



Reyrolle
Protection
Devices

7SR158 Argus

Voltage and Frequency Relay

Energy Management.

SIEMENS

7SR158 Argus

Voltage & Frequency Relay



Fig. 1 7SR158 Fascia

Description

The 7SR158 is a voltage and frequency protection relay developed to enhance the Argus family of products by providing a familiar device using the latest generation of hardware technology.

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

Function Overview

Protection (can include)

27/59	Under/Over Voltage
47	Negative Phase Sequence Voltage
59N	Neutral Voltage Displacement
78	Vector Shift
81	Under/Over Frequency
81R	Rate-of-Change-of-Frequency (df/dt)

Supervision

74T/CCS	Trip & Close Circuit Supervision
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Control

86	Lockout
CB Control	
User Programmable Logic	

Features

Four Settings Groups
 Password Protection – 2 levels
 Self Monitoring

User Interface

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

Monitoring Functions

Primary/Secondary Line and Phase Voltages
 Positive Phase Sequence (PPS) Voltage
 Negative Phase Sequence (NPS) Voltage
 Zero Phase Sequence (ZPS) Voltage
 Frequency
 Binary Input/Output status
 Time and date
 Starters
 Fault data
 Event records
 CB trip and maintenance counters and Time to Trip

Data Communication

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

Additional Optional Communication Ports

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

Standard Protocols

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

Optional Protocols

IEC61850 (E6 Case)

Ethernet Redundancy Protocols:

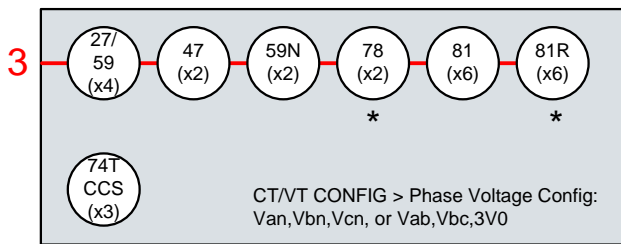
Standard in all IEC61850 models:
 PRP (Parallel Redundancy Protocol)
 RSTP (Rapid Spanning Tree Protocol)
 HSR (High-availability Seamless Redundancy)

Data

Up to 1000 event records
 User configurable fault record duration
 Waveform records
 Measurands
 Commands
 Time synchronism
 Viewing and changing settings

Function Matrix

FUNCTION	FUNCTIONAL REQUIREMENT	7SR1587-5*A**-*CA0	7SR1587-5*A**-*DA0
27	Undervoltage	■	■
47	Negative Phase Sequence Voltage	■	■
59	Overtoltage	■	■
59N	Neutral Voltage Displacement	■	■
78	Vector Shift		■
81	Under/Over Frequency	■	■
81R	Rate of Change of Frequency		■
CONTROL / MONITOR			
74T/CCS	Trip & Close Circuit Supervision	■	■
86	Lockout	■	■



* Not all versions - see Function Matrix

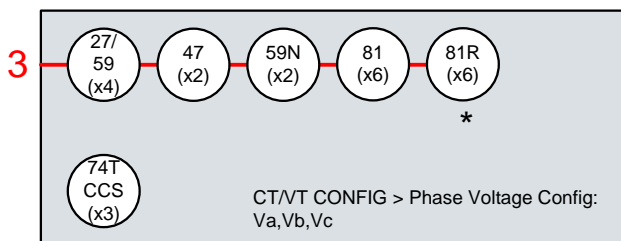


Fig. 2 Functional Diagrams

VT Connections

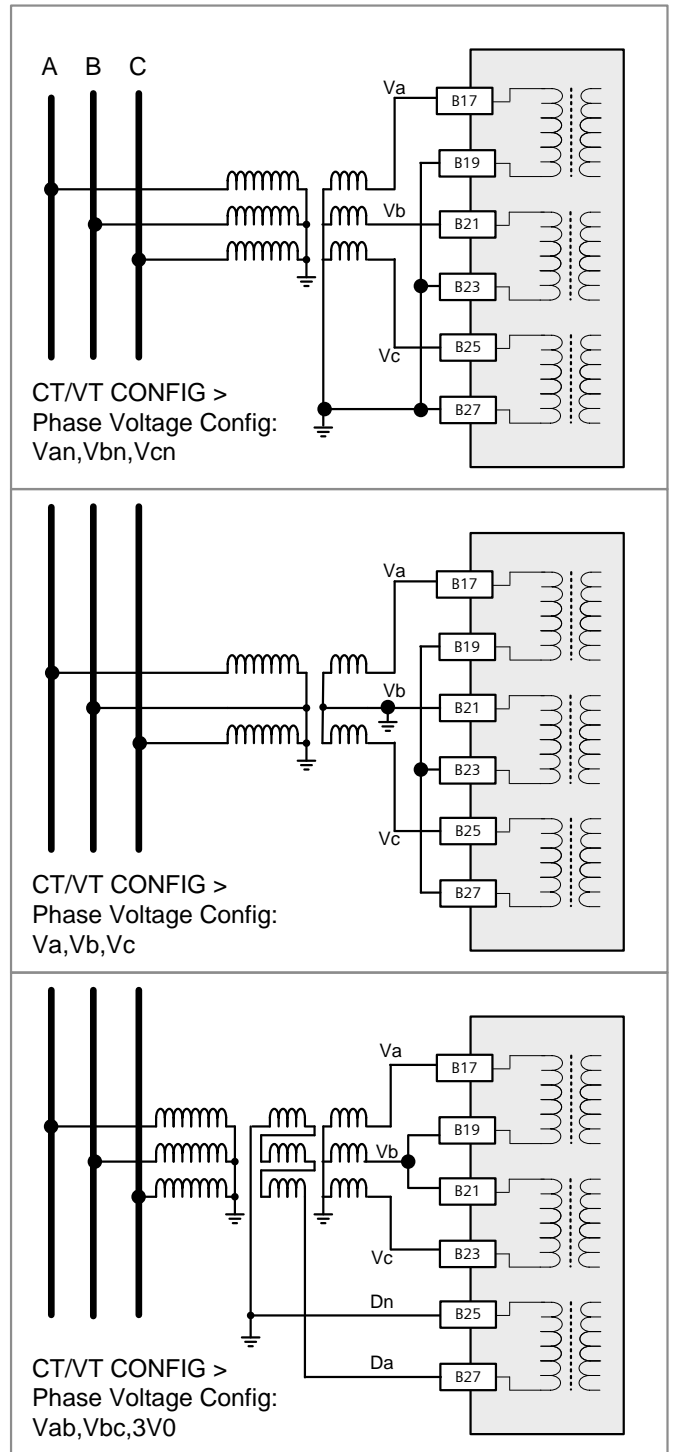


Fig. 3 VT Connections

Description of Functionality

With reference to figure 2 'Function Diagrams'.

27/59 Under/Over Voltage

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

47 Negative Phase Sequence Voltage

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

59N Neutral Overvoltage

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

74T/CCS Trip & Close Circuit Supervision

The trip or close circuit(s) can be monitored via binary inputs. Detection of trip circuit failure can be used to raise an HMI alarm (general alarm) and/or output(s).

78 Vector Shift

Operates if the voltage vector 'jumps' by more than setting during abrupt change in load. The function is applied to detect 'islanding' or loss of connection between a generator and the main utility supply.

81 Under/Overfrequency

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

81R Rate of Change of Frequency (df/dt)

Each element has settings for pickup level and Definite Time Lag (DTL) delay. Operates when the df/dt gradient exceeds setting for duration of delay. The function is typically applied in load shedding schemes or to detect 'islanding' or loss of connection between a generator and the main utility supply.

Programmable Logic

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

Virtual Inputs/Outputs

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

Circuit Breaker Maintenance

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

delta counter records the number of operations since the last reset.

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

Control Mode

The relay has a control menu with access to commonly used command operations. Access to the control commands is restricted by a 4 character control function password. Each command requires a select then execute operation, if the execute operation is not performed within a time window the command is aborted. The following control functions are available:

- CB Control
- Local or remote operation



Fig.4 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.

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 seconds of waveform storage are available, configurable as 10 records of 1 second duration, 5 of 2 seconds, 2 of 5 seconds or 1 record of 10 seconds duration.

Demand Metering

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

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 or 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.

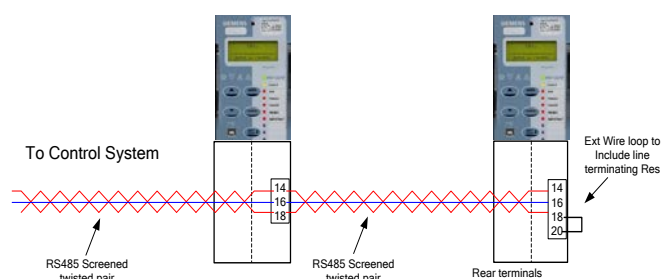


Fig.5 Typical RS485 connection

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

Ethernet Communications

IEC 61850

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

Information on IEC61850 functionality can be found in the following 7SR158 documents:

Model Implementation Conformance Statement (MICS)

Protocol Implementation Conformance Statement (PICS)

Protocol Implementation Extra Information for Testing (PIXIT)

Reydisp Evolution

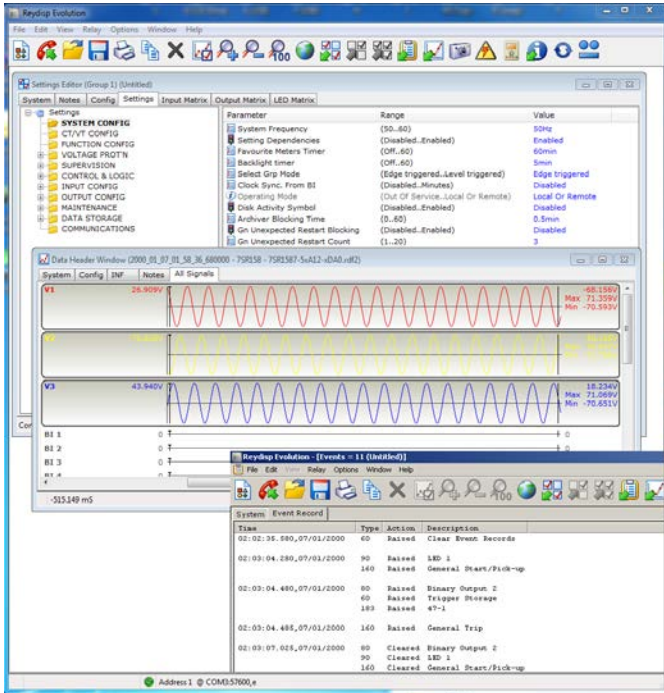


Fig.6 Typical Reydisp Evolution Screenshot

Reydisp Evolution is common to the entire range of Reyrolle numeric products. The user can apply settings, interrogate settings, retrieve events and fault data.

Language Editor

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

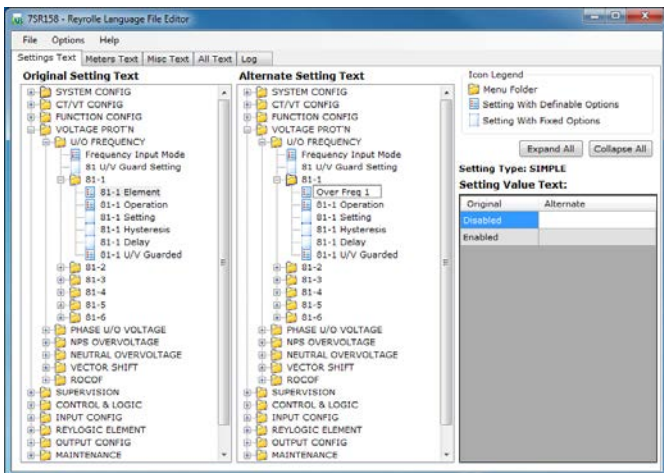


Fig.7 Typical Language Editor Screenshot

Communications Editor

To facilitate interfacing to a substation the relay 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.

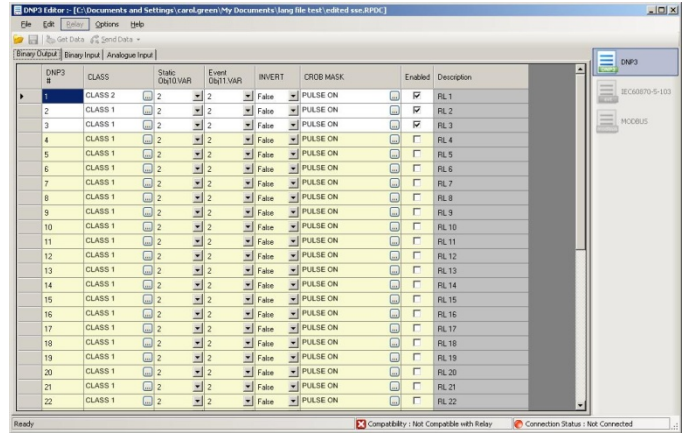


Fig.8 Typical Communications Editor Screenshot

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.

Construction

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

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

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



Fig.9 Rear view of relay (E4 Case)



Fig.10 Rear view of relay with 2x LC Fibre Optic ports (E6 Case with IEC61850)

User Interface



Fig.11 User Interface

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

LCD

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

LEDs

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

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

Relay Information

The device is identified by the rating label on the fascia. The user can give the device its own unique identity by editing the 'Relay Identifier' displayed on the LCD, also space is provided for a further slip-in label.

Technical Data

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

Inputs and Outputs

Voltage Inputs

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

Auxiliary Supply

Rated DC Voltage	110/125/220/250V Range 64 to 300V 24/48/60V Range 18 to 72V	
Allowable superimposed ac component	12% of DC voltage	
Rated AC Voltage	115 VAC 50/60Hz Range 92 to 138 V rms AC 50/60Hz $\pm 5\%$	
Power Consumption:	E4 Min (DC)	3.9W
	E4 Max (DC)	8W
	E4 Min (AC)	9VA 0.5PF
	E4 Max (AC)	16VA 0.5PF
	E6 Min (DC)	6.4W
	E6 Max (DC)	10.5W
Allowable breaks/dips in supply (collapse to zero)	E6 Min (AC)	14.5VA 0.5PF
	E6 Max (AC)	21.5VA 0.5PF
	DC	50ms
	AC	2.5/3 cycles @50/60Hz

Binary Inputs

Number	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	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 Make and carry (L/R ≤ 40 ms and V ≤ 300 V)	5A ac or dc 20A ac or dc for 0.5s 30A ac or dc for 0.2s	
Breaking Capacity (≤ 5 A and ≤ 300 V): AC Resistive AC Inductive DC Resistive DC Inductive	1250 VA 250 VA at p.f. ≤ 0.4 75 W 30 W at L/R ≤ 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 2.7kg E4 case, 3.65 kg E6 case. Additional Transport packaging: add 0.4kg
IP Rating installed with cover	IP 51 from front
IP Rating installed without cover	IP 20 from front

Data Communication Interface

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

EN100 Fibre Optic Data Communication Interface (IEC 61850 Option)

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

EN100 Electrical Ethernet Data Communication Interface (IEC 61850 Option)

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

Data Storage

Fault Record	10
Waveform Record	10 x 1sec 2 x 5sec 5 x 2sec 1 x 10sec Pre trigger 10...90%
Events	1000 1ms Resolution

Mechanical Tests

Vibration (Sinusoidal)

IEC 60255-21-1 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 Class IV

Type	Level	Variation
Contact discharge	8.0 kV	≤ 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 50ms DTL pick-up delay applied to binary inputs

Conducted Radio Frequency Interference

IEC 60255-22-6

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

Radiated Radio Frequency

IEC 60255-25

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

Environmental Tests

Temperature

IEC 60068-2-1/2

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

Humidity

IEC 60068-2-78

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

IEC 60529

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

Performance

27/59 Under/Over Voltage

Number of Elements	4 Under or Over
Operate	Any phase or All phases
Under-Voltage Guard	1, 1.5...200V
Setting Range Vs	5, 5.5...200V
Hysteresis Setting	0.0.1...80%
Vs Operate Level	100% Vs, $\pm 1\%$ or $\pm 0.25V$
Reset Level: Overvoltage Undervoltage	$= (100\% - \text{hyst}) \times V_{op}, \pm 1\%$ $= (100\% + \text{hyst}) \times V_{op}, \pm 1\%$
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	73ms $\pm 10\text{ms}$
0 to 2.0xVs	63ms $\pm 10\text{ms}$
1.1 to 0.5xVs	58ms $\pm 10\text{ms}$
Operate time following delay.	Tbasic + td, $\pm 1\%$ or $\pm 10\text{ms}$
Inhibited by	Binary or Virtual Input Voltage Guard

47 Negative Phase Sequence Voltage

Number of Elements	2
Under-Voltage Guard	1, 1.5...200V
Setting Range Vs	1, 1.5...90V
Hysteresis Setting	0.0.1...80%
Operate Level	100% Vs, $\pm 2\%$ or $\pm 0.5V$
Reset Level	$(100\% - \text{hyst}) \times V_{op}, \pm 1\%$ or $\pm 0.25V$
Delay Setting td	0.00, 0.01...20, 20.5...100, 101... 1000, 1010...10000, 10100...144 00s
Basic Operate Time :	
0 to 2.0 x Vs	80ms $\pm 20\text{ms}$
0 to 10 x Vs	70ms $\pm 20\text{ms}$
Operate time following delay.	Tbasic + td, $\pm 2\%$ or $\pm 20\text{ms}$
Inhibited by	Binary or Virtual Input Voltage Guard

74T/CC Trip/Close Circuit Supervision

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

78 Vector Shift

Number of Elements	2
Under-Voltage Guard	1, 1.5...200V
Setting Range Vs	2.0, 2.5 ... 30 °
Operate Level	100% Vs, $\pm 2^\circ$
Operate Time	$\leq 40\text{ms}$

81 Under/Over Frequency

Number of Elements	6 Under or Over
Under Voltage Guard	35, 35.5...200V
Setting Range	43, 43.01...68Hz
Hysteresis Setting	0, 0.1... 2%
Operate Level	100% Fs $\pm 10\text{mHz}$
Operate Time	Maximum $< 150\text{ms}$
Operate Delay	0...14400s

81R Rate of Change of Frequency (df/dt)

Number of Elements	6
Under Voltage Guard	35, 35.5...200V
Setting Range Rs	0.050, 0.075 ...10.0 Hz/s
Operate Level	Rs $\pm 50\text{mHz/s}$ (F.nom $\pm 3\text{Hz}$)
Operate Time for ROCOF 1.3x setting for ROCOF 2x setting	$\leq 300\text{ms}$ $\leq 200\text{ms}$
Operate Delay	0...200s

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

Control Functions

CB	Open/Close
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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

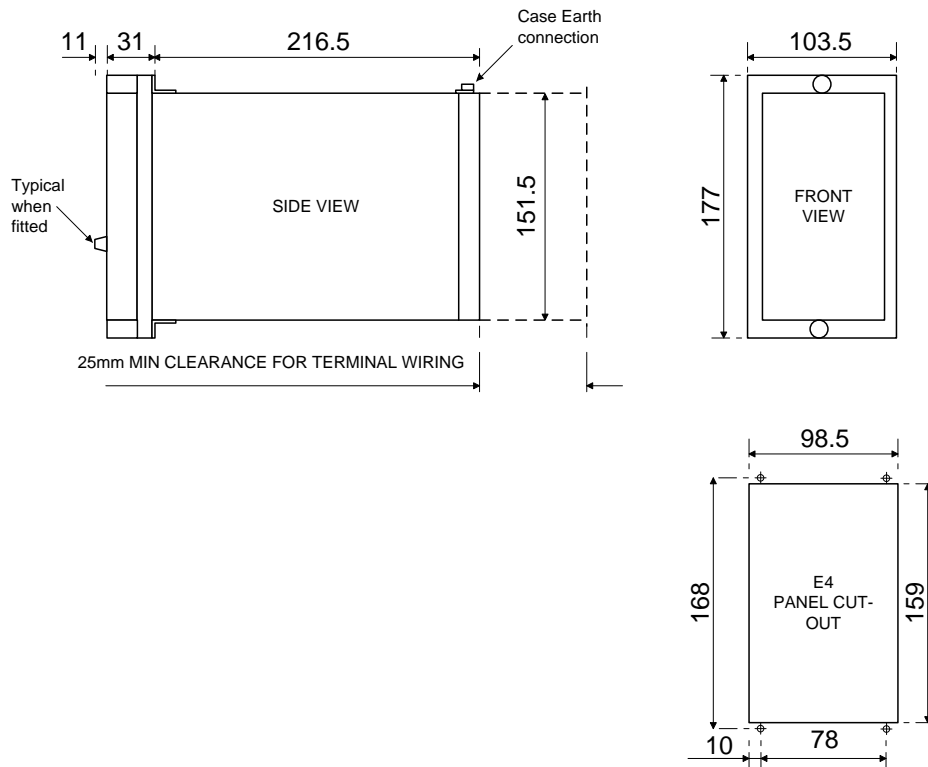
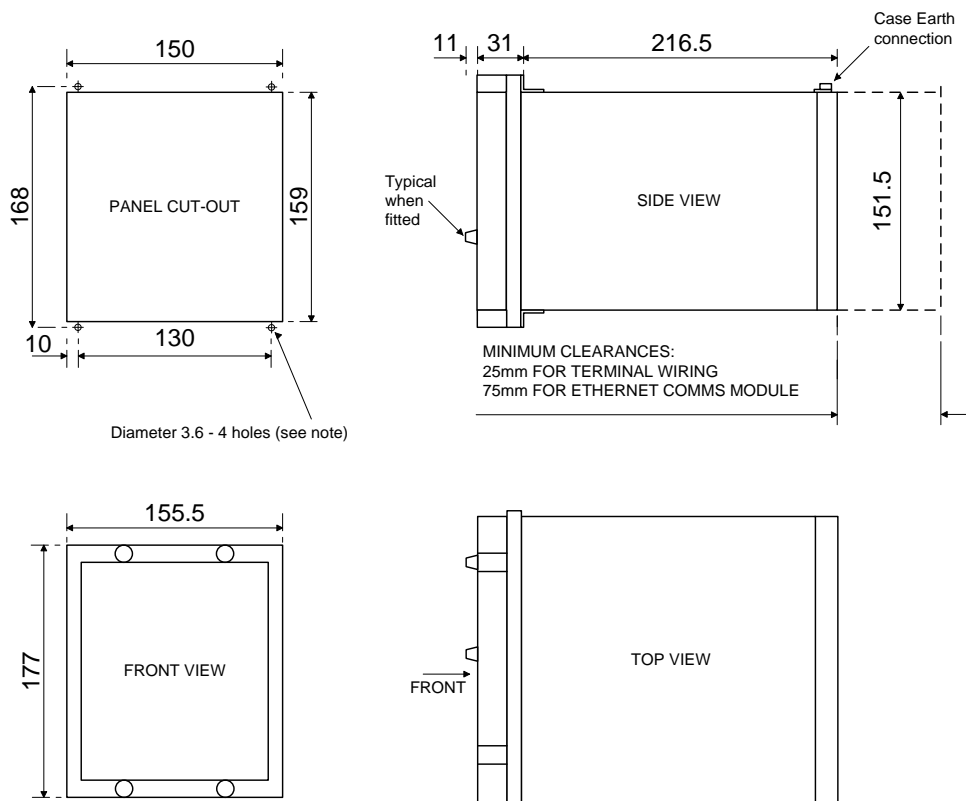


Fig.12 E4 Case overall dimensions and panel drilling details (all dimensions are in mm)



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.13 E6 Case overall dimensions and panel drilling details (all dimensions are in mm)

7SR1587 Connection Diagram

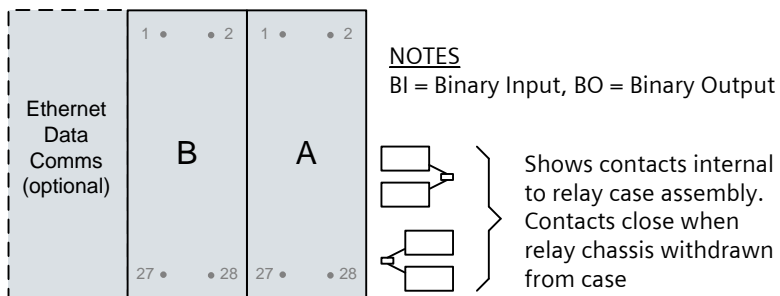
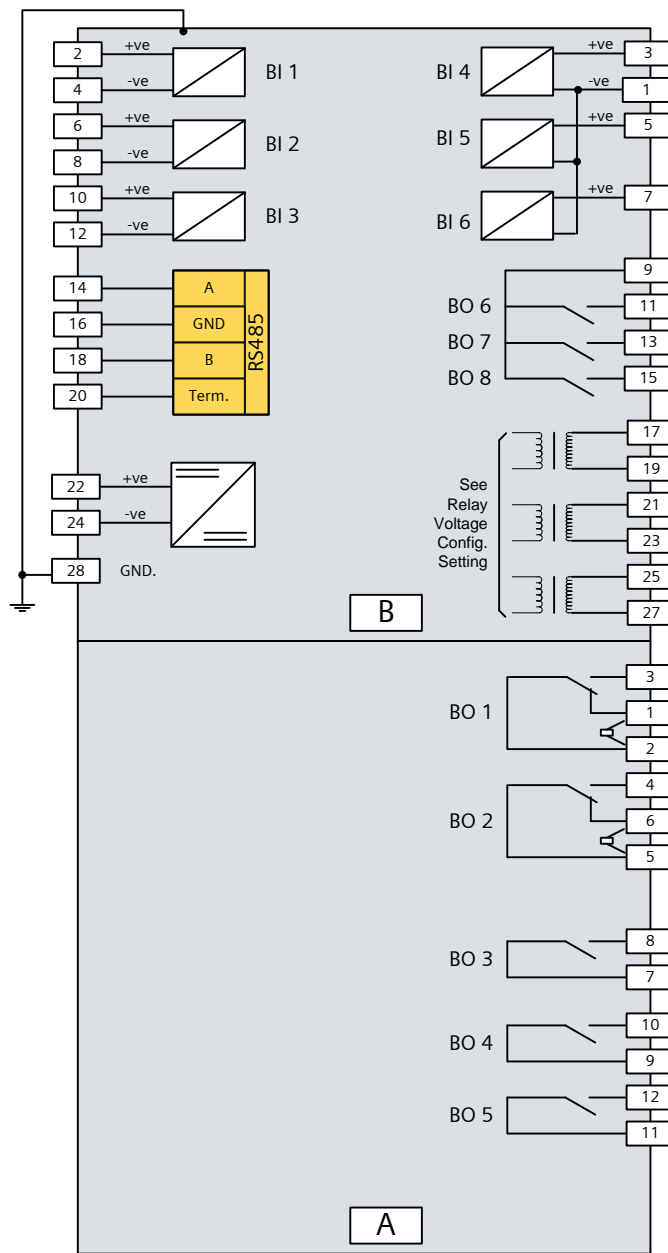


Fig.14 - 7SR1587 Connection Diagram

Ordering Information – 7SR1587

Product description	Variants	Order No.
Voltage/frequency relay		7 S R 1 5 8 7 - 5 □ A □ □ - □ □ A 0
<u>Protect Product Family</u> Voltage		5
<u>Relay Type</u> Voltage & Frequency		8
<u>Case, I/O and Fascia</u> E4 case, 3 VT, 6 Binary Inputs / 8 Binary Outputs, 10 LEDs		7
<u>Measuring input</u> 40 to 160 V, 50/60Hz		5
<u>Auxiliary voltage</u> 80 to 250 V DC / 115 V AC, binary input threshold 19 V DC 80 to 250 V DC binary input threshold 88 V DC 24 to 60 V DC, binary input threshold 19 V DC		G H J
<u>Spare</u>		A
<u>Communication Interface</u> Standard version – included in all models, USB front port, RS485 rear port (E6 Case) ¹⁾ Standard version - plus additional rear electrical Ethernet RJ45 (x2) (E6 Case) ¹⁾ Standard version - plus additional rear optical Ethernet duplex (x2) (E6 Case) ¹⁾		1 2 7 7 8 7
<u>Protocol</u> IEC 60870-5-103, Modbus RTU and DNP3(user selectable setting) IEC 60870-5-103, Modbus RTU, DNP3 and IEC 61850. (user selectable settings)		2 7
<u>Front Cover</u> Standard Version – No Push Buttons Push Buttons – Down and right Arrows		1 2
<u>Protection Function Packages</u> For future development For future development Standard Version 27/59 Under/overvoltage 47 Negative phase sequence voltage 59N Neutral voltage displacement 74T&C Trip & Close circuit supervision 81 Under/overfrequency		A B C
Standard version – plus 78 Voltage Vector Shift 81R Rate of Change of Frequency		D
<u>Additional Functionality</u> No additional functionality		A
<u>Spare</u>		0

¹⁾ E4 case is standard, E6 case is required if IEC61850 option fitted

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