



Reyrolle  
Protection  
Devices

## 7SR210 & 7SR220 Argus

Overcurrent Protection Relay

Energy Management

**SIEMENS**

# 7SR210 7SR220 Argus

Overcurrent Protection Relay



## Description

The 7SR210 and 7SR220 are a new generation of non-directional and directional overcurrent protection relays, built on years of numeric relay protection experience with the Argus family of products. Housed in 4U high, size E6, E8 or E12 cases, these relays provide protection, control, monitoring, instrumentation and metering with integrated input and output logic, data logging & fault reports. Communication access to relay functionality is via a front USB port for local PC connection or rear electrical RS485 port for remote connection. Additional rear port options are available.

## Function Overview

### Standard Functionality – 7SR210 & 7SR220

37	Undercurrent
46BC	Broken Conductor / Load Unbalance
46NPS	Negative Phase Sequence Overcurrent
49	Thermal Overload
50	Instantaneous Overcurrent
50G/N	Instantaneous Earth Fault
50BF	Circuit Breaker Fail
50AFD	Arc Flash Detector
51	Time Delayed Overcurrent
51G/N	Time Delayed Measured Earth Fault /SEF
60CTS-I	CT Supervision
64H	High Impedance REF
74TC/CC	Trip/Close Circuit Supervision
81HBL2	2nd Harmonic Block/Inrush Restraint
51c	Cold Load Pickup
8	Settings Groups
Password Protection – 2 levels	
User Programmable Logic	
Self Monitoring	
CB Control	

### Standard Functionality - 7SR220 Directional Relay

21FL	Fault Locator
21LB	Load Blinder
32	Power
32S	Sensitive Power
27/59	Under/Over Voltage
47	Negative Phase Sequence (NPS) voltage
51V	Voltage Controlled Overcurrent
55	Power Factor
59N	Neutral Voltage Displacement
60CTS	CT Supervision
60VTS	VT Supervision
67/50	Bi-Directional Instantaneous Overcurrent
67/50G/N	Bi-Directional Instantaneous Earth Fault
67/51	Bi-Directional Time Delayed Overcurrent
67/51G/N	Bi-Directional Time Delayed Earth Fault
67/50/51	SEF for Compensated Networks
81	Under/Over Frequency
86	Lockout

### Optional Functionality – 7SR210 & 7SR220

79 + 25	Auto Reclose + Check Sync
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## User Interface

- 20 character x 4 line backlit LCD
- Menu navigation keys
- 3 fixed LEDs
- 8, 16 or 32 Programmable Tri-colour LEDs (Option)
- 6 or 12 Programmable Function Keys each with Tri-colour LED (Option)

## Monitoring Functions

### Standard Monitoring – 7SR210 & 7SR220

- Primary & Secondary current phases and earth
- Positive Phase Sequence (PPS) Current
- Negative Phase Sequence (NPS) Current
- Zero Phase Sequence (ZPS) Current
- Binary Input/Output status
- Trip circuit healthy/failure
- Time and date
- Starters
- Fault records
- Event records
- Waveform records
- Circuit breaker trip counters
- I<sup>2</sup>t summation for contact wear
- Demand metering

### Standard Monitoring - 7SR220 Directional Relay

- Direction
- Frequency
- Primary line and phase voltages
- Secondary voltages
- Apparent power and power factor
- Real and reactive power
- W Hr forward and reverse
- VAr Hr forward and reverse
- Historical demand record
- Positive phase sequence (PPS) Voltage
- Negative phase sequence (NPS) Voltage
- Zero phase sequence (ZPS) Voltage

## Data Communications

### Standard Communications Ports

Communication access to relay functionality is via a front USB port for local PC connection or rear electrical RS485 port for remote connection

### Optional Communications Ports

2 Rear ST fibre optic ports (2 x Tx/Rx) + IRIG-B port  
1 Rear RS485 + IRIG-B port  
1 Rear RS232 + IRIG-B port  
2 Electrical Ethernet  
2 Optical Ethernet

### Protocols

IEC60870-5-103, Modbus RTU and optional DNP 3.0 protocols – User selectable with programmable data points  
IEC61850 over Ethernet – optional  
Ethernet Redundancy: RSTP, HSR & PRP – standard on ethernet equipped models

### Data

Event records  
Fault records  
Waveform records  
Measurands  
Commands  
Time synchronism  
Viewing and changing settings

## Description of Functionality

With reference to figure 8 and figure 9 'Function Diagrams'.

## Standard Functionality

### 37 Undercurrent

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

### 46BC Phase Unbalance/Broken Conductor

Element has settings for pickup level and DTL delay. With the circuit breaker closed, if one or two of the line currents fall below setting this could be due to a broken conductor.

### 46NPS Negative Phase Sequence Overcurrent

Two elements, one DTL and one IDMT, with user settings for pickup level and delays, will operate if NPS Current exceeds setting and delay. NPS Current elements can be used to detect unbalances on the system or remote earth faults when a delta-star transformer is in circuit.

### 49 Thermal Overload

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

### 50/51 Phase Fault

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

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

Two earth fault measurement modes are available. One mode directly measures the earth current from an independent CT, or the residual connection of the 3 line CTs. This input can be set to be either earth fault or sensitive earth fault (50G/51G). The second mode derives the earth current internally from the 3 phase CTs (50N/51N). 50 INST/DTL and 51 IDMT/DTL elements provide overcurrent protection, each with independent settings for pickup current, time-multiplier (51) and time-delays. User can select IEC or ANSI Time Current Characteristics. The IDMT stage has a user programmable reset characteristic either DTL or shaped current/time reset characteristic to improve grading with electromechanical protection.

### 50BF Circuit Breaker Fail

The circuit breaker fail function may be triggered from an internal trip signal or from a binary input. Line currents are monitored following a trip signal and an output is issued if any current is still detected after a specified time interval. This can be used to re-trip the CB or to back-trip an upstream CB. A second back-trip time delay is available to enable another stage to be utilized if required.

### 60CTS-I CT Supervision

The CTS-I CT Supervision function monitors each phase current input and operates if any one or two inputs fall below the setting. The element types have user operate and delay settings.

### 64H Restricted Earth Fault - scheme

The measured earth fault input may be used in a 64H high impedance restricted earth fault scheme. Required external series stabilising resistor and non-linear shunt resistor can be supplied.

### 74TC/CC Trip/Close Circuit Supervision

The trip/close circuit(s) can be monitored via binary inputs connected in H4/H5/H6 or H7 schemes. Trip/Close circuit failure raises an HMI alarm and output(s).

### 81HBL2/5 Harmonic Block / Inrush Restraint / Overfluxing

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

### 51c Cold Load

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

### 21FL Fault Locator

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

### 21LB Load Blinder

Load Blinders are used with overcurrent elements to block tripping during periods of high reverse load currents that can occur in distribution networks. The blinder is operated during user defined load conditions and is used in conjunction with the relay protection elements.

### 50AFD Arc Flash Detector

The 7SR2 relays can be used with the 7XG31 ReyArc range of Arc Flash Detection devices. Arc fault protection is a technique employed for the fast clearance of arcing faults on busbars, within metal clad switchgear & associated cable boxes. The arc is detected using an optical sensor & the signal input to a protection device which also monitors the load current on the system. A trip signal can be achieved in less than 10 ms using arc detection only or within 20 ms when using overcurrent check.

### Programmable User Logic

The user can map Binary Inputs and Protection operated outputs to Function Inhibits, Logic Inputs, LEDs and/or Binary Outputs. The user can also enter up to 16 equations defining scheme logic using standard functions e.g. Timers, AND/OR gates, Inverters and Counters. Each Protection element output can be used for Alarm & Indication and/or tripping.

### Circuit Breaker Maintenance

Two circuit breaker operations counters are provided. The Maintenance Counters record the overall number of operations and the Delta Counter the number of operations since the last reset. An I<sup>2</sup>t summation Counter provides a measure of the contact wear indicating the total energy interrupted by the circuit breaker contacts. Each counter has a user set target operations count which, when reached, can be mapped to raise Alarms/ Binary Outputs. These counters assist with maintenance scheduling.

### Function LED's

Eight, sixteen or thirty-two user programmable tri-colour LED's are provided eliminating the need for expensive panel mounted pilot lights and associated wiring. Each LED can be user set to red, green or yellow allowing for clear indication of the associated function's state. A slip-in label pocket along-side enables the user to insert customised notation. A printer compatible template is available.

### Function Keys

Six or twelve user programmable function keys are available for implementing User logic and scheme control functionality, eliminating the need for expensive panel mounted control switches and associated wiring. Each function key has an associated user programmable tri-colour LED (red, green, yellow) allowing for clear indication of the associated function's state. A slip-in label pocket along-side enables the user to insert his own notation for the function Key LED Identification. Each Function Key can be mapped directly to any of the built-in Command functions or to the User Logic equations.

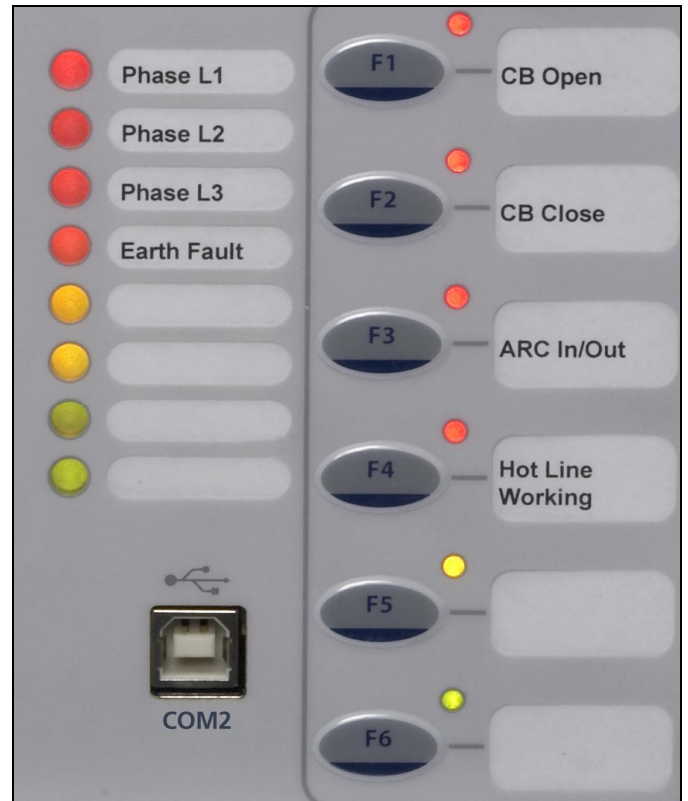


Fig 1. Tri-colour LED's and function keys

## Additional Functionality

### 27/59 Under/Over Voltage

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

### 47 Negative Phase Sequence Overvoltage

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

### 51V Voltage Controlled OverCurrent

Element has settings for UnderVoltage pickup level and operates if voltage falls below setting. On Pick-up this element applies the set 51v Multiplier to the pickup setting of the 67/51 phase fault elements.

### 59N Neutral Overvoltage

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

### 60CTS CT Supervision

The CT Supervision considers the presence of negative phase sequence current, without an equivalent level of negative phase sequence voltage, for a user set time as a CT failure. Element has user operate and delay settings.

### 60VTS VT Supervision

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

### 67/67N Directional Control

Phase fault, Earth fault and Sensitive Earth fault elements can be directionalised. Each element can be user set to Forward, Reverse, or Non-directional. Directional Phase fault elements are polarised from quadrature voltage. Earth fault elements can be user set to be polarised from residual voltage or negative phase sequence voltage.

### 81 Under/Overfrequency

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

### 81 Under/Overfrequency

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

## Optional Functionality

### 79 Auto-Reclose

This function provides independent Phase fault and Earth Fault/Sensitive Earth fault sequences of up to 5 Trips i.e. 4 Reclose attempts before Lockout. Auto-Reclose sequence can be user set to be initiated from internal protection operation or via Binary Input from an external Protection. The user can set each trip in the sequence to be either instantaneous (Fast) or delayed. Independent times can be set by the user for Reclose (Dead) time and Reclaim time.

### 25 Check Sync

The check synchronizing function is used to check that the voltage conditions, measured by the voltage transformers on either side of the open circuit breaker, indicate that it is safe to close without risk of damage to the circuit breaker or disturbance to the system.

## Data Acquisition - Via Communication Interface

### Sequence of event records

Up to 5000 events are stored and time tagged to 1 ms resolution. These can be viewed on the fascia LCD.

### Fault Records

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.

### Waveform recorder

The waveform recorder stores analogue data for all poles and the states of protection functions, binary inputs, LEDs and binary outputs with user settable pre & post trigger data. The last ten waveform records are stored for easy selection. Their duration is user selectable from 1 second, 2 seconds, 5 seconds or 10 seconds.

### Demand Monitoring

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

### Data Log

The average values of voltages, current and real & reactive power are recorded at a user selectable interval and stored to provide data in the form of a Data Log which can be downloaded for further analysis. A typical application is to record 15 minute intervals over the last 7 days.

### Real Time Clock

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



# Reydisp Evolution

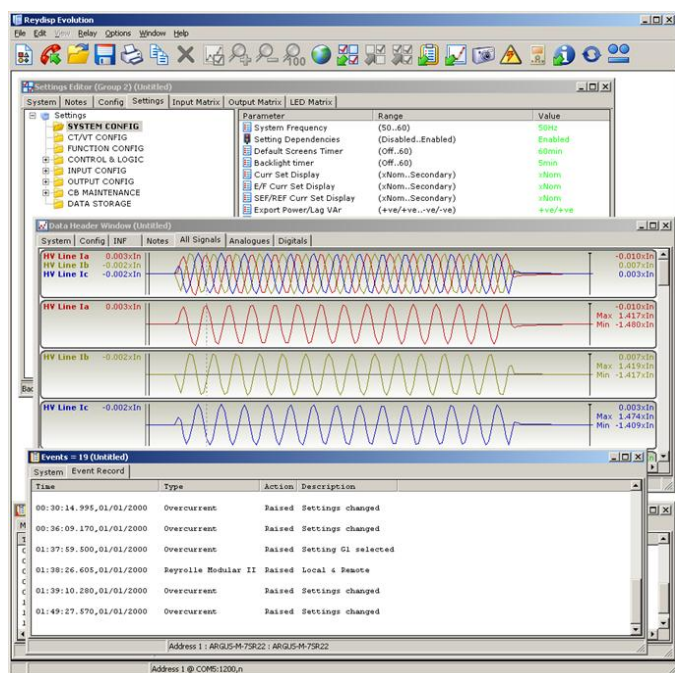


Fig 2. Typical Reydisp Evolution screenshot

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

## Technical Data

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

## Inputs and Outputs

### Current Inputs

Quantity	3 x Phase & 1 x Earth or Sensitive Earth
Rated Current I <sub>N</sub>	1 A / 5 A
Measuring Range	80 x I <sub>N</sub>
Instrumentation $\geq 0.1$ x I <sub>N</sub>	$\pm 1\%$ I <sub>N</sub>
Frequency	50 Hz / 60 Hz
Thermal Withstand:	
Continuous	3.0 x I <sub>N</sub>
10 Minutes	3.5 x I <sub>N</sub>
5 Minutes	4.0 x I <sub>N</sub>
3 Minutes	5.0 x I <sub>N</sub>
2 Minutes	6.0 x I <sub>N</sub>
3 Seconds	57.7 A (1 A) 202 A (5 A)
2 Seconds	70.7 A (1 A) 247 A (5 A)
1 Second	100 A (1 A) 350 A (5 A)
1 Cycle	700 A (1 A) 2500 A (5 A)
Burden @ In	$\leq 0.1$ VA (1 A phase and Earth element) $\leq 0.3$ VA (5 A phase and earth element)

### Voltage Inputs

Quantity	4
Nominal Voltage	40...160 V a.c. Range
Instrumentation $\geq 0.8$ x V <sub>N</sub>	$\pm 1\%$ V <sub>N</sub>
Thermal Withstand:	
Continuous	300 V
1 Second	
Burden @ 110 V	$\leq 0.1$ VA

### DC Auxiliary supply

Nominal voltage	Operating Range V dc
24 V dc to 60 V dc	18 V dc to 72 V dc
80 V dc to 250 V dc	64 V dc to 300 V dc
115 V ac	92 V dc to 138 V ac
24 V dc to 250 V dc	19.2 V dc to 275 V dc
100 V ac to 230 V ac	80 V ac – 253 V ac
Allowable superimposed ac component	12% of DC voltage
Allowable breaks/dips in supply (collapse to zero)	50 ms (DC) 2.5/3 cycles (AC)

### Auxiliary supply: Burdens

Power Consumption	Quiescent (typical)	Quiescent (back-light on)
30 V dc	6.0 W	7.0 W
48 V dc	5.5 W	6.5 W
110 V dc	6.5 W	7.5 W
220 V dc	7.5 W	8.5 W

### Binary Inputs

Operating Voltage	19 V dc: Range 17 to 290 V dc 88 V: Range 74 to 290 V dc
Maximum dc current for operation	1.5 mA

### Binary Outputs

Operating Voltage	Voltage Free
Operating Mode	User selectable - Self or Hand Reset
Contact Operate / Release Time.	7 ms / 3 ms
Making Capacity:	
Carry continuously	5 A ac or dc
Make and carry	20 A ac or dc for 0.5 s
(L/R $\leq 40$ ms and V $\leq 300$ V)	30 A ac or dc for 0.2 s
Breaking Capacity	
( $\leq 5$ A and $\leq 300$ V):	
AC Resistive	1250 VA
AC Inductive	250 VA at p.f. $\leq 0.4$
DC Resistive	75 W
DC Inductive	30 W at L/R $\leq 40$ ms 50 W at L/R $\leq 10$ ms

## Mechanical Tests

### Vibration (Sinusoidal)

IEC 60255-21-1 Class I

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

### Shock and Bump

IEC 60255-21-2 Class I

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

### Seismic

IEC 60255-21-3 Class I

Type	Level	Variation
Seismic response	1 gn	≤ 5 %

### Mechanical Classification

Durability	>10 <sup>6</sup> 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)	2.5 kV	≤ 5 %
Series (transverse) mode	1.0 kV	≤ 5 %

### Electrostatic Discharge

IEC 60255-22-2 Class IV

Type	Level	Variation
Contact discharge	8.0 kV	≤ 5 %

### Fast Transients

IEC 60255-22-4 Class IV

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

### Surge Immunity

IEC 60255-22-5

Type	Level	Variation
Between all terminals and earth	4.0 kV	≤ 10% or 1 mA
Between any two independent circuits	2.0 kV	

### Conducted Radio Frequency Interference

IEC 60255-22-6

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

### Radiated Radio Frequency

IEC 60255-25

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

### Conducted Radio Frequency

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

### Radiated Immunity

IEC 60255-22-3 Class III

Type	Level	Variation
80 MHz to 1000 MHz	10 V/m	≤ 5 %

### Magnetic Field with Power Frequency

IEC 61000-4-8, Class V

Type	Level
100 A/m (0.126 mT) continuous	50 Hz
1000 A/m (1.26 mT) for 3s	

## Environmental Tests

### Temperature

IEC 60068-2-1, IEC 60068-2-2

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

### Humidity

IEC 60068-2-30, IEC 60068-2-78

Operational test (Indoor)	56 days at 40 °C and 95% relative humidity (r.h.)
Operational test (Outdoor)	6 cycles at 24 h between +25 °C (97% r.h.) and +55 °C (93% r.h.)

### IP Ratings

IEC 60529

Type	Level
Installed with cover	IP 51 from front of relay
Installed with cover removed	IP 20 from front of relay

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

## Performance

### 27/59 Under/Over Voltage

Number of Elements	4 Under or Over
Operate	Any phase or All phases
Voltage Guard	1, 1.5...200 V
Setting Range Vs	5,5.5...200 V
Hysteresis Setting	0,0.1...80%
Vs Operate Level	100% Vs, ±1% or ±0.25 V
Reset Level: - Undervoltage Overvoltage	=(100%+hyst) xVop, ±1% or 0.25 V =(100%-hyst) xVop, ±1% or 0.25 V
Delay Setting td	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400 s
Basic Operate Time: - 0 to 1.1xVs 0 to 2.0xVs 1.1 to 0.5xVs	73 ms ±10 ms 63 ms ±10 ms 58 ms ±10 ms
Operate time following delay.	t <sub>basic</sub> + t <sub>d</sub> , ±1% or ±10 ms
Inhibited by	Binary or Virtual Input VT Supervision, Voltage Guard

### 37 Undercurrent

Number of Elements	2
Setting Range Is	0.05,0.10...5.0 x In
Operate Level	100% Is, ±5% or ±1% xIn
Delay Setting td	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400 s
Basic Operate Time: - 1.1 to 0.5xIn	35 ms ±10 ms

Operate time following delay.	t <sub>basic</sub> + t <sub>d</sub> , ±1% or ±10 ms
Overshoot Time	< 40 ms
Inhibited by	Binary or Virtual Input

### 46 Negative Phase Sequence Overcurrent

Number of Elements	DT & IT
DT Setting Range Is	0.05,0.10...4.0 x In
DT Operate Level	100% Is, ±5% or ±1%xIn
DT Delay Setting td	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400 s
DT Basic Operate Time – 0 to 2 xls 0 to 5 xls	40 ms ±10 ms 30 ms ±10 ms
DT Operate time following delay.	t <sub>basic</sub> + t <sub>d</sub> , ±1% or ±10 ms
IT Char Setting	IEC NI,VI,EI,LTI ANSI MI,VI,EI & DTL
IT Setting Range	0.05, 0.06..2.5 xIn
Tm Time Multiplier	0.025,0.050...1.6
Char Operate Level	105% Is, ±4% or ±1% xIn
Overshoot Time	< 40 ms
Inhibited by	Binary or Virtual Input

### 47 Negative Phase Sequence Voltage

Number of Elements	2
Setting Range Vs	1, 1.5...90 V
Hysteresis Setting	0, 0.1...80%
Operate Level	100% Vs, ±2% or ±0.5 V
Delay Setting td	0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400 s
Basic Operate Time: - 0V to 2.0xVs 0V to 10xVs	80 ms ±20 ms 55 ms ±20 ms
Operate time following delay.	t <sub>basic</sub> + t <sub>d</sub> , ±2% or ±20 ms
Overshoot Time	< 40 ms
Inhibited by	Binary or Virtual Input

### 49 Thermal Overload

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



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

Operation	Non directional, Forward or reverse
Elements	Phase, Derived Earth, Measured Earth & SEF
Number of Elements	4 x OC 4 x Derived E/F 'N' 4 x Measured E/F 'G' 4 x SEF
Setting Range Is: - O/C Derived E/F 'N' Measured E/F 'G' SEF	0.05,0.06...50 xIn 0.05,0.06...50 xIn 0.005...25 xIn 0.005...5 xIn
Time Delay	0.00...14400 s
Operate Level	100% Is, ±5% or ±1% xIn
Operate time: - Current switched from 0 to 2x Current switched from 0 to 5x	2x Is: 40 ms, ±10 ms, 5x Is: 30 ms, ±10 ms
Operate time following delay	t <sub>basic</sub> + t <sub>d</sub> , ±1% or ±10 ms
Inhibited by	Binary or Virtual Input Inrush detector VT Supervision

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

Operation	Non directional, Forward or reverse
Elements	Phase, Derived Earth, Measured Earth & SEF
Number of Elements: -	4 x OC 4 x Derived EF 'N' 4 x Measured EF 'G' 4 x SEF
Characteristic	IEC NI,VI,EI,LTI ANSI MI,VI,EI & DTL
Setting Range Is: - O/C Derived E/F 'N' Measured E/F 'G' SEF	0.05,0.06...2.5 xIn 0.05,0.06...2.5 xIn 0.005...1 xIn 0.005...1 xIn
Time Multiplier	0.025,0.05...1.6
Time Delay	0,0.01... 20 s
Operate Level	105% Is, ±4% or ±1%xIn
Minimum Operate time IEC	$t_{op} = \frac{K}{\left[\frac{I}{I_s}\right]^{\alpha} - 1} \times T_m$
ANSI	$t_{op} = \left[ \frac{A}{\left[\frac{I}{I_s}\right]^p - 1} + B \right] \times T_m$ ± 5 % absolute or ± 30 ms
Follower Delay	0 – 20 s
Reset	ANSI decaying, 0 – 60 s
Inhibited by	Binary or Virtual Input Inrush detector VT Supervision

## 51V Voltage Controlled Overcurrent

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

## 50BF Circuit Breaker Fail

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

## 59N Neutral Voltage Displacement

Number of Elements	NDT & NIT
NDT Operate Level	100% Vs, ±2% or ±0.5V
NDT Delay Setting t <sub>d</sub>	0, 0.01 20, 20.5... 100, 101... 1000, 1010... 10000, 10100... 14400 s
NDT Basic Operate Time: - 0V to 1.5 xVs 0V to 10 xVs	76 ms ±20 ms 63 ms ±20 ms
NDT Operate time following delay.	t <sub>basic</sub> + t <sub>d</sub> , ±1% or ±20 ms
NDT & NIT Setting Range Is	1, 1.5...100 V
T <sub>m</sub> Time Multiplier(IDMT)	0.1, 0.2... 10, 10.5... 140
Delay (DTL)	0, 0.01...20 s
Reset	ANSI decaying, 0 ... 60 s
NIT Operate Level	105% Vs, ±2% or ±0.5 V
Inhibited by	Binary or Virtual Input

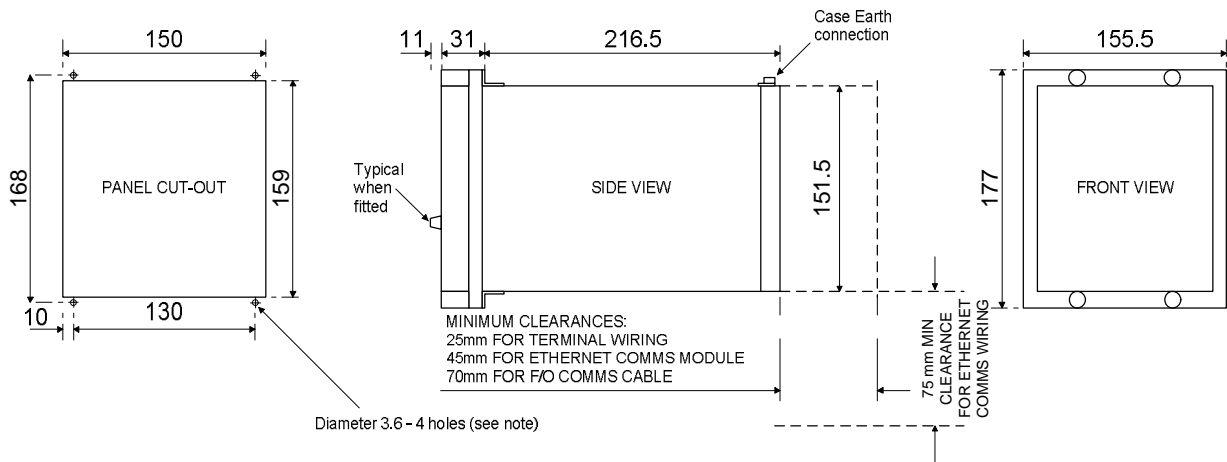
## 60 Supervision

CT	(7SR210n) CTS-I (7SR220n) CTS-I, CTS Vnps, CTS Inps
VT	(7SR220n) VTS Vnps, VTS Vzps
Delay	0.03, 0.04... 20.00, 20.50... 100, 101... 1000, 1010...10000, 10100... 14400 s

## 64H Restricted Earth Fault

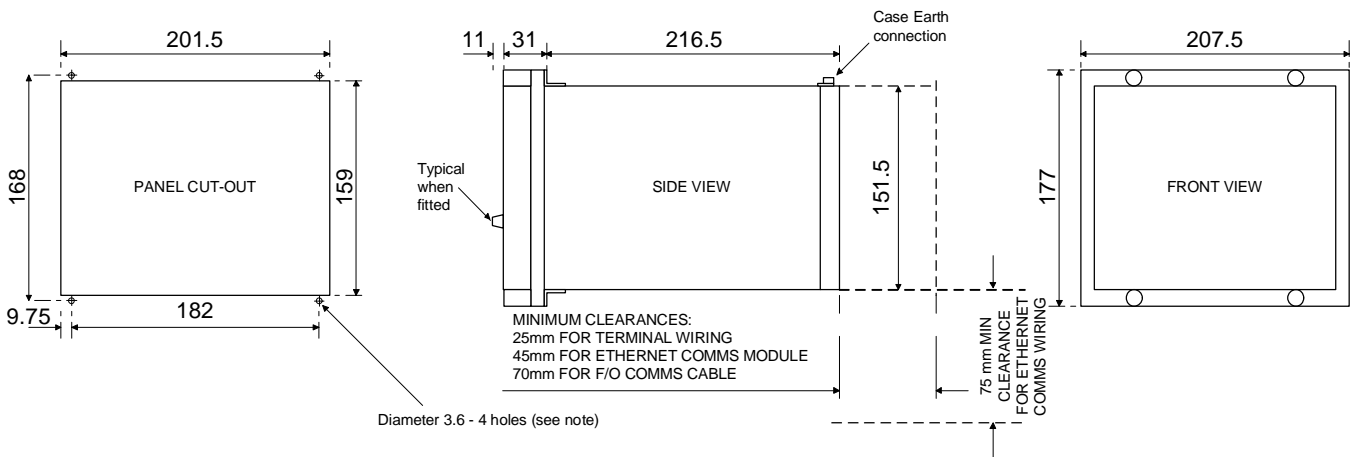
Setting Range	0.005...0.95 xIn
Operate Level	100% Is, ±5% or ±1% xIn
Time Delay	0.00... 14400 s
Basic Operate Time	0 to 2 xIs 40 ms ±10 ms 0 to 5 xIs 30 ms ±10 ms
Inhibited by	Binary or Virtual Input

# Case Dimensions



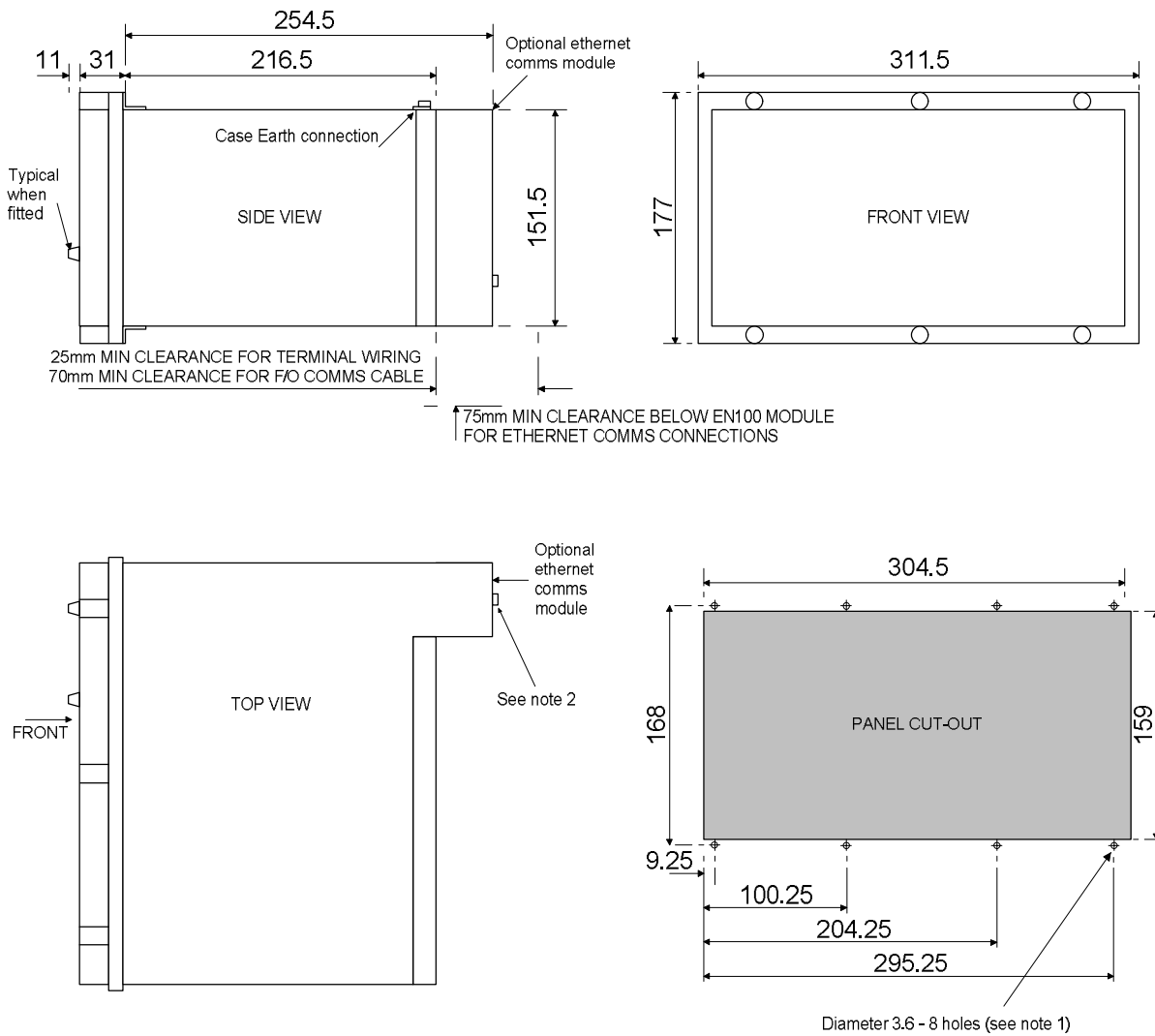
NOTE:  
THE 3.6 HOLES ARE FOR M4 THREAD FORMING (TRILOBULAR) SCREWS. THESE ARE SUPPLIED AS STANDARD AND ARE SUITABLE FOR USE IN FERROUS / ALUMINIUM PANELS 1.6mm THICK AND ABOVE. FOR OTHER PANELS, HOLES TO BE M4 CLEARANCE (TYPICALLY 4.5 DIAMETER) AND RELAYS MOUNTED USING M4 MACHINE SCREWS, NUTS AND LOCKWASHERS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

Fig 3. E6 Case overall dimensions and panel drilling details (All dimensions in are mm)



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

Fig 4. E8 Case overall dimensions and panel drilling details (All dimensions are in mm)



**NOTES:**

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

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

Fig 5. E12 Case overall dimensions and panel drilling details (All dimensions are in mm)

# 7SR210 Connection Diagram

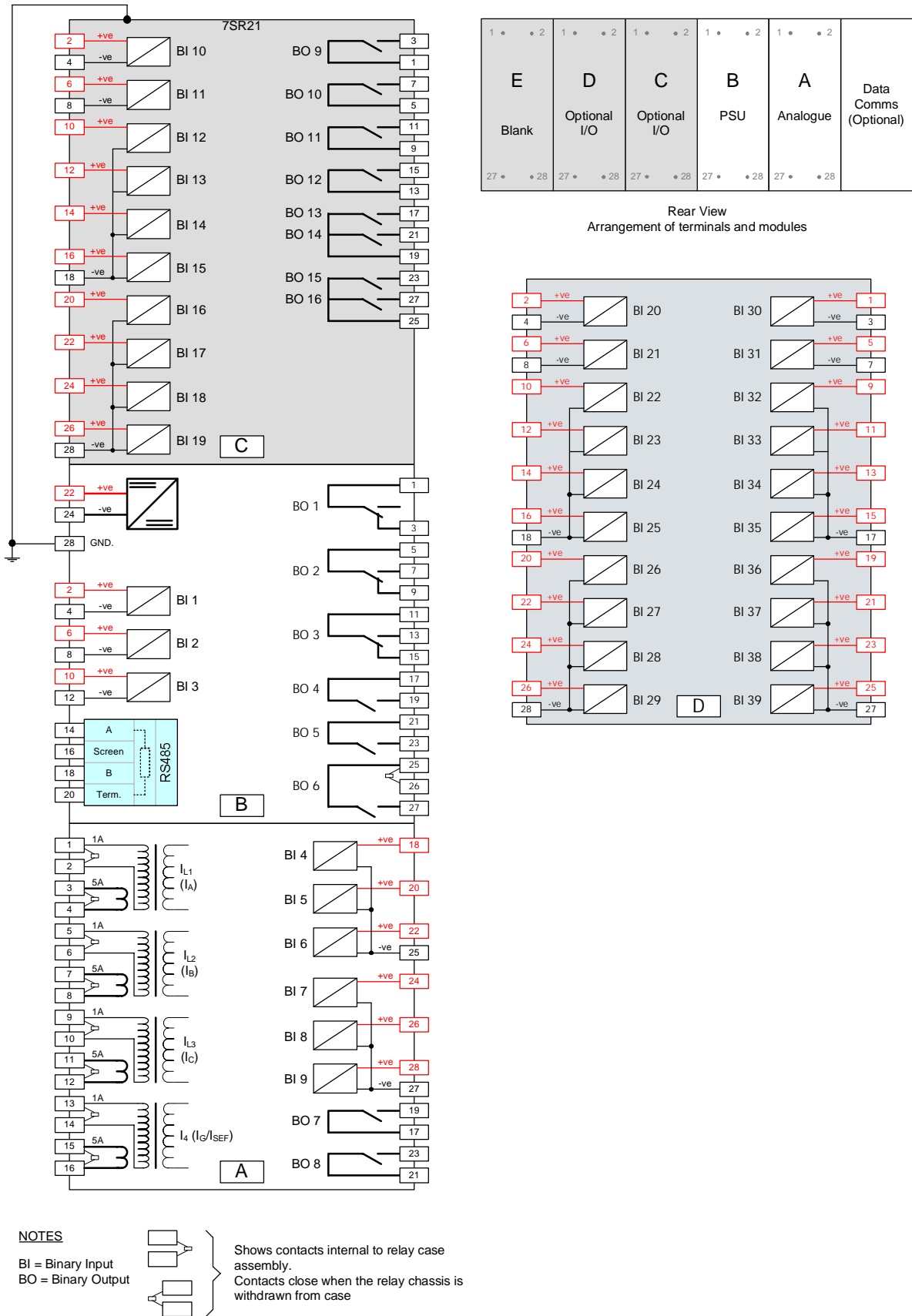
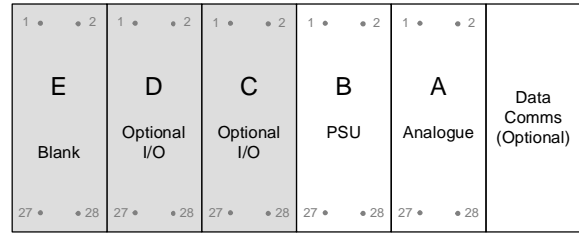
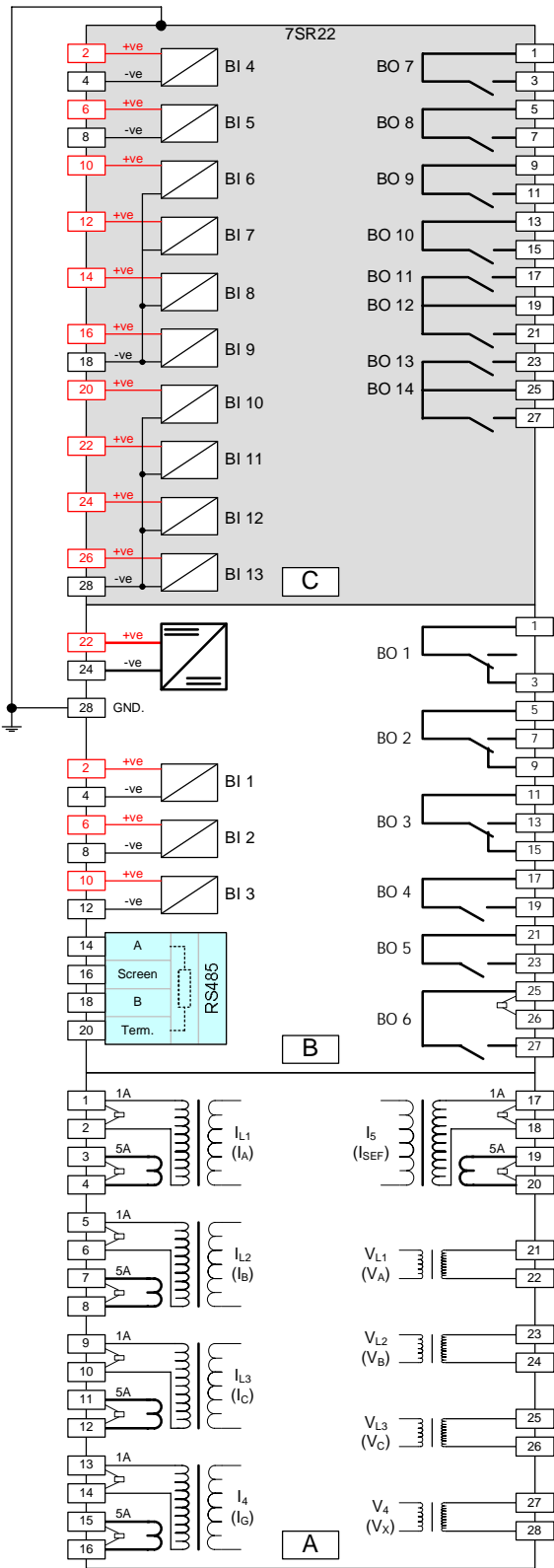
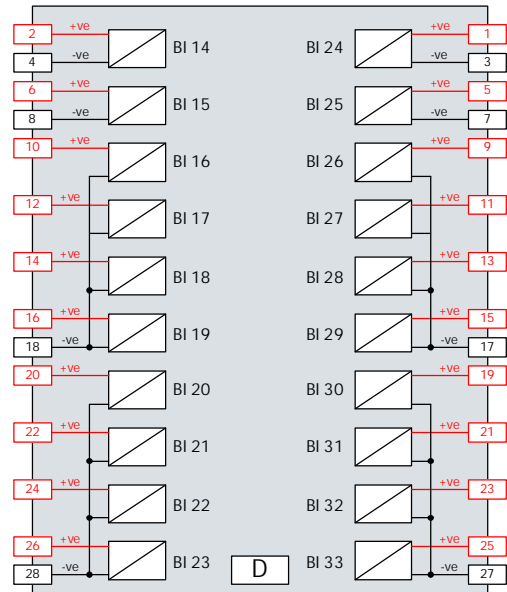


Fig 6. 7SR210 Wiring Diagram

# 7SR220 Connection Diagram

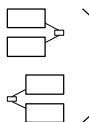


Rear View  
Arrangement of terminals and modules



**NOTES**

BI = Binary Input  
BO = Binary Output



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

Fig 7. 7SR220 Wiring Diagram



# Function Diagrams for 7SR210 & 7SR220

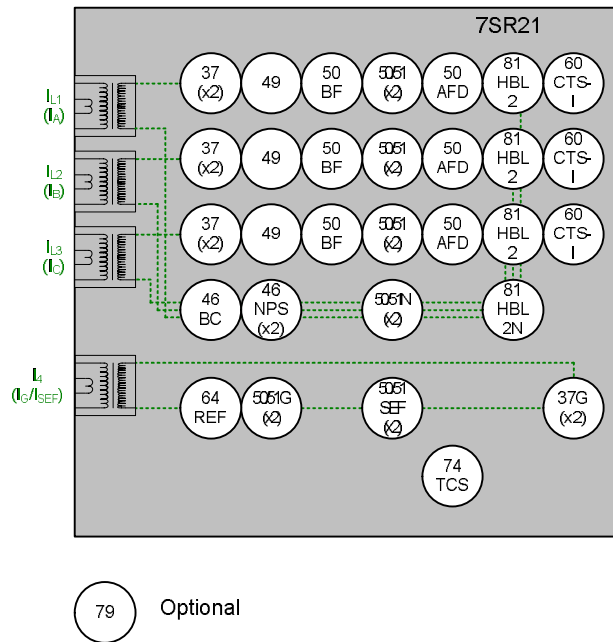


Fig 8. 7SR210 Function Diagram

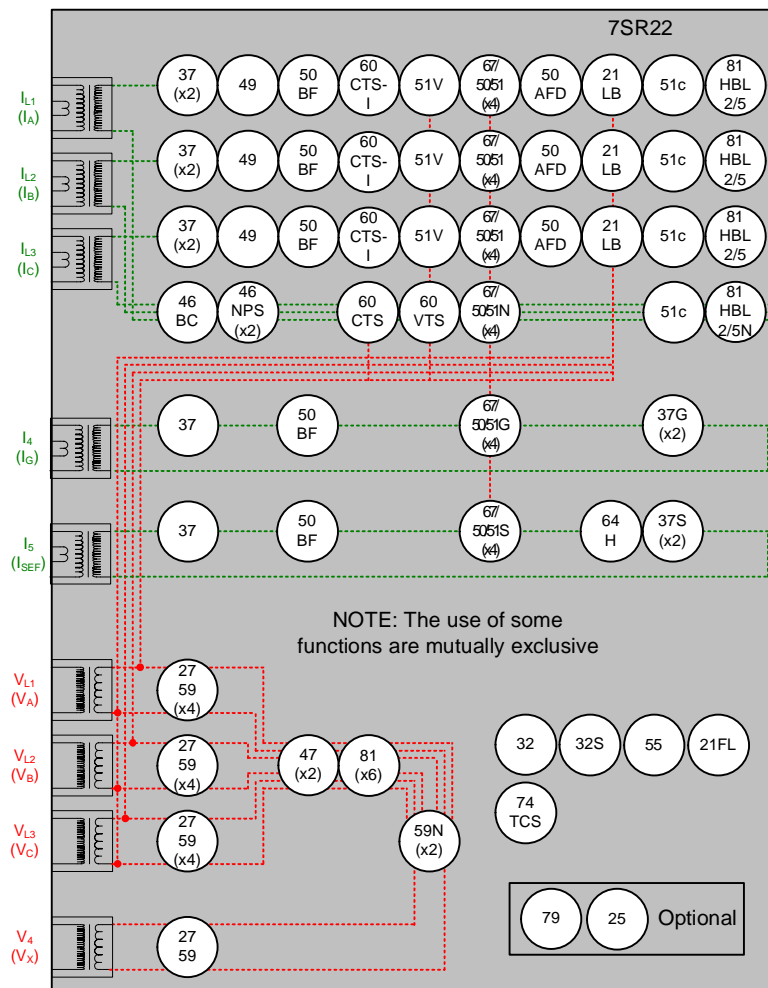


Fig 9. 7SR220 Function Diagram

# Ordering Information – 7SR210 Overcurrent Relay

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

<sup>2)</sup> Rated: 24 V DC to 250 V DC / 100 V AC to 120 V AC

<sup>3)</sup> Rated: 110 V DC to 250 V DC

Export Data  
HS: 8536900  
ECCN: N  
AL: N

# Ordering Information – 7SR220 Directional Overcurrent Relay

Product description      Variants      Order No.

	7	S	R	2	2	0	-	2	A	-	0	A	0	
<b>Protection Product Family</b>														
Overcurrent - Directional							2							
<b>Relay Type</b>							0							
<b>Case I/O and Fascia<sup>1)</sup></b>														
E6 case, 5 CT, 4 VT, 3 Binary Inputs, 6 Binary Outputs, 8 LEDs							2							
E8 case, 5 CT, 4 VT, 13 Binary Inputs, 14 Binary Outputs, 16 LEDs							3							
E8 case, 5 CT, 4 VT, 13 Binary Inputs, 14 Binary Outputs, 8 LEDs + 6 keys							4							
E12 case, 5 CT, 4 VT, 33 Binary Inputs / 14 Binary Outputs, 32 LEDs							5							
E12 case, 5 CT, 4 VT, 33 Binary Inputs / 14 Binary Outputs, 16 LEDs, 12 keys							6							
<b>Measuring input</b>														
1 A or 5 A, 40 V to 160 V, 50 Hz or 60 Hz							2							
<b>Auxiliary voltage</b>														
30 V to 220 V DC, binary input threshold 19 V DC								A						
30 V to 220 V DC, binary input threshold 88 V DC								B						
24 V DC to 250 V DC, 100 V AC to 230 V AC, binary input threshold 19 V DC <sup>(2)</sup>								M						
24 V DC to 250 V DC, 100 V AC to 230 V AC, binary input threshold 88 V DC <sup>(3)</sup>								N						
<b>Spare</b>														
								A						
<b>Communication Interface</b>														
Standard version - included in all models, USB front port, RS485 rear port														
Standard version - plus additional rear F/O ST connectors (x2) and IRIG-B														
Standard version - plus additional rear RS485 and IRIG-B														
Standard version - plus additional rear RS232 and IRIG-B														
Standard version - plus additional rear Electrical Ethernet RJ45 (x2)														
Standard version - plus additional rear Optical Ethernet Duplex (x2)														
<b>Protocol</b>														
IEC 60870-5-103 and Modbus RTU (user selectable)														
IEC 60870-5-103 and Modbus RTU and DNP 3.0 (user selectable)														
IEC 60870-5-103 and Modbus RTU and DNP 3.0 (user selectable) and IEC61850														
<b>Spare</b>														
<b>Protection Function Packages</b>														
Standard version - included in all models														
21FL Fault Locator														
21LB Load Blinder														
27/59 <sup>1)</sup> Under/overvoltage														
32 Power														
32S Sensitive Power														
37 Undercurrent														
37G <sup>1)</sup> Ground Undercurrent														
37SEF <sup>1)</sup> SEF Undercurrent														
46BC Broken conductor/load unbalance														
46NPS Negative phase sequence overcurrent														
47 <sup>1)</sup> Negative phase sequence voltage														
49 Thermal overload														
50 Instantaneous phase fault overcurrent														
50BF Circuit breaker fail														
50G/50N Instantaneous earth fault														
50 AFD Arc Flash Detector														
51V Voltage dependent overcurrent														
55 Power factor														
59N Neutral voltage displacement														
60CTS CT supervision														
60CTS-I CT supervision														
60VTS VT supervision														
64H High impedance REF														
67/50 Directional instantaneous phase fault overcurrent														
67/50G Directional instantaneous earth fault/SEF														
67/51 Directional time delayed phase fault overcurrent														
67/51G Directional time delayed earth fault/SEF														
67/51N Directional time delayed earth fault/SEF														
74TC/CCS Trip & close circuit supervision														
81 Under/overfrequency														
81HBL2 Inrush Detector														
81HBL5 Overfluxing														
86 Lockout														
Cold load pickup														
Programmable logic														
CB Control														
Standard version - plus														
79 Autoreclose														
Standard version - plus														
79 + 25 Autoreclose + Check Sync														
<b>Additional Functionality</b>														
No additional functionality														
<b>Spare</b>														

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

<sup>2)</sup> Rated: 24 V DC to 250 V DC / 100 V AC to 120 V AC

<sup>3)</sup> Rated: 110 V DC to 250 V DC

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HS: 8536900  
ECCN: N  
AL: N



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