeover and 4 N/C), 4 modules	V
	<u>Frequency</u>	
	Not applicable	0
	50Hz	1
	60Hz	2
	<u>Nominal current</u>	
	1/ 5 A	0
	<u>Voltage inputs</u>	
	Not applicable	0
	63.5/110 V AC	1
	<u>Housing size</u>	
	Case size E12 (4U high)	G
	<u>Communication interface</u>	
	Fibre optic (ST-connector) / IEC 60870-5-103 or Modbus RTU	B

1) These binary inputs may be used from 110/125V & 220/250V via external dropper resistors, order combination of the following resistor boxes to suit number of binary inputs.

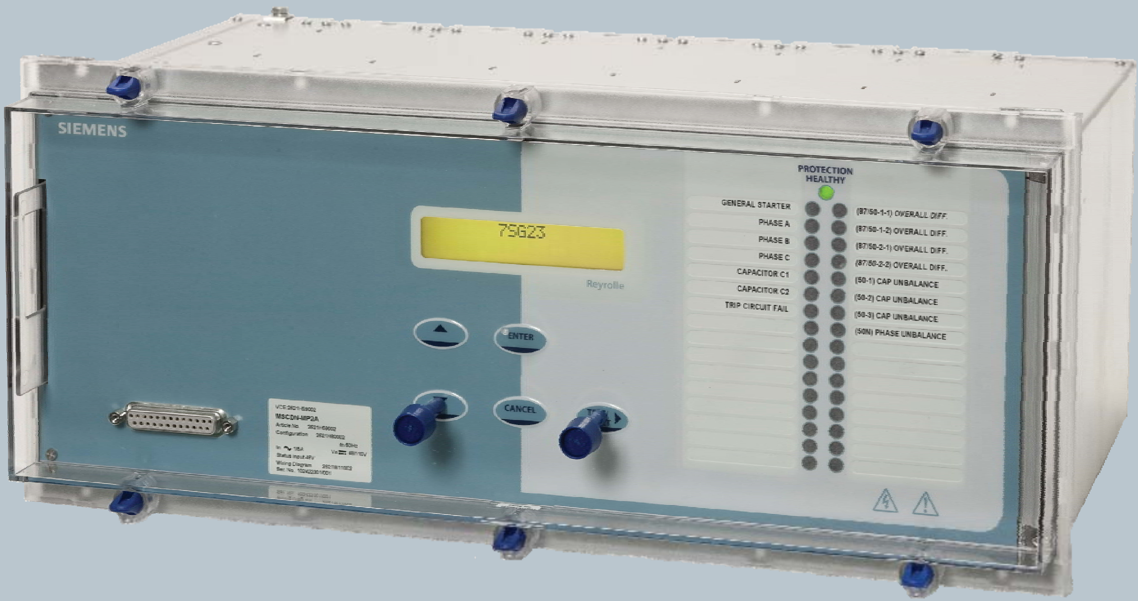
2512H10064 (9 inputs, 110/125V)	2512H10067 (5 inputs, 220/250V
2512H10065 (5 inputs, 110/125V)	2512H10068 (1 inputs, 220/250V)
2512H10066 (1 inputs, 110/125V)	

2) Additional input/output modules must not exceed available module positions.

Ordering Information - Iota 7SG22

Product description	Variants	Order No.
IOTA (300 series)		**7 S G 2 2 □ □ - 0 □ □ □ □ - □ □ □ 0**
Input/output units.		
	<u>Relay type</u>	
	300 series – Input/Output Units	3
	<u>Functionality</u>	
	Binary Inputs and Binary Outputs, 6 module positions for additional I/O	0 0 0
	Binary Inputs, Binary Outputs and 4 Voltage Inputs, 5 module positions for additional I/O	1 1
	Binary Inputs, Binary Outputs and 4 Current Inputs, 5 module positions for additional I/O	2 0 0
	Binary Inputs, Binary Outputs, 4 Current and 4 Voltage Inputs, 4 module positions for additional I/O	3 1
	<u>Auxiliary supply /binary input voltage</u>	
	30 V DC auxiliary, 30 V DC binary input	A
	30 V DC auxiliary, 48 V DC binary input	B
	48/110 V DC auxiliary, 30 V DC binary input	C
	48/110 V DC auxiliary, 48 V DC binary input 1)	D
	48/110 V DC auxiliary, 110 V DC low burden binary input	E
	220 V DC auxiliary, 110 V DC low burden binary input	F
	220 V DC auxiliary, 220 V DC low burden binary input	G
	<u>Additional I/O Modules</u> 2)	
	19 Binary Inputs / 21 Binary Outputs (incl. 3 changeover), 2 modules	C
	27 Binary Inputs / 29 Binary Outputs (incl. 3 changeover), 3 modules	D
	27 Binary Inputs / 29 Binary Outputs (incl. 3 changeover and 4 N/C), 3 modules	G
	27 Binary Inputs / 13 Binary Outputs (incl. 3 changeover), 2 modules	H
	35 Binary Inputs / 37 Binary Outputs (incl. 3 changeover), 4 modules	L
	43 Binary Inputs / 45 Binary Outputs (incl. 3 changeover), 5 modules	M
	43 Binary Inputs / 45 Binary Outputs (incl. 3 changeover AND 4 N/C), 5 modules	M
	51 Binary Inputs / 53 Binary Outputs (incl. 3 changeover), 6 modules	P
	59 Binary Inputs / 45 Binary Outputs (incl. 3 changeover), 6 modules	U
	35 Binary Inputs / 37 Binary Outputs (incl. 3 changeover and 4 N/C), 4 modules	V
	<u>Frequency</u>	
	Not applicable	0
	50Hz	1
	60Hz	2
	<u>Nominal current</u>	
	1/ 5 A	0
	<u>Voltage inputs</u>	
	Not applicable	0
	63.5/110 V AC	1
	<u>Housing size</u>	
	Case size E16 (4U high)	J
	<u>Communication interface</u>	
	Fibre optic (ST-connector) / IEC 60870-5-103 or Modbus RTU	B

1) These binary inputs may be used from 110/125V & 220/250V via external dropper resistors, order combination of the following resistor boxes to suit number of binary inputs.
2512H10064 (9 inputs, 110/125V)
2512H10065 (5 inputs, 110/125V)
2512H10066 (1 inputs, 110/125V)
220/250 V application, order resistor box 2512H10066 in addition
2512H10067 (5 inputs, 220/250V)
2512H10068 (1 inputs, 220/250V)
2) Additional input/output modules must not exceed available module positions.



Reyrolle
Protection
Devices

7SG23 - MSCDN

Capacitor Bank Protection

Answers for energy

SIEMENS

7SG23 - MSCDN

Capacitor Bank Protection

Description

Capacitor banks require a varied range of protection devices to monitor the system. Traditional solutions use many different relay types most of which were designed for other purposes. The MSCDN-MP has a unique range of purpose designed functions to cover all of the protection requirements in three multi-functional boxes:

MSCDN-MP1
MSCDN-MP2a
MSCDN-MP2b

Function Overview

MSCDN-MP*

Analogue Inputs

Current & Voltage signals are sampled at 32 samples per cycle which provides accurate measurements up to 750Hz (15^{th} Harmonic).

Output Relays

All the output relays are capable of handling circuit breaker tripping duty. All relays are fully user configurable and can be programmed to operate from any or all of the control functions. In normal operation output relays remain energised for a minimum of 100ms and a maximum dependent on the energising condition duration. However outputs can be programmed as latching relays.

Status Inputs

The Status Inputs can be programmed to be used for any function, a timer is associated with each input and a pickup time setting may be applied. Each input can also be logically inverted and each input may be mapped to the fascia LED's or any output relay contact. Status inputs can be used to give a trip circuit supervision scheme.

Fascia LED's

There are 32 user programmable LED flag indicators on the front fascia of each relay. The user can customise which LED is used for which purpose as well as being able to program each LED as being latching or self-resetting.

Self Monitoring

The relay incorporates a number of self-monitoring features. Each of these features can initiate a controlled reset recovery sequence, which can be used to generate an alarm output. In addition, the Protection Healthy LED will give visual indication.

A watchdog timer continuously monitors the microprocessor. The voltage rails are also continuously supervised and the microprocessor is reset if any of the rails falls outside of their working ranges. Any failure is detected in sufficient time so that the micro can be shut down in a safe and controlled manner.

Monitoring Functions

RMS capacitor bank currents (primary, secondary and relay)
RMS overall differential currents (secondary and relay)
RMS capacitor spill currents (primary, secondary and relays)
RMS Phase unbalance currents (primary, secondary and relay)
System voltage (Primary, secondary)
Digital input status
Output relay
Time & Date

Application

The MSCDN range represents an integration of the protection elements required to provide a single box Main 1 and Main 2 protection of EHV capacitor banks.
Applications covered include overall differential protection, capacitor unbalance protection additional phase unbalance backup protection, true RMS phase by phase resistor thermal overload protection, resistor open circuit protection, true RMS phase-by-phase reactor thermal overload protection, backup overcurrent and earth faults protection and overvoltage protection.

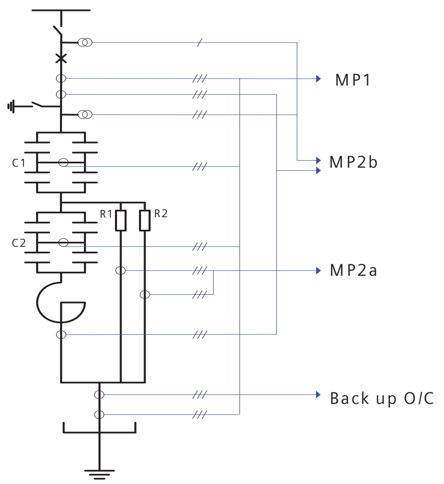


Fig 1. Typical application for the MSCDN range

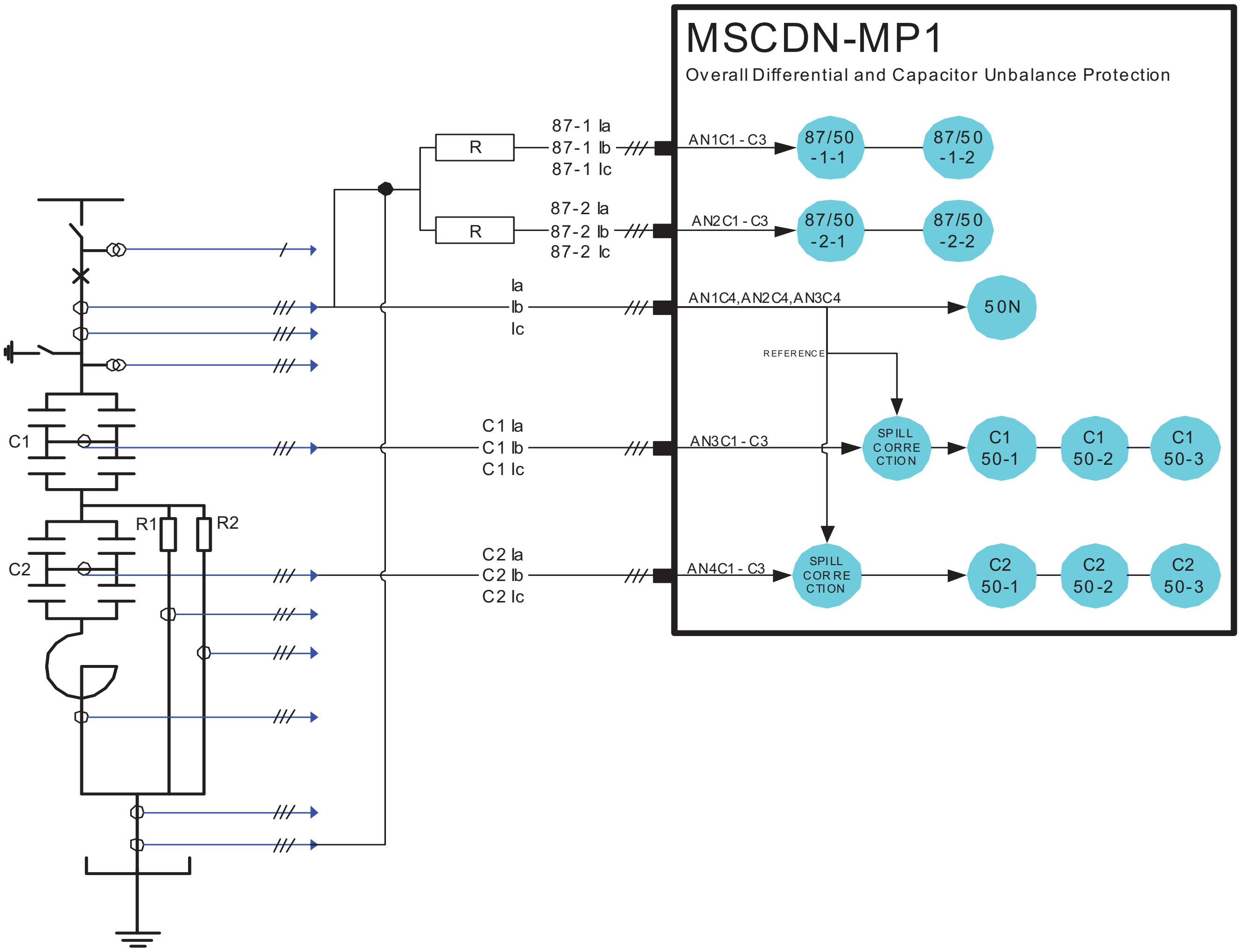


Fig 2. MSCDN MP1 Overview

Overall Differential (87/50)

The overall differential protection uses the high impedance circulating principle. The protection consists of two DTL over-current 87/50-1 and CT-1, 87/50-1 is set for tripping and the CT-1 element is utilised for CT supervision. The protection is duplicated for dependability, with elements 87/50-2 and CT-2 available for this purpose.

Capacitor Unbalance Protection (C1 50 and C2 50)

The relay contains two identical Capacitor Unbalance protection units, which are primarily designed to protect phase segregated capacitor stacks, with a central 'H' connection, although application to alternative stack arrangements is possible. Thus providing complete capacitor unbalance protection for main and auxiliary capacitor stacks.

For each unit, expected capacitive spill current for each phase is calculated, based on a proportion of the overall Capacitor bank current. This expected spill current is then compared with the measured phase spill current and this difference is the operating quantity for the two DTL elements available per unit.

Each DTL element is phase segregated, but utilises a common operate setting.

Phase Unbalance Protection (50N)

The operating quantity for the 50N element, is calculated from the RMS residual of the three phase currents, which is then connected to a DTL overcurrent element.

Trip circuit supervision

Status inputs on the relay can be used to supervise trip circuits while the associated circuit breakers (CB) are either open or closed. Since the status inputs can be programmed to operate output contacts and LED's alarm can be also generated from this feature

Function Diagram – 7SG232

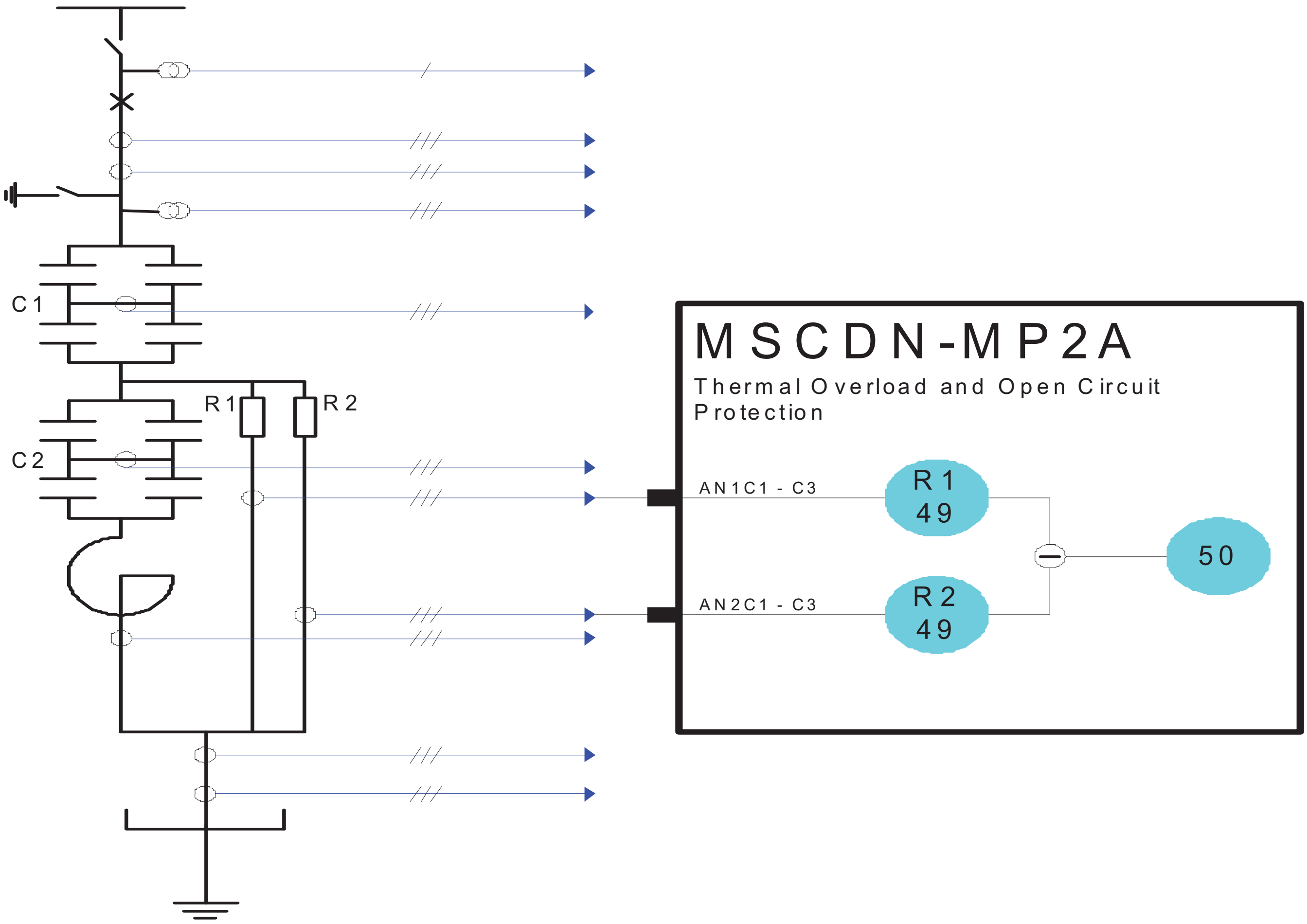


Fig 3. MSCDN MP2A Overview

Resistor R1 and R2 Thermal Overload (R1 49, R2 49)

The relay provides thermal overload protection for R1 and R2. The elements, one per phase, use 32 samples/cycle to provide a flat frequency response up to 550Hz and beyond.

The temperature of the protected equipment is not measured directly. Instead, thermal overload condition are detected by calculating the RMS of the current flowing in each phase of the resistor.

Should the RMS current rise above a defined level (the overload setting) for a defined time (the operating time t), the system will be tripped to prevent damage.

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

Where

I_P = Previous steady state current level

I_B = Basic current of resistor, typically the same as In

k = Multiplier resulting in the overload pickup setting $k.I_B$

I = The measured resistor current

τ = Thermal time constant

Additionally, an alarm can be given if the thermal state of the system exceeds a specified percentage of the protected equipment's thermal capacity (Capacity alarm)

Resistor R1 and R2 Open Circuit 50OC

The resistor open circuit protection works by comparing the current in resistor R1 and resistor R2 on a phase-by-phase basis. Because the resistors are the same value then the current through each resistor should be equal. An instantaneous/time delayed overcurrent element monitors the difference between the currents on a phase-by-phase basis. If the element operates then the resistor, which has the lowest current, is indicated on the Fascia LEDs. For an open circuit condition then this will be the faulty resistor. However if there has been a short circuit in a resistor then this will not be true. The waveform records should be downloaded to confirm the actual fault condition that has occurred.

Function Diagram – 7SG233

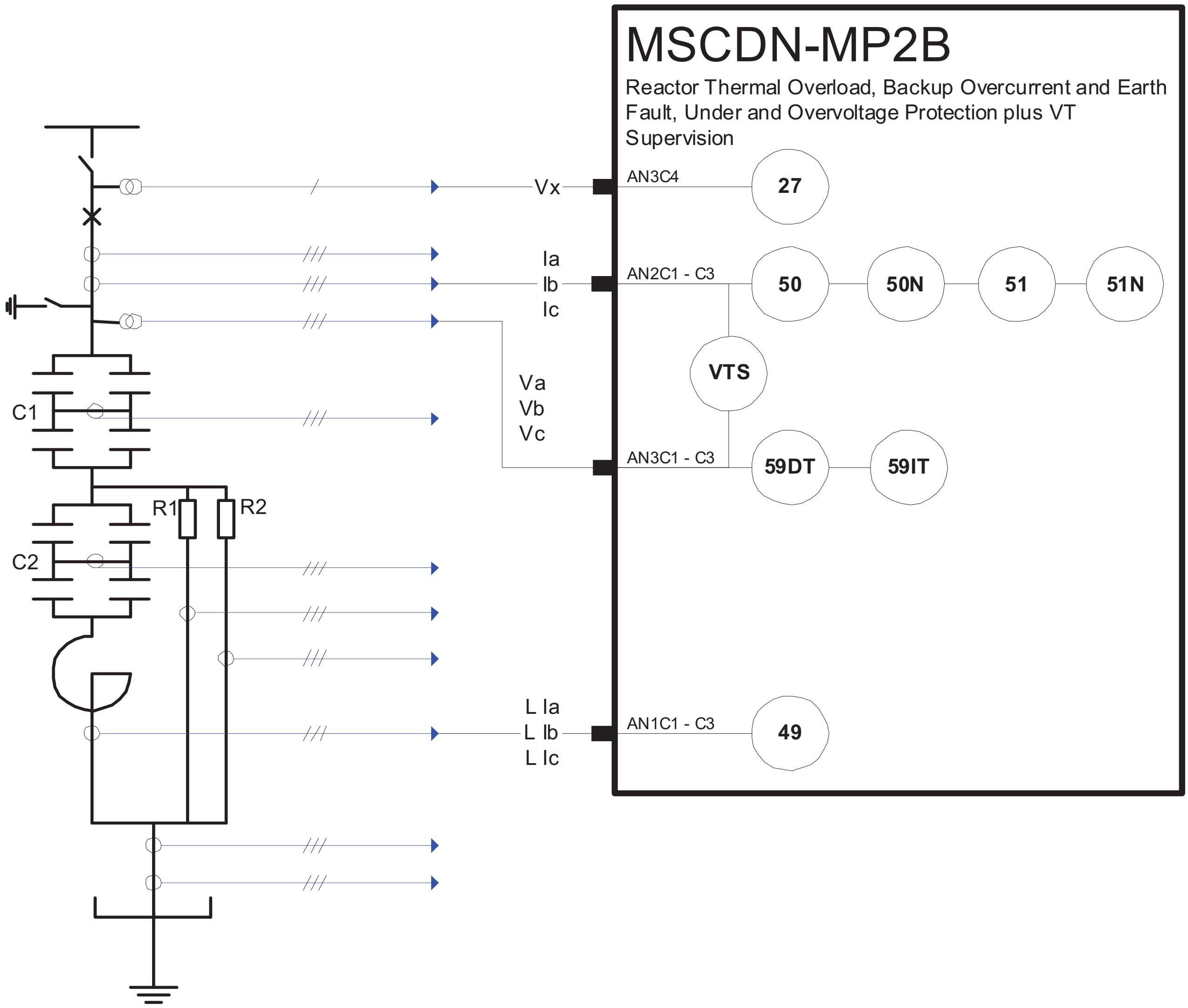


Fig 4. MSCDN MP2B Overview

Backup Overcurrent and Derived earth fault Protections 50/50N/51/51N

The relay provide true RMS backup overcurrent and earth fault protection for the capacitor bank. The elements, one per phase, use 32 samples/cycle to provide a flat frequency response up to 550Hz and beyond.

Undervoltage Detector 27

The relay provides true RMS measuring single-phase definite time under voltage detector. A guard element may be enabled to prevent the under voltage element from operating when there is a complete loss of voltage.

Definite Time Overvoltage Protection 59DT

The relay provides true RMS measuring three-phase definite time over voltage protection. The elements one per phase, use 32 samples per cycle to provide a flat frequency response up to 550Hz and beyond.

Inverse Time Overvoltage Protection

The relay provides true RMS measuring three-phase definite time over voltage protection. The inverse curve is specified using a 7 point user defined curve. The elements one per phase, use 32 samples per cycle to provide a flat frequency response up to 550Hz and beyond.

VT Supervision

The VTS function is performed using an undervoltage element (27VTS) and a current check element (50VTS) on a phase by phase basis. Each element is usually set instantaneous. Fuse failure operates if both the current check element (50VTS) and the undervoltage element (27VTS) is picked up for the VTS delay setting period, which indicates the capacitor bank is energised, and operates, which is set to 10 seconds by default i.e. A sustained condition of rated current without rated volts indicates a fuse failure on a per phase basis

Function Overview

Measurements and indication

Analogue values can be displayed on the LCD screen. In addition most values can be obtained via the IEC60870-5-103 communications.

System data
Sequence of event records

Up to 500 events are stored and time tagged to 1ms resolution. These are available via the communications.

Fault records

The last 10 fault records are available from the fascia with time and date of trip, measured quantities and type of fault.

Disturbance recorder

10 seconds of waveform storage is available and is user configurable as 10*1s, 5*2s or 1*10s records. Within the record the amount of per-fault storage is also configurable. The recorder is triggered from a protection operation, or status input.

The records contain the analogue waveforms of the line currents, the relay currents after vector group correction and the digital input and output signals.

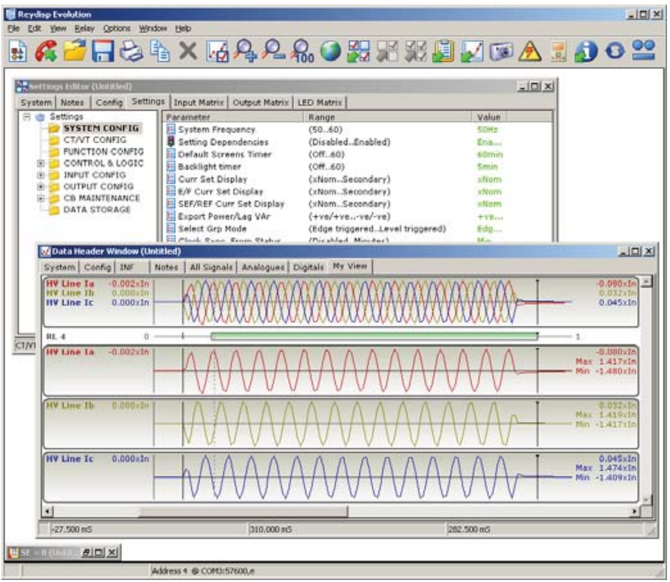
Communications

Two Fibre-optic communications ports are provided on the rear of the relay. They are optimised for 62.5/125µm glass-fibre, with BFOC/2.5(ST®) bayonet style connectors.

In addition users may interrogate the MSCDN locally with a laptop PC and the RS232 port on the front of the relay.

The MSCDN uses IEC 60870-5-103 as its communications standard

Reydisp Evolution



Reydisp Evolution is common to the entire range of Reyrolle numeric products. It provides a means for the user to apply settings to the MSCDN, interrogate settings and retrieve disturbance waveforms from the MSCDN

Figure (of screen shot of disturbance records in Reydisp Evolution

Technical Information

Accuracy Reference Conditions

General	IEC60255 Parts 6, 6A & 13
Auxiliary Supply	Nominal
Frequency	50 Hz
Ambient Temperature	20°C

Modular II Specification

Mechanical

Vibration (Sinusoidal) –IEC 60255-21-1 Class 1

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

Shock and Bump–IEC 60255-21-2 Class 1

		Variation
Shock response	5 gn 11ms	≤ 5%
Shock withstand	15 gn 11ms	≤ 5%
Bump test	10 gn 16ms	≤ 5%

Seismic – IEC 60255-21-3 Class 1

		Variation
Seismic Response	1gn	≤ 5%

Durability	In excess of 10^6 operations

Auxiliary Energizing Quantity DC Power Supply

Nominal	Operating Range
30V	24V to 37.5V dc
48/110V	37.5V to 137.5V dc
220/250V	175V to 286V dc

Auxiliary DC Supply – IEC 60255-11

Allowable superimposed ac component	≤ 12% of DC voltage
Allowable breaks/dips in supply (collapse to zero from nominal voltage)	≤ 20ms

D.C. Burden

Quiescent (Typical)	15 Watts
Max	27 Watts

A.C Current Inputs

1 Amp and 5 Amp current inputs are both available on the rear terminal blocks for most functions except Capacitor Unbalance.

Electrical

Insulation - IEC 60255-5

Between all terminals and earth	2.0kV rms for 1 min
Between independent circuits	2.0kV rms for 1 min
Across normally open contacts	1.0kV rms for 1 min

High Frequency Disturbance - IEC 60255-22-1 Class III

	Variation
2.5kV Common (Longitudinal) Mode	≤ 5%
1.0kV Series (Transverse) Mode	≤ 5%

Electrostatic Discharge - IEC 60255-22-2 Class IV

	Variation
8kV contact discharge	≤ 5%

Conducted & Radiated Emissions - EN 55022 Class A (IEC 60255-25)

Conducted 0.15MHz – 30MHz Radiated 30MHz – 1GHz

Conducted Immunity - (IEC 61000-4-6; IEC 60255-22-6)

	Variation
0.15MHz – 80MHz 10V rms 80% modulation	≤ 5%

Radiated Immunity - IEC60255-22-3 Class III

	Variation
80MHz to 1000MHz, 10V/m 80% modulated	≤ 5%

Fast Transient – IEC 60255-22-4 Class IV

	Variation
4kV 5/50ns 2.5kHz repetitive	≤ 5%

Surge Impulse - IEC 61000-4-5 Class IV; (IEC 60255-22-5)

	Variation
4KV Line-Earth (O/C Test voltage ±10%) 2KV Line-Line	≤ 10

Environmental Withstand

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% RH

Transient Overvoltage –IEC 60255-5

Between all terminals and earth or between any two independent circuits without damage or flash-over	5kV 1.2/50µs 0.5J

Thermal Withstand

Continuous and Limited Period Overload

AC Current Inputs

3.0 x In	Continuous
3.5 x In	for 10 minutes
4.0 x In	for 5 minutes
5.0 x In	for 3 minutes
6.0 x In	for 2 minutes
250A	for 1 second
625A peak	for 1 cycle

A.C. Burden

1A tap	≤0.1 VA
5A tap	≤0.3 VA

NB. Burdens are measured at nominal rating.

A.C Voltage Inputs

Thermal Withstand

Continuous Overload

AC Voltage	320Vrms (452Vpk)

A.C. Burden

110Vrms	0.05 VA
63.5Vrms	0.01 VA

Rated Frequency

Two operating frequencies are available
Frequency: 50Hz or 60Hz

Frequency

Range	47Hz to 52Hz or 57Hz to 62Hz
Setting variation	≤ 5%
Operating time variation	≤ 5% or 5ms

Accuracy Influencing Factors

Temperature

Ambient range	-10°C to +55°C
Variation over range	≤ 5%

Output Contacts

Output contacts functionality is fully programmable. The basic I/O module has 5 output contacts three of which are change over. Additional modules can be added with consequential increase in case size, to provide more contacts. These are added in-groups of eight up to a maximum of 29

Output Contact Performance

Contact rating to IEC 60255-0-2.

Carry continuously

5A ac or dc

Make and Carry

(limit L/R ≤ 40ms and V ≤ 300 volts)

for 0.5 sec	20A ac or dc
for 0.2 sec	30A ac or dc

Break

(limit ≤ 5A or ≤ 300 volts)

Ac resistive	1250VA
Ac inductive	250VA @ PF ≤ 0.4
Dc resistive	75W
Dc inductive	30W @ L/R ≤ 40 ms 50W @ L/R ≤ 10 ms
Minimum number of operations	1000 at maximum load
Minimum recommended load	0.5W, limits 10mA or 5V

Status inputs

Status Inputs functionality is fully programmable. The basic I/O module has 3 status inputs these can be set to high speed for signalling. Additional modules can be added to provide more inputs. Additional inputs are added in-groups of eight up to a maximum of 27. A pickup timer is associated with each input and each input may be individually inverted where necessary.

Nominal Voltage	Operating Range
30	18V to 37.5V
48	37.5V to 60V
110	87.5V to 137.5V
220	175 to 280V

NB: the status input operating voltage does not have to be the same as the power supply voltage.

Status Input Performance

Minimum DC current for operation	48V 10mA 110V 2.25mA 220V 2.16mA
Reset/Operate Voltage Ratio	≥ 90%
Typical response time	< 5ms
Typical response time when programmed to energise an output relay contact	< 15ms
Minimum pulse duration	40ms

250V RMS 50/60Hz applied for two seconds through a 0.1μF capacitor.
500V RMS 50/60Hz applied between each terminal and earth.
Discharge of a 10μF capacitor charged to maximum DC auxiliary supply voltage.

Auxiliary Timer Accuracy

Auxiliary Timers are those timers created in Reylogic, whose delay settings appear in the reylogic elements menu

Accuracy

Timing	< +1% or +10ms

Accuracy Influencing Factors

Common Performance Disengaging Time

Disengaging Time	30ms

Note: Output contacts have a minimum dwell time of 100ms, after which the disengaging time is as above.

87/50-x-x Overall Differential

Phase segregated High impedance Overall Differential scheme using external stabilizing resistors. Function is insensitive to third harmonic currents.

Accuracy

Pickup	100% of setting ± 5% or ± 0.01 I_n
Reset	80% of I_s
Repeatability	± 2%
Transient Overreach	5%

Operating Time

Current Applied	Typical
2 x setting	≤ 1.5 cycle
4 x setting	≤ 1 cycle

C1/2 50-x Capacitor Unbalance

Phase segregated Capacitor Unbalance element, whose operate quantity is calculated from the ratio of capacitor load current and the measured spill current, followed by three identical instantaneous Overcurrent elements with following time delay

Accuracy

Pickup	100% of setting ± 5% or ± 0.02 I_n
Reset	80% of I_s
Repeatability	± 2%
Operate Time	± 1% or ± 10ms

Operating Time

Current Applied	Typical
2 x setting	1.5 cycles
4 x setting	1 cycle

50N Cap Bank Phase Unbalance

Derived phase unbalance quantity, from the sum of phase currents, applied to an instantaneous overcurrent element with following time delay.

Accuracy

Pickup	100% of setting ± 5% or ± 0.01 I_n
Reset	80% of I_s
Repeatability	± 2%
Operate Time	± 1% or ± 10ms

Operating Time

Current Applied	Typical
2 x setting	1.5 cycles
4 x setting	1 cycle

R1/2 49 Resistor Thermal Overload

Thermal overload element applied to each phase of each resistor independently.

Accuracy

Operating Time

Characteristic	Ranges
Thermal IEC 60255-8	Operate times are calculated from: $t = \tau \times \ln\left\{\frac{I^2 - I_P^2}{I^2 - (k \times I_B)^2}\right\}$ τ = thermal time constant I = measured current I_P = prior current I_B = basic current k = constant

50 Resistor Open Circuit

An instantaneous/delayed overcurrent element measures the difference in currents on each resistor on a phase-by-phase basis.

Accuracy

Pickup	100% of setting ± 5% or ± 0.02 I_n
Reset	95% of I_s
Repeatability	± 2%
Operate Time	± 1% or ± 10ms

Operating Time

Current Applied	Typical
2 x setting	2 cycles
4 x setting	1.5 cycle

49 Reactor Thermal Overload

Thermal overload element applied to each phase of the reactor independently.

Accuracy

Pickup	100% of setting ± 5% or ± 0.02 I_n
Reset	≥ 95% of I_s
Repeatability	± 2%
Operate Time	± 5%
Frequency Range	1^{st}, 2^{nd} ...15^{th} Harmonic

Pickup	100% of setting ± 5% or ± 0.02 I_n
Reset	95% of I_s
Repeatability	± 2%
Operate Time	± 5% or ± 0.1s
Frequency Range	1^{st}, 2^{nd} ...15^{th} Harmonic

Operating Time

Characteristic	Ranges
THERMAL IEC 60255-8	Operate times are calculated from: $t = \tau \times \ln\left\{\frac{I^2 - I_P^2}{I^2 - (k \times I_B)^2}\right\}$ τ = thermal time constant I = measured current I_P = prior current I_B = basic current k = constant
τ Factor	1 to 1000 Δ 0.5 minutes

50 Backup Overcurrent

Three phase definite time overcurrent element.

Accuracy

Pickup	100% of setting ± 5% or ± 0.02 I_n
Reset	95% of I_s
Repeatability	± 2%
Operate Time	± 1% or ± 10ms
Frequency Range	1^{st}, 2^{nd} ...15^{th} Harmonic

Operating Time

Current Applied	Typical
2 x setting	2 cycles
4 x setting	1.5 cycle

50N Backup Earth Fault

Definite time derived earth fault element.

Accuracy

Pickup	100% of setting ± 5% or ± 0.02 I_n
Reset	≥ 95% of I_s
Repeatability	± 2%
Operate Time	± 1% or ± 10ms
Frequency Range	1^{st}, 2^{nd} ...15^{th} Harmonic

Operating Time

Current Applied	Typical
2 x setting	2 cycles
4 x setting	1.5 cycle

51 Backup Overcurrent

Three phase inverse time overcurrent element.

Accuracy

Pickup	105% of setting ± 5% or ± 0.02 I_n
Reset	95% of I_s
Repeatability	± 2%
Operate Time	± 5% or ± 40ms
Frequency Range	1^{st}, 2^{nd} ...15^{th} Harmonic

Operating Time

Characteristic	Ranges
IEC IDMTL CURVES	Operate times are calculated from: $t = Tm \times \left[\frac{K}{\left[\frac{I}{Is}\right]^{\alpha} - 1}\right]$ I = fault current Is = current setting Tm = time multiplier NI: K = 0.14, α = 0.02 VI: K = 13.5, α = 1.0 EI: K = 80.0, α = 2.0 LTI: K = 120.0, α = 1.0
Time Multiplier	0.025 to 1.600 Δ 0.025 sec
Reset	0.0 to 60.0 Δ 1.0 sec
ANSI IDMTL CURVES	Operate times are calculated from: $t = M \times \left[\frac{A}{\left[\frac{I}{Is}\right]^{P} - 1} + B\right]$ I = fault current Is = current setting M = time multiplier MI: A = 0.0515, B = 0.114, P = 0.02 VI: A = 19.61, B = 0.491, P = 2.0 EI: A = 28.2, B = 0.1217, P = 2.0
ANSI RESET CURVES	Operate times are calculated from: $t = M \times \left[\frac{R}{\left[\frac{I}{Is}\right]^{2} - 1}\right]$ I = fault current Is = current setting M = time multiplier MI: R = 4.85 VI: R = 21.6 EI: R = 29.1

51N Derived Earth Fault

Inverse time derived earth fault element.

Accuracy

Pickup	105% of setting ± 5% or ± 0.02 I_n
Reset	95% of I_s
Repeatability	± 2%
Operate Time	± 5% or ± 40ms
Frequency Range	1^{st}, 2^{nd} ...15^{th} Harmonic

Operating Time

Characteristic	Ranges
IEC IDMTL CURVES	Operate times are calculated from: $t = Tm \times \left[\frac{K}{\left[\frac{I}{Is}\right]^{\alpha} - 1}\right]$ I = fault current Is = current setting Tm = time multiplier NI: K = 0.14, α = 0.02 VI: K = 13.5, α = 1.0 EI: K = 80.0, α = 2.0 LTI: K = 120.0, α = 1.0
Time Multiplier	0.025 to 1.600 Δ 0.025 sec
Reset	0.0 to 60.0 Δ 1.0 sec
ANSI IDMTL CURVES	Operate times are calculated from: $t = M \times \left[\frac{A}{\left[\frac{I}{Is}\right]^{P} - 1} + B\right]$ I = fault current Is = current setting M = time multiplier MI: A = 0.0515, B = 0.114, P = 0.02 VI: A = 19.61, B = 0.491, P = 2.0 EI: A = 28.2, B = 0.1217, P = 2.0
ANSI RESET CURVES	Operate times are calculated from: $t = M \times \left[\frac{R}{\left[\frac{I}{Is}\right]^{2} - 1}\right]$ I = fault current Is = current setting M = time multiplier MI: R = 4.85 VI: R = 21.6 EI: R = 29.1

27 Undervoltage

Single phase definite time undervoltage element. An under voltage guard element may be used to block this elements operation.

Accuracy

Pickup	100% of setting ± 0.1% or ± 0.1 V
Reset	≤ 100.5% of V_s (Adjustable)
Repeatability	± 0.1%
Operate Time	± 1% or ± 20ms
Frequency Range	1st, 2nd ...15th Harmonic

Operating Time

Operate Time	< 3 cycles

59DT Definite Time Overvoltage

Three phase definite time overvoltage element

Accuracy

Pickup	100% of setting ± 0.1% or ± 0.1 V
Reset	≥ 99.5% of V_s
Repeatability	± 0.1%
Frequency Range	1st, 2nd ...15th Harmonic

Operating Time

Operate Time	< 4 cycles

59IT Inverse Time Overvoltage

Three phase inverse time overvoltage element specified using seven user defined points on a curve.

Accuracy

Pickup	± 0.1% of setting or ± 0.1 V
Reset	≥ 99.5% of V_s
Repeatability	± 0.1%
Operate Time	± 5% or ± 0.1s
Frequency Range	1st, 2nd ...15th Harmonic

Operating Time

Characteristic	**Ranges**
CURVE	7 Point user defined inverse curve X_0,Y_0 : X_6,Y_6 X_i:=1.00xVn ... 2.00xVn Y_i:=0.1 ... 20000s

VT Supervision

The VT supervision element operates when the 27 VTS and the 50 VTS element operate to indicate that the capacitor bank is energised but rated voltage has not been applied to the relay on a phase by phase basis.

27 VTS Undervoltage

Three phase definite time undervoltage element

Accuracy

Pickup	100% of setting ± 0.1% or ± 0.1 V
Reset	≥ 99.5% of V_s
Repeatability	± 0.1%

Operating Time

Operate Time	< 4 cycles

50 VTS Current Check

Three phase definite time overcurrent check element

Accuracy

Pickup	100% of setting ± 5% or ± 0.02 I_n
Reset	≥ 95% of I_s
Repeatability	± 2%
Operate Time	± 1% or ± 10ms

Operating Time

Current Applied	Typical
2 x setting	2 cycles
4 x setting	1.5 cycle

Ordering Information – 7SG23 MSCDN-MP

Product description	Variants	Order No.							
MSCDN-MP		7 S G 2 3 □ 0 - 0	□	□	□	□ -	□	□	□ 0
	Relay type								
	MSCDN-MP1 - Two overall unit protection elements - CT supervision - Two capacitor out of balance units - Phase unbalance	1		C		1	0	J	
	MSCDN-MP2a - Resistor thermal overload - Resistor open circuit	2		B		0	0	G	
	MSCDN-MP2b - Reactor thermal overload - Excessive RMS overcurrent - Capacitor under/overvoltage - Overcurrent and earth-fault - VT supervision	3		C		0	1	J	
	Auxiliary supply /binary input voltage								
	30 V DC auxiliary, 30 V DC binary input		A						
	30 V DC auxiliary, 48 V DC binary input		B						
	48/110 V DC auxiliary, 30 V DC binary input		C						
	48/110 V DC auxiliary, 48 V DC binary input [1])		D						
	48/110 V DC auxiliary, 110 V DC low burden binary input		E						
	220 V DC auxiliary, 110 V DC low burden binary input		F						
	220 V DC auxiliary, 220 V DC low burden binary input		G						
	I/O range								
	11 Binary Inputs / 13 Binary Outputs (incl. 3 changeover)			B					
	19 Binary Inputs / 21 Binary Outputs (incl. 3 changeover)			C					
	Frequency								
	50Hz				1				
	Nominal current								
	1/ 5 A					0			
	1 A					1			
	Voltage inputs								
	Not available						0		
	63/110 V AC						1		
	Housing size								
	Case size E12 (4U high)							G	
	Case size E16 (4U high)							J	
	Communication interface								
	Fibre optic (ST-connector) / IEC 60870-5-103								A

[1]) High burden 110/125V binary inputs compliant with ESI48-4 ESI 1 available via external dropper resistors with 48V binary input version

110/125 V application, order combination of the following resistor boxes to suit number of binary inputs

VCE:2512H10064 (9 inputs, 110V)

VCE:2512H10065 (5 inputs, 110V)

VCE:2512H10066 (1 inputs, 110V)

Refer to website for application note about ESI48-4 compliance

Reyrolle
Protection
Devices

7SG12 DAD N

Numerical High Impedance

Answers for energy

SIEMENS

7SG12 DAD N

Numerical high Impedance

Description

The 7SG12 DAD-N overall differential protection uses the high impedance circulating current principle; a single line diagram of such a scheme is shown in fig. 1.

The 7SG12 is a three phase relay providing high-speed, high impedance phase segregated current differential protection and phase segregated open circuit monitoring of the current transformer secondary circuits (CT supervision). Outputs from the differential and CT supervision elements operate when their input current exceeds their individual current settings. The programmed time delays, LEDs and output contacts are initiated.

Relays can be supplied with binary input/output and LED combinations as follows:

3BI + 5BO + 16 LEDs, E8 case
11BI + 13BO + 16 LEDs, E8 case
19BI + 21BO + 32LEDs, E12 case
27BI + 29BO + 32LEDs, E12 case.

All output contacts are fully programmable to any relay function listed in the output relay menu. Output relays can be configured as self reset or hand reset.

It is recommended that class ‘PX’ current transformers to IEC 60044-1 are used with high impedance protection.

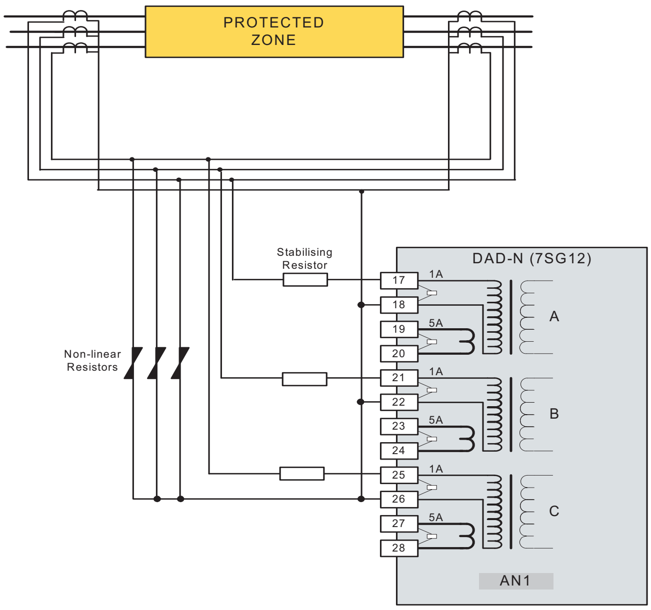


Fig 1. Simplified Typical A.C. Schematic Diagram

Function Overview

High speed phase segregated differential protection
Harmonic rejection
Integrated open circuit current transformer monitoring
Continuous self monitoring
Compatibility with generic communications software
Reydisp Evolution
Settings stored in EEPROM
Storage of up to 500 time tagged event records
Storage of up to 10 waveform records in non-volatile memory without the use of batteries.
Metering of analogue and digital quantities.
Expandable I/O of up to 27 binary inputs and 29 output contacts replaces the need for external trip lockout relays.
Programmable LEDs for trip and alarm conditions.
E8 or E12 case.

User Interface

20 character x 2 line backlit LCD
Menu navigation keys
1 fixed LED.
16 or 32 programmable LEDs.

Monitoring Functions

Monitored quantities can be displayed on the LCD screen or via the data communications channel(s). Monitored values include:-

- Differential currents
- Binary inputs
- Output relays

Application

Typically applied to provide 3 – phase high impedance differential protection of busbar, connections, auto-transformers, reactors and motors, see figure 4.

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 depends upon the operate voltage setting being greater than the maximum voltage which can appear across the relay under a given through fault condition. An external series stabilising resistor and shunt non-linear resistor per phase complete the scheme. The series resistor value is determined by the voltage level required for stability and the value of relay current calculated to provide the required primary fault setting. Non-linear resistors protect the relay circuit from high over-voltages.

The 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.

The CT supervision function of the DAD-N relay provides monitoring of CT secondary wiring connections, this is particularly relevant where current transformer wiring is switched as in some busbar protection arrangements.

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 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 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:

(1) $$V = I_{max}\left(R_{CT} + R_{L}\right)$$

Where:

R_L = The largest value of pilot loop Resistance between the current transformer and the relay circuit terminals

R_{CT} = Current transformer secondary winding resistance

I_{max} = Current transformer secondary current corresponding to the maximum steady state through fault current of the protected equipment.

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:

(2) $$I_S = I_F - \left(\sum I_{mag} + I_{NLR}\right)$$

Where:

I_S = Relay setting current

I_F = Current transformer secondary current at the primary fault setting required i.e. at V_S.

ΣI_{mag} = Current transformer magnetising currents at the value of V_S.

I_{NLR} = Current taken by the non-linear resistor/voltage limiting device at V_S (this value is usually small and often may be neglected).

Equation (2) should properly be the vector sum, however arithmetic addition is normally used.

Establishing the Value of Setting Resistors

Resistor value R is given by:

(3) $$R = \frac{V_S}{I_S}$$

Exact resistor values are not necessary, a higher resistor standard value may be chosen provided a check calculation using that value shows sufficient margin ie:

(4) $V < V_{actual}$ setting $< 0.5V_{CT\ knee\ point}$

The required watt-second rating of the resistor is established at setting and at the maximum fault rating – short time rating. Stabilising resistors should be mounted vertically in a well ventilated location and clear of all other wiring and equipment to avoid the effects of their power dissipation

Data Storage and Communication

Sequence of event records

Up to 500 events are stored and time tagged to 1ms resolution. These are available via the communications.

Fault records

The last 10 fault records are available from the fascia with time and date of trip, measured quantities and type of fault.

Disturbance recorder

5 seconds of waveform storage is available and is user-configurable as 5 x 1s or 1 x 5s records. Within the record the amount of pre-fault storage is also configurable. The recorder is triggered from a protection operation, or binary input. (e.g. Buchholz flag indication).
The records contain the analogue waveforms of the line currents and the digital input and output signals.
The relay settings must be appropriately programmed in order for a wave form to be triggered from an external protection device.

Communications

Two fibre-optic communications ports are provided on the rear of the relay. They are optimised for 62.5/125µm glass-fibre, with BFOC/2.5 (ST®) bayonet style connectors.
In addition users may interrogate the relay locally with a laptop PC and the RS232 port on the front of the relay.
The relay can be user selectable to either IEC 60870-5-103 or Modbus RTU as its communications standard.

Reydisp evolution

Reydisp Evolution is common to the entire range of Reyrolle numeric products, providing means for the user to apply settings to the relay, interrogate settings and retrieve stored data records.
Reydisp evolution utilises IEC 60870-5-103 protocol.

Settings

Current Inputs

Description	Range	Default
87/50 Element	Disabled, Enabled	Disabled
87/50 Setting	0.005, 0.006 …0.100In 0.105, 0.110 …2.000In	0.5xIn
87/50 Delay	0,0.01…60s	0.00s
CT 50 Element	Disabled, Enabled	Disabled
CT 50 Setting	0.001, 0.002 …0.100In 0.105, 0.110 …2.000In	0.10xIn
CT 50 Delay	0.1,0.2…60s	10.00s

Technical Data

For full technical data refer to the Performance Specification Section

Inputs and Outputs

DC Power Supply

Nominal	Operating Range
30V	24V to 37.5V dc
48/110V	37.5V to 137.5V dc
220V	175V to 286V dc

Auxiliary DC Supply – IEC 60255-11

Allowable superimposed ac component	≤ 12% of DC voltage
Allowable breaks/dips in supply (collapse to zero from nominal voltage)	≤ 20ms

D.C. Burden

Quiescent (Typical)	15
Max	27

Binary Input

Nominal Voltage	Operating Range
30V	18V to 37.5V
48V	37.5V to 60V
110V	87.5V to 137.5V
220V	175 to 280V

Performance

Minimum DC current for operation	48V 10mA 110V 2.25mA 220V 2.16mA
Reset/Operate Voltage Ratio	≥90%
Typical response time	<5ms
Typical response time when programmed to energise an output relay contact	<15ms
Minimum pulse duration	40ms

Output Contacts

Contact rating to IEC 60255-0-2
Carry continuously 5A ac or dc

Make and Carry

(limit L/R ≤ 40ms and V ≤ 300 volts)

For 0.5 sec	20A ac or dc
For 0.2 sec	30A ac or dc

Break

(limit ≤ 5A or ≤ 300 volts)

Ac resistive	1250VA
Ac inductive	25VA @ PF ≤ 0.4
Dc resistive	75W
Dc inductive	30W @ L/R ≤ 40 ms 30W @ L/R ≤ 40 ms

Minimum number of operations	1000 at maximum load
Minimum recommended load	0.5W, limits 10mA or 5V

Mechanical

Vibration (Sinusoidal)

IEC 60255-21-1 Class 1

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

Shock and Bump

IEC 60255-21-2 Class1

		Variation
Shock response	5 gn 11ms	≤ 5%
Shock withstand	15 gn 11ms	≤ 5%
Bump test	10 gn 16ms	≤ 5%

Seismic IEC 60255-21-3 Class 1

		Variation
Seismic Response	1gn	≤ 5%

Mechanical Classification

Durability	In excess of 10^6 operations

Ambient range	-10°C to +55°C
Variation over range	≤ 5%

Electrical Tests

Transient Overvoltage

IEC 60255-5

Between all terminals and earth or between any two independent circuits without damage or flashover	5kV 1.2/50µs 0.5J

Insulation

IEC 60255-5

Between all terminals and earth	2.0kV rms for 1 min
Between independent circuits	2.0kV rms for 1 min
Across normally open contacts	1.0kV rms for 1 min

High Frequency Disturbance

IEC 60255-22-1 Class III

	Variation
2.5kV Common (Longitudinal) Mode	≤ 5%
1.0kV Series (Transverse) Mode	≤ 5%

Electrostatic Discharge

IEC 60255-22-2 Class IV

	Variation
8kV contact discharge	≤ 5%

Conducted & Radiated Emissions

EN 55022 Class A (IEC 60255-25)

Conducted	0.15MHz – 30MHz
Radiated	30MHz – 1GHz

Conducted Immunity

(IEC 61000-4-6; IEC 60255-22-6)

	Variation
0.15MHz – 80MHz 10V rms 80% modulation	≤ 5%

Radiated Immunity

IEC60255-22-3 Class III

	Variation
80MHz to 1000MHz, 10V/m 80% modulated	≤ 5%

Fast Transient

IEC 60255-22-4 Class IV

	Variation
4kV 5/50ns 2.5kHz repetitive	≤ 5%

Surge Impulse

IEC 61000-4-5 Class IV; (IEC 60255-22-5)

	Variation
4KV Line-Earth (O/C Test voltage 10%) 2KV Line-Line	≤ 10

Environmental

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% RH

Protection Elements

General Accuracy

Reference Conditions	
General	IEC60255 Parts 6, 6A & 13
Auxiliary	Nominal
Frequency	50/60Hz
Ambient Temperature	20°C

Accuracy influencing factors

Temperature	
10 °C to +55 °C	≤ 5% variation
Frequency	
47 Hz to 52 Hz	Setting: ≤5% variation
57 Hz to 62 Hz	Operate Time: ≤ 5% variation

87/50-1, 87/50-2 Differential

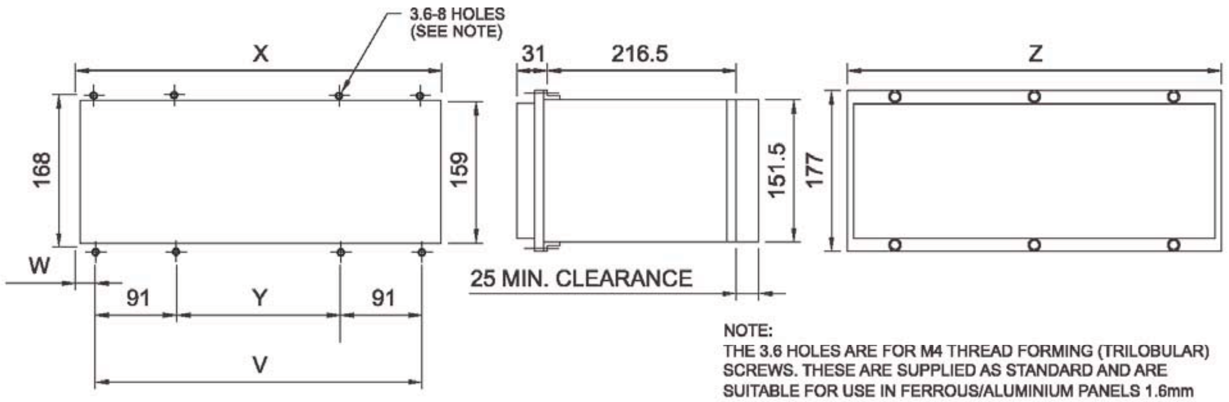
Pickup	± 5% of setting or ± 0.01 I_n whichever is the greater
Reset	0.95% of I_s
Repeatability	± 2%
Operate Time 2 x Setting 4 x Setting	Operate Time 1 cycle ± 5ms < 1 cycle
Time Delay	± 1% or ± 5ms whichever is the greater

CT-50 CT Supervision

Pickup	± 5% of setting or ± 0.01 I_n whichever is the greater
Reset	0 95% of I_s
Repeatability	± 2%
Operate Time 2 x Setting	Operate Time < 1.5 cycles
Time Delay	Time Delay setting +/- 5% or +/- 10 milliseconds, whichever is the greater**

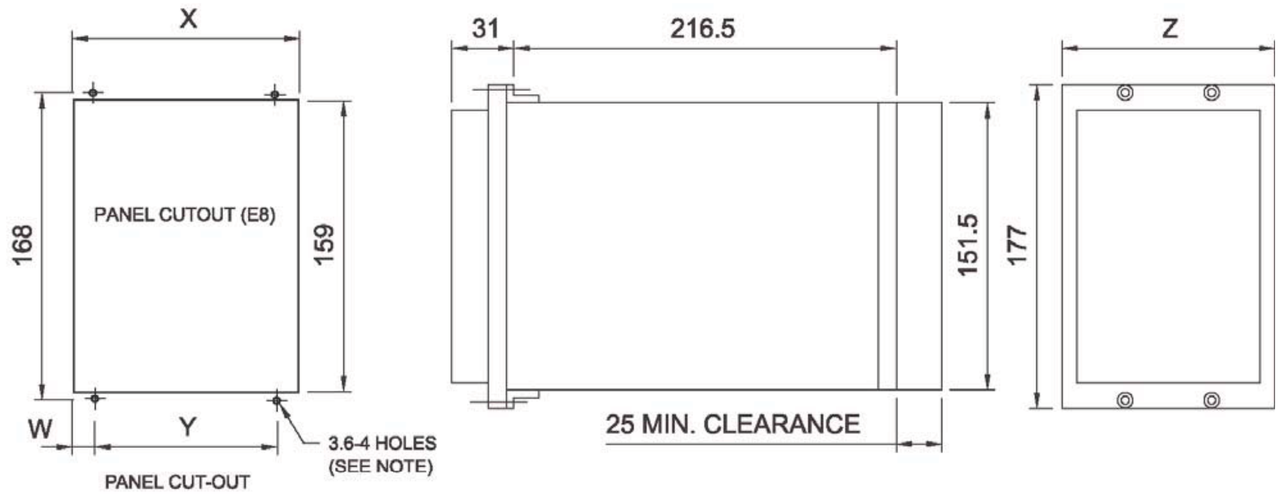
Case Dimensions

The 7SG12 is supplied in either a size 8 or size 12 case, depending on the binary input and output relay requirement.



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

Overall Dimensions and panel drilling for Epsilon E12 case



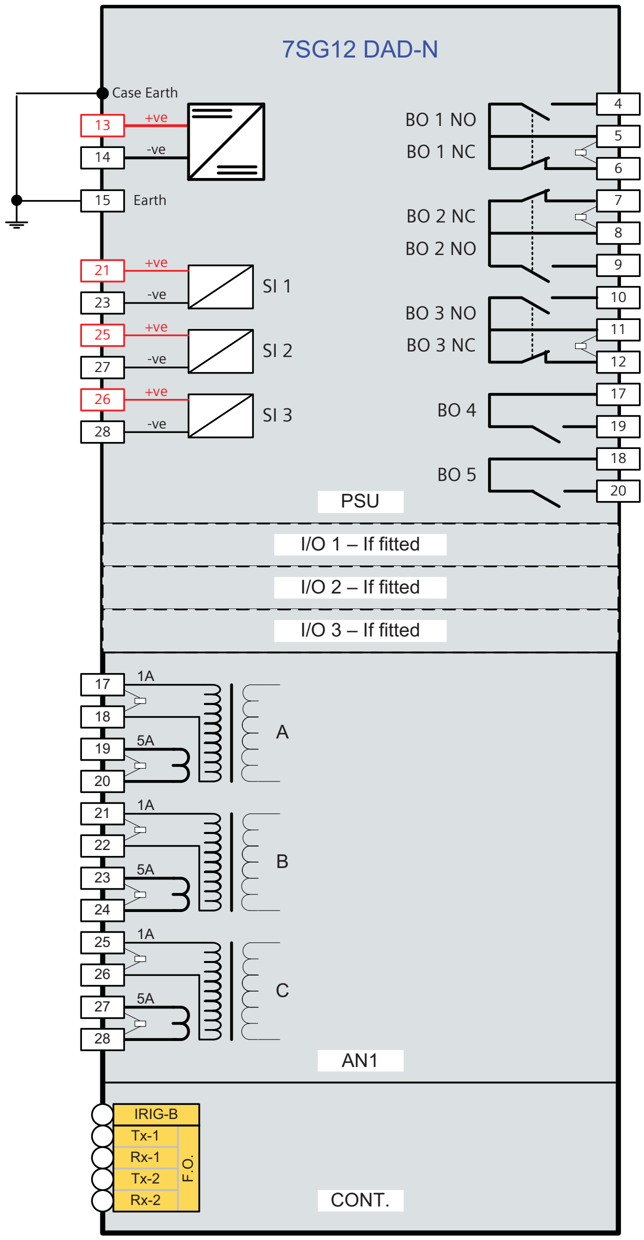
Overall Dimensions and panel drilling for Epsilon E8 case

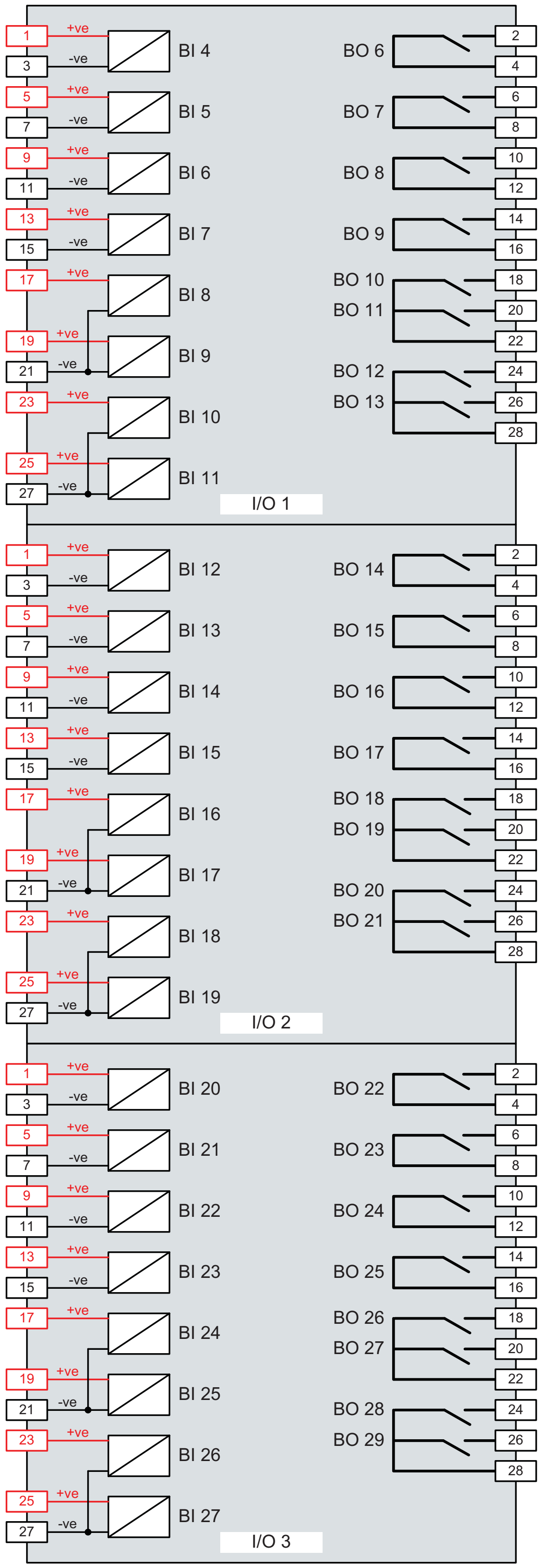
	E8	E12
V	–	286
W	9.75	9.25
X	201.5	304.5
Y	182	104
Z	207.5	311.5

All dimensions are in Millimetres

Fig 2. Case Dimensions

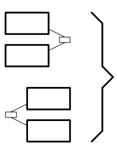
Connection Diagram





Notes:
1) Alternative output contact arrangement available:
3 Change-over + 22 normally open + 4 normally closed
2) NLR and stabilising resistors to be ordered separately.

BI = Binary Input
BO = Binary Output



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

Fig 3. Connection Diagram for 7SG1211 Relay

Typical Applications

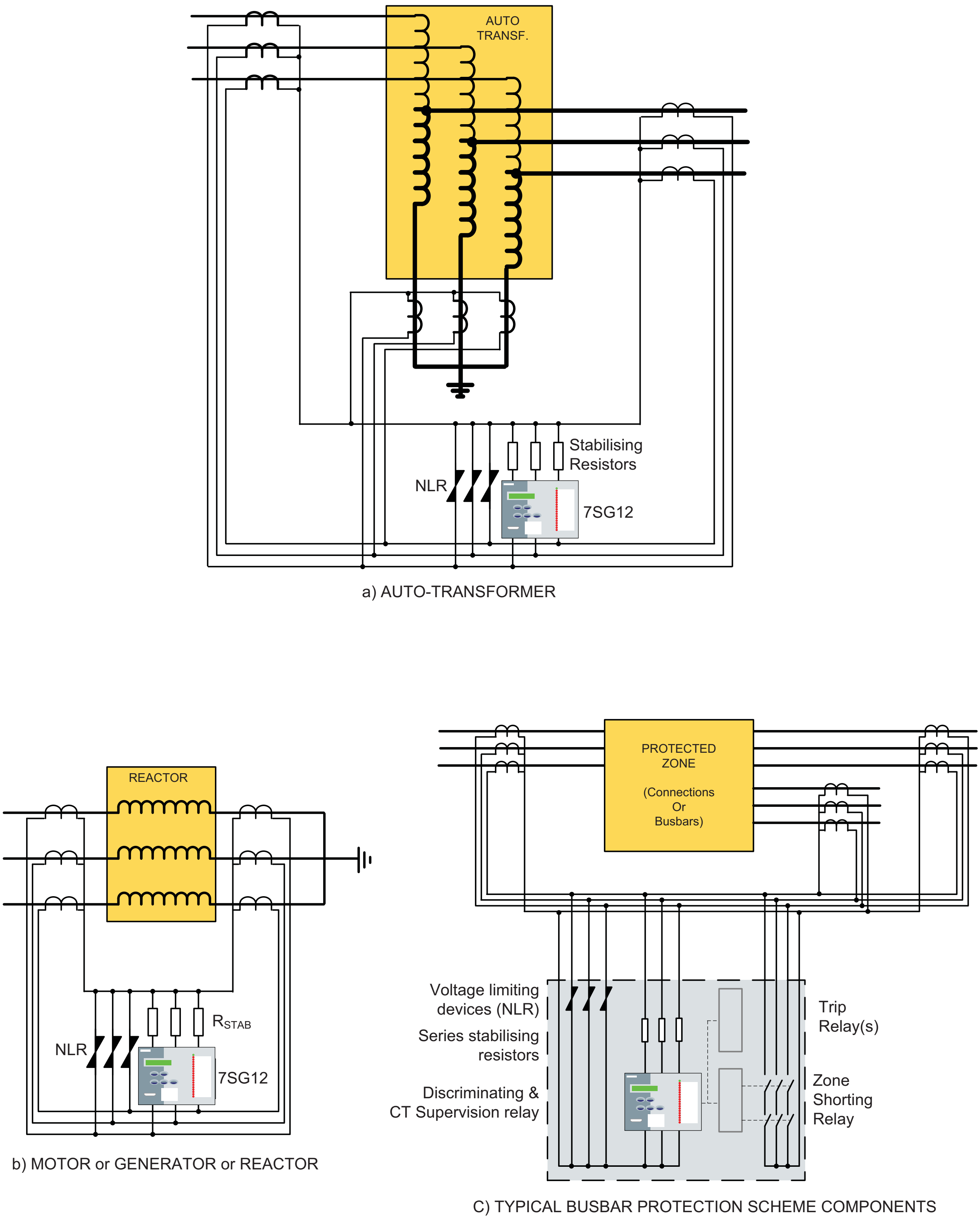


Fig 4. Typical Applications of 7SG1211 Relay

Ordering Information – 7SG12 DAD-N

Product description	Variants	Order No.
Nondirectional O/C Relay		**7 S G 1 2 □ □ - 0 □ □ □ □ - 0 □ B 0**
Numeric high impedance circulating current protection.		
	Relay type	
	100 series - High Impedance Circulating Current Protection	1
	Protection options	
	Option 01	1
	- CT supervision (CT50)	
	- Overall differential (87/50-1, 87/50-2)	
	Auxiliary supply /binary input voltage	
	30 V DC auxiliary, 30 V DC binary input	A
	30 V DC auxiliary, 48 V DC binary input	B
	48/110 V DC auxiliary, 30 V DC binary input	C
	48/110 V DC auxiliary, 48 V DC binary input [1])	D
	48/110 V DC auxiliary, 110 V DC low burden binary input	E
	220 V DC auxiliary, 110 V DC low burden binary input	F
	220 V DC auxiliary, 220 V DC low burden binary input	G
	I/O range [1])	
	3 Binary Inputs / 5 Binary Outputs (incl. 3 changeover)	A ... E
	11 Binary Inputs / 13 Binary Outputs (incl. 3 changeover)	B ... E
	19 Binary Inputs / 21 Binary Outputs (incl. 3 changeover)	C
	27 Binary Inputs / 29 Binary Outputs (incl. 3 changeover)	D
	Frequency	
	50Hz	1
	60Hz	2
	Nominal current	
	1/ 5 A	0
	Housing size	
	Case size E8 (4U high)	E
	Case size E12 (4U high)	G
	Case size E12 (4U wide, vertical)	H
	Communication interface	
	Fibre optic (ST-connector) / IEC 60870-5-103 or Modbus RTU	B

[1]) High burden 110V & 220V binary inputs compliant with ESI48-4 ESI 1 available via external dropper resistors with 48V binary input version

110/125 V application, order combination of the following resistor boxes to suit number of binary inputs

VCE:2512H10064 (9 inputs, 110V)

VCE:2512H10065 (5 inputs, 110V)

VCE:2512H10066 (1 inputs, 110V)

220/250 V application, order resistor box VCE:2512H10066 in addition

VCE:2512H10067 (5 inputs, 220V)

VCE:2512H10068 (1 inputs, 220V)

Refer to website for application note about ESI48-4 compliance

Reyrolle Protection Devices

7SG16 Ohmega

Distance Protection

Answers for energy

SIEMENS

7SG16 Ohmega

Distance Protection

Description

The 7SG16 Ohmega range of numeric distance relays combines the power and flexibility of microprocessor technology with the proven measuring techniques of previous impedance relays.
7SG16 relays provide mho or quadrilateral elements operating as a full scheme distance protection. All fault loops and all zones are continuously monitored providing superior fault coverage when compared to relays employing starters.
The distance protection is supplemented by integrated signalling schemes allowing the relays to be applied as unit protections.
Complementing the distance protection is a range of protection and control features, which are combined in the various models in the range to suit different applications.
Communications facilities using the IEC 60870 standard allow remote update of settings and provide access to the instrumentation, waveform storage and data collection features of the relay.
7SG163n series relays are suitable for distribution networks.
7SG164n series relays are suitable for sub-transmission networks.

Functional Overview

Standard

- 3 zone Distance protection with mho characteristics and earth fault compensation.
- Voltage Transformer supervision detects blown VT fuses by monitoring sequence components of voltage and current.
- Switch on to fault (SOTF) protection provides fast tripping if the CB is closed with earthing clamps left in place.
- Transient - free Highset overcurrent protection.
- Power swing detection can be set to block distance protection tripping.
- Fault locator provides the location of the fault in either miles, kilometres or line percentage.
- Permissive underreach and Permissive overreach Signalling Schemes are provided in addition to time stepped operation.
- Trip circuit supervision
- Self monitoring. Hardware and software watchdogs and data integrity checks ensure that the relay operates in the correct manner
-

Optional

- 4th distance protection zone
- Quadrilateral characteristics for earth fault
- Single-pole tripping
- Blocking, acceleration and loss of load schemes
- Stub protection
- Directional Earth-Fault (DEF) (High Resistance Earth-Fault) protection (single or dual) with Permissive Overreach and Blocking signalling schemes.
- Sensitive Earth-Fault protection
- Autoreclose (high-speed single-pole or three-pole as appropriate) with Reach extension scheme
- Check synchronising
- Overvoltage and undervoltage protection

Monitoring Functions

Analogue values can be displayed in primary or secondary quantities on the LCD screen.

- Primary current per phase
- Primary earth current
- Secondary current per phase
- Secondary earth current
- Primary phase voltages
- Secondary voltages
- Apparent power and power factor
- Real and reactive power
- Direction
- Autoreclose status
- Check sync line and bus voltages
- Check sync differential voltage
- Check sync phase difference
- Bus and line frequency
- Check sync slip frequency
- Output contacts
- Status inputs
- Trip counters
- Number of waveform and event records stored
- Time and Date

LED indication

32 user programmable LEDs are provided, these can be assigned to indicate fault and alarm status.

Description of Functionality

7SG16 relays use proven phase comparator techniques to provide full scheme distance protection with mho and quadrilateral characteristics. All fault loops are continuously measured, requiring no starter characteristics. This allows developing faults to be correctly cleared.
The reach of each zone is set independently with separate settings for phase and earth fault protection. Time delays may be set separately for phase and earth faults on all zones.
The distance protection can trip the CB directly, or a signalling scheme can be used to verify a trip decision. The section below describes the standard schemes available.
On some models the signalling schemes include current reversal detection, circuit breaker echo and weak infeed detection to ensure correct operation of the relay.

Power swing

System power swings can lead to an apparent drop in impedance, due to heavy load variation or remote system faults, which can lead to the measured impedance entering a protection zone and causing operation. This can be detected using two dedicated impedance characteristics that encompass the protection zones. They are arranged so that one is larger than the other, a fault will cause them to pick up in quick succession while a power swing will cause a longer delay between the outer element picking up and the inner one.
Once a power swing is detected the distance protection can be inhibited.

Switch on to fault

Inadvertent closing of the circuit breaker with the earth clamps left in place causes a 3 phase short circuit fault. Switch on to fault (SOTF) protection detects this condition and provides instantaneous fault clearance. Two styles of SOTF are provided, AC SOTF is for use where line VTs are fitted, DC SOTF is for use with bus VTs.

Voltage transformer supervision

Loss of supply from the VTs can cause unwanted operations of the distance protection. To avoid this, the sequence component voltages present on the voltage inputs are monitored. During healthy conditions no residual or NPS voltage is present. If a VT fuse fails, residual and NPS voltage are generated with no increase in the corresponding sequence current. The VT supervision operates and raises an alarm. If required, it can also inhibit operation of the distance protection.

Circuit breaker fail (50BF)

The circuit breaker fail function operates by monitoring the current following a trip signal and issues an output if the current does not cease within a specified time interval. This output contact can be used to backtrip an upstream circuit breaker. The circuit breaker fail function has a fast reset feature.

Optional Functionality

Phase-fault (highset) overcurrent

A transient free phase-fault definite-time overcurrent element is provided, which operates with a DTL characteristic.

Directional earth-fault

To achieve effective clearance of high impedance earth-faults a directional earth-fault protection is available. This provides a directional element operating from residual current and voltage, and an overcurrent element operating from the residual current.
A second DEF element can be provided to detect faults in forward and reverse directions.
A variety of signalling schemes are available for use with DEF protection – see section on ‘Application’ below.

Sensitive earth-fault

A non-directional sensitive earth fault protection operating from residual current is available. It can be set down to 2% of nominal current to allow clearance of very high impedance earth faults. A definite-time delay is provided to allow the SEF to be graded with the distance protection.

Overvoltage and undervoltage

Two overvoltage elements and two undervoltage elements are available, with definite-time delays. These monitor line voltages providing alarm and trip levels of operation.

Autoreclose

An integrated autorecloser is available. This provides delayed or high-speed autoreclose following a zone 1 or scheme-generated trip.
The 7SG163n, with three-pole tripping only, provides a single-shot three-pole autoreclose.
The 7SG164n recloser can provide up to 2 reclosing shots. A variety of sequences may be set up, to allow trips and recloses in different combinations of single- and three-pole.

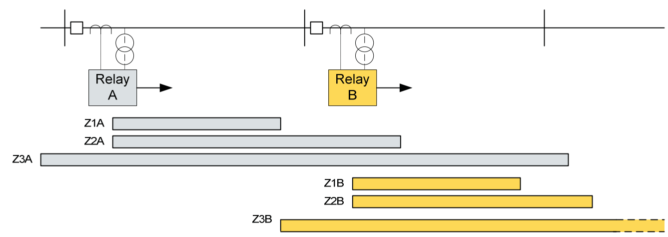
Check Synchronising

An integrated synchroniser is available, which prevents the circuit breaker being closed if the two power systems are not synchronised with one another.

Application

Time Stepped Distance

Time delayed Zones 2,3 & 4. Direct intertripping can be applied.

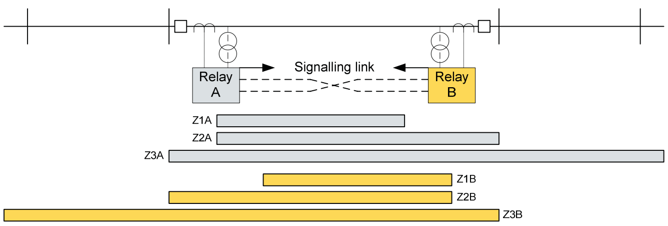


Permissive Underreach (PUR)

Zone 1 is typically set to give instantaneous coverage up to 80% of the line length and aided tripping using accelerated Zone 3 (7SG163n) or Zone 2 (7SG164n) for the remaining 20%.

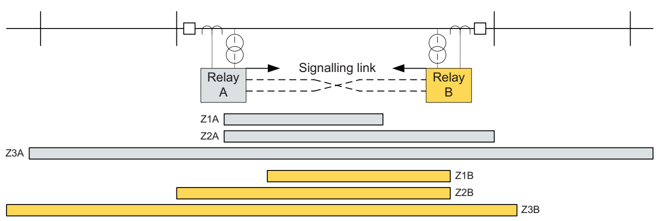
Zone 2 Accelerated (PA)

Zone 1 is set to give instantaneous coverage typically up to 80% of the line length and aided tripping using accelerated Zone 2 for the remaining 20%.



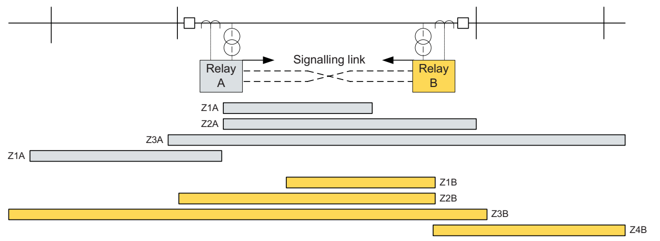
Blocking Overreach Type 1 (without Z4)

Zone 2 is set to overreach giving instantaneous coverage over 100% of the line length. It is blocked for out of zone faults by the remote Z3.Z2 elements.



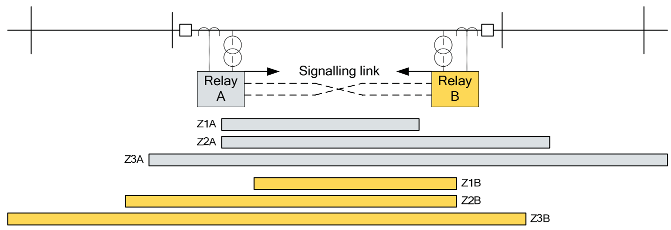
Blocking Overreach Type 2 (Zone 4)

Zone 2 is set to overreach giving instantaneous coverage over 100% of the line length. It is blocked for out of zone faults by the remote Zone 4 reverse element.



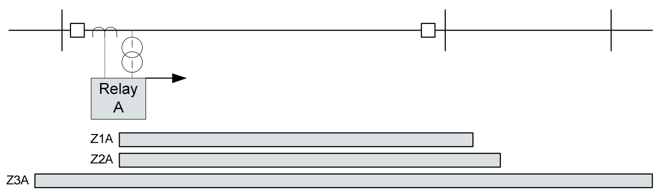
Permissive Overreach Type 2 (POR2)

Zone 2 is set to overreach giving instantaneous coverage of 100% of the line length with a permissive signal from the remote Zone 2.



Reach extension (RE)

Instantaneous coverage up to Zone 1 extended setting for the first fault detected with delayed stepped distance for persistent faults. For relays with autoreclose, instantaneous coverage with Zone 1 can be extended for the initial fault. Time stepped distance is applied for persistent faults.



DEF Permissive Overreach (DPOR)

Overreach DEF to give short time delayed coverage over 100% of the line length for earth faults, with a permissive signal from the remote DEF.

Current Reversal Logic

This logic is used in conjunction with permissive overreach schemes applied to dual circuit lines. Tripping of the faulted feeder at one end may result in sudden reversal of fault current in the adjacent feeder. This may otherwise cause false tripping of the healthy adjacent feeder due to delayed resetting of the permissive signal.

Data Storage and Communication

Sequence of event records

Up to 500 events are stored and time tagged to 1ms resolution. These are available via the communications.

Fault records

The last 10 fault records are available from the fascia with time and date of trip, measured quantities and type of fault.

Disturbance recorder

The waveform recorder may be triggered from a protection function or external input and has a configurable pre-fault trigger. Up to 10 fault waveforms may be stored with associated analogue and digital values.

Communications

Two fibre-optic communications ports are provided on the rear of the relay. They are optimised for 62.5/125µm glass-fibre, with BFOC/2.5 (ST®) bayonet style connectors.
In addition users may interrogate the relay locally with a laptop PC and the 25-pin female D-type connector RS232 port on the front of the relay.
The relay data comms are compliant with IEC 60870-5-103 communications standard.

Reydisp Evolution

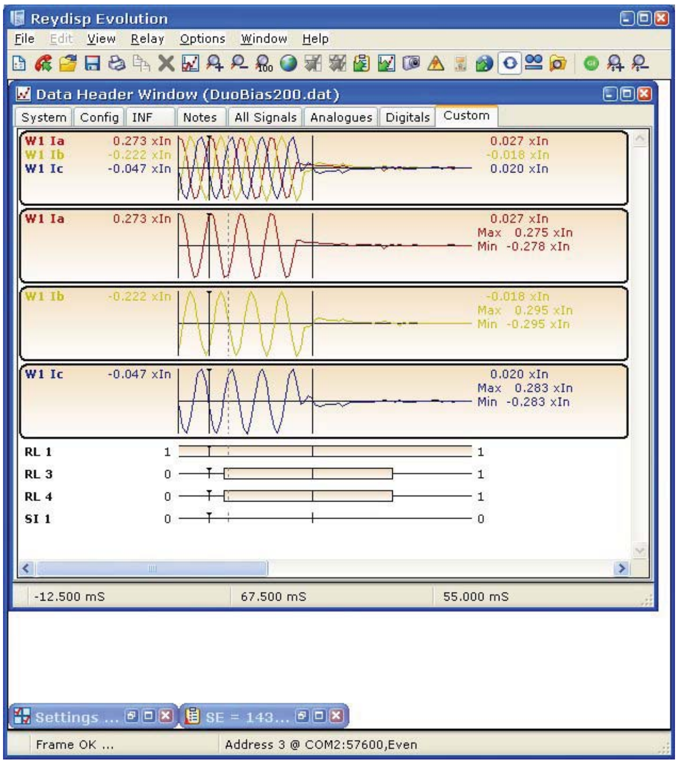


Fig 1. Disturbance Records in Reydisp Evolution

Reydisp Evolution is common to the entire range of Reyrolle numeric products. It provides a means for the user to apply settings to the relay, interrogate settings and retrieve disturbance waveforms.
Reydisp Evolution utilises IEC 60870-5-103 protocol.

Technical Data

For full technical data refer to the Performance Specification of the Technical Manual.

Inputs and Outputs

Characteristic energising quantity

Performance data To IEC 60255-3

AC Current/Voltage	Frequency
1A, 2A or 5A ,3-phase	50 / 60Hz
63.5V line-neutral, 3-phase	

Current Inputs

Thermal Withstand	
12A	continuous
15A	10 minutes
30A	2 minutes
240A	2 Seconds
340A	1 Second
625A peak	I Cycle

Burden	
5A	≤ 0.625 VA
	≤ 0.1 VA
1A	≤ 0.025 VA

Note: Burdens are measured at nominal rating.

Voltage Inputs: Thermal Withstand

Thermal Withstand	
3.5 x Vn	continuous

Burden	
	≤ 0.01 VA

Note: Burdens are measured at nominal rating.

DC Auxiliary Supply

Nominal Voltage	Operating Range V dc
30V	24 to 37.5V
48/110V	37.5 to 137.5
220 V	178.0 to 280.0
110/220V	88 to 275

Operate State	Burden
Quiescent (Typical)	15 W
Maximum	27 W

Allowable superimposed ac component	≤12% of dc voltage
Allowable breaks/dips in supply (collapse to zero from nominal voltage)	≤20 ms

Binary inputs

Nominal Voltage	Operating Range V dc
30V	18 to 37.5V
48V	37.5 to 60V
110 V	87.5 to 137.5V
220V	175 to 280V

The binary input voltage need not be the same as the main energising voltage.

Binary input performance

Parameter	Value
Minimum DC current for operation (30V and 48V inputs only)	10 mA
Reset/Operate Voltage Ratio	≥ 90 %
Typical response time	< 5 ms
Typical response time when used to energise an output relay contact	< 15 ms
Minimum pulse duration	40 ms

Binary inputs will not respond to the following:
250V RMS 50/60 Hz applied for two seconds through a 0.1μF capacitor.
500 V RMS 50/60 Hz applied between each terminal and earth.
Discharge of a 10μF capacitor charged to maximum DC auxiliary supply voltage.

Output Relays

Carry continuously	5A ac or dc
Make and carry (L/R ≤ 40 ms and V ≤ 300V)	20A ac or dc for 0.5s 30A ac or dc for 0.2s
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 ≤ 40ms 50 W at L/R ≤ 10ms
Minimum number of operations	1000 at maximum load
Minimum recommended load	0.5 Watt limits 10mA or 5V

Mechanical

Vibration (Sinusoidal)

IEC 60255-21-1 Class 1

0.5 gn, Vibration response	≤ 5% variation
1.0 gn, Vibration endurance	

Shock Bump

IEC 60255-21-2 Class 1

5 gn, Shock response, 11ms	≤ 5% variation
15 gn, Shock withstand, 11ms	
10 gn, Bump test, 16ms	

Seismic

IEC 60255-21-3 Class 1

1 gn, Seismic response	≤ 5% variation

Mechanical Classification

Durability	In excess of 10^6 operations

Electrical Tests

Insulation

IEC 60255-5 RMS levels for 1 minute

Between all terminals and earth	2.0 kV
Between 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 flashover	5 kV 1.2/50 µs 0.5 J

High Frequency Disturbance

IEC 60255-22-1 Class III

2.5kV, Longitudinal mode	≤3% variation
1.0kV, Transverse mode	

Electrostatic Discharge

IEC 60255-22-2 Class III

8kV, Contact discharge	≤5% variation

Fast Transient

IEC 60255-22-4Class IV

4kV, 5/50ns, 2.5 kHz, repetitive	≤3% variation

Radio Frequency Interference

IEC 60255-22-3

10 V/m, 80 to 1000 MHz	≤5% variation

Conducted RFI

IEC 60255-22-6

10 V, 0.15 to 80 MHz	≤5% variation

Conducted limits

IEC 60255-25

Frequency Range	Limits dB(µV)	
	Quasi-peak	Average
0.15 to 0.5 MHz	79	66
0.5 to 30 MHz	73	60

Radiated limits

IEC 60255-25

Frequency Range	Limits at 10 m Quasi-peak, dB(µV/m)
30 to 230 MHz	40
230 to 10000 MHz	47

Environmental

Temperature

IEC 60068-2-1/2

Operating	-10 °C to +55 °C
Storage	-25 °C to +70 °C

Humidity

IEC 60068-2-3

Operational test	56 days at 40 °C and 93% RH

Protection Elements

General Accuracy

Reference Conditions	
General	IEC60255 Parts 6, 6A & 16
Auxiliary	Nominal
Frequency	50Hz
Ambient Temperature	20°C
Impedance setting	6 Ohms
Line angle	75^0
Z_0/Z_1	2.5

Accuracy influencing factors

Temperature	
10 °C to +55 °C	≤ 5% variation
Frequency	
47 Hz to 52 Hz	Setting: ≤5% variation
57 Hz to 62 Hz	Operate Time: ≤ 5% variation

Distance Protection

Impedance Reach	
Z_N setting	0.1 to 250 Ω
Φ_N Angle	0 to 90° step 5°
Accuracy (Z_N = 6Ω, mho characteristic, 3-phase fault)	
Z_N^1 ($\Phi = \Phi_N \pm 3°$)	$Z_N \pm$ 5% or 0.1 Ω for SIR <30
	$Z_N \pm$ 10% or 0.1 Ω for SIR ≥30
Z ($\Phi = \Phi_N \pm 10°$) Z ($0° \le \Phi \le 90°$)	Z_N^1 x $\cos(\Phi_N - \Phi) \pm 0.05 Z_N$ Ω Z_N^1 x $\cos(\Phi_N - \Phi) \pm 0.1 Z_N$ Ω
Accuracy (all Z_N)	class index plus an error not exceeding class index
Transient overreach	class index plus an error not exceeding class index
Operating time (see Technical Manual)	
Operating time	min. 17ms (7SG164n)
	min. 35ms (7SG163n)
Delay (additional to operating time)	
Setting	0 to 10 s step 10 ms
Accuracy	Setting ± 1 % or 10

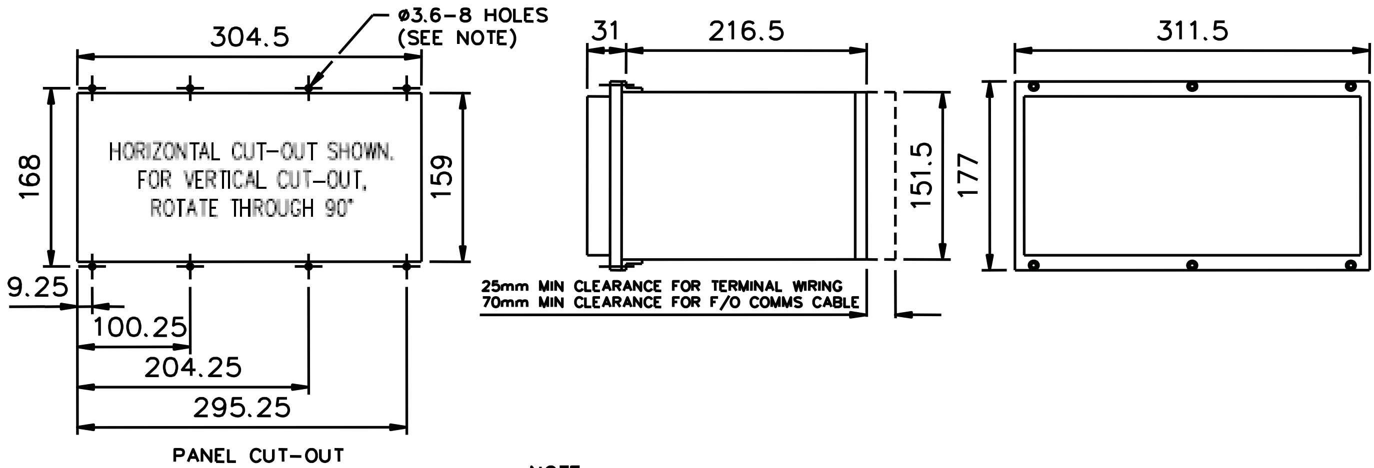
Directional earth-fault protection

Characteristic	DTL
Level	
Settings	0.05 to 4.00 x In
Accuracy	Operate: Setting ± 5%
	Reset:≥ 95% of operate level
Delay	
Settings	0 to 20s steps 1ms
Accuracy	Setting ± 1% or 5ms

Phase-fault (highset) overcurrent protection

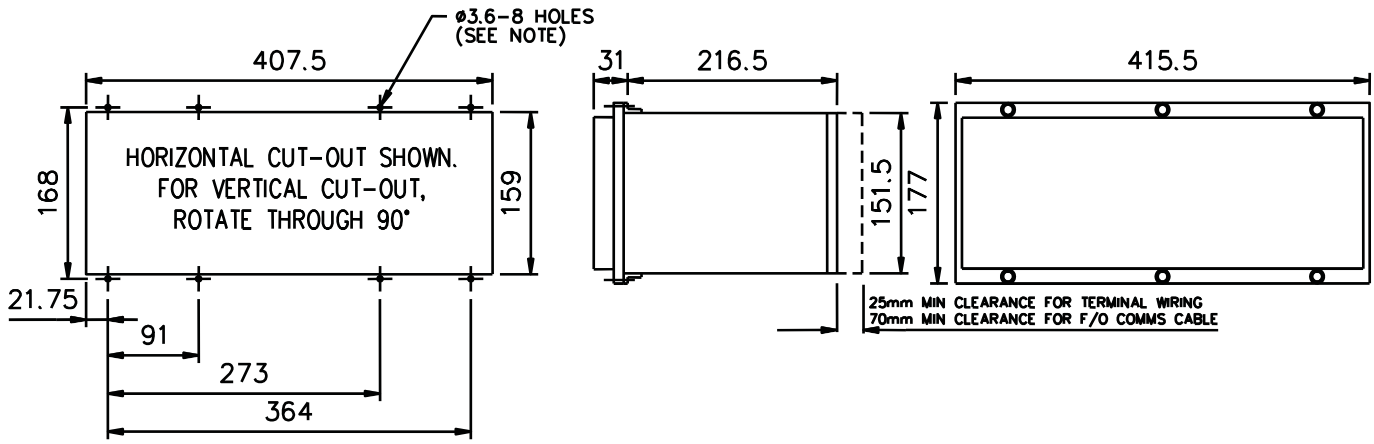
Characteristic	DTL
Level	
Settings	0.1 to 35.0 x In
Accuracy	Operate: Setting ± 5%
	Reset:≥ 95% of operate level
Delay	
Settings	0 to 1000ms
Accuracy	Setting ± 1% or 10ms

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/ALUMINIUM 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).

Fig 2. E12 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/ALUMINIUM 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).

Fig 3. E16 Case Dimensions

Connection Diagram 7SG16 Ohmega

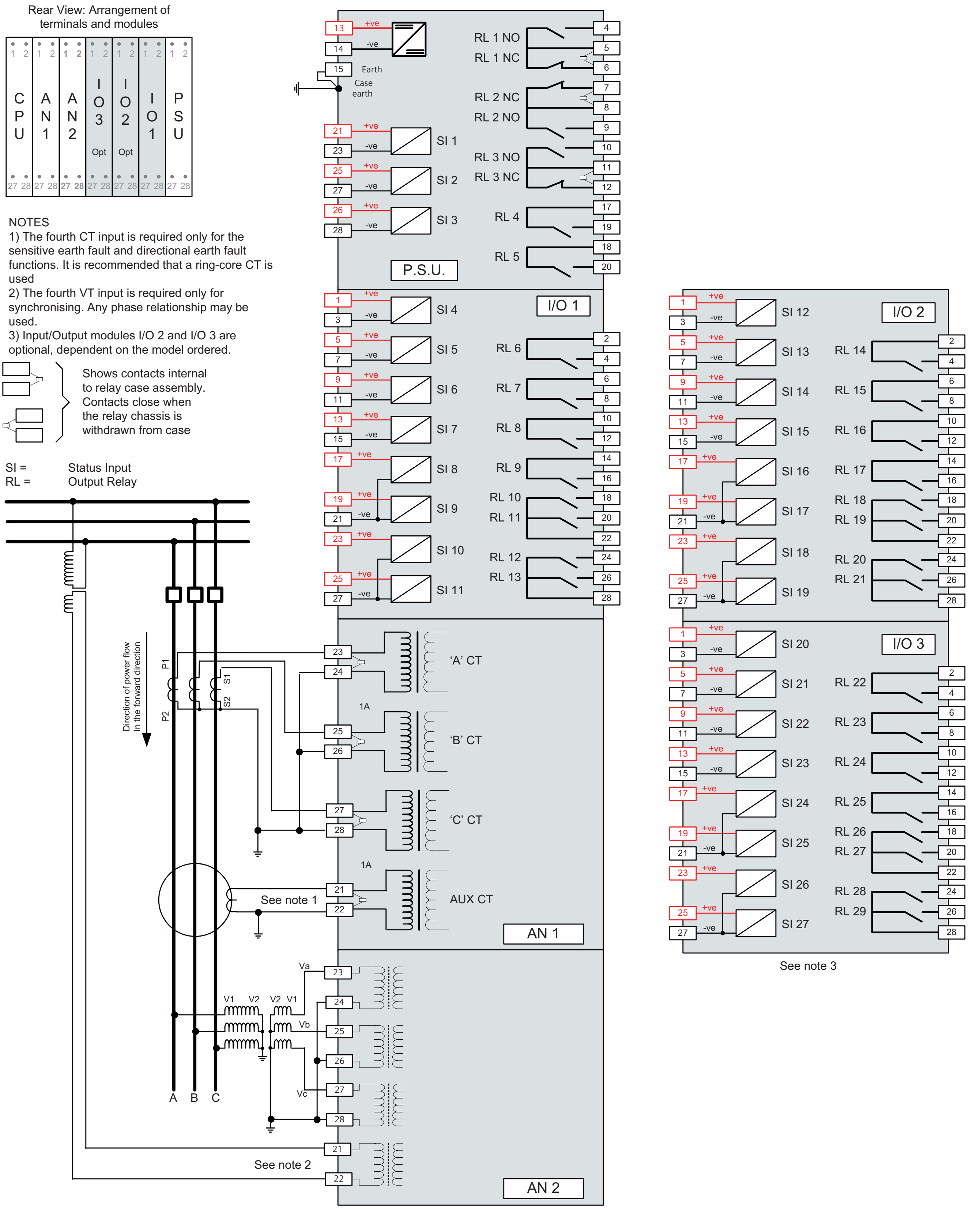


Fig 4. 7SG16 Connection Diagram

Ordering Information 7SG163 Ohmega

Product description	Variants	Order No.
Ohmega (300 series)		**7 S G 1 6 □ □ - 0 □ □ □ □ - □ □ □ 0**
Distance protection for sub-transmission and distribution networks .		
	Relay type OHMEGA 300 series - Standard functionality Numeric distance protection with a range of integrated standard functions. All relays can accommodate 1, 2 and 5A inputs and communications using IEC60870-5-103 protocol. Distance Protection (21/21N) - Phase and earth-fault mho characteristics - Loss of load - Power swing blocking (68) - Switch on to fault - Fault locator (21FL) Distance signalling schemes - Time-stepped distance, permissive underreach, permissive overreach - Accelerated underreach - Current reversal, CB echo, weak infeed Auxiliary functions - VT supervision - Phase-fault overcurrent (50) - Trip circuit supervision (74TC)	3
	Protection options OHMEGA 305 - Relay specific functionality Distance Protection (21/21N) - Three mho impedance zones	1
	OHMEGA 308 - Relay specific functionality Distance Protection (21/21N) - Three mho impedance zones - Earth-fault quadrilateral characteristics Directional (high impedance) earth-fault (67N) - IDMTL direct tripping and permissive overreach schemes - Current reversal and CB echo Auxiliary functions - Single shot auto-reclose (79) - Check synchronising (25) - Sensitive earth-fault (50G) - Power swing blocking (68) - Two stage DTL undervoltage (27) - Two stage DTL overvoltage (59)	2
	OHMEGA 311 - Relay specific functionality Distance Protection (21/21N) - Three mho impedance zones Directional (high impedance) earth-fault (67N) - IDMTL direct tripping and permissive overreach schemes - Current reversal and CB echo Auxiliary functions - Single shot auto-reclose with reach extension scheme (79) - Check synchronising (25) - Broken conductor - Circuit breaker fail (50BF)	3 ... 1

(continued on following page)

Ordering Information 7SG163 Ohmega

Product description	Variants	Order No.
Ohmega (300 series)		**7 S G 1 6 □ □ - 0 □ □ □ □ - □ □ □ 0**
(continued from previous page)		
	Protection options	
	OHMEGA 314 - Relay specific functionality	4 1
	Distance Protection (21/21N) - Four mho impedance zones - Earth-fault quadrilateral characteristics Distance signalling schemes - Blocking overreach Dual directional (high impedance) earth-fault (67N) - IDMTL direct tripping and permissive overreach schemes - Blocking scheme - Current reversal, CB echo, weak infeed Auxiliary functions - Single shot auto-reclose with reach extension scheme (79) - Check synchronising (25) - Sensitive earth-fault (50G) - Two stage DTL undervoltage (27) - Two stage DTL overvoltage (59)	
	OHMEGA 315 - Relay specific functionality	5 1
	Distance Protection (21/21N) - Four mho impedance zones - Earth-fault quadrilateral characteristics - Overcurrent guard Distance signalling schemes - Blocking overreach Dual directional (high impedance) earth-fault (67N) - IDMTL direct tripping and permissive overreach schemes - Blocking scheme - Current reversal, CB echo, weak infeed Auxiliary functions - Single shot auto-reclose with reach extension scheme (79) - Check synchronising (25) - Sensitive earth-fault (50G) - Two stage DTL undervoltage (27) - Two stage DTL overvoltage (59)	
	Auxiliary supply /binary input voltage	
	30 V DC auxiliary, 30 V DC binary input	A
	30 V DC auxiliary, 48 V DC binary input	B
	48/110 V DC auxiliary, 30 V DC binary input	C
	48/110 V DC auxiliary, 48 V DC binary input [1])	D
	48/110 V DC auxiliary, 110 V DC low burden binary input	E
	220 V DC auxiliary, 110 V DC low burden binary input	F
	220 V DC auxiliary, 220 V DC low burden binary input	G
	110/220 V DC auxiliary, 110 V DC low burden binary input	L
	I/O range	
	11 Binary Inputs / 13 Binary Outputs (incl. 3 changeover)	B
	19 Binary Inputs / 21 Binary Outputs (incl. 3 changeover) [2])	C
	27 Binary Inputs / 29 Binary Outputs (incl. 3 changeover) [2])	D
	11 Binary Inputs /29 Binary Outputs (incl. 3 changeover) [2])	F

(continued on following page)

Ordering Information 7SG163 Ohmega

Product description	Variants	Order No.
Ohmega (300 series)		**7 S G 1 6 □ □ - 0 □ □ □ □ - □ □ □ 0**
(continued from previous page)		
	Frequency	
	50Hz	1
	60Hz	2
	Nominal current	
	1, 2 or 5 A	1
	Voltage inputs	
	63/110 V AC	1
	Housing size	
	Case size E12 (4U high)	G
	Case size E12 (4U wide, vertical)	H
	Case size E16 (4U high)	J
	Case size E16 (4U wide, vertical)	K
	Communication interface	
	Fibre optic (ST-connector) / IEC 60870-5-103	A

[1]) High burden 110V & 220V binary inputs are available via external dropper resistors with 48V binary input version

110/125 V application, order combination of the following resistor boxes to suit number of binary inputs

VCE:2512H10064 (9 inputs, 110V)

VCE:2512H10065 (5 inputs, 110V)

VCE:2512H10066 (1 inputs, 110V)

220/250 V application, order resistor box 2512H10066 in addition

VCE:2512H10067 (5 inputs, 220V)

VCE:2512H10068 (1 inputs, 220V)

[2]) Case size E16

Ordering Information 7SG164 Ohmega

Product description	Variants	Order No.
Ohmega (400 series) Distance protection for sub-transmission networks		7 S G 1 6 □ □ - 0 □ □ □ □ - □ □ □ 0
	<u>Relay type</u>	
	<u>OHMEGA 400 series - Standard functionality</u> Numeric distance protection (Sub-transmission) with a range of integrated standard functions. All relays can accommodate 1, 2 and 5A inputs and communications using IEC60870-5-103 protocol. <u>Distance Protection (21/21N)</u> - Four mho impedance zones - Phase and earth-fault mho characteristics - Power swing blocking (68) - Switch on to fault - Fault locator (21FL) <u>Distance signalling schemes</u> - Time-stepped distance, permissive underreach, permissive overreach - Blocking overreach <u>Auxiliary functions</u> - VT supervision - Phase-fault overcurrent (50)	4
	<u>Protection options</u>	
	<u>OHMEGA 402 - Relay specific functionality</u> Distance Protection (21/21N), three pole tripping - Stub protection	1
	<u>OHMEGA 406 - Relay specific functionality</u> <u>Distance Protection (21/21N)</u> - Earth-fault quadrilateral characteristics - Single pole tripping - Loss of load - Stub protection <u>Distance signalling schemes</u> - Current reversal, CB echo, weak infeed <u>Directional (high impedance) earth-fault (67N)</u> - DTL direct tripping and permissive overreach schemes - Current reversal and CB echo - Weak infeed <u>Auxiliary functions</u> - Two shot 1P/3P auto-reclose with reach extension scheme (79) - Check synchronising (25)	2 1
	<u>OHMEGA 408 - Relay specific functionality</u> <u>Distance Protection (21/21N)</u> - Earth-fault quadrilateral characteristics - Single pole tripping <u>Distance signalling schemes</u> - Current reversal, CB echo, weak infeed - Thermal overload	3 1

(continued on following page)

Ordering Information 7SG164 Ohmega

Product description	Variants	Order No.
Ohmega (400 series)		**7 S G 1 6 □ □ - 0 □ □ □ □ - □ □ □ 0**
(continued from previous page)		
	Auxiliary supply /binary input voltage	
	30 V DC auxiliary, 30 V DC binary input	A
	30 V DC auxiliary, 48 V DC binary input	B
	48/110 V DC auxiliary, 30 V DC binary input	C
	48/110 V DC auxiliary, 48 V DC binary input 1)	D
	48/110 V DC auxiliary, 110 V DC low burden binary input	E
	220 V DC auxiliary, 110 V DC low burden binary input	F
	220 V DC auxiliary, 220 V DC low burden binary input	G
	110/220 V DC auxiliary, 110 V DC low burden binary input	L
	I/O range	
	11 Binary Inputs / 13 Binary Outputs (incl. 3 changeover)	B
	19 Binary Inputs / 21 Binary Outputs (incl. 3 changeover) 2)	C
	27 Binary Inputs / 29 Binary Outputs (incl. 3 changeover) 2)	D
	11 Binary Inputs /29 Binary Outputs (incl. 3 changeover) 2)	F
	Frequency	
	50Hz	1
	60Hz	2
	Nominal current	
	1, 2 or 5 A	1
	Voltage inputs	1
	63/110 V AC	
	Housing size	
	Case size E12 (4U high)	G
	Case size E12 (4U wide, vertical)	H
	Case size E16 (4U high)	J
	Case size E16 (4U wide, vertical)	K
	Communication interface	
	Fibre optic (ST-connector) / IEC 60870-5-103	A

1) High burden 110V & 220V binary inputs are available via external dropper resistors with 48V binary input version

110/125 V application, order combination of the following resistor boxes to suit number of binary inputs

VCE:2512H10064 (9 inputs, 110V)

VCE:2512H10065 (5 inputs, 110V)

VCE:2512H10066 (1 inputs, 110V)

220/250 V application, order resistor box 2512H10066 in addition

VCE:2512H10067 (5 inputs, 220V)

VCE:2512H10068 (1 inputs, 220V)

2) Case size E16

Reyrolle Protection Devices

7SG24 Sigma

Communication Interface

Answers for energy

SIEMENS

7SG24 Sigma

Communication Interface

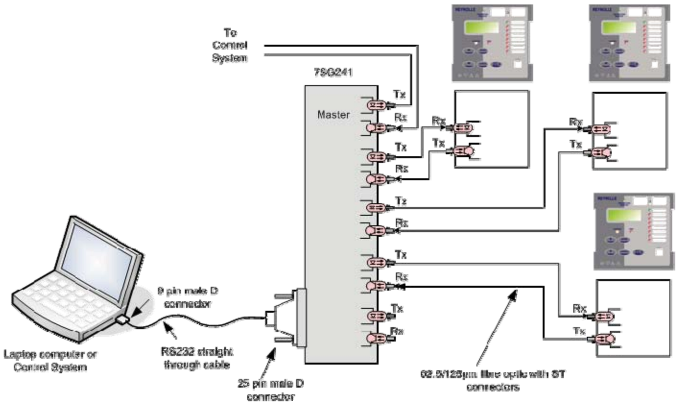


Fig 1. 7SG241 Connection Diagram

Description

The 7SG24 provide a range of relay communication interface devices between RS232 electrical and fibre optic connections.
The 7SG24 can be used to provide a single point of communication with a number of relays within fibre optic systems having a loop connected or star connected topology.

Functional Overview

7SG241

Fibre optic hub with 5, 10, 20 or 30 channels (channel 1 is always the master channel)
Power and channel activity indicators.
Front mounted RS232 connection with automatic switchover from rear fibre master channel.
Light off and light on modes.
Suitable for glass fibres up to 3km in length

7SG243

Provides a dual RS232 to fibre optic interface for use with a single relay or ring of relays.
Power indicator
Powered from RS232 pc connection
Input for external power supply

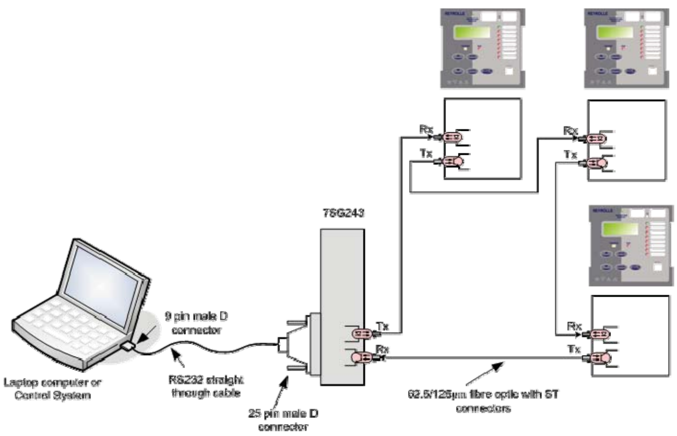


Fig 2. 7SG243 Connection Diagram

7SG244

Provides a RS232 to fibre optic interface.
Powered from RS232 pc connection
Input for external power supply

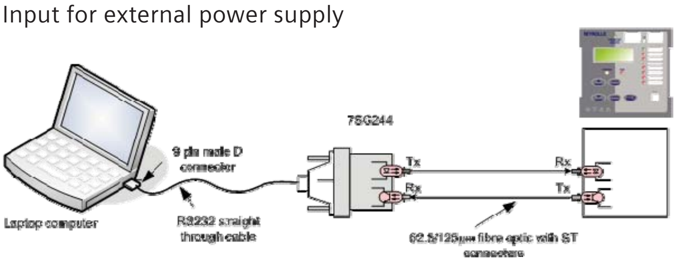


Fig 3. 7SG244 Connection Diagram

Technical Information

Optical Interface

Connectors	ST
Optimised for use	62.5/125µm
Wavelength	1300nm
Launch power	-24.7 max to -20.7 min dbm
Receiver sensitivity	-24 to -9 dbm

Electrical Interface

Type	RS232
Optimised for use	25 way female D-type
Pin out	
2	Rx (Input)
3	Tx (output)
4-5	RTS/CTS (internally connected)
6-8-20	DSR/CD/DTR (internally connected)
7	Ground
9	External power (6-15V)

Auxiliary power supply input 7SG243 & 7SG244

Type	Jack socket tip +ve
Auxiliary input	6-15V dc 50mA

Auxiliary power supply input 7SG241

Type	Rear terminals 13+ve 14-ve
Nominal 48/110v 220v	Operating Range V dc 37.5 to 137.5 178.0 to 280.0
Burden Quiesent (typical)	15w

Ordering Information – 7SG241 Sigma 1

Product description	Variants	Order No.
Sigma 1		**7 S G 2 4 □ 0 - □ □ A 0 0 - □ □ A 0 - □ □ □**
	<u>Relay type</u>	
	Fibre Optic hub	**1**
	<u>Channel options</u>	
	5 channel	**1** … **C**
	10 channel	**3** … **C**
	20 channel	**5** … **D**
	30 channel	**7** … **E**
	<u>Auxiliary supply</u>	
	48/110V DC auxiliary	**A**
	220V DC auxiliary	**B**
	<u>Communication interface</u>	
	Fibre optic (ST connector)	**1**
	<u>Housing size</u>	
	Case size E4	**C**
	Case size E6	**D**
	Case size E8	**E**

Ordering Information – 7SG243 Sigma 3

Product description	Variants	Order No.
Sigma 3		**7 S G 2 4 □ 0 - □ □ A 0 0 - 0 □ A 0 - □ □ □**
	<u>Relay type</u>	
	Fibre Optic to RS232 converter providing two RS232 interfaces.	**3**
	<u>Channel options</u>	
	1 channel, ST connectors for glass fibre	**3**
	<u>Auxiliary supply</u>	
	External – see note 1	**A**
	<u>Housing size</u>	
	Case special – see note 2	**A**

1) Self powered from PC or via pin 9 on D connector or optional external supply 6-15V DC @50mA to jack socket (tip +ve)
2) Housing Dimensions – 4U high, size 2 width panel mounted, 140mm depth, excluding fibre bend radius
3) Housing Dimensions – 85mm (l) x 58mm (w) x 19mm (h)

Ordering Information – 7SG244 Sigma 4

Product description	Variants	Order No.
Sigma 4		**7 S G 2 4 □ 0 - □ □ A 0 0 - 0 □ A 0 - □ □ □**
	Relay type Fibre Optic to RS232 converter providing one RS232 interface.	**4**
	Channel options 1 channel, ST connectors for glass fibre	**3**
	Auxiliary supply External – see note 1	**A**
	Housing size Case special – see note 3	**A**

1) Self powered from PC or via pin 9 on D connector or optional external supply 6-15V DC @50mA to jack socket (tip +ve)
2) Housing Dimensions – 4U high, size 2 width panel mounted, 140mm depth, excluding fibre bend radius
3) Housing Dimensions – 85mm (l) x 58mm (w) x 19mm (h)

Reyrolle
Protection
Devices

7PG111 & 7PG112 AR

Auxiliary Relay

Answers for energy

SIEMENS

7PG111 & 7PG112 AR

Auxiliary Relay

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. Heavy duty contacts are available on most devices.

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. Heavy duty contacts are available on most models.
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

Table 1. Relay Features

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
AR101T	2,4,or 6	N.A.	Self
AR111T	2,4,or 6	Hand	Self
AR112T	2,4,or 6	Hand	Hand
AR121T	2,4,or 6	Hand*	Self
AR131T	2 or 4	Self	Self
AR141T	2 or 4	Self*	Self

** Indicates a reverse acting flag indicating on de-energisation.*

Table 2. Relay Features

Suffix T – identifies time delayed relays. The reference is completed by adding a code number:

Delay on De-energisation				
		Number of contacts available		
Suffix	Nominal Time	AR101T, AR111T, AR112T, AR121T	AR 131T	AR 141 T
T1	Up to 100ms	6	4	4
T2	101 to 200ms	6	4	4
T3	201 to 300ms	4	2	2
T4	301 to 400ms	2	N.A.	N.A
Delay on Energisation				
T6	50ms max.	6	6	4

Table 3.Summary of Time Delayed Operation

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 = 40ms
Minimum number of operations	1000 at maximum load
Minimum recommended load	0.5 Watt 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 flashover	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	25ms
Range	10ms to 50ms

Case Dimensions

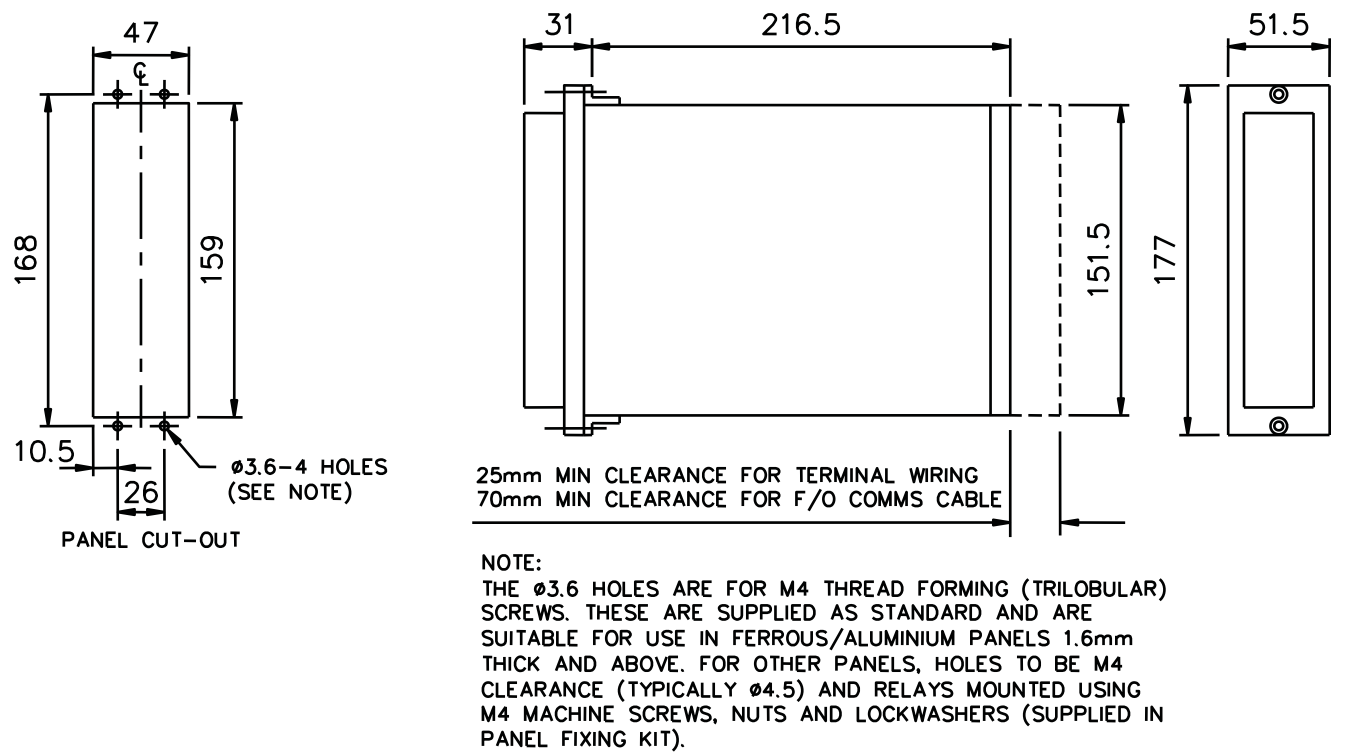


Fig 1. E2 Case Dimensions

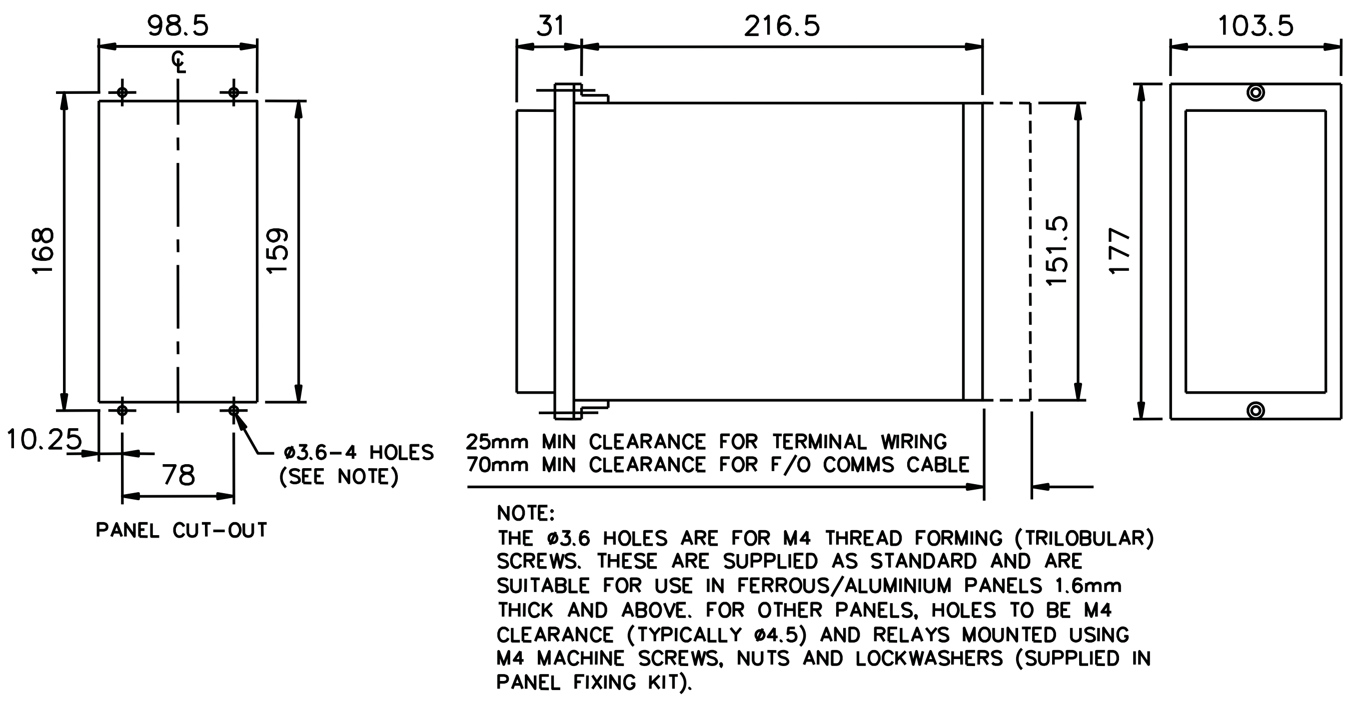
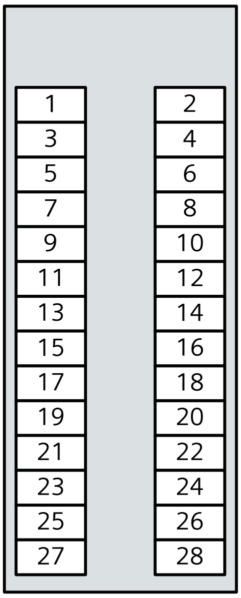


Fig 2. E4 Case Dimensions

Connection Diagram 7PG11 AR

Terminal Numbering (E2 Case)
Viewed from Rear



Terminal Numbering (E4 Case)
Viewed from Rear

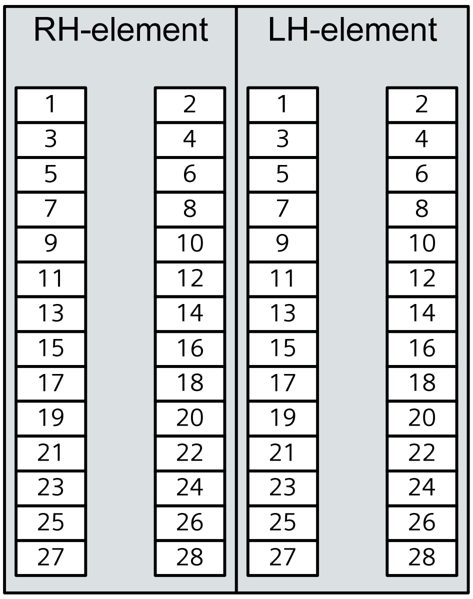


Fig 3. Connection Diagrams

Ordering Information – 7PG111 AR

Product description	Variants	Order No.
Auxiliary relay (AR101, AR103)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
A.C. or D.C. voltage operated relay.		
	<u>Number of elements</u>	
	Single element	1
	<u>Type of flag</u>	
	No flag	0
	<u>Contact operation</u>	
	Self reset contacts	1
	Hand and electrical reset contacts	3
	<u>Contact arrangement – NO</u>	
	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
	<u>Contact arrangement NC</u>	
	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
	<u>Number of contacts</u> 2)	
	Two	0
	Four	1
	Six	3
	Eight	5
	<u>Contact type</u> 1)	
	NO (Standard) / NC (Standard)	0
	<u>Time delay</u>	
	No additional time delay	0
	<u>Housing size</u>	
	Case size E2 (4U high)	A

(continued on following page)

Product description	Variants	Order No.
Auxiliary relay (AR101, AR103)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
(continued from previous page)		
	<u>Voltage rating</u>	
	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**
	<u>Back emf suppression diode</u>	
	Not Fitted	**0**
	Fitted	**1**

[1]) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

[2]) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Auxiliary relay (AR101T)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
D.C. voltage operated relay.		
	Number of elements	
	Single element	**1**
	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 [2]	
	Two	**0**
	Four [3]	**1**
	Six [4]	**3**
	Contact type [1]	
	NO (Standard) / NC (Standard)	**0**
	Time delay	
	T1 (up to 100ms) - Delay on de-energisation	**1**
	T2 (101 to 200ms) - Delay on de-energisation	**2**
	T3 (201 to 300ms) - Delay on de-energisation	**3**
	T4 (301 to 400ms) - Delay on de-energisation	**4**
	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**
	220V DC	**G**
	240V DC	**H**
	Back emf suppression diode	
	Not Fitted	**0**
	Fitted	**1**

1) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.
2) Number of contacts must match selected contact arrangement
3) Four contact arrangements may only have a time delay of T1, T2 or T3
4) Six contact arrangements may only have a time delay of T1 or T2

Product description	Variants	Order No.
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 [2])	
	Two	**0**
	Four	**1**
	Six	**3**
	Contact type [1])	
	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**
	220V DC	**G**
	240V DC	**H**
	63.5V AC	**J 0**
	110V AC	**K 0**
	220V AC	**L 0**
	240V AC	**M 0**

(continued on following page)

Product description	Variants	Order No.
Auxiliary relay (AR106)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
(continued from previous page)	Back emf suppression diode	
	Not Fitted	**0**
	Fitted	**1**

[1]) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

[2]) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
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 [2])	
	Two	**0 A**
	Four	**1 C**
	Six	**3 C**
	Contact type [1])	
	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**
	220V AC	**L 0**
	240V AC	**M 0**

(continued on following page)

Product description	Variants	Order No.
Auxiliary relay (AR201)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
(continued from previous page)	Back emf suppression diode	
	Not Fitted	**0**
	Fitted	**1**

1) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

2) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Auxiliary relay (AR201T)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
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 2)	
	Two	0 A
	Four 3)	1 C
	Six 4)	3 C
	Contact type 1)	
	NO (Standard) / NC (Standard)	0
	Time delay	
	T1 (up to 100ms) - Delay on de-energisation	1
	T2 (101 to 200ms) - Delay on de-energisation	2
	T3 (201 to 300ms) - Delay on de-energisation	3
	T4 (301 to 400ms) - Delay on de-energisation	4
	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
	Back emf suppression diode	
	Not Fitted	0
	Fitted	1

1) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.
2) Number of contacts must match selected contact arrangement
3) Four contact arrangements may only have a time delay of T1, T2 or T3
4) Six contact arrangements may only have a time delay of T1 or T2

Product description	Variants	Order No.
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 [2])	
	Two	**0**
	Four	**1**
	Six	**3**
	Eight	**5**
	Contact type [1])	
	NO (Standard) / NC (Standard)	**0**
	Time delay	
	No additional time delay	**0**
	Housing size	
	Case size E2 (4U high)	**A**

(continued on following page)

Product description	Variants	Order No.
Auxiliary relay (AR111, AR112)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
(continued from previous page)		
	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**

[1]) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

[2]) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Auxiliary relay (AR111T)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
D.C. voltage operated relay.		
	Number of elements	
	Single element	**1**
	Type of flag	
	Hand reset flag	**1**
	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 [2])	
	Two	**0**
	Four [3])	**1**
	Six [4])	**3**
	Contact type [1])	
	NO (Standard) / NC (Standard)	**0**
	Time delay	
	T1 (up to 100ms) - Delay on de-energisation	**1**
	T2 (101 to 200ms) - Delay on de-energisation	**2**
	T3 (201 to 300ms) - Delay on de-energisation	**3**
	T4 (301 to 400ms) - Delay on de-energisation	**4**
	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**
	220V DC	**G**
	240V DC	**H**
	Back emf suppression diode	
	Not Fitted	**0**
	Fitted	**1**

[1]) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.
[2]) Number of contacts must match selected contact arrangement
[3]) Four contact arrangements may only have a time delay of T1, T2 or T3
[4]) Six contact arrangements may only have a time delay of T1 or T2

Product description	Variants	Order No.
Auxiliary relay (AR112T)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
D.C. voltage operated relay.		
	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
	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)	0
	Time delay	
	T6 (50ms max) - Delay on energisation	6
	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
	220V DC	G
	240V DC	H
	Back emf suppression diode	
	Not Fitted	0
	Fitted	1

[1]) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

[2]) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
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**

(continued on following page)

Product description	Variants	Order No.		
Auxiliary relay (AR112SB)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**		
(continued from previous page)				
	<u>Voltage rating</u>			
	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**
	<u>Back emf suppression diode</u>			
	Not Fitted			**0**
	Fitted			**1**

[1]) One NO contact allocated for series break

[2]) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Auxiliary relay (AR113)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
A.C. or D.C. voltage operated. relay		
	<u>Number of elements</u>	
	Single element	**1**
	<u>Type of flag</u>	
	Hand reset flag	**1**
	<u>Contact operation</u>	
	Hand and electrical reset contacts	**3**
	<u>Contact arrangement – NO</u>	
	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**
	<u>Contact arrangement NC</u>	
	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**
	<u>Number of contacts</u> [2])	
	Four	**1**
	Six	**3**
	Eight	**5**
	<u>Contact type</u> [1])	
	NO (Standard) / NC (Standard)	**0**
	<u>Time delay</u>	
	No additional time delay	**0**
	<u>Housing size</u>	
	Case size E2 (4U high)	**A**

(continued on following page)

Product description	Variants	Order No.
Auxiliary relay (AR113)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
(continued from previous page)		
	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**

[1]) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

[2]) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
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**
	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**

(continued on following page)

Product description	Variants	Order No.
Auxiliary relay (AR114)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
(continued from previous page)	Back emf suppression diode	
	Not Fitted	**0**
	Fitted	**1**

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

Product description	Variants	Order No.
Auxiliary relay (AR211, AR212)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
A.C. or D.C. voltage operated. relay		
	<u>Number of elements</u>	
	Two element	**2**
	<u>Type of flag</u>	
	Hand reset flag	**1**
	<u>Contact operation</u>	
	Self reset contacts	**1**
	Hand reset contacts	**2** **C**
	<u>Contact arrangement – NO</u>	
	0 NO	**A**
	1 NO	**B**
	2 NO	**C**
	3 NO	**D**
	4 NO	**E**
	5 NO	**F**
	6 NO	**G**
	<u>Contact arrangement NC</u>	
	0 NC	**A**
	1 NC	**B**
	2 NC	**C**
	3 NC	**D**
	4 NC	**E**
	5 NC	**F**
	6 NC	**G**
	<u>Number of contacts/element</u> 2)	
	Two	**0** **A**
	Four	**1** **C**
	Six	**3** **C**
	<u>Contact type</u> 1)	
	NO (Standard) / NC (Standard)	**0**
	<u>Time delay</u>	
	No additional time delay	**0**
	<u>Housing size</u>	
	Case size E2 (4U high)	**A**
	Case size E4 (4U high)	**C**
	<u>Voltage rating</u>	
	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**

(continued on following page)

Product description	Variants	Order No.
Auxiliary relay (AR211, AR212)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
(continued from previous page)	Back emf suppression diode	
	Not Fitted	**0**
	Fitted	**1**

[1]) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

[2]) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Auxiliary relay (AR211T)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
D.C. voltage operated relay.		
	<u>Number of elements</u>	
	Two element	**2**
	<u>Type of flag</u>	
	Hand reset flag	**1**
	<u>Contact operation</u>	
	Self reset contacts	**1**
	<u>Contact arrangement – NO</u>	
	0 NO	**A**
	1 NO	**B**
	2 NO	**C**
	3 NO	**D**
	4 NO	**E**
	<u>Contact arrangement NC</u>	
	0 NC	**A**
	1 NC	**B**
	2 NC	**C**
	3 NC	**D**
	4 NC	**E**
	<u>Number of contacts/element</u> 2)	
	Two	**0**
	Four 3)	**1** **C**
	<u>Contact type</u> 1)	
	NO (Standard) / NC (Standard)	**0**
	<u>Time delay</u>	
	T1 (up to 100ms) - Delay on de-energisation	**1**
	T2 (101 to 200ms) - Delay on de-energisation	**2**
	T3 (201 to 300ms) - Delay on de-energisation	**3**
	T4 (301 to 400ms) - Delay on de-energisation	**4**
	<u>Housing size</u>	
	Case size E2 (4U high)	**A**
	Case size E4 (4U high)	**C**
	<u>Voltage rating</u>	
	12V DC	**A**
	24V DC	**B**
	30V DC	**C**
	50V DC	**D**
	60V DC	**E**
	125V DC	**F**
	220V DC	**G**
	240V DC	**H**
	<u>Back emf suppression diode</u>	
	Not Fitted	**0**
	Fitted	**1**

1) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

2) Number of contacts must match selected contact arrangement

3) Four contact arrangements may only have a time delay of T1, T2 or T3

Product description	Variants	Order No.
Auxiliary relay (AR212T)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
D.C. voltage operated relay.		
	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**
	Contact arrangement NC	
	0 NC	**A**
	1 NC	**B**
	2 NC	**C**
	3 NC	**D**
	4 NC	**E**
	Number of contacts/element [2])	
	Two	**0**
	Four	**1** **C**
	Contact type [1])	
	NO (Standard) / NC (Standard)	**0**
	Time delay	
	T6 (50ms max) - Delay on energisation	**6**
	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**
	220V DC	**G**
	240V DC	**H**
	Back emf suppression diode	
	Not Fitted	**0**
	Fitted	**1**

[1]) Heavy duty contact arrangements available at extra cost. Refer Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

[2]) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
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/element [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**
	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**

1) One NO contact allocated for series break

2) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Auxiliary relay (AR121)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
A.C. or D.C. voltage operated. relay		
	<u>Number of elements</u>	
	Single element	**1**
	<u>Type of flag</u>	
	Hand reset reverse acting flag	**2**
	<u>Contact operation</u>	
	Self reset contacts	**1**
	<u>Contact arrangement – NO</u>	
	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**
	<u>Contact arrangement NC</u>	
	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**
	<u>Number of contacts</u> [2])	
	Two	**0**
	Four	**1**
	Six	**3**
	Eight	**5**
	<u>Contact type</u> [1])	
	NO (Standard) / NC (Standard)	**0**
	<u>Time delay</u>	
	No additional time delay	**0**
	<u>Housing size</u>	
	Case size E2 (4U high)	**A**

(continued on following page)

Product description	Variants	Order No.
Auxiliary relay (AR121)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
(continued from previous page)		
	<u>Voltage rating</u>	
	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**
	<u>Back emf suppression diode</u>	
	Not Fitted	**0**
	Fitted	**1**

[1]) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

[2]) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Auxiliary relay (AR121T)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
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**
	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 [3])	**1**
	Six [4])	**3**
	Contact type [1])	
	NO (Standard) / NC (Standard)	**0**
	Time delay	
	T1 (up to 100ms) - Delay on de-energisation	**1**
	T2 (101 to 200ms) - Delay on de-energisation	**2**
	T3 (201 to 300ms) - Delay on de-energisation	**3**
	T4 (301 to 400ms) - Delay on de-energisation	**4**
	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**
	220V DC	**G**
	240V DC	**H**
	Back emf suppression diode	
	Not Fitted	**0**
	Fitted	**1**

[1]) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.
[2]) Number of contacts must match selected contact arrangement
[3]) Four contact arrangements may only have a time delay of T1, T2 or T3
[4]) Six contact arrangements may only have a time delay of T1 or T2

Product description	Variants	Order No.
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 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
	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

(Continued on following page)

Product description	Variants	Order No.
Auxiliary relay (AR124)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
(continued from previous page)	Back emf suppression diode	
	Not Fitted	**0**
	Fitted	**1**

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

Product description	Variants	Order No.
Auxiliary relay (AR221)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
A.C. or D.C. voltage operated. relay		
	<u>Number of elements</u>	
	Two element	**2**
	<u>Type of flag</u>	
	Hand reset reverse acting flag	**2**
	<u>Contact operation</u>	
	Self reset contacts	**1**
	<u>Contact arrangement – NO</u>	
	0 NO	**A**
	1 NO	**B**
	2 NO	**C**
	3 NO	**D**
	4 NO	**E**
	5 NO	**F**
	6 NO	**G**
	<u>Contact arrangement NC</u>	
	0 NC	**A**
	1 NC	**B**
	2 NC	**C**
	3 NC	**D**
	4 NC	**E**
	5 NC	**F**
	6 NC	**G**
	<u>Number of contacts/element</u> [2])	
	Two	**0** **A**
	Four	**1** **C**
	Six	**3** **C**
	<u>Contact type</u> [1])	
	NO (Standard) / NC (Standard)	**0**
	<u>Time delay</u>	
	No additional time delay	**0**
	<u>Housing size</u>	
	Case size E2 (4U high)	**A**
	Case size E4 (4U high)	**C**
	<u>Voltage rating</u>	
	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**
	<u>Back emf suppression diode</u>	
	Not Fitted	**0**
	Fitted	**1**

1) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.
2) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Auxiliary relay (AR221T)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
D.C. voltage operated relay.		
	<u>Number of elements</u>	
	Two element	**2**
	<u>Type of flag</u>	
	Hand reset reverse acting flag	**2**
	<u>Contact operation</u>	
	Self reset contacts	**1**
	<u>Contact arrangement – NO</u>	
	0 NO	**A**
	1 NO	**B**
	2 NO	**C**
	3 NO	**D**
	4 NO	**E**
	5 NO	**F**
	6 NO	**G**
	<u>Contact arrangement NC</u>	
	0 NC	**A**
	1 NC	**B**
	2 NC	**C**
	3 NC	**D**
	4 NC	**E**
	5 NC	**F**
	6 NC	**G**
	<u>Number of contacts/element</u> 2)	
	Two	**0**
	Four 3)	**1** ... **C**
	Six 4)	**3** ... **C**
	<u>Contact type</u> 1)	
	NO (Standard) / NC (Standard)	**0**
	<u>Time delay</u>	
	T1 (up to 100ms) - Delay on de-energisation	**1**
	T2 (101 to 200ms) - Delay on de-energisation	**2**
	T3 (201 to 300ms) - Delay on de-energisation	**3**
	T4 (301 to 400ms) - Delay on de-energisation	**4**
	<u>Housing size</u>	
	Case size E2 (4U high)	**A**
	Case size E4 (4U high)	**C**
	<u>Voltage rating</u>	
	12V DC	**A**
	24V DC	**B**
	30V DC	**C**
	50V DC	**D**
	60V DC	**E**
	125V DC	**F**
	220V DC	**G**
	240V DC	**H**
	<u>Back emf suppression diode</u>	
	Not Fitted	**0**
	Fitted	**1**

1) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.
2) Number of contacts must match selected contact arrangement
3) Four contact arrangements may only have a time delay of T1, T2 or T3
4) Six contact arrangements may only have a time delay of T1 or T2

Product description	Variants	Order No.
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 [2])	
	Two	**0**
	Four	**1**
	Six	**3**
	Contact type [1])	
	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**
	220V DC	**G**
	240V DC	**H**
	63.5V AC	**J 0**
	110V AC	**K 0**
	220V AC	**L 0**
	240V AC	**M 0**

(Continued on following page)

Product description	Variants	Order No.
Auxiliary relay (AR131, AR136)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
(continued from previous page)	Back emf suppression diode	
	Not Fitted	**0**
	Fitted	**1**

1) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

2) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Auxiliary relay (AR131T)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
D.C. voltage operated relay.		
	Number of elements	
	Single element	**1**
	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 [2])	
	Two	**0**
	Four [3])	**1**
	Contact type [1])	
	NO (Standard) / NC (Standard)	**0**
	Time delay	
	T1 (up to 100ms) - Delay on de-energisation	**1**
	T2 (101 to 200ms) - Delay on de-energisation	**2**
	T3 (201 to 300ms) - Delay on de-energisation	**3**
	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**
	220V DC	**G**
	240V DC	**H**
	Back emf suppression diode	
	Not Fitted	**0**
	Fitted	**1**

1) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

2) Number of contacts must match selected contact arrangement

3) Four contact arrangements may only have a time delay of T1 or T 2

Product description	Variants	Order No.
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 [2])	
	Two	0
	Four	1
	Six	3
	Eight	5
	Contact type [1])	
	NO (Standard) / NC (Standard)	0
	Time delay	
	No additional time delay	0
	Housing size	
	Case size E2 (4U high)	A

(continued on following page)

Product description	Variants	Order No.
Auxiliary relay (AR133)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
(continued from previous page)		
	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**

[1]) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

[2]) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Auxiliary relay (AR231)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
A.C. or D.C. voltage operated. relay		
	<u>Number of elements</u>	
	Two element	**2**
	<u>Type of flag</u>	
	Self reset flag	**3**
	<u>Contact operation</u>	
	Self reset contacts	**1**
	<u>Contact arrangement – NO</u>	
	0 NO	**A**
	1 NO	**B**
	2 NO	**C**
	3 NO	**D**
	4 NO	**E**
	<u>Contact arrangement NC</u>	
	0 NC	**A**
	1 NC	**B**
	2 NC	**C**
	3 NC	**D**
	4 NC	**E**
	<u>Number of contacts/element</u> 2)	
	Two	**0 A**
	Four	**1 C**
	<u>Contact type</u> 1)	
	NO (Standard) / NC (Standard)	**0**
	<u>Time delay</u>	
	No additional time delay	**0**
	<u>Housing size</u>	
	Case size E2 (4U high)	**A**
	Case size E4 (4U high)	**C**
	<u>Voltage rating</u>	
	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**
	<u>Back emf suppression diode</u>	
	Not Fitted	**0**
	Fitted	**1**

1) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

2) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Auxiliary relay (AR231T)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
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 [2]	
	Two	**0**
	Four [3]	**1 C**
	Contact type [1]	
	NO (Standard) / NC (Standard)	**0**
	Time delay	
	T1 (up to 100ms) - Delay on de-energisation	**1**
	T2 (101 to 200ms) - Delay on de-energisation	**2**
	T3 (201 to 300ms) - Delay on de-energisation	**3**
	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**
	Back emf suppression diode	
	Not Fitted	**0**
	Fitted	**1**

1) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

2) Number of contacts must match selected contact arrangement

3) Four contact arrangements may only have a time delay of T1 or T2

Product description	Variants	Order No.
Auxiliary relay (AR141)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
A.C. or D.C. voltage operated relay		
	<u>Number of elements</u>	
	Single element	**1**
	<u>Type of flag</u>	
	Self reset reverse acting flag	**4**
	<u>Contact operation</u>	
	Self reset contacts	**1**
	<u>Contact arrangement – NO</u>	
	0 NO	**A**
	1 NO	**B**
	2 NO	**C**
	3 NO	**D**
	4 NO	**E**
	5 NO	**F**
	6 NO	**G**
	<u>Contact arrangement NC</u>	
	0 NC	**A**
	1 NC	**B**
	2 NC	**C**
	3 NC	**D**
	4 NC	**E**
	5 NC	**F**
	6 NC	**G**
	<u>Number of contacts</u> [2])	
	Two	**0**
	Four	**1**
	Six	**3**
	<u>Contact type</u> [1])	
	NO (Standard) / NC (Standard)	**0**
	<u>Time delay</u>	
	No additional time delay	**0**
	<u>Housing size</u>	
	Case size E2 (4U high)	**A**
	<u>Voltage rating</u>	
	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**
	<u>Back emf suppression diode</u>	
	Not Fitted	**0**
	Fitted	**1**

[1]) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

[2]) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Auxiliary relay (AR141T)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
D.C. voltage operated relay.		
	<u>Number of elements</u>	
	Single element	**1**
	<u>Type of flag</u>	
	Self reset reverse acting flag	**4**
	<u>Contact operation</u>	
	Self reset contacts	**1**
	<u>Contact arrangement – NO</u>	
	0 NO	**A**
	1 NO	**B**
	2 NO	**C**
	3 NO	**D**
	4 NO	**E**
	<u>Contact arrangement NC</u>	
	0 NC	**A**
	1 NC	**B**
	2 NC	**C**
	3 NC	**D**
	4 NC	**E**
	<u>Number of contacts</u> [2]	
	Two	**0**
	Four [3]	**1**
	<u>Contact type</u> [1]	
	NO (Standard) / NC (Standard)	**0**
	<u>Time delay</u>	
	T1 (up to 100ms) - Delay on de-energisation	**1**
	T2 (101 to 200ms) - Delay on de-energisation	**2**
	T3 (201 to 300ms) - Delay on de-energisation	**3**
	<u>Housing size</u>	
	Case size E2 (4U high)	**A**
	<u>Voltage rating</u>	
	12V DC	**A**
	24V DC	**B**
	30V DC	**C**
	50V DC	**D**
	60V DC	**E**
	125V DC	**F**
	220V DC	**G**
	240V DC	**H**
	<u>Back emf suppression diode</u>	
	Not Fitted	**0**
	Fitted	**1**

1) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

2) Number of contacts must match selected contact arrangement

3) Four contact arrangements may only have a time delay of T1 or T 2

Product description	Variants	Order No.
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/element 2)	
	Two	**0 A**
	Four	**1 C**
	Contact type 1)	
	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**
	220V AC	**L 0**
	240V AC	**M 0**
	Back emf suppression diode	
	Not Fitted	**0**
	Fitted	**1**

1) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

2) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Auxiliary relay (AR241T)		**7 P G 1 1 □ □ - □ □ □ □ □ - □ □ □ □**
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/element [2])	
	Two	0
	Four [3])	1 C
	Contact type [1])	
	NO (Standard) / NC (Standard)	0
	Time delay	
	T1 (up to 100ms) - Delay on de-energisation	1
	T2 (101 to 200ms) - Delay on de-energisation	2
	T3 (201 to 300ms) - Delay on de-energisation	3
	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
	Back emf suppression diode	
	Not Fitted	0
	Fitted	1

[1]) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.

[2]) Number of contacts must match selected contact arrangement

[3]) Four contact arrangements may only have a time delay of T1 or T2

Reyrolle
Protection
Devices

7PG13 – MR

Measuring Relay

Answers for energy

SIEMENS

7PG13 – MR

Measuring Relay

Description

Type MR relays use the same electro-mechanical assemblies as type AR family of relays with a specific operating point. Type MR relays have a consistent positive action, a long service life and comply with BS142.

Model range a.c. current

MR101 Single element, no flag, self reset contacts
MR111 Single element, hand reset flag, self reset contacts
MR102 Single element, no flag, self reset contacts
MR112 Single element, hand reset flag, self reset contacts

Application

Type MR relays are intended for use where a precise level of a.c. current is required to operate the relay. Type MR relays are robust and reliable in operation, suitable for instantaneous overcurrent or earth fault protection and/or in conjunction with other protection systems or plant.

Easy to test and maintain
Fixed or plug bridge settings

Technical information

Fixed settings (MR101, MR111) Is
Fixed setting relays are factory-set to a specific operating point
(Where a range is shown this indicates the relay coil operating range.)
0.1A 0.2A
0.25A to 0.33A 0.4A to 0.5A
0.8A to 1.0A 2A to 2.5A
5A
Variable setting (MR102 & MR112) Is

Adjustable using a 7 step plug bridge.
0.1A to 0.4A
0.5A to 2A

Burden – Typically 3VA at the setting.
Thermal withstand (continuous) 2 x Is
Accuracy Is ±5%
Contact arrangements
MR101 and MR111 2NO, 2NO + 2NC or 4NO
MR102 & MR112 2NO, 2NO +2NC or 4NO

Contact ratings

Make and carry continuously:
1250VAa.c or 1250Wd.c. with limits of 660V and 5A

Make and carry for 3 seconds:
7500VAa.c. with limits of 660V and 30A

Break:
1250VA a.c. or 100W resistive d.c. or 50W inductive (L/R = 0.04) d.c. with limits of 250V and 5A

Indication MR111 and MR112
The types MR111 and MR112 has a mechanically operated hand reset flag.

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 day s at 95% RH and +40°C	
Vibration	IEC 255-21-2

The relays comply with the requirements of BS142, section 1.5.11 1989, class 1
Shock and bump IEC 255-21-2

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
Insulation: IEC 255-5
Relays will withstand:
5kV 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 across normally open contacts.

Ordering information – 7PG13MR

Product description	Variants	Order No.
Measuring relay (MR101, MR111)		7 P G 1 3 □ □ - □ □ □ □ □ - 0 □ □ 0
Measuring relay for a.c. current, operation fixed setting.		
	Number of elements	
	Single element	1
	Type of flag	
	No flag	0
	Hand reset flag	1
	Setting type	
	Fixed	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
	Four	1
	Contact type	
	NO (Standard) / NC (Standard)	0
	Housing size	
	Case size E2 (4U high)	A
	Current setting	
	0.1 A	A
	0.2 A	B
	0.25 A to 0.33 A	C
	0.4 A to 0.5 A	D
	0.8 A to 1.0 A	E
	2.0 A to 2.5 A	F
	5.0 A	G

[1]) Number of contacts must match selected contact arrangement

Ordering information – 7PG13MR

Product description	Variants	Order No.
Measuring relay (MR102, MR112)		**7 P G 1 3 □ □ - □ □ □ □ □ - 0 □ □ 0**
Measuring relay for a.c. current, operation variable setting.		
	Number of elements	
	Single element	1
	Type of flag	
	No flag	0
	Hand reset flag	1
	Setting type	
	Variable with plug bridge	2
	Contact arrangement – NO	
	2 NO	C
	4 NO	E
	Contact arrangement NC	
	0 NC	A
	2 NC	C
	Number of contacts [1]	
	Two	0
	Four	1
	Contact type	
	NO (Standard) / NC (Standard)	0
	Housing size	
	Case size E2 (4U high)	A
	Current setting	
	0.1 A to 0.4 A (7 steps)	H
	0.5 A to 2.0 A (7 steps)	J
	1.0 A to 4.0 A (7 steps)	K

1) Number of contacts must match selected contact arrangemen

Reyrolle
Protection
Devices

7PG15 - TR Relays

High Speed Tripping

Answers for energy

SIEMENS

7PG15 - TR Relays

High Speed Tripping

Description

Type TR relays are a range of 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.

High speed, positive action
Can be supplied in modular and drawout type case
Robust design for a long, reliable service life

TR1	Low burden to ESI 48-4 EB1 & NGTS 3.6.15, ESI 1.
TR2	High burden to ESI 48-4 EB2 & NGTS 3.6.15, ESI 2
TR312	NGC (CEGB) P15. (low burden trip relay)
TR431	NGC (CEGB) TDM 5/11. (switching relay)
TR512	NGC (CEGB) P11 1978. (unstabilising relay)

Low burden, TR1 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 50V d.c. battery with a pilot loop resistance of up to 200 ohms.

Protection unstabilising 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.

Relay Type	Number of Contacts	Contact Reset Arrangement	Operating Coil Cut-off	Specification	Burden Level	Modular Case Size
TR112	7 or 11	Self	Economy	EB1	low	E
TR121	7 or 11	Hand	Instantaneous	EB1	Low	E
TR131	6 or 10	Electrical	Instantaneous	EB1	Low	E
TR141	6 or 10	Hand & electrical	Instantaneous	EB1	Low	E
TR212	6 or 10	Self	Economy	EB2	High	E
TR214	5 or 10	Self	Economy 25 delayed reset	EB2	High	E
TR221	7 or 11	Hand	Instantaneous	EB2	High	E
TR223	7 or 11	Hand	40/60ms delay	EB2	High	E
TR231	6 or 10	Electrical	Instantaneous	EB2	High	E
TR233	6 or 10	Electrical	40/60ms delay	EB2	High	E
TR241	6 or 10	Hand & electrical	Instantaneous	EB2	High	E
TR243	6 or 10	Hand & electrical	40/60ms delay	EB2	High	E
TR312	5	Self	Economy	NGC P15	Low	E
TR431	7	Electrical	Instantaneous	NGC TDM.5/11	Low	E
TR512	6	Self	Economy	NGC P11	High	E
TR901	10	electrical	Instantaneous	EB2	High	E

Table 1 Standard Relays

Technical Information

TR1 and TR2 relays

Operating time 10ms at rated voltage
Rated voltage Vn 24V, 30V, 48V, 125V, 240V d.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

	BURDEN (W)	
Rated voltage V d.c.	TR1--	TR2--
30	43	43
48	46	52
125	47	127
Reset coil	50	50

Relays with economy circuits reduce to approximately 7W after operation.

Contacts

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

Indication:
TR1 and TR2 relays have a hand reset mechanical flag indicator, TR4 and TR9 relays have a self reset 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
Vibration IEC 255-21-1 Class I.

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.

Insulation

Relays will withstand:
- 5kV 1.2/50μs waveform as IEC 255-4
- 2kV rms 50Hz for 1minute (2.5kV for 1s) between all terminals and earth
- 1kV rms 50Hz for 1 minute across normally open contacts to IEC 255-5 and BS142

Ordering Information – 7PG15TR

Product description	Variants	Order No.
Tripping relay (TR112)		7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 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 – NO	
	1 NO	B
	2 NO	C
	3 NO	D
	4 NO	E
	5 NO	F
	6 NO	G
	7 NO	H
	8 NO	J
	9 NO	K
	10 NO	L
	11 NO	M
	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
	9 NC	K
	Number of contacts [1]	
	Seven	4
	Eleven	7
	Contact type	
	NO (Standard) / NC (Standard)	0
	Type of flag	
	Hand reset flag	1
	Housing size	
	Case size E4 (4U high)	C

(Continued on following page)

1) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Tripping relay (TR112)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 0**
	Voltage rating	
	24V DC	**B**
	30V DC	**C**
	50V DC	**D**
	60V DC	**E**
	125V DC	**F**
	240V DC	**H**

[1]) Number of contacts must match selected contact arrangement

Ordering Information - 7PG15 TR

Product description	Variants	Order No.
Tripping relay (TR121)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 0**
Hand reset low burden tripping relay.		
	<u>TR – tripping</u>	
	TR1-- : low burden, EB1	1
	<u>Contact operation</u>	
	Hand reset contacts	2
	<u>Operating coil cut-off</u>	
	Instantaneous	1
	<u>Contact arrangement – NO</u>	
	1 NO	B
	2 NO	C
	3 NO	D
	4 NO	E
	5 NO	F
	6 NO	G
	7 NO	H
	8 NO	J
	9 NO	K
	10 NO	L
	11 NO	M
	<u>Contact arrangement NC</u>	
	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
	<u>Number of contacts</u> [1])	
	Seven	4
	Eleven	7
	<u>Contact type</u>	
	NO (Standard) / NC (Standard)	0
	<u>Type of flag</u>	
	Hand reset flag	1
	<u>Housing size</u>	
	Case size E2 (4U high)	A

(Continued on following page)

[1]) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Tripping relay (TR121)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 0**
	Voltage rating	
	24V DC	**B**
	30V DC	**C**
	50V DC	**D**
	60V DC	**E**
	125V DC	**F**
	240V DC	**H**

[1]) Number of contacts must match selected contact arrangement

Ordering Information - 7PG15 TR

Product description	Variants	Order No.
Tripping relay (TR131)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 0**
Electrical reset low burden tripping relay.		
	<u>TR - tripping</u>	
	TR1-- : low burden, EB1	**1**
	<u>Contact operation</u>	
	Electrical reset contacts	**3**
	<u>Operating coil cut-off</u>	
	Instantaneous	**1**
	<u>Contact arrangement – NO</u>	
	1 NO	**B**
	2 NO	**C**
	3 NO	**D**
	4 NO	**E**
	5 NO	**F**
	6 NO	**G**
	7 NO	**H**
	8 NO	**J**
	9 NO	**K**
	10 NO	**L**
	<u>Contact arrangement NC</u>	
	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**
	<u>Number of contacts</u> 1)	
	Six	**3**
	Ten	**6**
	<u>Contact type</u>	
	NO (Standard) / NC (Standard)	**0**
	<u>Type of flag</u>	
	Hand reset flag	**1**

(Continued on following page)

1) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Tripping relay (TR131)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 0**
	<u>Housing size</u>	
	Case size E2 (4U high)	**A**
	<u>Voltage rating</u>	
	24V DC	**B**
	30V DC	**C**
	50V DC	**D**
	60V DC	**E**
	125V DC	**F**
	240V DC	**H**

[1]) Number of contacts must match selected contact arrangement

Ordering Information - 7PG15 TR

Product description	Variants	Order No.
Tripping relay (TR141)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 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 – NO	
	1 NO	**B**
	2 NO	**C**
	3 NO	**D**
	4 NO	**E**
	5 NO	**F**
	6 NO	**G**
	7 NO	**H**
	8 NO	**J**
	9 NO	**K**
	10 NO	**L**
	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]	
	Six	**3**
	Ten	**6**
	Contact type	
	NO (Standard) / NC (Standard)	**0**
	Type of flag	
	Hand reset flag	**1**
	Housing size	
	Case size E2 (4U high)	**A**

(Continued on following page)

[1] Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Tripping relay (TR141)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 0**
	<u>Voltage rating</u>	
	24V DC	**B**
	30V DC	**C**
	50V DC	**D**
	60V DC	**E**
	125V DC	**F**
	240V DC	**H**

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG15 TR

Product description	Variants	Order No.
Tripping relay (TR212, TR214)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 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 second delay on reset	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
	7 NO	H
	8 NO	J
	9 NO	K
	10 NO	L
	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)	
	Six	3
	Ten	6
	Contact type	
	NO (Standard) / NC (Standard)	0

1) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Tripping relay (TR212, TR214)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 0**
	<u>Type of flag</u>	
	Hand reset flag	1
	<u>Housing size</u>	
	Case size E4 (4U high)	C
	<u>Voltage rating</u>	
	24V DC	B
	30V DC	C
	50V DC	D
	125V DC	F
	240V DC	H
	Contact type	
	NO (Standard) / NC (Standard)	

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG15 TR

Product Description	Variants	Order No.
Tripping relay (TR221)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 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 – 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**
	9 NO	**K**
	10 NO	**L**
	11 NO	**M**
	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]	
	Seven	**4** ... **A**
	Eleven	**7** ... **A**
	Contact type	
	NO (Standard) / NC (Standard)	**0**
	Type of flag	
	Hand reset flag	1

(Continued on following page)

[1] Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Tripping relay (TR221)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 0**
	Housing size	
	Case size E2 (4U high)	**C**
	Voltage rating	
	24V DC	**B**
	30V DC	**C**
	50V DC	**D**
	125V DC	**F**
	240V DC	**H**
	Contact type	
	NO (Standard) / NC (Standard)	

[1]) Number of contacts must match selected contact arrangement

Ordering Information - 7PG15 TR

Product description	Variants	Order No.
Tripping relay (TR223)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 0**
Hand reset high burden tripping relay.		
	TR - tripping	
	TR2-- : high burden, EB2	**2**
	Contact operation	
	Hand reset contacts	**2**
	Operating coil cut-off	
	40/60ms delay	**3**
	Contact arrangement – NO	
	3 NO	**D**
	4 NO	**E**
	5 NO	**F**
	6 NO	**G**
	7 NO	**H**
	8 NO	**J**
	9 NO	**K**
	10 NO	**L**
	11 NO	**M**
	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])	
	Seven	**4**
	Eleven	**7**
	Contact type	
	NO (Standard) / NC (Standard)	**0**
	Type of flag	
	Hand reset flag	**1**

(Continued on following page)

Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Tripping relay (TR223)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 0**
	Housing size	
	Case size E4 (4U high)	**C**
	Voltage rating	
	24V DC	**B**
	30V DC	**C**
	50V DC	**D**
	125V DC	**F**
	240V DC	**H**

Number of contacts must match selected contact arrangement

Ordering Information - 7PG15 TR

Product description	Variants	Order No.
Tripping relay (TR231)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 0**
Electrical reset high burden tripping relay.		
	<u>TR - tripping</u>	
	TR2-- : high burden, EB2	2
	<u>Contact operation</u>	
	Electrical reset contacts	3
	<u>Operating coil cut-off</u>	
	Instantaneous	1
	<u>Contact arrangement – NO</u>	
	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
	9 NO	K
	10 NO	L
	<u>Contact arrangement NC</u>	
	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
	<u>Number of contacts</u> [1])	
	Six	3 A
	Ten	6 A
	<u>Contact type</u>	
	NO (Standard) / NC (Standard)	0
	<u>Type of flag</u>	
	Hand reset flag	1
	<u>Housing size</u>	
	Case size E2 (4U high)	A

(Continued on following page)

1) Number of contacts must match selected contact arrangement

Product description	Variants	Order No.
Tripping relay (TR231)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 0**
	Voltage rating	
	24V DC	**B**
	30V DC	**C**
	50V DC	**D**
	125V DC	**F**
	240V DC	**H**

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG15 TR

Product description	Variants	Order No.
Tripping relay (TR233)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 0**
Electrical reset high burden tripping relay.		
	TR - tripping	
	TR2-- : high burden, EB2	**2**
	Contact operation	
	Electrical reset contacts	**3**
	Operating coil cut-off	
	40/60ms delay	**3**
	Contact arrangement – NO	
	2 NO	**C**
	3 NO	**D**
	4 NO	**E**
	5 NO	**F**
	6 NO	**G**
	7 NO	**H**
	8 NO	**J**
	9 NO	**K**
	10 NO	**L**
	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]	
	Six	**3**
	Ten	**6**
	Contact type	
	NO (Standard) / NC (Standard)	**0**
	Type of flag	
	Hand reset flag	**1**
	Housing size	
	Case size E4 (4U high)	**C**
	Voltage rating	
	125V DC	**F**

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG15 TR

Product description	Variants	Order No.
Tripping relay (TR241)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 0**
Hand and electrical reset high burden tripping relay.		
	<u>TR - tripping</u>	
	TR2-- : high burden, EB2	**2**
	<u>Contact operation</u>	
	Hand and electrical reset contacts	**4**
	<u>Operating coil cut-off</u>	
	Instantaneous	**1**
	<u>Contact arrangement – NO</u>	
	2 NO	**C**
	3 NO	**D**
	4 NO	**E**
	5 NO	**F**
	6 NO	**G**
	7 NO	**H**
	8 NO	**J**
	9 NO	**K**
	10 NO	**L**
	<u>Contact arrangement NC</u>	
	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**
	<u>Number of contacts</u> 1)	
	Six	**3** **A**
	Ten	**6** **A**
	<u>Contact type</u>	
	NO (Standard) / NC (Standard)	0
	<u>Type of flag</u>	
	Hand reset flag	1
	<u>Housing size</u>	
	Case size E2 (4U high)	A
	<u>Voltage rating</u>	
	24V DC	B
	30V DC	C
	50V DC	D
	125V DC	F
	240V DC	H

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG15 TR

Product description	Variants	Order No.
Tripping relay (TR243)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 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	
	40/60ms delay	**3**
	Contact arrangement – NO	
	2 NO	**C**
	3 NO	**D**
	4 NO	**E**
	5 NO	**F**
	6 NO	**G**
	7 NO	**H**
	8 NO	**J**
	9 NO	**K**
	10 NO	**L**
	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]	
	Six	**3**
	Ten	**6**
	Contact type	
	NO (Standard) / NC (Standard)	**0**
	Type of flag	
	Hand reset flag	**1**
	Housing size	
	Case size E4 (4U high)	**C**
	Voltage rating	
	125V DC	**F**

1) Number of contacts must match selected contact arrangement

Ordering Information - 7PG15 TR

Product description	Variants	Order No.
Tripping relay (TR312)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 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 – 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**
	Number of contacts	
	Five	**2**
	Contact type	
	NO (Standard) / NC (Standard)	**0**
	Type of flag	
	No flag	**0**
	Hand reset flag	**1**
	Housing size	
	Case size E4 (4U high)	**C**
	Voltage rating	
	125V DC	**F**

Ordering Information - 7PG15 TR

Product description	Variants	Order No.
Tripping relay (TR431)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 0**
Electrical reset low burden tripping relay.		
	<u>TR - tripping</u>	
	TR4-- : low burden, CEGB spec. TDM 5/11	**4**
	<u>Contact operation</u>	
	Electrical reset contacts	**3**
	<u>Operating coil cut-off</u>	
	Instantaneous	**1**
	<u>Contact arrangement – NO</u>	
	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**
	<u>Contact arrangement NC</u>	
	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**
	<u>Number of contacts</u> 1)	
	Seven	**4**
	Eight	**5**
	<u>Contact type</u>	
	NO (Standard) / NC (Standard)	**0**
	<u>Type of flag</u>	
	Self reset flag 2)	**3**
	<u>Housing size</u>	
	Case size E4 (4U high)	**C**
	<u>Voltage rating</u>	
	50 / 125V DC	**N**

1) Number of contacts must match selected contact arrangement

2) Flag indication "IN" and "OUT"

Ordering Information - 7PG15 TR

Product description	Variants	Order No.
Tripping relay (TR512)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 0**
Self reset high burden unstabilising relay.		
	<u>TR - tripping</u>	
	TR5-- : high burden, CEGB spec. P11	**5**
	<u>Contact operation</u>	
	Self reset contacts	**1**
	<u>Operating coil cut-off</u>	
	Economy	**2**
	<u>Contact arrangement – NO</u>	
	2 NO	**C**
	3 NO	**D**
	4 NO	**E**
	5 NO	**F**
	6 NO	**G**
	<u>Contact arrangement NC</u>	
	0 NC	**A**
	1 NC	**B**
	2 NC	**C**
	3 NC	**D**
	4 NC	**E**
	<u>Number of contacts</u>	
	Six	**3**
	<u>Contact type</u>	
	NO (Standard) / NC (Standard)	**0**
	<u>Type of flag</u>	
	No flag	**0**
	<u>Housing size</u>	
	Case size E4 (4U high)	**C**
	<u>Voltage rating</u>	
	50V DC	**D**
	125V DC	**F**

Ordering Information - 7PG15 TR

Product description	Variants	Order No.
Tripping relay (TR901)		**7 P G 1 5 □ □ - □ □ □ □ □ - □ □ □ 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 – NO	
	2 NO	**C**
	3 NO	**D**
	4 NO	**E**
	5 NO	**F**
	6 NO	**G**
	7 NO	**H**
	8 NO	**J**
	9 NO	**K**
	10 NO	**L**
	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	
	Ten	**6**
	Contact type	
	NO (Standard) / NC (Standard)	**0**
	Type of flag	
	Self reset flag 1)	**3**
	Housing size	
	Case size E2 (4U high)	**A**
	Voltage rating	
	50V DC	**D**
	125V DC	**F**

1) Flag indication "OPEN" and "CLOSED"

Reyrolle
Protection
Devices

7PG17 - XR

Intertripping, Interposing, Supervision and Special Purpose Relays.

Answers for energy

SIEMENS

7PG17 – XR101 & XR102

Intertripping Relay

Description

Type XR relays are developments for specific applications from the AR relay range. They are electro-mechanical relays with a consistent positive action, a long service life and complying with BS142.

XR101 – This relay is supplied with a loose 1500 ohm resistor for wiring in series with the coil. The resistor should be mounted vertically on a steel cubicle or switchgear compartment side sheet.
XR102 – This relay requires a 200 ohm resistor to be wired in series with the coil. As the resistor is a requirement of the overall intertripping scheme detailed by ESI 41-15 Part 5, it is NOT SUPPLIED with the relay.

Application

Type XR101 and XR102 are intended for use as intertrip send and receive relays.
XR101 intertrip send complies with ESI 48-4 Class ES1
XR102 intertrip send complies with ESI 41-15 Part 5 (1988)

Technical Data

	XR01	XR02
Rating	124Vd.c	48Vd.c
Operating time	10ms	15ms
Minimum operate current	25ms	10mA
Continuous maximum withstand at -40 C ambient	143V	60V
Maximum burden (Including external resistors)	13W	10W

Operating Range   50% to 120% of rated voltage

Thermal withstand
Both relays will withstand 13 times rated voltage for 10 seconds

Contact arrangement
XR101 – 2 normally open self reset
XR102 – 3 normally open and 1 normally closed self reset

Contracting

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

Break:
1250VA a.c. or 100W (resistive) d.c. or 50W (inductive)L/R = 0.04 d.c. with limits of 250V and 5A

Indication
Both relays are fitted with hand reset flags

insulation
2kV 50Hz rms for 1 minute:
- Between contacts to earth and to the coil
- Between any case terminal and earth
- Between case terminals of independent circuits

1kV 50Hz rms for 1 minute across normally open contacts

Temptation
- 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

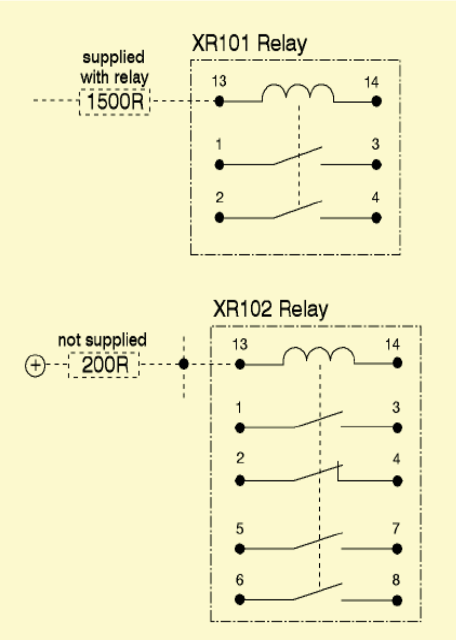


Fig 1. Connection details

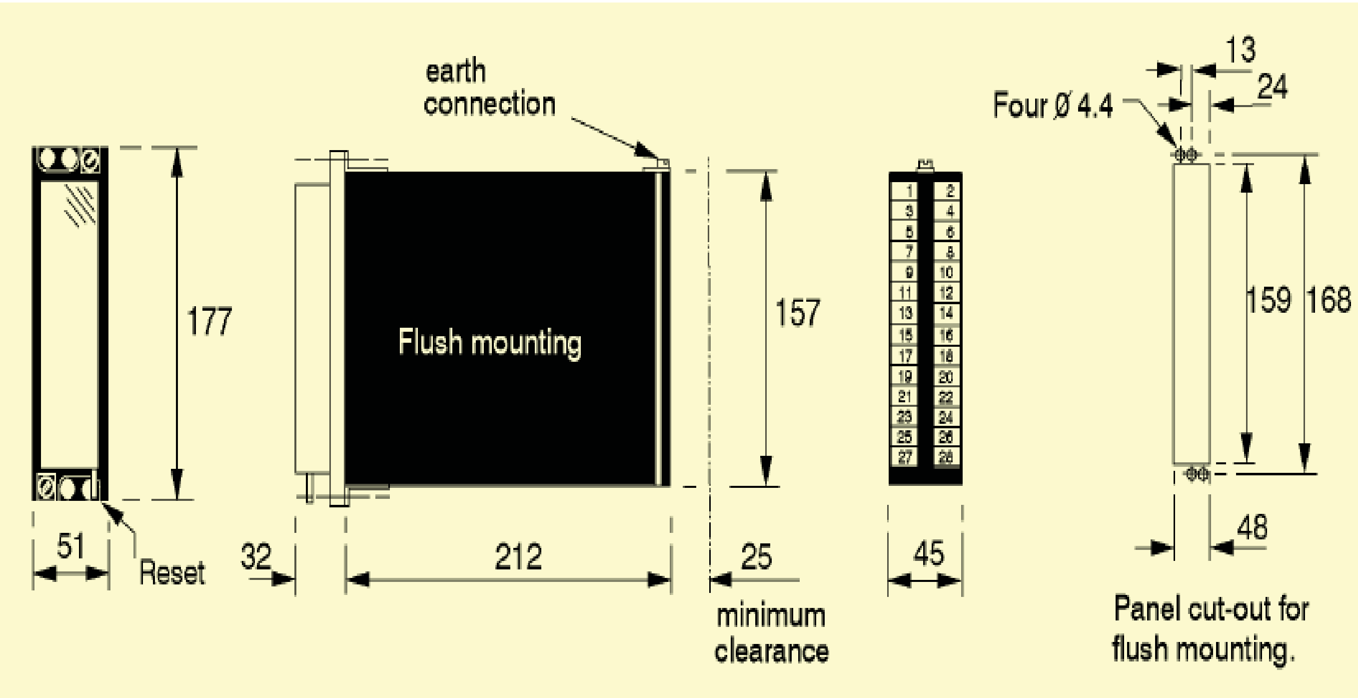


Fig 2. Dimensions of modular size 2 case (all dimensions are in mm)

7PG17 XR105 and XR106, XR205 and XR206

Interposing Relays

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, type XR106 has 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 and XR106 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 30ms. With 200ohms pilot resistance less than 80ms. Reset time is less than 35ms

Contacts

2 normally open, 4 normally open or 2 normally open and 2 normally closed self reset. Up to two contacts can have a heavy duty rating by fitting blow-out magnets
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

Heavy duty contact ratings

Make and carry continuously
1250W d.c. within the limits of 660V and 5A
Make and carry for 3 seconds
7500Wd.c. within the limits of 660V and 30A
Break, see duty curves over the page
Indication XR106, hand reset flag
Insulation
2kV 50Hz rms for 1 minute
between contacts to earth and to the coil
between any case terminal and earth
between case terminals of independent circuits
1kV 50Hz rms for 1 minute across normally open contacts

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.

Epsilon case	Plug-in no. 13 case
1	S2A
2	S1A
3	S2B
4	S1A
5	
6	
7	
8	
13	DC
14	DC

Table 1. case terminal numbers

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

Table 2. normally closed contact location

Contact arrangement	Epsilon case terminal numbers			
	1	3	2	4
2 NO HD		+ ve		+ ve
1 NO HD+ 1 NC std	Heavy duty		Standard duty	
		+ ve		
1 NO std+ 1 NC HD	Standard duty		Heavy duty	
			+ ve	
1 NO HD+ 1 NC HD	Normally open		+ ve	
		+ ve		
2 NC HD	+ ve		+ ve	

Table 3. polarity of heavy duty contacts

Heavy duty contacts are fitted with blowout magnets and are polarity conscious. In Table 3' +ve' indicates the terminal which must be connected to the supply positive.

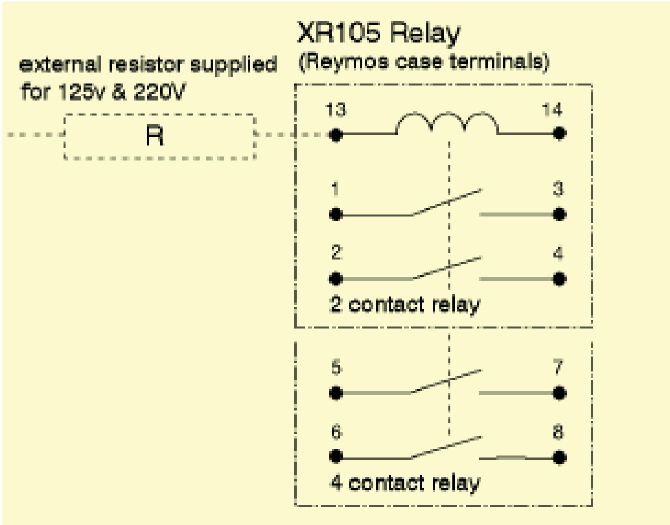


Fig 1. connection details for Epsilon Case

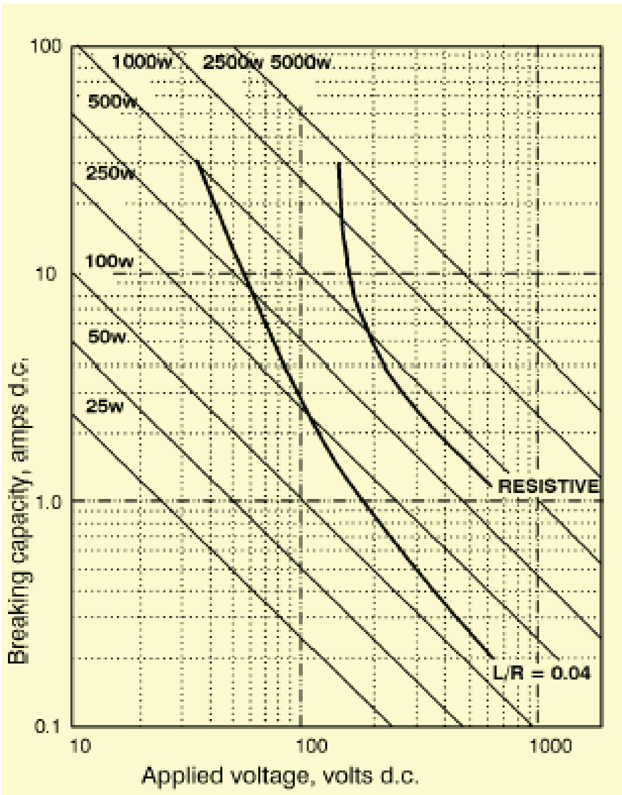


Fig 2. rating of heavy duty contacts

7PG17 XR152 and XR153

Supply Supervision Relays

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 Vn
Reset time	No less than 100ms when supply is switched from 100% to 26% of Vn.

Operating current	10mA nominal. (17mA for 24V & 30V ratings)
Burden	0.4W at 24Vd.c. 1.25W at 125Vd.c
Thermal Withstand	1.15 Vn continuously
Indication	A flag indicator shows when the relay is de-energised XR152 self reset flag XR153 hand reset flag

Contact arrangements

2 normally open and 2 normally closed
Or 4 normally open
Or 4 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.

7PG17 – XR250 to XR351

Trip Circuit Supervision Relays

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.

Model Range

XR151 and XR152
Trip supply supervision (see separate fact sheet)

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 Vn
Reset time	400ms when supply is switched from Vn 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 1.15Vn 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 in any combination of normally open and normally closed. Pre-closed supervision, XR350 & XR351, 1 normally open.

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

Ferro-resonance Detector Relay

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

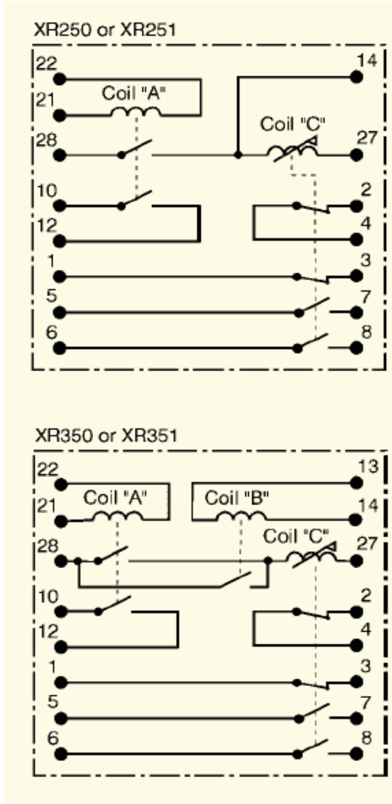


Fig 1. Typical relay wiring, modular case terminal numbers shown

7PG17 – XR309

Description

This relay provides ferro-resonance detection as required by NGTS 3.15.2.

Three attracted armature elements are connected phase-to-phase via full wave rectifiers.

Under normal healthy conditions, with the system energised or de-energised, all the relay elements will be in unison and either operated or reset. No output is given.

Application

On supergrid systems the phenomenon of ferro-resonance may be experienced following de-energisation of a directly connected transformer, and the ferro-resonance may be sustained by the induction from an energised parallel circuit. Re-energising the transformer whilst in a ferro-resonant state can risk severe switching overvoltages, therefore where there is such a risk, a ferro-resonance detector relay is essential.

Operation

The relay will detect ferro-resonance, with the system energised or de-energised, as follows:

On system de-energisation, the secondary voltage falls below the reset level, and all 3 elements drop-off.

In the event of ferro-resonance occurring two out of three elements will remain energized

If ferro-resonance is induced onto a de-energisation system the relay will only respond if the amplitude of ferro-resonance is above the relay element pick-up level 40V a.c. Relay contacts initiate either an alarm timer or an external suppression circuit.

When a system is ferro-resonant, only two out of three elements remain energized, giving an output.

Technical Information

Frequency	50Hz
Rating	110V a.c. Ø - Ø
Continuous rating	127V a.c.
Settings	

Pick-up not greater than 40V a.c. 50Hz
Drop-off not less than 25V a.c. 50Hz
Relay operation is checked down to 16.67Hz

Burden	Approximately 3VA per element
Indication	None
Contacts	See Fig. 1

Contact Rating

Make and carry continuously:
1250VA a.c. or 100W (resistive) d.c. within the limits of 660V and 5A.
Make and carry for 3 seconds:
7500VA a.c. or 7500W d.c. within the limits of 660V and 5A.

Insulation

2kV 50Hz rms for 1 minute:
Between contacts to earth and to the coil
Between any case terminal and earth
Between case terminals of independent circuits.
1kV 50Hz rms for 1 minute across normally open contacts.

Temperature

Storage	-25°C to 70°C
In Service	-10°C to 40°C

Mechanical Durability

Vibration
Relays comply with IEC 255-21-1
Shock
Relays comply with IEC 255-21-2
Seismic
Relays comply with IEC 225-21-3
Operational/mechanical life
In excess of 10,000 operations with the contact rating stated.

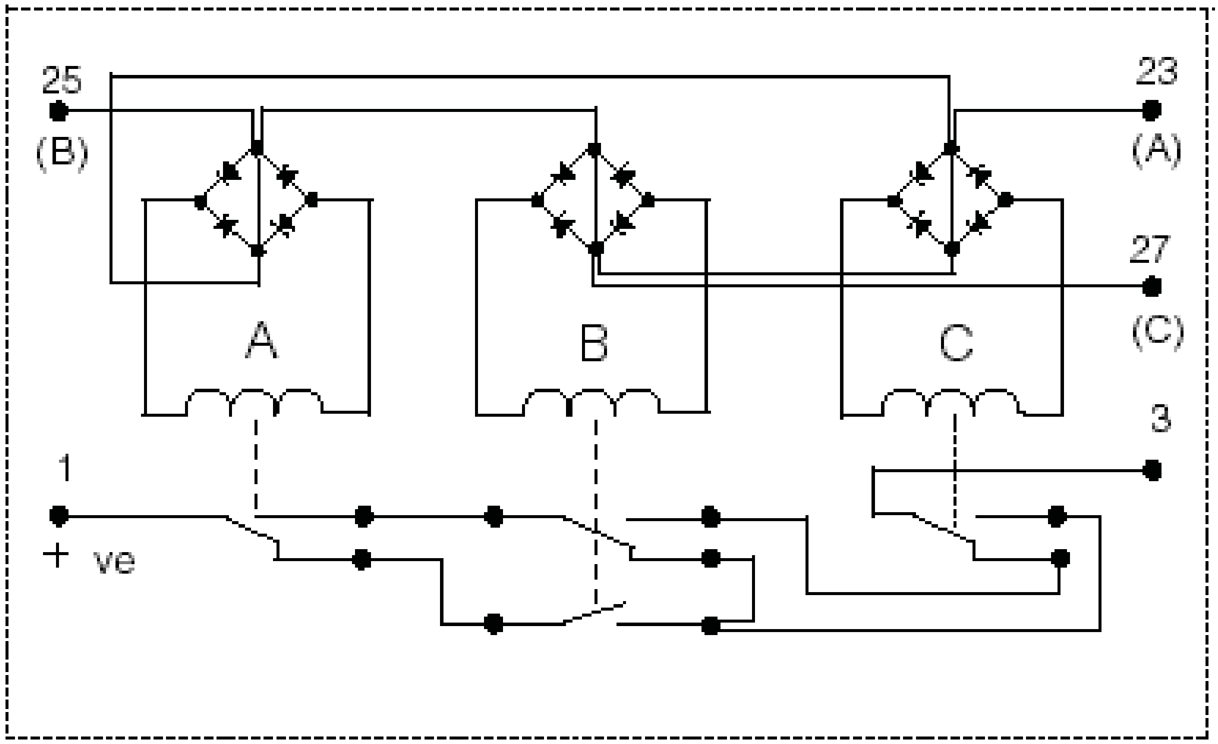


Fig 1. wiring diagram XR 309

Ordering Information – 7PG17XR

Product description	Variants	Order No.
Interposing control relay (XR105, XR106)		**7 P G 1 7 □ □ - □ □ □ □ □ - □ □ □ 0**
	XR relay type	
	Interposing control	**3**
	Number of elements	
	Single element, self reset contacts	**1**
	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 3)	
	Two	**0**
	Four	**1**
	Contact type 2)	
	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**

1) Supplied with resistor VCE:2101H10152 (1500 Ohm) for wiring in series with the coil
2) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.
3) Number of contacts must match selected contact arrangement

Ordering Information – 7PG17XR

Product description	Variants	Order No.
D.C. supply supervision relay (XR152, XR153)		**7 P G 1 7 □ □ - □ □ □ □ □ - □ □ □ 0**
	<u>XR relay type</u>	
	D.C. supply supervision	4
	<u>Number of elements</u>	
	Single element, self reset contacts	1
	<u>Type of flag</u>	
	Hand reset flag	1
	Self reset flag	3
	<u>Contact arrangement – NO</u>	
	0 NO	A
	1 NO	B
	2 NO	C
	3 NO	D
	4 NO	E
	<u>Contact arrangement NC</u>	
	0 NC	A
	1 NC	B
	2 NC	C
	3 NC	D
	4 NC	E
	<u>Number of contacts</u>	
	Four	1
	<u>Contact type</u>	
	NO (Standard) / NC (Standard)	0
	<u>Voltage rating</u>	
	24V DC	1
	30V DC	2
	50V DC	3
	125V DC	4
	240V DC	5
	<u>Housing size</u>	
	Case size E2 (4U high)	A
	<u>Voltage rating (alarm)</u>	
	Not Applicable	A
	<u>Back emf suppression diode</u>	
	Not Fitted	0

Ordering Information – 7PG17XR

Product description	Variants	Order No.
Interposing control relay (XR205, XR206)		**7 P G 1 7 □ □ - □ □ □ □ □ - □ □ □ □**
	<u>XR relay type</u>	
	Interposing control	**3**
	<u>Number of elements</u>	
	Two element, self reset contacts	**2**
	<u>Type of flag</u>	
	No flag	0
	Hand reset flag	1
	<u>Contact arrangement – NO</u>	
	0 NO	A
	1 NO	B
	2 NO	C
	3 NO	D
	4 NO	E
	<u>Contact arrangement NC</u>	
	0 NC	A
	1 NC	B
	2 NC	C
	3 NC	D
	4 NC	E
	<u>Number of contacts/element</u> 3)	
	Two	0
	Four	1 C
	<u>Contact type</u> 2)	
	NO (Standard) / NC (Standard)	0
	<u>Voltage rating</u>	
	24V DC	1
	30V DC	2
	50V DC	3
	125V DC 1)	4
	<u>Housing size</u>	
	Case size E2 (4U high)	A
	Case size E4 (4U high)	C
	<u>Voltage rating (alarm)</u>	
	Not Applicable	A
	<u>Back emf suppression diode</u>	
	Not Fitted	0
	Fitted	

1) Supplied with resistor VCE:2101H10152 (1500 Ohm) for wiring in series with the coil
2) Heavy duty contact arrangements available at extra cost. Please see separate non-MLFB list for already defined heavy duty contact arrangements. For arrangements not listed there please contact the factory.
3) Number of contacts must match selected contact arrangement

Ordering Information – 7PG17XR

Product description	Variants	Order No.
Trip circuit supervision relay (XR250, XR251)		**7 P G 1 7 □ □ - □ □ □ □ □ - □ □ □ □**
	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	2
	50V DC	3
	125V DC 1)	4
	240V DC 1)	5
	Housing size	
	Case size E3 (4U high)	B
	Voltage rating (alarm)	
	30V DC 1)	**C**
	50V DC 1)	**D**
	125V DC 1)	**E**
	240V DC 1)	**F**
	Back emf suppression diode	
	Not Fitted	**0**

1) Supplied with external resistors

Ordering Information 7PG17XR

Product description	Variants	Order No.
Trip circuit supervision relay (XR350, XR351)		**7 P G 1 7 □ □ - □ □ □ □ □ - □ □ □ □**
	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	2
	50V DC	3
	125V DC 1)	4
	240V DC 1)	5
	Housing size	
	Case size E3 (4U high)	B
	Voltage rating (alarm)	
	30V DC 1)	C
	50V DC 1)	D
	125V DC 1)	E
	240V DC 1)	F
	Back emf suppression diode	
	Not Fitted	0

1) Supplied with external resistors

2) Voltage rating for both trip coils

Ordering Information 7PG17XR

Product description	Variants	Order No.
Ferro-resonance detector relay (XR309)		**7 P G 1 7 □ □ - □ □ □ □ □ - □ □ □ □**
	XR relay type	
	Ferro-resonance detector	6
	Number of elements	
	Three element, self reset contacts	3
	Type of flag	
	No flag	0
	Contact arrangement – NO	
	1 NO	B
	Contact arrangement NC	
	0 NC 1)	A
	Number of contacts/element	
	Two	0
	Contact type	
	NO (Standard) / NC (Standard)	0
	Voltage rating	
	110V AC	4
	Housing size	
	Case size E4 (4U high)	C
	Voltage rating (alarm)	
	Not Applicable	A
	Back emf suppression diode	
	Not Fitted	0

1) Contact arrangement 1 NO / 1 C/O per element

Reyrolle
Protection
Devices

7PG23 - 5B3

Restricted Earth Fault

Answers for energy

SIEMENS

7PG23 - 5B3

Restricted Earth Fault

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.

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 fn:	50 or 60 Hz
Current Is:	Fixed at 20mA
Voltage Vs:	I5V to 270V in 5V steps
Thermal withstand:	Continuous 1.25 × Vs
Accuracy:	Vs ± 5%
Burden:	Vs x 20mA
Operating time:	45ms maximum at 3xV

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.

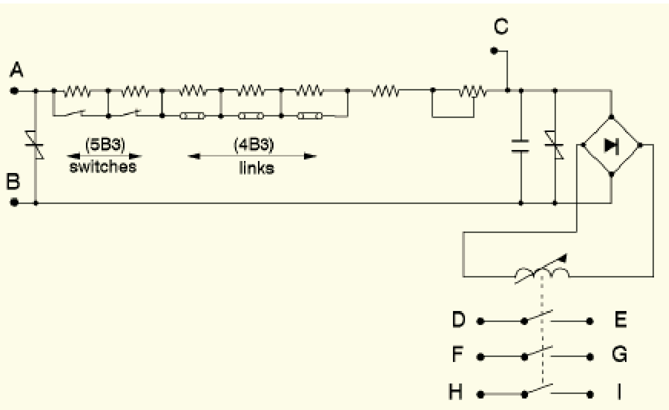
Insulation IEC 255-5

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.



	A	B	C	D	E	F	G	H	I
5B3 (size 3 case)	28	27	22	1	3	2	4	5	7

Fig 1. Modular relay case terminal numbers

Stability

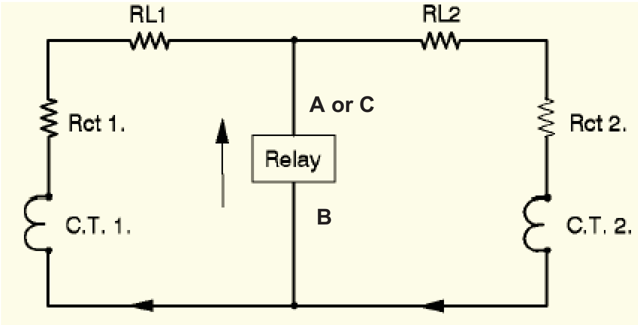


Fig 2. high Impedance Scheme

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

Ordering Information – 7PG23 – 5B3

Product description	Variants	Order No.
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	
	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**

1) Relay is pre-set to 15VAC, customer adjustable settings up to 270VAC in increments of 5V provided by heavy duty DIL switches

Reyrolle
Protection
Devices

7PG217 – B69

Overcurrent & Earth Fault Type

Answers for energy

SIEMENS

7PG217 – B69

Overcurrent & Earth Fault Type

Description

These relays are a.c. operated attracted armature elements with an 'L' shaped armature pivoted on a knife-edge which directly operates the self reset contacts.

Relays are fitted with a plug-bridge providing a range of plug settings.

Relays are supplied in single pole and three pole arrangements, in modular cases. When supplied as a three pole unit the center element can be provided with a different setting range.

Applications

Instantaneous overcurrent earth fault protection of feeders, or the earth fault protection of transformers.

A typical application is for 2 stage overcurrent protection in association with IDMTL relays. A definite time delay relay can be added to the scheme if required. The relay may be used as a guard relay for Solkor Schemes.

Technical Information

Ratings (50 or 60Hz) 1 or 5A
Operating time 10ms at 3 times the setting
Continuous rating 1.3 x setting

Setting Ranges
10 – 40% Step 5%
20 – 80% Step 10%
50 – 200% Step 25%

Burdens 3VA at the setting
Indication None
Contact arrangements 2 Make per phase

Contact ratings
Make and carry continuously:

150 VA a.c. or 1500 W d.c. within the limits of 660 V and 3A. Make and carry 8 A for 3 seconds or 16 A for 1 second.

Break:

300 VA a.c. or 75 W d.c. (inductive L/R – 0.04s) within the limits of 250 V and 5 A.

Accuracy:

Operation within 15% of settings.

Case Dimensions

Relays are available in the following cases:
Single Pole – Size E2 Modular
Three Pole - Size E6 Modular

Terminal Ref	**Single Pole**	**Three Pole**			
		1	**2**	**3**	Refer to the wiring diagram supplied with the Order Acknowledgement
A	27	23	25	27	
B	28	24	26	28	
C	1	9	5	1	
D	3	11	7	3	
E	2	10	6	2	
F	4	12	8	4	

Table 1. Case Terminal Numbers

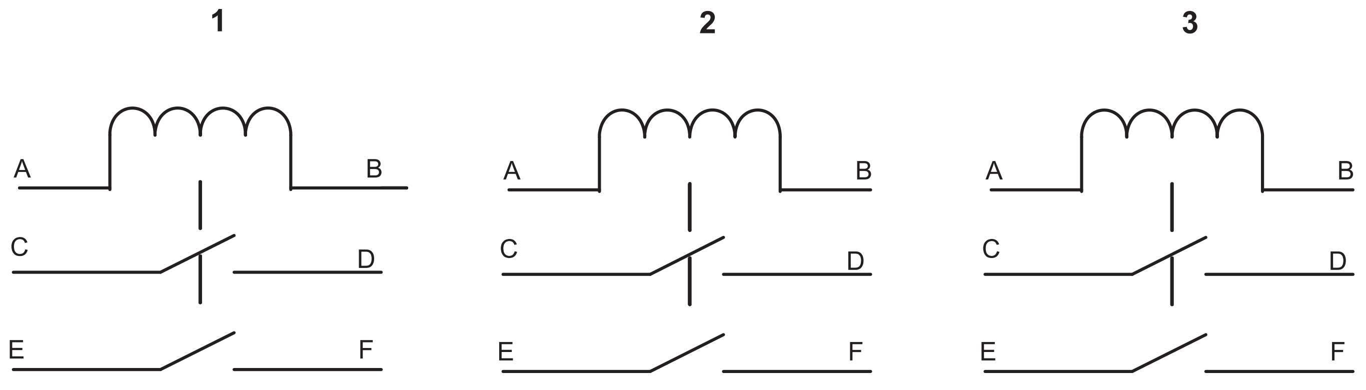


Fig 1. Typical Relay Wiring Diagram
(Arrangement looking on front of relay)

Reyrolle
Protection
Devices

7PG221 – BD

Surgeproof Intertrip

Answers for energy

SIEMENS

7PG221 – BD

Surgeproof Intertrip

Description

The BD relay consists of two component units, the relay unit and the filter unit. The filter unit contains inductors, capacitors, and setting resistors encapsulated in a thermosetting resin. The relay comprises a moving coil element insulated for either 5kV or 15kV, and an attracted armature repeat relay with a hand reset flag. Limiting devices are connected across the moving coil to by-pass the initial and final peak switching surges

Applications

For the tripping of remote circuit breakers in an interconnected power system where the fault current may be fed from more than one source.

Following fault detection and operation of the local circuit breaker, a d.c. trip signal is transmitted via pilot cables to the BD intertrip receive relay. These trip the remote circuit breaker in order to completely isolate the fault.

Very high voltages may be induced in the pilots, especially during heavy fault conditions, and the relay must remain inoperative to all but the correct trip signal. The BD relay caters for transverse voltages up to 5kV rms and longitudinal voltages of up to 5kV or 15kV. Its operating time is unaffected by induced voltages which may be present at the time of applying the intertrip signal. Any type of pilot cable can be used, but the maximum loop resistance should not exceed 1,000 ohms.

Multi-ended intertripping schemes

Multi-ended intertripping schemes often occur in practice and type BD surge proof relays are suitable for such applications. In order to achieve optimum performance they should be operated as near as is reasonably possible to their design parameters. To obtain this two main requirements should be fulfilled.

A.C. Requirements - These surge proof relays have been designed to remain stable with induced voltages of up to 5kV in pilot wires having a loop resistance not exceeding approximately 1,000ohms. It is therefore recommended that the loop resistance of the pilots between any two feeder ends, between which induced pilot voltages are expected, should be maintained within the range of 500 to 1,000ohms. When determining the loop resistance the pilots at the remote end are assumed to be short circuited. If the loop resistance obtained is less than 500ohms, the resistor in the filter unit, at the end being considered, may be used to make the effective loop resistance greater than 500ohms.

D.C. Requirements - In order to ensure satisfactory operation of the BD relays at all receiving ends, the d.c. currents in each receiving end relay should preferably be equal to or in excess of 12mA. The d.c. resistance of the type BD relays, as seen from the pilots across terminals (P3, R2) is about 3,000ohms. Using this value the minimum d.c. intertrip voltage required at the sending ends can be estimated.

Technical information

Auxiliary voltage (for repeat relay)
30V, 50V, 60V, 125V, 210/220V, 240Vd.c.

Operating voltage (over pilots)
Rated voltage 50Vd.c.

The relay will operate over a voltage range of 25V to 250V.

Contract arrangements

5kV Models	2 changeover 4 contacts	1V case 1V case
15kV Models	5 contacts 6 contacts	11/2 case 11/2V cae
Indication	Hand reset flag	

Make and carry continuously:- 1500VA a.c. or 1500W d.c. within the limits of 660V and 3A. Make and carry 8A for 3 seconds or 16A for 1 second.
Break:- 300VA a.c. or 75W d.c. (inductive L/R = 0.04) within the limits of 250V and 5A.

Pilot resistance

Two resistors are provided in the filter unit to adjust the pilot resistance. Terminals allow the selection of 200, 400, and 600ohms

Mounting

5kV relay may be flush or projecting mounted, however the 15kV relay, to maintain the electrical clearances, must be flush mounted. The filter unit is suitable for surface mounting on switchgear, inside control cubicles, or on a wall.

Ordering information – 7PG22 BD

Product description	Variants	Order No.
BD		**7 P G 2 2 □ □ - □ □ □ □ □ - □ □ □ □**
Surgeproof intertrip receive relay (5kV).		
	Relay type	
	BD - Surgeproof intertrip receive	1
	Model type	
	5kV with 2 C/O	1 A A 2 1 U
	5kV with 2NO2NC or 4NO	2 4 0 U
	5kV with 4NO2NC or 6NO	3 6 0 W
	Type of flag	
	Hand reset flag	1
	Contact arrangement – NO	
	0 NO	A
	2 NO	C
	4 NO	E
	6 NO	G
	Contact arrangement NC	
	0 NC	A
	2 NC	C
	Number of contacts 2)	
	Two	2
	Four	4
	Six	6
	Contact type	
	NO (Standard) / NC (Standard)	0
	C/O (Standard)	1
	Insulation level	
	5kV	1
	Housing size	
	Case size C1 Vedette	U
	Case size C1 1/2 Vedette	W
	Rating	
	30V DC	B
	50V DC	C
	60V DC	D
	125V DC	E
	240V DC	F
	Filter unit 1)	
	Not supplied	0

1) For filter unit please order the following:
Cubicle mounted filter unit – VCE:410A11245, Price €3200

2) Number of contacts must match selected contact arrangement

Ordering information – 7PG22 BD

Product description	Variants	Order No.
BD		**7 P G 2 2 □ □ - □ □ □ □ □ - □ □ □ □**
Surgeproof intertrip receive relay (15kV).		
	<u>Relay type</u>	
	BD - Surgeproof intertrip receive	1
	<u>Model type</u>	
	15kV with 3NO2NC or 5NO	4 5
	15kV with 4NO2NC or 6NO	5 6
	<u>Type of flag</u>	
	Hand reset flag	1
	<u>Contact arrangement – NO</u>	
	3 NO	D
	4 NO	E
	5 NO	F
	6 NO	G
	<u>Contact arrangement NC</u>	
	0 NC	A
	2 NC	C
	<u>Number of contacts</u> 2)	
	Five	5
	Six	6
	<u>Contact type</u>	
	NO (Standard) / NC (Standard)	0
	<u>Insulation level</u>	
	15kV	2
	<u>Housing size</u>	
	Case size C1 1/2 Vedette	W
	<u>Rating</u>	
	30V DC	B
	50V DC	C
	60V DC	D
	125V DC	E
	240V DC	F
	<u>Filter unit</u> 1)	
	Not supplied	0

1) For filter unit please order the following:
Cubicle mounted filter unit – VCE:410A11245, Price €3200

2) Number of contacts must match selected contact arrangement

Reyrolle
Protection
Devices

7PG223 - TEC

Surgeproof Intertrip Send Relay

Answers for energy

SIEMENS

7PG223 TEC

Surgeproof Intertrip Send Relay

Description

The type TEC relay comply with British Generating Board Engineering recommendation M16/2 class EB2. They consist of three elements:

(a) Type F relay.
(b) Type B34 relay delayed on energisation.
(c) Type TCD static timing relay.

Application

Intertrip Send Relay for use where the pilots are prone to high induced voltages.
Under fault conditions an interconnected power system may feed fault current from several sources, and in order to isolate a fault it becomes necessary to initiate the tripping of one or more remote circuit breakers. Remote intertripping of circuit breakers requires a fast, multi-contact, intertrip relay capable of withstanding the high voltages which may be induced in the pilots.

Model Range

Four type TEC relays are available:
5kV insulation contacts for pulse or sustained Intertrip.
15kV insulated contacts for pulse or sustained Intertrip.
5kV insulated contacts for 2 stage intertrip.
15kV insulated contacts for 2 stage intertrip.

Pulse Intertrip

The F relay is energised and within 10ms the intertrip contacts are closed. They are then maintained for a period of two seconds. When the initiating contact IC closes, the operating coils of the types F and B relays are both energised, their operating times are 10 and 100ms respectively. The type F relay contacts complete the intertrip circuits and the series contact F1 open circuits the operating coil to prevent battery drain. Contact F2 Initiates the time delay relay for the reset operation.
The type B34 relay contacts then "pick-up" open-circuiting the type F relay operating coil, contact B1, prevent a repeat operation upon reset. After the time delay elapses contact T1 is closed and the Type F relay resets.

Sustained Intertrip

Within 10ms the intertrip circuits are closed, this condition being maintained for two seconds after the initiating contact opens. The operation of the circuit is similar to that described in the pulse intertrip arrangement, with the exception that contactB2 is used to ensure that the time delay relay is not energised until the type B34 relay is de-energised, i.e. when the initiating contact IC id opened.

2 Stage Intertrip

Where the intertrip signal applied to the pilots is derived from a DC/AC inverter or DC/DC converter, such devices may be damaged if energised unloaded for long periods. Another small attracted armature element is incorporated in the TEC relay so that the inverter or converter is only energised for 2 seconds in the 'pulse intertrip' scheme, or for the duration of 'sustained intertrip'. For the latter the signal can be held at full level for 2 seconds then reduced to a 'hold on' level provided that the design of the inverter or converter permits an economy resistor to be switched into the drive circuit to its output transformer.

Technical Information

Ratings:

5kV versions, 30V, 50V, 60V, 125V and 240V d.c.
15kV versions, 24V, 30V, 60V, 125V and 240V d.c.
Type F relay
BURDEN: 15W
OPERATING TIME: 10mS

Output Contact Arrangement:

2 normally open with standard 2kV insulation,
2 normally open and 2 normally closed with 5kV or 15kV insulation to earth and 2 normally closed with 2kV insulation between contacts.

Output Contact Rating:

Make 30A, make and carry continuously 20A.
Break, a.c. (inductive), 2A at 550V.
a.c. (non-inductive), 50A at 12V, 5A at 660V.
d.c. (inductive), 2A at 110V, 0.5A at 240V
d.c. (non-inductive), 4A at 110V, 1A at 240V
INDICATION: Hand-reset flag.
Type B34 Element
BURDEN: 3W
OPERATING TIME: 100ms. (delayed on pick-up)
Type TCD Element
BURDEN: 12W
DELAY: 2seconds

Case

All models, Vedette size 1½V case.
Information required when ordering:
Model and rated d.c. voltage.

Table 1.
This table only applies for flush mounting relays
Terminal numbers for 5kV and 15kV pulse or sustained intertrip relays.

MODEL			MODEL		
	5kV	15kV		5kV	15kV
A	10	25	J	9	28
B	21	26	K	16	30
C	22	27	L	12	32
D	15	29	M	2	18
E	11	31	N	4	22
F	1	16	O	6	5
G	3	20	P	8	9
H	5	3	Q	-	-
I	7	7	R	-	-

Table 2.
This table only applies for flush mounting relays.
Terminal numbers for 5kV and 156kV 2 stage intertrip relays.

MODEL			MODEL		
	5kV	15kV		5kV	15kV
A	10	25	J	5	16
B	21	26	K	7	20
C	22	27	L	9	28
D	23	33	M	11	31
E	12	32	N	16	30
F	24	34	O	2	5
G	15	29	P	4	9
H	1	3	Q	6	18
I	3	7	R	9	22

NOTE
Where an insulation level of 15kV is required we recommend that relays are flush mounted. 15kV insulation level relays can be supplied for front connection, surface mounting, however customers are reminded of the need to maintain the 15kV insulation level on all wiring to the relay.

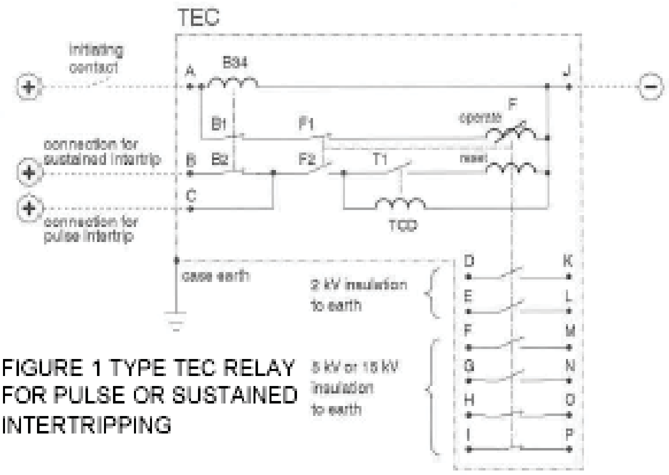


FIGURE 1 TYPE TEC RELAY FOR PULSE OR SUSTAINED INTERTRIPPING

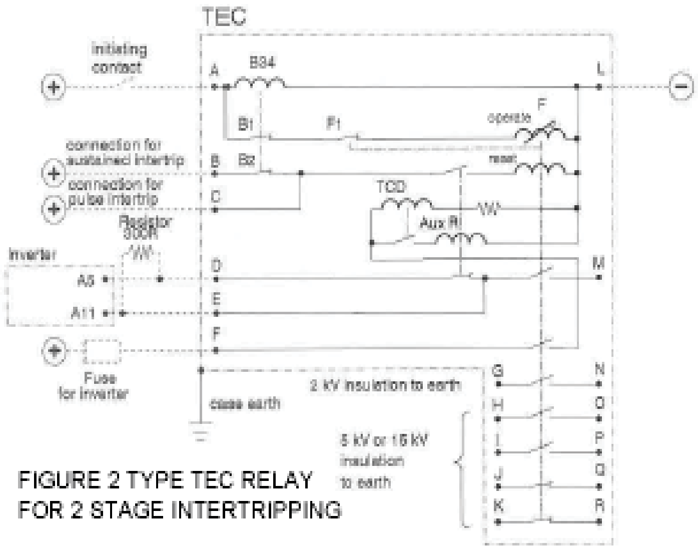


FIGURE 2 TYPE TEC RELAY FOR 2 STAGE INTERTRIPPING

Reyrolle
Protection
Devices

7XG22 – 2RMLG

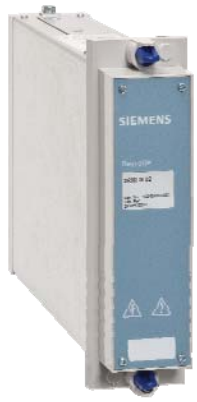
Catalogue Sheet

Answers for energy

SIEMENS

7XG22 – 2RMLG

Operating Recommendations



Description

The range of 2RMLG Test Blocks, housed within an Epsilon enclosure, offers facilities for monitoring and secondary injection testing of power system protection schemes in conjunction with the 2RMLB-S 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-S7 Test Plug which has connection terminals 21, 23, 25 & 27,internally – For typical application see Fig 4.

The 2RMLG08 is coded to only accept the 2RMLB-S8 Test Plug which has internal pairs 1&3, 5&7, 9&11 and 15&17 shorted together internally – For typical applications see Figs 5, 6, 7 & 8.

The 2RMLG09 is coded to only accept the 2RMLB-S9 Test Plug which has internal pairs 1-3-5-7, and 17-19 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 2RMLG 01 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 2RMLG 02/07/08/09 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 test plug is shorter in this position.

The short test finger in position 13-14 on the 2RMLB will open contacts 13-14 in the test block after the other fingers have made contact in all other positions.

Fig 1 & 2.

Note: It is important that the sockets in the test plug (2RMLBS-1) 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 (as shown in Figure 3).
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.

Mechanical Specification

The 2RMLG is a size E2 unit in the Epsilon range of enclosures. The overall dimensions and panel fixing details are shown in Figure 10.

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.

2RMLB-S series Multi-fingered test plugs

The 2RMLB-S series are inserted into the 2RMLG test socket and is securely retained by means of two knurled screws. The 2RMLB-SI test plug incorporates 28 test sockets, each socket accepting a shrouded or plain 4mm diameter plug.

2RMLB S7 with Shorting Contacts

The 2RMLB-S7 is similar to the 2RMLB-S1 with shorted contact pairs 21-23-25-27and is coded to be used with the MMLG07 Test Socket only.

2RMLB S8 with Shorting Contacts

The 2RMLB-S8 is similar to the 2RMLB-S1 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 S9 with Shorting Contacts

The 2RMLB-S9 is similar to the 2RMLB-S1 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.

Precautions

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.

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

Connections

The connections will depend upon the scheme and details must be obtained from the appropriate diagrams. If it is necessary to use the d.c. auxiliary supply during testing, then a test link may be fitted across the sockets in the Test Plug.

Technical Information

High Voltage withstand

Insulation
IEC 255-5: 1977

2RMLG 01/02/07/08/09	5kV rms for 1 minute between all case terminals connected together and the case earth terminal.
	5kV rms for 1 minute between any contact pair and either adjacent alternate contact pair, provided the intermediate contact pair is not used
	2kV rms for 1 minute between any contact pair and either adjacent contact pair
2RMLG 01 only	1kV rms for 1 minute between terminals 13 and 14 when the cover is removed (e.g. opening the auxiliary supply or trip circuit).
2RMLB-S1	As 2RMLG 01 plus 2kV rms for 1 minute between incoming and outgoing contacts when inserted
2RMLB-S7	As above with the exception of terminals 21, 23, 25 & 27 which are permanently shorted together
2RMLB-S8	As above with the exception of terminal pairs 1&3, 5&7, 9&11, 15&17 which are permanently shorted together as pairs
2RMLB-S9	As above with the exception of terminal pairs 1-3-5-7,17-19 which are permanently shorted together as pairs

Current withstand

2RMLG 01/02/07/08	All contact circuits rated at 20A continuously or 400A for 1s, ac or dc
2RMLBS1-S9	

Atmospheric environment

Temperature

IEC 255-6: 1988	Storage and transit - 25°C to +70°C
	Operating -25°C to +55°C
IEC 68-2-1: 1990	Cold
IEC 68-2-2: 1974	Dry Heat

Humidity

IEC 68-2-3: 1969	56 days at 93% RH and +40°C

Enclosure Protection

IEC 529: 1989	IP50 (dust protected)

Mechanical environment

Vibration

IEC 255-21-1: 1988	Response Class 2

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)

TYPICAL APPLICATION OF THE 2RMLG01 / 2RMLG02 TEST SOCKET AND MMLB01 TEST PLUG

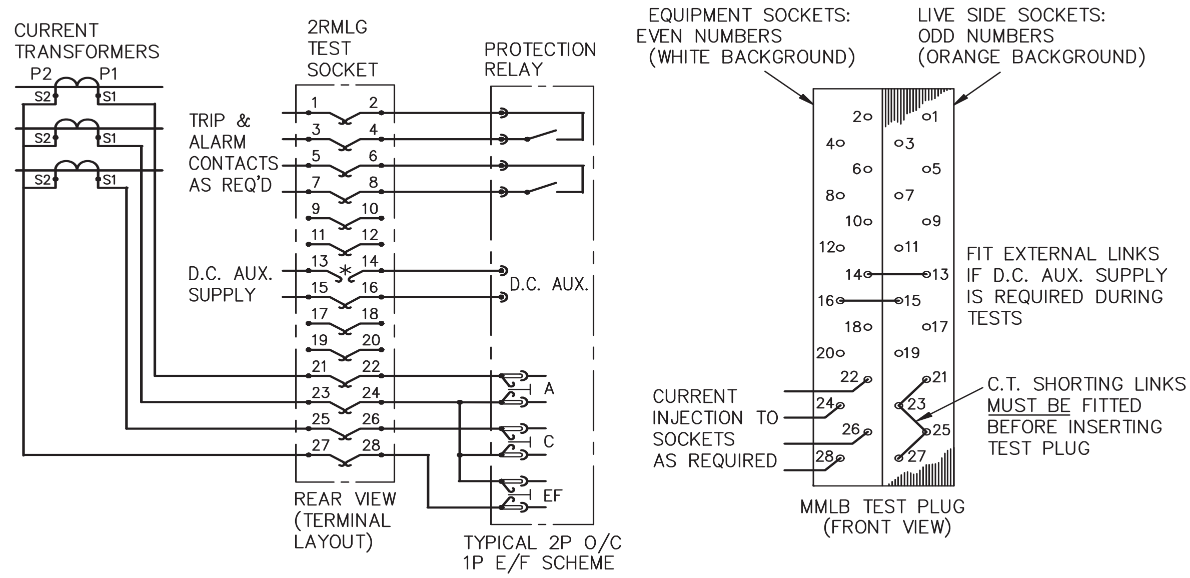


Fig 3.

*2RMLG01 13/14 OPEN CCT WHEN COVER REMOVED AND OTHER POSITIONS CONNECTED.
2RMLG02 13/14 CONNECTED AS PER OTHER POSITIONS.

TYPICAL APPLICATION OF THE 2RMLG07 TEST SOCKET AND MMLB07 TEST PLUG

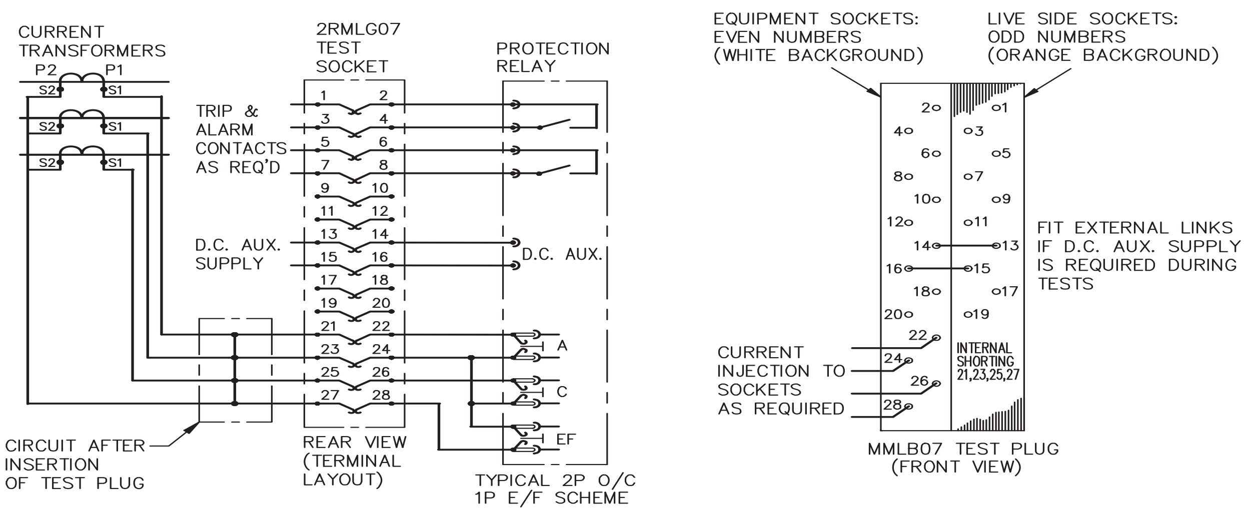


Fig 4.

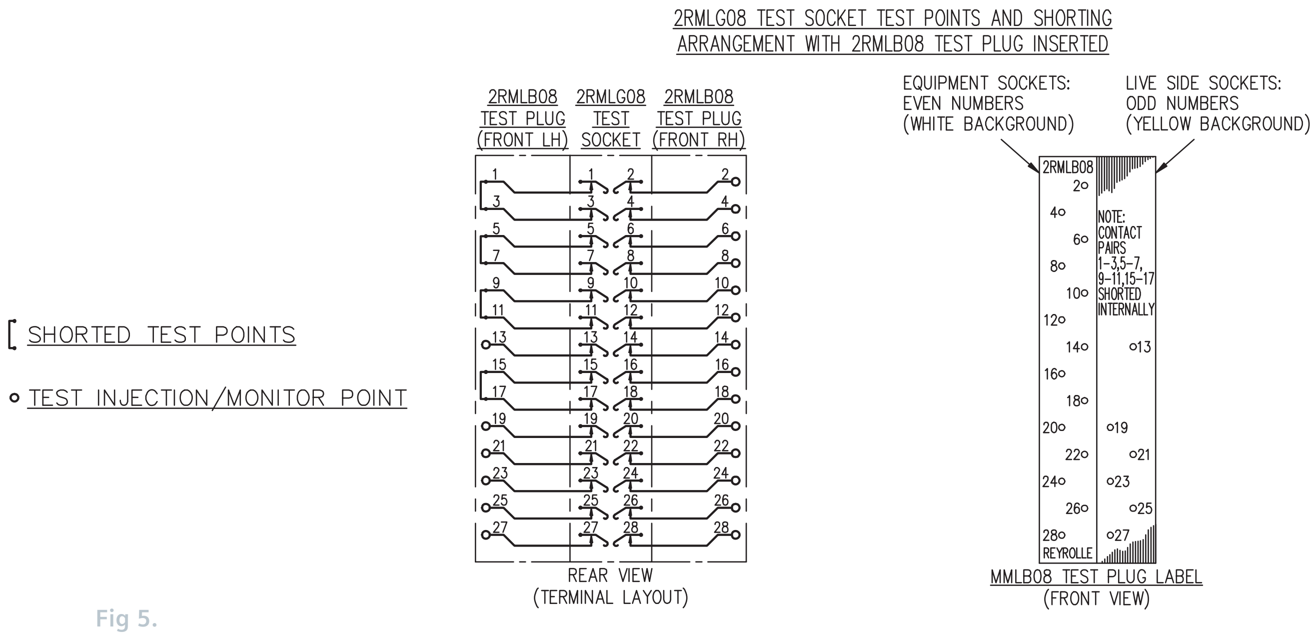

2RMLG08 TEST SOCKET TEST POINTS AND SHORTING ARRANGEMENT WITH 2RMLB08 TEST PLUG INSERTED
2RMLB08 TEST PLUG (FRONT LH)
2RMLG08 TEST SOCKET
2RMLB08 TEST PLUG (FRONT RH)
SHORTED TEST POINTS
TEST INJECTION/MONITOR POINT
REAR VIEW (TERMINAL LAYOUT)
EQUIPMENT SOCKETS: EVEN NUMBERS (WHITE BACKGROUND)
LIVE SIDE SOCKETS: ODD NUMBERS (YELLOW BACKGROUND)
2RMLB08
NOTE: CONTACT PAIRS 1-3,5-7, 9-11,15-17 SHORTED INTERNALLY
REYROLLE
MMLB08 TEST PLUG LABEL (FRONT VIEW)

Fig 5.

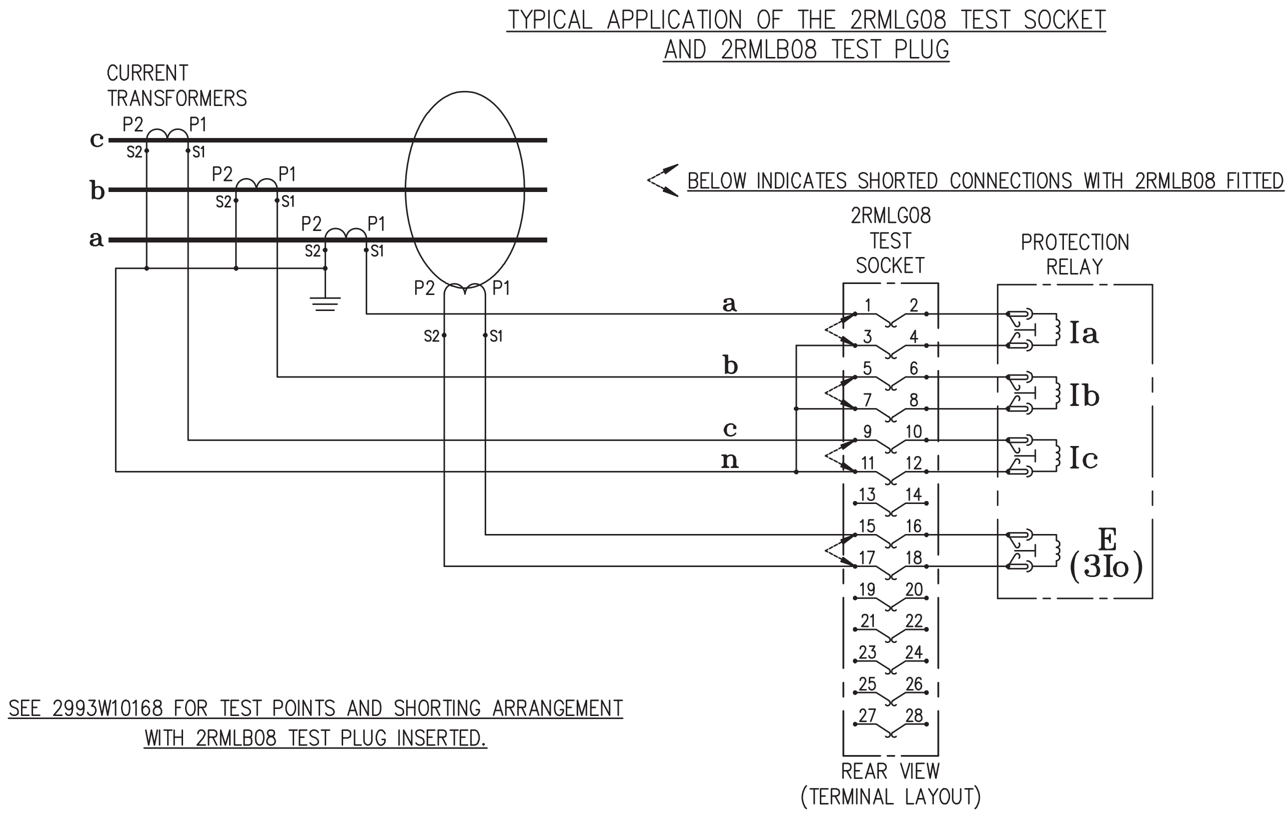

TYPICAL APPLICATION OF THE 2RMLG08 TEST SOCKET AND 2RMLB08 TEST PLUG
CURRENT TRANSFORMERS
BELOW INDICATES SHORTED CONNECTIONS WITH 2RMLB08 FITTED
2RMLG08 TEST SOCKET
PROTECTION RELAY
Ia
Ib
Ic
E (3Io)
SEE 2993W10168 FOR TEST POINTS AND SHORTING ARRANGEMENT WITH 2RMLB08 TEST PLUG INSERTED.
REAR VIEW (TERMINAL LAYOUT)

Fig 6.

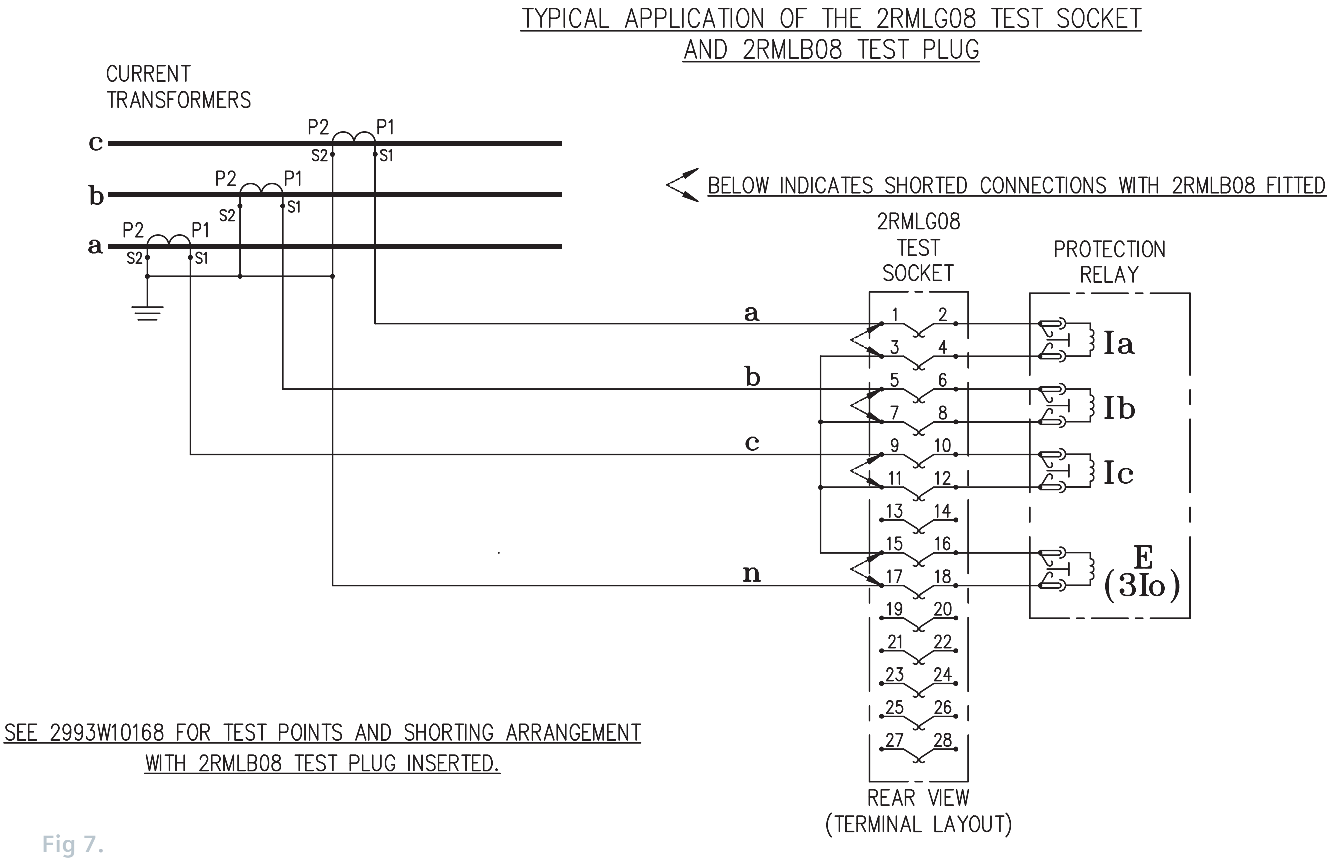

TYPICAL APPLICATION OF THE 2RMLG08 TEST SOCKET
AND 2RMLB08 TEST PLUG
CURRENT
TRANSFORMERS
BELOW INDICATES SHORTED CONNECTIONS WITH 2RMLB08 FITTED
2RMLG08
TEST
SOCKET
PROTECTION
RELAY
Ia
Ib
Ic
E
(3Io)
SEE 2993W10168 FOR TEST POINTS AND SHORTING ARRANGEMENT
WITH 2RMLB08 TEST PLUG INSERTED.
REAR VIEW
(TERMINAL LAYOUT)

Fig 7.

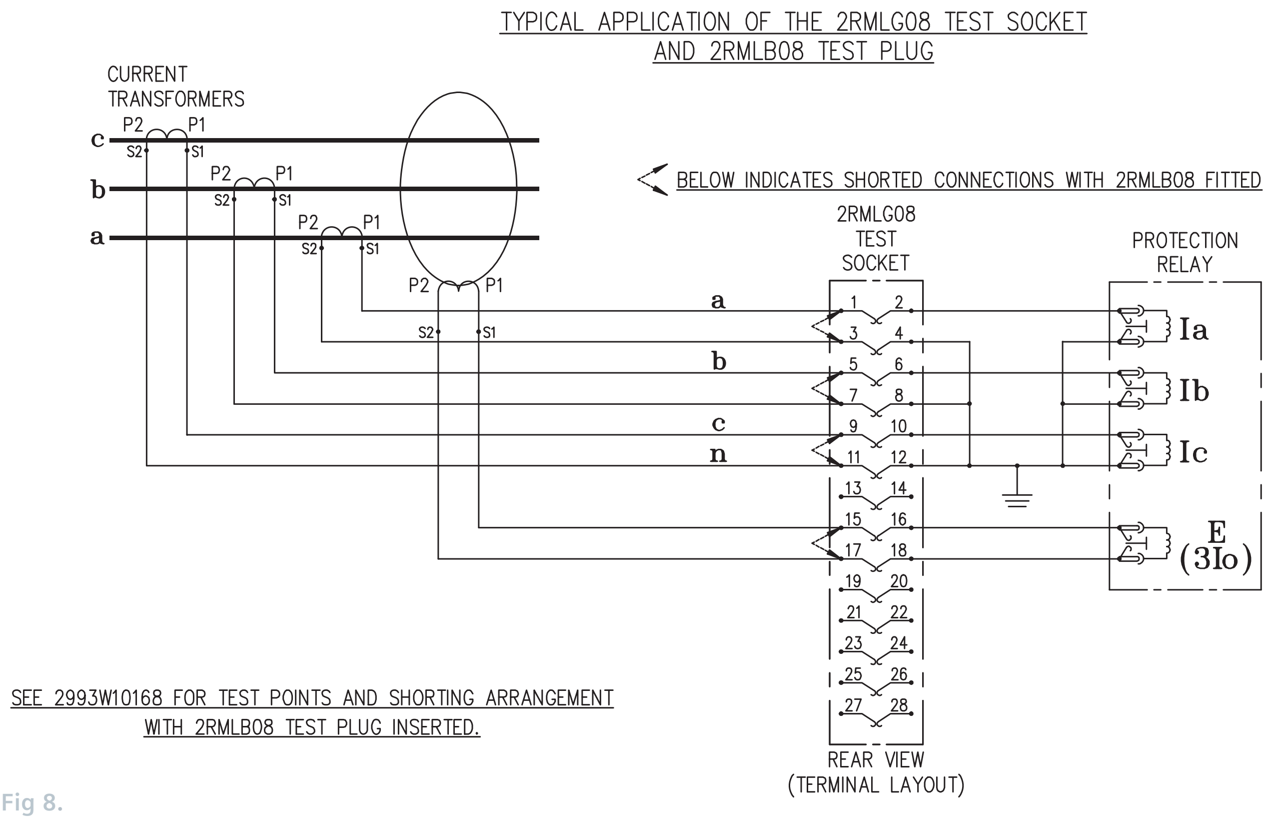
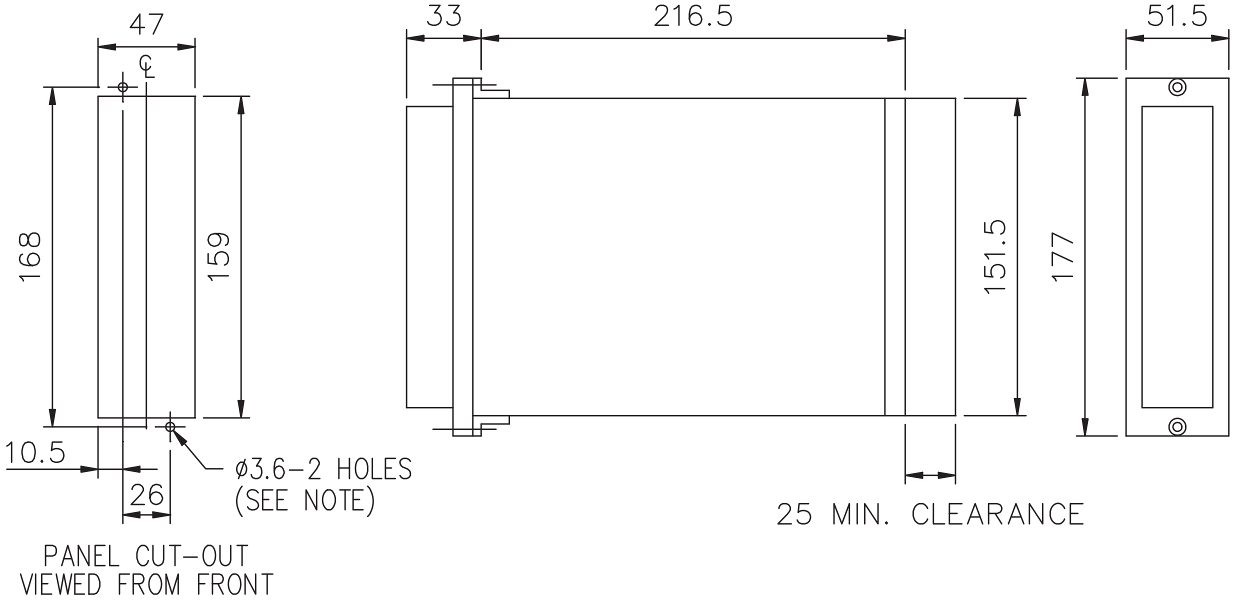

TYPICAL APPLICATION OF THE 2RMLG08 TEST SOCKET
AND 2RMLB08 TEST PLUG
CURRENT
TRANSFORMERS
BELOW INDICATES SHORTED CONNECTIONS WITH 2RMLB08 FITTED
2RMLG08
TEST
SOCKET
PROTECTION
RELAY
Ia
Ib
Ic
E
(3Io)
SEE 2993W10168 FOR TEST POINTS AND SHORTING ARRANGEMENT
WITH 2RMLB08 TEST PLUG INSERTED.
REAR VIEW
(TERMINAL LAYOUT)

Fig 8.

OUTLINE AND DRILLING DRAWING FOR 2RMLG TEST SOCKETS IN EPSILON E2 CASE



NOTE:
THE ø3.6 HOLES ARE FOR M4 THREAD FORMING (TRILOBULAR) SCREWS. THESE ARE SUPPLIED AS STANDARD AND ARE SUITABLE FOR USE IN FERROUS/ALUMINIUM PANELS 1.6mm THICK AND ABOVE. FOR OTHER PANELS, HOLES TO BE M4 CLEARANCE (TYPICALLY ø4.5) AND RELAYS MOUNTED USING M4 MACHINE SCREWS, NUTS AND LOCKWASHERS (SUPPLIED IN PANEL FIXING KIT).

Fig 9.

Ordering Information

Product description	Variants	Order No.

Test Modules — Order No. **7 X G 2 2 2 0 - □ A A 0 0 - 0 A A 0**

Modular case test components (MLG).

Category	4
Ancillary equipment	2
Ancillary equipment	5
Modular case test components	2
Test component type	**6**
Test modules (MLG)	**2**
Component type	
Test module in size E2 case (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

Test plugs — Order No. **7 X G 2 2 4 0 - □ A A 0 0 - 0 A A 0**

Modular case test components (MLB).

Category	4
Ancillary equipment	2
Ancillary equipment	5
Modular case test components	2
Test component type	**6**
Test modules (MLG)	**4**
Component type	
Multi finger test plug complete with leads (2RMLB-S1)	1
Multi finger test plug complete with leads and internal shorting links (2RMLB-S7)	3
Multi finger test plug complete with leads and internal shorting links (2RMLB-S8)	4
Multi finger test plug complete with leads and internal shorting links (2RMLB-S9)	5

Test plugs are coded to fit, and should only be used with the appropriate test block

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Data is subject to change without notification.

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