



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 |
|---------|---------------------------|

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
- I²t 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 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. 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.

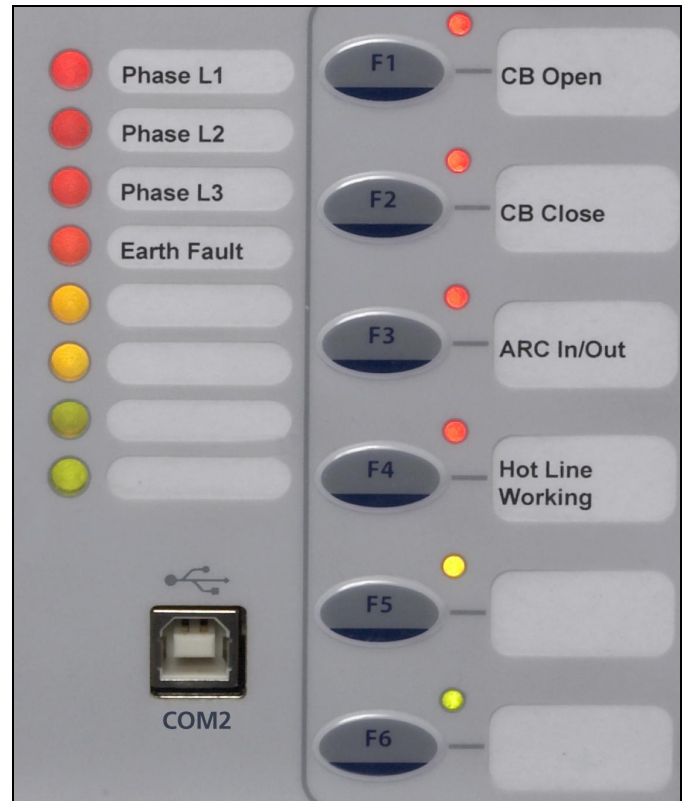


Fig 1. Tri-colour LED's and function keys

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

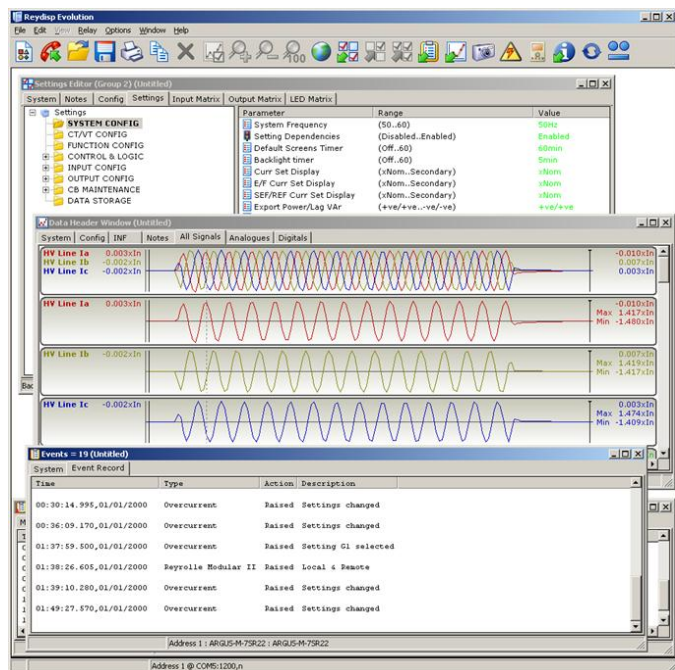


Fig 2. Typical Reydisp Evolution screenshot

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 IN | 1 A / 5 A |
| Measuring Range | 80 xIn |
| Instrumentation $\geq 0.1 \times In$ | $\pm 1\% In$ |
| Frequency | 50 Hz / 60 Hz |
| Thermal Withstand: | |
| Continuous | 3.0 xIn |
| 10 Minutes | 3.5 xIn |
| 5 Minutes | 4.0 xIn |
| 3 Minutes | 5.0 xIn |
| 2 Minutes | 6.0 xIn |
| 3 Seconds | 57.7 A (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 $\geq 0.8 \times Vn$ | $\pm 1\% Vn$ |
| Thermal Withstand: | |
| Continuous | 300 V |
| 1 Second | |
| Burden @ 110 V | $\leq 0.1 VA$ |

Auxiliary supply

| | |
|--|---------------------------------|
| Nominal voltage | Operating Range |
| 30 V dc to 220 V dc | 24 V dc to 290 V dc |
| 24 V dc to 250 V dc | 19.2 V dc to 275 V dc |
| 100 V ac to 230 V ac | 80 V ac to 253 V ac |
| Allowable superimposed ac component | 12% of DC voltage |
| Allowable breaks/dips in supply (collapse to zero) | 50 ms (DC) 2.5/3 cycles (AC) |

Auxiliary supply: Power Consumption

| | |
|----------------------|------------|
| Quiescent State (DC) | 24V: 8W |
| | 110V: 7W |
| | 250V: 7W |
| Maximum Load (DC) | 24V: 12W |
| | 110V: 11W |
| | 250V: 11W |
| Quiescent State (AC) | 100V: 16VA |
| | 230V: 21VA |
| Maximum Load (AC) | 100V: 23VA |
| | 230V: 30VA |

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 (L/R ≤ 40 ms and V ≤ 300 V) | 20 A ac or dc for 0.5 s 30 A ac or dc for 0.2 s |
| Breaking Capacity (≤ 5 A and ≤ 300 V): | |
| AC Resistive | 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 |

Mechanical Tests

Vibration (Sinusoidal)

IEC 60255-21-1 Class I

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

Shock and Bump

IEC 60255-21-2 Class I

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

Seismic

IEC 60255-21-3 Class I

| Type | Level | Variation |
|------------------|-------|-----------|
| Seismic response | 1 gn | ≤ 5 % |

Mechanical Classification

| | |
|------------|-----------------------------|
| Durability | >10 ⁶ operations |
|------------|-----------------------------|

Electrical Tests

Insulation

IEC 60255-5

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

High Frequency Disturbance

IEC 60255-22-1 Class III

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

Electrostatic Discharge

IEC 60255-22-2 Class IV

| Type | Level | Variation |
|-------------------|--------|-----------|
| Contact discharge | 8.0 kV | ≤ 5 % |

Fast Transients

IEC 60255-22-4 Class IV

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

Surge Immunity

IEC 60255-22-5

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

Conducted Radio Frequency Interference

IEC 60255-22-6

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

Radiated Radio Frequency

IEC 60255-25

| Type | Limits at 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 _{basic} + t _d , ±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 _{basic} + t _d , ±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 _{basic} + t _d , ±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 _{basic} + t _d , ±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 _{basic} + t _d , ±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 _{delay} ±1% or ±20 ms |
| Triggered by | Any function mapped as trip contact. |
| Inhibited by | Binary/Virtual Input |
| Timer By pass | Yes, 50BF CB Faulty Input |

59N Neutral Voltage Displacement

| | |
|--|---|
| Number of Elements | NDT & NIT |
| NDT Operate Level | 100% Vs, ±2% or ±0.5V |
| NDT Delay Setting t _d | 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 _{basic} + t _d , ±1% or ±20 ms |
| NDT & NIT Setting Range Is | 1, 1.5...100 V |
| T _m 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 |

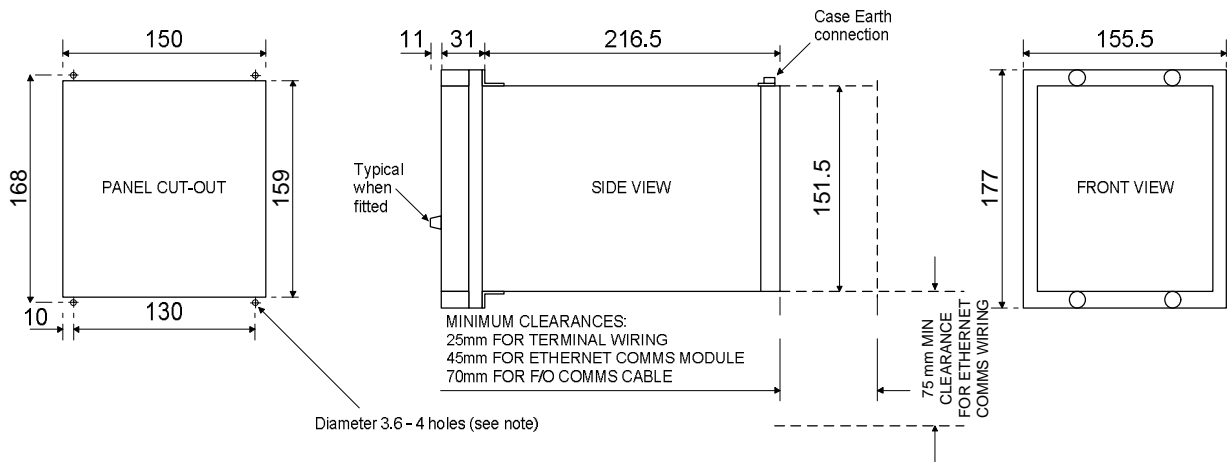
60 Supervision

| | |
|-------|--|
| 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

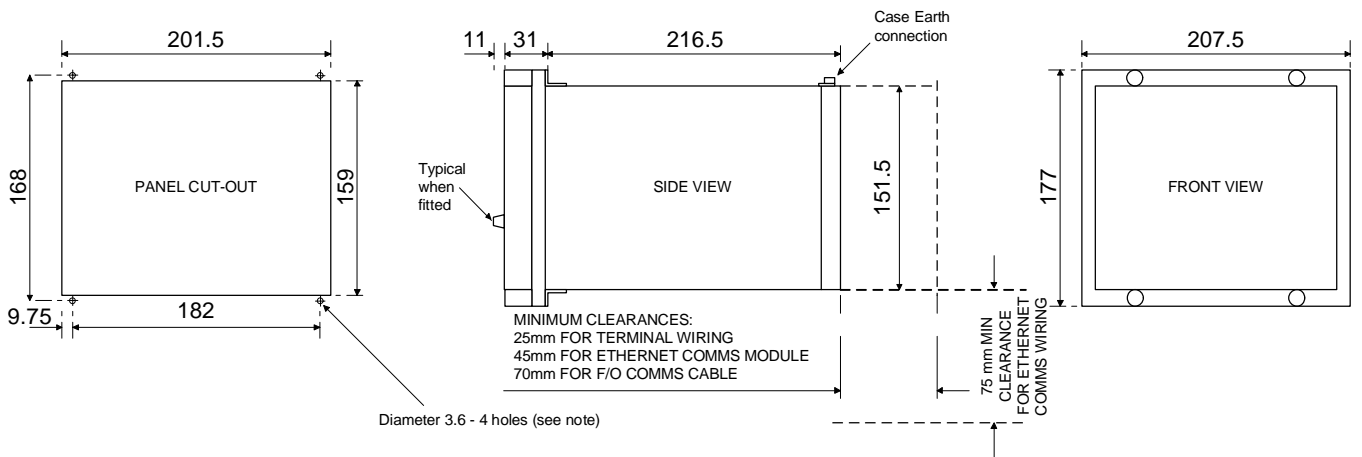
| | |
|--------------------|--|
| Setting Range | 0.005...0.95 xIn |
| Operate Level | 100% Is, ±5% or ±1% xIn |
| Time Delay | 0.00... 14400 s |
| Basic Operate Time | 0 to 2 xIs 40 ms ±10 ms 0 to 5 xIs 30 ms ±10 ms |
| Inhibited by | Binary or Virtual Input |

Case Dimensions



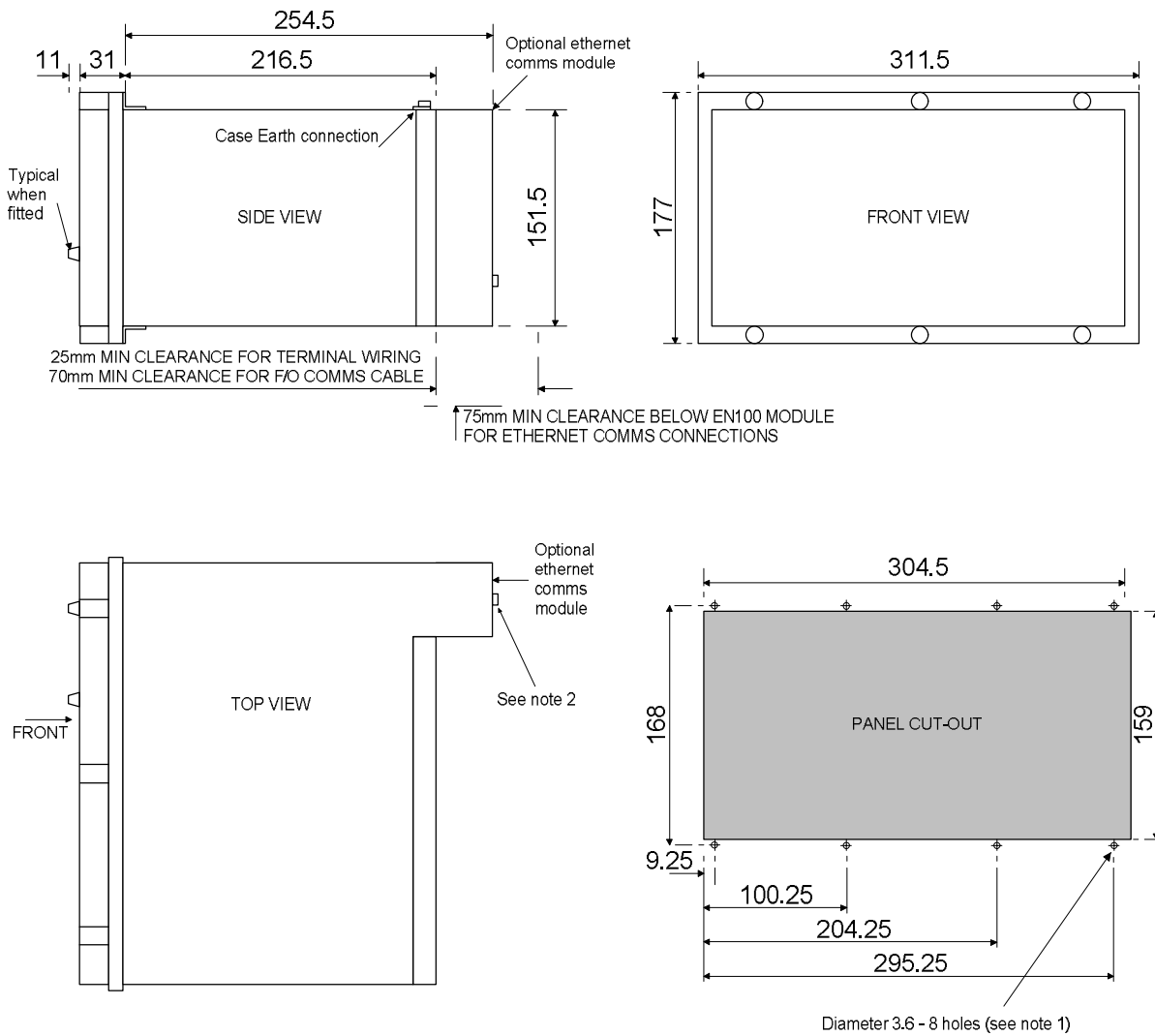
NOTE:
 THE 3.6 HOLES ARE FOR M4 THREAD FORMING (TRILOBULAR) SCREWS. THESE ARE SUPPLIED AS STANDARD AND ARE SUITABLE FOR USE IN FERROUS / ALUMINIUM PANELS 1.6mm THICK AND ABOVE. FOR OTHER PANELS, HOLES TO BE M4 CLEARANCE (TYPICALLY 4.5 DIAMETER) AND RELAYS MOUNTED USING M4 MACHINE SCREWS, NUTS AND LOCKWASHERS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

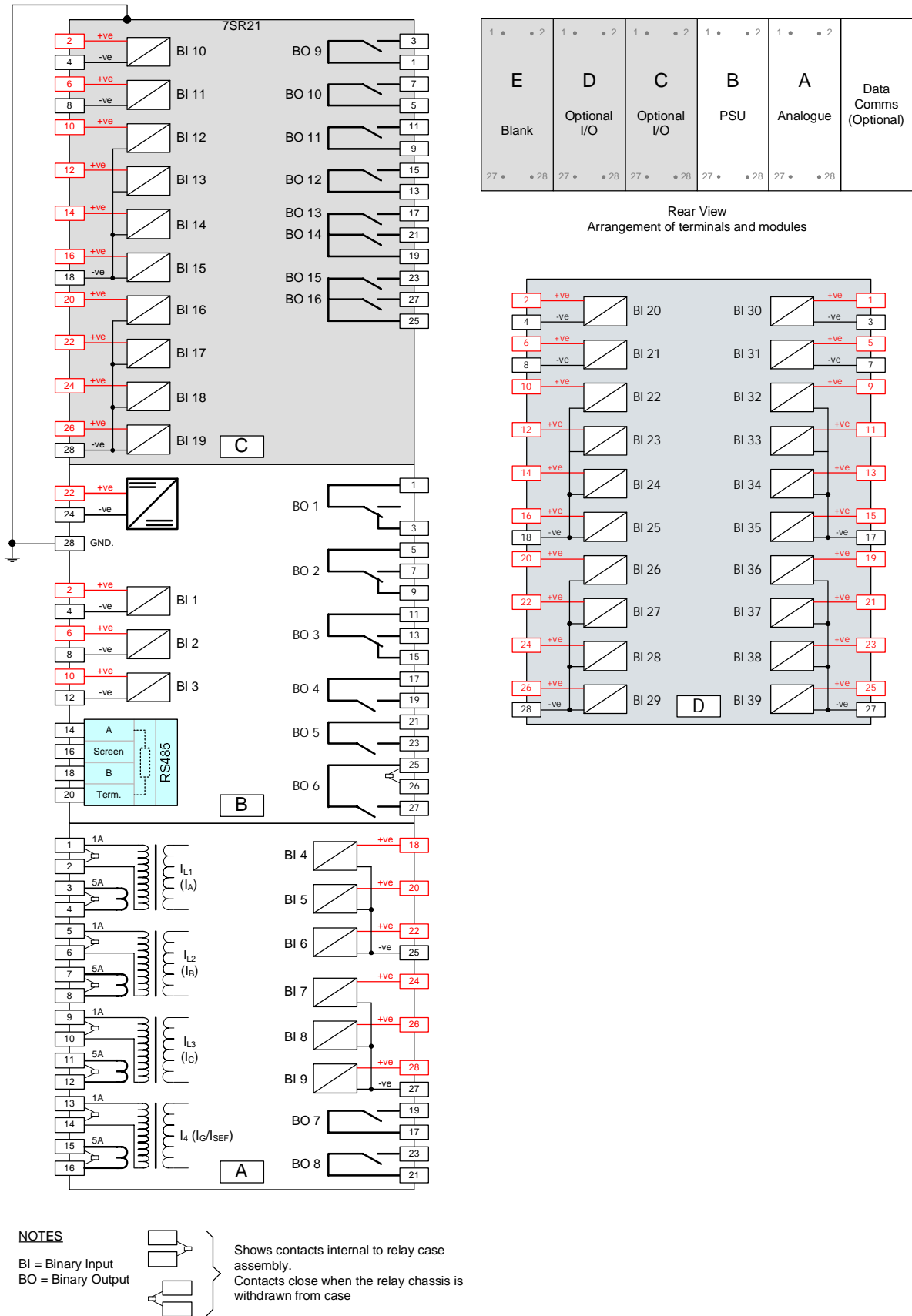
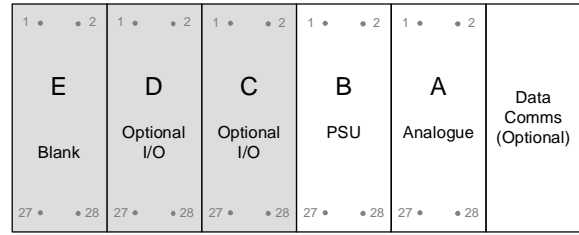
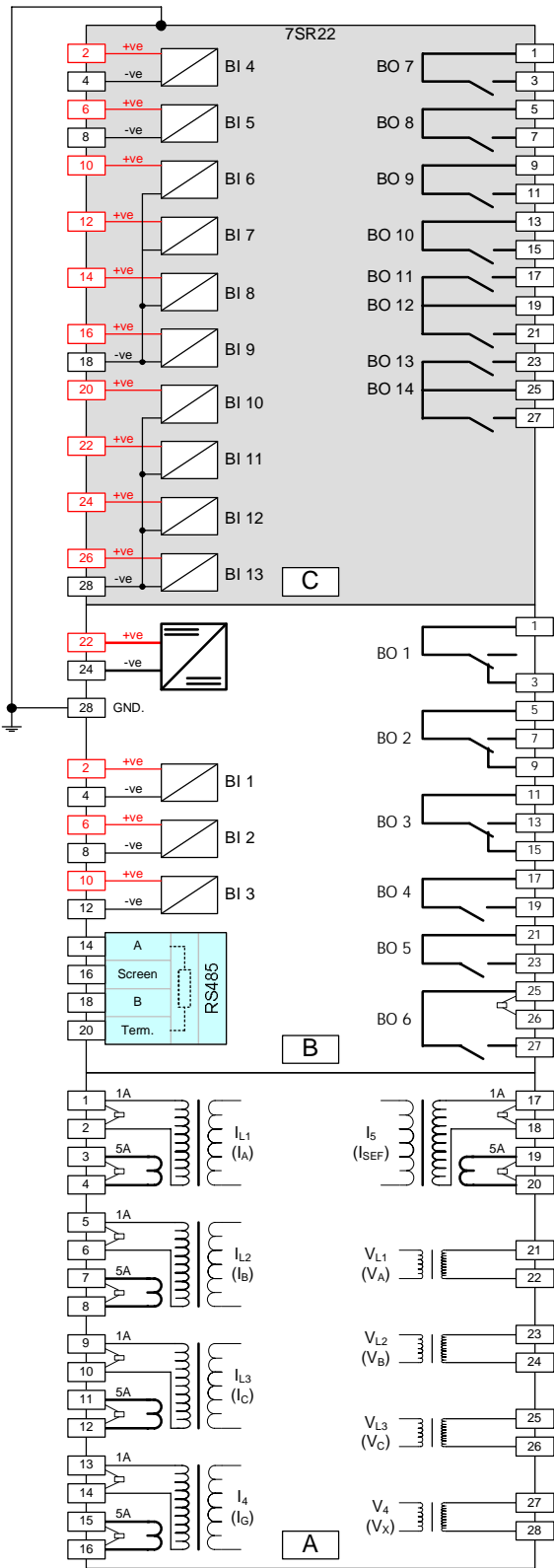
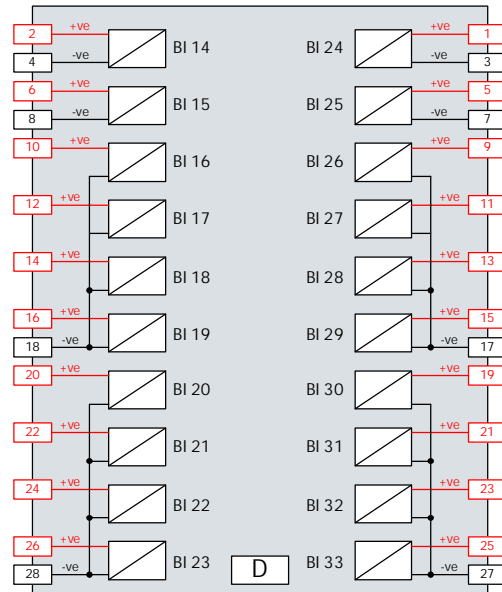


Fig 6. 7SR210 Wiring Diagram

7SR220 Connection Diagram

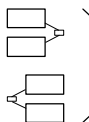


Rear View
Arrangement of terminals and modules



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

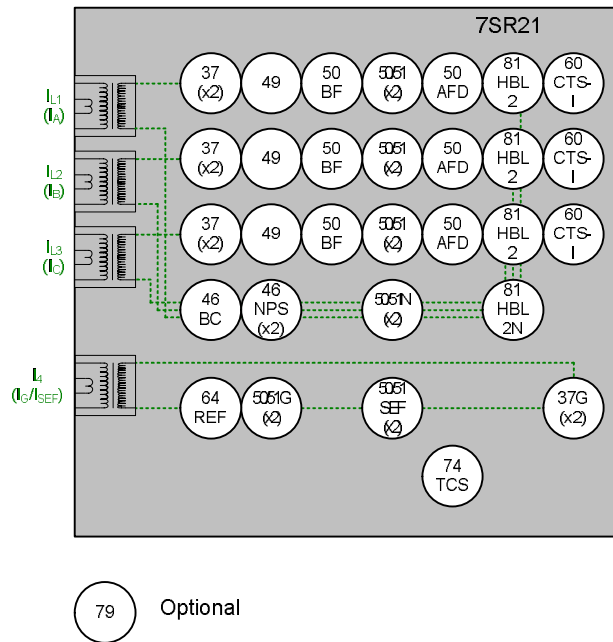


Fig 8. 7SR210 Function Diagram

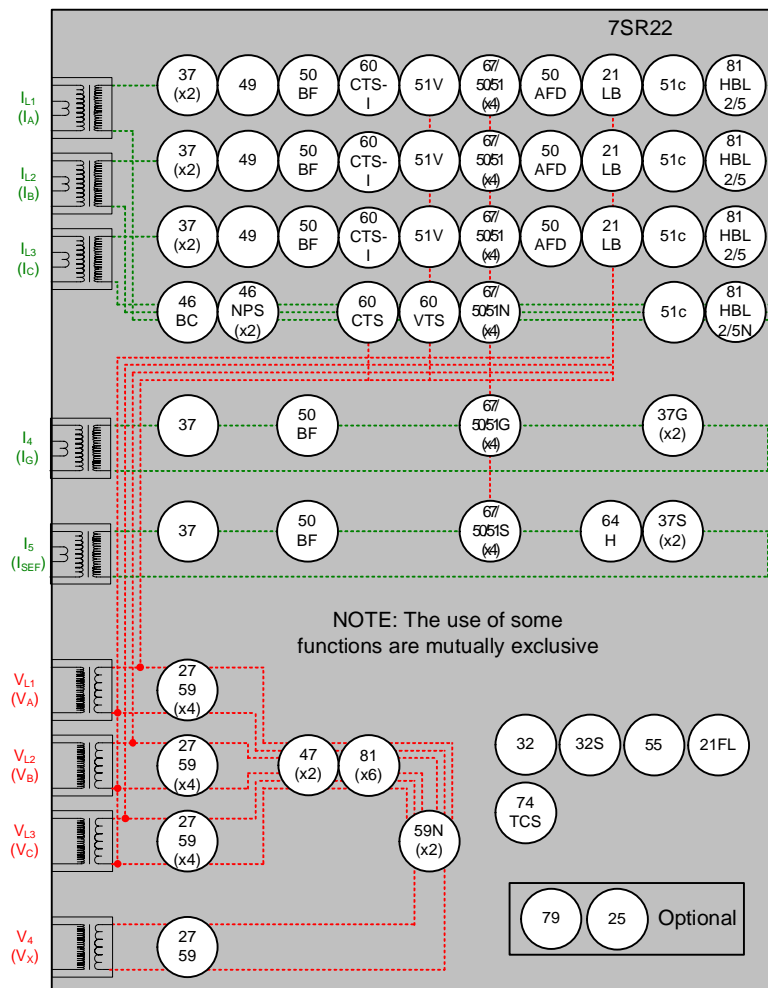


Fig 9. 7SR220 Function Diagram

Ordering Information – 7SR210 Overcurrent Relay

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

Export Data
HS: 8536900
ECCN: N
AL: N

Ordering Information – 7SR220 Directional Overcurrent Relay

| Product description | Variants | Order No. |
|---|---|---------------------------|
| | | 7 S R 2 2 0 - 2 A - 0 A 0 |
| Protection Product Family | Overcurrent - Directional | 2 |
| Relay Type | | 0 |
| Case, I/O and Fascia ¹⁾ | E6 case, 5 CT, 4 VT, 3 Binary Inputs, 6 Binary Outputs, 8 LEDs | 2 |
| | E8 case, 5 CT, 4 VT, 13 Binary Inputs, 14 Binary Outputs, 16 LEDs | 3 |
| | E8 case, 5 CT, 4 VT, 13 Binary Inputs, 14 Binary Outputs, 8 LEDs + 6 keys | 4 |
| | E12 case, 5 CT, 4 VT, 33 Binary Inputs / 14 Binary Outputs, 32 LEDs | 5 |
| | E12 case, 5 CT, 4 VT, 33 Binary Inputs / 14 Binary Outputs, 16 LEDs, 12 keys | 6 |
| Measuring input | 1 A or 5 A, 40 V to 160 V, 50 Hz or 60 Hz | 2 |
| Auxiliary voltage | PSU Rated: 24-250V DC / 100-230V AC, Binary Input threshold 19V DC (Rated: 24-250V DC) | M |
| | PSU Rated: 24-250V DC / 100-230V AC, Binary Input threshold 88V DC (Rated: 110-250V DC) | N |
| Spare | | A |
| Communication Interface | Standard version - included in all models, USB front port, RS485 rear port | 1 |
| | Standard version - plus additional rear F/O ST connectors (x2) and IRIG-B | 2 |
| | Standard version - plus additional rear RS485 and IRIG-B | 3 |
| | Standard version - plus additional rear RS232 and IRIG-B | 4 |
| | Standard version - plus additional rear Electrical Ethernet RJ45 (x2) | 7 |
| | Standard version - plus additional rear Optical Ethernet Duplex (x2) | 8 |
| Protocol | IEC 60870-5-103 and Modbus RTU (user selectable) | 1 |
| | IEC 60870-5-103 and Modbus RTU and DNP 3.0 (user selectable) | 2 |
| | IEC 60870-5-103 and Modbus RTU and DNP 3.0 (user selectable) and IEC61850 | 7-8 |
| Spare | | 0 |
| Protection Function Packages | Standard version - included in all models | C |
| | 21FL Fault Locator | |
| | 21LB Load Blinder | |
| | 27/59 ¹⁾ Under/overvoltage | |
| | 32 Power | |
| | 32S Sensitive Power | |
| | 37 Undercurrent | |
| | 37G ¹⁾ Ground Undercurrent | |
| | 37SEF ¹⁾ SEF Undercurrent | |
| | 46BC Broken conductor/load unbalance | |
| | 46NPS Negative phase sequence overcurrent | |
| | 47 ¹⁾ Negative phase sequence voltage | |
| | 49 Thermal overload | |
| | 50 Instantaneous phase fault overcurrent | |
| | 50BF Circuit breaker fail | |
| | 50G/50N Instantaneous earth fault | |
| | 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 | |
| | 67/50N Directional time delayed phase fault overcurrent | |
| | 67/51 Directional time delayed earth fault/SEF | |
| | 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 | D |
| | 79 Autoreclose | |
| | Standard version - plus | E |
| | 79 + 25 Autoreclose + Check Sync | |
| Additional Functionality | No additional functionality | A |
| Spare | | 0 |

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

Export Data
HS: 8536900
ECCN: N
AL: N

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December 2017

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