Reyrolle 7SR46
Dual Powered
Overcurrent Protection

Reyrolle 7SR46 Catalog · Edition 5.0

SIEMENS

Content

Digital Grid
Reyrolle 7SR46
Dual Powered Non-Directional Overcurrent and Earth Fault Relay with Specific CT

Introduction

Reyrolle – Solutions for Distribution Grids

Reyrolle founded in the UK
1891

First reactance & impedance measuring relays
1928

ARGUS product line introduced
1995

IEC 61850 is launched on Reyrolle products
2011

Launch of 7SR157, 7SR158 Argus, and 7SR191 Capa relays
2014

Launch of 7SR45 and 7SR10 Argus relays
2016

Launch of Reyrolle 5
2019

1906
First current differential protection 'Merz-Price', developed at Hebburn

1951
First transformer differential protection using second harmonic bias (Duobias)

2005
Siemens acquisition of VA TECH Reyrolle

2012
7SR23 DAD high impedance relay is launched

2015
IEC 61850 introduced onto the 7SR11 & 12 Argus relay

2017
Launch of 7SR18 Solkor relay

2022
Launch of 7SR46 Argus relay

[dw_reyrolle history, 4, en_US]

Figure 1/1   History of Reyrolle

Reyrolle has been synonymous with electrical protection devices in the sectors of subtransmission, 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 network.

Since its foundation, Reyrolle has been an innovation driver in product development – based on a strong focus on market, customers, and technology. 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: "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" are 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 products allow flexible, easy operation through high user-friendliness.
- One size fits all – standard housing height and compact devices. Device compatible with specific CTs (class 5P80) giving wide range of operation.

- 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 interaction.
- 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.

[sc_7SR46_IntroView, 2, --_--]

Figure 1/2   7SR4605

Device-Specific Overview of the Areas of Application

Main function	Device	Catalog Number
Overcurrent and Feeder Protection		
Overcurrent protection with control	7SR10 Argus	C53000-X7040-C021-1
	7SR11/12 Argus	EMEA-C10028-00-76GB
	7SR21/22 Argus	EMEA-C10030-00-76GB
	7SR51	C53000-X7040-C022-1
RMU Protection		
Self-powered/dual-powered overcurrent protection	7SR45 Argus	EMEA-C10020-00-76GB
Dual-powered overcurrent protection	*7SR46 Argus*	*This Catalog (C53000-X7040-C103-1)*
Line Protection		
Line differential protection with control	7SR18 Solkor	EMDG-C10087-00-76GB
Transformer Differential Protection		
Transformer differential protection with control and monitoring	7SR242 Duobias	EMEA-C10035-00-76GB
	7SR54	C53000-X7040-C022-1
Motor Protection		
Motor protection with control	7SR105 Rho	C53000-X7040-C021-1
	7SR17 Rho	EMEA-C10037-00-76GB
	7SR57	C53000-X7040-C022-1
Voltage and Frequency Protection		
Applicable for system decoupling, load shedding, and load restoration	7SR158 Argus	EMEA-C10033-00-76GB
Synchronizing		
Synchronizing	7SR157 Argus	EMEA-C10032-00-76GB
Distribution Automation		
Protection and automation for overhead lines	7SR224 Argus	EMEA-C10031-00-76GB
Capacitor-Bank Protection		
Capacitor-bank protection	7SR191 Capa	EMEA- C10036-00-76GB
High-Impedance Protection		
High-impedance protection	7SR23 DAD	EMEA-C10034-00-76GB

The Reyrolle product range offers a wide variety of protection devices. The preceding table lists all the devices available and the main application with protection type.

Devices and Application

Relay Selection Guide

Overview of Functions

ANSI	Functions	7SR46
	Protection functions for 3 pole tripping	■
49	Thermal overload protection	■
50	Instantaneous overcurrent – phase	■
50LC	Line check/switch onto fault	■
50N	Instantaneous earth fault – derived	■
51	Time-delayed overcurrent – phase	■
51N	Time-delayed earth fault – derived	■
81HBL2	Inrush current detection	■
86	Lockout	■
	Measured values	■
	External trip initiation	■
	Sequence-of-events recorder	■
	Monitoring and supervision	■
	Number of settings groups	2
	Binary inputs (max)	2
	Binary outputs (max) incl. life contact	2
	Current inputs (max)	3
	Auxiliary supply	■
	Small display (lines)	2
	Push-buttons	7
	LEDs (max) – Non-programmable LEDs (2) – User-programmable LEDs (2)	4
	Front user interface	■
	IEC 60870-5-103	■
	MODBUS RTU slave	■
	Mechanical flag	■

■ Basic

The Reyrolle 7SR46 dual-powered non-directional overcurrent and earth fault relay with specific CT (current transformer) is equipped with numerous protection functions and features. A full list of these can be seen in the table above.

Description

The Reyrolle 7SR46 Argus is a dual-powered non-directional overcurrent and earth-fault protection device - with specific CTs. The 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 is configured via a front USB port for local PC connection or via a rear electrical RS485 port for remote connection. With Reydisp Evolution software, you can update the settings and view the fault records (trip log) and the event records (event log).

The relay supports the communication protocols IEC 60870-5-103 and MODBUS RTU which help to establish connection with SCADA. Based on the ordering options, the relay can indicate the trip with local and remote flag indicator.

Main function	Overcurrent and earth-fault protection
Inputs and outputs	3 current transformers, 2 binary inputs, external trip initiation input, 2 binary outputs, pulse output, remote flag output, and local flag output
Communication	Front USB port (for configuration via Reydisp Evolution) and rear RS485 port
Housing	Non-draw-out polycarbonate 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 80 % of I_{smin} (1-phase) and 40 % of I_{smin} (3-phase)
- Intelligent power management – Fail-safe startup and shut-down modes
- Internal lithium battery backup for viewing fault data, setting options for protection and real-time clock, and resetting of indications
- Compatible with 6 types of specific CTs (class 5P80) - giving wide range of operation
- RS485 port communication is available in the self-powered and the auxiliary power supply mode.
- 2 user-programmable LEDs for indicating protection and other relay functions
- Mechanical flag indication
- External trip initiation input
- Suitable for RMU assembly

Functions

Protection functions:

- 49 Thermal overload protection
- 50 Instantaneous overcurrent – phase
- 50LC/SOTF Line check/switch onto fault

[sc_7SR45_mainImage, 2, --_--]

Figure 2.2/1   7SR46 Device

- 50N Instantaneous earth fault – derived
- 51 Time-delayed overcurrent – phase
- 51N Time-delayed earth fault – derived

Supervision functions:

- 81HBL2 Inrush current detection

Ancillary functions:

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

Communication

- IEC 60870-5-103
- MODBUS RTU

Reydisp Evolution Software

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

Application

The 7SR46 dual-powered relay is an overcurrent and earth-fault protection device primarily intended for secondary distribution in electrical networks.

The 7SR46 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 device provides definite-time and inverse-time overcurrent and earth-fault protection functions in accordance with IEC and ANSI standards.

The 7SR46 relay has a pulse output that operates when any configured protection function trips. The pulse output is used to interface directly with the low energy circuit breaker trip coil.

Devices and Application

7SR46 Argus Relay

The trip energy for the trip coil is stored in a capacitor built into the protection device.

The 7SR46 relay is targeted for the following applications:

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

Functional Diagram

[dw_7SR46_Functional Block Diagram, 2, en_US]
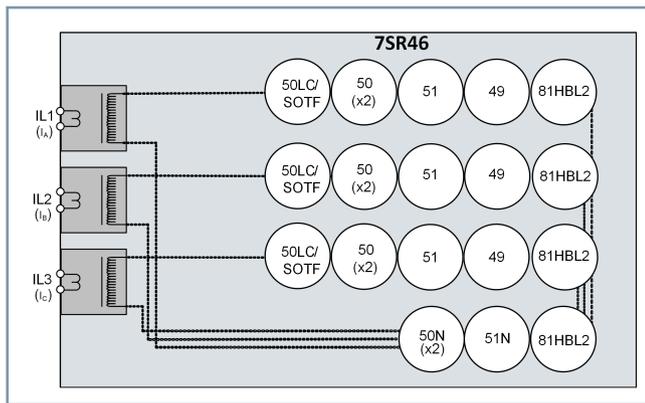
Figure 2.2/2   Functional Diagram of 7SR46 Dual-Powered Non-Directional Overcurrent and Earth Fault Relay

The relay provides 2 settings groups - Group number (Gn) 1 and 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.

1 thermal overload element is provided.

50 Instantaneous Overcurrent – Phase

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

2 overcurrent measurement stages are available.

50LC/SOTF Line Check/Switch onto Fault

The 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.
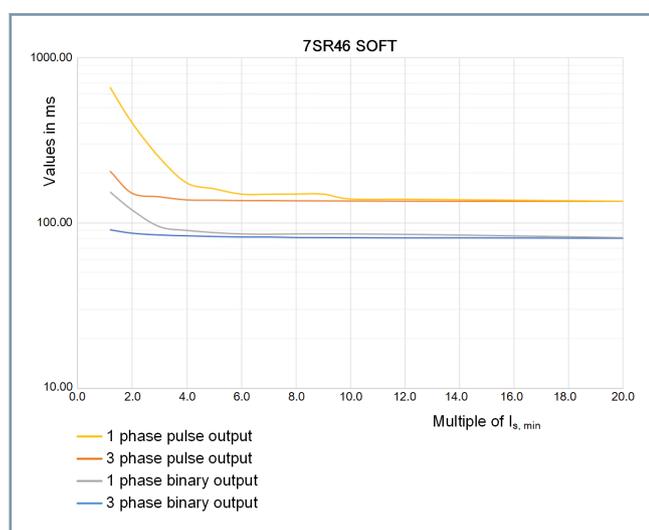
[dw_7SR46_SOTF_operatingtime_, 1, en_US]

Figure 3.1/1   50LC/SOTF for 3-Phase, 1-Phase with Binary Output and Pulse Output

50N Instantaneous Earth Fault – Derived

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

2 earth-fault stages are available.

50N INST/DTL elements provide earth-fault protection, each with independent settings for the 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 customer can select IEC or ANSI time-current characteristics. The IDMT has a user-selectable reset characteristic; either DTL or IEC/ANSI reset characteristic to improve the grading with electromechanical protection.

51N Time-Delayed Earth Fault – Derived

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

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

81HBL2 Inrush Current Detection

Where a 2nd harmonic current is detected (that is, during transformer energization), user-selectable protection-function elements can be blocked.

86 Lockout

Relay contacts can be configured to self-reset, or hand-reset operation.

Relay contacts can be used to directly trip the circuit breaker. The operate break duty of relay contacts is limited so the circuit-breaker trip coil must be opened by a suitably rated contact, typically a circuit-breaker auxiliary switch.

Sensitivity

In 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 the 7SR46 Argus relay is 80 % of I_{smin} for 1-phase and 40 % of I_{smin} for 3-phase. The LED **HEALTHY** turns on when the relay is ready at the current levels mentioned.

The following graph shows the sensitivity of the relay and the corresponding operating time for different starting currents.
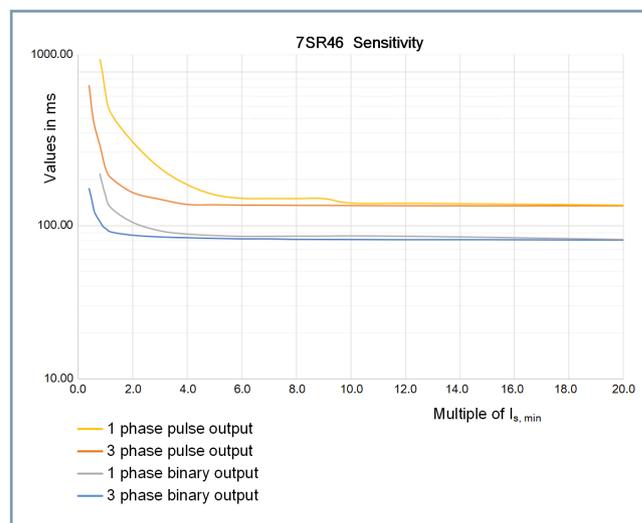

[dw_7SR46_sensitivity operating-time_, 1, en_US]

Figure 3.1/2   Operating Time for 3-phase, 1-phase with Binary Output and Pulse Output

System

Monitoring, and Data Acquisition and Recording

Monitoring

The relay is designed with several monitoring features.

Self-Monitoring

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

The `Healthy` LED is illuminated when the power-supply signals are healthy. The **Internal relay failure** (**IRF**) feature monitors the healthiness of the relay, provides an error message indication on the LCD when an internal error is detected. The error messages and error codes are available in the instrument mode. The IRF can also be mapped to a binary output.

Battery Monitoring

The battery profile menu provides the consumption of the battery power for 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 current phases and earth
Binary input status and binary output status
Thermal capacity
External trip initiation input status
Fault records (trip log)
Battery Profile

Intelligent power management ensures a healthy shutdown below the operating ranges and fail-safe startup 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. The records are displayed with time and date of trip, measured quantities, and type of fault.

Real-Time Clock

The time and date can be set and is maintained while the relay is de-energized. The real-time clock continues to operate on 3 V Lithium battery.

Communications

The relay offers a USB port as standard on the front of all units. All 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.

The front port can be switched off or set to use the protocols MODBUS-RTU or IEC 60870-5-103 for testing purposes. The default protocol is IEC 60870-5-103.

i **NOTE**

The Reydisp Evolution software works with the relay only when the USB port is configured to the protocol IEC 60870-5-103.

A rear RS485 electrical connection is 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.
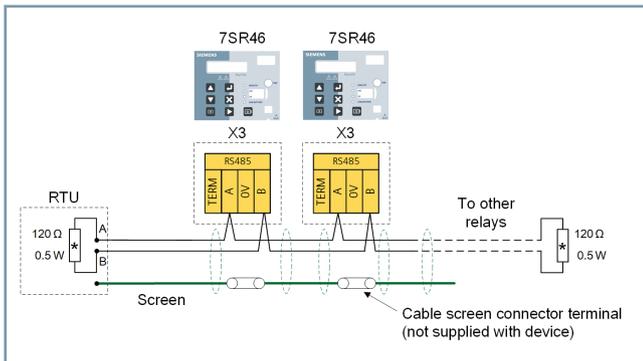
[dw_connection2wire_RS485, 2, en_US]

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 Microsoft Windows-based software tool. It allows you 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.
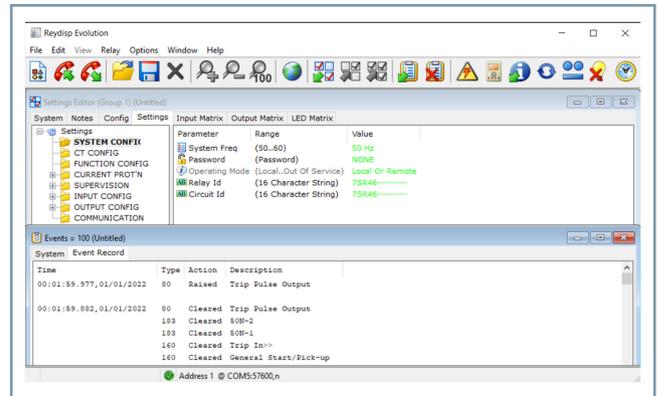
[sc_Reydisp Screenshot, 1, en_US]

Figure 3.3/2   Example Reydisp Evolution

System

## Hardware Construction

Hardware Construction

The relay is housed in a non-draw-out polycarbonate case.

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

The CT terminals are suitable for a nylon-insulated cord end connections to provide a secure and reliable termination.

[sc_7SR4605_frontview, 2, en_US]

Figure 3.4/1   Front View
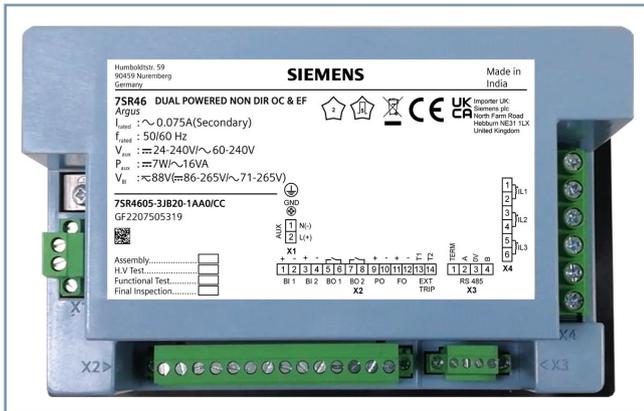
[dw_7SR46_rearview_spring_cc, 1, --_--]

Figure 3.4/2   Rear View (Screw Type Connection)
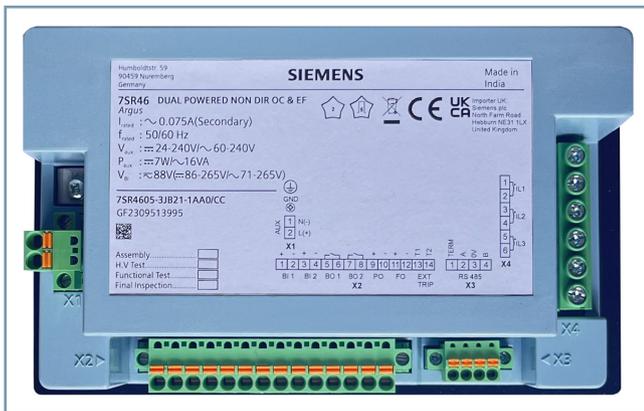
[dw_7SR46_rearview_pushin_cc, 1, --_--]

Figure 3.4/3   Rear View (Push-in Type Spring Connection)

User Interface
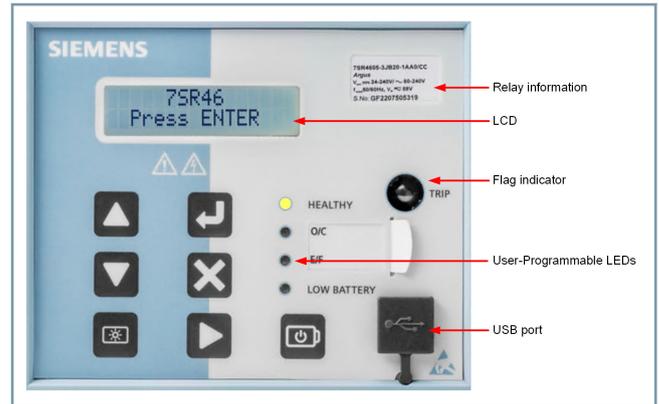
[dw_7SR46 user Interface, 2, en_US]

Figure 3.4/4   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. Also, 2 buttons are provided for the functionality battery ON/OFF and backlight ON/OFF.

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

2 non-programmable LEDs and 2 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 2 user-programmable LEDs can be configured for protection and other relay functions. By default, the LED L2 is mapped to the function 50-1 and 51-1 respectively. LED L3 is mapped to the function 50N-1 and 51N-1 respectively. 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.

LED	Names	Color	Function
LED 1	Healthy	Green	Indicates the relay protection function in a healthy state
LED 2	User-defined function	Red	LEDs 2 and 3 are user-programmable LEDs. They indicate when the respective mapped function is triggered.
LED 3		Red	
LED 4	Low Battery	Amber	Indicates when the battery voltage is less than the operating level

Flag Indicator

1 local flag indicator is provided and configured for the trip indication. The color of the flag is BLACK during normal operation and turns TANGERINE during trip condition. The trip indication

can be reset through HMI or via electrical reset (using binary input).
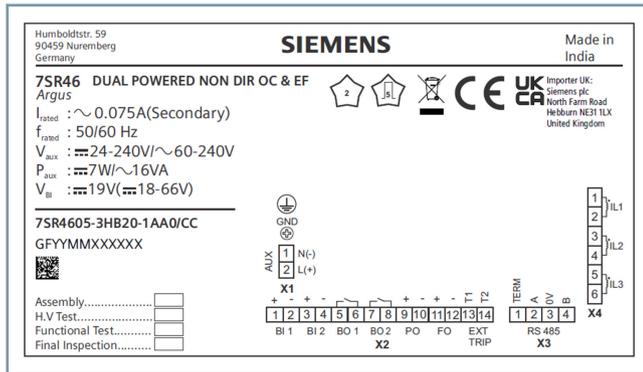
Figure 3.4/5   Terminal Label

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

	QR code that can be scanned using a QR-code reader application. This allows the device serial number to be quickly identified.
	2 kV dielectric test voltage
	5-kV impulse test voltage
	European CE marking
	Waste Electrical and Electronic Equipment Directive (WEEE)
	United Kingdom (UK) Conformity Assessed marking

Relay Information

The device is identified by the rating label on the front fascia. You can also give the device its own identity by editing the "Relay Identifier" displayed on the LCD.
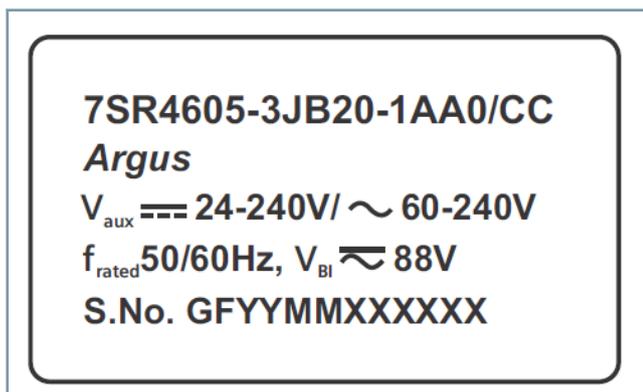
Figure 3.4/6   Fascia Relay Rating Label

Power

The 7SR46 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
- CT power
- USB power
- Battery power

Confirmation ID (Password Protection)

The relay allows you 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 3 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 (binary inputs or external trip input).

External Trip Input

The device has an external trip input which is routed through an external potential-free contact. The external trip input senses the external potential-free contact status by sending a periodic low-voltage signal (approximately 5 V). The external trip input is available only with CT power and auxiliary power supply. This functionality is configured through HMI and Reydisp Evolution.

Battery

The 7SR46 Argus relay is provided with CR2/3AZ battery. The battery is used to energize the device when auxiliary power supply, phase current, and USB power-up are not available.

7SR46 in battery mode is used for operating binary input, binary output, LED, LCD backlight and resetting local flag.
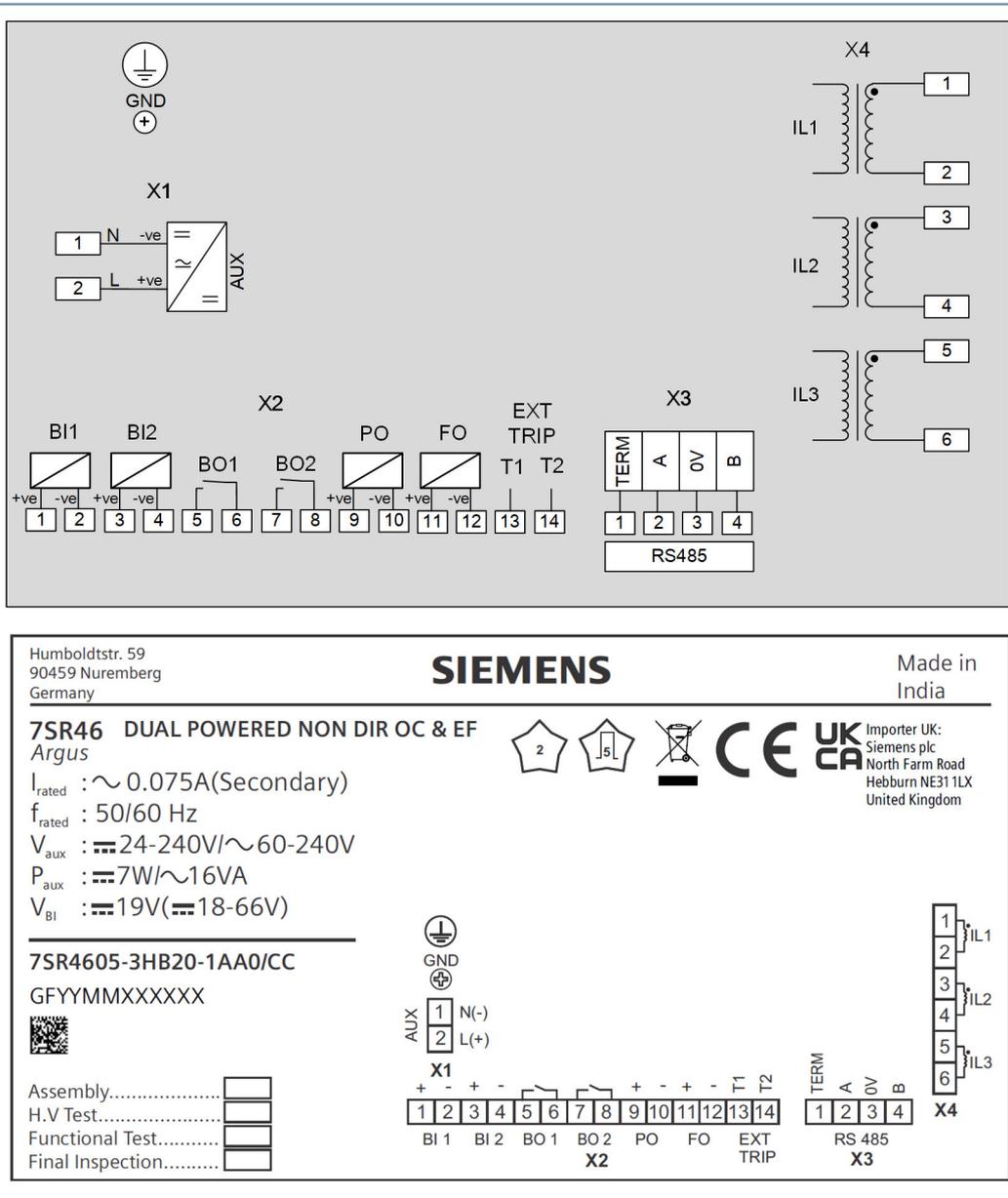
Connection Diagrams

Figure 4.1/1 Connection Diagram and Terminal Label
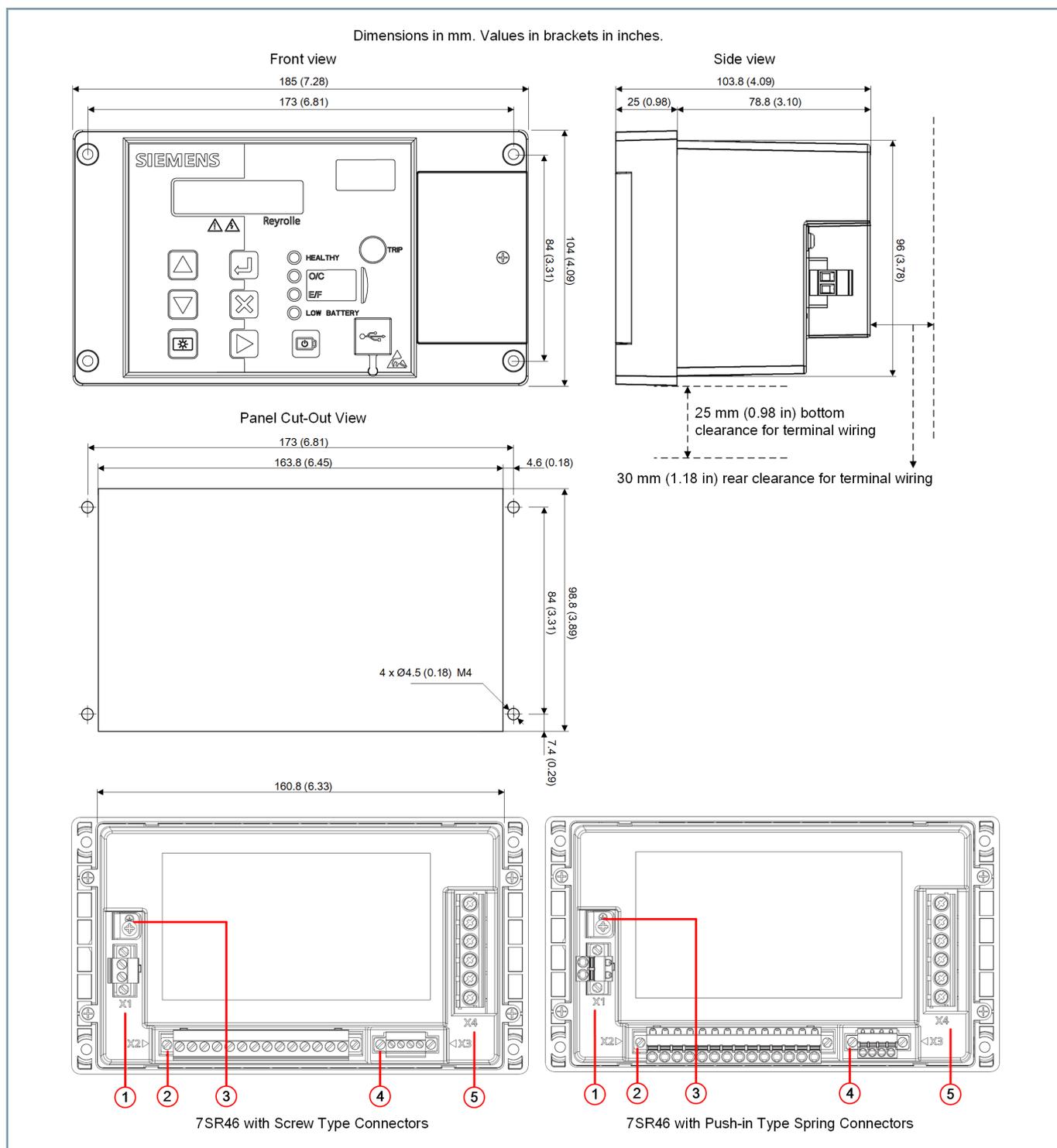
Dimensions in mm. Values in brackets in inches.

Figure 4.2/1   Front View, Side View, Panel Cut-Out View and Rear Terminal View

(1)   Auxiliary power supply

(2)   Binary inputs/binary outputs/pulse output/flag output/external trip input

(3)   Protective grounding terminal

(4)   Rear communication port

(5)   Current inputs

Technical Documentation

Technical Data

Technical Data

For complete technical data, refer to the Technical Data chapter in the *7SR46 Device Manual* and in the *7SR46 Hardware Manual*.

CE

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.

General Technical Data

Product family	Dual powered non-directional overcurrent and earth fault relay
Case and LEDs	Non draw-out polycarbonate case, 2 non-programmable LEDs & 2 programmable LEDs
Measuring inputs (current)	0.075 A (secondary) 50 Hz/60 Hz
Auxiliary voltage	AC 60 V to 240 V/DC 24 V to 240 V
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, 50N, 51, 51N, 50LC/SOTF
Supervision functions	81HBL2 (Inrush-current detector)
Binary input and binary output	2 BI and 2 BO
External trip initiation input	1 external trip initiation input
Remote flag (FO)	24 V, 0.01 Ws
Local flag	Mechanical flag indicator • Normal – black color • Trip – tangerine color
Pulse output (PO)	24 V, 0.1 Ws pulse output
Altitude of operation	Maximum up to 2000 m

Minimum phase current for relay operation	$0.8 \cdot I_{smin}$ in 1-phase $0.4 \cdot I_{smin}$ in 3-phase
For more information on minimum current requirements for respective peripheral operations, refer to 7SR46 Operating Manual.	

Design	Panel mounting, non-draw-out polycarbonate molded case
Enclosure	IP 54 (front side) IP 20 (rear side)
For operator protection	IP 2x for other terminal and current terminal with cover
Weight	Approx. 0.9 kg
Dimensions	Width: 185 mm Height: 105 mm Depth behind panel: 78.8 mm. Additional 30 mm clearance distance to be considered for wiring.

Overvoltage category	Class III

Degree of pollution	2

Current inputs	Nylon-insulated cord end terminal, 4 mm^2 Manufacturer/Part number: ENER , Mfr. Part No. ENEVN 4009 or equivalent Torque required: 0.8 Nm to 1 Nm
Auxiliary supply	For 7SR4605-3xB20-1AA0 device variant Connector type: screw connection with tension sleeve Wire end ferrule, insulated, 2.5 mm^2 , 8 mm Manufacturer/Part Number: Weidmueller, Mfr. Part No. 9019160000 or equivalent Torque required: 0.5 Nm to 0.6 Nm
	For 7SR4605-3xB21-1AA0 device variant Connector type: Push-in spring connection Wire end ferrule, insulated, 2.5 mm^2 , 12 mm Manufacturer/Part Number: Weidmueller, Mfr. Part No. 9019170000 or equivalent Interlock flange tightening torque: 0.3 Nm

4.3

Rear communication port	For 7SR4605-3xB20-1AA0 device variant
	Connector type: screw connection with tension sleeve
	Nylon insulated cord end terminal, 1.5 mm², 8 mm
	Manufacturer/Part No.: ENER, Mfr. Part No. ENEVN 1508 or equivalent
	Torque required: 0.22 Nm to 0.25 Nm
	For 7SR4605-3xB21-1AA0 device variant
	Connector type: Push-in spring connection
	Nylon insulated cord end terminal, 1.5 mm², 10 mm
	Manufacturer/Part No.: ENER, Mfr. Part No. ENEVN 1510 or equivalent
	Interlock flange tightening torque: 0.3 Nm
Front communication port	USB, type B
	Manufacturer/Part Number: Tyco/974329-1 or equivalent
Binary input/binary output/pulse output/ flag output/external trip input	For 7SR4605-3xB20-1AA0 device variant
	Connector type: screw connection with tension sleeve
	Wire end ferrule, insulated, 2.5 mm², 8 mm
	Manufacturer/Part Number: Weidmueller, Mfr. Part No. 9019160000 or equivalent
	Torque required: 0.5 Nm to 0.6 Nm
	For 7SR4605-3xB21-1AA0 device variant
	Connector type: Push-in spring connection
	Wire end ferrule, insulated, 2.5 mm², 12 mm
	Manufacturer/Part Number: Weidmueller, Mfr. Part No. 9019170000 or equivalent
	Interlock flange tightening torque: 0.3 Nm
Protective grounding terminal	Insulated ring terminal, M3 stud size, 4 mm² to 6 mm², 12 AWG to 10 AWG
	Manufacturer/Part Number: RS Stock No. 613-9334 or equivalent
	Torque required: 0.5 Nm to 0.6 Nm

Inputs and Outputs

Auxiliary Supply

Rated auxiliary voltage	AC 60 V to 240 V/DC 24 V to 240 V
	Tolerance: -20 % to +10 %
Rated frequency	50 Hz
	60 Hz
Allowable alternating component in DC (ripple)	15 % of DC voltage
Typical power consumption (DC)	< 7 W
Typical power consumption (AC)	< 16 VA

Inrush current	55 A for 200 µs maximum
Maximum 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
Rated current I_{smin}	0.075 A (secondary) or $0.9 \cdot I_{smin}$
Measuring range	Phase current: $0.2 \cdot I_{smin}$ to $20 \cdot I_{smax}$
Instrumentation[1]	±5 % or ±2 % $\cdot I_s$
Continuous thermal rating	$2.5 \cdot I_{smax}$
Short time thermal rating	$100 \cdot I_{smax}$
Rated frequency	50 Hz (range: 47.5 Hz to 52.5 Hz)
	60 Hz (range: 57 Hz to 63 Hz)

Binary Inputs (BI)

Number	2	
BI threshold/operating range	**BI voltage rating**	**BI operating range**
	DC 19 V	DC 18 V to 66 V
	DC 88 V	DC 86 V to 265 V
	AC 88 V	AC 71 V to 265 V
Maximum AC/DC current for operation	3.5 mA	
Pickup 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.	

External Trip Input

Number	1
Current pulse	5 mA (±1 mA)
Scanning time	Every 5 s off, 1 s on
Maximum cable length	Up to 20 m
Maximum wire resistance	20 Ω

Binary Outputs (BO)

Number	2 (make contacts)
Operating voltage	Potential-free
Operating mode	User-selectable
	BO 1 and BO 2 self or hand/electrical reset
Operating time from energizing binary input	< 20 ms
Disengaging time	< 20 ms
BO 1 and BO 2 Output Contact Details	
Switching voltage	AC 250 V and DC 125 V

4.3

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1   The accuracy mentioned is for the device. An Additional CT error must be considered along with the specific CTs.

Technical Documentation

Technical Data

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
Making capacity	1000 W at L/R ≤ 40 ms

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	

Front Communication Port

Quantity	1
Electrical connection	USB, type B
Supported protocols	Modbus RTU, IEC 60870-5-103

Rear Communication Port

Quantity	1
Electrical connection	RS485, 2-wire electrical, twisted pair
Supported protocols	Modbus RTU, IEC 60870-5-103
Rate	Transmission 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 IP 54 front IP 20 rear
Vibration	IEC 60255-21-1 Response and endurance Class I
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[2] Insulation resistance > 100 MΩ at DC 500 V Test duration: > 5 s (Between any terminal and earth, independent circuits)[3]
Impulse voltage withstand	IEC 60255-27[2] 5 kV, 1.2/50 μs, 0.5 J 5 +ve, -ve pulses (Between all terminals and earth and any 2 independent circuits)[3]
AC dielectric voltage	IEC 60255-27[2] AC 2 kV RMS for 1 min (Between any terminal and earth, independent circuits)[3] AC 1 kV RMS for 1 min (across normally open contacts)

NOTE: Phase-current inputs, flag output, and pulse output are excluded between any terminals and earth for insulation resistance, impulse voltage withstand, AC dielectric voltage tests respectively.

Test	Standard
Slow damped oscillatory wave	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: 200 Ω 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	Zone A Test severity amplitude: ±4 kV Repetition frequency: 5 kHz
Surge immunity[4]	IEC 60255-26 Test level: zone A Line-to-line: 0.5 kV, 1 kV, 2 kV Line-to-earth: 0.5 kV, 1 kV, 2 kV, 4 kV Front time/time to half-value: 1.2/50 μs Source impedance: 2 Ω

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[2] All aspect of IEC 60255-5 have been covered under IEC 60255-27.
[3] Phase current inputs, flag output, and pulse output are excluded between any terminals and earth.
[4] Additional 90-ms DTL pickup delay applied to binary inputs.

4.3

Test	Standard
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	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 MHz and 1.0 MHz, 100 A/m
Radiated emissions	IEC 60255-26
Conducted emissions	IEC 60255-26
Thermal withstand	IEC 60255-27[2]
	Continuous withstand: 2.5 · I_{smax}
	Short-time withstand:
	Test duration 1 s
	100 · I_{smax}
Functional performance	IEC 60255-151, IEC 60255-1, and IEC 60255-149
Maximum allowable temperature	IEC 60255-6
	Max. temperature limit +100 °C
Gradual shutdown/startup test	IEC 60255-26
	Shut down/start up ramp 60 s
	Power off 5 min
Power frequency immunity test[5]	IEC 60255-26
	Common-mode:
	● Test voltage: 300 V
	● Coupling resistor: 220 Ω
	● Coupling capacitor: 0.47 µF
Short circuit test[6]	20 kA for 3 s
	25 kA for 1 s
	62.5 kA for 10 ms dynamic withstand

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)[7]	-40 °C to +70 °C
Storage temperature (non-operational)[8]	-25 °C to +70 °C

Humidity

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

Damp heat test, cyclic	+25 °C 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

Product Safety Test

Clearances and creepage distances	IEC/EN 60255-27: Edition 2
	≥ 4 mm
IP rating	IEC/EN 60255-27: Edition 2
	IP54 (front side)
	IP20 (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 Protection

Elements	Thermal Overload
Setting range I_{set} (49)	0.2 · I_s to 1.5 · I_s
	Δ 0.1 · I_s
Heating time constant (TauH)	1.0 min to 300.0 min
	Δ 0.5 m
Cooling time constant (TauC)	1.0 · TauH to 6.0 · TauH
	Δ 0.5 · TauH
Capacity alarm	50 % to 100 %, Δ 1 %
Initial thermal level	0 % to 40 %, Δ 5 %
Operate level	Thermal capacity: 100 %, ±3 %
Reset level	≥ 95 % · θ
Overload trip operate time (t_{op})	$$t = \tau \cdot \ln\left[\frac{I^2 - I_P^2}{I^2 - I_\theta^2}\right]$$

4.3

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

[6]   Applicable with auxiliary power supply.

[7]   Applicable for the relay with the rated auxiliary voltage of DC 48 V and above.

[8]   To retain the battery life during the transportation and storage, Siemens recommends maintaining the permissible temperature range from -20 °C to +45 °C.

Technical Data

Operating time tolerance[9]	± 5 % of t_{op} or ± 10 s
Operating time tolerance Frequency variation[9] (47.5 Hz to 52.5 Hz) (57 Hz to 63 Hz)	± 10 % of t_{op} or ± 50 s
Operating time tolerance with Harmonics[9] 10 % of 3rd Harmonics 25 % of 5th Harmonics 15 % of 7th Harmonics	± 15 % of t_{op} or ± 50 s
Inhibited by	Binary input

50 Instantaneous Overcurrent – Phase

Operation	Non-directional
Elements	Phase fault
Setting range I_{set}	$0.2 \cdot I_s$ to $20.0 \cdot I_s$
Time delay	0 s to 600 s
Operate level I_{op}	100 % I_{set}, ± 5 % · I_s or ± 2% · I_s
Reset level	≥ 90 % I_{op} or I_{set}-4 % · I_s
Variation (-10 °C to +60 °C)	≤ 5%
Basic operate time (with auxiliary power/load current)	$1.2 \cdot I_{set}$: 40 ms, ±15 ms, $2 \cdot I_{set}$: 35 ms, ±15 ms
Operate time following delay	$t_{basic} + t_{delay}$, ±1 % or ±10 ms
Inhibited by	Binary input or inrush current detector
Disengaging time	< 50 ms[10]

50LC Line Check/Switch onto Fault

Operate level	100 % I_{set}
Setting range	$1 \cdot I_s$ to $20 \cdot I_s$
Operating time	Binary Output ● ≤165 ms for $1.2 \cdot I_{smin}$ ● ≤130 ms for $2 \cdot I_{smin}$ ● ≤100 ms for $5 \cdot I_{smin}$ ● ≤90 ms for $10 \cdot I_{smin}$ Pulse Output ● ≤660 ms for $1.2 \cdot I_{smin}$ ● ≤430 ms for $2 \cdot I_{smin}$ ● ≤175 ms for $5 \cdot I_{smin}$ ● ≤150 ms for $10 \cdot I_{smin}$ Refer to *Figure 3.1/1* for more information on operating time.
Inhibited by	Binary input or inrush current detector

50N Instantaneous Earth Fault – Derived

Operation	Non-directional
Elements	Earth fault, derived

Setting range I_{set}	$0.2 \cdot I_s$ to $20.0 \cdot I_s$
Time delay	0 s to 600 s
Operate level I_{op}	100 % I_{set}, ± 5% or ± 2 % · I_s
Reset level	≥ 90 % I_{op} or I_{set}-4 % · I_s
Variation (-10 °C to +60 °C)	≤ 5 %
Basic operate time (with auxiliary power/load current):	$1.2 \cdot I_{set}$: 40 ms, ±15 ms, $2 \cdot I_{set}$: 35 ms, ±15 ms
Operate time following delay	$t_{basic} + t_{delay}$, ±1 % or ±10 ms
Inhibited by	Binary input or inrush current detector
Disengaging time	< 50 ms[10]

51 Time-Delayed Overcurrent – Phase

Operation	Non-directional
Elements	Phase fault
Setting range I_{set}	$0.2 \cdot I_s$ to $2.5 \cdot I_s$
Time multiplier	0.01 to 10
Time delay (DTL)	0.00 s to 15 s
Operate level	110 % I_{set}, ±5 % or ±2% · I_s
Reset level	≥ 90 % I_{op} or I_{set}-4 % · I_s
Variation (-10 °C to +60 °C)	≤ 5 %
Operate time (with auxiliary power/load current)	**IEC:** $$t_{op} = \left[\frac{K}{\left(\frac{I}{I_{set}}\right)^{\alpha} - 1}\right] \cdot Tm$$ **ANSI:** $$t_{op} = \left[\frac{A}{\left(\frac{I}{I_{set}}\right)^{P} - 1} + B\right] \cdot Tm$$ ±5 % or ±50 ms[11]
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 – Derived

Operation	Non-directional
Elements	Earth fault, derived
Setting range I_{set}	$0.2 \cdot I_s$ to $2.5 \cdot I_s$
Time multiplier	0.01 to 10
Time delay (DTL)	0.00 s to 15 s
Operate level	110 % I_{set}, ±5 % or ±2 % · I_s
Reset level	≥ 90 % I_{op} or I_{set}-4 % · I_s

4.3

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[9]   Add current tolerance of ± 5 % of CT current measurement or ± 2 % · I_s (whichever is greater) to the operating time tolerance.

[10]   With auxiliary power supply

[11]   Add current tolerance of ±5 % of CT current measurement or ±2 % · I_s (whichever is greater) to the operating time tolerance

Operate time (with auxiliary power/load current)	**IEC:** $$t_{op} = \left[\dfrac{K}{\left(\dfrac{I}{I_{set}}\right)^{\alpha} - 1}\right] \cdot Tm$$ **ANSI:** $$t_{op} = \left[\dfrac{A}{\left(\dfrac{I}{I_{set}}\right)^{P} - 1} + B\right] \cdot Tm$$ $\pm 5\,\%$ or ± 50 ms[11]
Follower delay	0.00 s to 20 s
Reset	IEC/ANSI decaying, 0 s to 60 s
Inhibited by	Binary input or inrush current detector

81HBL2 Inrush Current Detection

Inrush setting (ratio of 2nd harmonic current to fundamental-component current)	0.10 to 0.50 · I Where, $I = I_2/I_1$
Inrush release block	0.30 · I_s to 20 · I_s
Element basic operate time (t_{basic})	Picks up before operation of any protection element due to magnetic inrush current
Reset time	Operates until drop-off of any protection element due to magnetic inrush current

Specific CT 5P80 Types

CT Type	CT Ratio	I_s Range	Relay Measurement	Relay Continuous Range (2.5 · I_{smax})
CT01	7.2/0.075	8 A to 28 A	1.6 A to 560 A	70 A
CT02	14.4/0.075	16 A to 56 A	3.2 A to 1120 A	140 A
CT03	28.8/0.075	32 A to 112 A	6.4 A to 2240 A	280 A
CT04	57.6/0.075	64 A to 224 A	12.8 A to 4480 A	560 A
CT05	115.2/0.075	128 A to 448 A	25.6 A to 8960 A	1120 A
CT06	230.4/0.075	256 A to 896 A	51.6 A to 17920 A	2240 A

Table 4.3/1   Specific CT Range

NOTE

7SR46 Argus relay is suitable with Specific CT (class 5P80) of the brand Eleq. All performance related claims are as per the testing conducted with Eleq specific CT (class 5P80).

4.3

Ordering Information – 7SR46 Argus

Product Description	Order Number																			
		1	2	3	4	5	6	7	–	8	9	10	11	12	–	13	14	15	16
Dual Powered Non-Directional Overcurrent and Earth Fault Relay with Specific CT		7	S	R	4	6	0	□	–	□	□	□	□	□	–	1	A	□	0
Case I/O and Fascia																			
Height 104 mm, molded case, 3 CT, 2 binary inputs, 2 binary outputs, 1 pulse output, 4 LEDs, 1 flag output, and 1 external trip input						5													
Measuring input																			
Specific CT						3													
Auxiliary Voltage																			
Dual powered (CT powered + Aux. powered: DC 24 V to DC 240 V/AC 60 V to AC 240 V, Binary input threshold: DC 19 V)									H										
Dual powered (CT powered + Aux. powered: DC 24 V to DC 240 V/AC 60 V to AC 240 V, Binary input threshold: AC 88 V/DC 88 V)									J										
Front Fascia																			
Standard version – with trip flag indicator										B									
Communication Options																			
Front port: USB and rear port: RS485 supporting IEC 60870-5-103 and MODBUS RTU (user-selectable setting)											2								
Wiring Terminal Type																			
Standard screw type terminals													0						
Standard screw type terminals for CT; Push-in type spring connectors for Aux, BI, BO, RS485 connection													1						
Protection and Supervision Functions - Standard Version																	A		
49 Thermal overload protection																			
50 Instantaneous overcurrent – phase																			
50LC Line check/switch onto fault																			
50N Instantaneous earth fault – derived																			
51 Time-delayed overcurrent – phase																			
51N Time-delayed earth fault – derived																			
81HBL2 Inrush current detection																			
Conformal Coating																			
Standard version – No conformal coating on PCBA																		A	

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

4.4

Indication of conformity

C E This product complies with the directive of the Council of the European Communities on 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.

Disclaimer of liability

Subject to changes and errors. The information given in this document only contains general descriptions and/or performance features which may not always specifically reflect those described, or which may undergo modification in the course of further development of the products. The requested performance features are binding only when they are expressly agreed upon in the concluded contract.

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