



Reyrolle
Protection
Devices

7SR11 and 7SR12 Argus

Overcurrent Relays

Energy Management

SIEMENS

7SR11 and 7SR12 Argus

Overcurrent Relays



Description

The 7SR11 & 7SR12 are overcurrent protection relays developed to enhance the Argus family of products by providing a familiar product using the latest generation of hardware technology. The 7SR11 provides overcurrent and earth fault protection, the 7SR12 comes with additional voltage inputs providing directional protection. Both relays are available in single and four pole variants. Housed in a 4U high, size E4 or E6 (Optional IEC61850 model) cases, these relays provide protection, monitoring, instrumentation and metering with integrated input and output logic, data logging & fault reports. Communication access to the relay functionality is via a front USB port for local PC connection, a rear electrical RS485 port for remote connection & optional IEC61850 communication through two rear Ethernet ports (Electrical or Optical).

Function Overview

Protection

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

Supervision

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

Control

79 Auto Reclose
86 Lockout
CB Control

Features

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

User Interface

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

Monitoring Functions

Primary/Secondary Current Phases and Earth Direction
Primary/Secondary Line and Phase Voltages
Apparent Power and Power Factor
Real and Reactive Power
W Hr & VAR Hr Forward and Reverse
Historical Demand Record
Positive Phase Sequence (PPS) Voltage & Current
Negative Phase Sequence (NPS) Voltage & Current
Zero Phase Sequence (ZPS) Voltage
Frequency
Direction
Binary Input/Output status
Trip circuit healthy/failure
Time and date
Starters
Fault records
Event records
Energy
Circuit breaker trip counters
I²t summation for contact wear

Hardware

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

Data Storage and Communication

Standard Communication Ports

Front USB port + Rear RS485 port

Additional Optional Communication Ports

2x Electrical RJ45 Ethernet ports
2x LC Fibre Optic Ethernet ports

Standard Protocols

IEC60870-5-103, DNP3.0 or Modbus RTU
User Selectable with programmable data points

Optional Protocols

IEC61850 (E6 Case)

Ethernet Redundancy Protocols:

Standard in all IEC61850 models:
PRP (Parallel Redundancy Protocol)
RSTP (Rapid Spanning Tree Protocol)
HSR (High-availability Seamless Redundancy)

Data

Event Records – User Configurable
Fault Records
Waveform Records
Measurands
Commands
Time Synchronism
Viewing and Changing Settings

Application

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

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

Function Matrix

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

Key - ■ - Included as standard
□ - Ordering option

7SR11 Functional Diagrams

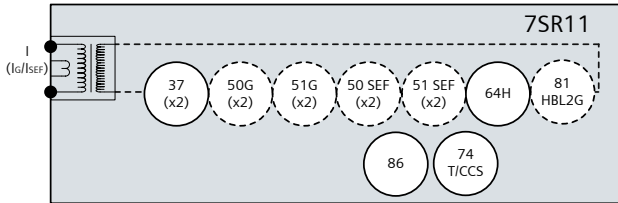


Fig 1. Single Pole Overcurrent Relay

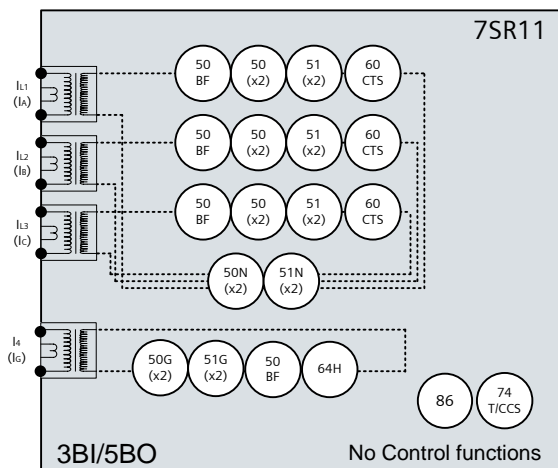


Fig 2. Four Pole Overcurrent Relay Version A software

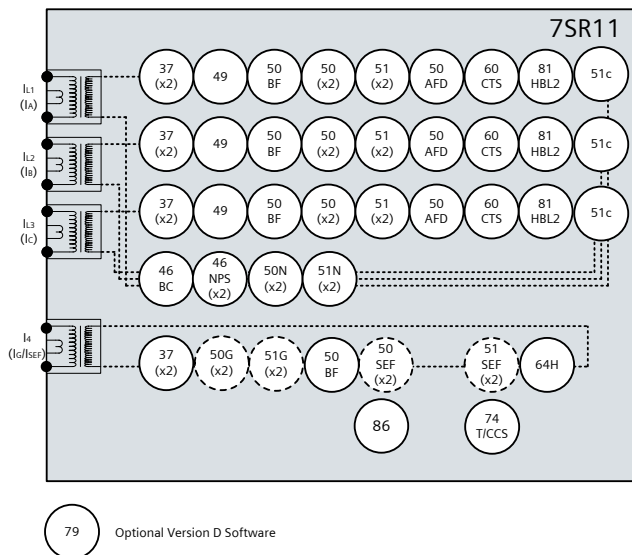


Fig 3 Four Pole Overcurrent Relay Version C Software

7SR12 Functional Diagrams

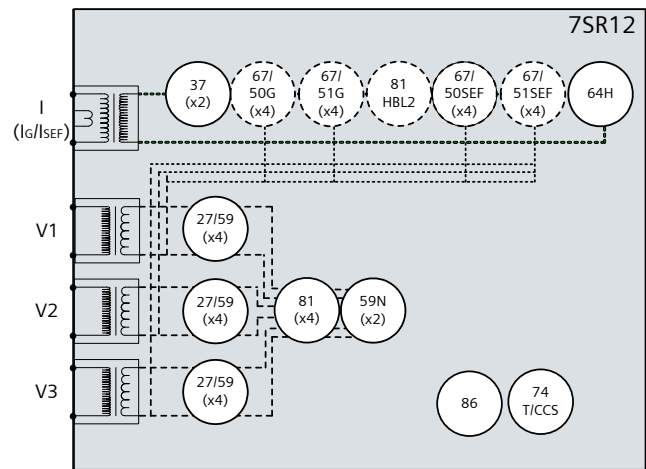


Fig 4. Single Pole Directional Relay

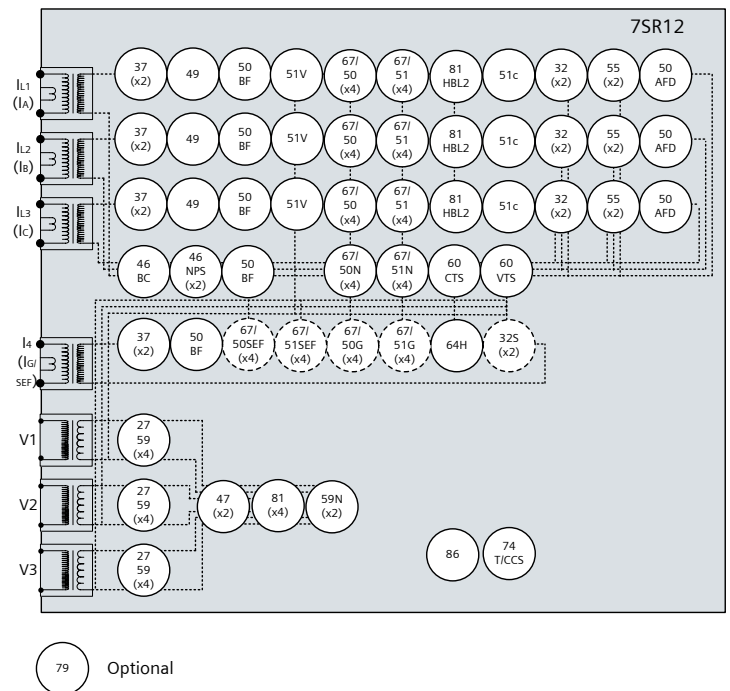


Fig 5. Four Pole Directional Overcurrent Relay

Notes

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

Description of Functionality

27/59 Under/Over Voltage

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

32 Power

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

32S Sensitive Power

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

37 Undercurrent

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

46BC Phase Unbalance/Broken Conductor

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

46NPS Negative Phase Sequence Overcurrent

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

47 Negative Phase Sequence Voltage

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

49 Thermal Overload

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

50BF Circuit Breaker Fail

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

51c Cold Load Pickup

If a circuit breaker is closed onto a 'cold' load, i.e. one that has not been powered for a prolonged period, this can

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

50/51 Phase Fault

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

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

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

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

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

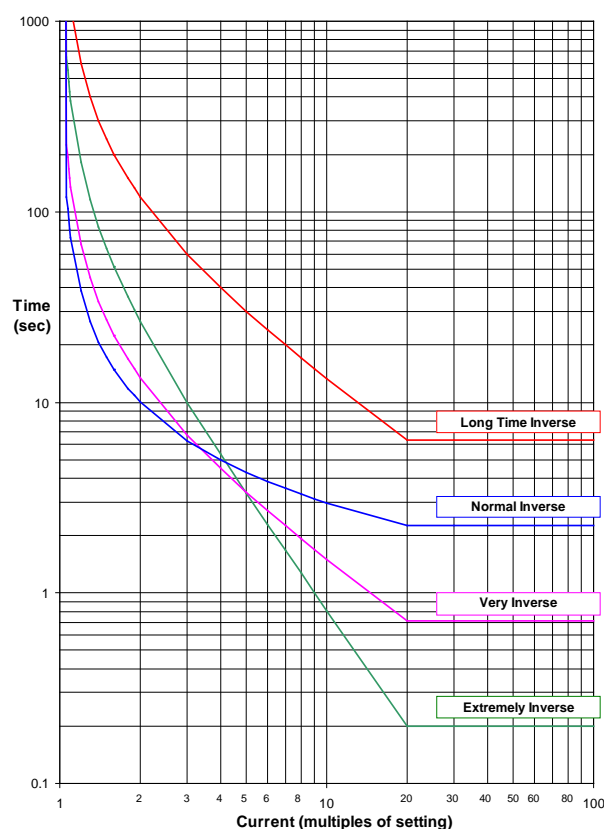


Fig 6. IEC Overcurrent Curves

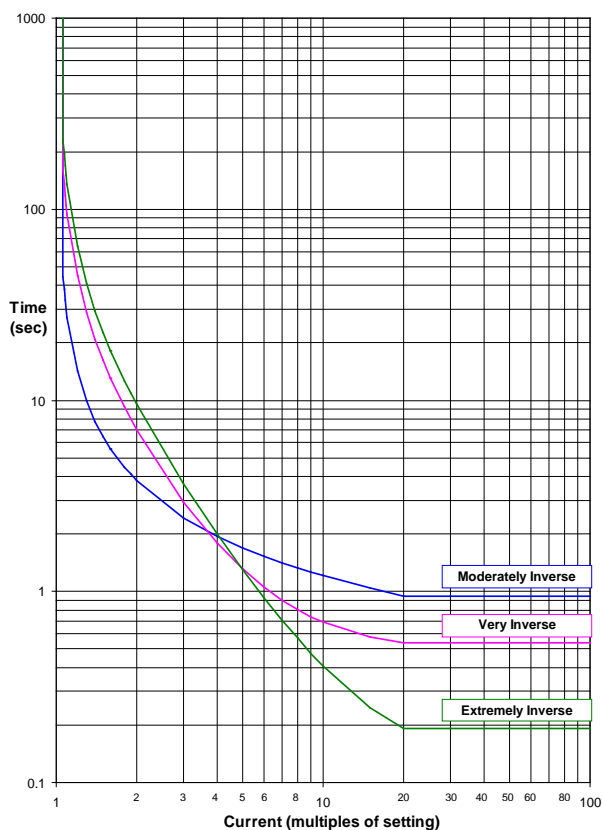


Fig 7. ANSI Overcurrent Curves

51V Voltage Controlled Overcurrent

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

50AFD Arc Flash Detector

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

55 Power Factor

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

59N Neutral Overvoltage

Neutral overvoltage can be used to detect earth faults in high impedance earthed or isolated systems. Operates if the neutral voltage exceeds setting for duration of delay.

60CTS CT Supervision

The relay has two methods of CT supervision.. The 7SR11 monitors each phase current input and operates if any one

or two inputs fall below the setting. The 7SR12 has the above method and an addition method that considers the presence of negative phase sequence current, without an equivalent level of negative phase sequence voltage, for a user set time as a CT failure. Both element types have user operate and delay settings.

60VTS VT Supervision

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

64H Restricted Earth Fault

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

67/67N Directional Control

Phase, earth and sensitive earth fault elements can be directionalised. Each element can be user set to Forward, Reverse, or Non-directional.

Directional Phase Fault elements are polarised from quadrature voltage.

Derived earth fault elements can be user set to be polarised from residual voltage or negative phase sequence voltage. Measured earth fault elements are polarized from V_0 .

74T/CCS Trip & Close Circuit Supervision

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

81HBL2 Inrush Restraint

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

81 Under/Overfrequency

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

Standard Version – Plus 79 Auto-Reclose

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

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

Programmable Logic

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

Virtual Inputs/Outputs

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

Circuit Breaker Maintenance

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

An I²t summation counter provides a measure of the contact wear indicating the total energy interrupted by the circuit breaker contacts.

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

Control Mode

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

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



Fig 8. Example of Control Function View

Data Acquisition - Via Communication Interface

Sequence of event records

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

Fault Records

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

Waveform recorder

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

Demand Metering

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

Real Time Clock

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

Serial Communications

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

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

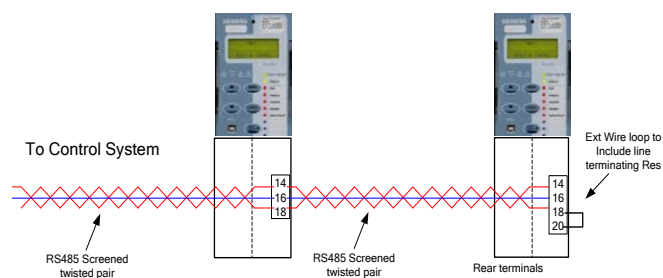


Fig 9. Typical RS485 connection

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

IEC 61850

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

Information on IEC61850 functionality can be found in the following 7SR11/12 documents:

- Model Implementation Conformance Statement (MICS)
- Protocol Implementation (PICS, PIXIT & TICS)

Reydisp Evolution

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

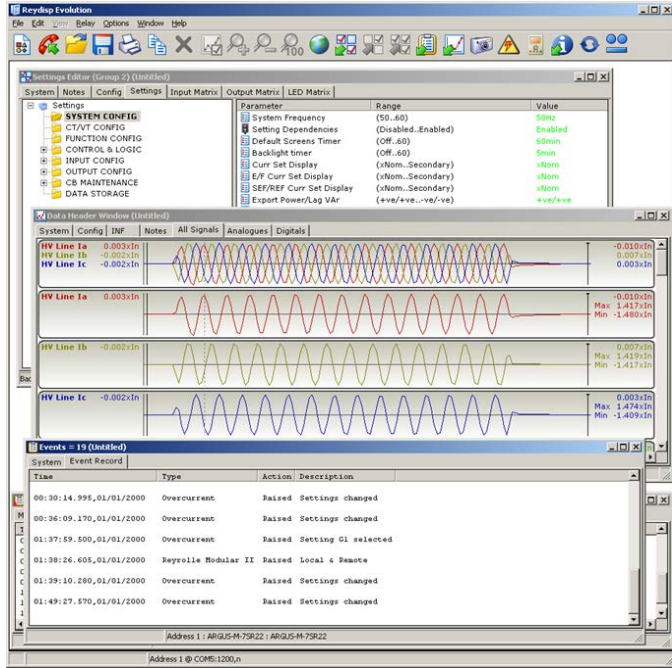


Fig 10. Typical Reydisp Evolution Screenshot

Language Editor

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

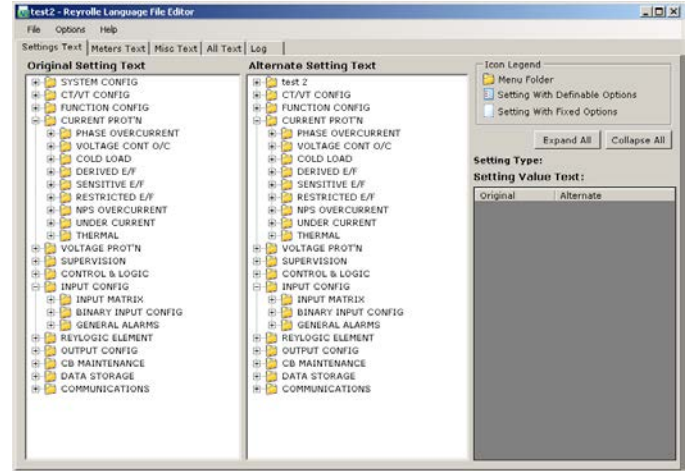


Fig 11. Typical Language Editor Screenshot

Communications Editor

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

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

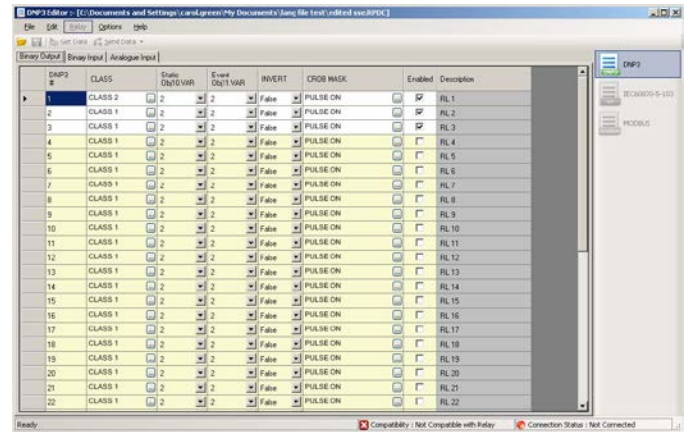


Fig 12. Typical Communications Editor Screenshot

Reydisp Manager

Reydisp Manager provides the functionality of Reydisp Evolution and also provides project management of multiple devices to allow engineering of IEC61850 projects. It also provides access to user logic within the devices via an easy to use graphical interface.

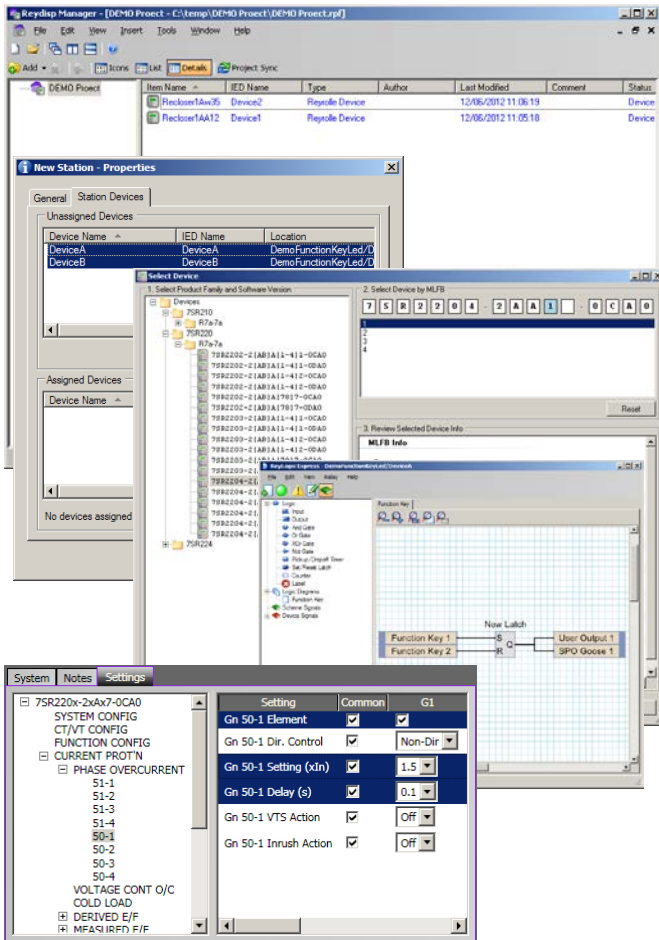


Fig 3. Typical Reydisp Manager screenshots

Construction

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

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

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



Fig 13. Rear view of relay (E4 Case)



Fig 14. Rear view of relay with 2x LC Fibre Optic ports (E6 Case with IEC61850)



Fig 15. Front view of relay (E4 Case with push buttons)



Fig 16. Front view of relay (E6 Case with IEC61850)

User Interface

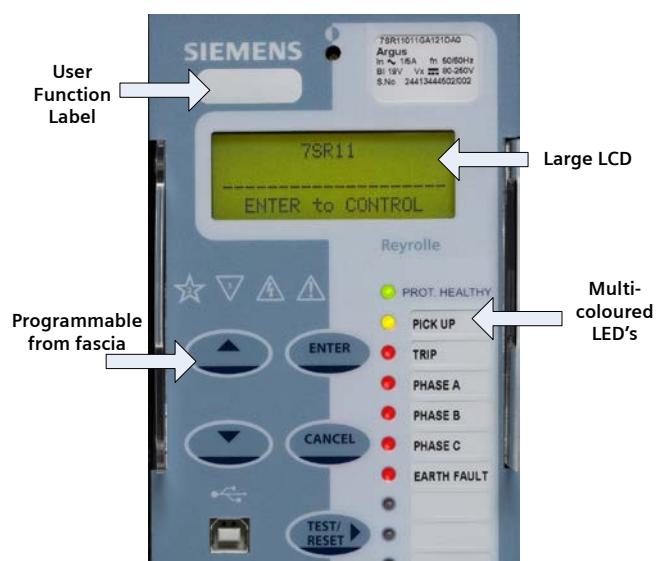


Fig 17. User Interface

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

LCD

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

LEDs

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

Relay Information

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

Technical Data

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

Inputs and Outputs

Current Inputs

Quantity	3 x Phase & 1 x Earth or Sensitive Earth
Rated Current In	1/5A
Measuring Range	80 x In
Instrumentation $\geq 0.1 \times I_n$	$\pm 1\% I_n$
Frequency	50/60Hz
Thermal Withstand:	
Continuous	3 x In
10 Minutes	3.5 x In
2 Minutes	6 x In
1 Second	100A (1A) 350A (5A)
1 Cycle	700A (1A) 2500A (5A)
Burden @ In	$\leq 0.02VA$ (1A phase and Earth element) $\leq 0.2VA$ (5A phase and earth element)

Voltage Inputs

Nominal	40...160 Vrms
Operating Range	0... 200 Vrms
Instrumentation $\geq 0.8 \times V_n$	$\pm 1\% V_n$
Burden @ 110V	$\leq 0.06 VA$
Overvoltage Withstand	300 Vrms

Auxiliary Supply

Rated DC Voltage	24-250V DC Operating Range 19.2 to 275V	
Allowable superimposed ac component	12% of DC voltage	
Rated AC Voltage	100-230 VAC 50/60Hz Range 80 to 253 V rms AC 50/60Hz $\pm 5\%$	
Power Consumption:	Min (DC)	3.6W (6.1W with IEC61850)
	Max (DC)	8.4W (11W with IEC61850)
	Min (AC)	9VA (14.5VA with IEC61850)
	Max (AC)	17VA (23VA with IEC61850)
Allowable breaks/dips in supply (collapse to zero)	DC	50ms
	AC	2.5/3 cycles @50/60Hz

Binary Inputs

Number	3,4 or 6	
Operating Voltage	19V dc	DC Range 17 to 320V dc AC Range 92 to 138 V _{RMS} AC
	88V dc	Range 70 to 320V dc
Maximum dc current for operation	1.5mA	
Maximum peak ac current for operation	1.5mA	
Pick Up Delay	User Selectable 0 to 14,400,000ms (up to 4 hours)	
Drop Off Delay	User Selectable 0 to 14,400,000ms (up to 4 hours)	

For AC operation the BI pick-up delay should be set to 0ms and the drop-off delay to 20ms.

Binary Outputs

Number	5 or 8 (3 change over contacts)	
Operating Voltage	Voltage Free	
Operating Mode	User selectable - Self or Hand/Electrical Reset or pulsed.	
Operating Time from Energizing Binary Input	<20ms	
Making Capacity:		
Carry continuously	5A ac or dc	
Make and carry (L/R ≤ 40 ms and V ≤ 300 V)	20A ac or dc for 0.5s 30A ac or dc for 0.2s	
Breaking Capacity (≤ 5 A and ≤ 300 V):		
AC Resistive	1250 VA	
AC Inductive	250 VA at p.f. ≤ 0.4	
DC Resistive	75 W	
DC Inductive	30 W at L/R ≤ 40 ms 50 W at L/R ≤ 10 ms	

Unit Design

Housing	E4 or E6(see dimension drawing)
Indication	20 Character 4 line Display Relay Healthy LED 9 Tri Coloured User Programmable Self or Hand Reset LED's
With-drawable Element	Yes
User Interface	5 Navigation Keys
Weight	Typical 3.1Kg
IP Rating installed with cover	IP 51 from front
IP Rating installed without cover	IP 20 from front

Data Communication Interface

Communication Port	Front USB Type B Rear RS485 2 wire electrical IEC61850 optional ports: 2x Electrical RJ45 Ethernet 2x LC Fibre Optic Ethernet
Protocols	IEC60870-5-103 MODBUS RTU (Serial) DNP3.0 O (Serial) IEC61850 - optional
Fibre Optic Ethernet Data Communication Interface (IEC 61850 Option)	

EN100 Fibre Optic Data Communication Interface (IEC 61850 Option)

Physical	layer Fibre-optic
Connectors	Duplex LC 100BaseF in acc. With IEEE802.3
Recommended fibre	62.5/125 µm glass fibre with Duplex-LC connector
Transmission Speed	100 Mbits/s
Optical Wavelength	1300 nm
Bridgeable distance	2 km

EN100 Electrical Ethernet Data Communication Interface (IEC 61850 Option)

Physical	Electrical
Connectors	RJ45 100BaseF in acc. With IEEE802.3
Transmission Speed	100 Mbits/s
Test Voltage (with regard to socket)	500 VAC 50 Hz
Bridgeable distance	20m

Data Storage

Fault Record	10 (5 for 7SR1102-1*A12-*AA0).
Waveform Record	10 x 1sec 2 x 5sec 5 x 2sec 1 x 10sec (5x1sec, 2x2sec, 1x5sec for 7SR1102-1*A12-*AA0) Pre trigger 10...90%
Events	1000 1ms Resolution

Mechanical Tests

Vibration (Sinusoidal)

IEC 60255-21-1 Class I

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

Shock and Bump

IEC 60255-21-2 Class I

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

Seismic

IEC 60255-21-3 Class I

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

Mechanical Classification

Durability	>10 ⁶ operations
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Electrical Tests

Insulation

IEC 60255-5

Type	Level
Between any terminal and earth	2.0 kV AC RMS for 1 min
Between independent circuits	2.0 kV AC RMS for 1 min
Across normally open contacts	1.0 kV AC RMS for 1 min

High Frequency Disturbance

IEC 60255-22-1 Class III

Type	Level	Variation
Common (longitudinal) mode	2.5 kV	≤ 5 %
Series (transverse) mode	1.0 kV	≤ 5 %

Electrostatic Discharge

IEC 60255-22-2

Type	Level	Variation
Front Cover Fitted	Class IV, 15 kV Air Discharge	≤ 5 %
Front Cover Removed	Class III, 8 kV Air Discharge	≤ 5 %

Fast Transients

IEC 60255-22-4 Class A (2002)

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

Surge Immunity

IEC 60255-22-5

Type	Level	Variation
Analog Inputs: Line to Earth	4.0 kV	≤ 10%
Case, Aux Power & I/O: Line to Earth	2.0 kV	≤ 10%
RS485 Comms port: Line to Earth	1.0 kV	No Data Loss
Analog Inputs: Line to Line	1.0 kV	≤ 10%
Case, Aux Power & I/O: Line to Line	1.0 kV *	≤ 10%

* Note 45ms DTL pick-up delay applied to binary inputs

Conducted Radio Frequency Interference

IEC 60255-22-6

Type	Level	Variation
0.15 to 80 MHz	10 V	≤ 5 %

Radiated Radio Frequency

IEC 60255-25

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

Conducted Radio Frequency

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

Radiated Immunity

IEC 60255-22-3 Class III

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

Climatic Tests

Temperature

IEC 60068-2-1/2

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

Humidity

IEC 60068-2-78

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

Performance

27/59 Under/Over Voltage

Number of Elements	4 Under or Over
Operate	Any phase or All phases
Voltage Guard	1, 1.5...200V
Setting Range Vs	5, 5.5...200V
Hysteresis Setting	0.0.1...80%
Vs Operate Level	100% Vs, ±1% or ±0.25V
Reset Level: Overvoltage Undervoltage	$= (100\% - \text{hyst}) \times V_{op}$, ±1% $= (100\% + \text{hyst}) \times V_{op}$, ±1%
Delay Setting td	0.00, 0.01...20, 20.5...100, 101... 1000, 1010...10000, 10100...144 00s
Basic Operate Time : 0 to 1.1xVs 0 to 2.0xVs 1.1 to 0.5xVs	73ms ±10ms 63ms ±10ms 58ms ±10ms
Operate time following delay.	Tbasic +td , ±1% or ±10ms
Inhibited by	Binary or Virtual Input VT Supervision Voltage Guard

32 Power (7SR12)

Number of Elements	2 Forward or Reverse
Operate	P, Q or S
U/C Guard	0.05 to 1.0 x In
Setting Range Ss	0.05 to 2.0 x Sn
Operate Level Sop	100% Ss, ±5% or ±2% Sn
Reset Level: -	≥95% Sop
Basic Operate Time: - 1.1 x Ss (over) 2.0 x Ss (over) 0.5 x Ss (under)	60ms ± 10ms 45ms ± 10ms 30ms ± 10ms
Delay Setting td	0 to 14400s
Operate time following delay.	tbasic +td , ±1% or ±10ms
Inhibited by	Undercurrent Guard, VTS

32S Sensitive Power (7SR12 SEF)

Number of Elements	2 Forward or Reverse
Operate	P, Q or S
U/C Guard	0.005 to 1.0 x In
Setting Range Ss	0.005 to 2.0 x Sn
Operate Level	100% Ss ± 5% or ± 2% Sn
Reset Level: -	≥95% Sop
Basic Operate Time: - 1.1 x Ss (over) 2.0 x Ss (over) 0.5 x Ss (under)	60ms ± 10ms 45ms ± 10ms 30ms ± 10ms
Delay Setting td	0 to 14400s
Operate time following delay.	tbasic +td ± 1% or ± 10ms
Inhibited by	Undercurrent Guard, VTS

37 Undercurrent

Number of Elements	2 Phase and 2 EF/SEF
Operate	Any phase or ALL
Setting Range Is	Phase and EF 0.05, 0.10...5.0 x In SEF 0.005, 0.010...5.0 x In
Operate Level	100% Is, ±5% or ±1% x In
Current Guard	Phase 0.05, 0.1...5.0 x In
Delay Setting td	0.00, 0.01...20, 20.5...100, 101... 1000, 1010...10000, 10100...144 00s
Basic Operate Time: 1.1 to 0.5xIn	35ms ±10ms
Operate time following delay.	Tbasic +td , ±1% or ±10ms
Overshoot Time	< 40ms
Inhibited by	Binary or Virtual Input

46 Negative Phase Sequence Overcurrent

Number of Elements	DT & IT
DT Setting Range Is	0.05, 0.10...4.0 x In
DT Operate Level	100% Is, ±5% or ±1% x In
DT Delay Setting td	0.00, 0.01...20, 20.5...100, 101... 1000, 1010...10000, 10100... 14400s
DT Basic Operate Time 0 to 2 xIs 0 to 5 xIs	40ms ±10ms 30ms ±10ms
DT Operate time following delay.	Tbasic +td , ±1% or ±10ms
IT Char Setting	IEC NI, VI, EI, LTI ANSI MI, VI, EI & DTL
IT Setting Range	0.05..2.5
Tm Time Multiplier	0.025, 0.030...1.6, 1.7...5, 6...100
Char Operate Level	105% Is, ±4% or ±1% In
Overshoot Time	< 40ms
Inhibited by	Binary or Virtual Input

47 Negative Phase Sequence

Number of Elements	2
Setting Range Vs	1, 1.5...90V
Hysteresis Setting	0, 0.1...80%
Operate Level	100% Vs, ±2% or ±0.5V
Delay Setting td	0.00, 0.01...20, 20.5...100, 101... 1000, 1010...10000, 10100... 14400s
Basic Operate Time 0V to 1.5xVs 0V to 10xVs	80ms ±20ms 55ms ±20ms
Operate time following delay.	Tbasic +td , ±2% or ±20ms
Overshoot Time	< 40ms
Inhibited by	Binary or Virtual Input

49 Thermal Overload

Operate levels	Operate and Alarm
Setting Range Is	0.10,0.11...3.0 x In
Operate Level	100% Is, ±5% or ±1%xIn
Time Constant Setting	1,1.5...1000min
Operate time	$t = \tau \times \ln \left\{ \frac{I^2 \cdot I_p^2}{I^2 \cdot (k \times I_B)^2} \right\}$ ±5% absolute or ±100ms where Ip = prior current
Alarm Level	Disabled, 50,51...100%
Inhibited by	Binary or Virtual Input

50 (67) Instantaneous & DTL OC&EF (Directional)

Operation – 7SR12 only	Non directional, Forward or reverse
Elements	Phase, Derived Earth, Measured Earth & SEF
Number of Elements 2 x 7SR11 4 x 7SR12	2/4 x OC 2/4 x Derived EF 'N' 2/4 x Measured EF 'G' where fitted 2/4 x SEF where fitted
Setting Range Is	0.05,0.06...50 x In SEF 0.005...5 x In
Time Delay	0.00...14400s
Operate Level Iop	100% Is, ±5% or ±1%xIn
Reset level	≥ 95 % Iop
Operate time: 50 50N	0 to 2xIs – 35ms, ±10ms, 0 to 5xIs – 25ms, ±10ms 0 to 2xIs – 40ms, ±10ms, 0 to 5xIs – 30ms, ±10ms
Operate time following delay	Tbasic +td , ±1% or ±10ms
Inhibited by	Binary or Virtual Input Inrush detector VT Supervision

51(67) Time Delayed OC&EF (Directional)

Operation – 7SR12 only	Non directional, Forward or reverse
Elements	Phase, Derived Earth, Measured Earth & SEF
Number of Elements 2 x 7SR11 4 x 7SR12	2/4 x OC 2/4 x Derived EF 'N' 2/4 x Measured EF 'G' 2/4 x SEF where fitted
Characteristic	IEC NI,VI,EI,LTI ANSI MI,VI,EI & DTL
Setting Range Is	0.05,0.06...2.5 x In SEF 0.005...0.5 x In
Time Multiplier	0.025,0.030...1.6,1.7...5,6...100
Time Delay	0,0.01... 20s
Operate Level	105% Is, ±4% or ±1%xIn
Minimum Operate time IEC	$t_{op} = \frac{K}{\left[\frac{I}{I_s}\right]^{\alpha} - 1} \times Tm$
ANSI	$t_{op} = \left[\frac{A}{\left[\frac{I}{I_s}\right]^{\beta} - 1} + B \right] \times Tm$
	± 5 % absolute or ± 30 ms

Follower Delay	0 - 20s
Reset	ANSI decaying, 0 – 60s
Inhibited by	Binary or Virtual Input Inrush detector VT Supervision

51V Voltage Controlled Overcurrent

Setting Range	5,5.5...200V
Operate Level	100% Vs, ±5% or ±1%xVn
Multiplier	0.25.0.3...1 x 51Is
Inhibited by	VT Supervision

50AFD Arc Flash Detector

Number of Zones	6, segregated outputs with and without current supervision.
Setting Range Is	1,2...10 x In
Operate Level Iop	100% Is, ±5% or ±1%xIn
Reset level	≥ 95 % Iop
Operate time:	50AFD Overcurrent <16ms AFD Zone Operate Time <25ms

50BF Circuit Breaker Fail

Operation	Current check - Phase and Measured Earth with independent settings Mechanical Trip CB Faulty Monitor
Setting Range Is	0.05,0.055...2.0 x In
2 Stage Time Delays	Timer 1 20...60000ms Timer 2 20...60000ms
Operate Level	100% Is, ±5% or ±1%xIn
Disengaging time	< 20ms
Operate time following delay	Tcbf ±1% or ±2ms
Triggered by	Any function mapped as trip contact.
Inhibited by	Binary/Virtual Input
Timer By pass	Yes, 50BF CB Faulty Input

55 Power factor (7SR12)

Number of Elements	2
Operation	Under or Over, Lead or Lag
U/C Guard	0.05 to 1.0
Setting Range PFs	0.05 to 0.99
Time Delays	0 to 14400s
Operate Level	± 0.05
Basic Operate time	≤ 70ms
Operate time following delay	tbasic +td ± 1% or ± 10ms
Inhibited by	Undercurrent Guard, VTS

59N Neutral Voltage Displacement

Number of Elements	DT & IT
DT Setting Range Is	1...100V
DT Operate Level	100% Vs, $\pm 2\%$ or $\pm 0.5V$
DT Delay Setting td	0 ...14400s
DT Basic Operate Time	
0V to 1.5 x Vs	76ms ± 20 ms
0V to 10 x Vs	63ms ± 20 ms
DT Operate time following delay.	Tbasic +td, $\pm 1\%$ or ± 20 ms
IT Char Setting	IDMTL & DTL
IT Setting Range	1...100V
Tm Time	0.1...140
Multiplier(IDMT)	
Delay (DTL)	0...20s
Reset	ANSI Decaying, 0...60s
Char Operate Level	105% Vs, $\pm 2\%$ or $\pm 0.5V$
Inhibited by	Binary or Virtual Input

60 Supervision

CT	7SR11 Current 7SR12 Current or Vnps & Inps
VT	nps/zps

64H Restricted Earth Fault

Setting Range	SEF input	0.005, 0.006 ... 0.100, 0.105 ... 0.950 xIn
	EF input	0.05, 0.055... 0.95 xIn
Operate Level	100% Is, $\pm 5\%$ or $\pm 1\% \times In$	
Time Delay	0.00... 14400s	
Basic Operate Time	0 to 2 xIs 45ms ± 10 ms 0 to 5 xIs 35ms ± 10 ms	
Inhibited by	Binary or Virtual Input	

74T/CC Trip/Close Circuit Supervision

Number of supervisable circuits	3 x Trip and 3 x Close
Number of BI's Required	1 or 2 per function

79 AutoReclose

Operating Mode	Phase, Earth, SEF External
Number of Reclosures	4
Number of Trips	5
Dead Time	0...14400
Reclaim Time	0...600
Lockout Reset	CB, Timer & BI

81 Under/Over Frequency

Number of Elements	4 Under or Over
Under Voltage Guard	Yes/No
Setting Range Hz	43,43.01...68Hz
Hysteresis Setting	0, 0.1... 2%
Operate Level	100% Fs ± 10 mHz
Operate Time	Typical <150ms
Vs Operate Delay	0...14400s

Control Functions

CB	Open/Close
Inst Prot	IN/OUT
EF	IN/OUT
SEF	IN/OUT
Hot Line	IN/OUT
Relay Mode	Local/Remote/Local or Remote
Reset	LED's & O/P's

Not available in 7SR1102-1*A12-*AAO

CB Maintenance

Trip Counter	Total & Delta 0...10000
Counts to AR Block	0...10000
Frequent Operations	0...10000
I ² t Alarm	10...100000

Case Dimensions

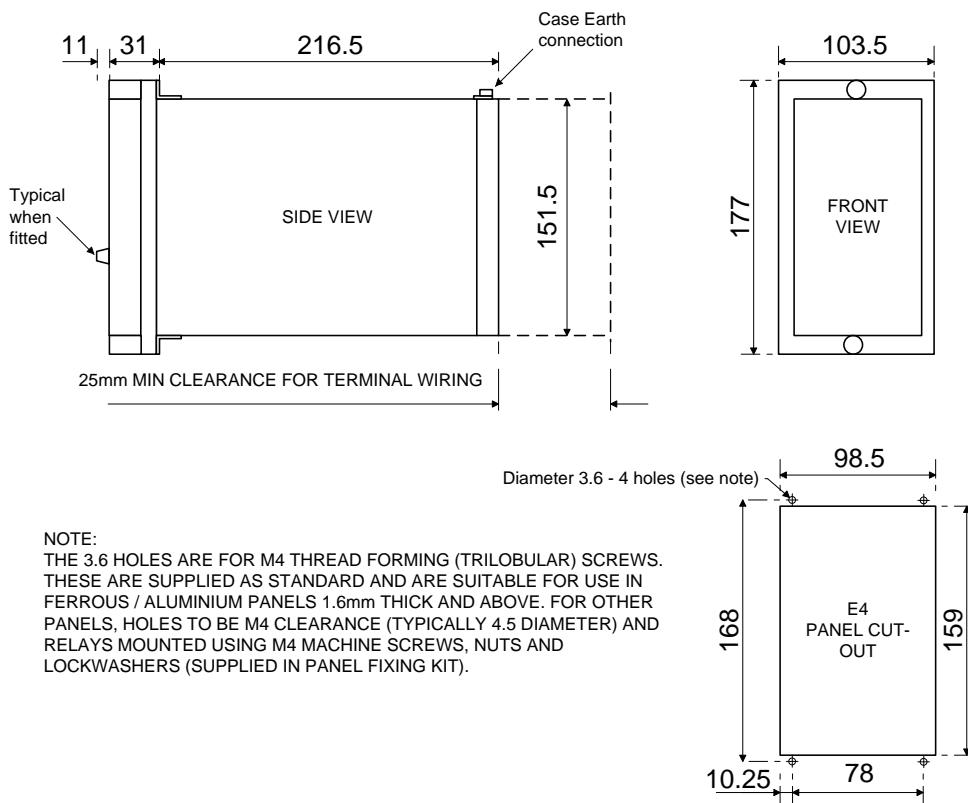


Fig 18. E4 Case Dimensions

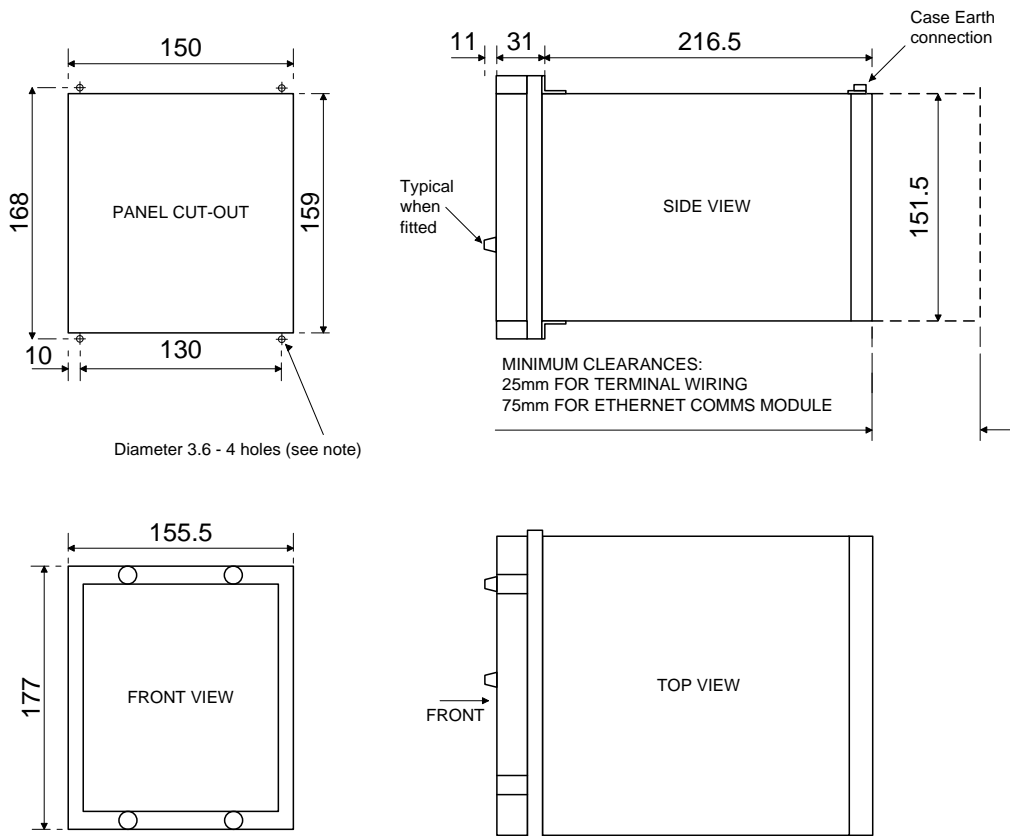


Fig 19. E6 Case Dimensions

7SR11 Connection Diagram

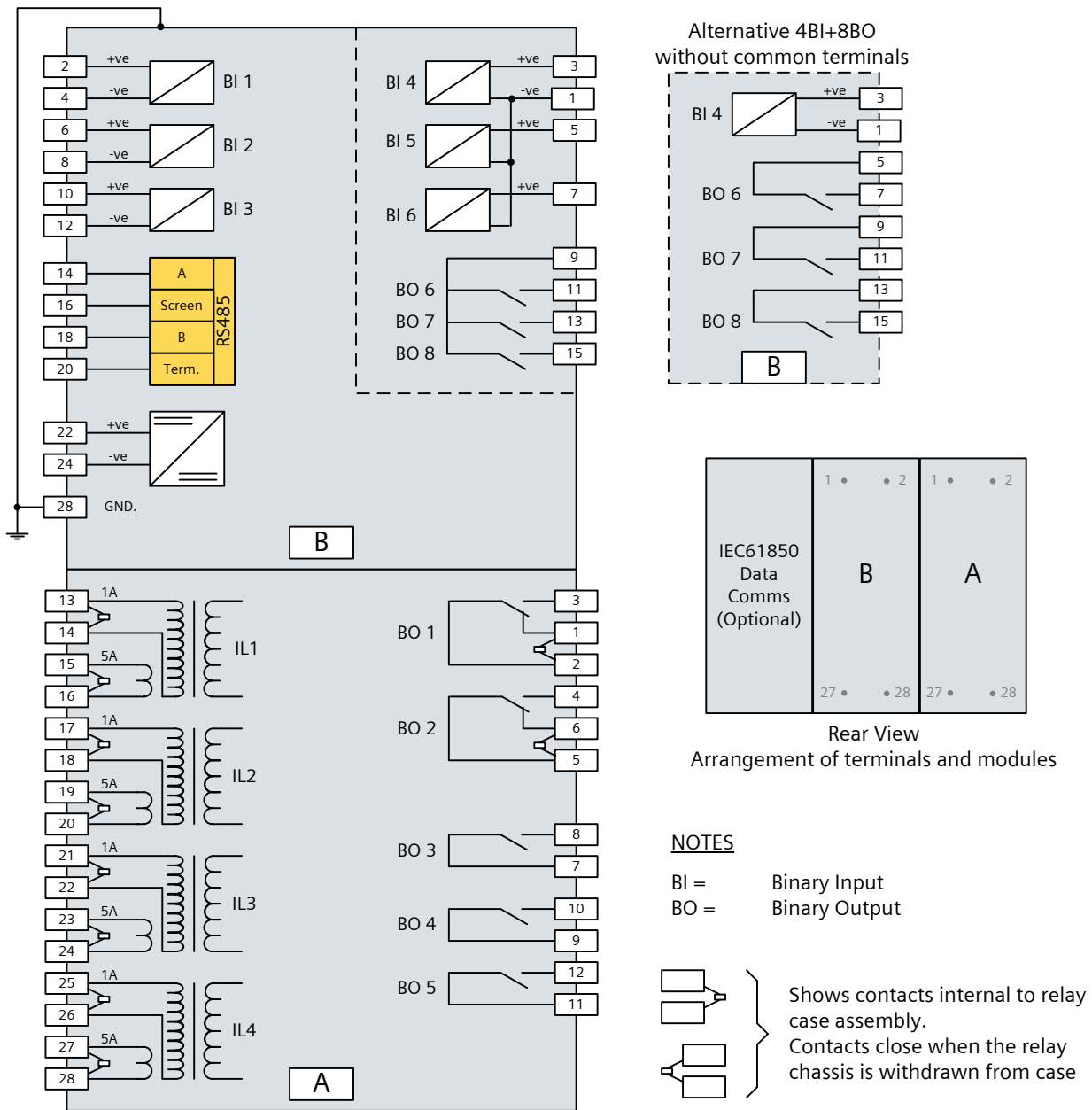


Fig20. Diagram showing 7SR11 relay with 4 CT inputs, up to 6 binary inputs and 8 binary outputs.

7SR12 Connection Diagram

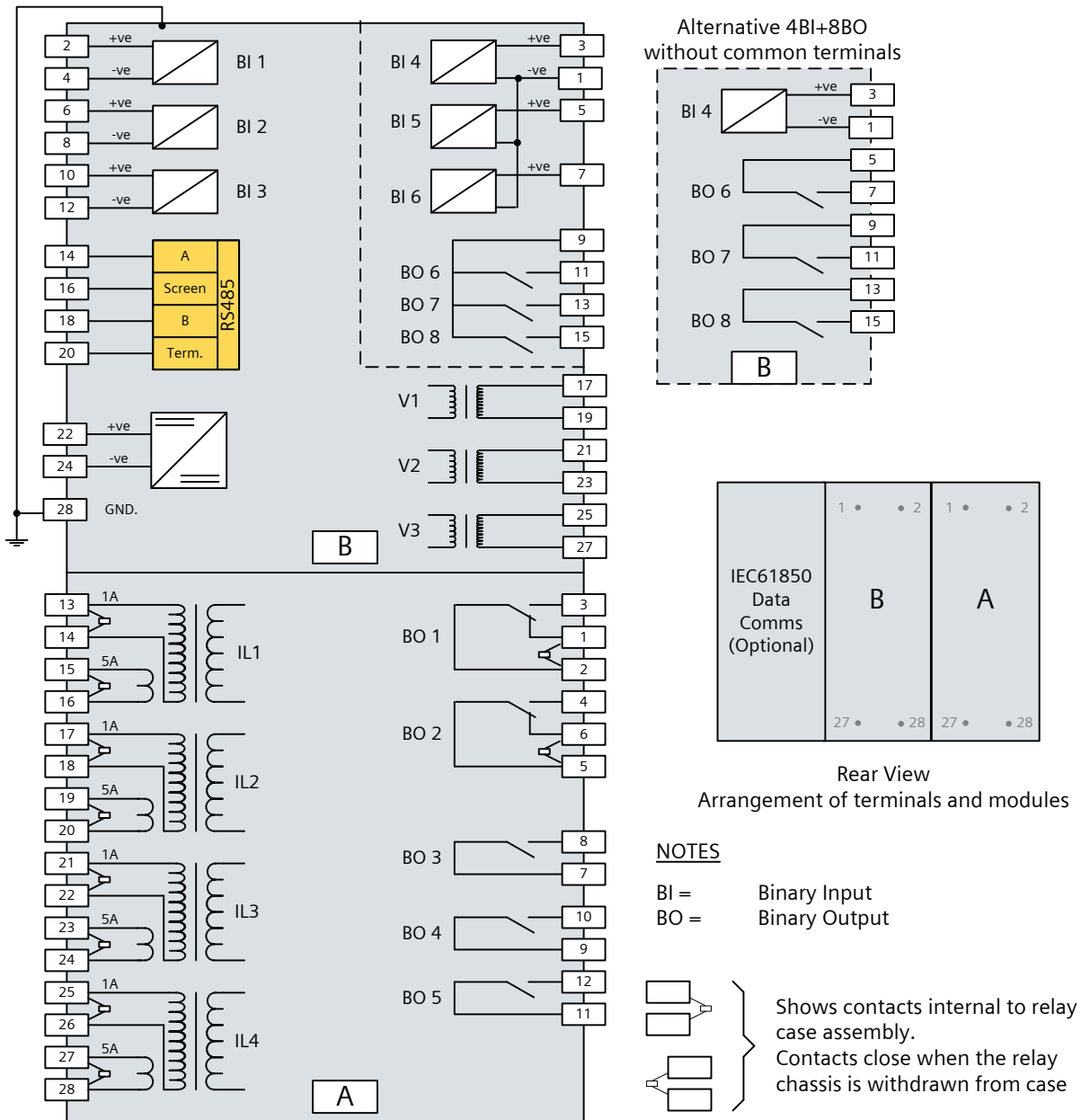


Fig21. Diagram showing 7SR12 relay with 4 CT inputs, 3 VT inputs, up to 6 binary inputs and 8 binary outputs.

Ordering Information – 7SR11 Argus Non-Directional Overcurrent

Product description Variants

Order No.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
Nondirectional O/C Relay (Argus)	7	S	R	1	1	0	□	-	□	□	A	□	□	-	□	□	A	0
Overcurrent and earth fault					↑													
Protection relay																		
<u>Protection Product</u>					1													
Overcurrent – Non Directional																		
<u>Housing I/O and Fascia</u>																		
1 CT, 3 Binary Inputs / 5 Binary Outputs, 10 LEDs							1				1							
4 CT, 3 Binary Inputs / 5 Binary Outputs, 10 LEDs							2											
4 CT, 6 Binary Inputs / 8 Binary Outputs, 10 LEDs							3											
4 CT, 4 Binary Inputs / 8 Binary Outputs, 10 LEDs ⁷⁾							7											
<u>Measuring Input</u>																		
1/5 A, 50/60Hz ¹⁾								1										
1/5 A, 50/60Hz with SEF Input ²⁾								3										
<u>Auxiliary voltage</u>																		
PSU Rated: 24-250V DC / 100-230V AC. BI threshold 19V DC (Rated: 24-250V DC / 100-120V AC)										M								
PSU Rated: 24-250V DC / 100-230V AC. BI threshold 88V DC (Rated: 110-250V DC)										N								
<u>Communication Interface</u>																		
Standard version – included in all models, USB front port, RS485 rear port (E4 Case)											1	2						
Standard version – plus additional rear electrical Ethernet RJ45 (x2), E6 Case ⁶⁾											7	7						C/D
Standard version – plus additional rear optical Ethernet duplex (x2), E6 Case ⁶⁾											8	7						C/D
<u>Protocol</u>																		
IEC 60870-5-103 Modbus RTU and DNP3 (user selectable)													2					
IEC 60870-5-103 Modbus RTU, DNP3 and IEC 61850 (user selectable settings) ⁶⁾													7					
<u>Relay Cover</u>																		
Standard Version – No Push Buttons																		
Push Buttons – Down and Right Arrows																		
<u>Protection Function Packages</u>																		
Basic version ⁵⁾																		
46BC ³⁾ Broken conductor/load unbalance																		
50 ³⁾ Instantaneous phase fault overcurrent																		
50BF ³⁾ Circuit breaker fail																		
50G/50N Instantaneous earth fault																		
51 ³⁾ Time delayed phase fault overcurrent																		
51G/51N Time delayed earth fault																		
60CTS ³⁾ CT Supervision																		
64H High impedance REF																		
74T&C Trip & Close circuit supervision																		
86 Hand reset contacts																		
Standard version																		
37 Undercurrent																		
46BC ³⁾ Broken conductor/load unbalance																		
46NPS ³⁾ Negative phase sequence overcurrent																		
49 ³⁾ Thermal overload																		
50 ³⁾ Instantaneous phase fault overcurrent																		
50AFD Arc Flash Detection																		
50BF ³⁾ Circuit breaker fail																		
50G/50N Instantaneous earth fault																		
50SEF ²⁾ Instantaneous sensitive earth fault																		
51 ³⁾ Time delayed phase fault overcurrent																		
51G/51N Time delayed earth fault																		
51SEF ²⁾ Time delayed sensitive earth fault																		
60CT ³⁾ CT Supervision																		
64H High Impedance REF																		
74T/CC Trip and Close circuit supervision																		
81HBL ²⁾ 2 nd harmonic block/inrush restraint																		
51C ³⁾ Cold load pickup																		
86 Hand reset contacts																		
Programmable logic																		

(continued on next page)

Ordering Information – 7SR11 Argus Non-Directional Overcurrent

Product description Variants Order No.

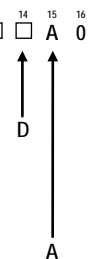
Nondirectional O/C Relay (Argus) 7 1 1 0 □ - □ □ A □ □ - □ □ A 0

continued from previous page

Standard version – plus
79 Autoreclose

Additional Functionality

No Additional Functionality



- 1) 4CT is configured as 3PF + EF
- 2) 4CT is configured as 3PF + SEF/REF.
- 3) Functions only available in 4CT relay
- 4) Not available on SEF input
- 5) Protection function package ordering option A is only available on hardware variant 7SR1102-1XA12-XAA0- 4CT 3BI 5BO
- 6) E4 case is standard, E6 case is required if IEC61850 model ordered
- 7) 4 Binary Input variant provides segregated Binary Outputs without a common terminal

Ordering Information – 7SR12 Argus Directional Overcurrent

Product description Variants Order No.

Directional O/C Relay (Argus)

Directional overcurrent and earth fault protection relay

Protection Product
Overcurrent – Directional

Housing I/O and Fascia

1 CT, 3 VT, 3 Binary Inputs / 5 Binary Outputs, 10 LEDs
4 CT, 3 VT, 3 Binary Inputs / 5 Binary Outputs, 10 LEDs
4 CT, 3 VT, 6 Binary Inputs / 8 Binary Outputs, 10 LEDs
4 CT, 3 VT, 4 Binary Inputs / 8 Binary Outputs, 10 LEDs⁴⁾

Measuring Input

1/5 A, 40 to 160 V, 50/60Hz¹⁾
1/5 A, 40 to 160 V, 50/60Hz with SEF Input²⁾

Auxiliary voltage

PSU Rated: 24-250V DC / 100-230V AC. BI threshold 19V DC (Rated: 24-250V DC / 100-120V AC)
PSU Rated: 24-250V DC / 100-230V AC. BI threshold 88V DC (Rated: 110-250V DC)

Communication Interface

Standard version – included in all models, USB front port, RS485 rear port (E4 Case)
Standard version – plus additional rear electrical Ethernet RJ45 (x2), E6 Case⁵⁾
Standard version – plus additional rear optical Ethernet duplex (x2), E6 Case⁵⁾

Protocol

IEC 60870-5-103, Modbus RTU and DNP3 (user selectable)
IEC 60870-5-103 Modbus RTU, DNP3 and IEC 61850 (user selectable settings)⁵⁾

Relay Cover

Standard Version – No Push Buttons
Push Buttons – Down and Right Arrows

Protection Function Packages

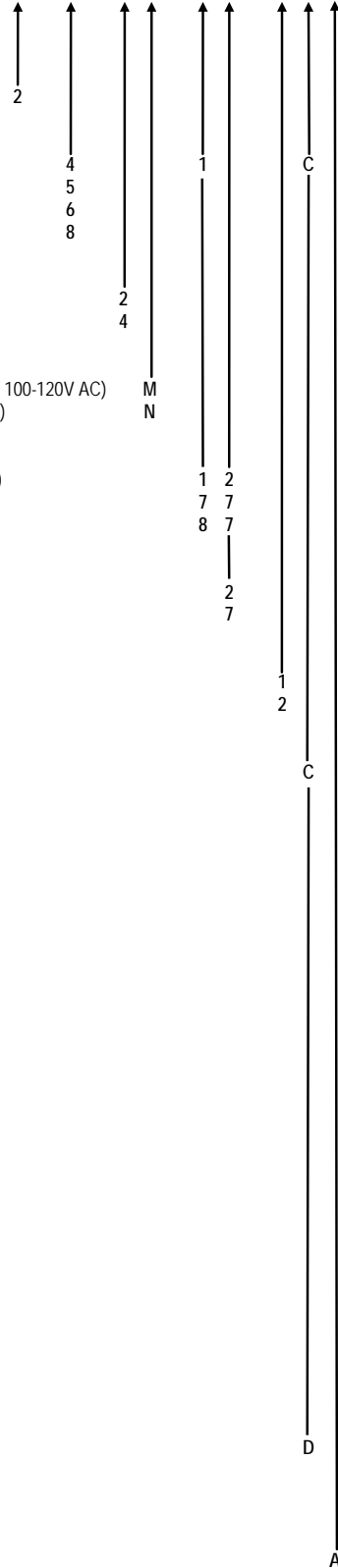
Standard version – Included in all models
27/59 Under/overvoltage
32³⁾ Power
32S⁷⁾ Sensitive Power
37 Undercurrent
46BC³⁾ Broken conductor/load unbalance
46NPS³⁾ Negative phase sequence overcurrent
47 Negative phase sequence voltage
49³⁾ Thermal overload
50AFD Arc Flash Detection
50BF³⁾ Circuit breaker fail
51V³⁾ Voltage controlled overcurrent
55³⁾ Power Factor
59N Neutral voltage displacement
60CTS³⁾ CT supervision
60VTS³⁾ VT supervision
64H High Impedance REF
67/50 Directional instantaneous phase fault overcurrent
67/50G 67/50N Directional instantaneous earth fault
67/50SEF²⁾ Instantaneous sensitive earth fault
67/51 Directional time delayed phase fault overcurrent
67/51G 67/51N Directional time delayed earth fault
67/51/SEF²⁾ Time delayed sensitive earth fault
81HBL2⁴⁾ 2nd harmonic block/inrush restraint
74T/CC Trip & Close circuit supervision
51C³⁾ Cold load pickup
81U/0 Under/Over Frequency
86 Hand reset contacts
Programmable logic

Standard version – plus
79 Autoreclose

Additional Functionality

No Additional Functionality

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
7 S R 1 2 0 □ - □ □ A □ □ - □ □ A 0



- 1) 4CT is configured as 3PF + EF
- 2) 4CT is configured as 3PF + SEF/REF
- 3) Functions only available in 4CT relay
- 4) Not available on SEF input
- 5) E4 case is standard, E6 case is required if IEC61850 model ordered
- 6) 4 Binary Input variant provides segregated Binary Outputs without a common terminal
- 7) Functions only available in 4CT SEF relay

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