



Catalog
Edition 9

REYROLLE

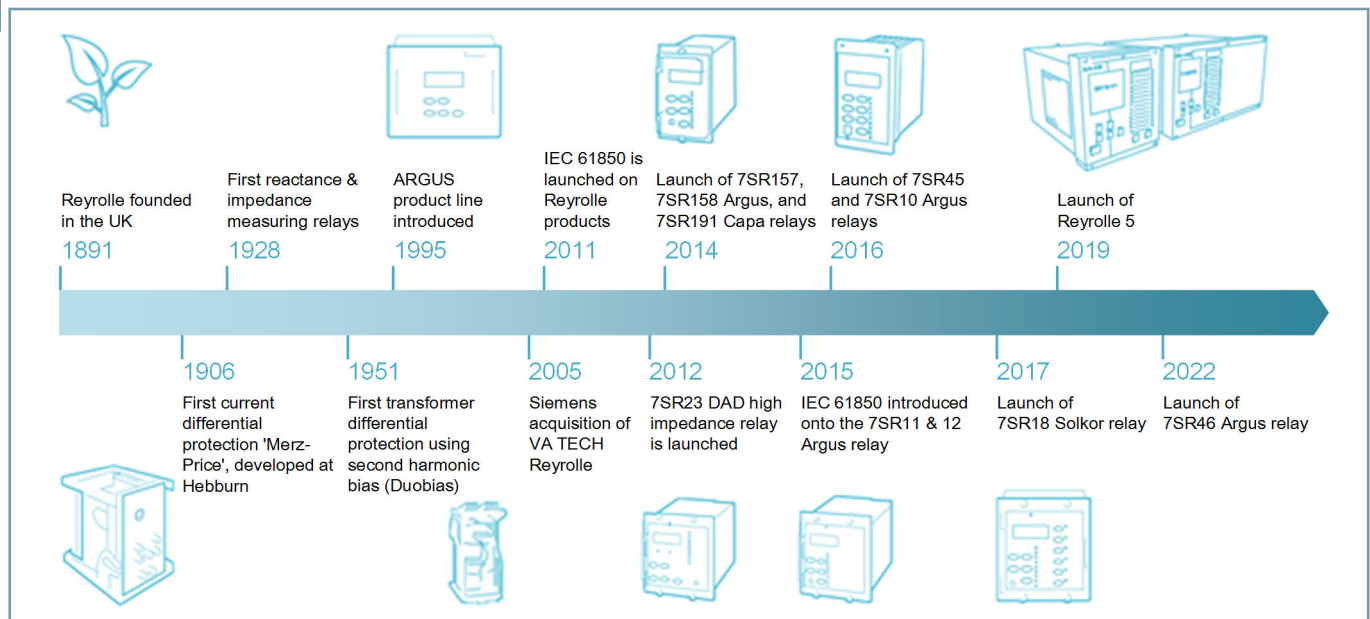
7SR45 Self/Dual Powered Overcurrent Protection

SIEMENS

7SR45 Self Powered/ Dual Powered Non- Directional Overcurrent and Earth Fault Relay Siemens Protection Devices

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Reyrolle – Solutions for Distribution Grids



[dw_reyrolle history, 4, en_US]

Figure 1/1 History of Reyrolle

Reyrolle has been synonymous with electrical protection devices in the sectors of sub-transmission, distribution, and industrial applications for decades. Historically, Reyrolle relays were sold mainly in traditional markets but are now sold worldwide as part of the Siemens protection network.

Since its foundation, Reyrolle has been an innovation driver in product development – based on a strong focus on market, customer and technology. Worldwide established brand names such as “Solkor” and “Argus” demonstrate this. But there is more: A wide range of Reyrolle products has determined technological firsts in the market.

The comprehensive range of Reyrolle products provides the total protection requirements of distribution markets – ranging from overcurrent protection via transformer protection and voltage control to a full spectrum of auxiliary and trip relays. The portfolio includes many famous products such as “Argus”, “Duobias”, “Solkor”, “Rho”, etc.

To serve specific needs in industrial applications, a range of proven products such as “Argus overcurrent”, “Solkor line differential” and “Rho motor protection devices” is offered.

Through successive generations, Reyrolle numerical products have been developed to increase value to system operators. This increase in value is the result of consistent development:

- Ease-of-use as a principle – our withdrawable product solutions allow flexible, easy operation through high user friendliness.
- One size fits all – the 4U housing height and the latest generation of numerical products features 1 A/5 A CT Input, and some models are provided with universal DC power supplies.
- Learn once, know all – the new product generation provides a similar look and feel as earlier products. If Reyrolle numerical devices have been previously used, there is a high consistency in both programming and interrogation.

- With Reydisp Evolution, a comprehensive software support toolkit for relay setting, fault interrogation and general system information is provided. It is backward-compatible with all previous Reyrolle numerical devices.
- IEC 61850 communication interface option



[sc_7SR45_FrontAngle_NewCover, 1, --]

Figure 1/2 7SR4504

Device-Specific Overview of the Areas of Application

1

Main function	Device
RMU Protection	
Self/dual powered overcurrent protection	7SR45 Argus

Devices and Application

Relay Selection Guide

Overview of Functions

ANSI	Functions	7SR45
	Protection functions for 3 pole tripping	■
49	Thermal overload	■
50	Instantaneous overcurrent – phase	■
50G	Instantaneous earth fault – measured	■
50LC	Line check/Switch onto fault	■
50N	Instantaneous earth fault – calculated	■
51	Time delayed overcurrent – phase	■
51G	Time delayed earth fault – measured	■
51N	Time delayed earth fault – calculated	■
74TC	Trip-circuit supervision	■
81HBL2	Inrush detector	■
86	Lockout	■
	Measured values	■
	External trip initiation	■
	Sequence-of-events recorder	■
	Monitoring and supervision	■
	Number of setting groups	2
	Hardware quantity structure expandable	●
	Binary inputs (max)	2/4
	Binary outputs (max) incl. life contact	2/4
	Current inputs (max)	4
	Auxiliary supply	●
	Size	4 x 4U
	Small display (lines)	2
	Push buttons	7
	LEDs (max)	9
	– Non-programmable LEDs (5)	
	– User-programmable LEDs (4)	
	Pickup LED (green)	●
	Trip counter	■
	Trip timer	■
	Front user interface	■
	IEC 60870-5-103	●
	Modbus RTU slave	●
	Mechanical flag	●

■ Basic

● Optional (additional price)

The Reyrolle 7SR45 self powered/dual powered non-directional overcurrent and earth fault relay is equipped with numerous protection functions and features. A full list of these can be seen in the table above.

Description

The 7SR45 numerical overcurrent and earth fault protection relay provides both definite-time and inverse-time overcurrent and earth fault protection functions. The relay is CT powered with an option for connection to an external auxiliary supply.

The relay functionality can be configured via a front USB port for local PC connection or rear electrical RS485 (optional) port for remote connection. By using the Reydisp Evolution software, the user can update the settings and view the fault records (trip log) and the event records (event log).

The relay supports the IEC 60870-5-103 and Modbus communication protocols which helps in establishing connection to SCADA. The relay can indicate the trip with local and remote flag indicator based on the ordering options.

The conformal coating on device electronic modules increases protection against harmful environmental influences such as extreme moisture, corrosive gases and aggressive dust.

Main Function	Overcurrent and Earth Fault Protection
Inputs and Outputs	4 current transformers with 1 A or 5 A inputs, 2 or 4 binary inputs and 2 or 4 binary outputs, pulse output, remote flag output and local flag output (optional)
Communication	Front USB port (for configuration via Reydisp Evolution) and rear RS485 port (optional)
Housing	Size 4 – non draw-out case with side mounting arrangement

Benefits

- CT powered with option for external auxiliary supply connection
- Dedicated switch onto fault (SOTF) protection
- Self monitoring – Including battery-condition monitor
- High sensitivity – Trip ready at 20 % of I_{rated} (1-phase) and 10 % of I_{rated} (3-phase)
- Intelligent power management – Fail-safe start up and shut down modes
- Internal lithium battery back-up for viewing fault data, setting the protection, and resetting of indications
- 4 user-programmable LEDs for indicating protection and other relay functions
- Mechanical flag indication
- Suitable for RMU mounting
- Fault log with fault trip time and circuit-breaker operating time

Functions

Protection Functions

- 49 Thermal overload
- 50 Instantaneous overcurrent – phase
- 50G Instantaneous earth fault – measured
- 50LC Line check/Switch onto fault
- 50N Instantaneous earth fault – calculated
- 51 Time-delayed overcurrent – phase



Figure 2.2/1 7SR45 Device

- 51G Time-delayed earth fault – measured
- 51N Time-delayed earth fault – calculated

Supervision Functions

- 81HBL2 Inrush-current detection
- 74TC Trip-circuit supervision

Ancillary Functions

- 49T High-speed external trip via BI
- 86 Lockout

Communication

- IEC 60870-5-103
- Modbus RTU

Reydisp Evolution Software

Our user-friendly PC software tool ensures a smooth installation providing an efficient and intuitive interface to the relay.

Application

7SR45 Self Powered/Dual Powered Relay is a numerical overcurrent and earth fault protection relay primarily intended for secondary distribution in electrical networks.

The 7SR45 Relay is designed to operate with/without an auxiliary supply. The relay is powered primarily from the auxiliary voltage even though all other power sources are available.

In the absence of auxiliary voltage, the relay is powered by CT input.

The relay offers definite-time and inverse-time overcurrent and earth fault protection functions in accordance to IEC and ANSI standards.

The 7SR45 relay has a built-in capacitor discharge pulse output for low-energy trip coil of the circuit breaker. Changeover binary outputs are also available for trip via an auxiliary powered shunt trip coil.

The 7SR45 relay is targeted for the following applications:

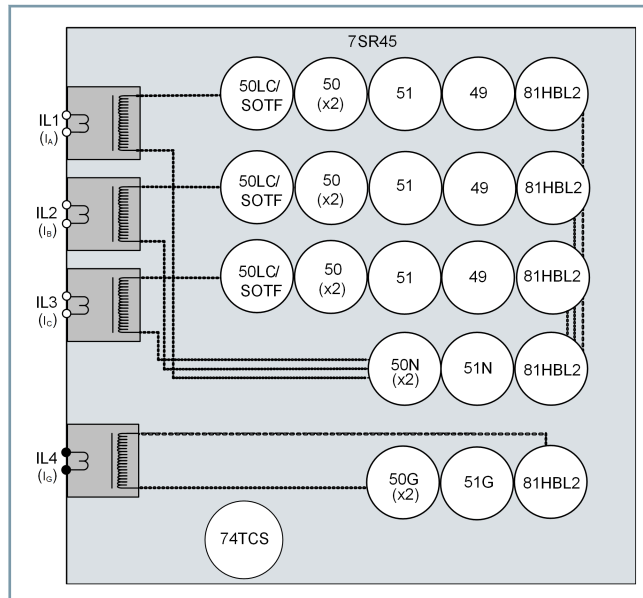
Devices and Application

7SR45 Argus Relay

- Protection relay for Ring Main Units (RMU)
- Backup protection relay for the medium-voltage applications
- Protection applications in remote locations where auxiliary supply is not available
- Incomers, Feeders, and MV/LV transformers
- Panel refurbishment of old electromechanical protection relays.

2.2

Functional Diagram



[dw_7SR45_Functional Block Diagram, 2, en_US]

Figure 2.2/2 Functional Diagram of 7SR45 Self Powered/Dual Powered Non-Directional Overcurrent and Earth Fault Relay

The relay provides 2 setting groups - Group number (Gn) 1 to 2 which can both be viewed/edited via the fascia or PC Software tool.

Protection

49 Thermal Overload Protection

The thermal overload function monitors thermal levels (Θ) of the electrical equipment thus tripping them in case of thermal overload.

One 49 thermal overload element is provided.

50 Instantaneous Overcurrent – Phase

2 phase overcurrent measurement stages are available.

50 INST/DTL elements provide overcurrent protection, each with independent settings for pickup current and time delays.

50G Instantaneous Earth Fault – Measured

2 earth fault measurement stages are available.

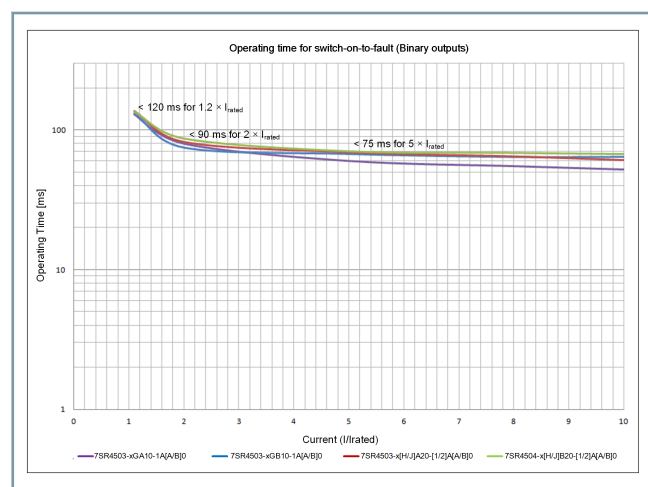
This function directly measures the earth current from an independent CT, or the residual connection of the 3 line CTs.

50G INST/DTL elements provide earth fault protection, each with independent settings for pickup current.

50LC Line Check

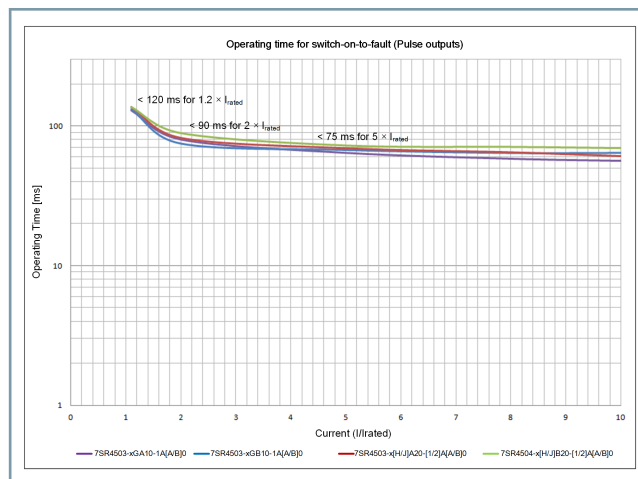
SOTF functionality provides high-speed tripping if a fault is still present on the feeder after the reclosure of the circuit breaker (Close onto Fault) or if earthing clamps are left connected after maintenance.

The following graph shows the SOTF operating time depending on the fault currents.



[dw_operating_time_Binary-outputs, 6, en_US]

Figure 3.1/1 Operating Time for Switch Onto Fault with Binary Output



[dw_operating_time_Pulse-outputs, 6, en_US]

Figure 3.1/2 Operating Time for Switch Onto Fault with Pulse Output



NOTE

Multi-phase current will result in shorter operating time.

50N Instantaneous Earth Fault – Calculated

This function derives the earth current internally from the 3-phase CT inputs to indicate earth fault.

2 earth fault measurement stages are available.

50N INST/DTL elements provide earth fault protection, each with independent settings for pickup current.

51 Time-Delayed Overcurrent – Phase

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

51G Time-Delayed Earth Fault – Measured

This mode directly measures the earth current from an independent CT, or the residual connection of the 3 line CTs.

51G IDMTL/DTL elements provide earth fault protection, each with independent settings for pickup current, time multiplier, and time delays. The user can select IEC or ANSI time current characteristics. The IDMT stage has a user selectable reset characteristic either; either DTL or IEC/ANSI time reset characteristic to improve grading with electromechanical protection.

51N Time-Delayed Earth Fault – Calculated

This function derives the earth current internally from the 3-phase CT inputs to give earth fault.

51N IDMTL/DTL elements provide earth fault protection, each with independent settings for pickup current, time multiplier, and time delays. The user can select IEC or ANSI time current characteristics. The IDMT stage has a user selectable reset characteristic either; either DTL or IEC/ANSI time reset characteristic to improve grading with electromechanical protection.

74TC Trip-Circuit Supervision

The trip circuit(s) can be monitored via binary inputs. Trip-circuit failure raises an alarm through configured output(s) and LED.

81HBL2 Inrush Current Detection

Where a second harmonic current is detected (i.e. during transformer energization), user selectable protection function elements can be blocked.

86 Lockout

Output relays can be configured to self reset, pulsed or hand reset operation.

3.1 Output relays can be used to directly trip the circuit breaker. The operate **break** duty of output relays is limited so the circuit-breaker trip coil must be open circuited by a suitably rated contact, typically a circuit-breaker auxiliary switch.

Trip Counter

The trip counter records the overall number of trip operations performed by the relay.

Trip Timer

The trip time (TT) is the time taken from the general pickup to the issued trip signal. The circuit-breaker operating time (BOT) is the time required to open the circuit breaker from the relay trip signal. The total trip time is the sum of the trip time and the circuit-breaker operating time.

Sensitivity

In case of absence of auxiliary voltage, the sensitivity of the relay is the minimum phase current required for the relay to energize, detect a fault, and trip as per the configuration.

The sensitivity of 7SR45 Self Powered/Dual Powered Non-Directional Overcurrent and Earth Fault Relay is 20 % of rated current for 1-phase and 10 % of rated current for 3-phase. The PROTECTION HEALTHY LED and TRIP READY LED turn on when the relay is TRIP ready at the above mentioned current levels.

The following graphs show the sensitivity of the relay and corresponding operating time for different starting currents.

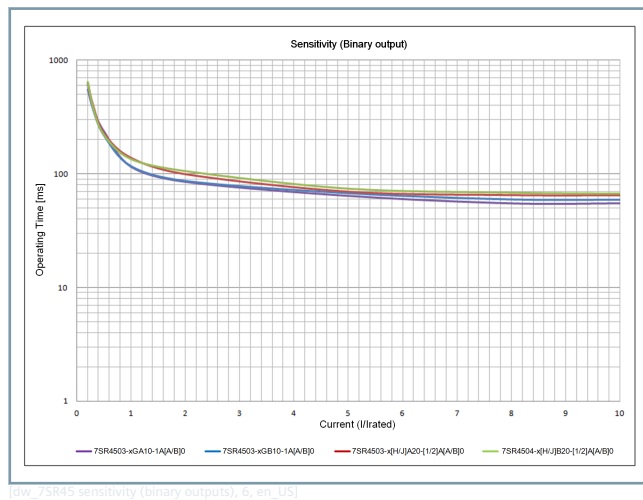


Figure 3.1/3 Sensitivity for 1-Phase Fault with Binary Output

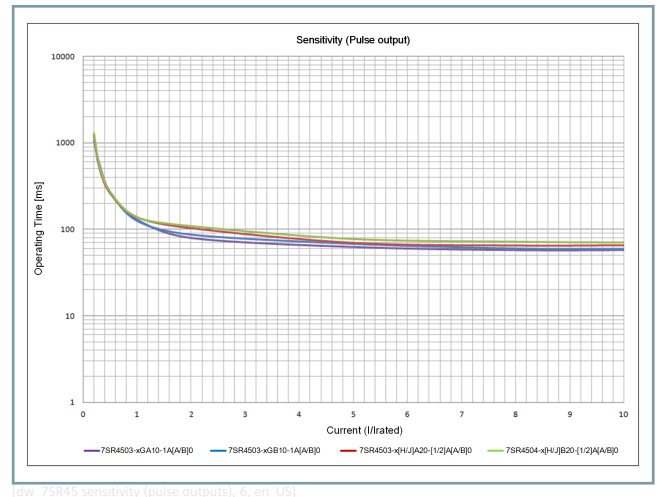


Figure 3.1/4 Sensitivity for 1-Phase Fault with Pulse Output



NOTE

Multi-phase current will improve the sensitivity.

Monitoring

The relay is designed with a number of monitoring features.

Self-Monitoring

The self-monitoring supervision includes monitoring of power-supply signals, code execution watchdog, memory checks by check sum, RTC check, and battery health checks.

The protection healthy LED is illuminated when the power supply signals are healthy. An internal relay fail feature provides indication of when an internal error is detected. The error codes are available in the instrument mode.

Configurable LED and BO is provided for internal relay failure feature.

Battery Monitoring

The battery profile menu provides the consumption on battery power of the different applications, and in addition, a Low battery indication is provided.

Instruments & Meters

The following measured values and status information are monitored and displayed in the relay under the Instrument mode.

Primary/secondary current phases and earth
Binary input/binary output status
Thermal capacity
Time and date
Fault records (Trip log)
Event records (Event log)
Trip Counter
Battery operation count

Intelligent power management ensures a healthy shut down below the operating ranges and fail-safe start-up mode.

Data Acquisition and Recording

Sequence-of-Event Records (Event Log)

Up to 100 events can be stored and time tagged to 1-ms resolution. The events are stored on first-in-first-out basis. The events are available through the communication interface.

Fault Records (Trip Log)

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, trip-time information, and type of fault.

Real-Time Clock

The time and date can be set and is maintained while the relay is de-energized by a coin cell battery.

Communications

The relay offers a USB port as standard on the front of all units. All of the relay functions can be set on a PC using the Reydisp Evolution software via the USB port. The connection is made with a USB cable and operates with a “plug and play” connection, so no presetting of the relay is required.

In the dual powered relays, the front port can be switched off or set to use either the Modbus RTU or IEC 60870-5-103 protocols for testing purposes. For self powered relays, the default protocol is IEC 60870-5-103.



NOTE

The Reydisp Evolution software will work with the relay only when the USB port is configured to the IEC 60870-5-103 protocol in the dual-powered relays.

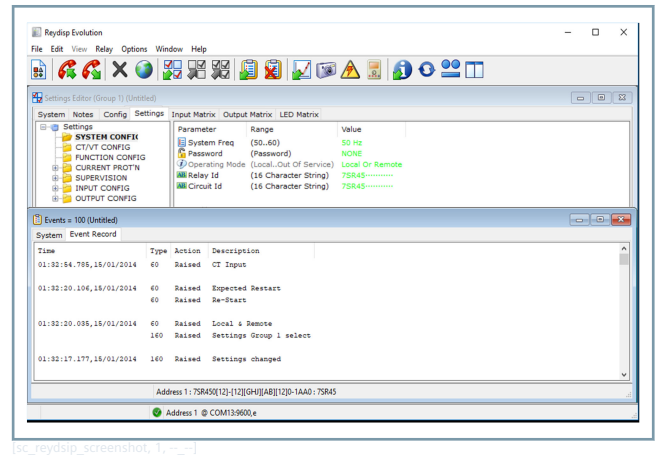


Figure 3.3/2 Example Application of the Reydisp Evolution

A rear RS485 electrical connection is optionally available on the relay 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.

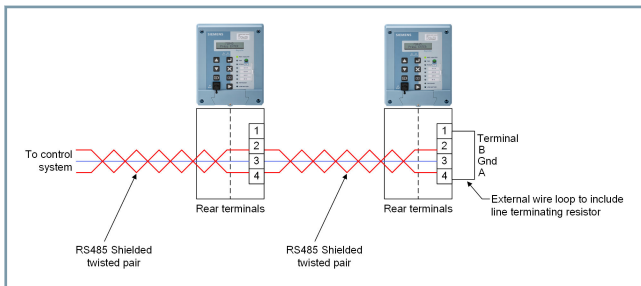


Figure 3.3/1 Typical RS485 Connection

The rear RS485 can be user-selected to be OFF, IEC 60870-5-103, or Modbus RTU.

Reydisp Evolution

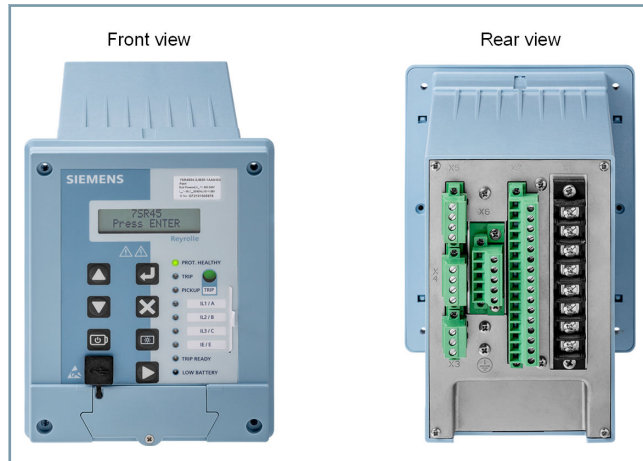
Reydisp Evolution is a Windows-based software tool, providing the means for the user to apply settings, interrogate settings, and retrieve events and disturbance waveforms from the device. It is common to the entire range of Reyrolle protection relays.

Hardware Construction

The relay is housed in a non draw-out 4U high, size 4 case.

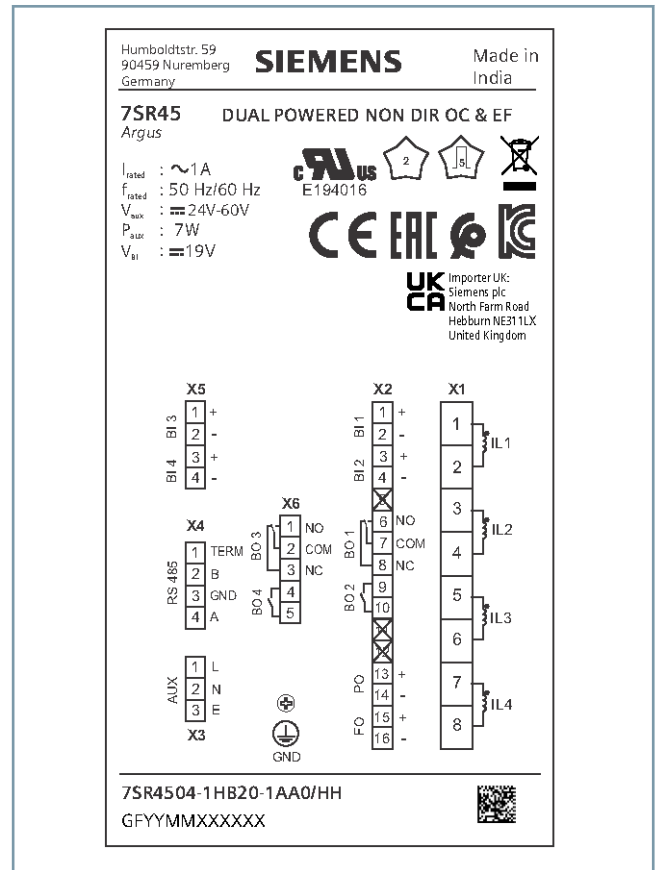
The rear connection comprises user-friendly pluggable type terminals for pulse and flag output, binary inputs, binary outputs, RS485 communication, and auxiliary input.

The CT terminals are suitable for ring-type lug connection to provide a secure and reliable termination.



[sc_7SR4504, 5, en_US]

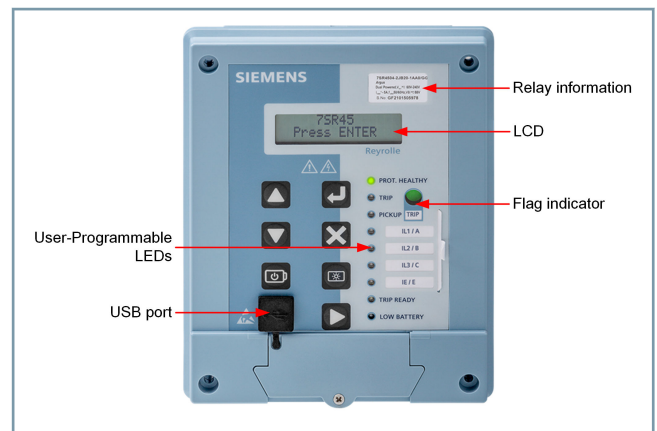
Figure 3.4/1 7SR4503/04



[sc_7SR45_SideLabel, 1, en_US]

Figure 3.4/2 7SR45 Terminal Label

User Interface



[dw_7SR45 user interface, 5, en_US]

Figure 3.4/3 User Interface

The user interface is designed to provide a user-friendly method of viewing menus, entering settings, and retrieving data from the relay. 5 buttons are provided for navigation around the menu structure. Additionally, 2 buttons are provided for the battery ON/OFF and backlight ON/OFF functionality.

System

Hardware Construction

LCD

A 2 line by 16 character liquid crystal display with power save operation indicates the relay identifier, settings, instrumentation, and fault data. The relay also provides 3 alert screens – Fault Trip Alert, Alarm Alert, and User Information Alert.

LEDs

5 non-programmable LEDs and 4 user-programmable LEDs are provided on the front fascia. Each non-programmable LED shows clear indication of the associated functions state and has a label for identification.

The 4 user-programmable LEDs can be configured for protection and other relay functions. By default, these LEDs are mapped to Phase IL1/A, IL2/B, IL3/C, IE/E. This default configuration is printed on one side of the paper label provided with the decal. If you prefer to change the configuration of user-programmable LEDs, then you must manually write the function name (to which the LED is mapped) on the paper label. Ordering selection for pickup LED is available in 2 colors: Amber or Green.

Flag Indicator

1 local flag indicator is provided and configured for the trip indication.

Relay Information

The device is identified by the rating label on the front fascia. The user can also give the device its own identity by editing the "Relay Identifier" displayed on the LCD.

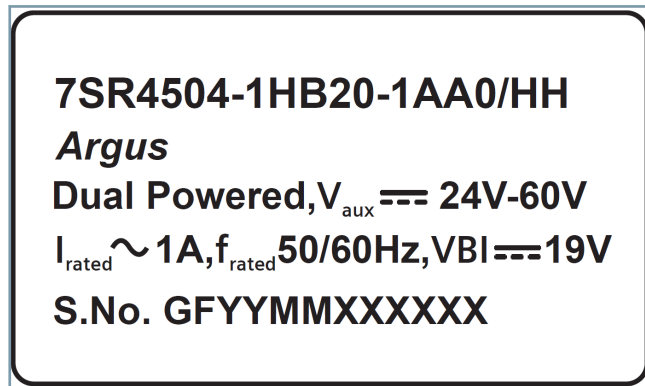


Figure 3.4/4 Fascia Relay Rating Label

The device terminal label displays the MLFB code, serial number, relay description, terminal contact details, and safety symbols.

	2 kV Dielectric test voltage
	5 kV impulse test voltage
	European CE marking
	Waste Electrical and Electronic Equipment Directive (WEEE)
	Guideline for the Eurasian Market

	Mandatory Conformity Mark for Electronics and Electro-technical Products in Morocco
	South Korea KC Certification for Electrical and Electronic Products
	UL recognized component marks for Canada and United States
	United Kingdom (UK) Conformity Assessed marking

Power

7SR45 Self Powered/Dual Powered Non-Directional Overcurrent and Earth Fault Relay can be powered in the following modes and their priority is as follows:

- Auxiliary power supply (only for dual powered relay)
- CT power
- USB power
- Battery power

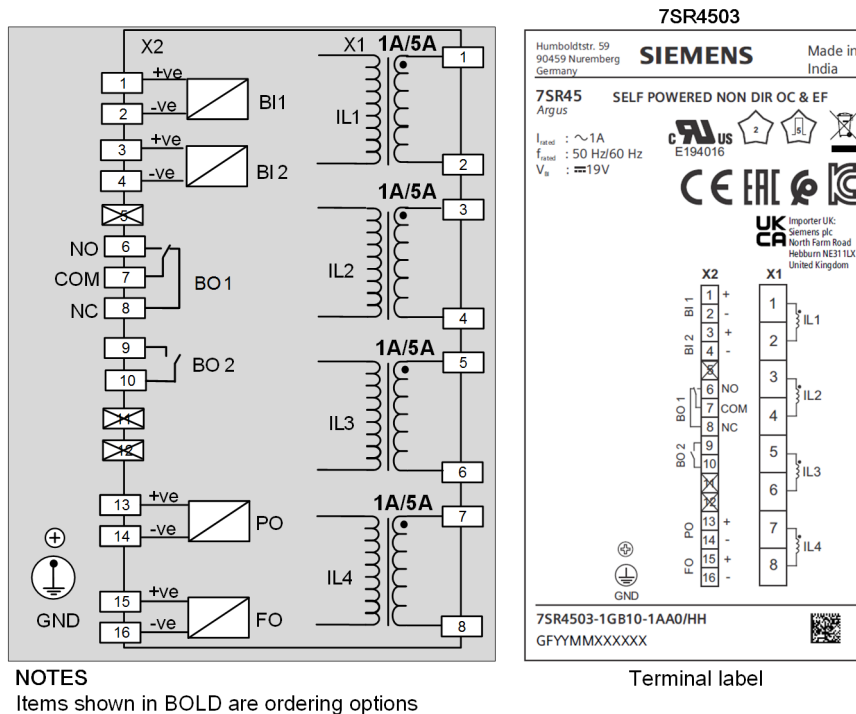
Confirmation ID (Password Protection)

The relay allows the user to set a 4-character confirmation ID (shown as Password in the relay LCD display). If a confirmation ID has already been set, then the user must enter the confirmation ID to gain access to the editing mode for setting parameters.

General Alarms

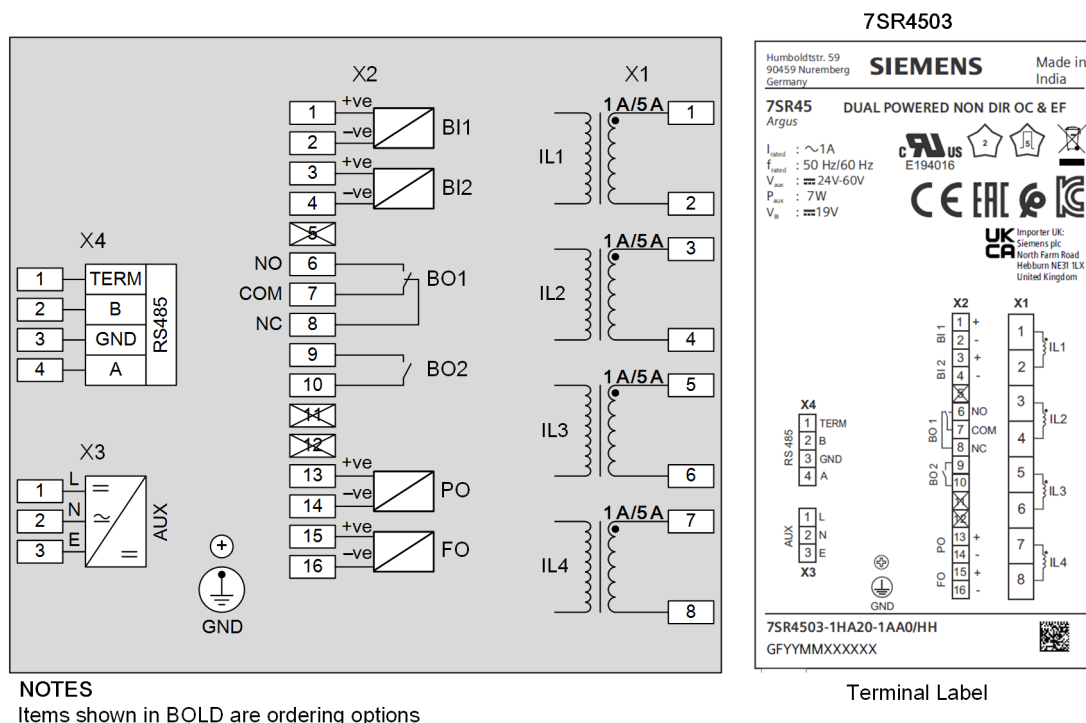
Up to 4 general alarms of 16 characters can be configured to display a text message on the LCD. The general alarms can be triggered from one or more inputs.

Connection Diagrams



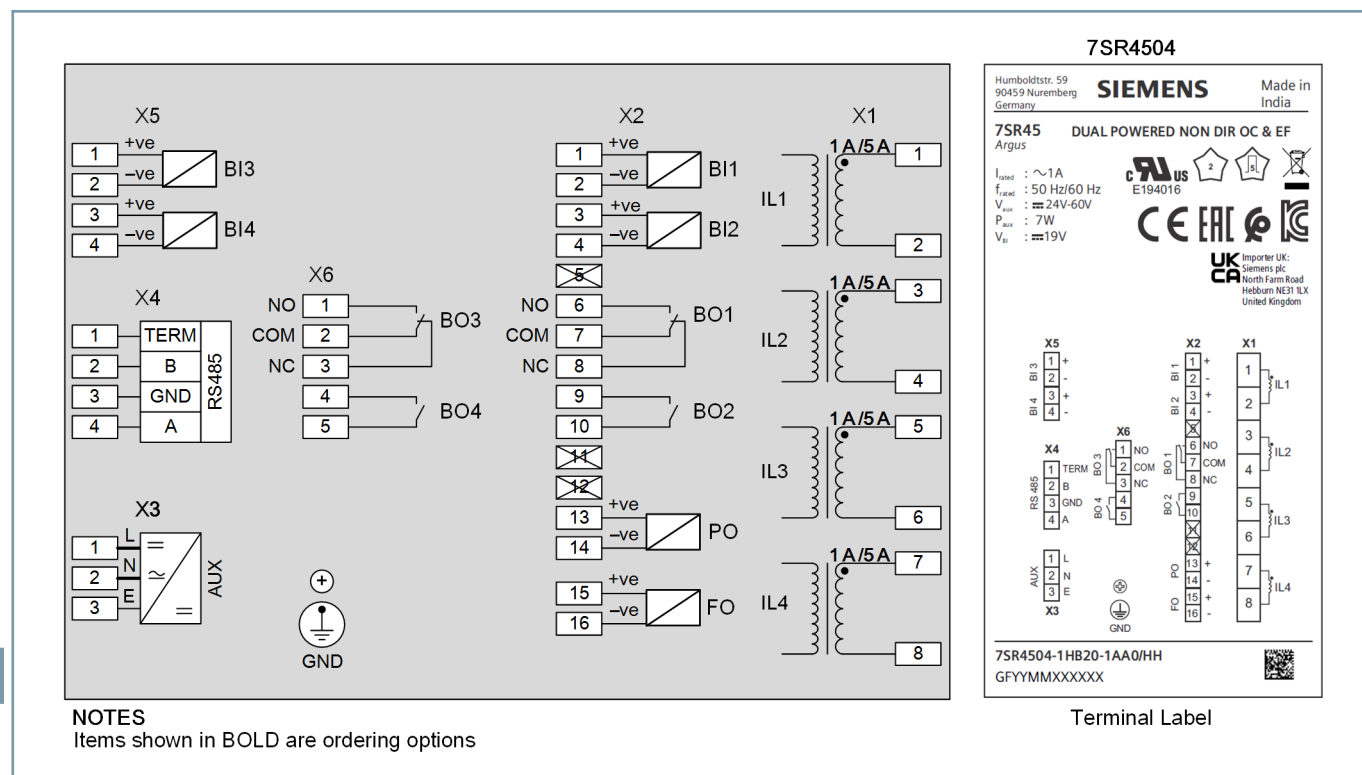
[io_7SR4501(03)-xGB10 terminal label/wiring diagram, 7, en_US]

Figure 4.1/1 Terminal Diagram of Self Powered (7SR4503-xGx10-1Ax0) Non-Directional Overcurrent and Earth Fault Relay with Flag



[dw_7SR450x-xH-J-A20-1AA0_termDia_dual-powered_non-dir_OCP_and_GndFit_without_Flag, 5, en_US]

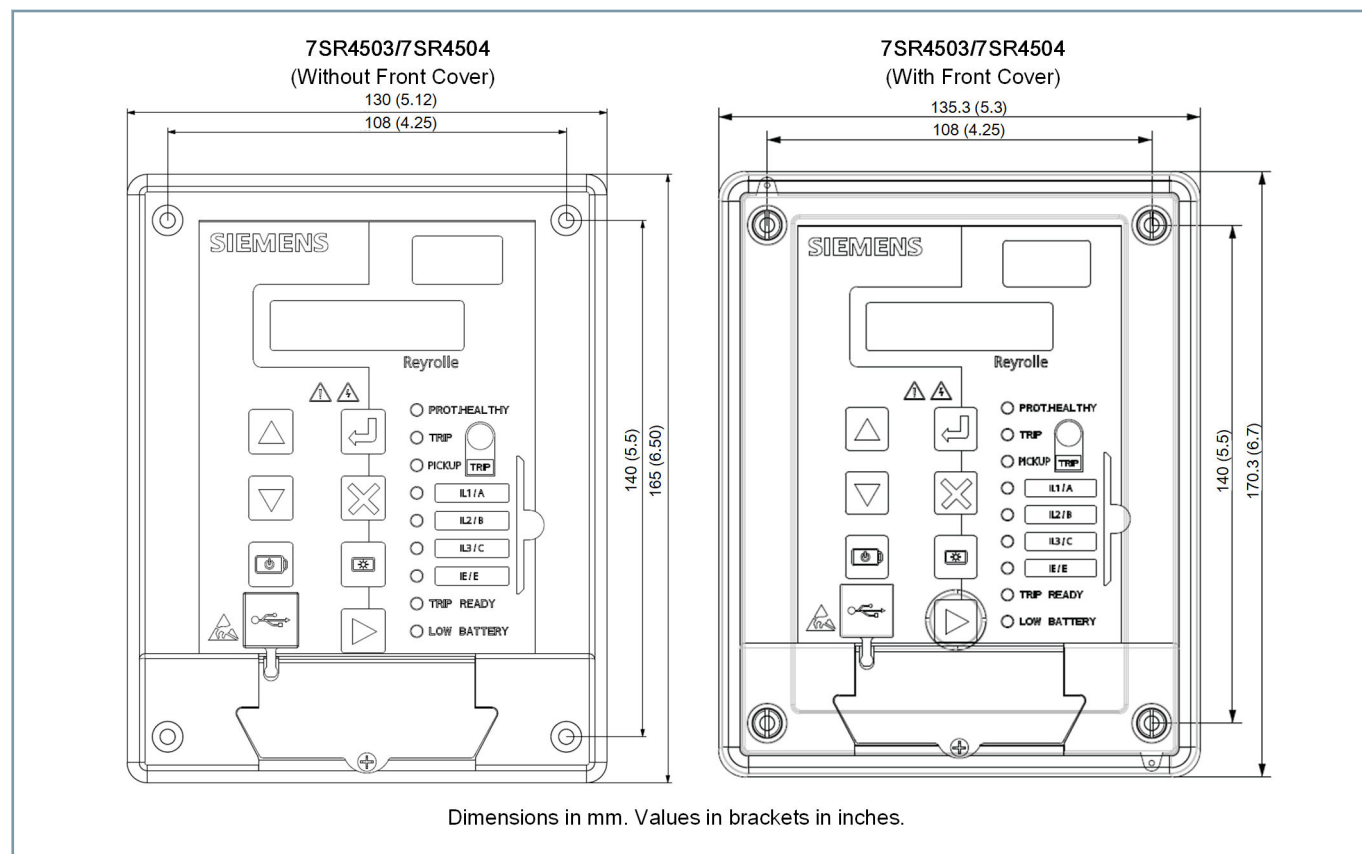
Figure 4.1/2 Terminal Diagram of Dual Powered (7SR4503-x[H/J]A20-1AA0) Non-Directional Overcurrent and Earth Fault Relay without Flag



[dw_7SR4504-xHB10-1AA0_termDia_dual-powered_non-dir_OCP_and_GndFit_with_Flag_5_en_US]

Figure 4.1/3 Terminal Diagram of Dual Powered (7SR4504-x[H/J]B20-1Ax0) Non-Directional Overcurrent and Earth Fault Relay with Flag

Dimension Drawings



[dw_7SR45 case dimensions front view, 7_en_US]

Figure 4.2/1 Front View

Technical Documentation

Dimension Drawings

4.2

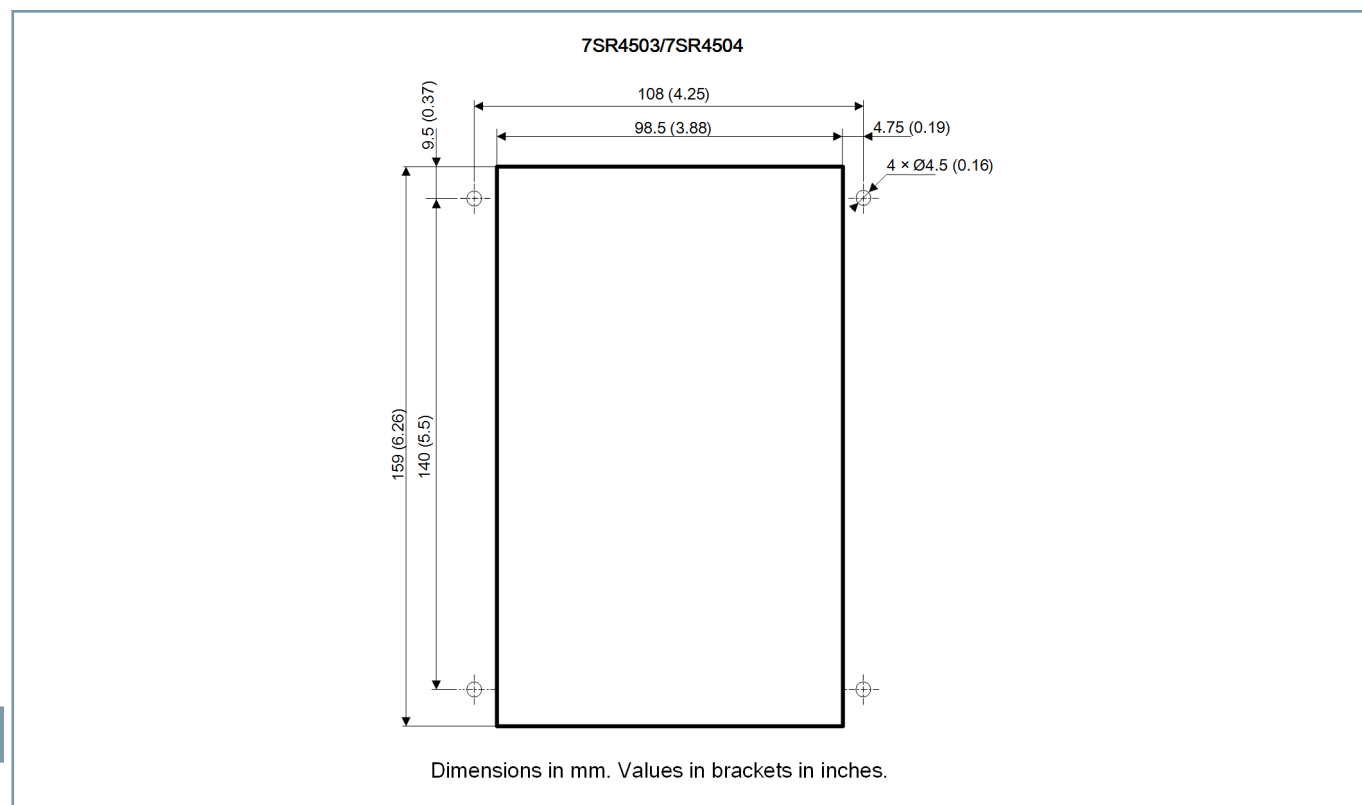


Figure 4.2/2 Panel Cut-out View

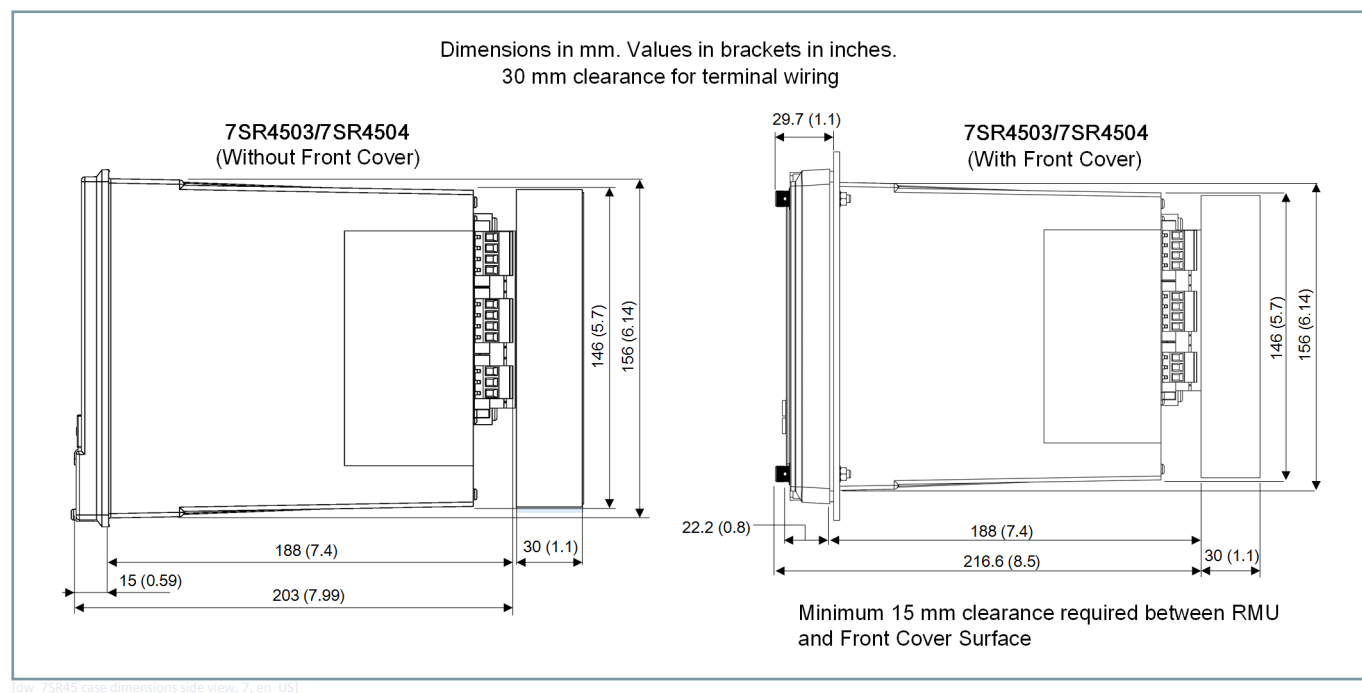
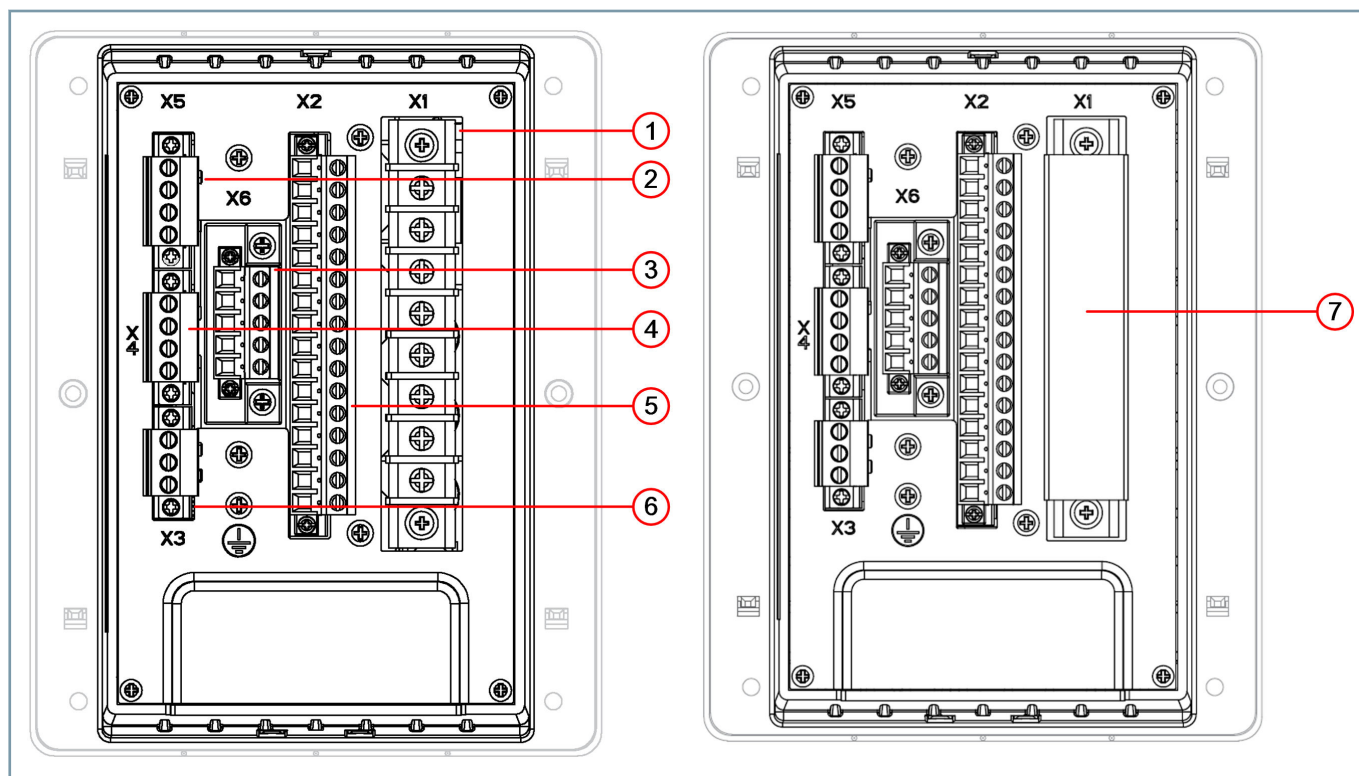


Figure 4.2/3 Side View

Rear Terminal Details



[6_7SR45_case_dim_rearview_1_...]

Figure 4.3/1 Rear Terminal Details (Dual Powered Full Version)

- (1) Current inputs
- (2) Additional binary inputs
- (3) Additional binary outputs
- (4) Rear communication port
- (5) Binary inputs/binary outputs/remote flag output/pulse output
- (6) Auxiliary power supply
- (7) IP20 cover for current terminals

Technical Documentation

Technical Data

Technical Data

For full technical data, refer to the Technical Data chapter in the Device Manual and in the Hardware Manual.

Indication of Conformity



This product complies with the directive of the Council of the European Communities on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 2014/30/EU) and concerning electrical equipment for use within specified voltage limits (Low Voltage Directive 2014/35/EU) as well as restriction on usage of hazardous substances in electrical and electronic equipment (RoHS Directive 2011/65/EU).

This conformity has been proved by tests conducted by Siemens AG in accordance of the Council Directive in accordance with the product standard IEC/EN 60255-26 for the EMC directives, and with the standard IEC/EN 60255-27 for the low-voltage directive.

RoHS directive 2011/65/EU is met using the standard IEC/EN 63000. The device has been designed and produced for industrial use.



IEEE Std C 37.90

The technical data of the product is approved in accordance with UL.

For more information about the UL database, see ul.com

You can find the product with the UL File Number: E194016

Remote flag	24 V, 0.01 Ws
Local flag	Mechanical flag indicator ¹ <ul style="list-style-type: none">• Normal – green color• Trip – red color
Pulse output	24 V, 0.1 Ws pulse output
Overvoltage	Category III
Pollution degree	2
Altitude of operation	Maximum up to 2000 m

Sensitivity

Minimum phase current for relay operation	20 % of I_{rated} in 1-phase 10 % of I_{rated} in 3-phase
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Mechanical Specifications

Design	Panel mounting, non draw-out polycarbonate moulded case
Width x Height x Depth (without front cover)	130 mm x 165 mm x 203 mm
Enclosure	IP 52 (front side without cover) IP 54 (front side with cover) ² IP 40 (enclosure sides) IP 10 (rear side without cover for current terminal) IP 20 (rear side with cover for current terminal)
For operator protection	IP 1x for current terminal without cover IP 2x for other terminal and current terminal with cover
Weight	approx. 1.97 kg (without front cover) approx. 2.08 kg (with front cover)

Installation Category

Installation category (overvoltage category)	Class III
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Pollution

Pollution degree	2
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Recommended Terminal Lugs Specifications

Current inputs	Terminal connectivity PIDG series insulated tin plated crimp ring terminal, M3.5 stud size, 2.6 mm ² to 6.6 mm ² , 12 AWG, torque is required of 1.0 Nm
Auxiliary supply	Insulated tin plated crimp pin connector, 2.6 mm ² to 6.6 mm ² , 12 AWG to 10 AWG, torque is required 0.5 Nm to 0.6 Nm

General Technical Data

Product family	Non-Directional Self Powered/Dual Powered Overcurrent and Earth Fault Relay
Case and LEDs	Non draw-out polycarbonate case (size 4 standard, non draw-out design), 5 non-programmable LEDs & 4 programmable LEDs Non-programmable pickup LED–Green or Amber color ¹
Measuring inputs (current)	1 A or 5 A ¹ 50 Hz/60 Hz
Auxiliary voltage	DC 24 V to DC 60 V, AC 60 V to AC 240 V/DC 60 V to DC 240 V ¹
Communication	Front communication port: USB (IEC 60870-5-103 or Modbus RTU) Rear communication port: RS485 (IEC 60870-5-103 or Modbus RTU)
Protection functions	49, 50, 50G/N, 51, 51G/N, 50LC/ SOTF
Supervision functions	74TC, 81HBL2
Binary input and binary output	4 BI and 4 BO or 2 BI and 2 BO ¹

¹ Depending on the ordering option

² Applicable for 7SR4503/7SR4504 variants only

Rear communication port	Pin type lug/1.5 mm ² control cable, torque is required 0.5 Nm to 0.6 Nm
Front communication port	USB, type B
Binary input/binary output/pulse output/flag output	Insulated tin plated crimp pin connector, 2.6 mm ² to 6.6 mm ² , 12 AWG to 10 AWG, torque is required 0.5 Nm to 0.6 Nm
Ground terminal	Tin plated crimp ring terminal, M3 stud size, 4 mm ² to 6 mm ² , 12 AWG to 10 AWG, yellow, torque is required 0.5 Nm to 0.6 Nm

Inputs and Outputs

Auxiliary Supply

Rated auxiliary voltage	AC 60 V to 240 V/DC 60 V to 240 V, Tolerance: -20 % to +10 % DC 24 V to 60 V, Tolerance: -20 % to +10 % ¹
Rated frequency	50 Hz (range: 45 Hz to 55 Hz) 60 Hz (range: 54 Hz to 66 Hz)
Allowable alternating component in DC (ripple)	15 % of DC voltage
Typical power consumption (DC)	< 7 W
Typical power consumption (AC)	< 13 VA
Max interruption time (collapse to zero)	≤ 20 ms (DC 19.2 V) ≤ 20 ms (DC 48 V) ≤ 500 ms (AC 230 V)

Current Inputs

Quantity	3 x phase and 1 x earth
Rated current I_{rated}	1 A or 5 A ¹
Measuring range	Phase current: $0.1 \cdot I_{rated}$ to $20 \cdot I_{rated}$ Earth current: $0.06 \cdot I_{rated}$ to $20 \cdot I_{rated}$
Instrumentation	Fundamental $\pm 5\%$ (relative) or $\pm 2\%$ I_{rated} (absolute) ($\geq 0.10 \cdot I_{rated}$ to $2 \cdot I_{rated}$) – whichever is greater $\pm 3\%$ ($> 2 \cdot I_{rated}$ to $20 \cdot I_{rated}$) RMS $\pm 5\%$ (relative) or $\pm 2\%$ I_{rated} (absolute) ($\geq 0.10 \cdot I_{rated}$ to $10 \cdot I_{rated}$) – whichever is greater
Rated frequency	50 Hz (range: 45 Hz to 55 Hz) 60 Hz (range: 54 Hz to 66 Hz)
Rated CT burden [measured at Rated currents (1 A and 5 A)]	≤ 2.5 VA per phase and ≤ 0.2 VA earth for 1 A CT input ≤ 2.5 VA per phase and ≤ 0.2 VA earth for 5 A CT input

Binary Inputs (BI)

Number	2 or 4 ¹	
BI threshold/operating range	BI Voltage rating DC 19 V DC 88 V AC 88 V	BI Operating range DC 18 V to 66 V DC 86 V to 265 V AC 71 V to 265 V
Maximum AC/DC current for operation	3.5 mA	
Pick up delay	User-selectable 0 s to 600 s (up to 10 min)	
Drop off delay	User-selectable 0 s to 600 s (up to 10 min)	
Maximum cable length	< 10 m For larger cable length, always use a multi-core screened or twisted pair (screened or unscreened) cables.	

Binary Outputs (BO)

Number	2 (1 make contact and 1 change-over contact) or 4 (2 make contacts and 2 change-over contacts) ¹
Operating voltage	Potential-free
Operating mode	User selectable – BO 1 and BO 2 self or hand/electrical reset BO 3 and BO 4 self reset (operated only with auxiliary input is present)
Operating time from energizing binary input	< 20 ms
Disengaging time	< 20 ms

4.4

BO 1 and BO 2 Output Contact Details

Switching voltage	AC 250 V and DC 125 V	
Contact current rating:		
Continuous	AC 5 A/DC 5 A	
Short time	AC 20 A/DC 20 A for 0.5 s AC 30 A/DC 30 A for 0.2 s	
Limiting making capacity: (L/R ≤ 40 ms)	1000 W	
Limiting breaking capacity:		
AC resistive	1250 VA	V/I = 250/5
AC inductive	250 VA	V/I = 250/1 @ PF ≤ 0.4
DC resistive	75 W	V/I = 48/1.5; 110/0.7
DC inductive (L/R ≤ 40 ms)	30 W	V/I = 48/0.7; 110/0.3
Mechanical/electrical endurance	10 000 operations	

BO 3 and BO 4 Output Contact Details

Switching voltage	AC 250 V/DC 250 V
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Contact current rating:	AC 5 A/DC 5 A	
Continuous	AC 20 A/DC 20 A for 0.5 s	
Short time	AC 30 A/DC 30 A for 0.2 s	
Limiting making capacity: (L/R ≤ 40 ms)	1000 W	
Limiting breaking capacity:		
AC resistive	1250 VA	V/I = 250/5
AC inductive	250 VA	V/I = 250/1@ PF ≤ 0.4
DC resistive	75 W	V/I = 48/1.5; 110/0.7; 220/0.3
DC inductive (L/R ≤ 40 ms)	30 W	V/I = 48/0.7; 110/0.3; 220/0.14
Mechanical/electrical endurance	10000 operations	

Front Communication Port

Quantity	1
Electrical connection	USB, type B
Protocol support	Modbus RTU, IEC 60870-5-103 ¹

Rear Communication Port

Quantity	1 ¹
Electrical connection	RS485, 2-wire electrical, twisted pair
Protocol support	Modbus RTU, IEC 60870-5-103
Rate	Data transfer rate: 1200 Bit/s to 57 600 Bit/s

Data Storage

Fault record (trip log)	10 records
Events (event log)	100 events (1 ms resolution)

Mechanical Tests

Test	Standard
Degree of protection	IEC 60529, IP54 front with cover ² IP52 front IP 10 (rear side without cover for current terminal) IP 20 (rear side with cover for current terminal)
Vibration	IEC 60255-21-1, Response and endurance, Class I

Test	Standard
Shock and bump	IEC 60255-21-2, Shock response and withstand, Class I Bump, class I
Seismic	IEC 60255-21-3, Class I
Contact performance	IEC 60255-1, (Ref: Std IEC 61810-1)

Electrical Tests

Test	Standard
Insulation resistance	IEC 60255-27 ³ Insulation resistance > 100 MΩ at DC 500 V Test duration: > 5 s (Between any terminal and earth, independent circuits) ⁴
Impulse voltage withstand	IEC 60255-27 ³ 5 kV, 1.2/50 μs, 0.5 J 5 +ve, -ve pulses (Between all terminals and case earth and any 2 independent circuits) ⁴
AC dielectric voltage	IEC 60255-27 ³ AC 2 kV RMS for 1 min (Between any terminal and earth, independent circuits) ⁴ AC 1 kV RMS for 1 min (across normally open contacts)
Slow damped oscillatory wave ⁵	IEC 60255-26 Common-mode: Test voltage: 2.5 kV peak voltage Differential mode: Test voltage: 1.0 kV peak voltage Test duration: 2 s Source impedance: 200Ω Voltage oscillation frequency: 1 MHz Repetition frequency: 400 Hz
Electrostatic discharge	IEC 60255-26 8 kV air discharge 6 kV contact discharge
Electrical fast transient or burst ⁵	Zone B Test severity amplitude: ±2 kV Repetition frequency: 5 kHz

³ All aspect of IEC 60255-5 have been covered under IEC 60255-27.

⁴ Flag output and pulse output are excluded between any terminals and earth.

⁵ Not applicable for flag output and pulse output.

Test	Standard
Surge immunity ^{6, 5}	IEC 60255-26 Test level: zone A Line to line: 0.5, 1, 2 kV Line to earth: 0.5, 1, 2, 4 kV Front time/time to half-value: 1.2/50 µs Source impedance: 2 Ω
Radiated immunity	IEC 60255-26 80 MHz to 1.0 GHz and 1.4 GHz to 2.7 GHz Field strength: 10 V/m (RMS) Amplitude modulated: 80 % AM
Conducted radio frequency interference ⁵	IEC 60255-26 150 kHz to 80 MHz, 10 V _{RMS} , dwell time: 0.5 s
Power frequency magnetic field	IEC 60255-26 30 A/m applied 1 min, 300 A/m applied for 3 s
Damped oscillatory magnetic field value	IEC 61000-4-10 0.1 and 1.0 MHz, 100 A/m
Radiated emissions	IEC 60255-26
Conducted emissions	IEC 60255-26
Thermal withstand	IEC 60255-27 ³ Continuous withstand: 2 · I _{rated} Short time withstand: Test duration 1 s 50 A (1 A current input) 150 A (5 A current input)
Functional performance	IEC 60255-151, IEC 60255-149 and IEC 60255-1
Maximum allowable temperature	IEC 60255-6 Max. temperature limit +100 °C
Gradual shutdown/start-up test	IEC 60255-26 Shut down/start up ramp 60 s Power off 5 min
Power frequency immunity test ⁷	IEC 60255-26 Common-mode: <ul style="list-style-type: none"> Test voltage: 300 V Coupling resistor: 220 Ω Coupling capacitor: 0.47 µF

Test	Standard
Fast transient burst (Common mode and differential mode test)	IEEE Std C37.90.1 Peak voltage level: 2 kV Rise time: 5 ns Impulse duration: 50 ns Repetition rate during the burst: 5 kHz Burst duration: 15 ms Burst period: 300 ms Output impedance: 50 Ω Test duration: 1 min on each polarity
Oscillatory waves (Common mode and differential mode test)	IEEE Std C37.90.1 Peak voltage level: 2.5 kV Rise time on the first peak: 75 ns Repetition rate: 6 to 10 bursts Oscillation frequency: 1 MHz Output impedance: 200 Ω Test duration: 2 s Waveform envelope decay: between pk5-pk10

Climatic Environmental Tests

Temperature

IEC 60068-2-1/IEC 60068-2-2/IEC 60255-1

Ambient operating temperature	-10 °C to +60 °C
Permissible temporary operating temperature, (tested for 16 h) ^{8, 9}	-40 °C to +70 °C
Storage temperature (non-operational) ¹⁰	-25 °C to +70 °C

Humidity

IEC 60068-2-30/IEC 60068-2-78/IEC 60255-1

Damp heat test, cyclic	+25 to 55 °C, RH > 93 % RH (6 cycles) At lower temperature, 97 %, -2 % to +3 % RH At upper temperature, 93 %, ±3 % RH
Damp heat test, steady state	10 days at 93 ±3 % RH, +40 °C

⁶ Additional 50 ms DTL pick-up delay applied to binary inputs.

⁷ DC binary input ports interfacing with cables whose total length is more than 10 m, need to have a multi core twisted screened cable for providing immunity against high level of power frequency interferences.

⁸ Applicable for the self powered relay with the rated current and the dual powered relay with the rated auxiliary voltage of DC 110 V and above.

⁹ Permissible temporary operating temperature is not applicable for UL.

¹⁰ To retain the battery life during the transportation and storage, it is recommended to maintain the permissible temperature range from -20 °C to +45 °C

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Product Safety Test

Clearances and creepage distances	IEC/EN 60255-27: edition 2 ≥ 4 mm
IP rating	IEC/EN 60255-27: edition 2 IP52 (front side) IP54 (front side with cover) ² IP10 (rear side)
Impulse voltage	IEC/EN 60255-27: edition 2 5 kV, 5 +ve, -ve pulses
AC dielectric voltage	IEC/EN 60255-27: edition 2 AC 2 kV, 50 Hz, 1 min
Insulation resistance	IEC/EN 60255-27: edition 2 DC 500 V, > 5 s, > 100 MΩ
Protective bonding resistance	IEC/EN 60255-27: edition 2 < AC 12 V/DC 12 V, 1 min, < 0.1 Ω
Protective bonding continuity	IEC/EN 60255-27: edition 2
Flammability	IEC/EN 60255-27: edition 2
Single-fault condition	IEC/EN 60255-27: edition 2

Performance

49 Thermal Overload

Elements	Thermal Overload
Setting range I_{set} (49)	$0.2 \cdot I_{rated}$ to $1.5 \cdot I_{rated}$
Heating time constant	1 min to 300 min
Cooling time constant	1 to 6 · TauH
Capacity alarm	50 % to 100 %
Initial thermal level	0 % to 40 %
Thermal operate level	100 % ± 3 %
Reset level	≥ 95 % I_{op}
Overload trip operate time (t_{op})	$t = \tau \cdot \ln \left[\frac{I^2 - I_p^2}{I^2 - I_\theta^2} \right]$
Operating time tolerance	± 5 % t_{op} or 10 s
Inhibited by	Binary input

50 Instantaneous Overcurrent – Phase

Operation	Non-directional
Elements	Phase fault
Setting range I_{set}	$0.2 \cdot I_{rated}$ to $20.0 \cdot I_{rated}$
Time delay	0 s to 600 s
Operate level I_{op}	100 % I_{set} ± 5 %
Reset level	≥ $0.2 \cdot I_{rated}$ to $0.9 \cdot I_{rated}$ setting: ≥ 90 % I_{op} ≥ $1 \cdot I_{rated}$ to $20 \cdot I_{rated}$ setting: ≥ 94 % I_{op}
Basic operate time (with auxiliary power/load current):	$2 \cdot I_{set}$: 25 ms, ±15 ms, $5 \cdot I_{set}$: 20 ms, ±15 ms

Operate time following delay	$t_{basic} + t_{delay}$, ± 1 % or ± 30 ms
Inhibited by	Binary input or Inrush detector
Disengaging time	< 50 ms ¹¹

50G Instantaneous Earth Fault – Measured

Operation	Non-directional
Elements	Measured earth fault
Setting range I_{set}	$0.2 \cdot I_{rated}$ to $20.0 \cdot I_{rated}$
Time delay	0 s to 600 s
Operate level I_{op}	100 % I_{set} ± 5 %
Reset level	≥ $0.2 \cdot I_{rated}$ to $0.9 \cdot I_{rated}$ setting: ≥ 90 % I_{op} ≥ $1 \cdot I_{rated}$ to $20 \cdot I_{rated}$ setting: ≥ 94 % I_{op}
Basic operate time (with auxiliary power/load current):	$2 \cdot I_{set}$: 25 ms, ±15 ms, $5 \cdot I_{set}$: 20 ms, ±15 ms
Operate time following delay	$t_{basic} + t_{delay}$, ± 1 % or ± 30 ms
Inhibited by	Binary input or Inrush detector
Disengaging time	< 50 ms ¹¹

50LC Line Check/Switch Onto Fault

Operate level	100 % I_{set} ± 5 %
Setting range	$1 \cdot I_{rated}$ to $20 \cdot I_{rated}$
Disengaging time	< 50 ms
Operating time	< 120 ms for $1.2 \cdot I_{rated}$ < 90 ms for $2 \cdot I_{rated}$ < 75 ms for $5 \cdot I_{rated}$
Inhibited by	Binary input or Inrush detector

For more information about 50LC, refer to SOTF.

50N Instantaneous Earth Fault – Calculated

Operation	Non-directional
Elements	Calculated earth fault
Setting range I_{set}	$0.2 \cdot I_{rated}$ to $20.0 \cdot I_{rated}$
Time delay	0 s to 600 s
Operate level I_{op}	100 % I_{set} ± 5 %
Reset level	≥ $0.2 \cdot I_{rated}$ to $0.9 \cdot I_{rated}$ setting: ≥ 90 % I_{op} ≥ $1 \cdot I_{rated}$ to $20 \cdot I_{rated}$ setting: ≥ 94 % I_{op}
Basic operate time (with auxiliary power/load current):	$2 \cdot I_{set}$: 25 ms, ±15 ms, $5 \cdot I_{set}$: 20 ms, ±15 ms
Operate time following delay	$t_{basic} + t_{delay}$, ± 1 % or ± 30 ms
Inhibited by	Binary input or Inrush detector
Disengaging time	< 50 ms ¹¹

¹¹ With auxiliary power supply

51 Time Delayed Overcurrent – Phase

Operation	Non-directional
Elements	Phase fault
Setting range I_{set}	$0.1 \cdot I_{rated}$ to $2.0 \cdot I_{rated}$
Time multiplier	0.01 to 10
Time delay (DTL)	0.00 s to 15 s
Operate level	$110 \% I_{set}$, $\pm 5 \%$ or $\pm 2 \% \cdot I_{rated}$
Reset level	$\geq 90 \% I_{op}$
Operate time (with auxiliary power/load current)	<p>IEC:</p> $t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1} \right] \cdot T_m$ <p>ANSI:</p> $t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^p - 1} + B \right] \cdot T_m$ <p>$\pm 5 \%$ or $\pm 50 \text{ ms}^{12}$</p>
Follower delay	0.00 s to 20 s
Reset	IEC/ANSI decaying, 0 to 60 s
Inhibited by	Binary input or Inrush detector

51G Time Delayed Earth Fault – Measured

Operation	Non-directional
Elements	Measured earth fault
Setting range I_{set}	$0.06 \cdot I_{rated}$ to $0.8 \cdot I_{rated}$
Time multiplier	0.01 to 10
Time delay (DTL)	0.00 s to 15 s
Operate level	$110 \% I_{set}$, $\pm 5 \%$ or $\pm 2 \% \cdot I_{rated}$
Reset level	$\geq 90 \% I_{op}$
Operate time (with auxiliary power/load current)	<p>IEC:</p> $t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1} \right] \cdot T_m$ <p>ANSI:</p> $t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^p - 1} + B \right] \cdot T_m$ <p>$\pm 5 \%$ or $\pm 50 \text{ ms}^{12}$</p>
Follower delay	0.00 s to 20 s
Reset	IEC/ANSI decaying, 0 s to 60 s
Inhibited by	Binary input or Inrush detector

51N Time Delayed Earth Fault – Calculated

Operation	Non-directional
Elements	Calculated earth fault
Setting range I_{set}	$0.10 \cdot I_{rated}$ to $0.8 \cdot I_{rated}$
Time multiplier	0.01 to 10
Time delay (DTL)	0.00 s to 15 s
Operate level	$110 \% I_{set}$, $\pm 5 \%$ or $\pm 2 \% \cdot I_{rated}$
Reset level	$\geq 90 \% I_{op}$
Operate time (with auxiliary power/load current)	<p>IEC:</p> $t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1} \right] \cdot T_m$ <p>ANSI:</p> $t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^p - 1} + B \right] \cdot T_m$ <p>$\pm 5 \%$ or $\pm 50 \text{ ms}^{12}$</p>
Follower delay	0.00 s to 20 s
Reset	IEC/ANSI decaying, 0 s to 60 s
Inhibited by	Binary input or Inrush detector

81HBL2 Inrush detector

81HBL2 Inrush setting (ratio of 2nd harmonic current to fundamental component current)	0.10 to $0.50 \cdot I$ Where, $I = I_2/I_1$
81HBL2 Inrush release block	$0.30 \cdot I_{rated}$ to $20 \cdot I_{rated}$
t_{basic} Element basic operate time	Will pick-up before operation of any protection element due to magnetic inrush
Reset time	Will pick-up before operation of any protection element due to magnetic inrush



NOTE

For better inrush accuracy, the fundamental current must be minimum of $0.15 \cdot I_{rated}$ in at least one phase.

74TC Trip-Circuit Supervision

Number of supervisable circuits	1 x trip
Number of BI's required	1



NOTE

Use the correct threshold voltages for BI when using 74TC function.

¹² Add current tolerance of $\pm 5 \%$ or $\pm 2 \% \cdot I_{rated}$ (whichever is greater) to the operating time tolerance for TMS below 0.1

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Ordering Information

Ordering Information – 7SR45 Argus

Product Description	Order Number																							
	1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16						
Non-Directional Overcurrent and Earth Fault Relay	7	S	R	4	5	0	□	–	□	□	□	□	0	–	□	A	□	0						
<u>Case I/O and Fascia</u>																								
Size 4 moulded case (height reduced), 4 CT, 2 BI/2 BO, pulse output, 9 LEDs							3			G	A/B													
Size 4 moulded case (height reduced), 4 CT, 2 BI/2 BO, pulse output, 9 LEDs							3			H/J	A													
Size 4 moulded case (height reduced), 4 CT, 4 BI/4 BO, pulse output, 9 LEDs							4			H/J	B													
<u>Measuring Input</u>																								
1 A, 50 Hz/60 Hz										1														
5 A, 50 Hz/60 Hz										2														
<u>Auxiliary Voltage</u>																								
Self powered (CT powered : BI threshold DC 19 V)												G		1										
Dual powered (CT powered + Aux. powered : DC 24 V to 60 V, BI threshold: DC 19 V)												H		2										
Dual powered (CT powered + Aux. powered : AC 60 V to 240 V/DC 60 V to 240 V, BI threshold: AC 88 V/DC 88 V)												J		2										
<u>Front Fascia</u>																								
Standard version													A											
Standard version – with trip flag indicator													B											
<u>Communication Options</u>																								
Front port : USB														1										
Front port: USB and rear port: RS485 supporting IEC 60870-5-103 and Modbus RTU (user-selectable setting)														2										
<u>LED Configuration</u>																								
Standard pickup LEDs, Amber color																				1				
Pickup LED, Green color																				2				
<u>Protection and Supervision Function Packages</u>																						A		
49 Thermal overload protection																								
50 Instantaneous overcurrent – phase																								
50G Instantaneous earth fault – measured																								
50LC Line check																								
50N Instantaneous earth fault – calculated																								
51 Time-delayed overcurrent – phase																								
51G Time delayed earth fault – measured																								
51N Time-delayed earth fault – calculated																								
74TC Trip-circuit supervision ¹³																								
81HBL2 Inrush current detection																								
<u>Conformal coating</u>																								
Standard version – No conformal coating on PCBA																		A						
Conformal coating on PCBA																		B						

¹³ Applicable for 7SR4503-[1/2][H/J][A/B]20-[1/2]AA0 and 7SR4504-[1/2][H/J][A/B]20-[1/2]AA0 only.

Users can explore the external signal lamp (blinking lamp) as an additional accessory with the following MLFB details. Refer to the *SICAM EFI Catalog* for more information with respect to the signal lamp.

MLFB	Description
6MD2301-0AA00-1LA5	Signal lamp with 5 m wire length
6MD2301-0AA00-1LB5	Signal lamp with 15 m wire length

Ordering Information – 7SR45 Argus Spares and Accessories

Variants	Description
7XG1900-0MA54-0FC0	Transparent front cover
7XG1900-0MA55-0FC0	Surface mounting bracket

Surface Mounting Bracket Dimensions and Panel Cut-out View

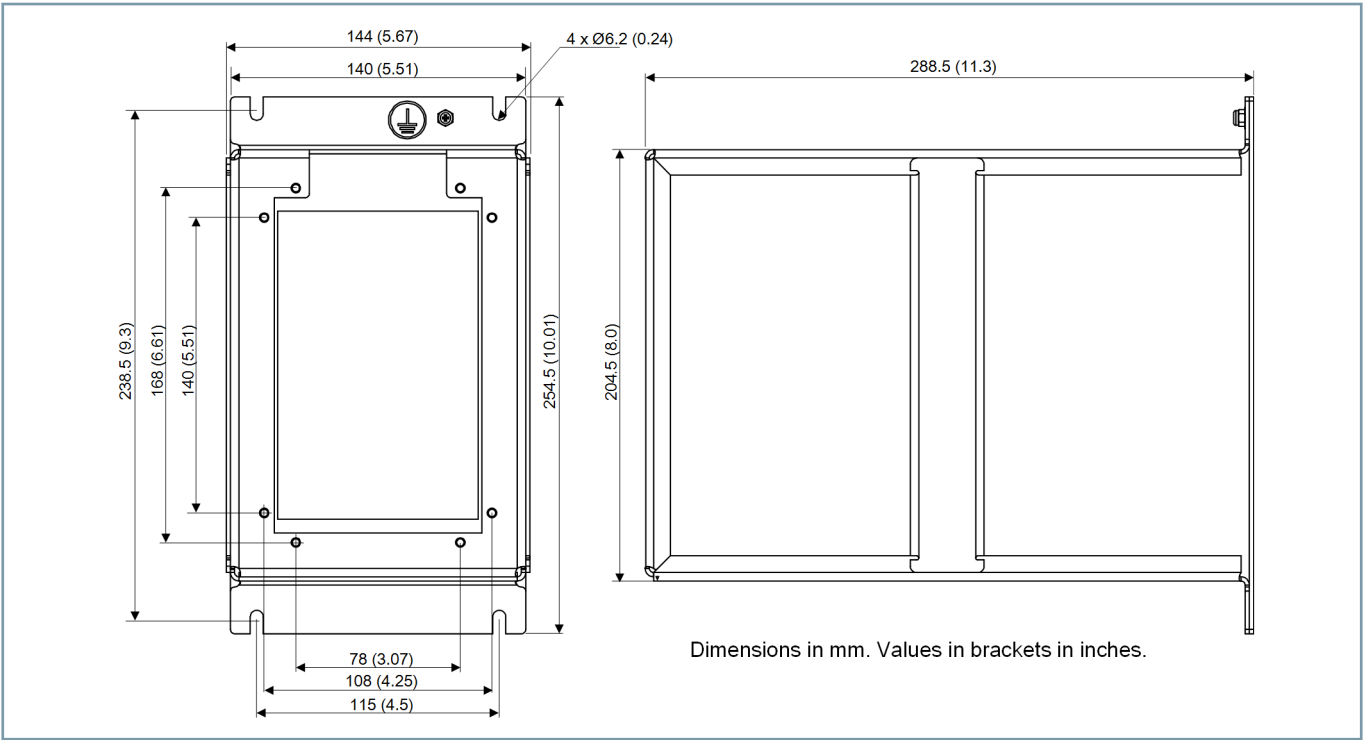


Figure 4.5/1 Front and Side Views

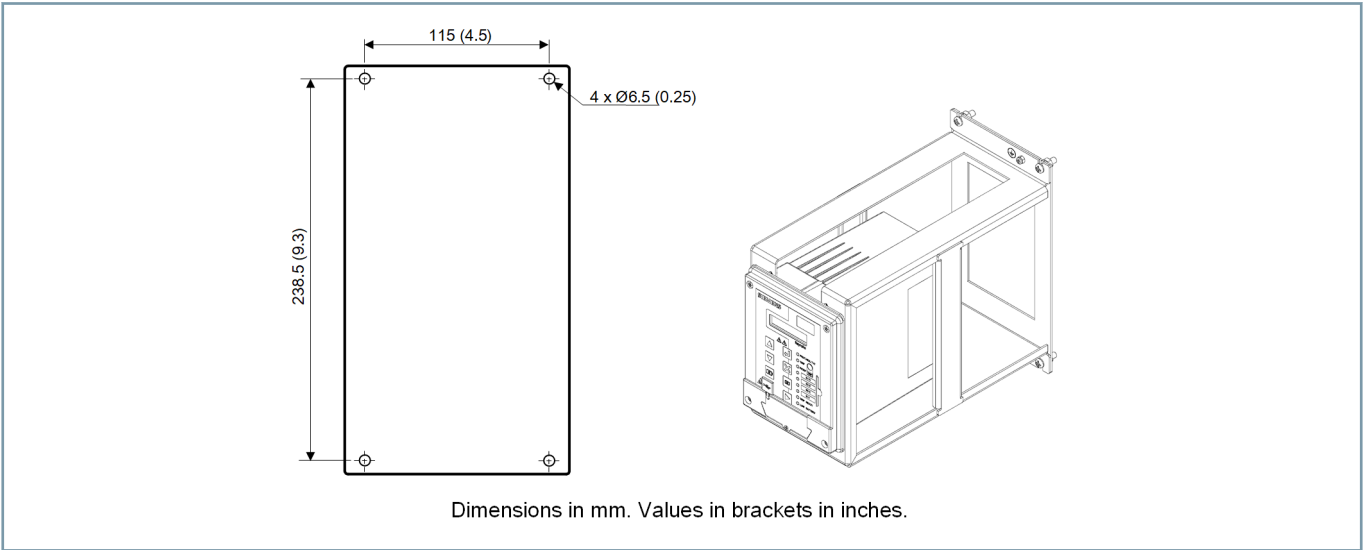


Figure 4.5/2 Mounting Holes for Surface Mount Bracket and Assembled Bracket with 7SR45

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