System Manual
1. Edition

sirius

SIEMENS

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We have checked this manual to ensure that its contents are correct and applicable in relation to the hardware and software it describes. Despite all our endeavors, however, discrepancies cannot be wholly excluded and so we cannot guarantee complete correctness and applicability. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

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1

System overview

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Introduction

Siemens is one of the leading manufacturers of switchgear. The product range extends from devices that switch a few mA to circuit breakers used in power distribution.

Throughout the continuing development of these products we have always striven to ensure that requirements in terms of fundamental performance features, electrical and mechanical service life, dimensions, and ease of installation and maintenance are met or exceeded.

We have been able to meet the demands resulting from increased environmental awareness, particularly in the last ten years or so, by developing and using environment-friendly and recyclable materials. As a result, we have developed modern industrial switching devices, particularly in the field of low-voltage switchgear, that meet all the relevant demands in terms of environment-friendliness.

Building on decades of experience, we have created a completely new generation of circuit breakers, contactors, auxiliary contactors, overload relays, contactor relays, time relays, and 3RW3 semiconductor motor control devices (referred to below as soft starters) under the name SIRIUS for the large and continuously growing number of motor drives in the range up to 45 kW.

These new SIRIUS devices fulfill all the demands placed on them in practice and can be used as stand-alone devices or modular components of complete load feeders, or integrated in low-voltage distribution cabinets or low-voltage switching stations.

1.1 Specifications/regulations/approvals

Explosion protection

Motor protection devices that protect a motor from overload in a hazardous area must meet certain requirements. These requirements are defined in the following standards:
DIN VDE 0660, DIN VDE 0165, EN 60947-1:1991..+A11:1994, EN 60947-4-1, EN 50014:1994, EN 50019:1978+A1 to A5
Compliance with these standards has up until now been established by means of a test. Compliance could be documented in two ways:
1. By a test certificate from the manufacturer
2. By a test certificate from an independent test laboratory (e.g. PTB, DMT, KEMA, etc.).

EU directive

Testing of explosion protection has been defined more precisely as a result of the harmonization of the European Union. In addition to the above standards, tests will also carried out in acc. with the EU directive 94/9/EC or ATEX 100a.
Two procedures are in operation during the transition period up until 2003:

Procedure 1
Test certificate from an independent test laboratory as usual (e.g. PTB, DMT, KEMA, etc.).

Procedure 2
Special test certificate from certified test laboratories (in acc. with extended European rules). The statutory basis for this is the Official Journal of the European Union (no. 95/C2 15/02 of 19.08.1995).

Siemens SIRIUS switching devices are tested and certified twice:

Certificate 1

Test certificate from KEMA in the same way as before (valid until 2003) in acc. with:
- DIN VDE 0660, DIN VDE 0165
- EN 60947-1:1991/A11
- EN 60947-4-1:1992, EN 50019:1978+A1 to A5

Certificate 2

Special test certificate from the DMT-BVS in acc. with:
- DIN VDE 0660, DIN VDE 0165
- EN 60947-1:1991..+A11:1994, EN 60947-4-1
- EN 50014:1994, EN 50019:1978 + A1 to A5
- EU directive 94/9/EC (ATEX 100a - EU directive)

DMT-BVS

The DMT-BVS is, like the PTB, a certified German testing organization in compliance with the EU directive 76/117/EEC and ElExV. Like the PTB and other testing institutes in Europe, the DMT-BVS tests and awards certificates in acc. with the explosion protection directive 94/9/EC and is accredited accordingly.
Over 100 years ago, the DMT-BVS became the first testing station for explosion protection in Germany, and it has been a testing station for electrical equipment as well since 1912. DMT-BVS certificates are recognized throughout the world. For support in export matters, the DMT-BVS works with the chemical industry and is of course recognized by it.

KEMA

KEMA, which is a testing institute that enjoys worldwide recognition, is a certified European institute with many years of experience of testing for explosion protection.
For support in export matters, KEMA also works with testing stations throughout the world.

1.2 Overview: Range of devices

SIRIUS system

The SIRIUS product range consists of 3RV circuit breakers, 3RT contactors, 3RH/3RT auxiliary contactors and contactor relays, 3RU thermal overload relays, 3RB10/3RB12 electronic overload relays, 3RP time relays, 3RW3 semiconductor motor control devices (referred to below as soft starters), and combinations of these devices, which form the 3RA load feeders.

The individual devices are developed and built in such a way that it is very easy to put them together to make load feeders. This is possible because the devices are all built to work together on both an electrical and a mechanical level.

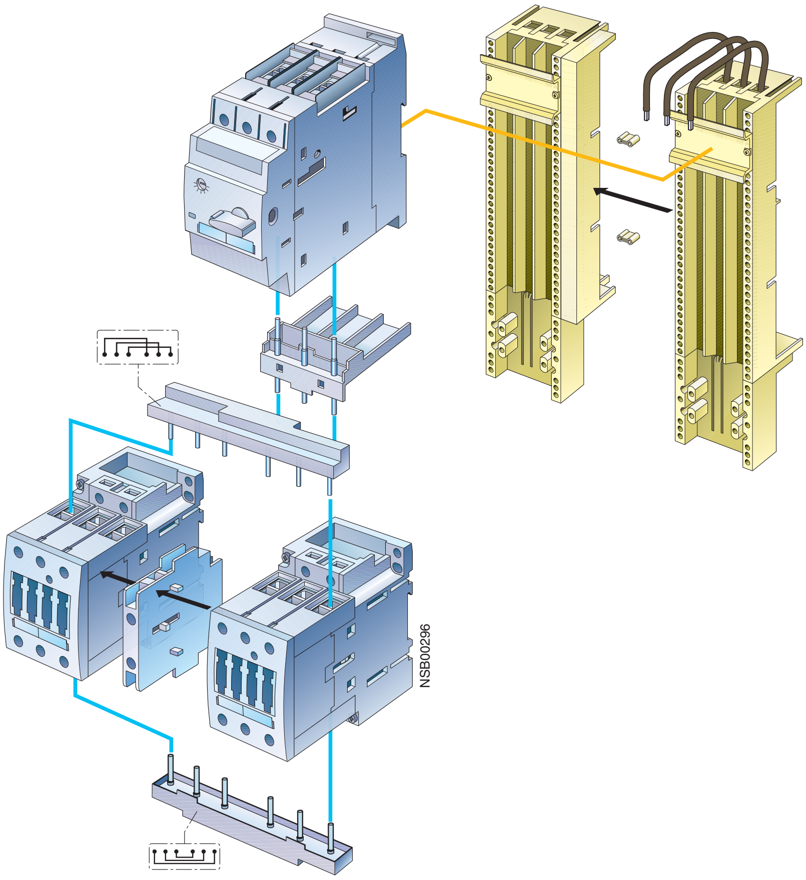


Figure 1-1: SIRIUS system

Circuit breaker with a frame size of S00 and attachable accessories:

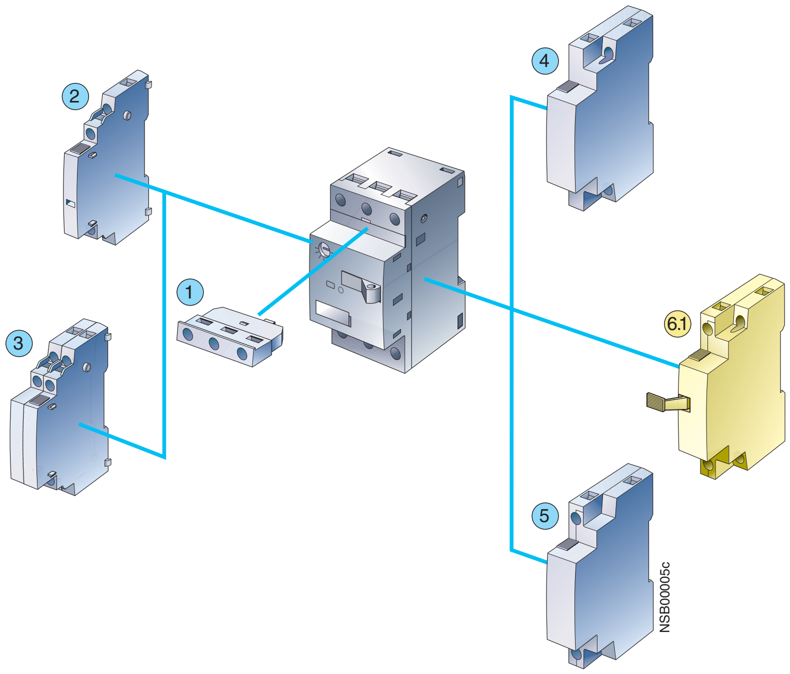


Figure 1-2: Circuit breaker, accessories (frame size S00)

Circuit breakers with frame sizes of S0, S2, and S3 and attachable accessories:

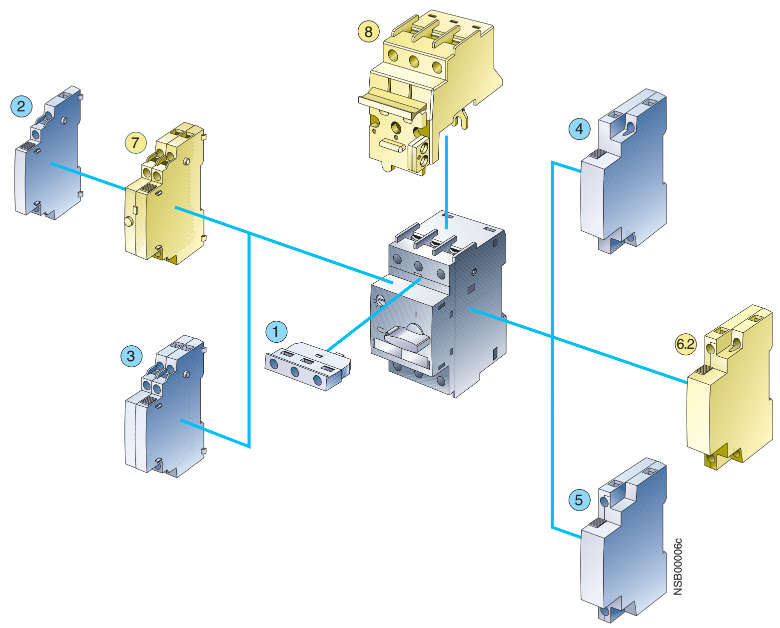


Figure 1-3: Circuit breakers, accessories (frame sizes S0, S2, and S3)

Attachable accessories for frame sizes S00, S0, S2, and S3:
1) Transverse auxiliary switch
2) Lateral auxiliary switch with 2 contacts
3) Lateral auxiliary switch with 4 contacts
4) Shunt release
5) Undervoltage release
6.1) Undervoltage release with leading auxiliary contacts (S00)
6.2) Undervoltage release with leading auxiliary contacts (S0 to S3)
7) Alarm switch (S0 to S3)
8) Disconnecting module (S0 and S2)

Contactors with a frame size of S00 and accessories:

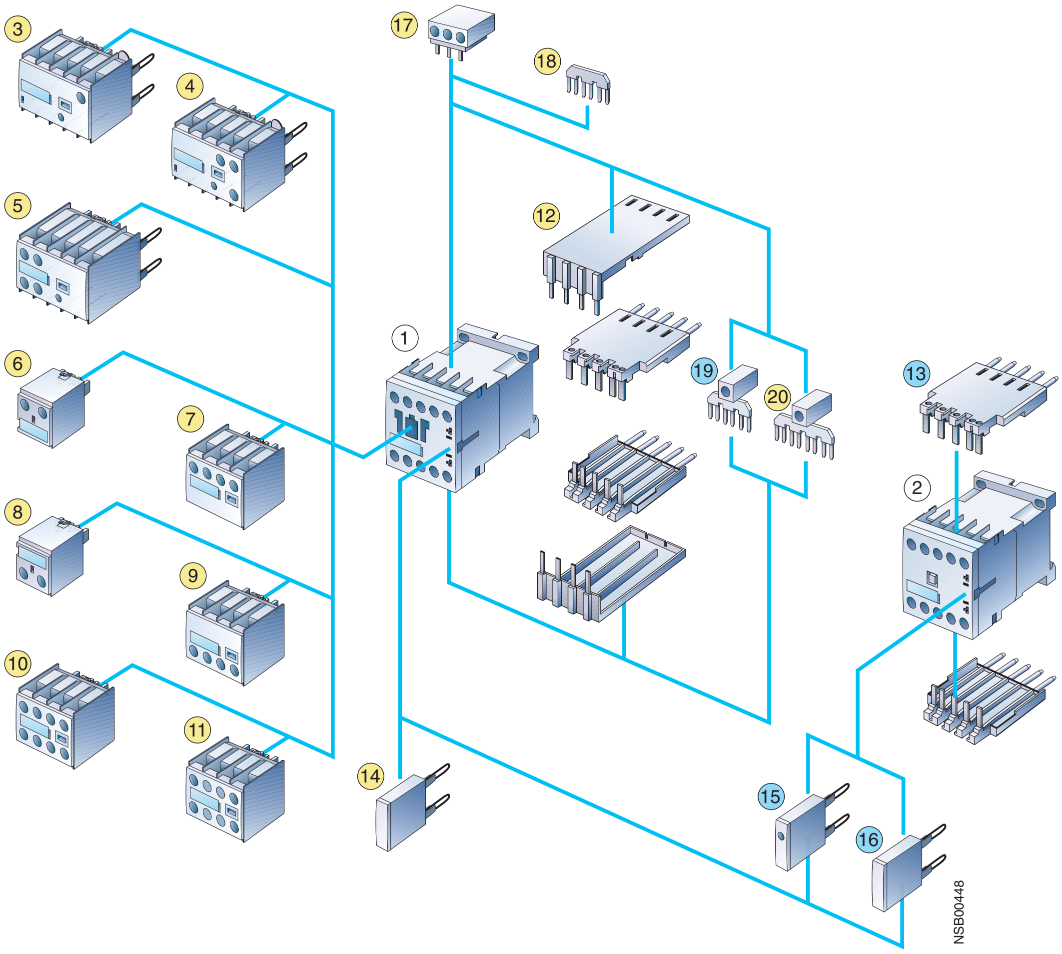


Figure 1-4: Contactors, accessories (frame size S00)

1) Contactor
2) Contactor relay
3) Solid-state time relay block, on-delay
4) Solid-state time relay block, off-delay
5) Auxiliary switch block, time-delay
   (on-delay or off-delay or star-delta function)
6) 1-pole auxiliary switch block, infeed from above
7) 2-pole auxiliary switch block, infeed from above
8) 1-pole auxiliary switch block, infeed from below
9) 2-pole auxiliary switch block, infeed from below
10) 4-pole auxiliary switch block
   (terminal markings in acc. with DIN EN 50 012 or DIN EN 50 005)
11) 2-pole auxiliary switch block, standard or electronic
   type (terminal markings in acc. with DIN EN 50 005)
12) Soldering pin adapter for contactors with 4-pole auxiliary switch block
13) Soldering pin adapter for contactors and contactor relays
14) Additional load module to increase the permissible residual current
15) Surge suppressor with LED
16) Surge suppressor without LED
17) 3-phase feed-in terminal
18) Parallel link (neutral bridge), 3-pole, without terminal
19) Parallel link, 3-pole, with terminal
20) Parallel link, 4-pole, with terminal

Contactors with frame sizes of S0 to S3 with accessories:

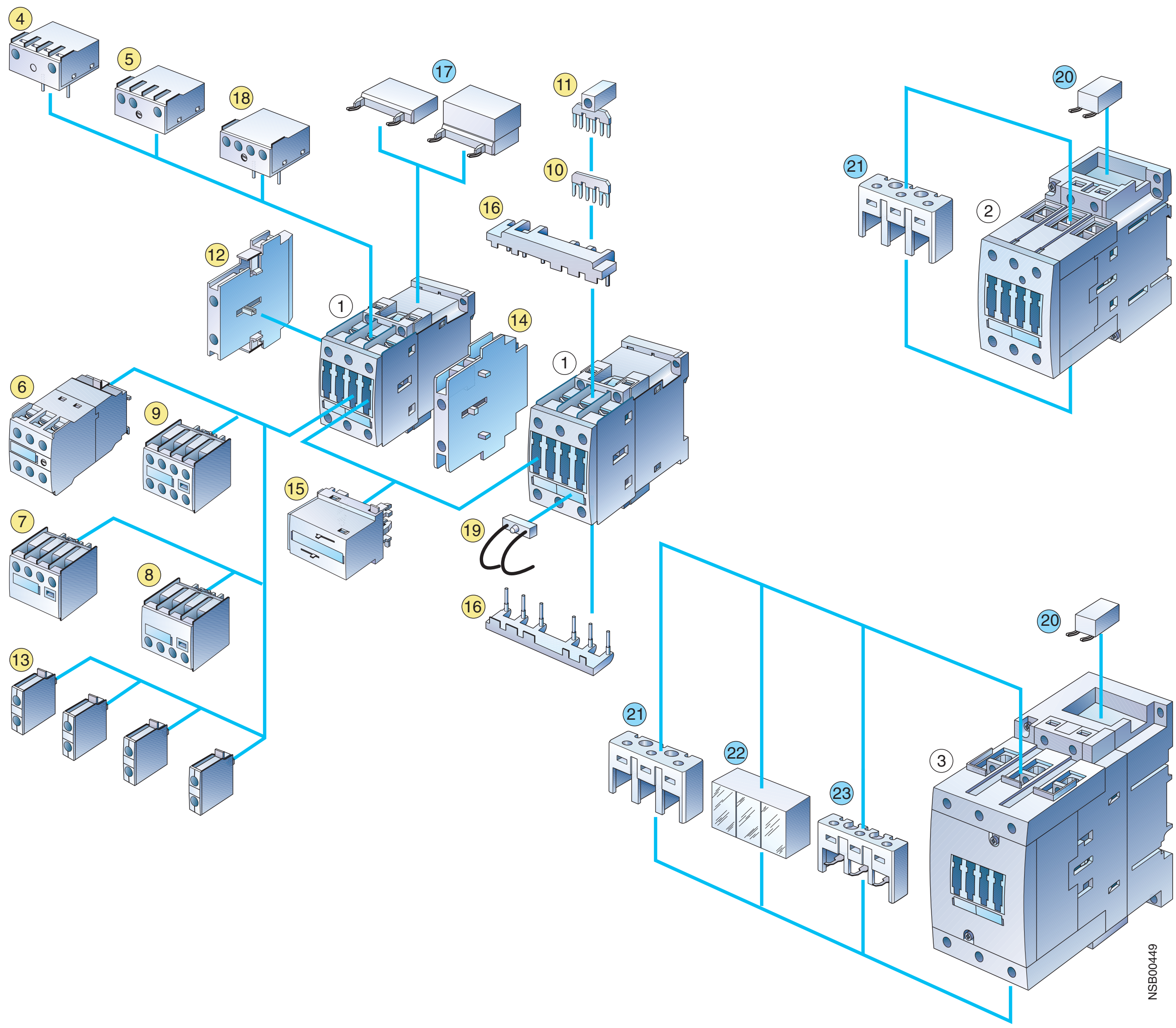


Figure 1-5: Contactors, accessories (frame sizes S0 to S3)

1) Contactor, frame size S0
2) Contactor, frame size S2
3) Contactor, frame size S3

For frame sizes S0 to S3:

4) Solid-state time relay block, on-delay
5) Solid-state time relay block, off-delay
6) Auxiliary switch block, time-delay (on- or off-delay or star-delta function)
7) 2-pole auxiliary switch block, infeed from above
8) 2-pole auxiliary switch block, infeed from below
9) 4-pole auxiliary switch block (terminal markings in acc. with DIN EN 50 012 or DIN EN 50 005)
10) Parallel link (neutral bridge), 3-pole, without terminal
11) Parallel link, 3-pole, with terminal

12) 2-pole auxiliary switch block, attachable on the right or left side (terminal markings in acc. with DIN EN 50 012 or DIN EN 50 005)
13) 1-pole auxiliary switch block (a maximum of 4 can be snapped on)
14) Mechanical interlock, attachable at the side
15) Mechanical interlock, attachable at the front
16) Wiring blocks above and below (reversing mode)
17) Surge suppressor (varistor, RC element, diode combination), attachable above or below (varies for S0 and S2/S3)
18) Coupling link for direct connection to the contactor coil
19) LED block to display contactor function

For frame sizes S2 and S3 only:

20) Terminal for contactor coil for setting up contactor combinations
21) Terminal cover for box terminals

For frame size S3 only:

22) Terminal cover for terminal end and bar connection
23) Auxiliary connecting lead terminal, 3-pole

1.3 System features

The entire SIRIUS range of devices is divided up into only four frame sizes (S00 up to 5.5 kW, S0 up to 11 kW, S2 up to 22 kW, and S3 up to 45 kW) with three different widths (45 mm for S00 and S0, 55 mm for S2, and 70 mm for S3) and has a uniform range of accessories for all frame sizes.

Modular system

The individual components of the SIRIUS range are building blocks in a modular system that are harmonized in terms of both their frame size and their technical specifications. This ensures that individual requirements can be met quickly and cost-effectively.

Uniformity

The devices are harmonized with regard to their ratings and their technical specifications:

- The same width ensures rapid installation.
- The terminal systems are standardized, and devices with the same rated current have the same terminals.

Performance capability

All SIRIUS devices can be mounted side by side without derating in an ambient air temperature of up to 60 °C.

Accessories

All accessories, such as the auxiliary switches and surge suppressors, can be mounted and removed without tools.
You can use link modules that connect devices both mechanically and electrically to put together combinations of devices and build fuseless load feeders.

Communication

Direct communication with a higher-level controller is possible using:

- The AS-Interface load feeder module
- The ET 200X distributed I/O devices on the PROFIBUS-DP bus system
- The ET 200S system

1.4 Components and combinations

This section describes the components of the SIRIUS system and the device combinations that are possible with these components.

Components of the SIRIUS system

The following table contains a list of the components of the SIRIUS system together with the most important accessories:

Components	Brief description/features	Accessories
3RV1 circuit breakers	- Switch and protect motors and other loads up to 100 A	- Auxiliary switches (transverse, lateral) - Undervoltage releases - Shunt releases - Alarm switches - Housing - 3-phase busbar system
3RT10 motor contactors	- Switch motors up to 4 kW and currents up to 95 A - Types: 3-pole for switching - 4-pole, with 4 NO and 2 S + 2 NC contacts - Soldering pin adapter - Capacitor switching contactor - Reversing and star-delta combinations	- Auxiliary switch blocks - Surge suppressors - Parallel links - Time relay blocks - Link modules - Wiring blocks
3RH11 contactor relays	- Same type of construction as the 3RT - Basic version: 4-pole, expandable to 8 pins by means of auxiliary switch blocks - High contact stability (1 mA; 17 V)	
3RT10/3RH11 contactor relays	- Switch motors and auxiliary contactors with an extended operating range (17 V to 30 V)	
3RU11 overload relays	- CLASS 10 - Phase loss sensitivity - Series auxiliary contacts 1 NO + 1 NC contact - Frame size S00: repetition terminal for the auxiliary contact and coil connection for attachment to contactors - Integrated, transparent and sealable cover for the adjusting knob and test function	- Remote RESET, electrical - Mechanical RESET - Terminal bracket for stand-alone installation
3RB10 overload relays	- CLASS 10 and CLASS 20 - Rapid tripping operation in the event of phase loss (< 3 s) - Series auxiliary contacts 1 NO + 1 NC - Low power loss, energy-saving - Wide adjustment ranges for simple configuration, selection, and less storage - Extremely low energy requirements, approx. 50 mW	- Remote RESET, electrical - Mechanical RESET - Terminal bracket for stand-alone installation

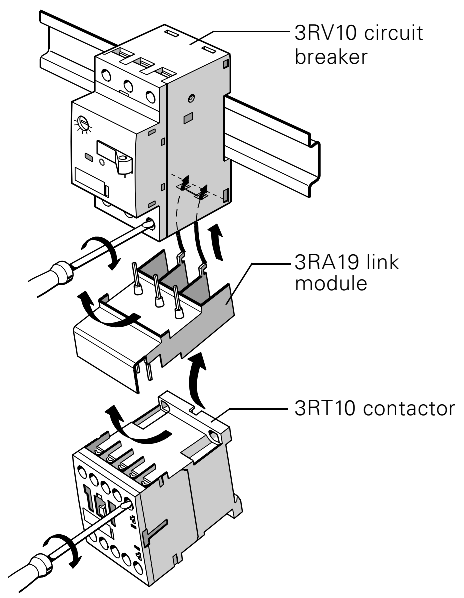
Components	Brief description/features	Accessories
3RB12 overload relays	- CLASS 5 to CLASS 30 can be set - Phase loss sensitivity - 2 outputs per 1 NO + 1 NC contact - Integrated current transformers in all sizes - Motor protection due to the connection of a thermistor sensor circuit - Internal ground fault monitoring - Overload warning - Remote and automatic reset possible - High tripping accuracy - Wide adjustment ranges - Self-monitoring	- Summation current transformer for external ground fault monitoring - DC adapter - Terminal cover
3RA1 load feeders	- Fuseless load feeder consisting of a circuit breaker and contactor - Simple assembly with link modules and wiring blocks - Reversing combination (link modules) - Star-delta combination	- Accessories for the basic devices (contactors and circuit breakers) - Special accessories: Auxiliary switches connectable from above or below
3RP10/15 solid-state time relays	- 8 adjustable time ranges from 0.05 seconds to 10 hours - Constantly high repeatability - Type with combination voltage (24 VDC and 110 to 240 VAC) - 2 device types: on-delay and multifunctional (7 functions) - Long mechanical and electrical service life	- Coding plug sets - Locking device
3RW30/31 soft starters	- Reduction of the starting current for a smooth start - Soft coasting down function - Only 3 motor supply leads are required - System adaptation using setting options: starting time, starting voltage, coasting down time	- Fans
Load feeders with communication capability	Complete load feeders - At the AS-Interface with the AS-Interface IP65 compact starter AS-Interface IP20 load feeder module - On the Profibus-DP through the following systems ET 200X with IP65 protection ET 200S with IP20 protection	- Supply modules - Wiring

Table 1-1: Components and combinations with accessories

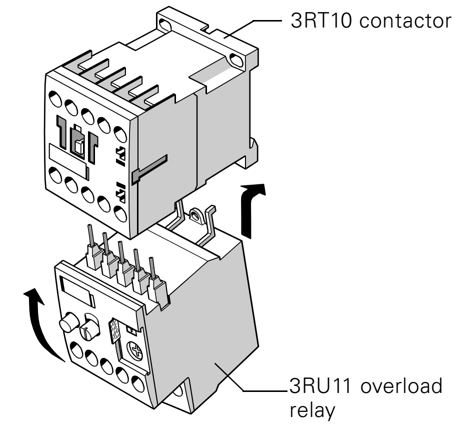
Device combinations

The following diagrams show you the possible device combinations, using the S00 frame size as an example:

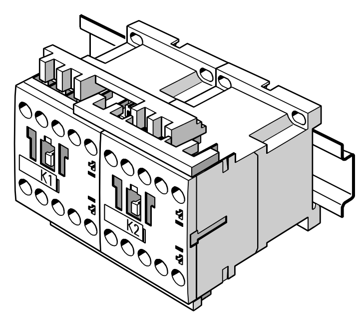
Fuseless load feeder



Fused load feeder



3RA13 reversing combination



3RA14 star-delta combination

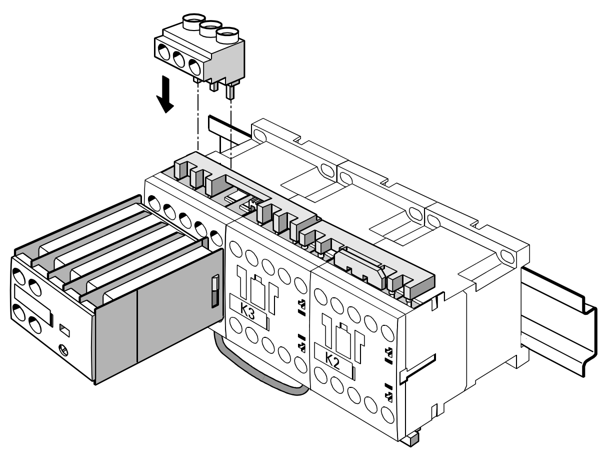


Figure 1-6: Device combinations

Contactor combination for reversing the S00 frame size (with accessories):

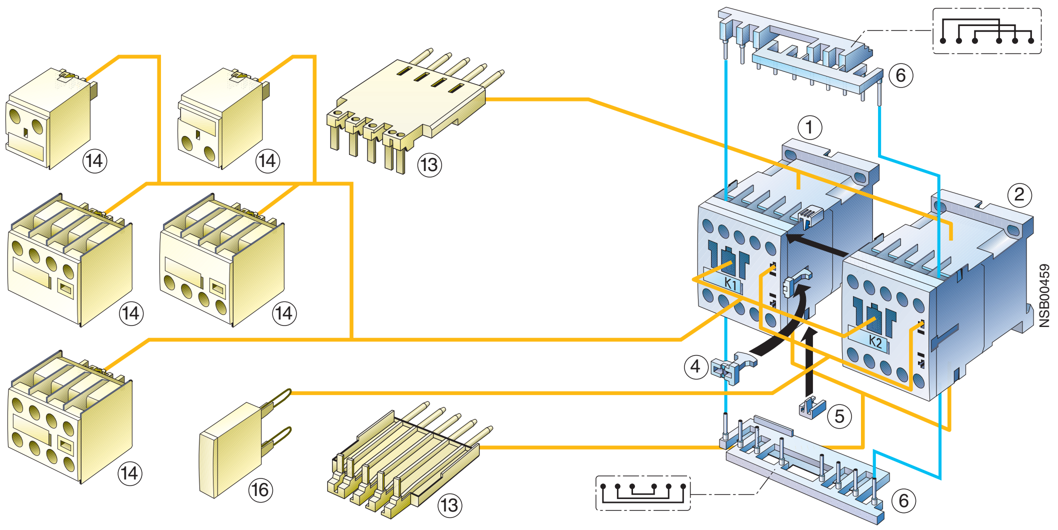


Figure 1-7: Contactor combination for reversing

Individual parts:
1/2) Contactors
4/5/6) Kit

The kit includes:

4) Mechanical interlock
5) 2 connection clips for 2 contactors
6) Wiring blocks above and below to connect the main conducting paths with electrical interlock (NC contact interlock - can be removed if required)

Attachable accessories:
13) Soldering pin adapter
14) Auxiliary switch block, on the front (only an auxiliary switch blocks that complies with DIN EN 50 005 can be used)
16) Surge suppressor

1.5 Mounting methods and terminal systems

1.5.1 Mounting the equipment

The method of mounting the equipment is uniform within each frame size.

Frame size	Mounting	Removal
S00 to S3	Screwed on	Removed with a screwdriver
S00, S0	Snapped onto a 35 mm rail (in acc. with DIN EN 50 022)	Removed without a tool
S2	Snapped onto a 35 mm rail (in acc. with DIN EN 50 022)	The snap-on spring can be opened with a screwdriver
S3	Snapped onto a 35 mm rail (in acc. with DIN EN 50 022) Snapped onto a 75 mm rail	The snap-on spring can be opened with a screwdriver

Table 1-2: Mounting methods

Screw-on mounting

The SIRIUS switching devices can be screwed on to a flat surface.
Please note the following points with some of the devices:

- 3RV1 circuit breaker, frame sizes S00/S0: Push-in lugs are required for screw-type mounting
- 3RP15 time relay: Push-in lugs are required for screw-type mounting
- Coupling links: No screw-type mounting
- Soft starters: No screw-type mounting

Snap-on mounting

The SIRIUS switching devices are snapped onto 35 mm rails in acc. with DIN EN 50 022 without a tool.
The devices with a frame size of S3 require a rail with an installation height of 15 mm. Alternatively, they can also be snapped onto 75 mm rails.

The following table shows you how to mount the device onto the rail:

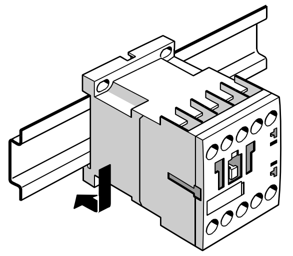
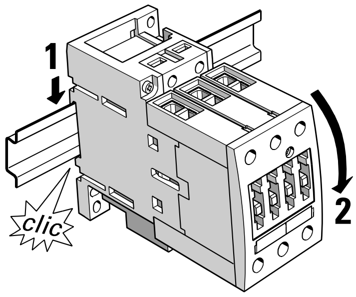
Frame size	Procedure	Illustration
S00/S0	Place the device on the upper edge of the rail, and press it downwards until it snaps onto the lower edge of the rail.	
S2/S3	Place the device on the upper edge of the rail, and tilt it towards the rail until it snaps onto the lower edge of the rail.	

Table 1-3: Mounting the device on the rail

The following table shows you how to remove the device from the rail:

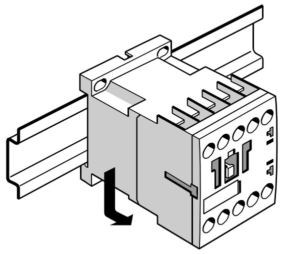
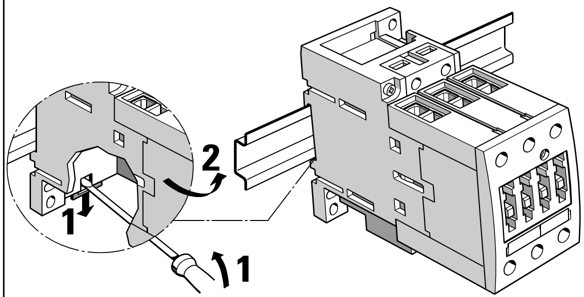
Frame size	Procedure	Illustration
S00/S0	Push the device downwards to release the tension of the mounting spring, and remove the device by tilting it.	
S2/S3	Using a screwdriver, push the clip on the lower rear side of the device downwards to release the tension of the mounting spring **(1)**, and remove the device by tilting it **(2)**.	

Table 1-4: Removing the device from the rail

You will find notes on mounting the different devices on the rail in the relevant parts of section n.5 on mounting methods and terminal systems.

1.5.2 Screw-type terminals

The terminals used do not vary within a frame size. The current switched by the different devices of a single frame size does not vary either. This means you can use the same tool, torque, and conductor cross-section for the circuit breakers, contactors, and overload relays of a single frame size. The stripped lengths are also the same. This is important in the case of prefabricated wiring.

Screw-type terminals

All the devices have screw-type terminals, either a terminal with a top washer or a box terminal, depending on the frame size.
Devices with frame sizes S00 and S0 have terminals with captive screws and terminal washers that enable you to connect 2 conductors, even if they have different cross-sections.
The box terminals of frame size S2 and S3 can also take 2 conductors with different cross-sections.

Connection tools

Use the following tools to make the connection:

- Frame sizes S00 to S2: Screws are available for rated currents of up to 50 A for Pozidriv2 screwdrivers.
- Frame size S3: To obtain the required torques for the frame size for up to 100 A, the screws have a 4 mm hexagon socket.

The screwdriver guides allow screwdriving machines to be used.

Lugs and connecting bars

You can remove the box terminals from the devices with a frame size of S3 to connect conductors with lugs or connecting bars. A terminal cover is available as shock protection and to ensure that you comply with the required creepages and clearances when the box terminals are removed.
You can find a detailed description in section n.4 on accessories.

1.5.3 Cage Clamp terminals

The Cage Clamp® terminal system is now available for circuit breakers, contactors, overload relays, and time relays.
Cage-type clamping units, known as Cage Clamp terminals in the case of SIRIUS products, facilitate quick and maintenance-free wiring.

Design

The Cage Clamp terminal consists of two parts:
- A power rail for conducting current
- A sprung cage-type clamp for clamping strength

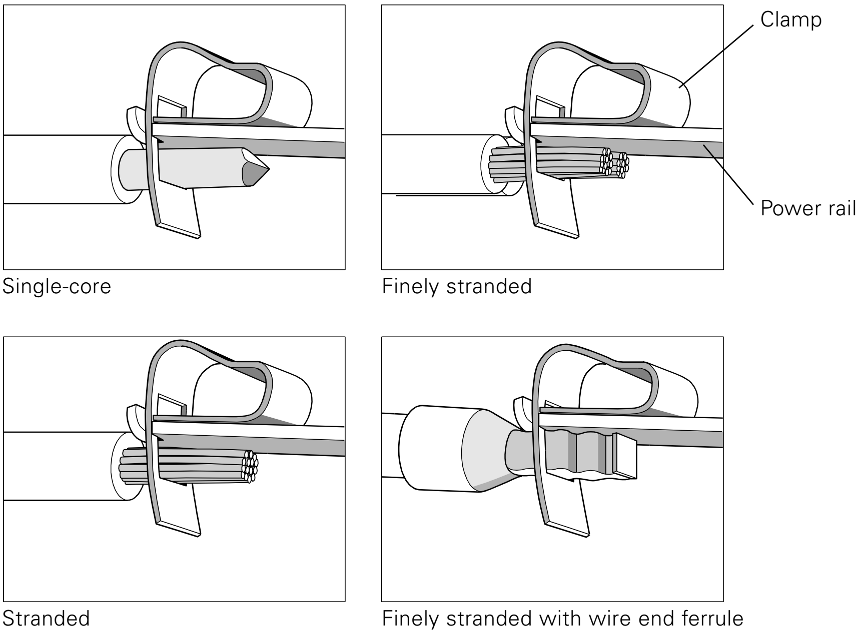


Figure 1-8: Cage Clamp terminal

Conductors

The Cage Clamp terminal on the switching devices clamps all copper wires (single-core, stranded and finely stranded) from 0.25 mm^2 to 2.5 mm^2. The conductors can be clamped directly or with some protection for splicing. To this end, wire end ferrules or pin-end connectors can be placed on the conductor ends. The best solution is an ultrasonically condensed conductor.

Safety

The devices are equipped with a two-wire connection. In other words, there are two independent connections for each conducting path.
Only one conductor is connected to each clamping unit.
The clamp presses the conductor against the power rail, which is curved at this point. The high specific compressive load thus achieved is gas-tight.
The clamp presses its flat surface against the conductor, thus avoiding damage to it. The spring force of the clamp is designed so that it automatically adjusts to the radius of the conductor. This allows any deformation of the conductor to be dealt with. It is not possible for the clamping unit to loosen by itself.
This connection is vibration- and shock-proof. These types of stress do not damage the conductor or cause any loss in contact.
Machines and systems in which this type of stress occurs, such as vibrators and elevators, are particularly suitable applications for this connection.

Transfer accuracy

The contact pressure between the conductor and power rail is optimal, making this clamp terminal suitable for high-voltage installations and also for the transfer of voltages and currents in the mV and mA ranges in measuring technology and electronics.

Tool

Screwdrivers can be obtained from the NSK (low-voltage switchgear) catalog for opening the Cage Clamp terminals.

Procedure

The following table shows you how to use the Cage Clamp:

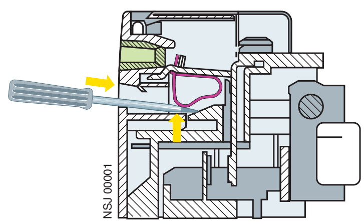
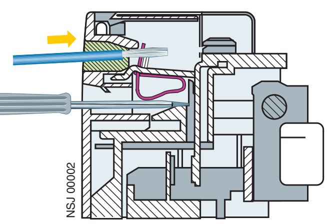
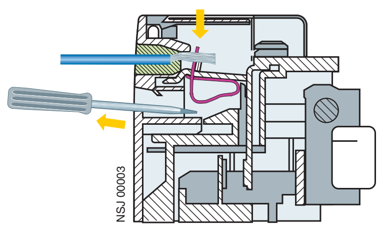
Step	Procedure
1	Insert the screwdriver into the rectangularopening until it stops. The screwdriver head automatically keeps the clamp open. 
2	Insert the conductor into the oval terminal opening. 
3	Remove the screwdriver. The terminal closes, and the conductor is thus securely clamped. 

Table 1-5: How to use a Cage Clamp terminal

Small conductor cross-sections

With conductor cross-sections that are ≤ 1 mm^2, you have to use an insulating stop to ensure the conductors remain securely clamped.
The illustration below shows the procedure:

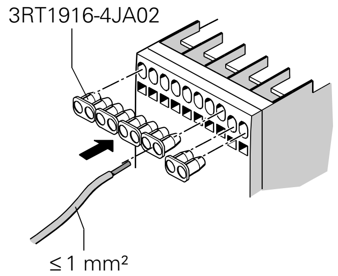


Figure 1-9: Conductor cross-sections ≤ 1 mm²

1.5.4 Connection cross-sections

Because SIRIUS is a modular system, the connection cross-sections are the same for all devices of a single frame size.
The following tables specify the permissible conductor cross-sections for main and auxiliary conductor connections:

Frame size S00

	Main and auxiliary conductors	
Ø 5 to 6 mm/PZ2	0.8 to 1.2 Nm 7 to 10.3 lb.in	**Cage Clamp**
10	2 x (0.5 to 1.5 mm²) 2 x (0.75 to 2.5 mm²)	2 x (0.25 to 2.5 mm²)
10	2 x (0.5 to 1.5 mm²) 2 x (0.75 to 2.5 mm²)	2 x (0.25 to 1.5 mm²)
10	----	2 x (0.25 to 2.5 mm²)
AWG	2 x (18 to 14)	2 x (24 to 14)

Table 1-6: Connection cross-section for frame size S00

Frame size S0

	Control conductor: A1/A2 Auxiliary conductor: NO/NC		Main conductor
	Screw-type terminal	**Cage Clamp terminal**	**L1 L2 L3 T1 T2 T3**
Ø 5 to 6 mm/PZ2	0.8 1.2 Nm 7 to 10.3 lb.in	----	2 to 2.5 Nm 18 to 22 lb.in
10	2 x (0.5 to 1.5 mm²) 2 x (0.75 to 2.5 mm²)	2 x (0.25 to 2.5 mm²)	2 x (1 to 2.5 mm²) 2 x (2.5 to 6 mm²)
10	2 x (0.5 to 1.5 mm²) 2 x (0.75 to 2.5 mm²)	2 x (0.25 to 1.5 mm²)	2 x (1 to 2.5 mm²) 2 x (2.5 to 6 mm²)
10	----	2 x (0.25 to 2.5 mm²)	----
AWG	2 x (18 to 14)	2 x (24 to 14)	2 x (14 to 10)

Table 1-7: Connection cross-section for frame size S0

Frame size S2

	Control conductor: A1/A2 Auxiliary conductor: NO/NC Screw-type terminal	 Cage Clamp terminal		Main conductor L1 L2 L3 T1 T2 T3
Ø 5 to 6 mm/PZ2	0.8 to 1.2 Nm 7 to 10.3 lb.in	----	Ø5 to 6 mm/PZ2	3 to 4.5 Nm 27 to 40 lb.in
10	2 x (0.5 to 1.5 mm²) 2 x (0.75 to 2.5 mm²)	2 x (0.25 to 2.5 mm²)	13	2 x (0.75 to 16 mm²)
10	2 x (0.5 to 2.5 mm²)	2 x (0.25 to 1.5 mm²)	13	2 x (0.75 to 16 mm²) 1 x (0.75 to 25 mm²)
----	—	----	13	2 x (0.75 to 25 mm²) 1 x (0.75 to 35 mm²)
AWG	2 x (18 to 14)	2 x (24 to 14)	**AWG**	2 x (18 to 3) 1 x (18 to 2)

Table 1-8: Connection cross-section for frame size S2

Frame size S3

	Control conductor: A1/A2 Auxiliary conductor: NO/NC Screw-type terminal	 Cage Clamp terminal		Main conductor L1 L2 L3 T1 T2 T3
Ø5 to 6 mm/PZ2	0.8 to 1.2 Nm 7 to 10.3 lb.in	----	min 22 4	4 to 6 Nm 35 to 53 lb.in
10	2 x (0.5 to 1.5 mm²) 2 x (0.75 to 2.5 mm²)	2 x (0.25 to 2.5 mm²)	17	2 x (2.5 to 16 mm²)
10	2 x (0.5 to 2.5 mm²)	2 x (0.25 to 1.5 mm²)	17	2 x (2.5 to 35 mm²) 1 x (2.5 to 50 mm²)
10	----	----	17	2 x (10 to 50 mm²) 1 x (10 to 70 mm²)
AWG	2 x (18 to 14)	2 x (24 to 14)	**AWG**	2 x (10 to 1/0) 1 x (10 to 2/0)

Table 1-9: Connection cross-section for frame size S3

1.6 Communication

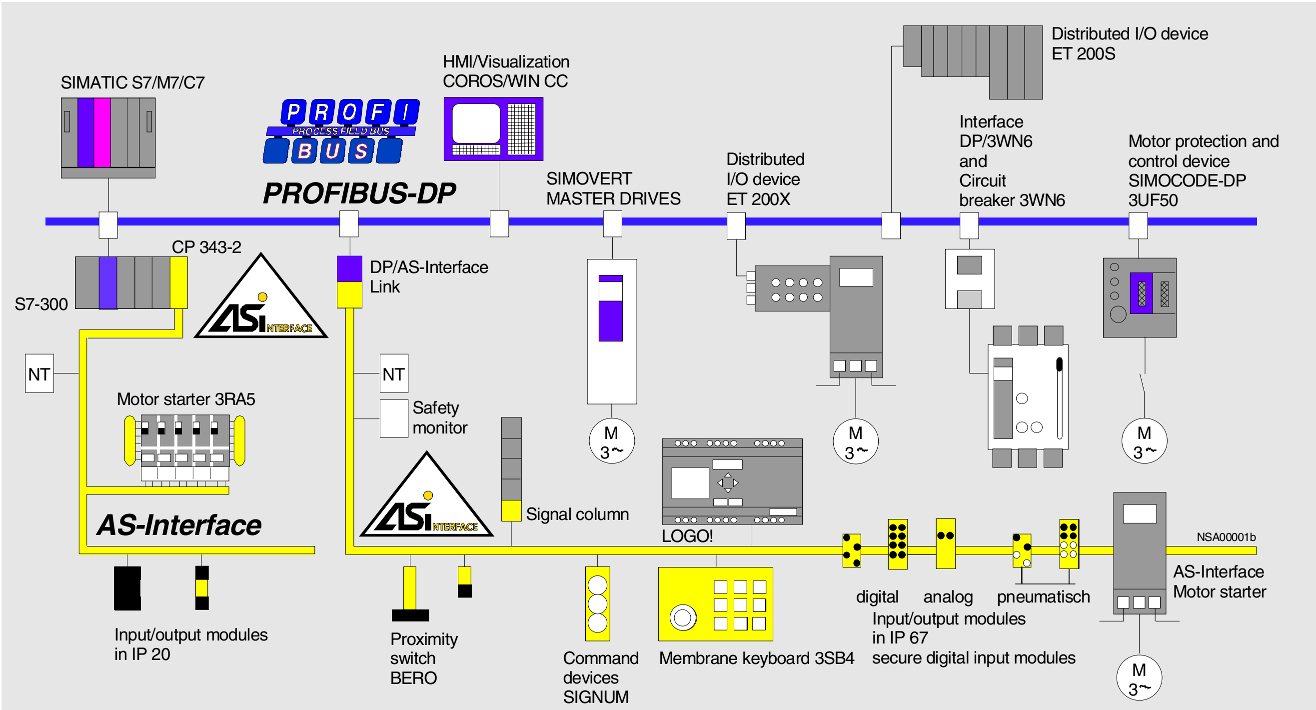


Figure 1-10: Communication

1.6.1 Communication-capable low-voltage switching technology

This uniform range of communication-capable Siemens switching devices represents an innovative concept for effective cubicle automation. Communication with the higher-level control system via open, PROFIBUS-DP, and AS-Interface connections.

Actuator-sensor interface (AS-Interface)

AS-Interface is a standardized, non-proprietary networking system (IEC 62026-2) for simple and usually binary actuators and sensors. It is possible to connect it to SIMATIC programmable logic controllers via different master modules. A DP/AS-Interface link also ensures direct integration in a PROFIBUS-DP system or connection to other field buses via couplers. Up to 248 sensors and 186 actuators can be connected to an AS-Interface network over a maximum of 500 m. Safety-related signals can now also be networked with AS-Interface, thus dispensing with the wiring of emergency stop signals that was needed previously.

PROFIBUS

PROFIBUS is a standardized, non-proprietary field bus system (IEC 61158) to which most PLCs of leading manufacturers can be connected. Up to 125 nodes can be incorporated in one bus segment. Distances of up to 9.6 km can be bridged with copper cables and up to 100 km with fiber-optic cables.

PROFIBUS-DP

PROFIBUS-DP (DP being a German abbreviation for distributed I/O) is used for switching devices with higher communication requirements (e.g. the transmission of analog actual values with extremely fast response times). It is also used to link individual AS-Interface segments.

1.6.2 Parameterization of PROFIBUS-DP and bus-capable low-voltage switching devices

Before commissioning, PROFIBUS-DP must be configured, and the individual bus nodes must be parameterized. There are user-friendly tools available to the user for configuration and parameter assignment.

Parameter assignment tools

- For SIMATIC S7 masters, all the functions are integrated in the STEP 7 programming language.
- For SIMATIC S5 masters and various non-Siemens masters, the COM PROFIBUS parameter assignment software is required.
- Manufacturers of non-Siemens masters offer other configuration and parameter assignment programs.

Applications

The above program packages make it easy to carry out the following for PROFIBUS-DP and its nodes:
- Configuration
- Parameter assignment
- Documentation
- Commissioning
- Testing
- Diagnostics

For additional information on communication-capable low-voltage switching devices, as well as system components and accessories, see the following catalogs:
- ST 70 "S7, M7 and C7 Programmable Logic Controllers"
- IK PI "Industrial Communication and Field Devices"

1.6.3 Actuator-sensor interface (AS-Interface)

The actuator-sensor interface (AS-Interface) is a modular networking system for sensors and actuators in the lowest field range.
It makes no difference to the program in the programmable controller whether parallel wiring with input/output modules or AS-Interface is used. It is therefore possible for existing systems to change to AS-Interface because you can continue to use the same programs. The entire system can be operated without additional software. It is not necessary to be familiar with the internal workings of AS-Interface.

Replacement for the cable harness

Process signals that occur in situ, are normally transferred to the open loop control using extensive parallel wiring and input/output modules. This means that each sensor or actuator in the field is connected to the input/output modules with its own cable. AS-Interface makes it possible to replace this cable harness with a simple two-wire cable for all sensors or actuators.

Data and power on a two-wire cable

The master communicates with the nodes via the AS-Interface cable. As well as data, this cable also transfers the supply voltage for the electronic components and sensors. The voltage is supplied to the AS-Interface cable from a special AS-Interface power supply unit with a data link.

Setting up different structures

The AS-Interface cable is laid in the same way as for an electrical installation. A new feeder can be inserted at any point. This makes it possible to set up network structures (e.g. tree, star or line structures). No shielding or terminating resistors are required. The wiring can be adapted individually to the system or machine.

Detailed configuration and installation guidelines can be found in the installation guideline "Montage des Vernetzungssystems AS-Interface" (on mounting the AS-Interface networking system).

Maximum system configuration

Up to 62 nodes can be connected to the AS-Interface cable. A node is, for example, an AS-Interface module (digital or analog) or a BERO (proximity switch) with an integrated AS-Interface chip. A maximum of 4 binary standard sensors and/or 4 actuators can be connected to an AS-Interface module.
This produces a maximum configuration of 248 sensors and 186 actuators (62 nodes x 4 inputs and 3 outputs).

IP 67 degree of protection

AS-Interface is a networking system for direct use on the machine. The AS-Interface user compact modules have IP 67 protection. They can be used in situ without being enclosed.
There are also AS-Interface modules for use with IP 20 protection in the cubicles or distributed switchboxes.

New installation system

All compact modules are placed on a mounting plate. The mounting plate takes the AS-Interface cable and keeps it in place. Polarity reversal is not possible due to the profile of the cable. The compact modules are simply hooked on at the top of the mounting plate and secured with just one screw. When you secure the modules, contact is made with the AS-Interface cable. You do not have to strip or screw on the cable.

Coding prevents errors

All the modules are mechanically and electrically coded.
The coding system prevents errors occurring in the event of replacement. At replacement, only one module of the same type can ever be mounted. This stops digital or analog modules (or even inputs or outputs) getting mixed up.

Addressing

To participate in data transfer with the master, each node must be assigned an address before commissioning of the AS-Interface network. Addressing devices are available for this.

Addressing an installed module

There is an additional feature which makes new Siemens modules even more user-friendly: the addressing socket.

Using this socket you can address a module after it has been installed. It is not necessary to unscrew the module. Installation can be carried out in the system by personnel who are not familiar with the AS-Interface. The commissioning engineer can address the modules easily when they are already installed. For the first time, this type of addressing is also possible with IP 67 protection.

Diagnostics at a glance

The new generation of AS-Interface modules (compact modules, analog modules, and SlimLine modules) has the new display system developed by Siemens.

The status of a module is displayed by two LEDs lighting up continuously or flashing.
This simple diagnostic feature directly on the module makes it possible for the user to find the error quickly and efficiently. This in turn reduces downtimes.

Certificates of the AS-Interface association

All Siemens AS-Interface products are tested in acc. with the relevant testing regulations in an accredited test laboratory and certified by the AS-Interface association.

Digital compact modules with IP 67 protection

The AS-Interface modules in the compact range are characterized by optimized operating features and improved user-friendliness.
This can reduce mounting and commissioning times for AS-Interface by up to 40%. Additional LEDs provide information on the most important operating modes of the module, resulting in a considerable increase in system availability.
The modules of the compact range consist of two components:
Mounting plate and compact module
The mounting plate mechanically fixes the AS-Interface profile cables, takes the compact module, and serves as a template with drill holes.
The compact module contains the electronic components for communication and the M12 standard connections for inputs/outputs. Up to four sensors and four actuators can be easily and reliably connected to the compact module using the M12 standard connection.
The mounting plate and compact module are only connected to each other by means of a single screw. Contact is established with the AS-Interface cable by means of the proven insulation displacement method.
AS-Interface modules in the compact range that have an M12 connection can have a protective conductor (PE) connected to them.
Using an addressing socket integrated in the compact module, you can also allocate addresses when the module is in place.

Analog compact modules with IP 67 protection

The design of the analog modules has been adapted for the compact modules. The analog input and output modules each have two channels. You can connect measuring sensors and analog actuators using standard M12 connectors. The following groups of analog modules exist:

- Input module for two current sensors
- Input module for two voltage sensors
- Input module for two thermal resistors
- Output module for two current actuators
- Output module for two voltage actuators

All the measured values - except for the thermal resistance value of Pt 100 (not linear) - are available in linear form. In other words, the non-linear transmission curve of the thermal resistor sensor is automatically linearized in the analog module, and measured values can be processed directly in the programmable controller.
The input and output channels are isolated. Two-wire and four-wire sensors can be connected. Differential inputs produce considerable suppression of common-mode interference. The integrating sigma-delta converter ensures high measurement accuracy.

Pneumatic compact modules with IP 65 and IP 67 protection

The pneumatic compact module is a highly integrated AS-Interface slave. As an input/output module that is entirely suitable for field deployment, it has four electrical inputs and two pneumatic outputs. The electrical inputs behave in the same way as the inputs of the digital input/output compact modules.
Both integrated pneumatic outputs are implemented by means of two pre-set 4/2-way valves (2 to 8 bar; 550 Nl/min) with a shared compressed-air supply and separate exhaust air collection and can be operated manually using separate slide valves. Two cylinders that work in tandem, for example, can be connected to a module in this range.
Connections to AS-Interface are made via the standard mounting plate. The AS-Interface cable is inserted into the corresponding cable guides, and the upper part is secured to the mounting plate by means of a screw. The module is ready for use.

Safety first - emergency stop via AS-i

AS-Interface is the first system on the market that can transmit both standard signals and safety-related input signals (e.g. emergency stop) via the same cable.
Only an additional safety monitor and safe modules are required to use AS-Interface as a safety bus. This enables category 4 in acc. with EN 954-1 to be achieved. A failsafe programmable controller or special master is not necessary.
The concept and implementation of AS-Interface Safety at Work (AS-Interface SaW) have been tested and certified by TÜV (technical testing association).
This means that the system can be converted to the considerably more flexible AS-Interface network, which is already available, thus obviating the need for the complex, separately implemented emergency stop wiring that has been necessary up to now.

2

3RV1 circuit breakers

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2.1 Specifications/regulations/approvals

Standards

- The 3RV1 circuit breakers comply with the specifications for circuit breakers in acc. with IEC 60947-2/DIN VDE 0660, Part 101.
- The circuit breakers for motor protection comply with the specifications in acc. with IEC 60947-4-1/DIN VDE 0660, Part 102.
- The auxiliary switches comply with IEC 60947-5-1/DIN VDE 0660 Part 200.

Approvals/ test reports

Confirmation of approvals, test certificates, and characteristics can be obtained on the Internet/intranet.

Terminal markings

The terminal markings comply with DIN EN 50 011.

Utilization categories

Circuit breaker in acc. with IEC 60947-2: A
Motor starter in acc. with IEC 60947-4-1: AC-3 (main conducting paths)
DC - 11 / AC - 15 (control and auxiliary conducting paths)

Main and emergency stop switches

The specifications for the main and emergency switches comply with IEC 60204/DIN VDE 0113 Part 1.

Disconnector specifications

Disconnector specifications comply with IEC 60947-3.

Shock protection

3RV1 circuit breakers are shockproof in acc. with DIN VDE 0106 Part 100, even without accessories. You can find additional information on the subject of shock protection in the "Switching, Protection and Distribution in Low-Voltage Networks" manual, p. 37 ff.

Degree of protection

The degree of protection of the 3RV1 circuit breaker is IP 20.
In the terminal area of frame sizes S2 and S3 the degree of protection is IP 00.

Characteristics

The time-current characteristics, the current limitation characteristics and the I^2t characteristics have been determined in acc. with IEC 60947 and DIN VDE 0660.

Conditions of application

Explosion-proof motors
KEMA test report no. EX-97.Y.3236 in acc. with EN 50 019:1977 +A1 to A5 and DIN VDE 0165
DMT certificate in acc. with directive 94/9 EC (ATEX) in preparation

Nuclear power plants
KTA certificate

Railway vehicles
DIN EN 50 155

Ships and docks
Shipbuilding certificates of classes GL, LRS or DNV.

2.2 Device description

3RV1 circuit breakers are used to switch and protect three-phase induction motors of up to 45 kW at 400 VAC and for loads with rated currents of up to 100 A.

The 3RV1 circuit breakers have 3 poles. To achieve the highest degree of flexibility, auxiliary switches, alarm switches, auxiliary releases, and other accessories can be easily attached to the circuit breakers without tools, as required.

3RV1 circuit breakers and 3RT1 contactors are built to work together on both an electrical level and physically. This enables them to be easily and quickly put together to make load feeders.

Frame sizes

3RV1 circuit breakers are available in 4 frame sizes (S00 to S3).

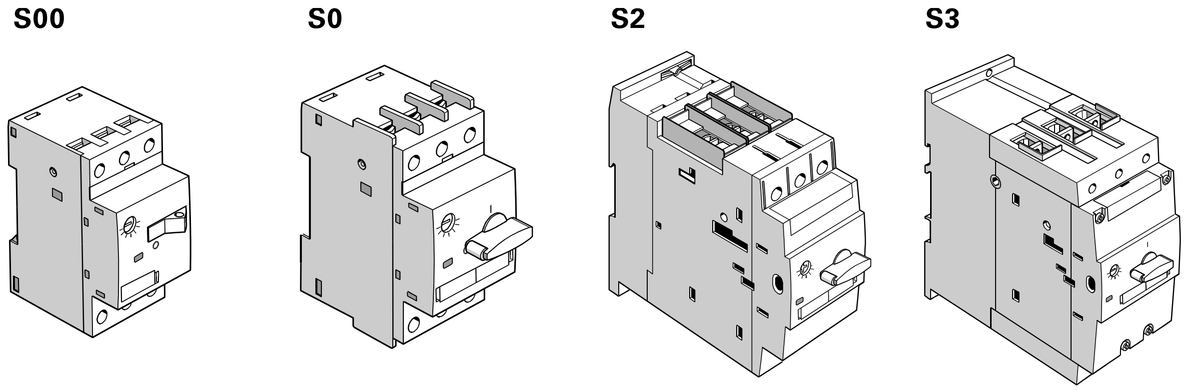


Figure 2-1: 3RV1 circuit breakers (frame sizes S00 to S3)

The following table shows you the frame sizes and the corresponding maximum rated operational current at a voltage of 400 VAC. The last column in the table tells you which three-phase induction motor is suitable for which particular size.

Frame size	Width	Max. rated operational current	Output power of the three-phase induction motor
S00	45 mm	12 A	5.5 kW
S0	45 mm	25 A	11 kW
S2	55 mm	50 A	22 kW
S3	70 mm	100 A	45 kW

Table 2-1: Circuit breakers, frame sizes

2.2.1 General description

Fields of application

The 3RV1 circuit breakers are suitable for:
- Motor and plant protection
- Transformer protection
- Starter protection (short-circuit protection)

The 3RV16 11-0BD10 circuit breaker, frame size S00, is used for fuse monitoring.

Releases

3RV1 circuit breakers have:
- Inverse-time delay, thermal overload releases
- Instantaneous short-circuit releases

The overload releases can be set to the load current.
The short-circuit releases are set permanently to 12 times the rated current, which allows motors to start up without problems. Circuit breakers used for transformer protection are set to 19 times the rated current to avoid being tripped by the high inrush current.
When the circuit breakers are tripped, in the case of frame size S00 the toggle switch goes into the tripped position, and in the case of frame sizes S0 to S3 the rotary switch switches to the tripped position. Before it is switched on again, the rotary switch must be put in the 0 position manually to avoid switching to the fault inadvertently.

In the case of circuit breakers with a rotary switch, the tripping operation can also be reported electrically by means of an alarm switch.

Tripping classes

In acc. with IEC 947-4-1:
- Frame sizes S00 to S3: class 10
- Frame sizes S2/S3: class 20

Auxiliary release

The circuit breakers can also be equipped with one of the following auxiliary releases:
- Shunt release
- Undervoltage release
- Undervoltage release with leading auxiliary contacts

Auxiliary contact elements

The circuit breakers can be equipped with a transverse auxiliary switch, an electronically optimized transverse auxiliary switch or a lateral auxiliary switch (Section 2.4 Accessories).

Shock protection

Shock protection can be improved by covering the terminals and connections. This can be achieved with the following accessories:
- Frame size S00, S0: protective caps for transverse auxiliary switches
- Frame size S2, S3: terminal covers for box terminals
- Terminal covers for lug and bar connection

Other accessories

Other accessories for circuit breakers:
- Alarm switch
- Disconnecting module
- Isolated 3-phase busbar system
- Busbar adapter
- Rotary switches
- Terminals for "Combination Motor Controller Type E" in acc. with UL 508
- Housing and front plates

2.2.2 Operation

Setting the values

Using a screwdriver, set the load rated current (current setting) I_e on the scale of the circuit breaker.
Note the two possible markings:
- Dash marking: marking for a circuit breaker in a stand-alone installation
- Triangle marking: marking for a circuit breaker in a side-by-side installation

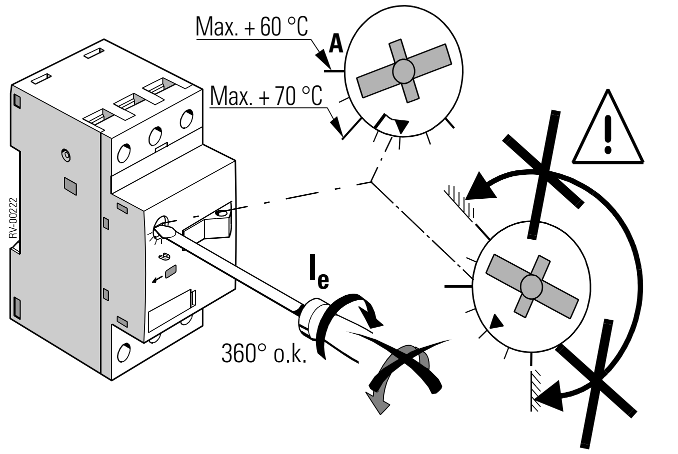


Figure 2-2: Setting the current setting I_e (example: frame size S00)

⚠ **Warning**
The adjusting knob can be turned 360° clockwise. You can only turn it counterclockwise within the adjustment range.

Sealing the adjustment scale

You can prevent unauthorized adjustment of the current setting by placing a transparent cover over it and sealing it.

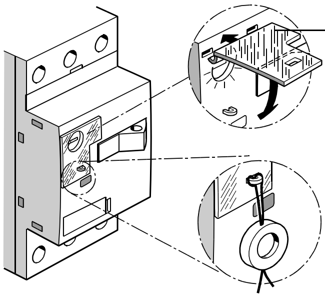


Figure 2-3: Sealing the adjustment scale (frame size S00)

Switches

The state of the circuit breakers can be determined by the position of the switches:

Frame size	Switch	STOP	ON	Tripped
S00	Toggle switch	O	I	O
S0, S2, S3	Rotary switch	OFF	ON	Tripped

Table 2-2: Contact position indicators of the circuit breakers

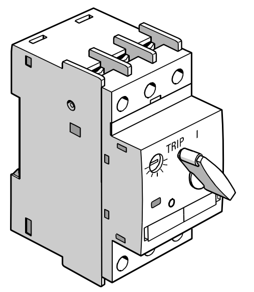


Figure 2-4: Tripped position, 3RV (frame size S0)

Locking the circuit breakers

You can prevent the circuit breaker from being switched on by unauthorized persons by securing the switch drive (toggle switch or rotary switch) with a padlock (shackle diameter 3.5 to 4.5 mm).

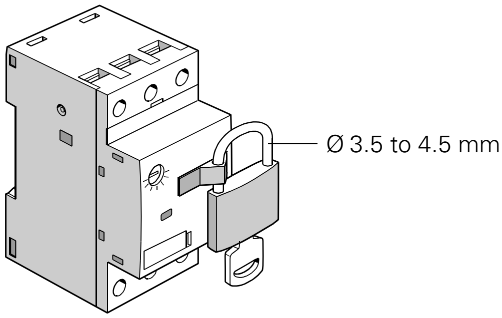


Figure 2-5: Locking the toggle switch (frame size S00)

Reclosing after a tripping operation

After the circuit breaker has been tripped, the switch goes into the tripped position to indicate this. You use the switch to close the circuit again.
In the case of frame sizes S0 to S3, the rotary switch must be put in the OFF position manually before it is switched on again to avoid switching to the fault inadvertently.
In the case of frame sizes S2 and S3, it is possible to switch on and off using a motorized remote-control mechanism (see Section 2.4, Accessories).

Testing overload tripping

The following table shows you how overload tripping of the circuit breaker is tested:

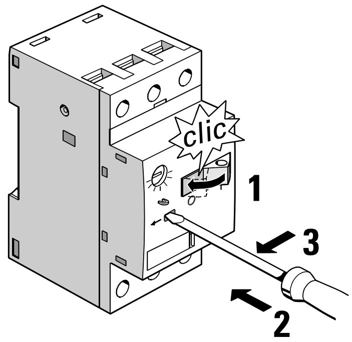
Drawing	Step	Procedure
	**1**	Switch the toggle switch/rotary switch from 0 to 1.
	2, 3	Put a screwdriver in the test opening and push it to the left. Overload tripping is in working order when the toggle switch switches from 1 to 0 (frame size S00) or goes into the tripped position (frame sizes S0 to S3).

Table 2-3: Testing overload tripping (example: frame size S00)

2.2.3 Information on configuration

Short-circuit protection

The short-circuit releases of the 3RV1 circuit breakers execute a three-phase isolation of the faulty load feeder from the network and prevent any further damage.
With a short-circuit breaking capacity of 50 kA or 100 kA and a voltage of 400 VAC, the switches are considered to be short circuit-proof, since higher short-circuit currents are not to be expected where the switches are installed.
Backup fuses are only required if the short-circuit current at the point of installation exceeds the rated short-circuit breaking capacity of the circuit breakers.
You will find the short-circuit breaking capacity for other voltages and the size of any required fuse listed in Section 2.6, Technical specifications.

Conditions of application

3RV1 circuit breakers are climate-proof. They are intended for use in closed areas where there are no harzardous operating conditions such as dust, corrosive fumes or destructive gases.
Appropriate housings are available as an accessory for use in dusty and damp areas (see Section 2.4).

Inrush current

Because the operational currents, the starting currents and the current spikes vary on account of the inrush current, even in motors of the same power, the motor powers listed in the tables are only guide values. Most important when selecting the correct circuit breakers are the concrete starting data and rating of the motor to be protected. This also applies to circuit breakers used for transformer protection.

Phase loss sensitivity

The phase loss sensitivity of the circuit breaker ensures that it is tripped in good time in the event of the loss of a phase and the resulting overcurrents in the other phases.
During normal operation, the device should have a three-pole load. To protect single-phase loads or direct current loads, all 3 main conducting paths should be switched in series.

Explosion protection

Note
In the case of a three-pole load, at 5 to 8 times the set current, the release time deviates by a maximum of ± 20% and therefore complies with the requirement of DIN VDE 0165 and EN 50019: 1977 +A1 to A5 and DIN VDE 0165.

Characteristics

The tripping characteristic of the inverse-time delayed overload release (thermal overload release, a-release) is valid for direct current and alternating current with frequencies of 0 to 400 Hz.

The characteristics are valid for tripping operations from a cold state. From a warm state, the release times of the thermal releases are reduced to approximately 25 %.

The tripping characteristics of the instantaneous electromagnetic overcurrent releases (short-circuit release, n-release) is based on the rated current I_n, which in circuit breakers with adjustable overload releases is also the upper value of the adjustment range.
The following is a chart of the time-current characteristic:

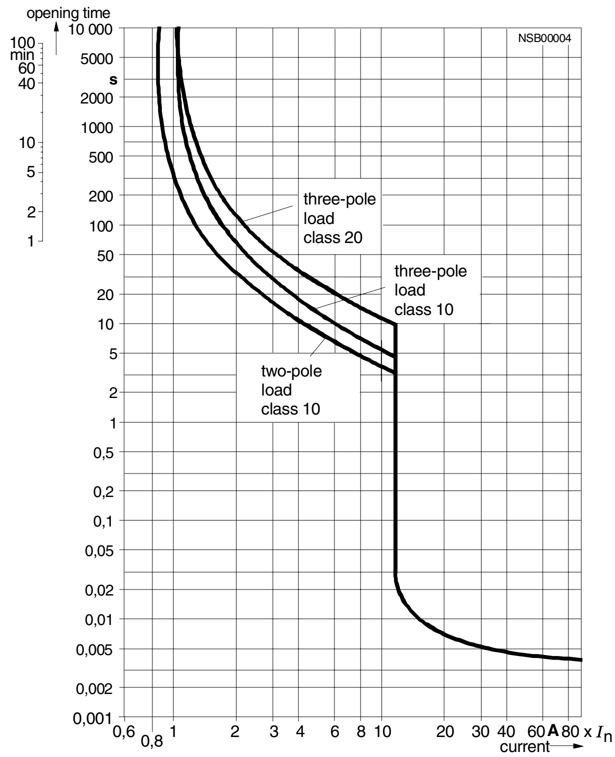


Figure 2-6: Time-current characteristic, chart

Time-current characteristics, current-limiting characteristics and I^2t characteristics can be requested directly from your sales representative, if necessary.

Frequency sensitivity of the short-circuit releases

The characteristics of the short-circuit releases apply to frequencies of 50/ 60 Hz. For lower frequencies, such as 16 $^2/_3$ Hz, for higher frequencies up to 400 Hz, and for direct current, appropriate correction factors have to be taken into account.
The following characteristic curve illustrates the frequency sensitivity of the short-circuit releases (calibrated to 12 times I_u +20%):

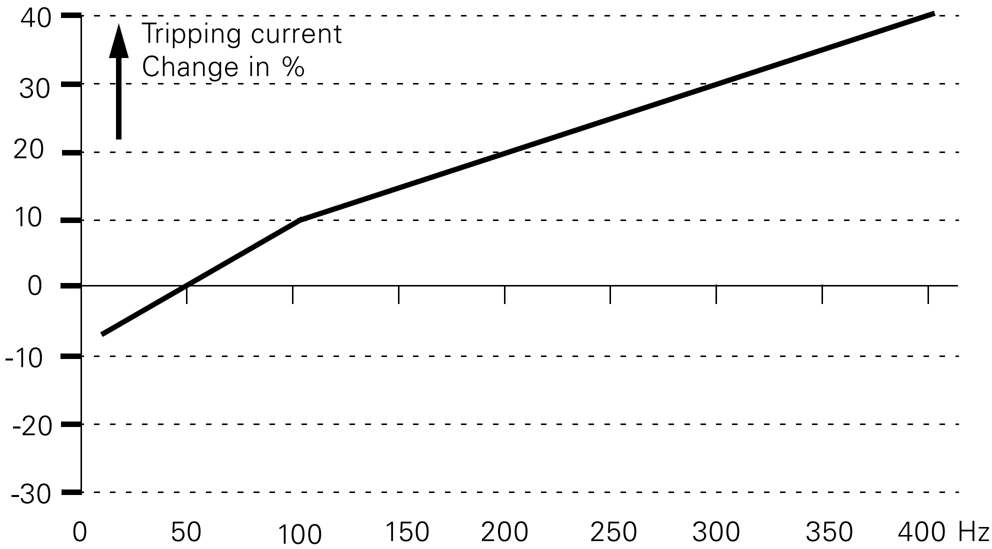


Figure 2-7: Frequency sensitivity of the n-short-circuit releases

The increase in tripping current is approximately 30% for DC voltage.

Frequency converters

The thermal switch disconnectors do not have to be corrected when you use frequency converters.

2.3 Field of application/variants

The tripping characteristics of the 3RV1 circuit breakers are designed primarily to protect three-phase induction motors.
The circuit breakers are therefore also referred to as motor protecting switches.
The 3RV1 circuit breakers for motor protection are limited to the protection of systems.

2.3.1 Motor protection

Set current

The current of the motor that is to be protected is set on the adjustment scale. The short-circuit release is set at the factory to 12 times the value of the rated current of the circuit breaker. This ensures problem-free startup and reliable protection of the motor.

Phase loss sensitivity

The phase loss sensitivity of the circuit breaker ensures that it is tripped in good time in the event of the loss of a phase and the resulting overcurrents in the other phases.

CLASS10/CLASS20

Circuit breakers of frame sizes S00 to S3 with thermal overload releases comply with tripping class 10 (CLASS 10). Circuit breakers with the CLASS 20 tripping characteristic are available for frame sizes S2 and S3 in difficult startup conditions.

2.3.2 Transformer protection

Inrush current

In the case of primary protection of control transformers, the high inrush currents that occur when the transformers are switched on often result in the unwanted tripping of the protective devices.
The 3RV1 circuit breakers with frame sizes S0 and S2 therefore have overcurrent releases for the protection of transformers that are set at the factory to approximately 19 times the rated current. This makes it possible to protect transformers in which the inrush currents reach peak values of up to 30 times the rated current with circuit breakers in the primary circuit.

In the case of 4AM control transformers with low inrush current (Siemens control transformers, for example), this is not required. 3RV1 circuit breakers can be used here for motor protection.

2.3.3 Starter protection

The 3RV13 starter protection switches are circuit breakers without overload releases. They are used together with a contactor and overload relay if the circuit breaker is not to be triggered in the case of overload tripping.

2.3.4 Circuit breakers with overload relay function

Circuit breakers with the 3RV11 overload relay function are available for frame sizes S0, S2, and S3.

Description

Circuit breakers with the overload relay function contain overload releases that do not affect the breaker mechanism of the circuit breakers. In the event of an overload, the circuit breaker remains switched on.
To protect the following loads, 2 auxiliary contacts (1S + 1Ö) are attached on the right side. These are operated in the event of an overload. The auxiliary switch function can be evaluated or used to disconnect a downstream contactor. After the circuit breaker has cooled down, the auxiliary contacts are reset automatically.

Caution
In the overload range, the circuit breaker does not protect itself with the overload relay function. You must therefore ensure that the circuit breaker is safely disconnected by means of a downstream switching device (e.g. a contactor).

Fixed link: auxiliary contacts with circuit breaker

Note:
The auxiliary contacts are connected to the circuit breaker on the right side and cannot be removed.

Diagrams

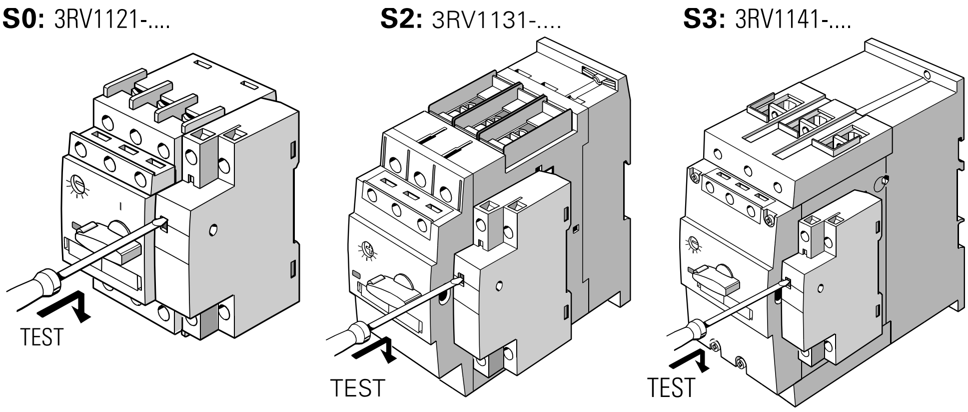


Figure 2-8: Circuit breaker with overload relay function (frame sizes S0 to S3)

2.3.5 Fuse monitoring

The 3RV16 11-0BD10 circuit breaker is used with frame size S00 for fuse monitoring.
A conducting path of the circuit breaker is switched in parallel for each fuse. If one fuse fails, the current flows via the parallel-switched conducting path of the circuit breaker and trips it.

Warning
Fuse monitoring using the 3RV16 11-0DB10 circuit breaker is not permissible in feeders with power control regulators where a DC feedback with higher values can occur in the event of a fault.

Auxiliary switch functions

The circuit breaker used for fuse monitoring can be equipped with a transverse or lateral auxiliary switch (Section 2.4, Accessories). The auxiliary switch reports the tripping of the circuit breaker and thus the failure of the fuse and initiates an all-pole disconnection of the problem circuit by a corresponding switching device.

Safety sign

Note
When fuses used for isolation purposes are monitored, a warning sign must be put up next to them. Via the parallel-switched voltage circuit of the monitoring facility, voltage may get into the area that is supposed to be isolated if the monitoring equipment has not bee disconnected.

We suggest the following text for the warning:

Attention
To ensure isolation, also disconnect the fuse-monitoring device with the item designation ....

Voltages

The 3RV16 11-0DB10 circuit breaker is suitable for fuse monitoring in the following voltage ranges:
- 24 to 690 VAC, 50/60 Hz
- 24 to 250 VDC, 100 to 600 VDC

Switching capacity I_{CN} 100 kA

Circuit diagrams

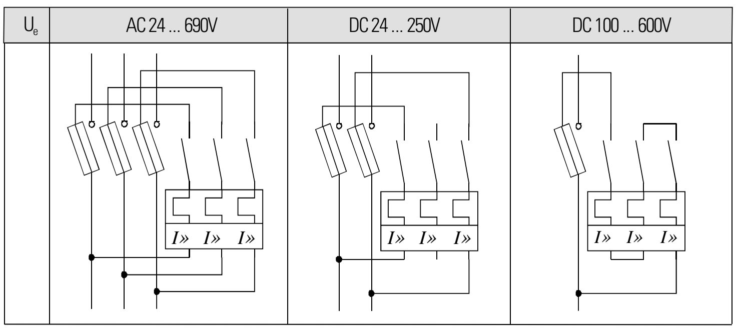


Figure 2-9: Circuit diagrams of circuit breakers for fuse monitoring

Parallel cables/meshed networks

Attention
In the case of parallel cables and meshed networks, a tripping operation and report only occurs when the voltage difference at the circuit breaker is at least 24 V.

2.3.6 Switching direct current

The 3RV1 circuit breakers for alternating current are suitable for switching direct current. However, you must note the maximum permissible DC voltage per conducting path. In the case of higher voltages, series connection of 2 or 3 conducting paths is required.

Response thresholds

The response thresholds of the overload releases remain unchanged. The response thresholds of the short-circuit releases are increased with direct current by approximately 40%.
The following table lists suggestions for switching direct current:

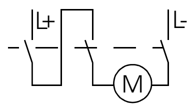
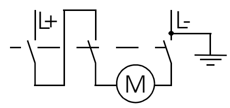
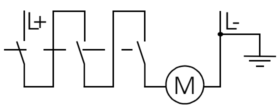
Suggestion	Circuit breaker	Frame size	Max. permissible direct voltage E_I	Meaning
	3RV1.	S00 to S3	150 VDC	2-pole switching Ungrounded system If a ground fault can be excluded, or if every ground fault is immediately corrected (ground-fault monitoring), the maximum permissible DC voltage can be tripled.
	3RV1.	S00 to S3	300 VDC	2-pole switching Grounded system The grounded pole must always be assigned to the individual conducting path so that in the event of a ground fault there are always 2 conducting paths in series.
	3RV1.	S00 to S3	450 VDC	1-pole switching Grounded system 3 conducting paths in series. The grounded pole should be assigned to the unswitched conducting path.

Table 2-4: Suggestions for switching direct current

Double ground fault

Note
In the case of the circuit with 2-pole switching and an ungrounded system, it is assumed that even in the event of a double ground fault that bridges two contacts, safe disconnection still occurs.

2.3.7 Main and emergency stop switches

Since the circuit breakers meet the requirements for disconnectors in acc. with IEC 60947-3 and the additional test requirements for circuit breakers with disconnector features in acc. with IEC 60947-2, they can be used with the appropriate accessories as main and emergency stop switches. They must also comply with DIN VDE 0113.

2.4 Accessories

2.4.1 Attachable accessories: Overview

Auxiliary switches, alarm switches, auxiliary releases and other accessories can be easily attached to the circuit breakers without tools, as required.

Accessories	Function/use	Width	Attach to
Transverse auxiliary switch	The contacts of the auxiliary switches close and open together with the main contacts of the circuit breaker. Variants: • 1 changeover contact • 1 NO + 1 NC contact • 2 NO contacts	Width of the circuit breaker remains the same	Front
Electronically optimized transverse auxiliary switch	One transverse auxiliary switch can be attached for each circuit breaker: Variants: • 1 changeover contact		
Lateral auxiliary switch	One lateral auxiliary switch can be attached for each circuit breaker: • 1 NO + 1 NC contact • 2 NO contacts • 2 NC contacts • 2 NO + 2 NC contacts	9 mm 18 mm	Left side
Alarm switch Frame sizes S0, S2 and S3	One alarm switch can be attached at the side of the circuit breakers with rotary switches. The alarm switch has two contact systems: • One contact system (1 NO + 1 NC) reports a general **tripping operation**, irrespective of whether it was caused by a short circuit, overload or auxiliary release. • The other contact system (1 NO + 1 NC) only switches in the event of a **short circuit** tripping operation. To reclose the circuit breaker after a short circuit, the alarm switch must be reset manually after the cause of the error has been eliminated.	18 mm	
Shunt release	Remote release of the circuit breaker: • Via PLC: The coil of the release should be connected to the voltage only briefly • Especially suitable for emergency stop disconnection by means of appropriate emergency stop switches in acc. with DIN VDE 0113	18 mm	Right side Accessories cannot be attached on the right of a circuit breaker with a relay function.
Undervoltage release	Trips the circuit breaker in the event of a voltage interruption (e.g. when the power plug is removed) and prevents the motor starting up inadvertently when the voltage returns.		
Undervoltage release with leading auxiliary contacts 2 NO	Function and use, see undervoltage release. Additional function: The auxiliary contacts isolate the undervoltage release from the power system on both sides in the event of breaking or a tripping operation and thus prevent voltage distortion to the control circuit when the switch is in the off position. It is possible to reclose the circuit breaker because the contacts reclose.		

Accessories	Function/use	Width	Attach to
Disconnecting module Frame sizes S0 and S2	The supply is fed to the circuit breaker via the disconnecting module. A connector which can only be removed when the circuit breaker is switched off isolates the circuit breaker from the power system on 3 poles. The shock-protected isolation position is easily visible and is secured by a padlock to ensure that the connector cannot be used during maintenance work, for example.	Width of the circuit breaker remains the same	Upper side
Motorized remote-control mechanism For frame sizes S2 and S3	The circuit breakers can be opened and closed via the remote-controlled mechanism by means of electrical commands. This enables a load or system to be disconnected from and then reconnected to the power system from an operator control panel. The circuit breaker can be disconnected from and reconnected to the remote-control mechanism in situ.		
Rotary switch extension for the door	The rotary switch extension for the door consists of a knob, a drive coupling and an extension shaft. They comply with IP 65. The door interlock prevents the cubicle door being opened inadvertently when the switch is in the on position. The off position can be secured with a maximum of 3 padlocks.		
Emergency stop rotary switch extension	Rotary switch extension with emergency stop function.		

Table 2-5: Attachable accessories

2.4.2 Auxiliary switch, alarm switch, and auxiliary release

The maximum configuration for each 3RV1 circuit breaker is one transverse auxiliary switch, one lateral auxiliary switch, one alarm switch, and one auxiliary release.

Possible combinations

The following combinations of auxiliary switches and alarm switches or of auxiliary switches are possible:

- Auxiliary and alarm switches can be installed individually or together. The lateral auxiliary switch is installed on the left of the alarm switch.
- Transverse and lateral auxiliary switches can be combined.
- One auxiliary release can be attached on the right for each circuit breaker:

Mounting the auxiliary switches

The auxiliary switches, alarm switches, and auxiliary releases are mounted in the same way for all frame sizes:

Transverse auxiliary switch (3RV1901-1D, -1E, -1F)

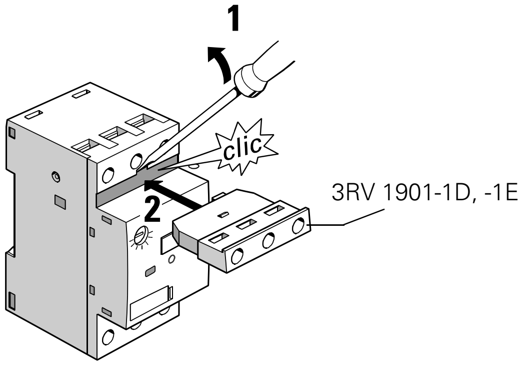


Figure 2-10: Mounting the transverse auxiliary switch (frame size S00)

Lateral auxiliary switch (3RV1901-....)
Undervoltage release (3RV1901-....)

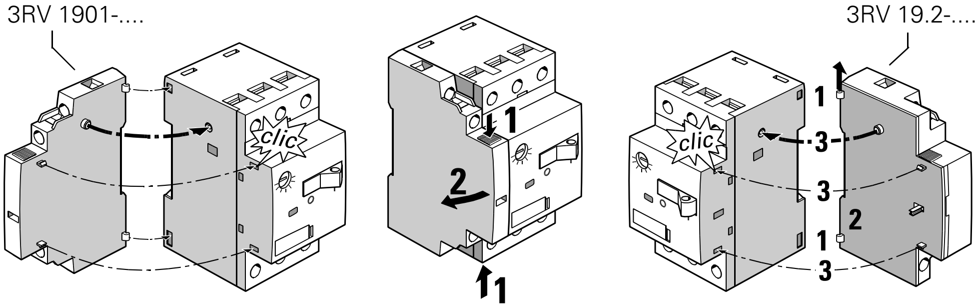


Figure 2-11: Mounting/removing the lateral auxiliary switch/undervoltage release (frame size S00)

Voltage ranges of the auxiliary releases

One undervoltage release or shunt release can be installed for each circuit breaker. The following voltage ranges are possible:

Auxiliary release	Frequency	
Undervoltage release	**AC 50 Hz**	**AC 60 Hz**
	24 V 110 V 230 V 400 V 415 V	 120 V 208 V 240 V 480 V
Undervoltage release with leading auxiliary contacts	230 V 400 V 415 V	240 V 480 V
Shunt release	**AC 50/60 Hz 100% duty cycle 1)**	**AC 50/60 Hz; DC 5 sec. duty cycle 2)**
	20 V - 24 V 90 V - 110 V 210 V - 240 V 350 V - 415 V 500 V	20 V - 70 V 70 V - 190 V 190 V - 330 V 330 V - 500 V -

Table 2-6: Voltage ranges of the auxiliary releases

1) Transformer operational voltage of the lower mark of the voltage range at 0.85 (Tu = 60 °C) is valid for 100% (continuous) duty cycle only at AC 50/60 Hz
2) Transformer operational voltage of the lower mark of the voltage range at 0.9 (Tu = 60 °C) is valid for 5 seconds duty cycle at AC 50/60 Hz and DC

Mounting the alarm switch

The following table explains how the 3RV19.2-.... alarm switch is mounted onto the circuit breaker:

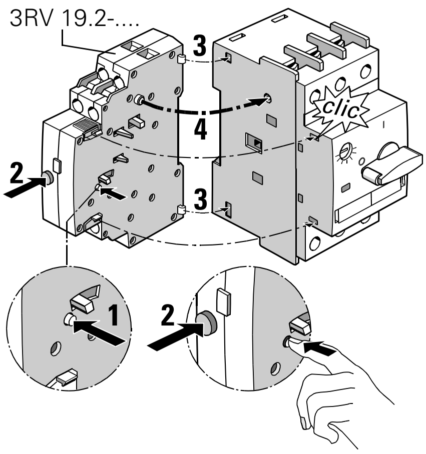
Drawing	Step	Procedure
	1	Press and hold down the transport safety button on the inside of the alarm switch.
	2	Then press the blue RESET button on the front of the alarm switch.
	3	Hook the alarm switch onto the circuit breaker.
	4	Move the alarm switch towards the circuit breaker until you hear it click into place.

Table 2-7: Testing overload tripping (example: frame size S0)

Alarm switch signals

The alarm switch has two signals:
- Tripped
- Short circuit

The following table lists the signals, the status of the alarm switch, and the procedure required:

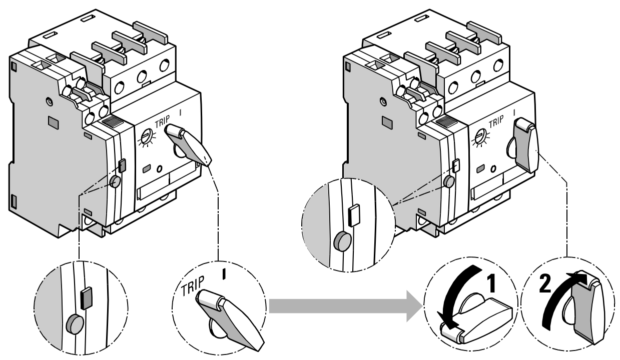
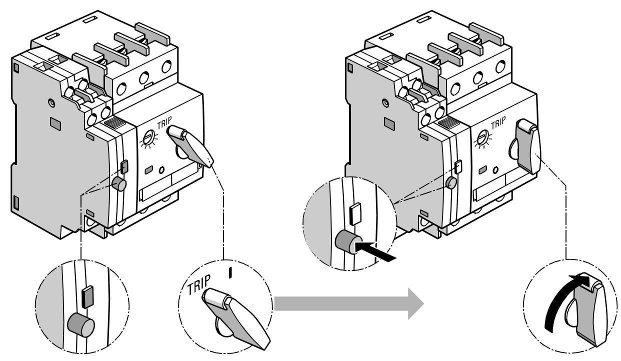
Drawing	Status	Procedure
	**Tripped signal** Tripped position LED: Red RESET button (blue): remains depressed	Switch off (0 position) Switch on again (I position)
	**Short circuit** Tripped postion LED: red RESET button (blue): not depressed	Switch off (0 position) Switch on again (I position) RESET button (blue): press

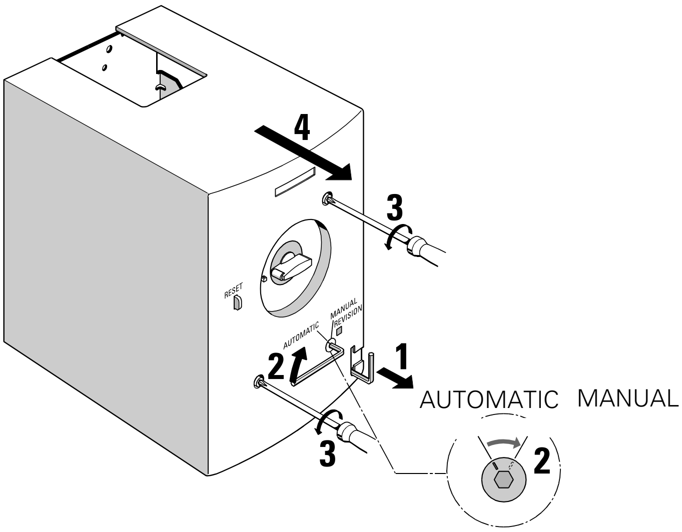
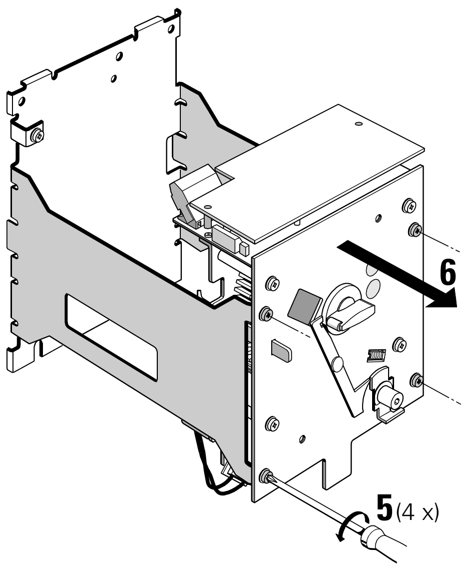
Table 2-8: Alarm switch with tripped signal and short circuit signal

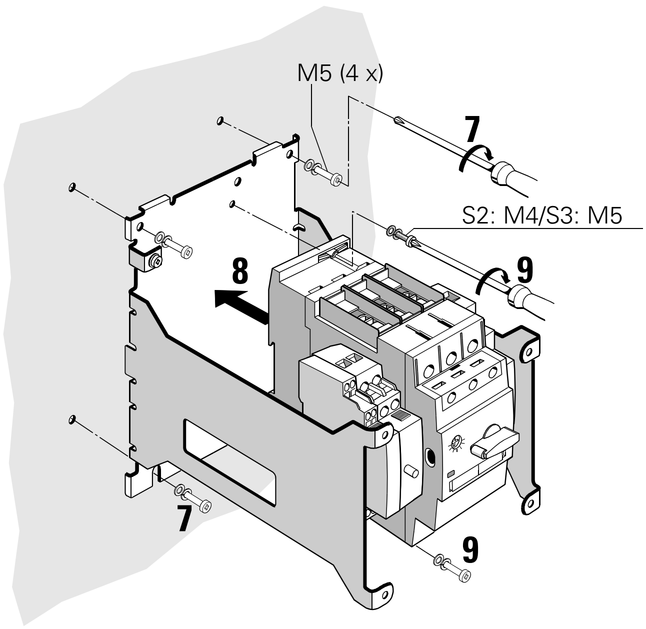
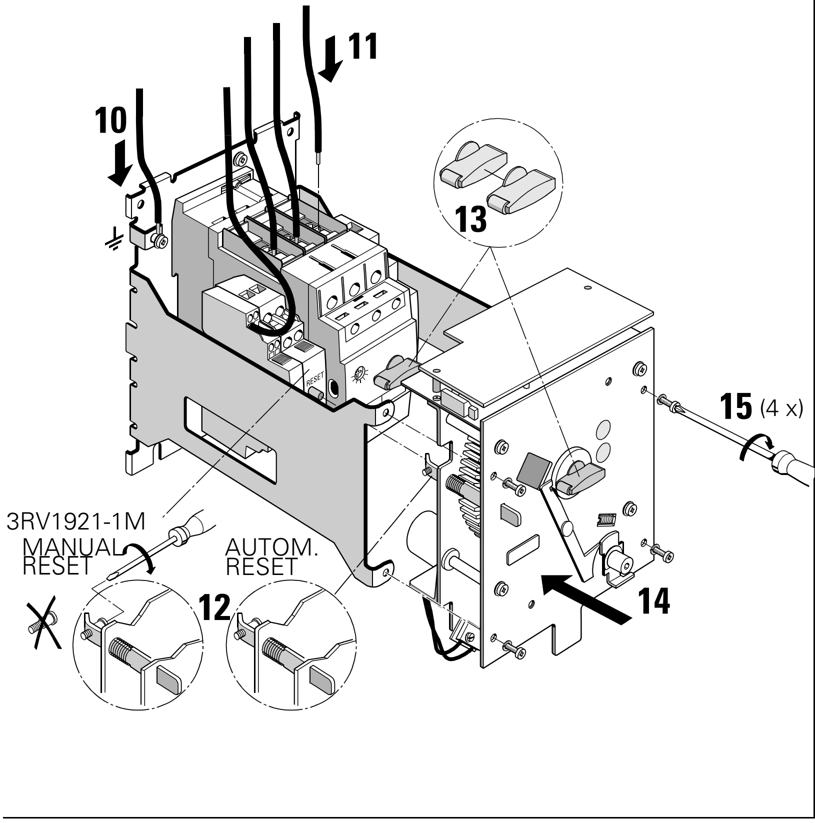
2.4.3 Motorized remote-control mechanism

The motorized remote-control mechanism is available for 230 VAC, 50 Hz and 24 VDC
- Frame size S2: I_{nmax} = 50 A
- Frame size S3: I_{nmax} = 100 A

Mounting and connection

The following table shows you how to mount and connect the motorized remote-control mechanism:

Drawing	Step	Procedure
	1	Remove the Allen key from the cover of the circuit breaker.
	2	Use the Allen key to change the selector switch to "Manual".
	3, 4	Undo the 2 screws and remove the cover.
	5, 6	Undo the 4 screws on the remote-controlled mechanism, and remove it. (Pozidriv 2).

Drawing	Step	Procedure
	**7**	Screw the frame onto the mounting surface using 4 screws (M5).
	8, 9	Attach the circuit breaker using 2 screws. Attention: Use screws 14 mm in length.
	**10**	Attach the ground wire.
	11	Connect the main and control wires to the circuit breaker.
	12	If desired, set MANUAL RESET: Remove the screw from the RESET lever.
	13-15	Put the remote-control mechanism module into place, making sure that the driver covers the knob on the circuit breaker, and screw it on.

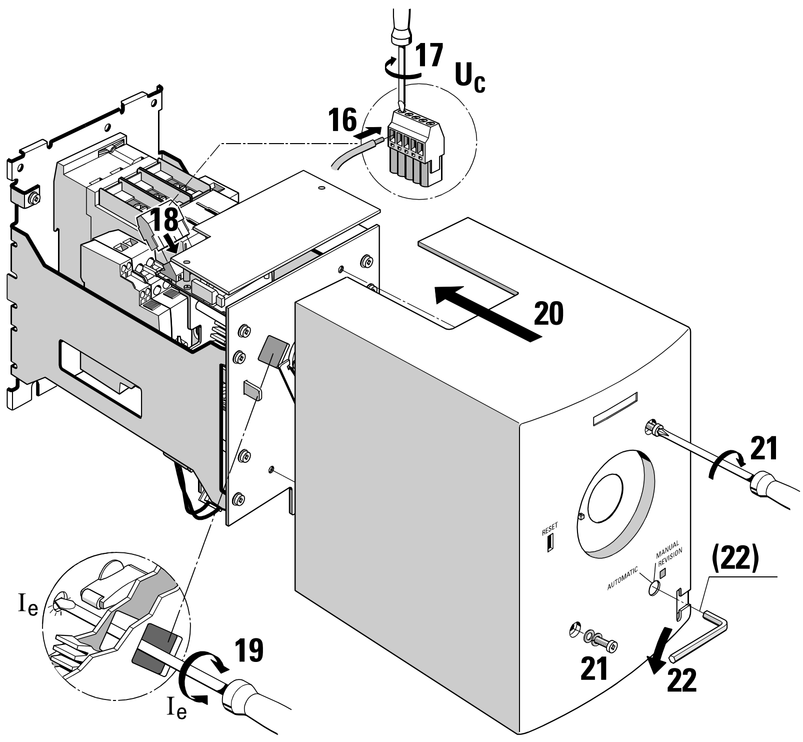
Drawing	Step	Procedure
	**16-18**	Screw the control wires for the remote-control mechanism onto the connector, and insert it.
	19	Set the current.
	20, 21	Put the cover on, and screw it tightly.
	22	Use the Allen key to switch to AUTOMATIC and replace the Allen key in the cover.

Table 2-9: Mounting the remote-control mechanism (frame size S2)

Warning
Do **not** set the "Automatic" position or operate the remote-control mechanism when open! There is a risk of injury!

If used as an emergency stop, it is not permissible to switch on manually.

Manual RESET

Remove the screw from the RESET lever (step **12**)

2.4.4 Disconnecting module

The disconnecting module is suitable for creating a visible isolating distance. The isolating connector can only be removed in a deenergized state. The isolating distance can be secured with padlocks when open. Disconnecting modules are available for the circuit breakers of frame sizes S0 and S2.

Mounting sequence for the disconnecting module and lateral auxiliary switch

Attention
The disconnecting module covers the terminal screws of the transverse auxiliary switch. We therefore recommend that you use the lateral auxiliary switches or that you only install the disconnecting module once the transverse auxiliary switch has been wired.

Locking

Disconnecting modules can be mounted on the circuit breakers of every frame size. The modules are mounted in the same way for frame sizes S0 and S2. The following diagrams show you how to mount the disconnecting module for frame size S0 (3RV1928-1A):

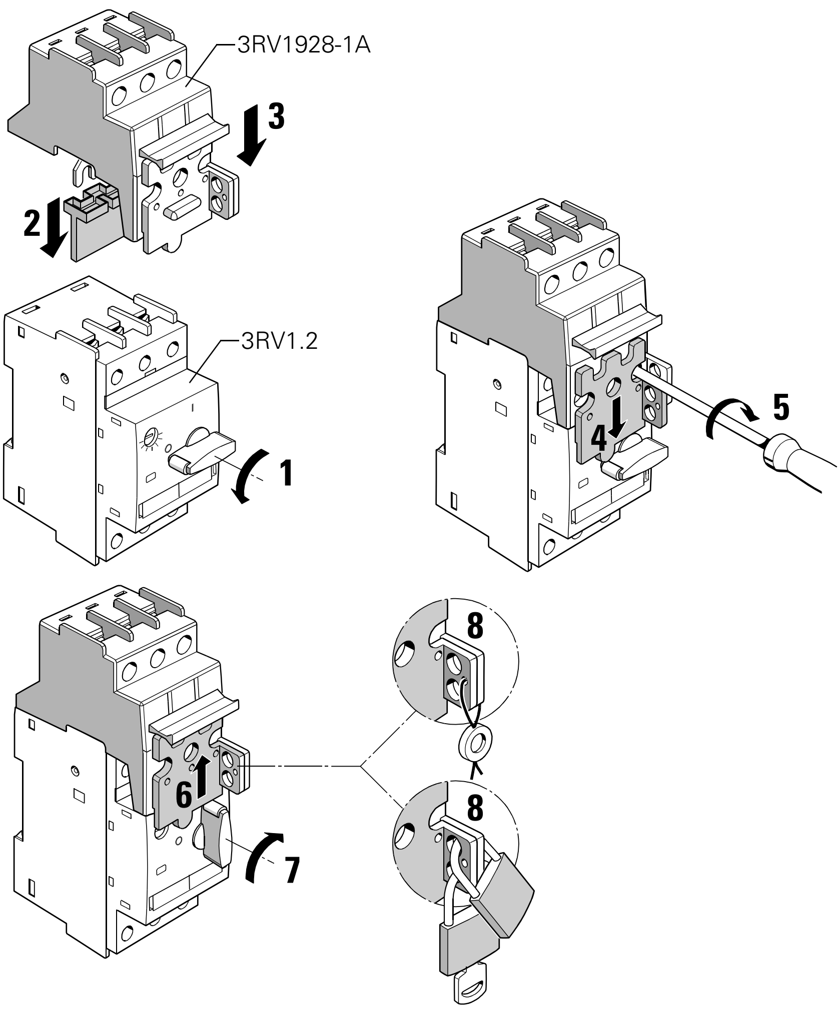


Figure 2-12: Mounting the disconnecting module (frame size S0)

Disconnecting and locking

The disconnecting module can be locked and sealed or secured with two padlocks if the connector is removed during maintenance work, for example. The circuit breaker itself can also be secured with a third padlock.

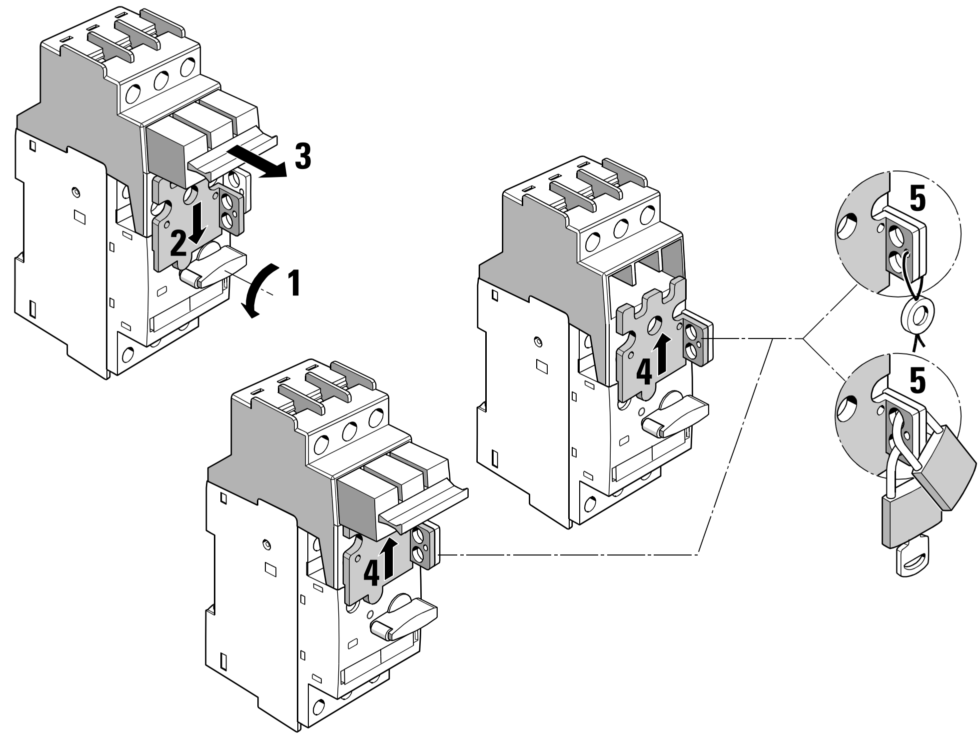


Figure 2-13: Locking the disconnecting module (frame size S0)

Terminal cover (frame size S2)

A terminal cover (3RT1936-4EA2) is available for the disconnecting module in frame size S2 (3RV1938-1A) that protects the contacts from dirt and provides additional shock protection.

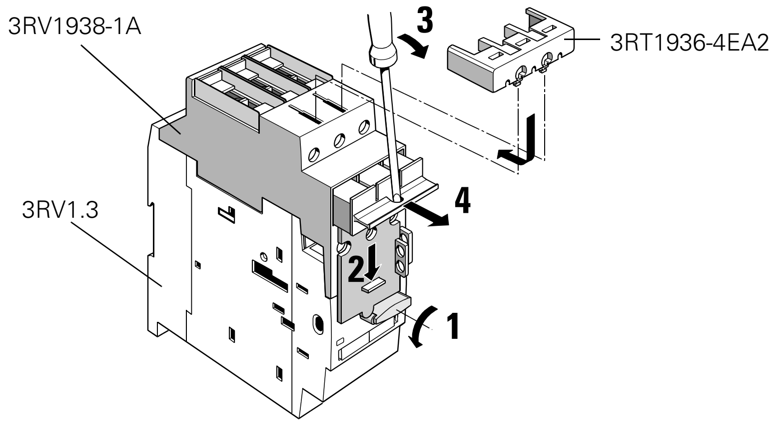


Figure 2-14: Locking the disconnecting module and mounting the cover (frame size S2)

2.4.5 Rotary switch extension for door

Rotary switch extensions for doors are available for frame sizes S0, S2, and S3. They consist of a lockable rotary switch with a detachable door coupling, a 150 mm long extension shaft, and a connector for the switch drive. The door handle complies with IP 65.

Installation

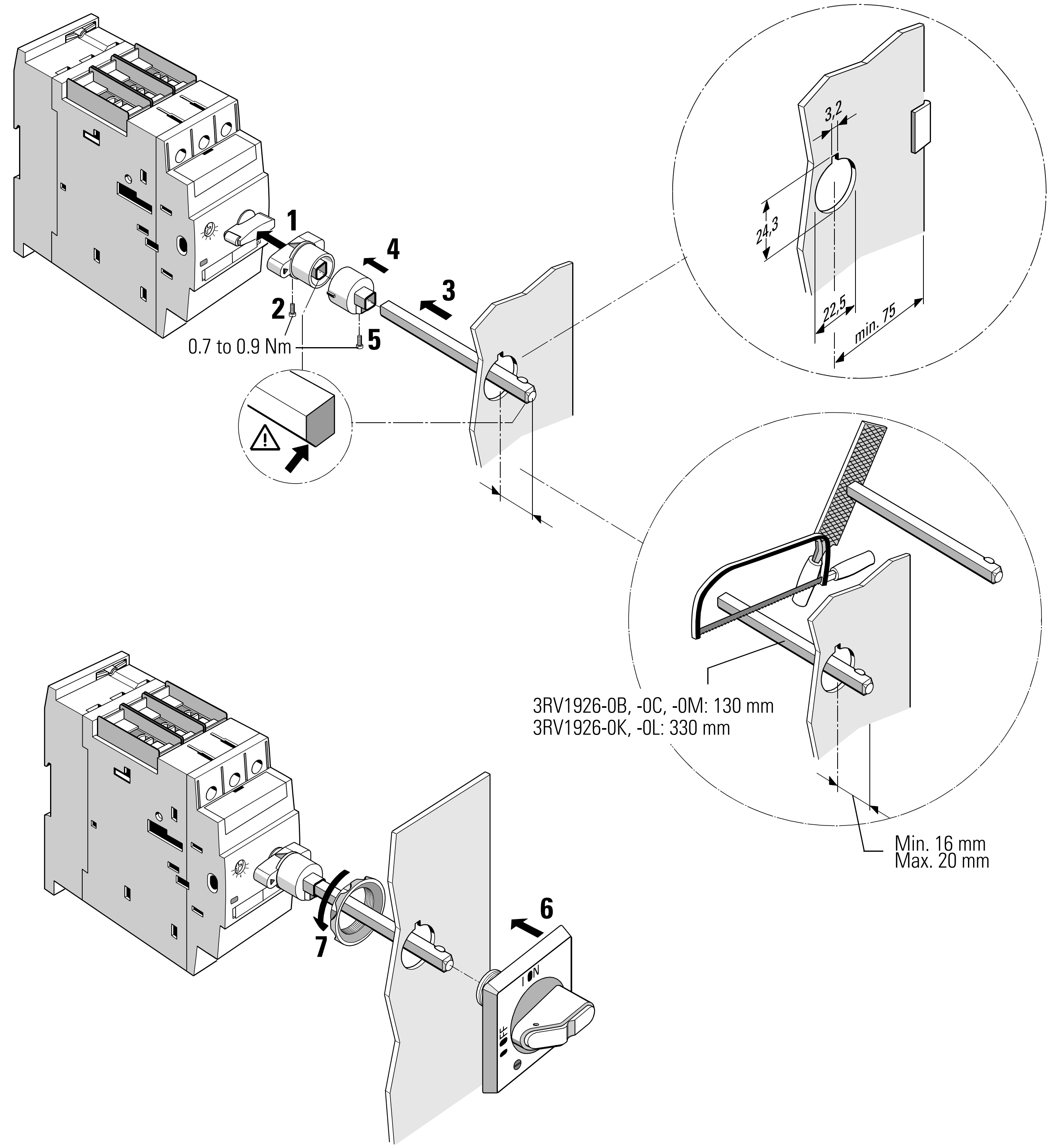


Figure 2-15: Mounting the rotary switch extension for the door (frame size S2)

Opening the door

The following table shows you how the cubicle door can be opened using the rotary switch extension for the door:

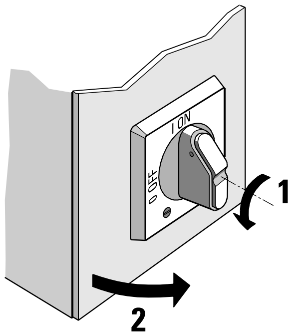
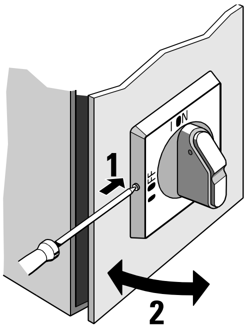
Drawing	Procedure
	To open the cubicle door, set the circuit breaker to O (OFF). This releases the extension shaft from the rotary switch and allows the door to be opened.
	If you want to open the cubicle door during operation, you can override the procedure by pressing the button at the side of the rotary knob (step **1**). To close it during operation, press the button again so that the extension shaft snaps into place again.

Table 2-10: Opening a cubicle door using the rotary switch extension

Opening the door with great force

Note:
If the circuit breaker is in the ON position and the door is opened with a force >150 N to 200 N, the cap of the extension shaft is separated from the rotary switch of the circuit breaker to prevent the circuit breaker being destroyed.
The circuit breaker remains in the ON position.

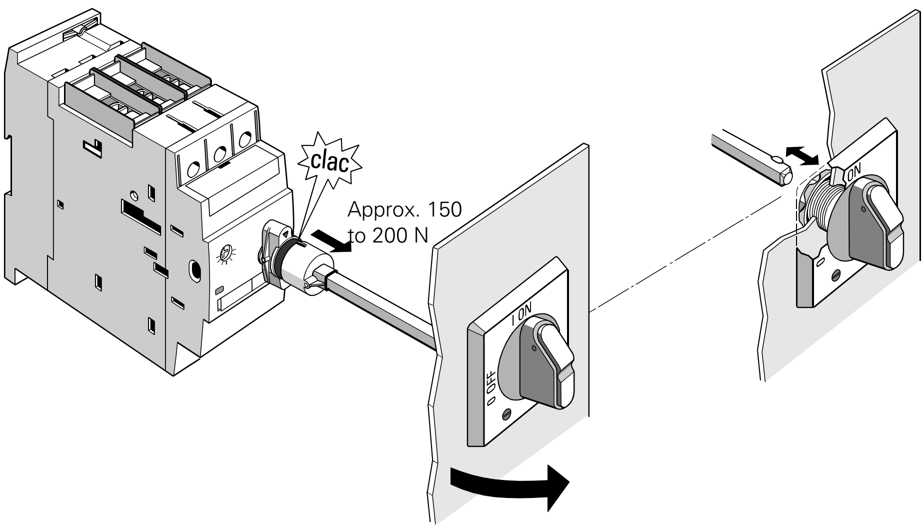


Figure 2-16: Operating the rotary switch extension for the door

The extension shaft must then be remounted on the circuit breaker and the rotary switch extension for the door as follows:

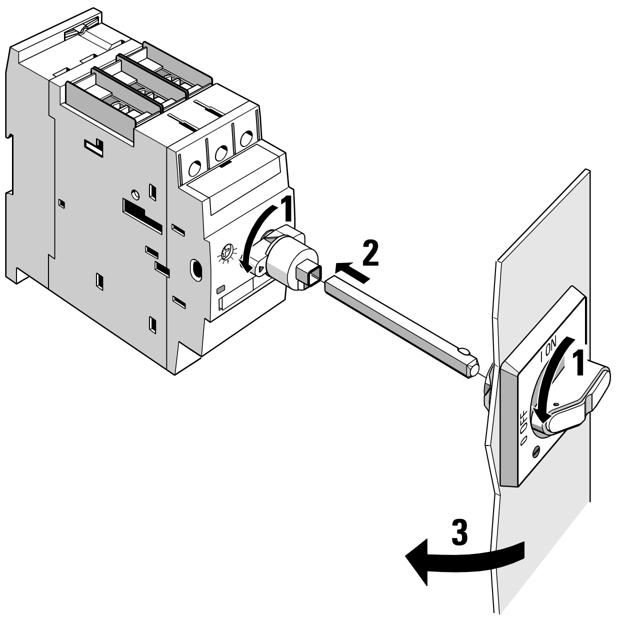
Drawing	Procedure
	**1** Switch the circuit breaker off, and turn the rotary switch on the door to OFF. **2** Put the cap of the extension shaft on the rotary switch of the circuit breaker, and put the extension shaft in the cap. **3** Close the cubicle door.

Table 2-11: Mounting the extension shaft

Security

When the rotary switch is in the OFF position, it can be secured with up to 3 padlocks (e.g. during maintenance work on the system).

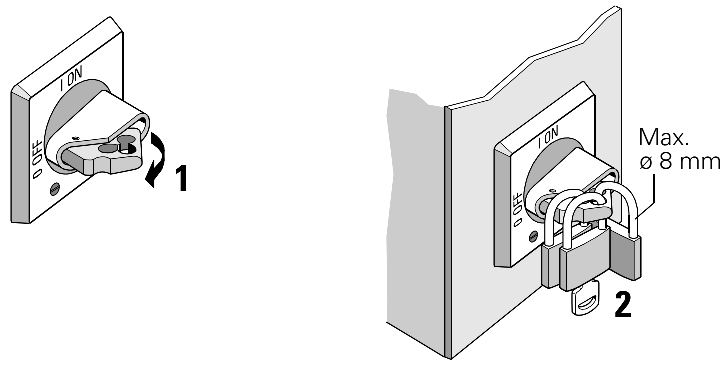


Figure 2-17: Locking the rotary switch extension for the door

2.4.6 Terminals for "Combination Motor Controller Type E" in acc. with UL 508

Since July 16, 2001, 1 inch air clearance and 2 inch creepage distance is required for "Combination Motor Controller Type E" on the input side in acc. with UL 508. Use terminal blocks 3RV1928-1H and 3RT1946-4GA07 for the 3RV10 circuit breakers in frame sizes S0 and S3. The 3RV10 circuit breaker in frame size S2 complies with the required air clearance and creepage distance without a terminal block. Terminal blocks are not required for use in acc. with CSA. These terminal blocks cannot be used in the S0 frame size at the same time as the 3RV19.5 3-phase busbars or in the S3 frame size at the same time as a transverse auxiliary switch.

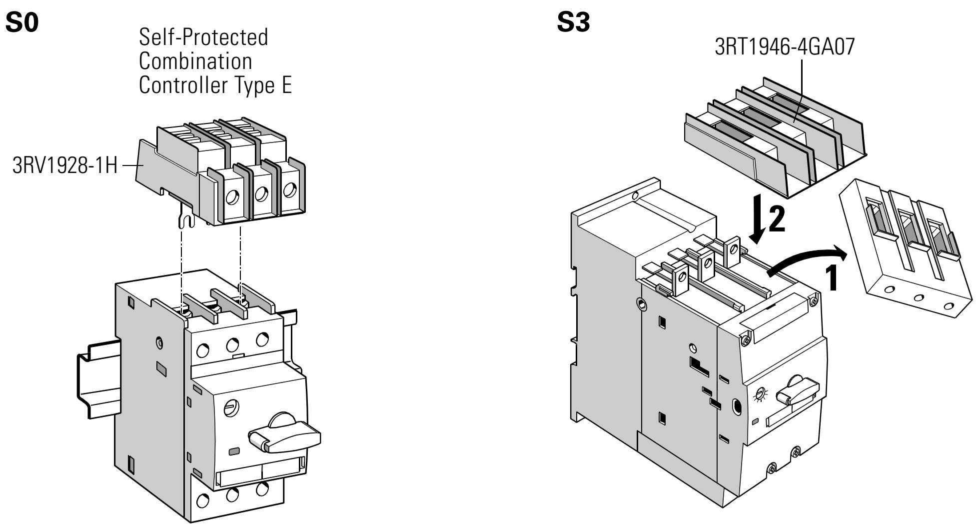


Figure 2-18: Terminals for "Combination Motor Controller Type E"

2.4.7 Housings and mounting accessories

Molded-plastic housings (IP 55) are available if you want to install circuit breakers as single units. All the housings are equipped with neutral and ground terminals. Above and below are two openings that can be knocked out for cable glands. On the back of the housing there are 2 precut openings. All the cable bushings have metric dimensions. The surface casings can be sealed. There is space in the housing on the rail for additional modular terminal blocks.

Model	Molded-plastic ...	Width	Frame size
Housing with actuator membrane for toggle switch	Surface casing	54 mm, 72 mm	S00
	Bay	72 mm	S00
Lockable housing with rotary switch	Surface casing	54 mm, 72 mm 82 mm	S0 S2
	Bay	72 mm	S0
Lockable housing with emergency stop rotary switch (red/ yellow)	Surface casing	54 mm, 72 mm 82 mm	S0 S2
	Bay	72 mm	S0

Table 2-12: Housings for circuit breakers

Widths

The widths of the housing depend on whether auxiliary releases are used:

- 54 mm: circuit breaker + lateral auxiliary switch
- 72, 82 mm: circuit breaker + lateral auxiliary switch + auxiliary release

Mounting the surface casing

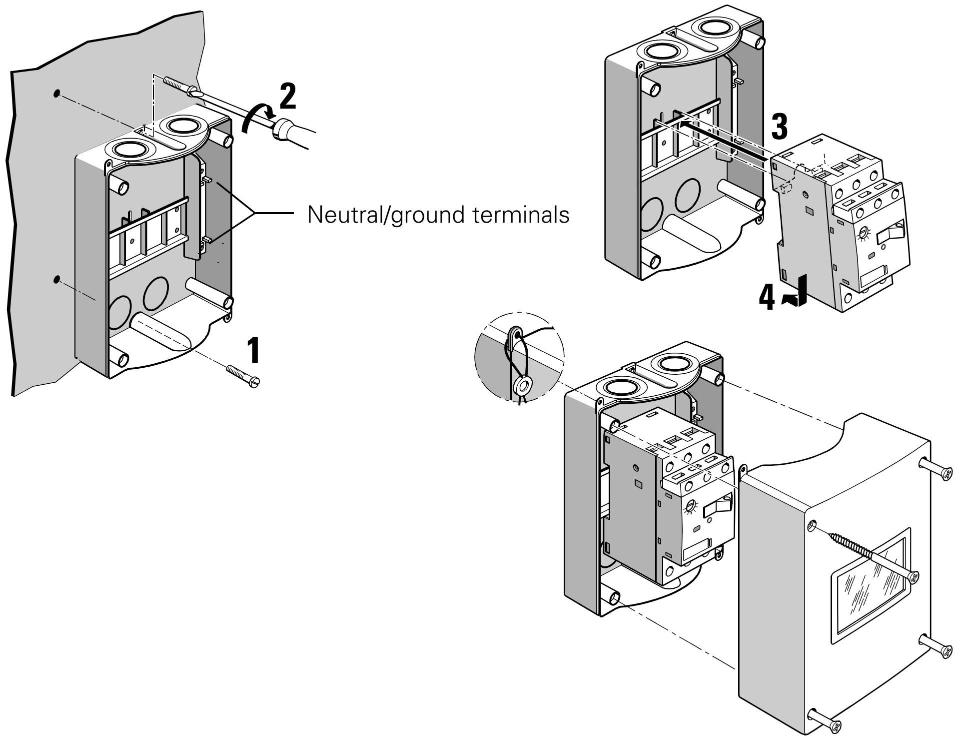


Figure 2-19: Molded-plastic surface casing (frame size S00)

Mounting the bay

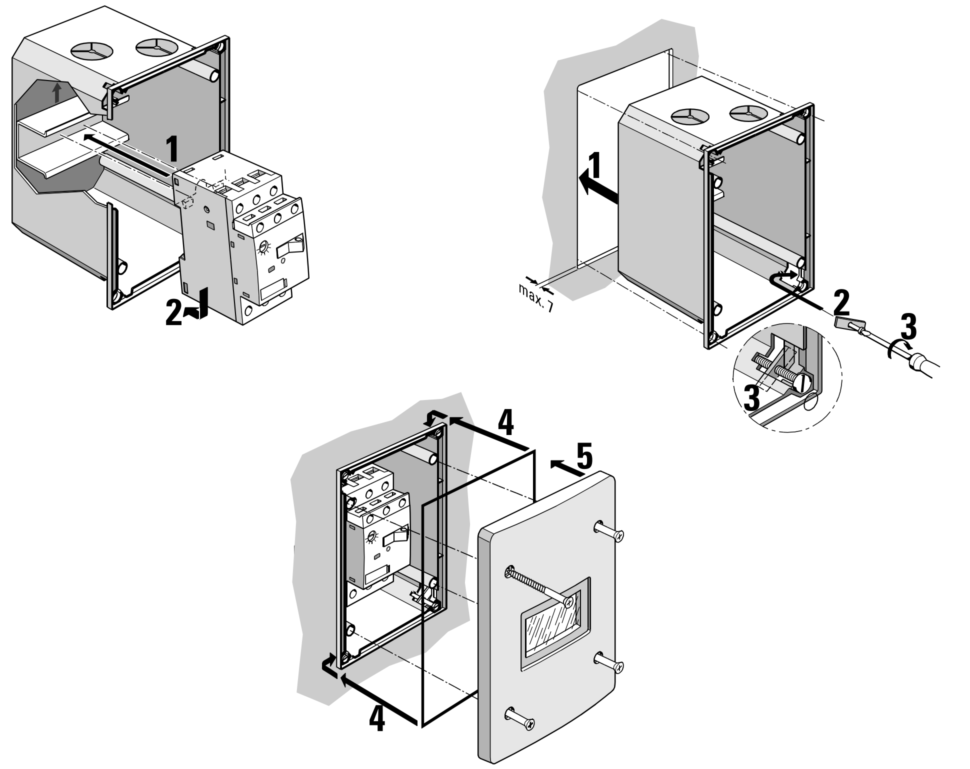


Figure 2-20: Molded-plastic bay (frame size S00)

Front plates

Molded-plastic front plates that have IP 55 protection are suitable for any housing:

Front plates and accessories	Model	Frame size
Front plates	With actuator membrane and support for switch	S00
	With lockable with rotary switch	S0, S2, S3
	With lockable emergency-stop rotary switch (red/ yellow)	S0, S2, S3
Accessories	Support for front plate	S0

Table 2-13: Front plates for any housings

Mounting the front plates

Frame size S00

3RV1913-4C

3RV1913-4B

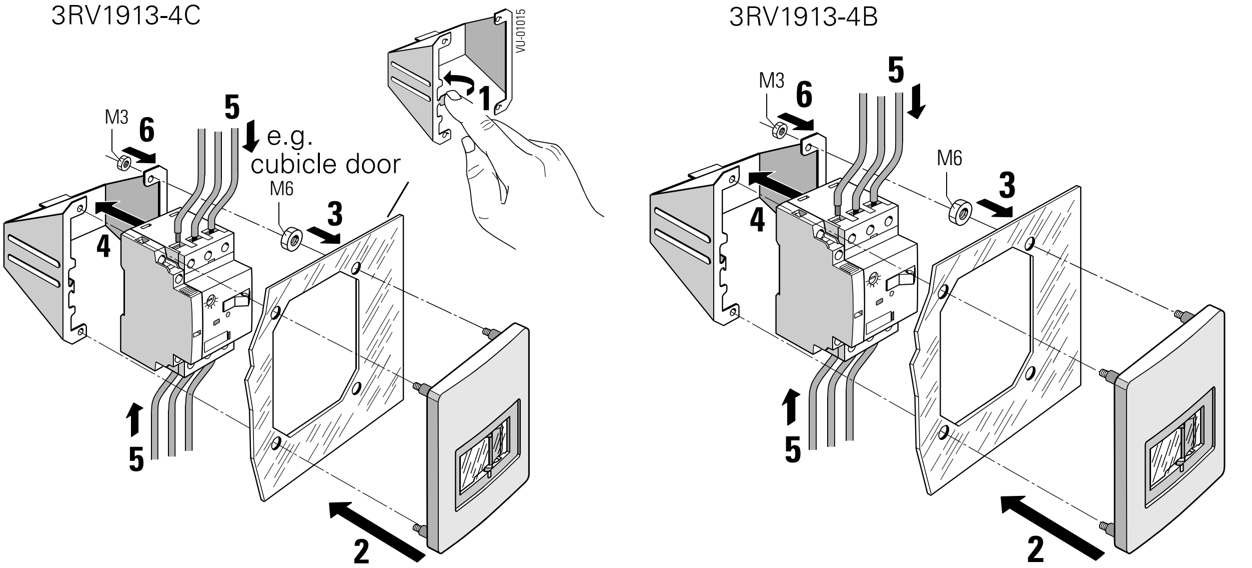
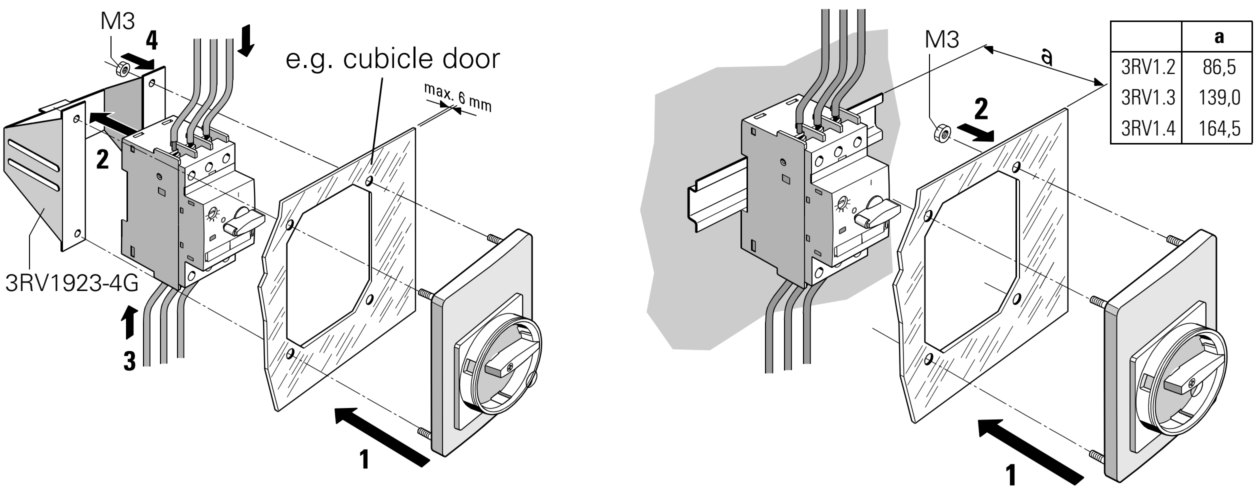


Figure 2-21: Mounting the front plate (frame size S00)

Frame size S0

3RV1923-4. + 3RV1923-4G

3RV1923-4.



	a
3RV1.2	86,5
3RV1.3	139,0
3RV1.4	164,5

Figure 2-22: Mounting the front plate (frame size S0)

Accessories for the housings and front plates (S00)

The following accessories are available for the housings and front plates of the circuit breakers in frame size S00:

- Replacement actuator membrane
- Locking device for 3 padlocks
- Emergency-stop button (red/yellow)
- Emergency-stop button (red/yellow) with safety lock

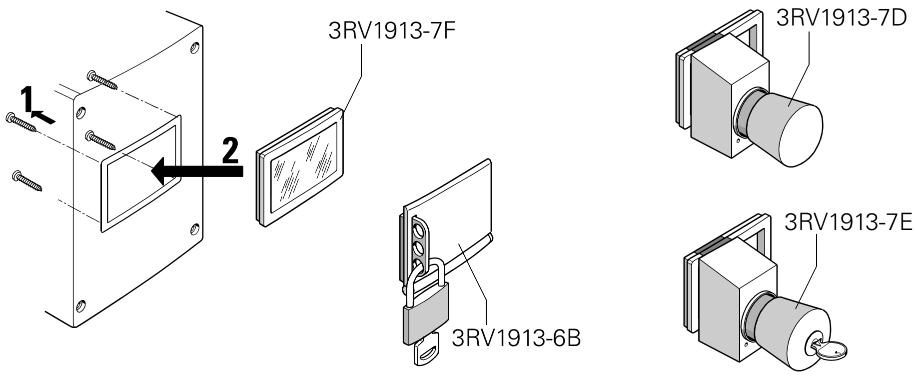


Figure 2-23: Accessories for the housings and front plates (frame size S00)

Locking device

The locking device can be used on the inside of the housings or front plates. To do this, remove the frame of the actuator membrane. The locking device can be secured with up to 3 padlocks that can prevent the circuit breaker from being switched on during maintenance work, for example.

Emergency-stop button

The emergency-stop button is attached to the actuator membrane. When hit, the circuit breaker is switched off and the button locks into position. You can release the button by turning it or using a key. The circuit breaker can then be switched on again.

Indicator lights

Indicator lights are available for the housings and front plates of circuit breakers in frame sizes S00, S0, and S2. They contain a glow lamp and red, green, yellow, orange, and transparent lenses. Indicator lights are available for the following voltage ranges: 110-120 V, 220-240 V, 380-415 V and 480-500 V.

Installation

There is a precut opening on the front of the housing that can be knocked out to install an indicator light:

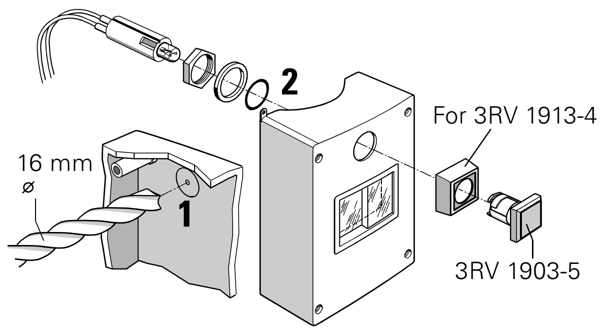


Figure 2-24: Indicator light installation in a molded-plastic housing

2.4.8 Busbar adapter

To enable the circuit breakers to be mounted without using up too much space, and to ensure that the infeed is economical in terms of both time and money, the switches are mounted directly onto busbar systems using busbar adapters.

The circuit breakers are snapped onto the adapter and connected at the input side. This prepared unit is mounted directly onto the busbar systems, thus both attaching it mechanically and establishing electrical contact.

Busbar systems

The adapters are suitable for the following systems:

Busbar systems with center-to-center spacing	**For copper busbars in acc. with DIN 46 433**	
	Width	**Depth**
40 mm systems	12 mm and 15 mm	5 mm and 10 mm
60 mm systems	12 mm to 30 mm	5 mm and 10 mm

Table 2-14: Busbar systems

Accessories

The following accessories are available for busbar adapters:

- Modules that can be mounted on either side to widen the adapters
- Busbar holder for 3 rails
- Molded-plastic covers for 3 terminals (40 mm system)
- Molded-plastic cover profiles for shock protection

Measurements

The following table lists the dimensions of the busbar adapters and accessories.

System	**Busbar adapter and accessories**	**Length**	**Width**	**For circuit breakers in frame size**
40 mm	Circuit breaker + lateral auxiliary switch	121 mm	45 mm 55 mm	S00, S0
	Circuit breaker	139 mm	55 mm	S2
	Circuit breaker	182 mm	70 mm 72 mm	S3 (up to 400 V) S3 (up to 690 V)
	Side module	139 mm 182 mm	13.5 mm 13.5 mm	S2 S3
60 mm	Circuit breaker	182 mm	45 mm	S00, S0
		182 mm	55 mm	S2
		182 mm	70 mm 72 mm	S3 (up to 400 V) S3 (up to 690 V)
	Side module	182 mm	13.5 mm	S00 to S3

Table 2-15: Dimensions of the busbar adapters and accessories

Link module for circuit breaker and contactor

Link modules are needed to make electrical and mechanical connections between the circuit breaker and contactor to form a load feeder. Link modules are available for the following combinations:

Actuating voltage of contactor	Frame size of contactor	For circuit breakers of frame size
AC and DC	S00	S00
	S00	S0
	S0	S0
	S2	S2
	S3	S3

Table 2-16: Link modules for connecting circuit breakers to contactors

You can find additional information about load feeders on busbar systems in Chapter 5, "Fuseless load feeders".

Mounting circuit breakers on busbars

The following illustrations show you how to mount circuit breakers in frame sizes S00 and S0 onto busbar adapters (8US1..1-5D) and how to remove them again, using frame size S00 as an example:

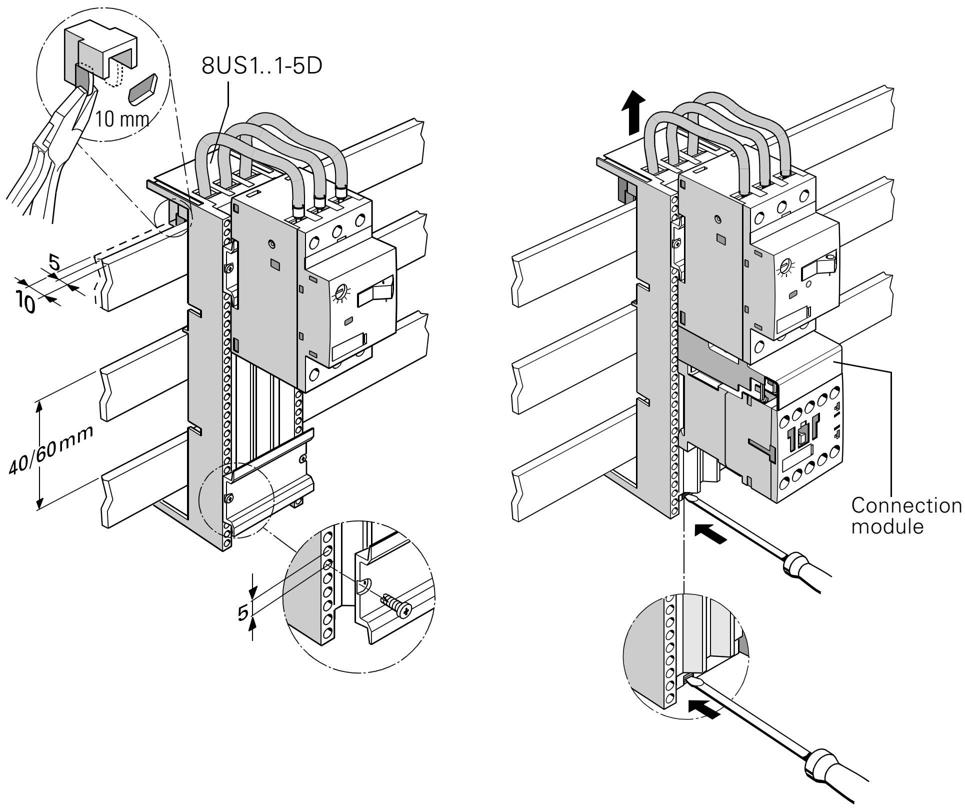
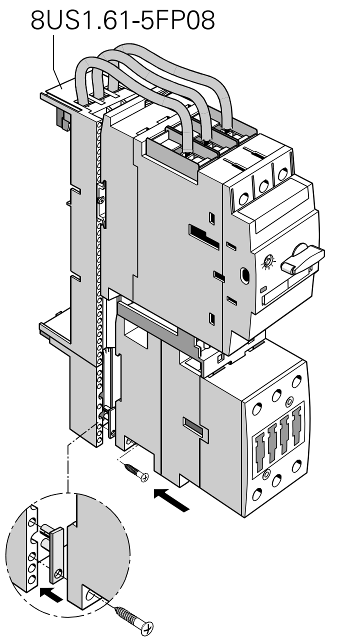


Figure 2-25: Mounting circuit breakers on busbar adapters (frame sizes S00 and S0)

Mounting circuit breakers on a busbar system

The following illustrations show you how to mount circuit breakers in frame sizes S2 and S3 onto a busbar adapter:

S2



S3

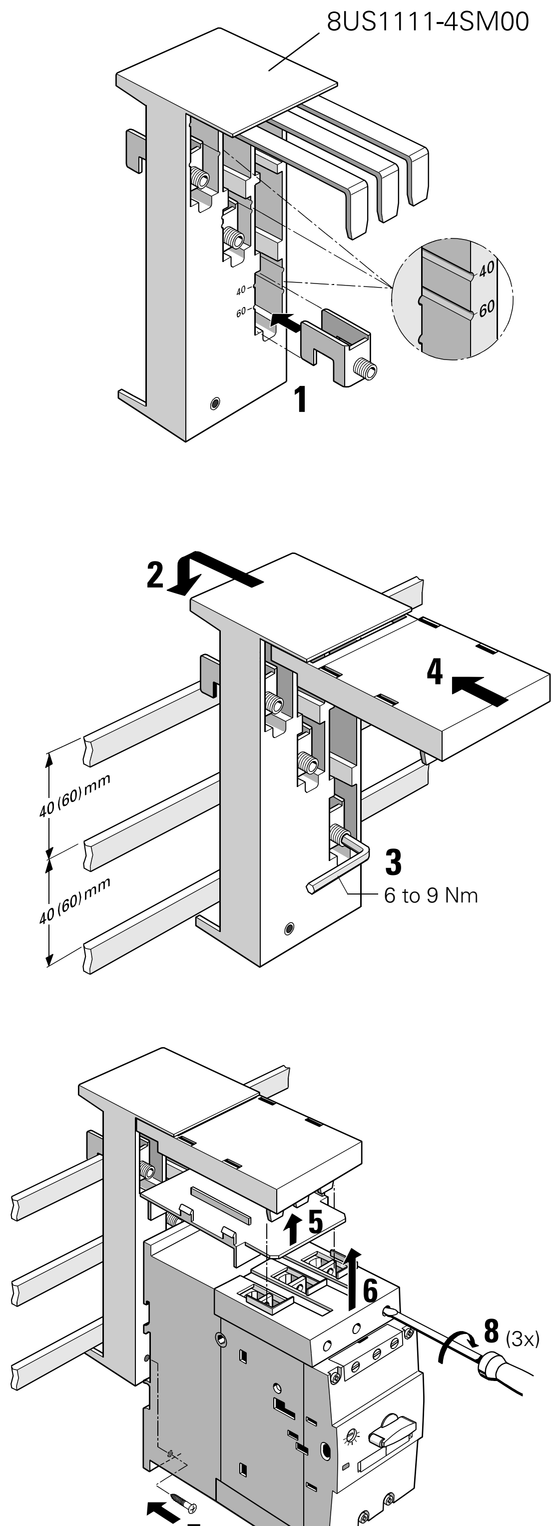


Figure 2-26: Mounting circuit breakers on busbar adapters (frame sizes S2 and S3)

Mounting accessories

The following illustration shows you how to mount accessories for busbar adapters for frame sizes S00 to S2:

- Side module
- Device holder
- Extension piece
- Outgoing terminal rail (for frame sizes S00 and S0 only)

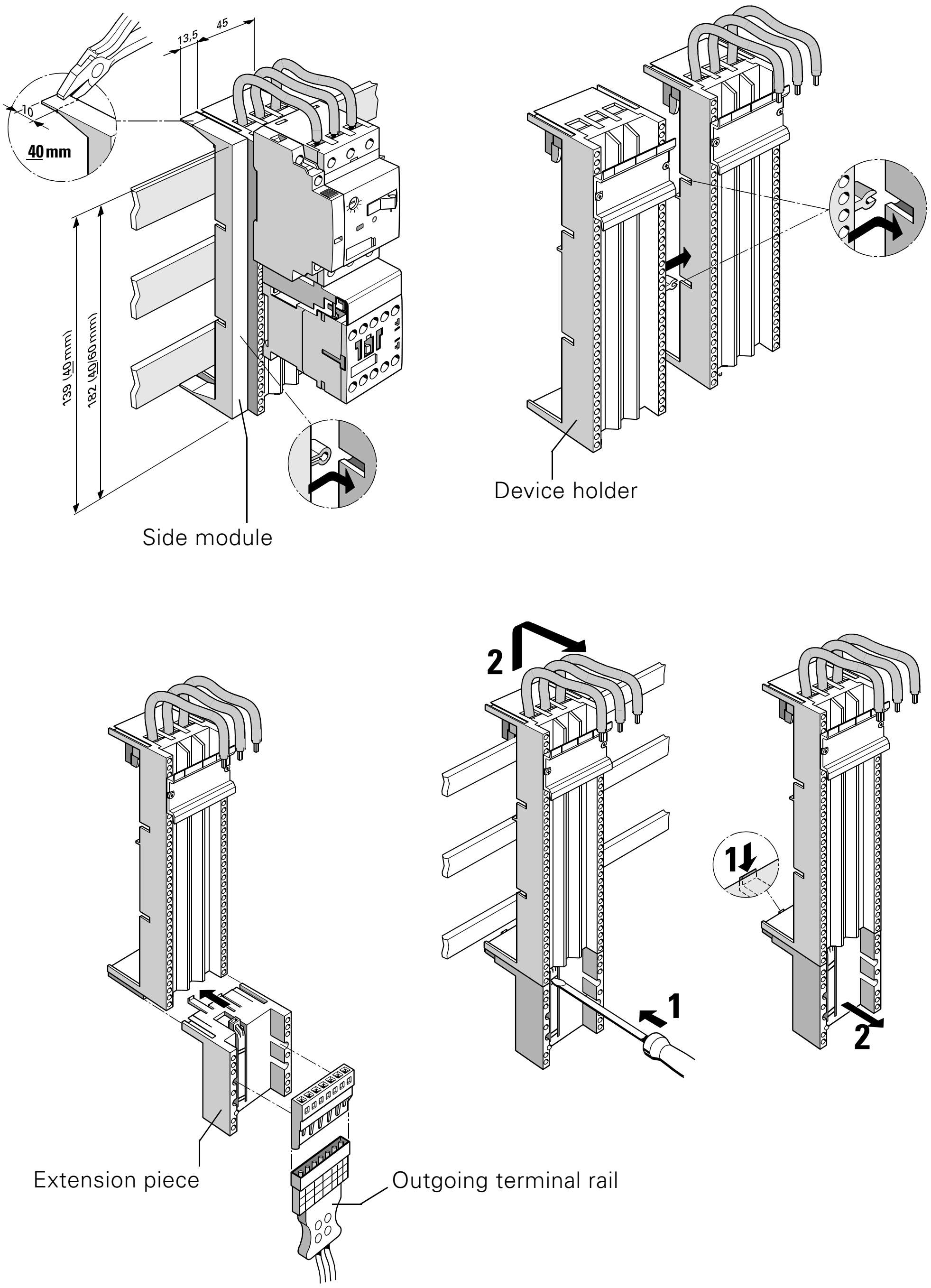


Figure 2-27: Accessories for busbar adapters (frame sizes S00 to S2)

2.4.9 Isolated 3-phase busbar system

3-phase busbars are used to snap circuit breakers of frame sizes S00, S0, and S2 quickly and easily in a row onto a rail. There is only one power supply, via a feed-in terminal.

The 3-phase busbar systems are safe from fingers and are shock protected. They are rated for the short-circuit stress that can occur on the output side of the connected circuit breakers.

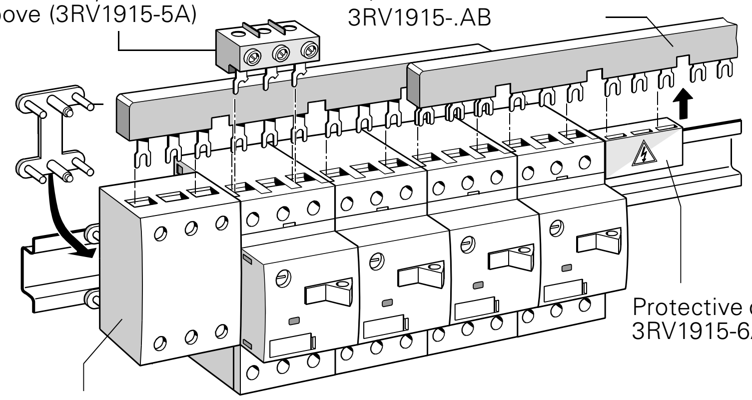


Figure 2-28: 3-phase busbar system

Rated operational voltage/current

Rated operational voltage	690 V
Rated current	Frame sizes S00, S0: 63 A
	Frame size S2: 108 A

Table 2-17: Rated operational voltage/current

Models

The 3-phase busbars take 2 to 5 circuit breakers, depending on the model. There are busbars with more generous spacing for circuit breakers with accessories attached on the side.

Frame size of the circuit breaker	Spacing	Models
S00, S0	45 mm	For 2, 3, 4, or 5 circuit breakers
	55 mm	For 2, 3, 4, or 5 circuit breakers + accessories
	63 mm	For 2 or 4 circuit breakers + accessories
S2	55 mm	For 2, 3, or 4 circuit breakers
	75 mm	For 2, 3, or 4 circuit breakers + accessories

Table 2-18: Types of 3-phase busbars

Combination of frame sizes S00 and S0

Circuit breakers in frame sizes S00 and S0 vary in height and depth and therefore **cannot** be combined on one busbar. You can combine two busbars for circuit breakers in frame sizes S0 and S00 using an extension piece.

Extending the bus

It is possible to extend the busbars by clamping the connecting lugs of a further bus (turned 180°) under the terminals of the last circuit breaker (see the section on mounting).

Attention
Note the current-carrying capacity of the busbars when you extend them.

Accessories

The following accessories are available for the isolated 3-phase busbar system:

- Feed-in terminal from above (3RV1915-5A for S00, 3RV1925-5AB for S0, 3RV1935-5A for S2)
- Feed-in terminal from below (3RV1915-5B for S00, S0)
- Connector
  A connector links two 3-phase busbars over a space of 45 mm for circuit breakers in frame sizes S00 and S0.
- Protective cap for connecting lugs (3RV19 15-6AB)
  Protective caps provide shock protection for spare slots. To extend the bus, remove the protective caps.
- Spacer

Feed-in terminal

3-phase feed-in terminals make it possible to have greater conductor cross-sections than on the circuit breaker itself.
Tightening torque: 2 to 4 Nm (17.6 to 35.2 LB.IN).

Frame size of the circuit breaker	Connection	Conductors	Conductor cross-section
S00, S0	From above	Single- or multi-core Finely stranded with wire end ferrule AWG	2.5 to 25 mm^2 2.5 to 25 mm^2 12 to 4
S00, S0	From below	Single- or multi-core Finely stranded with wire end ferrule AWG	6 to 25 mm^2 4 to 16 mm^2 10 to 4
S2	From above	Single- or multi-core Finely stranded with wire end ferrule AWG	2.5 to 50 mm^2 1.5 to 35 mm^2 14 to 0

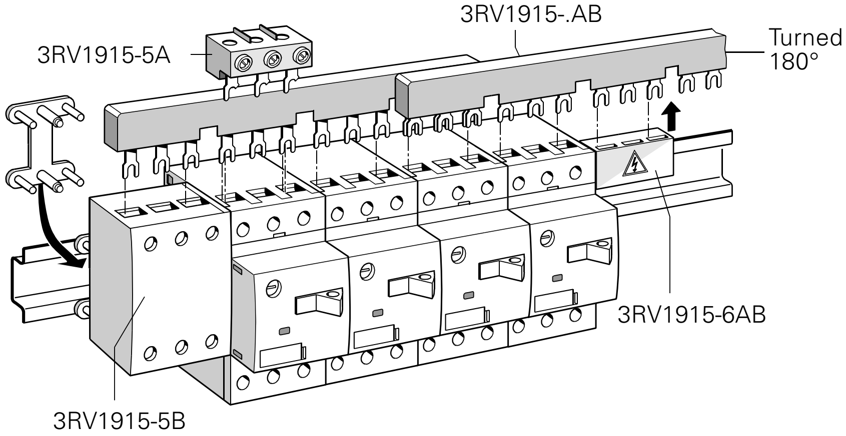
Table 2-19: Conductor cross-section of the 3-phase feed-in terminals

Feed-in terminal - connection from below

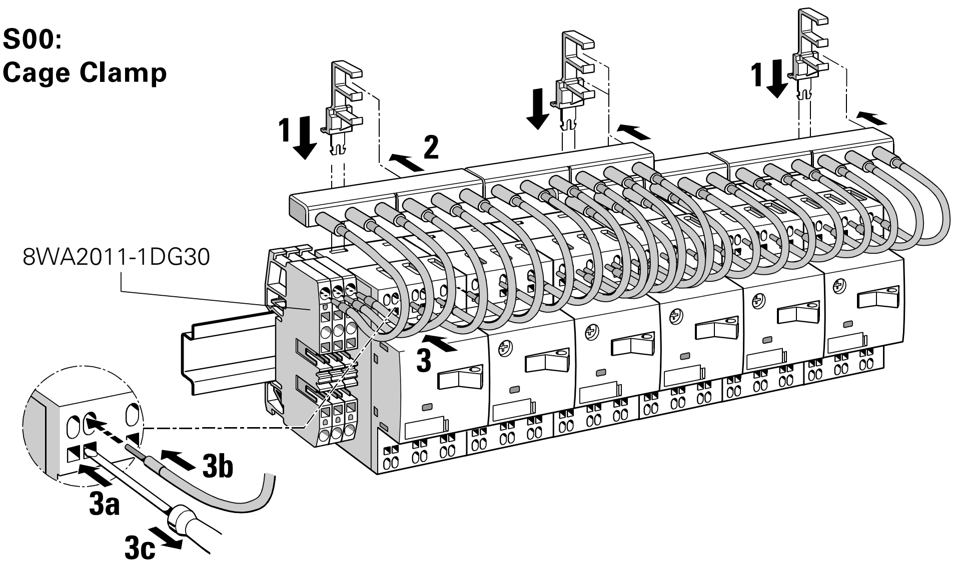
Attention
The feed-in terminal with connection from below is clamped on **instead** of a circuit breaker. Make sure you check how much space you require when you order the 3-phase busbars.

Mounting the 3-phase busbars

S00



S00:
Cage Clamp



S0

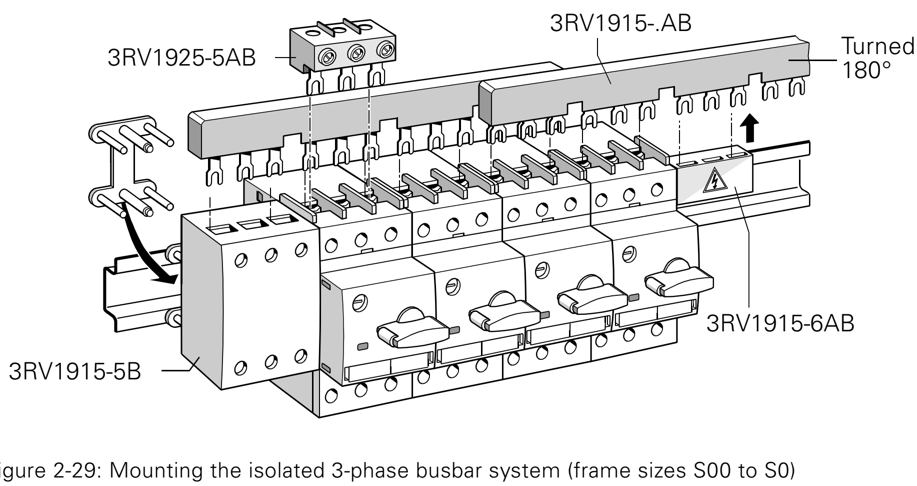


Figure 2-29: Mounting the isolated 3-phase busbar system (frame sizes S00 to S0)

S2

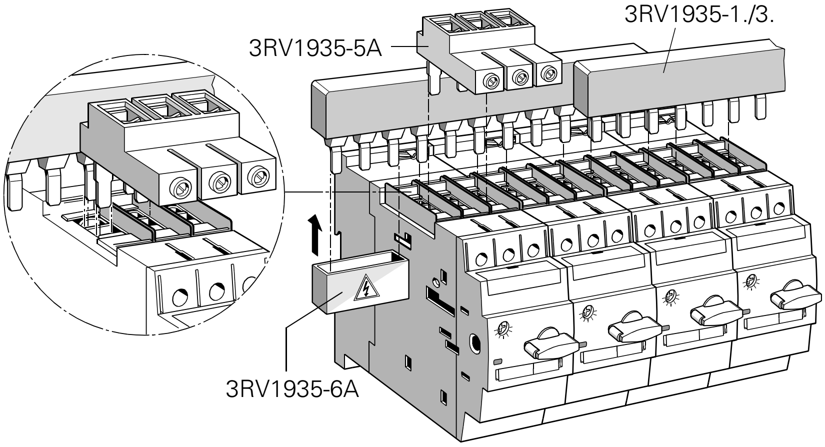


Figure 2-30: Mounting the isolated 3-phase busbar system (frame size S2)

2.5 Mounting and connection

2.5.1 Mounting

Mounting position

You can install the 3RV1 circuit breakers anywhere.

Snap-on mounting

The circuit breakers are mounted by snapping them onto 35 mm rails that comply with DIN EN 50 022. The circuit breakers with a frame size of S3 require a rail with an installation height of 15 mm. Alternatively, they can also be snapped onto 75 mm rails.

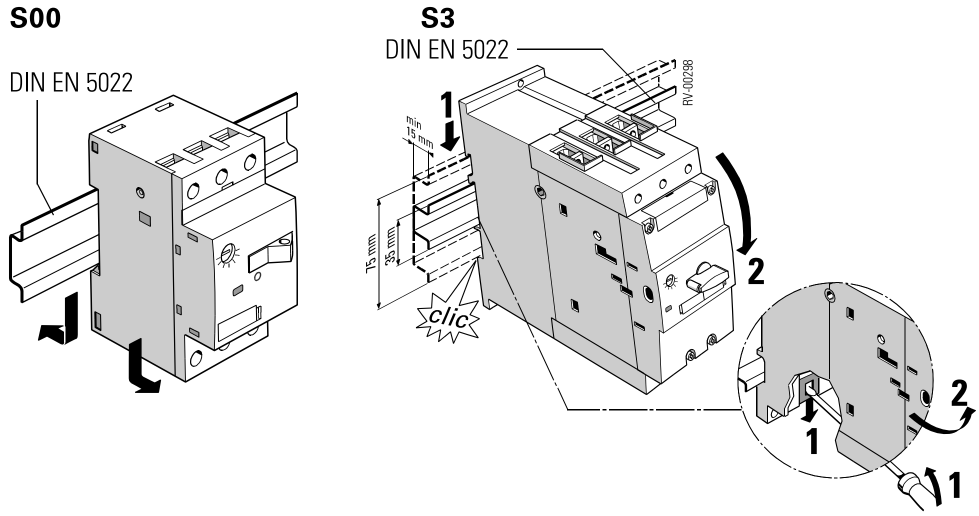


Figure 2-31: Mounting the circuit breakers onto the rail

Screw-on mounting

The circuit breakers are attached to a flat surface with 2 screws. For circuit breakers in frame sizes S00 and S0, two push-in lugs (3RB1900-0B) (pack of 10) are also required.
Circuit breakers in frame sizes S2 and S3 can be screwed directly onto a base plate.

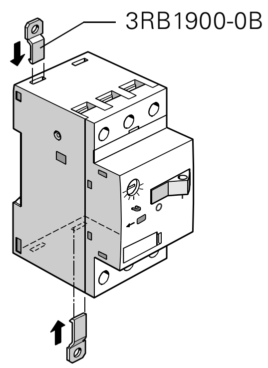


Figure 2-32: Screw-on mounting of the 3RV1 (example: frame size S00)

2.5.2 Connection

Tools

You require the following to connect the circuit breakers:
- Frame sizes S00 to S2: Pozidriv 2 screwdriver
- Frame size S3: Allen key (4 mm)

Conductor cross-sections

The typical SIRIUS conductor cross-sections apply (see Section 1.5.2 "Conductor cross-sections").

Screw-type terminals

3RV1 circuit breakers with frame sizes S00 and S0 have terminals with captive screws and terminal washers that enable you to connect 2 conductors, even if they have different cross-sections.

The box terminals of the circuit breakers of frame sizes S2 and S3 can also take 2 conductors with different cross-sections. With the exception of circuit breakers of frame size S3, which have terminal screws with a 4 mm Allen screw, all the terminal screws can be tightened using a standard screwdriver or a Pozidriv screwdriver (size 2).

You can remove the box terminals from circuit breakers with a frame size of S3 to connect conductors with lugs or connecting bars. A terminal cover is available as shock protection and to ensure that you comply with the required creepages and clearances when the box terminals are removed.

Soldering pin connector

Circuit breakers in frame size S00 can be soldered onto printed circuit boards by means of a soldering pin connector. A soldering pin connector is available for the main contacts and the transverse auxiliary switch.

Mounting the soldering pin adapters

The soldering pin adapters are clamped above and below in the screw-type terminals of the circuit breakers. Alternatively, the power supply can be taken to the printed circuit boards via cables.

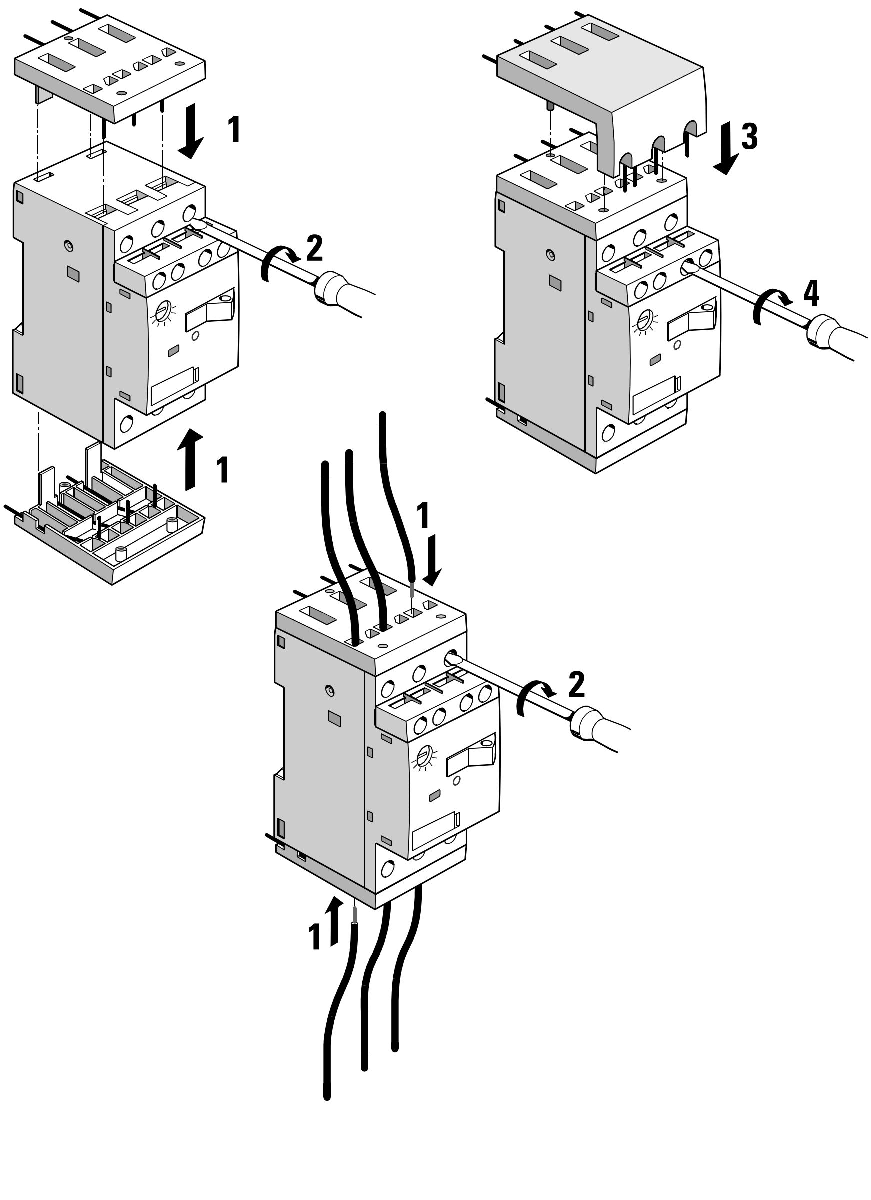


Figure 2-33: Circuit breaker, soldering pin connector (frame size S00)

2.5.3 Device circuit diagrams

Frame size S00

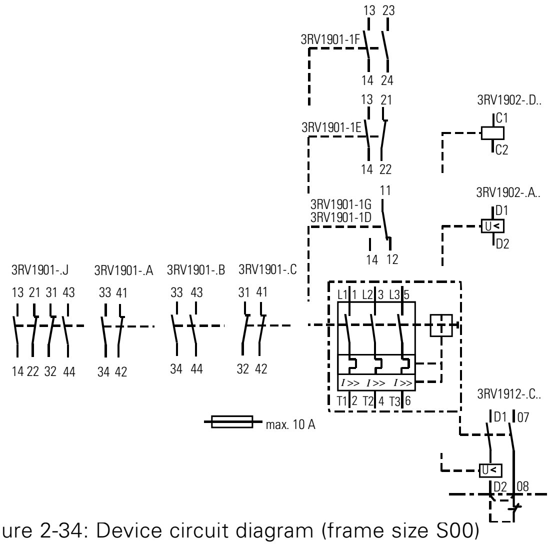


Figure 2-34: Device circuit diagram (frame size S00)

Frame sizes S0 to S3

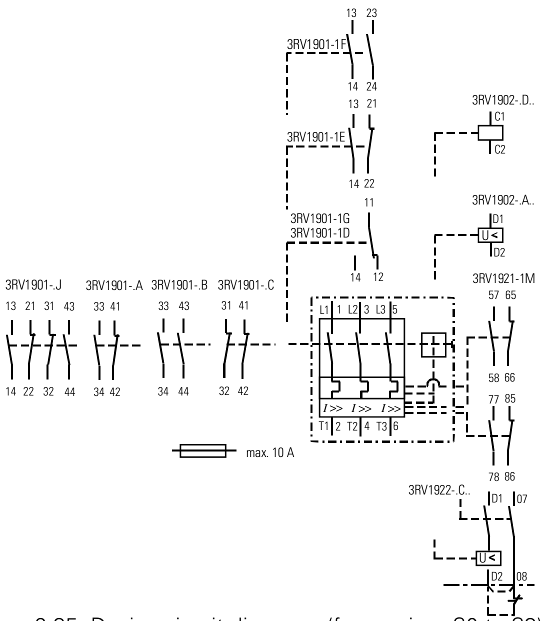


Figure 2-35: Device circuit diagrams (frame sizes S0 to S3)

Circuit breaker with overload relay function
Frame sizes S0 to S3

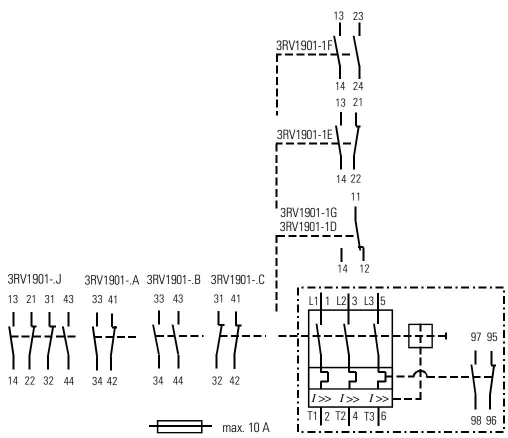


Figure 2-36: Circuit breaker with relay function, device circuit diagrams (frame sizes S0 to S3)

2.6 Dimensioned drawings (measurements in mm)

3RV1 circuit breakers

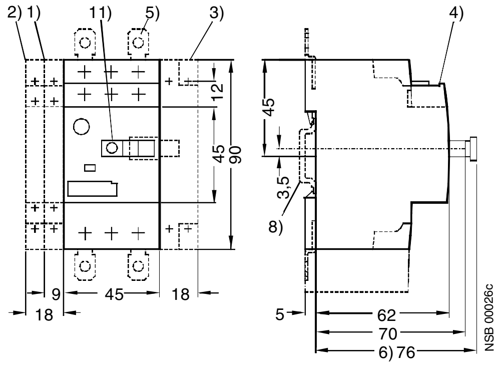
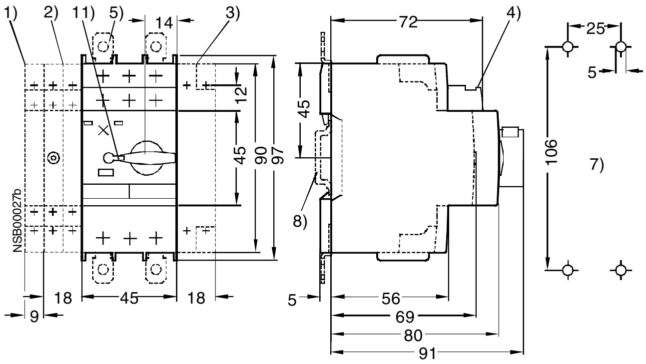


Figure 2-37: 3RV10 11, 3RV16 (frame size S00)



3RV10 21 (frame size S0)

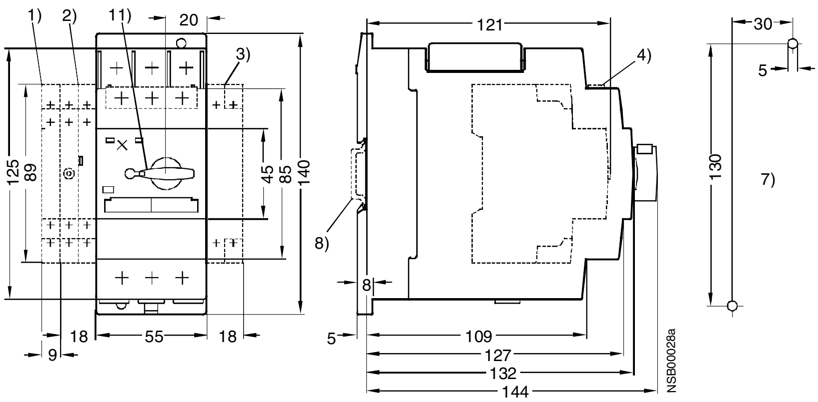


Figure 2-38: 3RV10 31 (frame size S2)

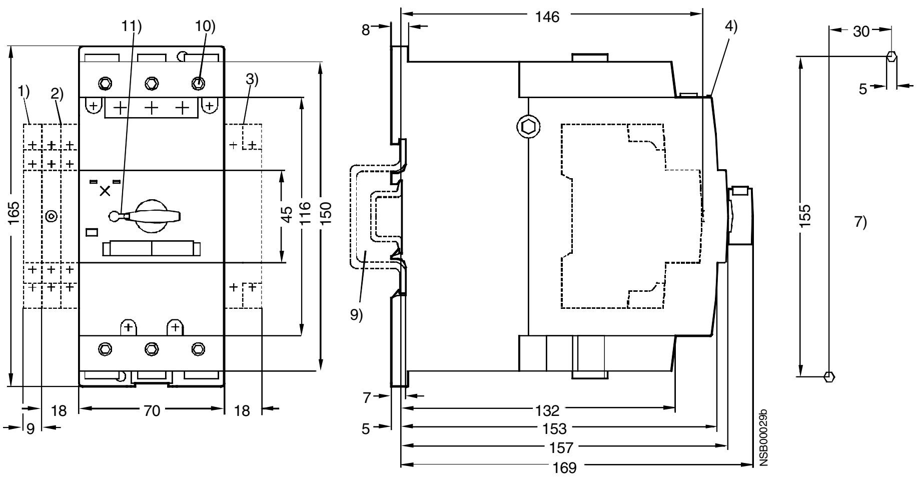


Figure 2-39: 3RV10 4 (frame size S3)

1) Lateral auxiliary switch, 2-pole
2) Alarm switch (S0 to S3) or lateral auxiliary switch, 4-pole (S00 to S3)
3) Auxiliary release
4) Transverse auxiliary switch
5) Push-in lugs for screw mounting
6) Only with undervoltage release with leading auxiliary switch
7) Drilling pattern
8), 35 mm rail in acc. with EN 50022
9) Mounting onto 35 mm rail, 15 mm high, in acc. with EN 50 022 or 75 mm rail in acc. with EN 50023
10) 4 mm Allen screw
11) Lockable in 0 position with shackle (5 mm in diameter)

3RV11 circuit breaker with overload relay function

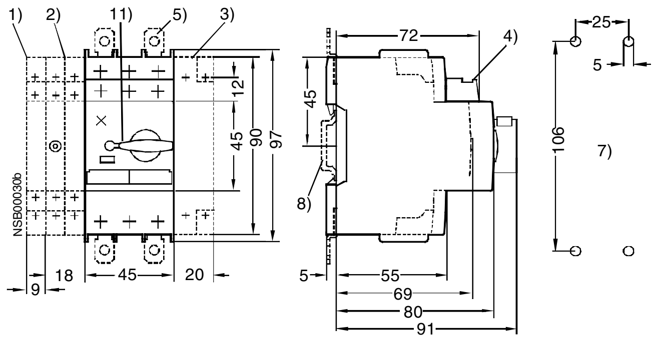
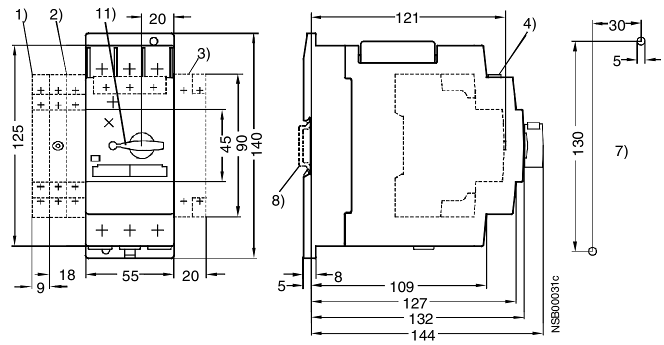


Figure 2-40: 3RV11 21 (frame size S0)



3RV11 31 (frame size S2)

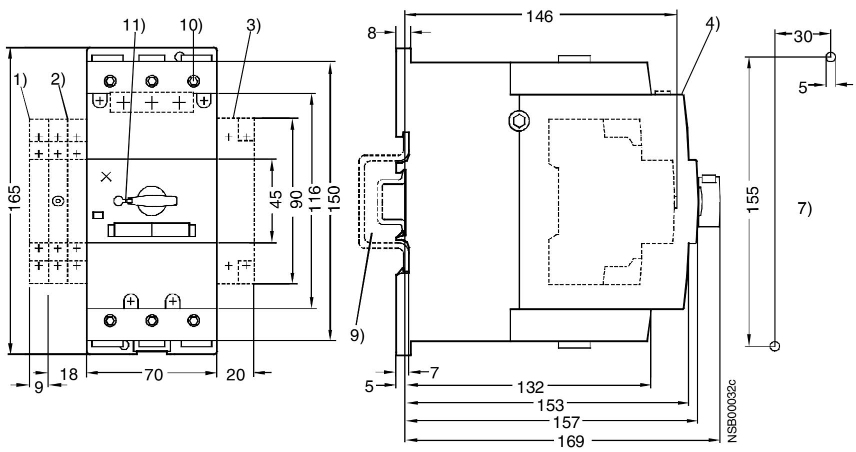


Figure 2-41: 3RV11 42 (frame size S3)

1) Lateral auxiliary switch, 2-pole
2) Alarm switch or lateral auxiliary switch, 4-pole
3) Block for overload relay function
4) Transverse auxiliary switch
5) Push-in lugs for screw-type mounting
7) Drilling pattern
8) 35 mm rail in acc. with EN 50 022
9) Mounting onto 35 mm rails, 15 mm high, in acc. with EN 50 022 or 75 mm rails in acc. with EN 50 023
10) 4 mm Allen screw
11) Lockable in 0 position with shackle (5 mm in diameter)

Disconnecting module

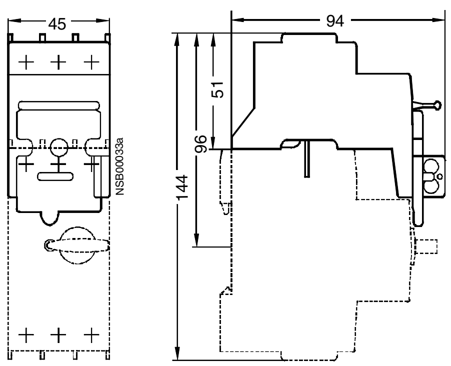
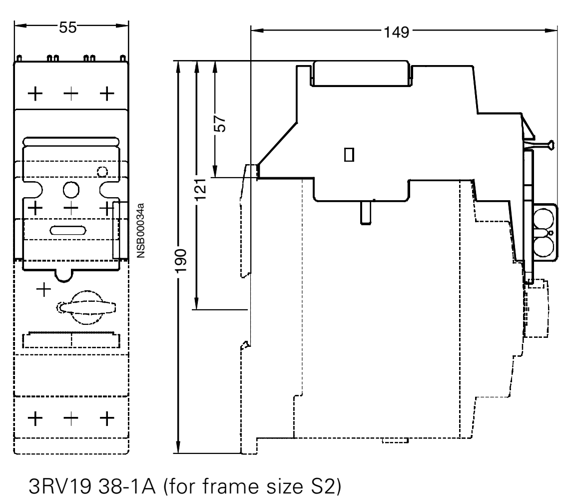


Figure 2-42: 3RV19 28-1A (for frame size S0)



3RV19 38-1A (for frame size S2)

Molded-plastic surface casing

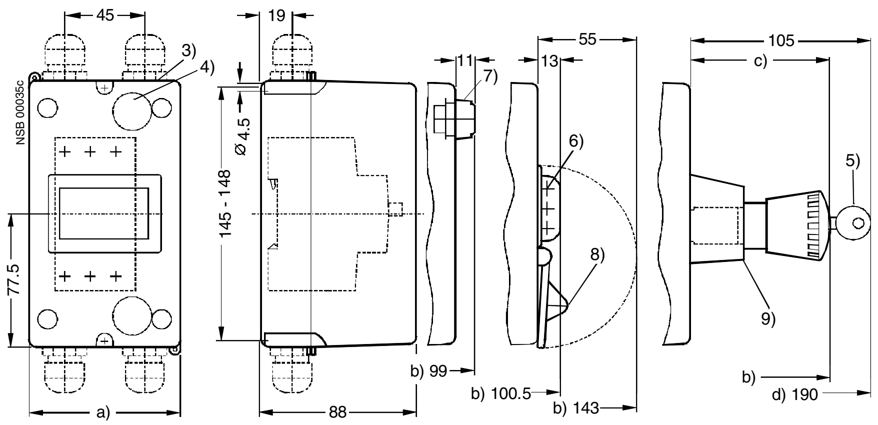


Figure 2-43: 3RV19 13-1. (for frame size S00)

a) 3RV19 13-1CA00 85 mm
   3RV19 13-1DA00 105 mm
b) With 3RV19 13-7D: 146.5 mm
   With 3RV19 13-7E: 166.5 mm
   The dimensions relate to the mounting surface
c) With 3RV19 13-7D: 64 mm
   With 3RV19 13-7E: 84 mm
d) The dimensions relate to the mounting surface

3) Knockout opening for M25
4) Knockout opening for rear M20 cable routing
5) With safety lock
6) Max. shackle diameter for padlock is 8 mm
7) Indicator light 3RV19 03-5
8) Locking device 3RV19 13-6B
9) Emergency-stop button 3RV19 13-7

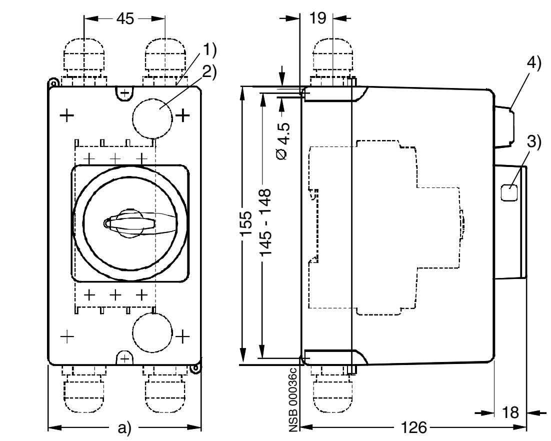
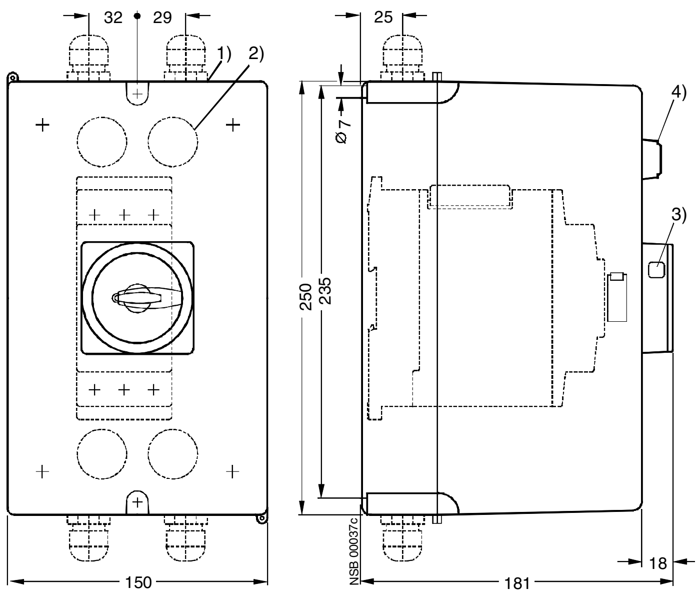


Figure 2-44: 3RV19 23-1. (for frame size S0)

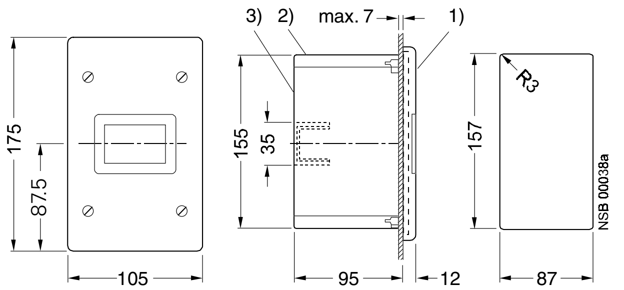
a) 3RV19 23-1CA00 85 mm
   3RV1923-1DA00 105 mm
1) Knockout opening for M25
2) Knockout opening for rear M20 cable entry
3) Opening for padlock with a max. shackle diameter of 8 mm
4) Indicator light 3RV19 03-5.



3RV19 33-1. (for frame size S2)

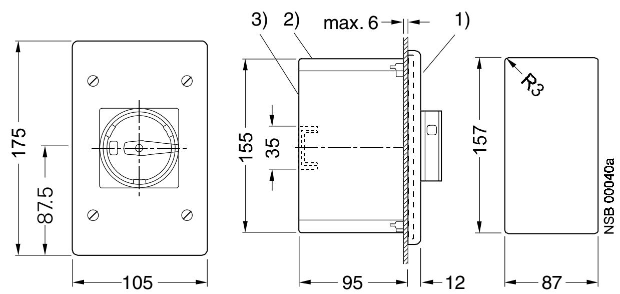
1) Knockout opening for M32 (left) and M40 (right)
2) Knockout opening for rear M32 cable entry
3) Opening for padlock with a max. shackle diameter of 8 mm
4) Indicator light 3RV19 03-5.

Molded-plastic bay



1) Indicator light 3RV19 03-5.
2) Knockout opening for M25
3) Knockout opening for M20

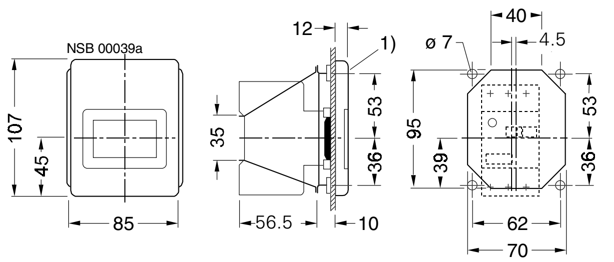
Figure 2-45: 3RV19 13-2DA00 (frame size S00)



1) Indicator light 3RV19 03-5.
2) Knockout opening for M25
3) Knockout opening for M20

3RV19 23-2DA00/-2GA00 (frame size S0)

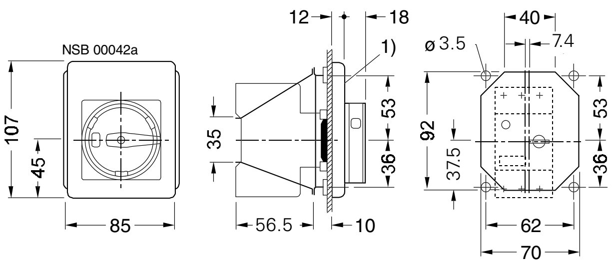
Molded-plastic front plate



1) Indicator light 3RV19 03-5.

Figure 2-46: 3RV19 13-4C (frame size S00)

Molded-plastic front plate + support



1) Indicator light 3RV19 03-5.

Figure 2-47: 3RV19 23-4. (frame sizes S0, S2, S3)

Soldering pin connector for main and auxiliary switches

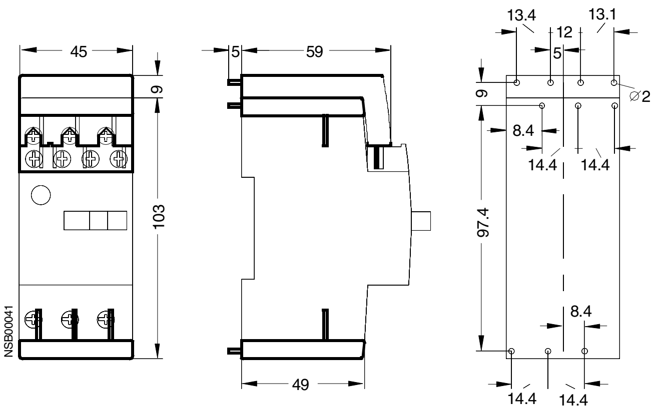


Figure 2-48: 3RV19 18-5A/-5B (frame size S00)

Rotary switch extension for the door

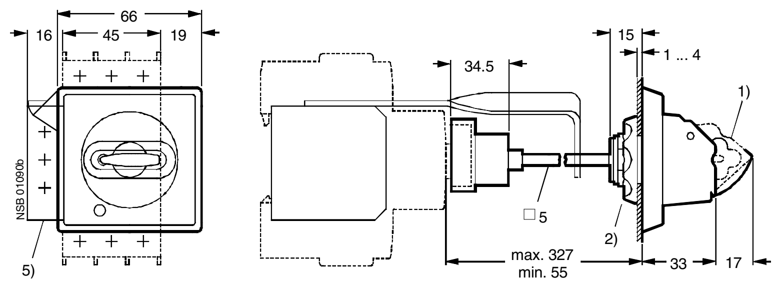


Figure 2-49: 3RV19 26-0 (frame sizes S0, S2, S3)

1) Lockable in 0 position with shackle (max. 8 mm in diameter)
2) Affixed with screw caps
5) Ground terminal 35 mm^2 and support bracket for 330 mm shaft

Terminals for "Combination Motor Controller Type E" in acc. with UL 508

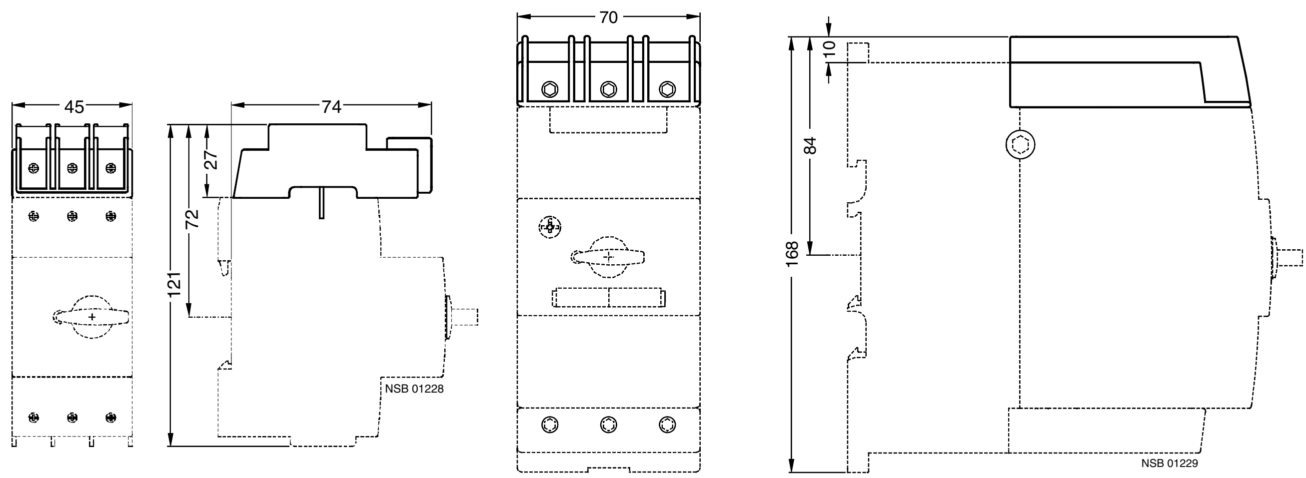


Figure 2-50: 3RV19 28-1H (frame size S0) and 3RT19 46-4GA07 (frame size S3)

Motorized remote-control mechanism

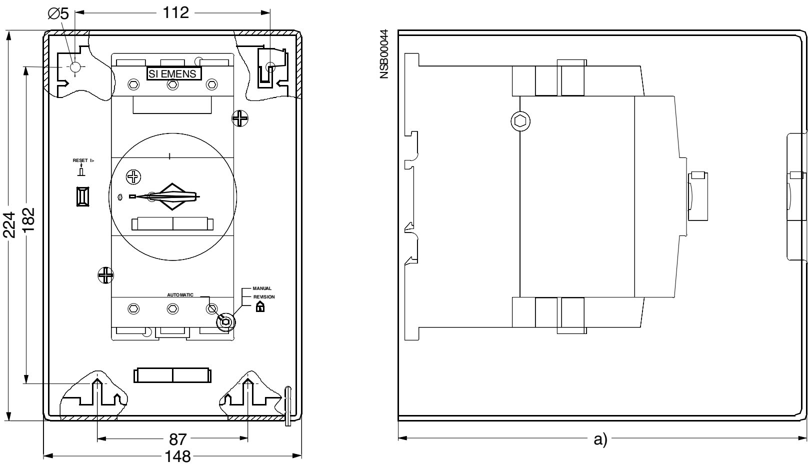


Figure 2-51: 3RV19. 6-3AP0 for circuit breaker
a) 3RV19 36-3AP0, frame size S2, 211 mm
b) 3RV19 46-3AP0, frame size S3, 236 mm

Busbar adapter

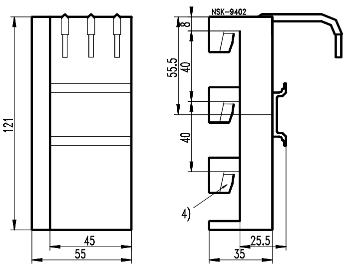
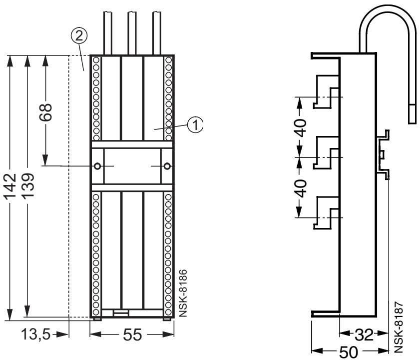


Figure 2-52: 8US10.1-5DJ07

4) For busbars
   Width: 12 to 15 mm
   Depth: 5 mm and 10 mm



8US1061-5FK08

1) For 40 mm busbar systems
2) Side module 8US1998-2KB00

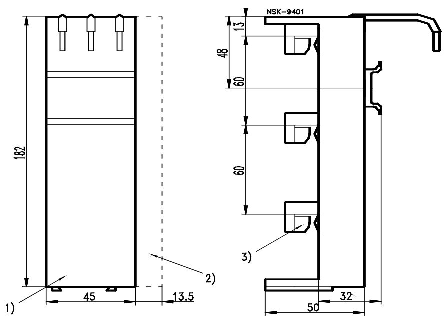
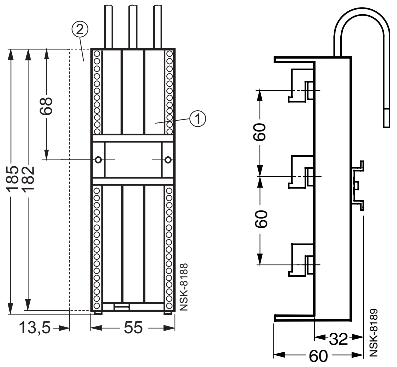


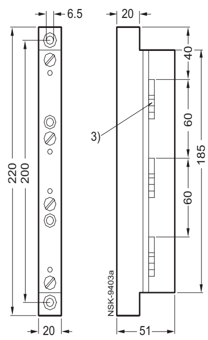
Figure 2-53: 8US1251-5DM07

1) For 60 mm busbar systems
2) Side module 8US1998-2BM00



8US1261-5FM08

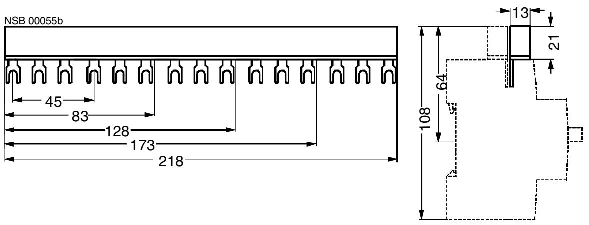
1) For 60 mm busbar systems
2) Side module 8US1998-2BM00



8US1923-2AA00

3) For busbars
   Width: 12 to 30 mm
   Depth: 5 and 10 mm

3-phase busbar systems



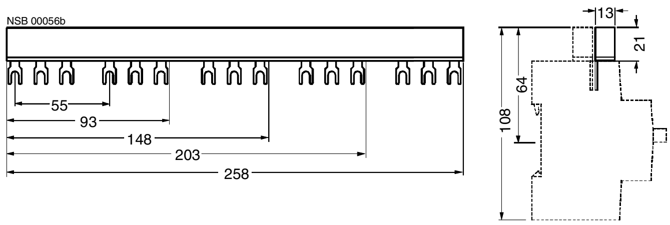


Figure 2-54: 3RV19 15-1. (frame sizes S00, S0)

3RV19 15-1A for 2 circuit breakers (length 83 mm)
3RV19 15-1B for 3 circuit breakers (length 128 mm)
3RV19 15-1C for 4 circuit breakers (length 173 mm)
3RV19 15-1D for 5 circuit breakers (length 218 mm)

3RV19 15-3A for 2 circuit breakers with accessories (length 93 mm)
3RV19 15-3B for 3 circuit breakers with accessories (length 148 mm)
3RV19 15-3C for 4 circuit breakers with accessories (length 203 mm)
3RV19 15-3D for 5 circuit breakers with accessories (length 258 mm)

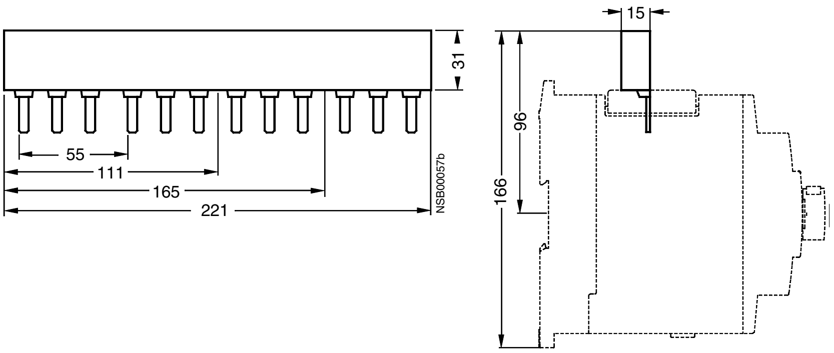


Figure 2-55: 3RV19 35-1 (for circuit breakers in frame size S2)

3RV19 35-1A for 2 circuit breakers (length 111 mm)
3RV19 35-1B for 3 circuit breakers (length 166 mm)
3RV19 35-1C for 4 circuit breakers (length 221 mm)

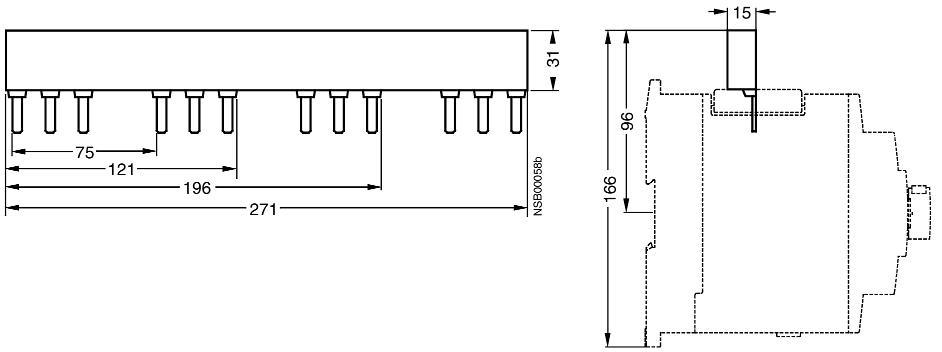
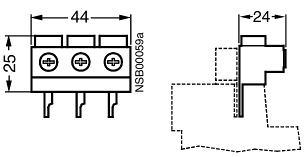
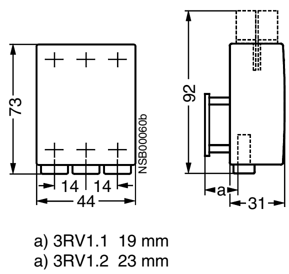


Figure 2-56: 3RV19 35-3 (for circuit breakers in frame size S2)

3RV19 35-3A for 2 circuit breakers with accessories (length 121 mm)
3RV19 35-3B for 3 circuit breakers with accessories (length 196 mm)
3RV19 35-3C for 4 circuit breakers with accessories (length 271 mm)

3-phase feed-in terminals





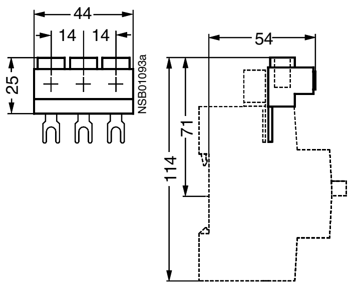


Figure 2-57: 3RV19 15-5A
Connection from above (for frame size S00)

3RV19 15-5B
Connection from below
(frame size S00/S0)

3RV19 25-5AB
Connection from above (frame size S0)

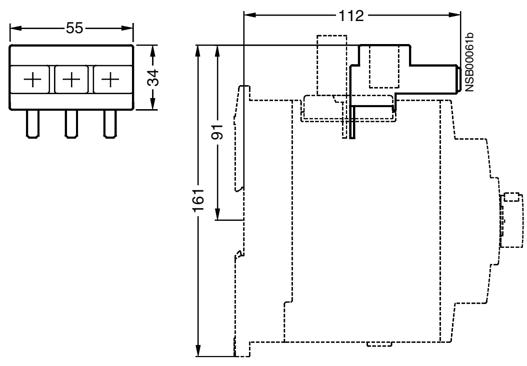
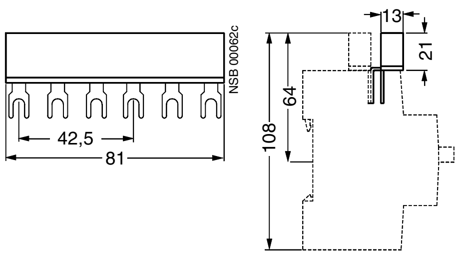


Figure 2-58: 3RV19 35-5A
(for frame size S2)

Connector



3RV19 15-5D
(frame size S0 (left) and frame size S00 (right))

2.7 Technical specifications

2.7.1 General specifications

Type			3RV1. 1	3RV1. 2	3RV1. 3	3RV1. 4
Specifications						
• IEC 60 947-1, EN 60 947-1 (VDE 0660 Part 100)			Yes			
• IEC 60 947-2, EN 60 947-2 (VDE 0660 Part 101)			Yes			
• IEC 60 947-4-1, EN 60 947-4-1 (VDE 0660 Part 102)			Yes			
Frame size			S00	S0	S2	S3
Pole number			3			
Max. rated current I_{nmax} (= max. rated operational current I_e)		A	12	25	50	100
Permissible ambient temperature						
Storage/transportation		°C	-50 to +80			
Operation		°C	-20 to +70 [1])			
Permissible rated current with the following internal cubicle temperature:						
• +60 °C		%	100			
• +70 °C		%	87			
<u>Circuit breaker in housing</u>						
Permissible rated current with the following ambient housing temperature:						
• +35 °C		%	100			
• +60 °C		%	87			
Rated operational voltage U_e		V	690 [2])			
Rated frequency		Hz	50/60			
Rated insulation voltage U_i		V	690			
Rated impulse strength U_{imp}		kV	6			
Utilization category						
• IEC 60 947-2 (circuit breaker)			A			
• IEC 60 947-4-1 (motor starter)			AC-3			
CLASS	In acc. with IEC 60 947-4-1		10		10/20	
Direct current short-circuit breaking capacity (time constant τ = 5 ms) (time constant t = 5 ms)						
• 1 conducting path 150 VDC		kA	10			
• 2 conducting paths in series 300 VDC		kA	10			
• 3 conducting paths in series 450 VDC		kA	10			
Power loss (Pv) per circuit breaker	I_n -> to 1.25 A	W	5	-	-	-
Depends on rated current I_n	I_n -> 1.6 A to 6.3 A	W	6	-	-	-
(Upper setting range)	I_n -> 8 A to 12 A	W	7	-	-	-
	I_n -> to 0.63 A	W	-	5	-	-
$R_{per\ conducting\ path} = P/I^2 \times 3$	I_n -> 0.8 A to 6.3 A	W	-	6	-	-
	I_n -> 8 A to 16 A	W	-	7	-	-
	I_n -> 20 A to 25 A	W	-	8	-	-
	I_n -> to 25 A	W	-	-	12	-
	I_n -> 32 A	W	-	-	15	-
	I_n -> 40 A to 50 A	W	-	-	20	-
	I_n -> to 63 A	W	-	-	-	20
	I_n -> 75 A and 90 A	W	-	-	-	30
	I_n -> to 100 A	W	-	-	-	38

Type			3RV1. 1	3RV1. 2	3RV1. 3	3RV1. 4
Shock resistance	In acc. with IEC 68 Part 2-27	g/ms	25/11 (rectangular and sine pulse)			
Degree of protection	In acc. with IEC 60 529		IP20		IP 20 3)	
Shock protection	In acc. with DIN VDE 0106 Part 100		protected against touching by fingers			
Temperature compensation	In acc. with IEC 60 947-4-1	°C	-20 to +60			
Phase loss sensitivity	In acc. with IEC 60 947-4-1		Yes			
Explosion protection	In acc. with DIN VDE 0165 and EN 50 019		Yes for 3RV10 (KEMA test certificate no. Ex-97.4.32 36)4)			
Isolating function	In acc. with IEC 60 947-2		Yes			
Main and emergency-stop switch features5)	In acc. with IEC 60 204-1 (VDE 0113)		Yes			
Safe isolation between the main circuit and the auxiliary circuit required for PELV applications	In acc. with DIN VDE 0106 Part 101					
• to 400 V + 10%			Yes			
• to 415 V+ 5 % (higher voltage on request)			Yes			
Mechanical life		Operating cycles	100,000		50,000	
Electrical life			100,000		25,000	
Max. switching frequency per hour (motor star-tups)		1/h	15			

1) Reduction in current above +60 °C
2) With molded-plastic housing 500 V
3) Connection room IP 00
4) ATEX certification in acc. with EU directive 94/9/EC in preparation
5) With corresponding accessories

Conductor cross-sections - main circuit

Type		**3RV1.**	**3RV1. 2**	**3RV1. 3**	**3RV1. 4**
Connection type		Screw-type terminal		Screw-type terminal with box terminal	
Terminal screw		Pozidriv size 2		Pozidriv size 2	Allen screw 4 mm
Specified tightening torque	Nm	0.8 to 1.2 Nm	2 to 2.5	3 to 4.5	4 to 6
Conductor cross-sections, 1 or 2 conductors					
Single-core	mm^2	2 x (0.5 to 1.5)	2 x (1 to 2.5)	2 x (0.75 to 16)	2 x (2.5 to 16)
	mm^2	2 x (0.75 to 2.5) (max. 4)	2 x (2.5 to 6)	-	-
Finely stranded with wire end ferrule:	mm^2	2 x (0.5 to 1.5)	2 x (1 to 2.5)	2 x (0.75 to 16)	2 x (2.5 to 35)
	mm^2	2 x (0.75 to 2.5)	2 x (2.5 to 6) (max. 10)	1 x (0.75 to 25)	1 x (2.5 to 50)
Stranded	mm^2	2 x (0.5 to 1.5)	2 x (1 to 2.5)	2 x (0.75 to 25)	2 x (10 to 50)
	mm^2	2 x (0.75 to 2.5) (max. 4)	2 x (2.5 to 6) (max. 10)	1 x (0.75 to 35)	1 x (10 to 70)
AWG cables, single- or multi-core	AWG	2 x (18 to 14)	2 x (14 to 10)	2 x (18 to 3)	2 x (10 to 1/0)
	AWG	-	-	1 x (18 to 2)	1 x (10 to 2/0)
Ribbon cables (number x width x depth)	mm	-	-	2 x (6 x 9 x 0.8)	2 x (6 x 9 x 0.8)
Removable box terminal [1]					
With copper busbars	mm	-	-	-	18 x 10
With lug	mm^2	-	-	-	To 2 x 70
Cage Clamp connections[2][3][4] (1 or 2 conn. can be connected) Single-coil	mm^2	2 x (0.25 to 2.5)	-		
Finely stranded with wire end ferrule	mm^2	2 x (0.25 to 1.5)	-		
Finely stranded without wire end ferrule	mm^2	2 x (0.25 to 2.5)	-		
AWG cables, single-core or stranded	AWG	2 x (24 to 14)	-		
Max. outer diameter of the conductor insulation: 3.6 mm					
Permissible service position		Any In acc. with IEC 60 447 start command "I" Right or above			

Control switch

Transverse auxiliary switch at front with 1 changeover contact		**Switching capacity with different voltages**				
Rated operational voltage U_e	AC voltage	VAC	**24**	**230**	**400**	**690**
Rated operational current I_e/AC-15		A	4	3	1.5	0.5
Rated operational current I_e/AC-12 ≙ I_{th}		A	10	10	10	10
Rated operational voltage U_e	DC voltage L/R 200 ms	VDC	**24**	**110**	**220**	
Rated operational current I_e/DC-13		A	1	0.22	0.1	
Transverse electronically optimized auxiliary switch at front with 1 changeover contact						
Rated operational voltage U_e	AC voltage	VAC	**3 to 60**			
Rated operational current I_e/AC-14		mA	1 to 300			
Rated operational voltage U_e	DC voltage L/R 200 ms	VDC	**3 to 60**			
Rated operational current I_e/DC-13		mA	1 to 300			
Transverse auxiliary switch at front with 1 NO + 1 NC, 2 NO contacts						
Rated operational voltage U_e	AC voltage	VAC	**24**	**230**		
Rated operational current I_e/AC-15		A	2	0.5		
Rated operational current I_e/AC-12 ≙ I_{th}		A	2.5	2.5		
Rated operational voltage U_e	DC voltage L/R 200 ms	VDC	**24**	**48**	**60**	
Rated operational current I_e/DC-13		A	1	0.3	0.15	
Lateral auxiliary switch with 1 NO + 1 NC, 2 NO, 2 NC, 2 NO + 2 NC and alarm switch						
Rated operational voltage U_e	AC voltage	VAC	**24**	**230**	**400**	**690**
Rated operational current I_e/AC-15		A	6	4	3	1
Rated operational current I_e/AC-12 ≙ I_{th}		A	10	10	10	10
Rated operational voltage U_e	DC voltage L/R 200 ms	VDC	**24**	**110**	**220**	**440**
Rated operational current I_e		A	2	0,5	0.25	0.1

1) After the box terminals have been removed, lug or busbar connections are possible.
2) For notes on the Cage Clamp system, see pages 1-19.
3) Use an insulation stop for a conductor cross-section ≤ 1 mm^2.
5) Associated opening tool 8WA28 03/8WA28 04

Permissible rating of approved devices for North America, UL CSA

The circuit breakers in the SIRIUS 3RV1 series are approved for UL/CSA and can also be used in acc. with UL 508 and C22.2 No.14 with a contactor as a load feeder. You can use these circuit breakers as a "Manual Motor Starter" for "Group Fusing" or for "Group Installation" or as a "Combination Motor Controller **Type E**".

3RV1 circuit breaker as a "Manual Motor Starter"
When the circuit breaker is used as a "Manual Motor Starter", it is always with a device for short-circuit protection (upstream short-circuit protection device). Any fusible link ("group fusing") or circuit breaker ("group installation") can be used as a device for short-circuit protection. The type and size are selected in acc. with the American NFPA 70 standard, Article 430-53 (c) for adequate protection of supply lines.
Accreditation was issued under the following file numbers with the listed data:
UL File No. E14705, Product Class NLRV
CSA File No. LR12730, Product Class 3211 05

Circuit breaker Type	V	Hp rating For FLA max. 1-phase	3-phase	Rated current I_n A	**To 240 VAC** I_{cu} 1) kA	**To AC 480 Y/277 V** I_{cu} 1) kA	**To AC 600 Y/347 V** I_{cu} 1) kA
				0.11 to 2	50	50	10
3RV10 11				2.5	50	50	10
3RV16 11-0BD10	115	½	-	3.2	50	50	10
	200	1½	3	4	50	50	10
Frame size S00	230	2	3	5	50	50	10
	460	-	7½	6.3	50	50	10
FLA max. 12 A, 600 V	575/600	-	10	8	50	50	10
NEMA Size 00				10	50	50	10
				12	50	50	10
				0.11 to 3.2	50	50	30
3RV10 21/3RV11 21				4	50	50	30
3RV13 21				5	50	50	30
	115	2	-	6.3	50	50	30
Frame size S0	200	3	7½	8	50	50	30
	230	5	7½	10	50	50	30
FLA max. 25 A, 600 V	460	-	15	12.5	50	50	30
NEMA Size 1	575/600	-	20	16	50	50	30
				20	50	50	30
				22	50	50	30
				25	50	50	30
3RV10 31/3RV11 31				11 to 16	50	50	25
3RV13 31				20	50	50	25
	115	3	-	25	50	50	25
Frame size S2	200	7½	15	32	50	50	25
	230	10	20	40	50	50	25
FLA max. 50 A, 600 V	460	-	40	45	50	50	25
NEMA Size 2	575/600	-	50	50	50	50	25
				11 to 16	50	50	30
3RV10 41/3RV10 42				20	50	50	30
3RV11 42	115	10	-	25	50	50	30
3RV13 41/3RV13 42	200	20	30	32	50	50	30
	230	20	40	40	50	50	30
Frame size S3	460	-	75	50	50	50	30
	575/600	-	100	63	50	50	30
FLA max. 99 A, 600 V				75	50	50	30
NEMA Size 3				90	50	50	30
				100 (99)	50	50	30

Hp rating = output power in horse power (maximum motor power)
FLA = full load amps

1) Corresponds to "short circuit breaking capacity" in acc. with UL

Permissible rating of approved devices for North America, Ⓤ Ⓢ

3RV10.A circuit breaker as "Combination Motor Controller Type E"
Since 16.07.2001, 1 inch air clearance and 2 inch creepage distance is required for a "Combination Motor Controller Type E" on the input side with UL 508 The 3RV10 circuit breaker in frame sizes S0 and S3 are therefore approved with the terminal blocks listed below in acc. with UL 508.
The 3RV10 circuit breaker in frame size S2 already complies with the required air clearance and creepage distance as a basic unit. These extended air clearances and creepage distances are not required for CSA. The terminal blocks are therefore not required for use as a "Combination Motor Controller Type E" in acc. with CSA. 3RV10 circuit breakers are certified as "Combination Motor Controller **Type E**" under the following file numbers with the listed data:
Ⓤ File No. E156943, Product Class NKJH
Ⓢ File No. LR12730, Product Class 3211 08

Circuit breaker Type	V	Hp rating For FLA max. 1-phase	3-phase	Rated current I_n A	**To 240 VAC** I_{cu} 1) kA	**To AC 480 Y/277 V** I_{cu} 1) kA	**To AC 600 Y/347 V** I_{cu} 1) kA
				0.11 to 1.6	50	50	30
3RV10 21				2	50	50	30
+ 3RV19 28-1H	115	2	-	2.5	50	50	30
	200	3	7½	3.2	50	50	30
Frame size S0	230	3	7½	4	50	50	30
	460	-	15	5	50	50	30
FLA max. 22 A, 480 V	575/600	-	10	6.3	50	50	30
12.5 A, 600 V				8	50	50	30
NEMA Size 1				10	50	50	30
				12.5	50	50	30
				16	50	50	-
				20	50	50	-
				22	50	50	-
				0.9 to 16	50	50	25
3RV10 31				20	50	50	25
	115	3	-	25	50	50	25
Frame size S2	200	7½	15	32	50	50	25
	230	10	20	40	50	50	25
FLA max. 50 A, 600 V	460	-	40	45	50	50	25
NEMA Size 1	575/600	-	50	50	50	50	30
3RV10 31/3RV11 31				11 to 16	50	50	25
3RV13 31				20	50	50	25
	115	3	-	25	50	50	25
Frame size S2	200	7½	15	32	50	50	25
	230	10	20	40	50	50	25
FLA max. 50 A, 600 V	460	-	40	45	50	50	25
	575/600	-	50	50	50	50	25
NEMA Size 2							
				11 to 16	50	50	30
3RV10 41				20	50	50	30
+ 3RT19 46-4GA07	115	10	-	25	50	50	30
	200	20	30	32	50	50	30
Frame size S3	230	20	40	40	50	50	30
	460	-	75	50	50	50	30
FLA max. 100 A, 480 V	575/600	-	75	63	50	50	30
75 A, 600 V				75	50	50	30
				90	50	50	-
NEMA Size 3				100	50	50	-

Hp rating = output power in horse power (maximum motor power)
FLA = full load amps
1) Corresponds to "short circuit breaking capacity" in acc. with UL

Rating of the control switches and alarm switches		**Lateral auxiliary switch with 1 NO + 1 NC, 2 NO, 2 NC, 2 NO + 2 NC and alarm switch**	**Transverse auxiliary switch with 1 changeover contact**	**Transverse auxiliary switch with 1 NO + 1 NC, 2 NO**
Max. rated voltage				
• In acc. with NEMA Ⓤ	VAC	600		240
• In acc. with NEMA Ⓢ	VAC	600		240
Continuous current	A	10	5	2.5
Switching capacity		A600	B600	C300
		Q300	R300	R300

2.7.2 Rated short-circuit breaking capacity I_{cn} in acc. with IEC 60 947-2

The table lists the rated limit short-circuit breaking capacity I_{cu} and the rated service short-circuit breaking capacity I_{cs} of 3RV1 circuit breakers with different inception voltages and related to the rated current I_n of the circuit breakers.
The incoming supply of the circuit breakers is permissible at the upper or lower terminals irrespective of the rating.
If the short-circuit current at the installation location exceeds the rated short-circuit breaking capacity of the circuit breaker specified in the table, a backup fuse is required. You can also use an upstream circuit breaker with a limiter function.
The maximum rated current of this backup fuse is specified in the tables. The rated short-circuit breaking capacity specified for the fuse then applies.
Circuit breaker/contactor combinations for short-circuit currents of up to 50 kA can be used as fuseless load feeders in acc. with Part 5.

Circuit breaker	Rated current I_n	**To 240 VAC [2])**			**To 400 VAC [2])/415 V [3])**			**To 440 VAC [2])/460 V [3])**			**To 500 VAC [2])/525 V [3])**			**To 690 VAC [2])**		
		I_{cu}	I_{cs}	Max. Fuse (gL/gG)	I_{cu}	I_{cs}	Max. Fuse (gL/gG)	I_{cu}	I_{cs}	Max. Fuse (gL/gG)	I_{cu}	I_{cs}	Max. Fuse (gL/gG)	I_{cu}	I_{cs}	Max. Fuse (gL/gG)
Type	A	kA	kA	A	kA	kA	A	kA	kA	A	kA	kA	A	kA	kA	A
3RV10, 3RV16 11-0BD10 frame size S00	0.16 to 0.8	100	100	•	100	100	•	100	100	•	100	100	•	100	100	•
	1	100	100	•	100	100	•	100	100	•	100	100	•	100	100	•
	1.25	100	100	•	100	100	•	100	100	•	100	100	•	2	2	20
	1.6	100	100	•	100	100	•	100	100	•	100	100	•	2	2	20
	2	100	100	•	100	100	•	100	100	•	10	10	35	2	2	35
	2.5	100	100	•	100	100	•	100	100	•	10	10	35	2	2	35
	3.2	100	100	•	100	100	•	50	10	40 [1])	3	3	40	2	2	40
	4	100	100	•	100	100	•	50	10	40 [1])	3	3	40	2	2	40
	5	100	100	•	100	100	•	50	10	50 [1])	3	3	50	2	2	50
	6.3	100	100	•	100	100	•	50	10	50 [1])	3	3	50	2	2	50
	8	100	100	•	50	12.5	80 [1])	50	10	63 [1])	3	3	63	2	2	63
	10	100	100	•	50	12.5	80 [1])	10	10	63	3	3	63	2	2	63
	12	100	100	•	50	12.5	80 [1])	10	10	80	3	3	80	2	2	80
3RV1. 2 Frame size S0	0.16 to 1.25	100	100	•	100	100	•	100	100	•	100	100	•	100	100	•
	1.6	100	100	•	100	100	•	100	100	•	100	100	•	100	100	•
	2	100	100	•	100	100	•	100	100	•	100	100	•	8	8	25
	2.5	100	100	•	100	100	•	100	100	•	100	100	•	8	8	25
	3.2	100	100	•	100	100	•	100	100	•	100	100	•	8	8	32
	4	100	100	•	100	100	•	100	100	•	100	100	•	6	3	32
	5	100	100	•	100	100	•	100	100	•	100	100	•	6	3	32
	6.3	100	100	•	100	100	•	100	100	•	100	100	•	6	3	50
	8	100	100	•	100	100	•	50	25	63 [1])	42	21	63	6	3	50
	10	100	100	•	100	100	•	50	25	80 [1])	42	21	63	6	3	50
	12.5	100	100	•	100	100	•	50	25	80 [1])	42	21	80	6	3	63
	16	100	100	•	50	25	100 [1])	20	10	80 [1])	10	5	80	4	2	63
	20	100	100	•	50	25	125 [1])	50	10	80 [1])	10	5	80	4	2	63
	22	100	100	•	50	25	125 [1])	50	10	100 [1])	10	5	80	4	2	63
	25	100	100	•	50	25	125 [1])	50	10	100 [1])	10	5	80	4	2	63
3RV1. 3 Frame size S2	16	100	100	•	50	25	100 [1])	50	25	100 [1])	12	6	63	5	3	63
	20	100	100	•	50	25	125 [1])	50	25	100 [1])	12	6	80	5	3	63
	25	100	100	•	50	25	125 [1])	50	15	100 [1])	12	6	80	5	3	63
	32	100	100	•	50	25	125 [1])	50	15	125 [1])	10	5	100	4	2	63
	40	100	100	•	50	25	160 [1])	50	15	125 [1])	10	5	100	4	2	63
	45	100	100	•	50	25	160 [1])	50	15	125 [1])	10	5	100	4	2	63
	50	100	100	•	50	25	160 [1])	50	15	125 [1])	10	5	100	4	2	80

Circuit breaker	Rated current I_n	To 240 VAC[2]			To 400 VAC[2]/415 V[3]			To 440 VAC[2]/460 V[3]			To 500 VAC[2]/525 V[3]			To 690 VAC[2]		
		I_{cu}	I_{cs}	Max. Fuse (gL/gG)	I_{cu}	I_{cs}	Max. Fuse (gL/gG)	I_{cu}	I_{cs}	Max. Fuse (gL/gG)	I_{cu}	I_{cs}	Max. Fuse (gL/gG)	I_{cu}	I_{cs}	Max. Fuse (gL/gG)
Type	A	kA	kA	A	kA	kA	A	kA	kA	A	kA	kA	A	kA	kA	A
3RV1. 41	40	100	100	•	50	25	125 [1]	50	20	125 [1]	12	6	100	6	3	63
Frame size S3	50	100	100	•	50	25	125 [1]	50	20	125 [1]	12	6	100	6	3	80
	63	100	100	•	50	25	160 [1]	50	20	160 [1]	12	6	100	6	3	80
	75	100	100	•	50	25	160 [1]	50	20	160 [1]	8	4	125	5	3	100
	90	100	100	•	50	25	160 [1]	50	20	160 [1]	8	4	125	5	3	125
	100	100	100	•	50	25	160 [1]	50	20	160 [1]	8	4	125	5	3	125
3RV1.42	16	100	100	•	100	50	•	100	50	•	30	15	80	12	7	63
Frame size S3 With increased switching capacity	20	100	100	•	100	50	•	100	50	•	30	15	80	12	7	63
	25	100	100	•	100	50	•	100	50	•	30	15	80	12	7	63
	32	100	100	•	100	50	•	100	50	•	22	11	100	12	7	63
	40	100	100	•	100	50	•	100	50	•	18	9	160	12	6	80
	50	100	100	•	100	50	•	100	50	•	15	7.5	160	10	5	100
	63	100	100	•	100	50	•	70	50	200 [1]	15	7.5	160	7.5	4	100
	75	100	100	•	100	50	•	70	50	200 [1]	10	5	160	6	3	125
	90	100	100	•	100	50	•	70	50	200 [1]	10	5	160	6	3	160
	100	100	100	•	100	50	•	70	50	200 [1]	10	5	160	6	3	160

- No backup fuse required because it is short circuit-proof up to 100 kA.

1 A backup fuse is only required if the short-circuit current at the installation location is > I_{cu}.
2 10% overvoltage
3 5% overvoltage

2.7.3 Limiter function with standard devices for 500 VAC and 690 VAC in acc. with IEC 60 947-2

The table lists the rated limit short-circuit breaking capacity I_{cu} and the rated service short-circuit breaking capacity I_{cs} with an upstream standard circuit breaker that fulfills the limiter function at 500 VAC and 690 VAC.
The short-circuit breaking capacity can be significantly increased using the upstream standard circuit breaker with a limiter function.
The circuit-breaker connected downstream, should be set to the rated current of the load. Be sure when you set up circuit breaker combinations to note to the distances between the grounded parts and the distances between the circuit breakers.
Make sure that the cabling between the circuit breakers is short circuit-proof. You can set up the circuit breakers side by side.

Standard circuit breaker with limiter function	Standard circuit breaker		**To 500 VAC** [1]/ **525 V** [2]		**To 690 VAC** [1]	
Type Rated current I_n	Type	Rated current I_n A	I_{cu} kA	I_{cs} kA	I_{cu} kA	I_{cs} kA
3RV13 21-4DC10	**3RV10 2**	To 1	•	•	•	•
Frame size S0	Frame size S0	1.25	•	•	•	•
I_n = 25 A		1.6	•	•	•	•
		2	•	•	50	25
		2.5	•	•	50	25
		3.2	•	•	50	25
		4	•	•	50	25
		5	•	•	50	25
		6.3	•	•	50	25
		8	100	50	20	10
		10	100	50	20	10
		12.5	100	50	20	10
		16	100	50	20	10
		20	100	50	20	10
		22	100	50	20	10
		25	100	50	20	10
3RV13 31-4HC10	**3RV10 3**	16	100	50	50	25
Frame size S2	Frame size S2	20	100	50	50	25
I_n = 50 A		25	100	50	50	25
		32	100	50	50	25
		40	100	50	50	25
		50	100	50	50	25
3RV13 41-4HC10	**3RV10 4**	32	100	50	50	25
Frame size S3	Frame size S3	40	100	50	50	25
I_n = 50 A		50	100	50	50	25
3RV13 41-4MC10	**3RV10 4**	50	100	50	50	25
Frame size S3	Frame size S3	63	100	50	50	25
I_n = 100 A		75	100	50	50	25
		90	100	50	50	25
		100	100	50	50	25

•No upstream circuit breaker required because it is short circuit-proof up to 100 kA
1)10% overvoltage
2)5% overvoltage

Characteristics

You can obtain the characteristics for all the setting ranges from our Technical Assistance team by e-mail: (nst.technical-assistance@siemens.de).

3

3RT1/3RH1 contactors

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3.1 Specifications/regulations/approvals

Regulations

The following regulations apply to contactors:
- IEC 60 947-1, EN 60 947-1 (VDE 0660 Part 100), which includes the general specifications for low- voltage switching devices.
- IEC 60 947-4-1, EN 60 947-4-1 (VDE 0660 Part 102), which contains, in particular, the requirements for contactors and motor starters.

The following regulations apply to auxiliary contactors:
- IEC 60 947-1, EN 60 947-1 (VDE 0660 Part 100), which includes the general specifications for low-voltage switching devices.
- IEC 60 947-5-1, EN 60 947-5-1 (VDE 0660 Part 200) which includes, in particular, the requirements for control equipment and switching elements for the control, signaling, locking, etc. of switchgear and controlgear.

Standards

The following standards apply to the terminal markings of the contactors:
- EN 50 012: terminal markings and identification numbers for auxiliary contact elements of particular contactors (also applies to contactors with a built-on auxiliary switch block)
- EN 50 011: terminal markings, identification numbers, and identification letters for particular auxiliary contactors (also applies to auxiliary contactors with a built-on auxiliary switch block)
- EN 50 005: terminal markings and identification numbers, general rules

Approvals/ test reports

Confirmation of approvals and test certificates and characteristics can be obtained on the Internet/intranet.

Shock protection

The shock protection provided is in acc. with DIN VDE 0106 Part 100.

3.1.1 Utilization categories

In acc. with EN 60 947-4-1, the purpose of the contactors and the stress placed on them is indicated by the utilization category together with details of the rated operational current or motor output and the rated voltage.

The following tables list the definitions of the utilization categories for low-voltage switching devices and contactors from IEC 60 947 (VDE 0660) an. The rated operational voltages for the various utilization categories are listed in the low-voltage switching devices catalog.

Utilization category for AC voltages

AC	Utilization category for AC voltages	Switching capacity I/I_e On	Off	Electrical service life I/I_e On	Off
AC-1	Not an inductive load or a slightly inductive load	1.5	1.5	1	1
AC-2	Slipring motors: switch on, switch off	4	4	2.5	2.5
AC-3	Squirrel-cage motors: switch on, switch off during the run	10	8	6	1
AC-4	Squirrel-cage motors: switch on, plugging or reversing, inching	12	10	6	6

Table 3-1: Utilization categories, test conditions for AC voltage

Definition of AC-1 to AC-4

The definitions of the utilization categories AC-1 to AC-4 for main circuits can be found in the relevant regulations.
The main areas of application for contactors are:

- AC-3 operation: switching of squirrel-cage motors
- AC-1 operation: switching of resistive loads
- AC-4 operation: plugging, reversing, inching

Test conditions

Test conditions for the various utilization categories:

- In AC-1 operation, the contactor must be able to switch 1.5 times the rated operational current on and off.
- In AC-3 operation, the starting currents of the motors must be controlled. In other words, the contactor must be able to switch on 10 times the rated operational current (I_e), and switch off 8 times the I_e.
- In AC-4 operation, the contactor must be able to switch off 12 times the rated operational current (I_e) and 10 times the I_e. This represents extremely high stress for contactors because the high starting currents of the motors have to be switched off.

The breaking current is decisive in calculating the electrical service life:

- In AC-1 and AC-3 operation, 1 x I_e must be assumed.
- In AC-4 operation, 6 x I_e must be assumed because the contactor also has to switch off the motor during startup.

Utilization category for DC voltages

DC	Utilization category for DC voltages	Switching capacity I/I_e Make/break	Switching capacity Time constant $^L/_R$ (ms)
DC-1	Not an inductive load or a slightly inductive load, resistance furnaces	1.5	1.0
DC-3	Shunt motors: switching on, plugging, reversing, inching	4.0	2.5
DC-5	Series motors: switching on, plugging, reversing, inching	4.0	15
DC-6	Switching of incandescent lamps	1.5	(Incandescent lamp test)

Table 3-2: Utilization categories, test conditions for DC voltages

Definition of DC-1 to DC-6

The definitions of the utilization categories DC-1 to DC-6 apply to main circuits for switching DC voltage.
The main areas of application for contactors are:
- DC-3/DC-5 operation: switching of shunt or series motors
- DC-1 operation: switching of resistive loads, resistance furnaces

Note:
In the information on DC switching capacity in previous documents, the utilization categories DC-2 and DC-4 correspond to the current utilization categories DC-3 and DC-5.

Utilization category for AC voltage (auxiliary contact elements)

AC	Utilization category for AC voltage (auxiliary contact elements)	Switching capacity		
		Make I/I_e	Break I/I_e	$\cos\varphi$
AC-12	Control of resistive load and semiconductor load in the input circuits of optocouplers	1	1	0.9
AC-14	Control of a small electromagnetic load (max. 72 VA)	6	1	0.3
AC-15	Control of an electromagnetic load (greater than 72 VA)	10	1	0.3

Table 3-3: Utilization categories, test conditions for AC voltage (auxiliary contact elements)

Definition of AC-12 to AC-15

IEC 60 947-5-1/EN 60 947-5-1 (VDE 0660 Part 200) contains the definitions of the utilization categories AC-12 to AC-15 for switching elements for the control, signaling, locking, etc. of switchgear and controlgear.
The main areas of application for auxiliary contactors are:
- AC-14/AC-15 operation: switching of contactor coils, solenoid valves, for example
- AC-14/AC-12 operation: switching of resistive loads, for example

Rated operational currents

The rated operational currents for the various utilization categories are listed in the low-voltage switching devices catalog. The test specifications given in the table for each utilization category represent the scale for the making and breaking capacity of the auxiliary contacts.

Example

3RT1016 contactor:
I_e/AC-15 of the auxiliary contact: 6 A/230 V
Making capacity: 10 x I_e/AC-15 = 60 A

- This enables the contactor coil with the greatest power consumption (3TF56) to be switched on.
- Current value of the contactor coil when switched on: 10.7 A
- Only the holding current is decisive for switching off the contactor coil: Approximately 0.5 A in the example

According to regulations, the auxiliary contact must normally be able to switch off the rated operational current.

Utilization category for DC voltage (auxiliary contact elements)

DC	Utilization category for DC voltage (auxiliary contact elements)	Switching capacity		
		Make I/I_e	Break I/I_e	Break $^L/_R$ (ms)
DC-12	Control of resistive load and semiconductor load in the input circuits of optocouplers	1	1	1
DC-13	Control of solenoids	1	1	300
DC-14	Control of electromagnetic loads with economy resistors in the circuit	10	1	15

Table 3-4: Utilization categories, test conditions for DC voltage (auxiliary contact elements)

Definition of DC-12 to DC-14

The DC voltage switching capacity of auxiliary contacts is defined in utilization categories DC-12 to DC-14.
The main areas of application for contactors are:
- DC-12: switching of resistive loads (typical application)
- DC-13: switching of inductive loads, such as contactor coils and solenoid valves

In DC operation, the difference in stress is also determined by the L/R time constant. This must be specified by the user.

3.1.2 Positively driven operation

Regulations

The regulations for positively driven operation are:
- For contactors IEC 60 947-4-1, Appendix H (draft 17B/996/DC)
- For auxiliary contactors IEC 60 947-5-1, Amendment 2, Annex L, edition 10.1999
- ZH 1/457 Safety rules for controllers on power-operated presses
- SUVA Accident prevention guidelines of the Schweizer Unfallversicherungsanstalt (Swiss institute for accident insurance)

SIRIUS contactors comply with these regulations.

The core message of these regulations is:
Positively driven operation in contactors means that the NO contacts and NC contacts must on no account be closed at the same time.

Definition: positively driven contacts

Positively driven contacts are contacts that are mechanically connected with one another in such a way that the NC contacts and NO contacts can never be closed at the same time. This means ensuring that there is a distance between the contacts of at least 0.5 mm throughout the entire service life of the contactor, even when there is a defect, such as when the contact has been wrongly welded (ZH 1/457).

Positively driven operation in the case of 3RT1/3RH11

Positively driven operation occurs in:
- 3RT101 contactors and 3 RH11 auxiliary contactors in frame size S00 in both the basic unit and in the auxiliary switch block and also between the basic unit and the built-on auxiliary switch block
- 3RT1 contactors in frame sizes S0 to S3 between the main contacts and the normally closed auxiliary contacts. In other words, if the main contact is welded, the normally closed auxiliary contact will not close.

Positively driven operation does not occur in the case of:
- Electronically optimized auxiliary switch blocks in frame size S00

Positively driven operation is not compulsory for normal controllers. It is, however, imperative for protective circuits.

3.1.3 Safe isolation

The term "safe isolation" occurs in connection with safety/protective extra-low voltage (SELV/PELV) and functional extra-low voltage (FELV). Safe isolation reliably prevents voltage that is capable of causing electric shock from transferring to the safely isolated voltage (e.g. to safety extra-low voltage that is applied to or switched to the same device).
Safe isolation is also becoming increasingly important due to the more widespread use of electronic systems in high-voltage installations.

Definition

Circuits are safely isolated when a single fault does not result in a transfer of voltage from one circuit to another. Faults to be taken into account are, for example, a bent or loose conductive part, a bent soldering pin, broken winding wire, a screw that has fallen out, or a broken partition wall in a device.

Regulations

IEC 61 140 (replacing VDE 0106 Part 101/IEC 536) lists basic requirements that can be met using safe isolation between circuits in electrical equipment.
Basic requirements are, for example:
- Double or reinforced insulation
- Protective screening
- Combination of double or reinforced insulation and protective screening

The insulation must be resistant to aging throughout the expected service life.

Circuits without protective extra-low voltage or functional extra-low voltage do not require safe isolation.

Safe isolation in the case of 3RT1 and 3RH1 contactors

If the conducting paths of a contactor are operated with different voltages, the requirements for safe isolation must be met.
In the case of the 3RT1 and 3RH1 contactors, safe isolation is ensured up to the following voltage:
- Safe isolation between the different main conducting paths is always 400 V.
- Safe isolation between the different main conducting paths and the coil connection is always 400 V.
- The following table lists the values for safe isolation between the main and auxiliary conducting paths and the coil connection:

	3RT1 and 3RH1 contactors			
	Frame size S00 Main contact	Frame size S0 Main contact	Frame size S2 Main contact	Frame size S3 Main contact
Aux. switch				
at front	690 (*)	500	500	500
at side	-	690	500	690
Coil connection	400	400	400	400

Table 3-5: Safe isolation

(*) Only applies to 4-pole auxiliary switch blocks at the front

All the data are power system specifications with 10% overvoltage in volts [V].
400 V + 10% corresponds to 415 V + 5% and 500 V + 10% corresponds to 525 V + 5%.

Attention
In the table, the voltage that can cause electric shock and that must be safely isolated is critical. If the voltages 400 V and 24 V are to be safely isolated from one another, contactors with safe isolation up to 400 V must be used between the two points of connection used.

3.1.4 Explanation of terms

Safety extra-low voltage

Safety extra-low voltage (SELV) allows circuits with a rated voltage of up to 50 VAC or 120 VDC to be operated ungrounded. The higher voltage is safely isolated from the SELV circuits.
Safety extra-low voltage helps protect people.

Functional extra-low voltage

Functional extra-low voltage (FELV) allows circuits with a rated voltage of up to 50 VAC or 120 VDC can be operated. It does not, however, meet the requirements of safety extra-low voltage and is therefore subject to additional conditions. FELV is implemented using a ground terminal.
Functional extra-low voltage helps protect devices (e.g. programmable controllers).

PELV

PELV (protective extra-low voltage) has the same requirements as safety extra-low voltage, except for the fact that the circuit and/or exposed conductive part is/are grounded (so it is basically grounded SELV).

3.2 Device description

The SIRIUS contactors are components of the SIRIUS modular system and can therefore offer the typical benefits of SIRIUS when it comes to the selection of components and the assembly and operation of controllers and load feeders.

The SIRIUS range of contactors encompasses the following:
- Contactors for switching motors of up to 45 kW/400 V
- Auxiliary contactors with the contact variants 4 NO, 3 NO +1 NC, and 2 NO + 2 NC
- Contactor relays for system-specific cooperation with electronic controllers
- Contactors for particular applications:
  - Contactors with 4 main contacts
  - Capacitor switching contactors
  - Contactors for switching resistive loads
  - Contactors with an extended operating range
  - Contactor combinations

Frame sizes

The SIRIUS range of contactors covers everything up to 45 kW in 4 frame sizes. Each frame size has 3 or 4 standard motor outputs:

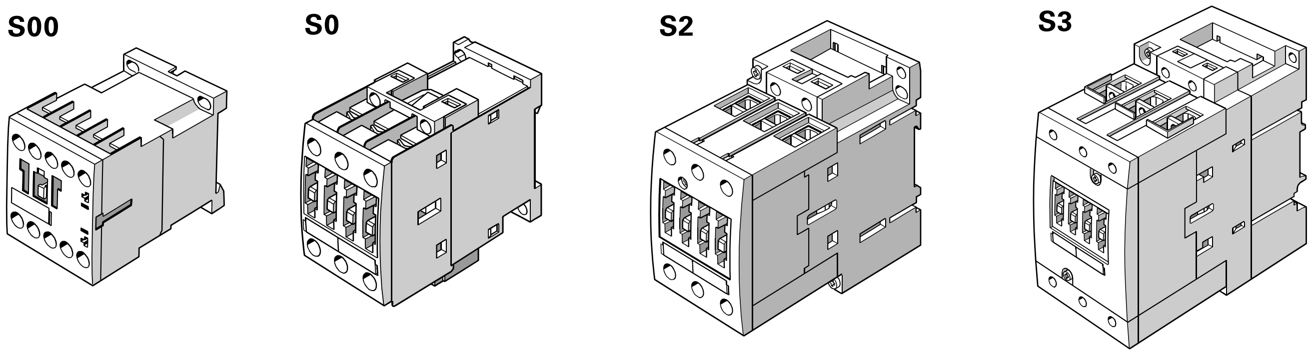


Figure 3-1: Frame sizes of the 3RT1 contactors

Performance ranges

The following table specifies the performance ranges for the frame sizes of the 3RT10 contactors:

Frame size	S00			S0				S2			S3		
Order number	3RT10..			3RT10..				3RT10..			3RT10..		
	15	16	17	23	24	25	26	34	35	36	44	45	46
At 400 V:													
P/AC-3kW	3	4	5.5	4	5.5	7.5	11	15	18.5	22	30	37	45
I_e/AC-3 A	7	9	12	9	12	17	25	32	40	50	65	80	95
Width	45 mm			45 mm				55 mm			70 mm		

Table 3-6: Performance ranges of the 3RT10 contactors

The following table provides an overview of the existing variants of the 3RT and 3RH contactors:

Models		Frame size
3RT10 contactors	AC/DC operation To operate motors, 3-pole, up to 45 kW/400 V I_e/AC-1 up to 40 °C: up to 120 A to 690 V I_e/AC-3 up to 60 °C: up to 95 A/400 V	S00 to S3
3RT14 contactors	AC/DC operation To switch resistive loads, 3-pole, up to 92 kW/400 V I_e/AC-1 at 40 °C: up to 140 A to 690 V	S3
3RT13 contactors	AC/DC operation, 4 main contacts (NO contacts) To switch resistive loads, up to 92 kW/400 V I_e/AC-1 up to 40 °C: up to 140 A to 690 V	S00 to S3
3RT15 contactors	AC/DC operation, 4 main contacts (2 NO contacts + 2 NC contacts) To switch three-phase induction motors up to 18.5 kW/400 V I_e/AC-3 up to 60 °C: up to 40 A to 400 V	S00 to S2
3RT16 contactors	AC operation To switch three-phase capacitors up to 50 kvar/400 V	S0 to S3
3RH/3RT contactors	DC operation with an extended operating range: 0.7 to 1.25 x U_S 3RT: to switch motors up to 45 kW/400 V I_e/AC-3 up to °C: 95 A to 400 V 3RH: to switch auxiliary circuits I_e/AC-15/AC-14 up to 70 °C: 6 A/230 V	S00 to S3
3RT contactor relays (interface)	DC operation with an extended operating range: 0.7 to 1.25 x U_S To switch motors, 3-pole, up to 11 kW/400 V I_e/AC-3 up to 60 °C: 25 A to 400 V	S00 and S0
3RA13 contactor combina-tions	AC/DC operation To reverse up to 45 kW/400 V, I_e/AC-3: 95 A/400 V	S00 to S3
3RA14 contactor combina-tions	AC/DC operation, for star-delta startup up to 75 kW/400 V, I_e/AC-3: 150 A/400 V	S00-S00-S00 to S3-S3-S2
3RH11 auxiliary contactors	AC/DC operation, to switch auxiliary circuits, 4-pole (basic unit) I_e/AC-15/AC-14 up to 60 °C: 6 A/230 V	S00
3RH14 latched auxiliary contactors	AC/DC operation, to switch auxiliary circuits, 4-pole (basic unit) I_e/AC-15/AC-14 up to 60 °C: 6 A/230 V	S00
3RH11 contactor relays (interface)	DC operation with an extended operating range (0.7 to 1.25 x $U_{S)}$ to switch auxiliary circuits, 4-pole I_e/AC-15/AC-14 up to 60 °C: 6 A/230 V	S00
Unwelded contactors 3RT11 24, 3RT11 35	The unwelded contactors are put together using a circuit breaker to make an unwelded feeder. The features are: • Standard: IEC 947-6-2 (for feeders with increased requirements) • Compact • Extremely high reliability in the entire current range up to 50 kA	S0, S2

Table 3-7: Types of 3RT/3RH contactors

Auxiliary contacts and built-on accessories

- A uniform and diverse range of auxiliary switches and accessories that can be quickly upgraded and replaced is available for 3RT1 contactors up to 45 kW for various applications.
- The 3RH auxiliary contactors can be extended to form variants with a maximum of 8 poles using attachable 2 or 4-pole auxiliary switch blocks.
- Wiring kits with and without mechanical interlocking are available for putting together 3RA contactor combinations for reversing and for star-delta starting.

The accessories are described in detail in Section 3.4, "Accessories".

3.2.1 Actuating systems

AC coil:	• Ferromagnetic iron core (due to eddy current losses) • Adequate holding power • Automatic reduction from high closing power to low holding power • Short switching times
DC coil:	• Solid parts are permissible • Larger unit volumes (to achieve a tensile force comparable to that of an AC coil) • High holding power • Closing power = holding power • Longer switching times

Table 3-8: Actuating systems

3.2.2 Short-circuit protection of the SIRIUS contactors

Section 3.7, "Technical specifications", has information on short-circuit protection. Fuses and circuit breakers can be used as short-circuit protective devices for the contactors.
The test criteria that apply in this case are stipulated by EN 60 947-4-1 (VDE 0660 Part 102).

Coordination types

Two types of assignment are defined in the standards that correspond to two different levels of damage.
The following applies to both types of assignment:
In the event of a short-circuit, the short-circuit protective device used must be able to disconnect the overcurrent that occurs both safely and successfully. Persons or other parts of the system must not be put at risk.

Coordination type 1

The load feeder (e.g. motor starter) can be inoperable after each short-circuit disconnection. Damage to the contactor and the overload relay is permissible, but it is only possible to continue operation after defective devices have been repaired or replaced.

Coordination type 2

After short-circuit disconnections, there must be no damage to the load feeder devices. The only exception is if the contactor contacts have been welded and can be easily separated again without distorting the contact pieces.

Contactors with overload relay

If contactors are combined with an overload relay, a smaller fuse as specified in the NSK catalog on permissible short-circuit protection fuses for motor starters should be used.

The information required to ensure unwelded fusing of the contactors is contained in the NSK catalog.

3.2.3 Operation

3.2.3.1 General information

Ambient temperature

The 3RT10 contactors are designed for use in ambient temperatures of -25 °C to +60 °C. Some variants can be used in temperatures of -35 °C to +70 °C.

Degree of protection

The degree of protection of the SIRIUS contactors is IP20.

⚠ **Warning**
When the supply voltage and load are present, the contactor must not be actuated by pressing the contact support. It is permissible, however, to carry out tests with an extra-low test voltage (e.g. ≤ 24 V).

Mechanical life

A significant criterion for the economical use of contactors is their mechanical endurance. This is expressed in the number of operations that are possible without placing a load on the conducting path. You cannot expect too much in terms of mechanical endurance from switches that have to work with a relatively high contact load, such as isolators and circuit breakers without neglecting their cost-efficiency. Contactors, on the other hand, are switching devices designed specifically for very high numbers of operations and switching frequency.
The following table shows you the mechanical endurance of 3RT1 contactors:

Device	Mechanical endurance
Basic unit, frame size S00	30 mill. operating cycles
Basic unit, frame size S00 with built-on auxiliary switch block	10 mill. operating cycles
Basic unit, frame sizes S0 to S3	10 mill. operating cycles
Basic units, frame sizes S00 to S3 with built-on, electronically optimized auxiliary switch block	5 mill. operating cycles

Table 3-9: Mechanical endurance

The mechanical endurance can be increased if low current is used (for example, 17 V 5 mA) but only if there is no arcing during switching.

Display of the contactor function

The 3RT1926 LED indicator block can be connected to the coil connections of the contactors in frame sizes S00 to S3. It indicates the status of the contactors by means of the yellow LED. The indicator block can be snapped onto the front in the opening intended for the inscription plate.
The advantage is that the LED indicator block can be used for AC/DC voltages of 24 V to 240 V and that it is protected against polarity reversal.

3.2.3.2 Contact reliability

Increasingly in industrial control engineering, conventional contactor controls are combined with electronic control systems. Working together in this way gives rise to higher demands than those when used in conventional contactor controls.
An important requirement is that the signal generators (auxiliary contacts of contactors, for example) display high contact reliability at low voltages and currents, while retaining their full switching capacity at high voltages.

Switching with auxiliary contacts (≤ 110 V and ≤ 100 mA)

The following applies to the contactors of the SIRIUS range:
If voltages ≤ 110 V and currents ≤ 100 mA are to be switched, the auxiliary contacts of the 3RT1 contactors or the 3RH1 auxiliary contactors should be used instead of the main contacts because of their contact reliability. This comes from their high contact stability due, in particular, to the shape of the contact pieces (cross-ribbing).
This ensures that the points of contact remain conductive in spite of surface contamination and the effect of dust.

These auxiliary contacts are suitable for electronic circuits (programmable controllers) with voltages > 17 V and currents in the milliampere range (test circuit: 17 V, 5 mA).

Cross-ribbing

Surface contamination is the most common cause of contact faults. Cross-ribbing the contact areas is an extremely effective way of increasing contact reliability. All the auxiliary contacts of the SIRIUS contactors have this feature.
The following illustration show you how cross-ribbing is particularly effective against surface contamination due to the high number of contact areas and high surface pressure:

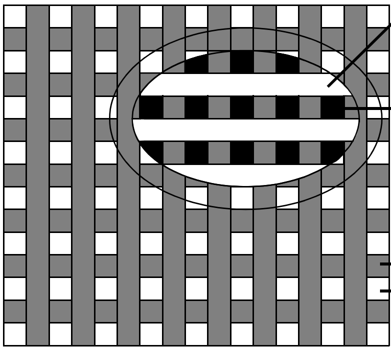


Figure 3-2: Contact areas

Contact reliability of the auxiliary contacts

The contact areas of the SIRIUS auxiliary contacts display a high degree of contact reliability. Fault frequency rates of $H_F \leq 10^{-8}$ (i. e. < 1 fault per 100 mill. operating cycles at 17 V, 1 mA) have been registered.
These values apply to auxiliary contacts that are either integrated in the contactor housing or can be snapped on as auxiliary switch blocks.
In the case of built-on auxiliary switch blocks at the side, fault frequency rates are between 10^{-6} and 10^{-8}.
The tests are based on the requirements placed on signal generators by electronic controllers.
This means that with the auxiliary contacts of the SIRIUS contactors or auxiliary contactors, the permissible contact resistance is only exceeded once during a total of 10^8 (100 million) switching operations. During a long period of operation, therefore, a fault is not expected to occur, irrespective of the number of switching operations.
A restriction applies in the case of auxiliary switch blocks built on at the side.

Definition of switch fault frequency H_F

The fault frequency H_F is defined as the number of contact faults that occur during a certain number of switching operations.

Electrical service life of the main contacts

The rated operational current I_e is defined in acc. with utilization category AC-4 (switching off 6 times the rated operational current) for a contact service life of approximately 200 000 operating cycles.
If mixed modes are used - in other words, if normal switching mode (the rated operational current is switched off in acc. with utilization category AC-3) is mixed with occasional inching mode (several times the rated operational current is switched in acc. with utilization category AC-4) - the service life of the contact pieces can be roughly calculated with the following formula:

$$X = \frac{A}{1 + \frac{C}{100} \cdot \left(\frac{A}{B} - 1\right)}$$

Key to the formula:

- X Contact service life in mixed mode in operating cycles
- A Contact service life in normal operation ($I_a = I_e$) in operating cycles
- B Contact service life in inching mode (I_a = a multiple of I_e) in operating cycles
- C Percentage of the total number of switching operations accounted for by inching operations

The following characteristic curves illustrate the contact service life of contactors when switching inductive three-phase loads (AC-3), irrespective of the breaking current and rated operational voltage. The prerequisites are arbitrary (i.e. not synchronous with the phase relation of the control station operating the network).

Characteristic curve: contact service life of the main contacts

The characteristic curves illustrate the contact service life of the main contacts of contactors when switching inductive three-phase loads (AC-3).
I_a = breaking current
I_e = rated operational current
P_N = rated output of three-phase induction motors with squirrel cage at 400 V

Frame size S00

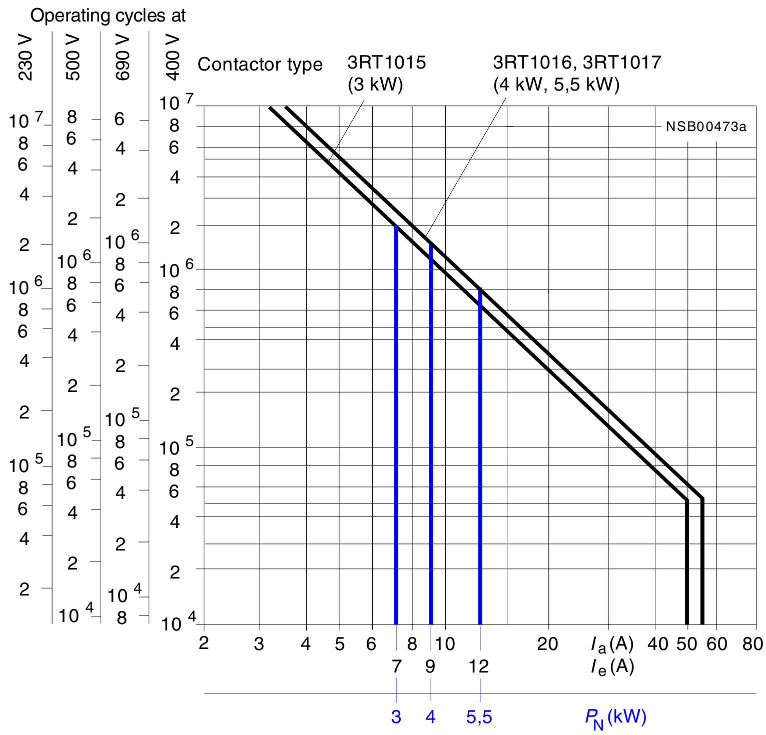


Figure 3-3: Characteristic curve of the electrical service life of the main contacts (frame size S00)

Frame size S0

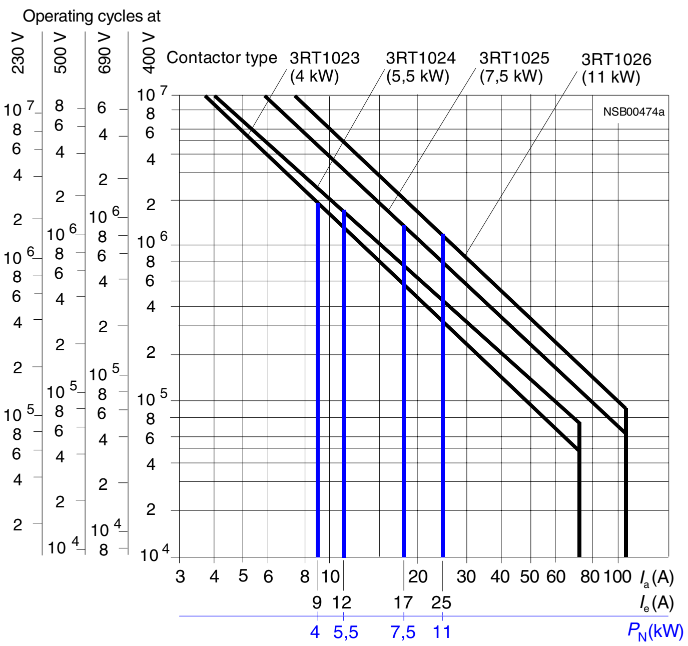


Figure 3-4: Characteristic curve of the electrical service life of the main contacts (frame size S0)

Frame size S2

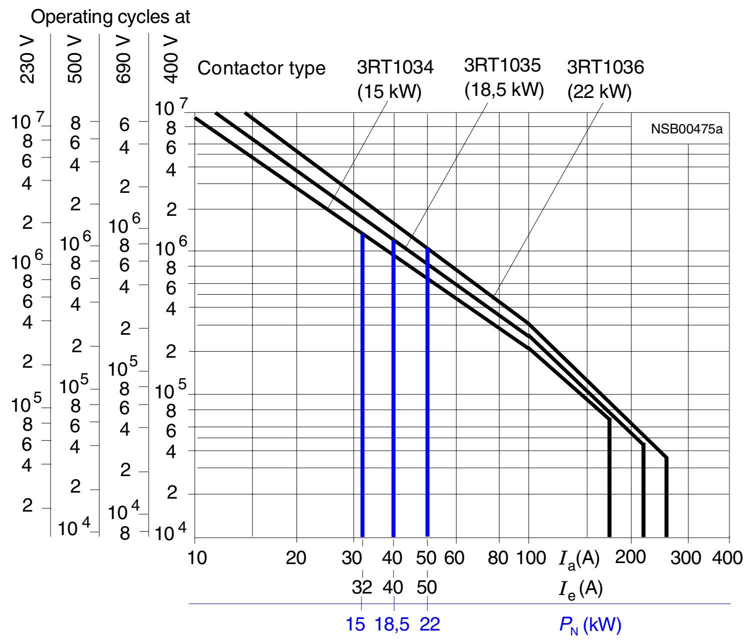


Figure 3-5: Characteristic curve of the electrical service life of the main contacts (frame size S2)

Frame size S3

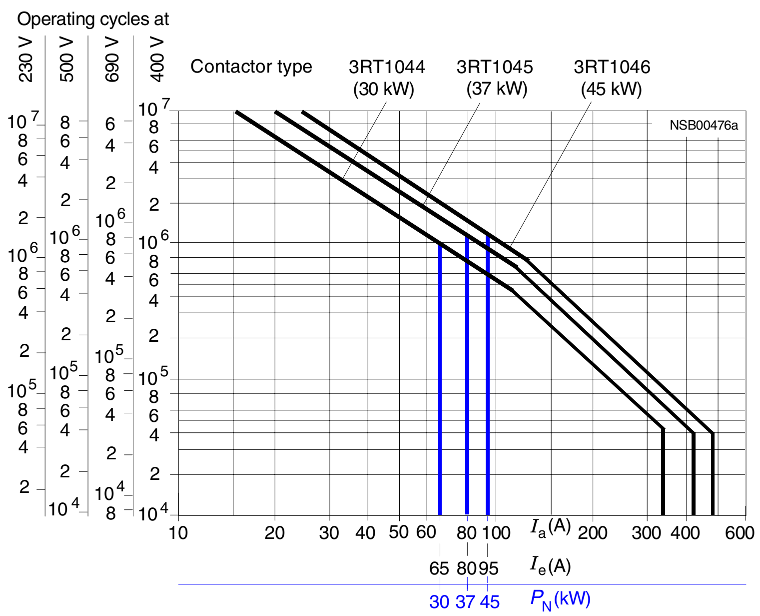


Figure 3-6: Characteristic curve of the electrical service life of the main contacts (frame size S3)

Characteristic curve: contact service life of the auxiliary contacts

The contact service life depends on the breaking current. The prerequisites are arbitrary (i.e. not synchronous with the phase relation of the control station operating the network).

The characteristic curves apply to:

- Integrated 3RT10 auxiliary contacts
- 3RH1911 auxiliary switch blocks for contactors in frame size S00
- 3RH1921 auxiliary switch blocks for contactors in frame sizes S0 to S3

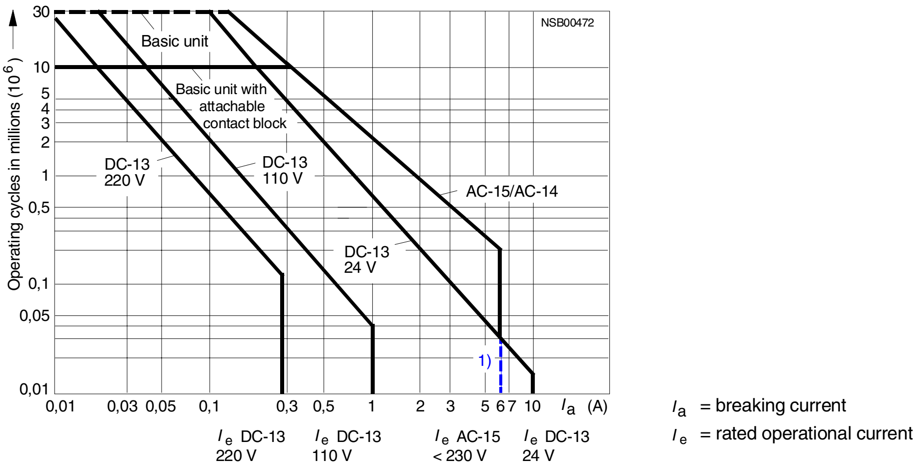


Figure 3-7: Characteristic curve of the electrical service life of the auxiliary contacts

1) DC-13: built-on auxiliary switch blocks for frame size S00: 6 A

3.3 Application and areas of use

Various switching devices are available for switching electrical loads. The contactor is most suitable device for frequent switching operations. Contactors are the most commonly used switching device in industry, mechanical engineering and in switchgear and controlgear. Due to the increased automation of production, contactors have become more important, involving greater and often different types of demands.

Automated production systems are considerably more sensitive to operational malfunctions than manually operated systems. Each fault on an electrical device means downtimes, wastage, loss of production and often considerable outlay in order to get the system up and running again.
For this reason, we concentrated on high reliability when developing the SIRIUS contactor range. This includes, in particular, increased service life, high contact reliability, and the possibility to use the contactors at higher ambient temperatures in the cubicle. It is possible to use the contactors up to 60 °C and also without derating when the devices are installed in a row.

To deal with the variety of possible applications, there are also contactor variants for special applications, such as for switching resistive loads or capacitors, in addition to the main 3RT10 range of contactors (for switching motors).
The different contactor ranges and their possible applications are described in the following subsections.

3.3.1 3RT10 contactors with 3 main contacts for switching motors

Field of application

The 3-pole 3RT10 contactors use 3 NO contacts as main contacts. They are mainly used to switch three-phase induction motors.

Frame sizes

The full performance range from 3 to 45 kW/400 V (utilization categories AC-2 and AC-3) is covered by 4 frame sizes.
The frame sizes cover the following levels of standard motor output:

- Frame sizes S00, S2, S3: three standard levels of motor output each
- Frame size S0: 4 standard levels of motor output

Dimensions

The contactors are provided with alternating or direct current magnetic systems. The required floor areas of the devices of the two operating mechanism types are the same. As of frame size S0, the installation depth for contactors with the DC magnet system is between 10 mm and 15 mm greater than for the variants with the AC magnet system.

Power ratings

All the specified power and current ratings apply to an ambient temperature of 60 °C without derating.

Increasing the power

The ease of expansion is an advantage for configuration. In many applications there is enough space to insert the contactor with the next higher rating class and thus increase motor output.

3.3.2 3RT1446 contactors with 3 main contacts for switching resistive loads (AC-1)

Field of application

The 3RT14 46 contactors with 3 main contacts for switching resistive loads are used for applications in the AC-1 utilization category:

- Switching of resistive loads such as heating systems or resistance furnaces
- Applications in which a low switching capacity is sufficient
- Applications in which high continuous currents occur without peaks (e.g. as a generator contactor or in the case of variable-speed drives.

Switching capacity

1.5 times the I_e/AC-1 can be switched on and off. Switching off higher currents, with the emergency stop, for example, is possible up to 8 times the I_e/AC-3 current.

Comparison: 3RT1046/ 3RT1446

The following table shows you the difference between the 3RT1446 and 3RT1046 contactors for normal AC-3 applications:

	Contact material	Conducting paths
3RT1446	Contact material with high current-carrying capacity and better thermal properties	Larger conducting paths that permit better cooling
3RT1046	Contact material that ensures better switching capacity	

Table 3-10: Comparison between the 3RT1446 and 3RT1046 contactors

Note on configuration

The 3RT10 range of contactors for switching motors also has a specific AC-1 switching capacity. It is much less costly, however, to use the AC-1 contactor 3RT14 for this specific purpose.

Accessories

You can use the same accessories for the 3RT14 contactors as you can for the 3RT104 contactors in frame size S3.

3.3.3 3RT13 and 3RT15 contactors with 4 main contacts

Model

There are two variants of the contactors with 4 main contacts :
- 3RT13 with 4 NO contacts
- 3RT15 with 2 NO and 2 NC contacts

You can use the accessories for both the 3-pole SIRIUS contactors and the 4-pole variants.

Field of application

The following table gives the fields of application for the 3RT13 and 3RT15 contactors:

3RT13 contactors with 4 NO contacts	3RT15 contactors with 2 NO + 2 NC contacts
• Switching of resistive loads • Isolation of networks with ungrounded or badly grounded neutral conductors • Supply switchovers in the case of alternative AC power supplies • As a contactor - for example, in variable-speed drives that only have to carry the current, not switch it	• Pole switchover in the case of crane-type motors • Switching of 2 separate loads

Table 3-11: Applications of 4-pole contactors

Auxiliary contacts

The following table specifies the maximum number of auxiliary contacts that can be attached:

Frame size S00	Frame size S0	Frame sizes S2 and S3
4 auxiliary contacts	Maximum 2 auxiliary contacts (built on at the side or snapped on at the top)	Maximum of 4 auxiliary contacts (built on at the side or snapped on at the top)

Table 3-12: 4-pole contactors and auxiliary contacts

Contactor combination with mechanical interlocking

The 4-pole 3RT13 contactors with 4 NO contacts as main contacts in frame sizes S0 to S3 are suitable for putting together contactor combinations with mechanical locking for use, for example, in supply switchovers.
The following tables show how the contactor combinations are put together in different frame sizes:

Assembly of the contactors in frame size S0 with front interlocking

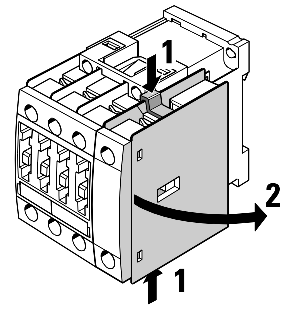
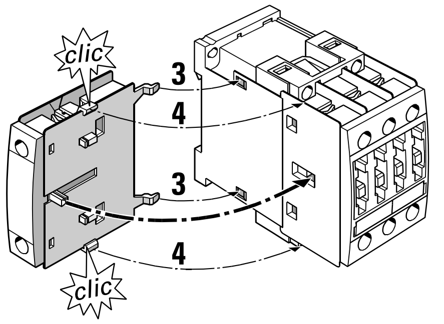
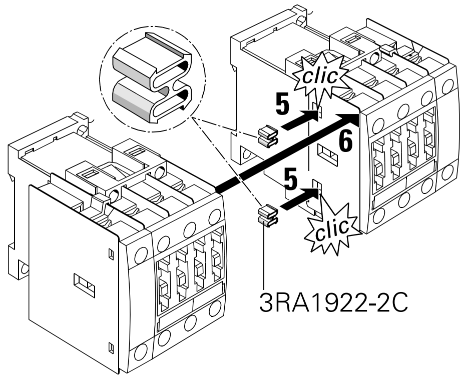
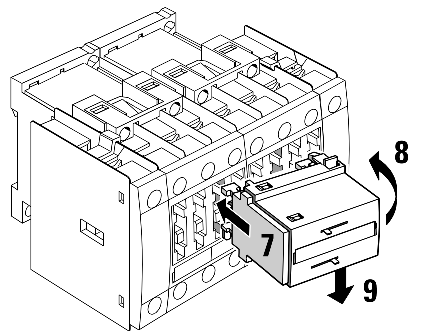
Drawing: frame size S0	Step	Procedure
	**1/2**	Remove the fourth pole of the left contactor by pressing the ribbed surfaces at the top and bottom at the same time **(1)** and then removing the pole **(2)**.
	**3/4**	Attach the pole to the left side of the same contactor.
	**5/6**	Put the contactors together by inserting two mechanical couplers (3RA1922-2C) in the appropriate openings of the contactor **(5),** and then press the other contactor onto these mechanical couplers **(6)**.
	**7/8/9**	Mount the mechanical interlock at the front (3RA1924-1A) over the two contactors.

Table 3-13: 4-pole reversing contactor combination with front interlock (frame size S0)

Assembly of the contactors in frame size S0 with lateral interlocking

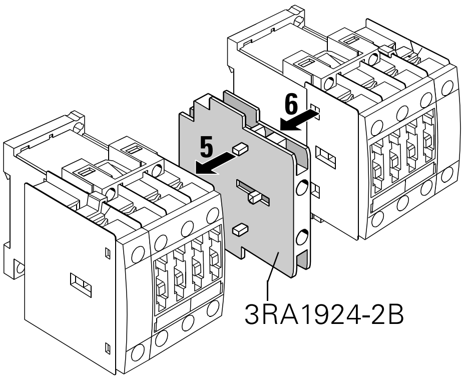
Drawing: frame size S0	Step	Procedure
	**5/6**	**Note:** The lateral mechanical interlock (3RA1924-2B) can be used if the contactor combination is to be mounted on a base plate.

Table 3-14: 4-pole reversing contactor combination with lateral interlock (frame size S0)

Assembly of the contactors in frame sizes S2/S3

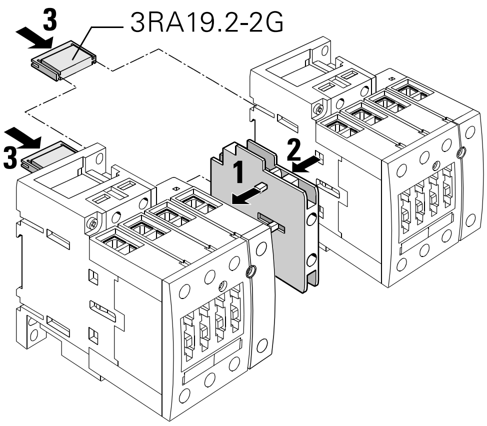
Drawing: frame sizes S2 and S3	Step	Procedure
	**1/2**	Mount the mechanical interlock between the two contactors **(1/2),** and insert the 2 connecting clips (10 mm spacing) **(3)** on the back of the two contactors.

Table 3-15: 4-pole reversing contactor combination (frame sizes S2 and S3)

Attention
The mechanical interlock at the front cannot be used in contactors in frame sizes S2 and S3.

3.3.4 3RT16 capacitor-switching contactors for switching capacitors

Field of application

3RT16 capacitor-switching contactors are used to switch power capacitors that are used in reactive-current compensation.

Frame sizes

The capacitor-switching contactors are available in frame sizes S00 to S3 with the rating levels 12.5, 15 kvar, 25 kvar, and 50 kvar at 400 V.

S00 **S3**

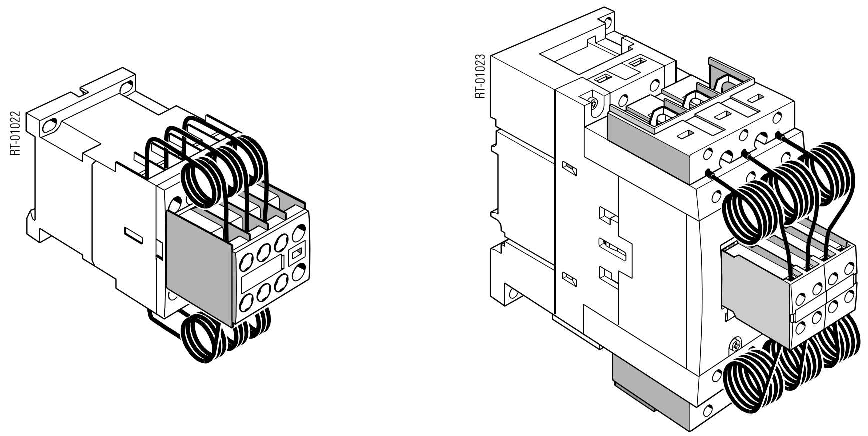


Figure 3-8: Capacitor-switching contactors (frame sizes S0 and S2)

Auxiliary switch

The auxiliary switch block snapped onto the capacitor-switching contactor contains three leading NO contacts and a normal NO contact that can be assigned as you wish. A 2-pole auxiliary switch block can also be attached at the side of the capacitor-switching contactors (variants: 2 NO contacts, 2 NC contacts, or 1 NO + 1 NC contact).

Switching capacitors/ banks of capacitors

A single capacitor can normally be switched on because the current is limited by the inductance of the upstream transformer and the cables. It is more difficult to switch banks of capacitors (parallel connection of a capacitor to capacitors already present) because the current is now only limited by the low inductance of the connecting leads and the capacitors.
This problem is solved in the case of capacitor-switching contactors using precharging resistors.

Precharging resistors

The precharging resistors are an integral part of the contactor in 3RT16 capacitor-switching contactors. They are switched on via leading auxiliary contacts before the main contacts close. This results in damping down to approximately 10 % of the undamped peak currents. Damping of peaks in the making current prevents disturbances to the network.

Important
Make sure when switching banks of capacitors that you adhere to the specified minimum inductance between the capacitors connected in parallel that are to be provided in addition.

3RT10. capacitor switching capacity

The normal 3RT10 contactors for switching motors also have a certain capacitor switching capacity. Details of this can be found in Section 3.7, Technical specifications: Utilization category AC-6b, switching of individual capacitors and switching of low-inductance three-phase capacitors. The tables contain information on the switching of individual capacitors and the switching of banks of capacitors.

Operation

Caution
Only switch to discharged capacitors! Do not carry out a function test by hand.
The precharging resistors must not be removed as this will damage the contact pieces in circuits with a load.

Circuit diagram

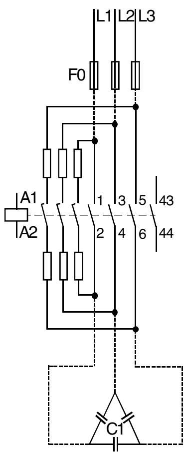


Figure 3-9: Capacitor-switching contactors, circuit diagram

3.3.5 Contactors with an extended operating range

Field of application

The contactors with an extended operating range are used in systems with strong fluctuations in the control supply voltage and at the same time high ambient temperatures, such as railway applications in extreme climatic conditions, rolling mills, etc.

Standards

Contactors with an extended operating range comply with the following standards:

- IEC 60 947-4-1
- EN 60 947-4-1 (VDE 0660 Part 102)
- The requirements of IEC 60 077

They are shockproof in acc. with DIN VDE 0106 Part 100.
Exception: the series resistor in frame sizes S0 to S3

Control current circuits and auxiliary current circuits

The magnet coils of the contactors have an extended operating range of 0.7 to 1.25 x U_S and are wired with varistors as standard to provide protection against overvoltage. This increases the time to contact parting compared with standard contactors by 2 ms to 5 ms.

With/without a series resistor

The 3RH11 and 3RT10 contactors with the suffix -0LA0 at digits 13 to 16 in the order number are used particularly where, in addition to a wide operating range and a high ambient temperature of 70 °C, several auxiliary contacts are required. Up to 4 auxiliary contacts can be used in these variants. To ensure that the magnetic system can produce the required amount of power at power-up, the contactors initially require a certain amount of overexcitation. By means of the series resistor, the contactors are switched to the normal hold-in coil level after power-up.
If fewer auxiliary contacts are required, contactors with the same extended operating range that work without a series resistor are available up to frame size S0.
The two ranges are described in more detail below.

3.3.5.1 Contactors with an extended operating range (3RH11...-0LA0/3RT10...-0LA0)

The DC magnetic systems of the contactors must be switched to hold-in coil level via a series resistor.

Arrangement of components in frame size S00

Auxiliary contactors and contactors of frame size S00 are available with the following:
- A built-on block that contains the series resistor (the NC contact required for the switchover in the basic unit is already wired).
- Integrated varistor
- A 4-pole auxiliary switch block (in acc. with EN 50 005) can also be built on.

Arrangement of components in frame sizes S0 to S3

Contactors of frame sizes S0 to S3 are fitted on the front with an auxiliary switch block with 2 NO contacts + 2 NC contacts. The separate series resistor that is attached at the side next to the contactor on the 35 mm rail has connecting leads for contactor attachment. An NC contact of the auxiliary switch block is required for the switchover to hold-in coil level. A circuit diagram with the terminal points is stuck onto each contactor.

Auxiliary contacts

One NC contact of the auxiliary contacts is required for the series resistor. The number of auxiliary contacts that are available beyond this is listed in the selection and order data. With frame size S00, the auxiliary switch block that you may need must be ordered separately.

Installation

The following types of installation are permissible for contactors and auxiliary contactors in ambient temperatures of up to 70 °C:
Frame size S00: installation in series
Frame sizes S0 to S3: The resistor block must be installed on the right next to the contactor because of the connecting leads there.

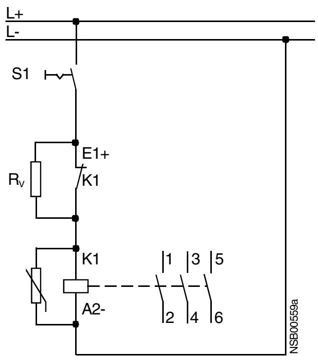
Dimensions

When the resistor is mounted, the contactors of frame sizes S0 to S3 become wider (see Section 3.6, Dimensioned drawings).

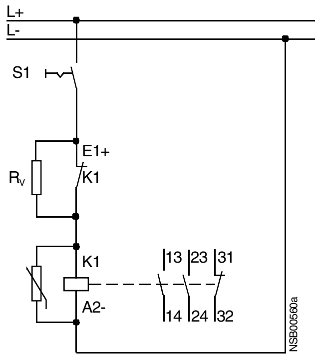
Circuit diagrams

Frame size S00

Terminal markings in acc. with DIN EN 50 012
Contactors 3RT1017-2K.42-0LA0



Terminal markings in acc. with DIN EN 50 005
Auxiliary contactors 3RH1122-2K.40-0LA0

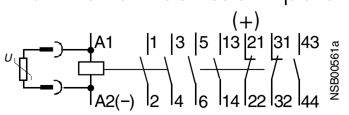


Series resistor R_V attached
NC contact wired
2 NO + 1 NC contacts available

Figure 3-10: Contactors with an extended operating range, circuit diagrams

Frame sizes S0 to S3

Terminal markings in acc. with EN 50 012
Contactors 3RT102.-, 3RT103.-, 3RT104.-3K.44-0LA0
With front-mounted 4-pole auxiliary switch block 3RH1921-1HA22



2 NO + 2 NC contacts
Identification number 22

Figure 3-11: Contactors with an extended operating range, terminal markings

NC contact 21/22 is required for the wiring of the series resistor.

Circuit diagram for wiring of the series resistor

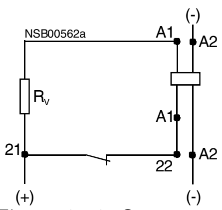


Figure 3-12: Contactors with an extended operating range, circuit diagram

3.3.5.2 Contactors with an extended operating range (3RH1122-2K.40, 3RT1017-2K.4., 3RT102.-3K.40)

Contactors of frame size S00: 3RH11 22-2K.40, 3RT1017-2K.4. and frame size S0: 3RT102.-3K.40 have the following features:

- Extended operating range of 0.7 to 1.25 x U_s
- The magnet coils are wired with a varistor; an additional series resistor is not required
- Permissible ambient temperature 60 °C

Note the following:

- Frame size S00: an auxiliary switch block cannot be attached
- Frame size S0: a maximum of two 1-pole auxiliary switch blocks can be attached

Installation

At an ambient temperature > 60 °C ≤ 70 °C, there must be spacing of 10 mm when installing in series.

Ambient temperature

The permissible ambient temperature for operating the contactors at the full operating range of the magnet coils is -35 °C to +70 °C. During continuous operation with temperatures > +55 °C, the mechanical service life, the current-carrying capacity of the conducting paths, and the switching frequency are reduced.

3.3.6 3RH1 auxiliary contactors

Auxiliary contactors are switching devices for auxiliary circuits for controlling, reporting, and interlocking. Auxiliary contactors have to meet specific requirements in terms of clear terminal markings and a time- and cost-saving terminal system.
The SIRIUS 3RH1 auxiliary contactors (frame size S00) meet these requirements

Terminal markings

The terminal markings comply with EN 50 011 and EN 50 005 (for a more detailed explanation, see Section 3.4.1, Auxiliary switches).

Frame size and features

3RH1 auxiliary contactors are available with the following:

- Frame size S00
- With AC and DC operation
- Format as for motor contactor of frame size S00
- 4-pole basic version
- Can be extended to 8 poles with snap-on auxiliary switch blocks
- Screw-type or Cage Clamp terminals

Screw-type terminals

The 3RH1 auxiliary contactors have captive screws (cross-tip Pozidriv, size 2), with all the terminal points open on delivery. The screwdriver guides allow screwdriving machines to be used.

Cage Clamp terminals

The 3RH11 auxiliary contactors are also available with Cage Clamp terminals - a screwless terminal system. This type of terminal is particularly suitable if strong shaking or vibrations can be expected at the installation location. These terminals are also suitable for two-conductor connections. All the terminals are accessible from the front and are easily visible.

Soldering pin connections

Both the 4-pole basic version as well as the auxiliary contactors that have an auxiliary switch block attached at the front (see Section 3.4, Accessories) can be soldered onto printed circuit boards using a soldering pin adapter.

Contact reliability

All the switching elements of the 3RH1 auxiliary contactors are equipped with contact pieces that have particularly high contact stability, ensuring high contact reliability even at low voltages and currents. This subject is discussed in detail in Section 3.2.3.2, "Contact reliability".

3RH14 latched auxiliary contactors

If there is a short circuit in the low-voltage network, or when large drive motors are switched on directly, the control supply voltage for the auxiliary contactors may fail briefly or fall under the permissible tolerance level. To ensure continuous operation, the variant with mechanical latching (3RH14) can be used with the auxiliary contactors.
These auxiliary contactors latch mechanically after power-up and remain in an energized state even in the event of a power failure. The auxiliary contactor can be unlocked electrically using an interlock release magnet or manually using a button on the front of the attached latched block. When the voltage returns, the production program can be resumed immediately without resetting times due to the storage feature of the auxiliary contactors. The contactor coil and the coil of the release magnet are both designed for continuous operation.
The power input is the same for the contactor coil and the release coil. The mechanical service life is 1 million operating cycles.

3.3.7 3RT10 contactor relays for switching motors (interface) and 3RH11 contactor relays for switching auxiliary circuits

Contactor relays are available in the SIRIUS modular system for switching motors and auxiliary circuits for the purpose of smooth interaction with electronic controllers. These are variants of the 3RT10/3RH11 contactor series with the following features:
- Low power input
- Wide operating range of the magnet coil 0.7 to 1.25 x U_S
- High contact reliability of the auxiliary contacts
- Integrated or attachable overvoltage damping

Contact reliability

The high contact reliability of the auxiliary contacts ensures that false signals do not occur even at low switching capacities. With a voltage of 17 V and a current of 1 mA, there is on average less than one contact fault per 100 million switching operations.

Overvoltage damping

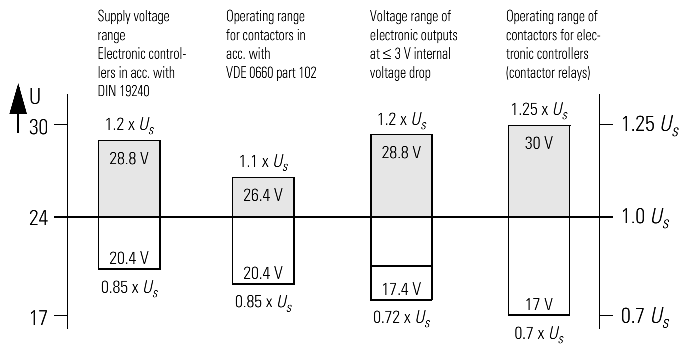
Overvoltage damping protects sensitive output levels of electronic controllers against switching overvoltages of the coil.

Extended operating range

The operating range of the coil of the contactor relays covers a voltage range from 0.7 to 1.25 x U_S (U_S= rated control supply voltage). This wide operating range is required for the supply voltage of electronic controllers with the required voltage tolerances.
The supply voltage of electronic controllers with 24 VDC covers the range 20.4 V to 28.8 V in acc. with DIN 19 240. If you take into consideration an additional loss of voltage of up to 3 V during the output phases, the contactor drive must be able to operate perfectly with voltages between 17.4 V and 28.8 V. The 3RT10 and 3RH11 contactor relays for electronic controllers operate safely from 17 V to 30 V, which corresponds to a voltage range of 0.7 x U_S to 1.25 x Us. This is a considerably wider operating range than that of 0.85 to 1.1 x U_S for contactors and auxiliary contactors in acc. with IEC 60 947, DIN EN 60 947 (VDE 0660).

Voltage ranges

The following graphic shows you the voltage ranges for electronic controllers and drives of contactors and contactor relays with a rated control supply voltage of U_S = 24 VDC:



Voltage ranges for electronic controllers and drives of contactors and contactor relays with a rated control supply voltage of U_S = 24 VDC

Figure 3-13: Contactor relays: voltage ranges

Auxiliary switch blocks

Auxiliary switch blocks can be built on as follows:
Frame size S00: none
Frame size S0: a maximum of two 1-pole auxiliary switch blocks

Power consumption

Variant 1: The power input of the magnet coils for contactor relays in frame size S00 is 2.3 W at 24 VDC (operating range: 0.7 to 1.25 x U_S).

Variant 2: Contactor relays with reduced coil performance in frame size S00, P = 1.4 W at 24 VDC (operating range: 0.85 to 1.85 U_S).

The power input of magnet coils for contactor relays in frame size S0 is 4.2 W at 24 VDC (operating range: 0.7 to 1.25 x U_S).

3.3.8 Contactor combinations for reversing

Contactor combinations are available for reversing (3RA1) in frame sizes S00 to S3:

- Installed in the factory
  Frame sizes S2 and S3 are delivered already mounted on a base plate.
- As a kit for self-assembly

The same accessories can be used as for the basic units of the corresponding frame size (see Section 3.4).
For motor protection an overload relay must be attached.

4-pole contactor combinations for reversing can be put together in frame sizes S0 and S2.

S00 **S0**

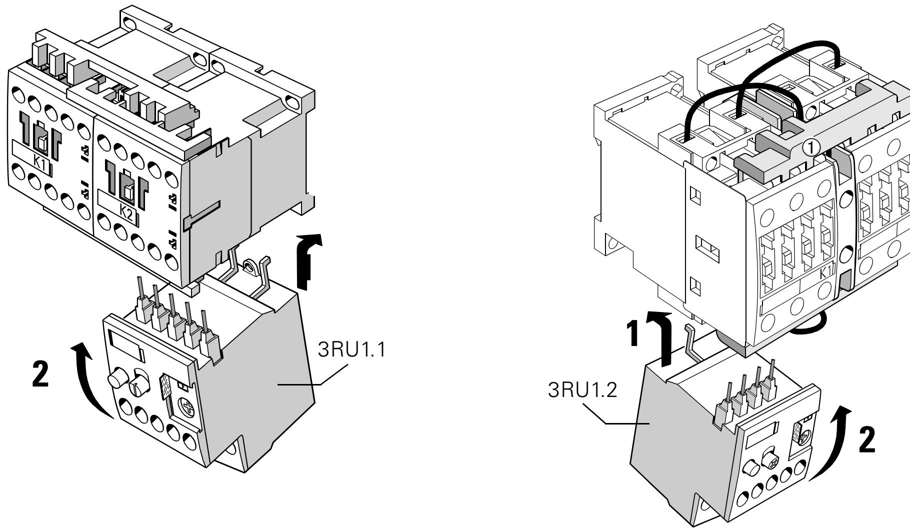


Figure 3-14: Fully assembled contactor combination for reversing (frame sizes S00 and S0)

Approvals

The CSA and UL approvals only apply to complete contactor combinations and not to combinations you have assembled from separate parts.

Switchover time

If the contactors are interlocked by means of their auxiliary switches (electrical interlocking) or by mechanical interlocking, there is no overlapping of the contacting and the arcing time between the contactors at switchover.
The switching times of the contactors are not affected by the mechanical interlock.

Note for frame size S00:
At voltages of >500 V a switchover pause of 50 ms must be included.
AC-operated 3RT10 contactors in reversing or Dahlander mode require an NC contact interlock and a switchover pause of 50 ms.

Auxiliary contact elements

Different auxiliary switches can be attached (at the front or the side) to the 3RA1 reversing combination. An integrated auxiliary switch contact is available in frame size S00.

Accessories

The following accessories for the basic units can also be used for contactor combinations for reversing:
- Auxiliary switch blocks (at the front/side)
- Surge suppressors
- Soldering pin adapters (frame size S00)

The following accessory is designed specifically for contactor combinations for reversing:
- Locking devices for mechanical interlocking
- Locking devices for mechanical and electrical interlocking (at the front/side)
- Terminals for contactor coils (for frame sizes S0 to S3)
- Mechanical connectors
- Wiring modules

Terminals for contactor coils

To reach the coil terminals A1 and A2 of the contactor combinations for reversing more easily from contactors of frame sizes S2 and S3, you can use terminals for contactor coils.
For each combination, 2 x A1 and 1 x A2 are required.

Wiring module

Wiring modules are available to enable you to carry out different types of wiring (Dahlander wiring, for example).
You can find out how to mount the wiring modules in the diagrams of the self-assembly kits.

Mechanical interlocking

Mechanical interlocking (for frame sizes S0 to S3) is available in 2 variants:
- Attachable at the front (contactor spacing: 0 mm)
- Attachable at the side (for frame sizes S0 to S3) with integrated NC contact for electronic interlocking

Note
If you want NC contact interlocking, you must use contactors with 1 NC contact in the basic unit with the 3RT1 contactors of frame size S00.

The following graphics show you how to mount the locking devices at the front for mechanical interlocking in frame size S0:

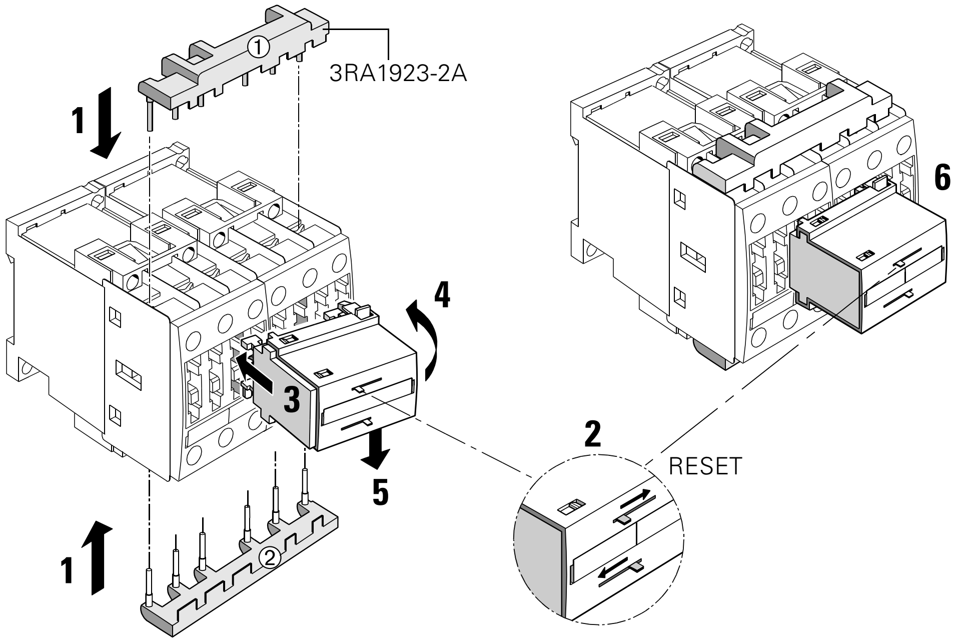


Figure 3-15: Star-delta combination, locking device at the front (frame size S0)

The following graphics show you how to mount the locking devices at the front for mechanical interlocking with frame sizes S2 and S3:

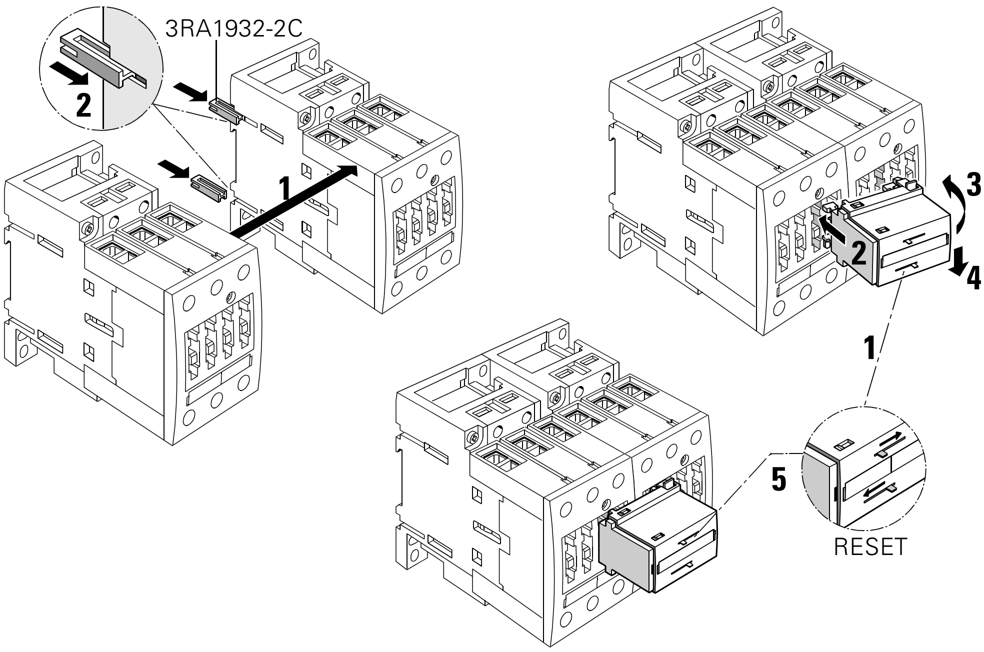


Figure 3-16: Star-delta combination, locking devices at the front (frame sizes S2/S3)

The following accessories are components of the self-assembly kits and they are described in the diagrams of the relevant kit:

- Lateral locking device
- Mechanical connectors
- Wiring modules

Kits

The following table shows you the components of the kit for the contactor combination for reversing in frame size S00 and explains how to put it together:

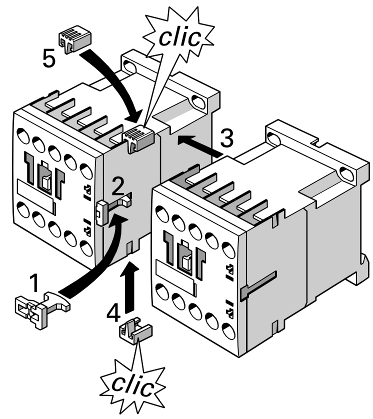
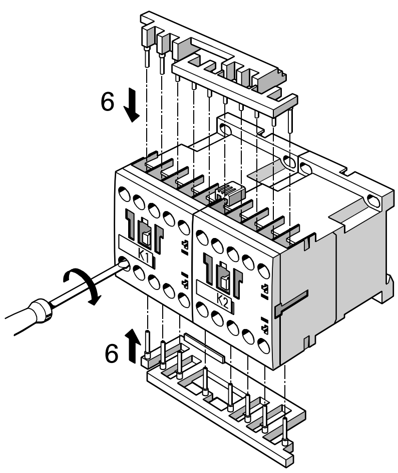
Drawing: frame size S00	Step	Procedure
	**1/2/3**	Mount the mechanical interlock between the two contactors.
	4/5	Press the two connecting clips from above and below onto the two contactors.
	**6**	Attach the wiring modules to connect the main conducting paths and to electrically interlock the two contactors (3RT10.1). Make sure that the wiring modules are flush with the contactor at the side.

Table 3-16: Assembling the contactor combination for reversing (frame size S00)

Electrical interlock

Note:
Contactors with an NC contact in the basic unit (3RT101.) are required for the electrical interlock.

The following table shows you the components of the kit for the contactor combination for reversing in frame size S0 and explains how to put it together:

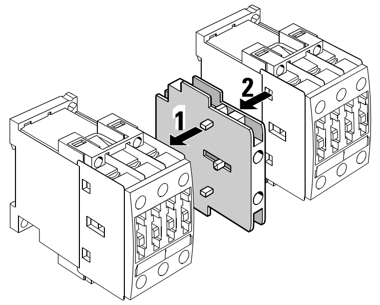
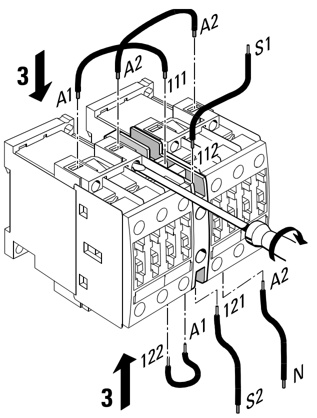
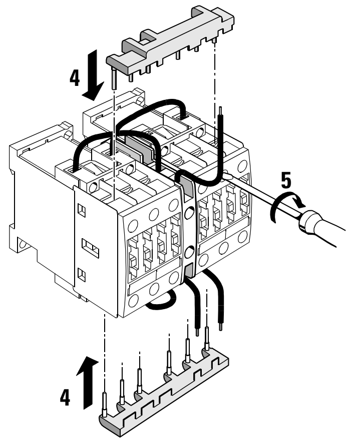
Drawing: frame size S0	Step	Procedure
	**1/2**	Mount the mechanical interlock between the two contactors.
	**3**	Wire the actuating voltage and the electrical reversing interlock using the auxiliary conducting paths.
	**4/5**	Attach the wiring modules **(4)** in order to connect the main conducting paths and tighten the terminals **(5)**.

Table 3-17: Assembling the contactor combination for reversing (frame size S0)

The following table shows you the components of the kits for the contactor combination for reversing in frame size S2 and S3 and explains how to put it together:

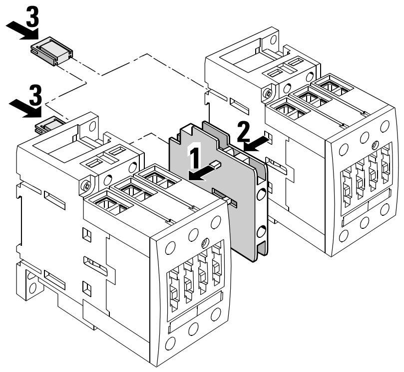
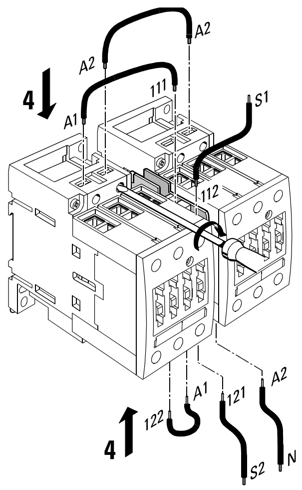
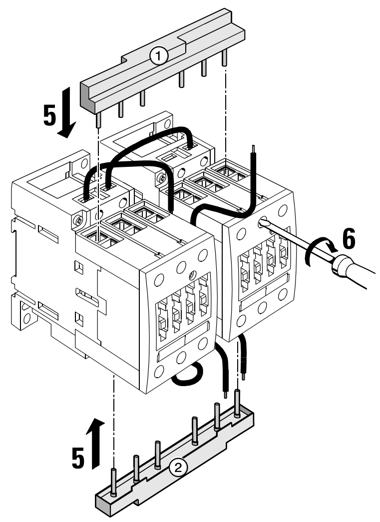
Drawing: frame size S2 (S3)	Step	Procedure
	**1/2/3**	Mount the mechanical interlock between the two contactors **(1/2),** and insert the 2 connecting clips (10 mm spacing) **(3)** on the back of the two contactors.
	**4**	Wire the actuating voltage and the electrical reversing interlock using the auxiliary conducting paths.
	**5/6**	Attach the wiring modules **(5)** in order to connect the main conducting paths and tighten the terminals **(6)**.

Table 3-18: Assembling the contactor combination for reversing (frame sizes S2/S3)

4-pole contactor combination for reversing

4-pole contactor combinations for reversing are available in frame sizes S0 and S2. You will require the following to mount these combinations:
- Frame size S0: locking device for mechanical interlock
- Frame size S2: locking device for mechanical interlock and 2 connecting clips

The following table shows you how to set up the 4-pole contactor combination for reversing in frame size S0:

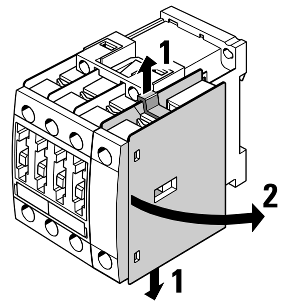
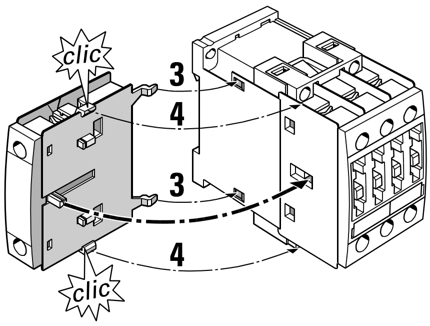
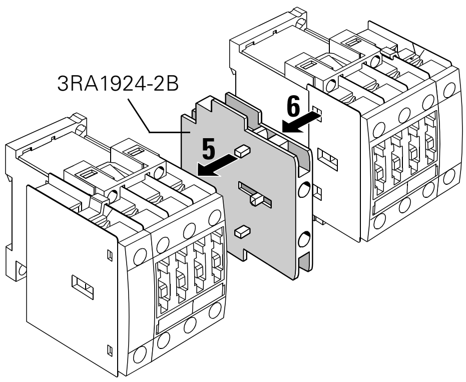
Drawing: frame size S0	Step	Procedure
	**1/2**	Remove the 4th pole from one of the two contactors by releasing the snap catch **(1)**.
	**3/4**	Put the 4th pole on the other side of the same contactor by placing the catches on the pole into the openings shown on the contactor and snapping the pole onto the contactor.
	**5/6**	Mount the mechanical interlock between the two contactors **(5/6)**.

Figure 3-17: 4-pole contactor combination for reversing (frame size S0)

The following table shows you how to set up the 4-pole contactor combination for reversing in frame size S2:

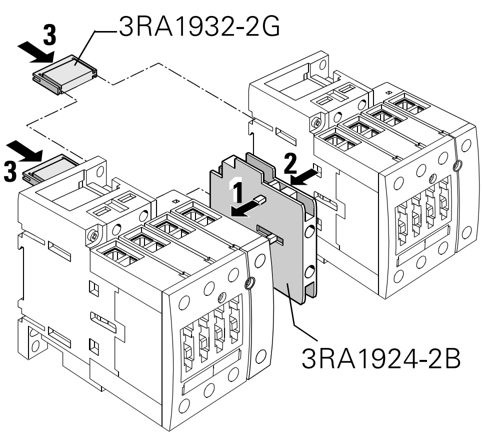
Drawing: frame size S2	Step	Procedure
	**1/2**	Mount the mechanical interlock between the two contactors **(1/2)**.
	3	Press the two connecting clips **(3)** onto the back of the two contactors.

Figure 3-18: 4-pole contactor combination for reversing (frame size S2)

NO contact function not locked

If contactors are used with 1 NO contact that is intended for an auxiliary function (e.g. as a signaling device), the wiring module must be separated. The illustration below shows you the wiring for this function:

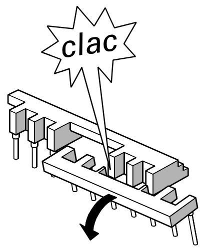


Figure 3-19: NC contact interlock (frame size S00)

Mounting and connection

The contactor combinations for reversing have screw-type connections that are suitable for both screw-on and snap-on mounting on a 35 mm rail.

Conductor cross-sections

The permissible conductor cross-sections of the contactor combinations for reversing correspond to those of the basic units for the corresponding frame size.

Circuit diagrams

Main circuit: S00, S0, S2, S3

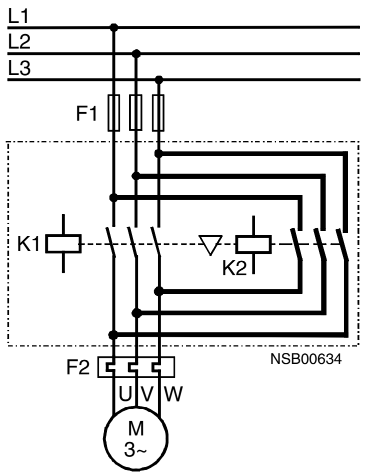


Figure 3-20: Contactor combination for reversing, main circuit (frame sizes S00 to S3)

Control circuit: S00

Pushbutton switch control

Continuous contacting

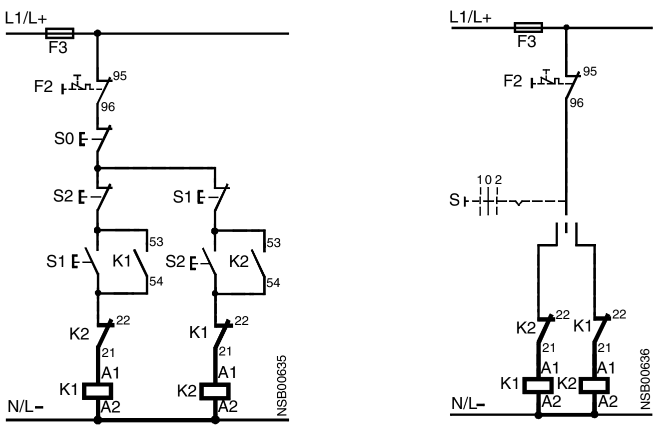


Figure 3-21: Contactor combination for reversing, control circuit (frame size S00)

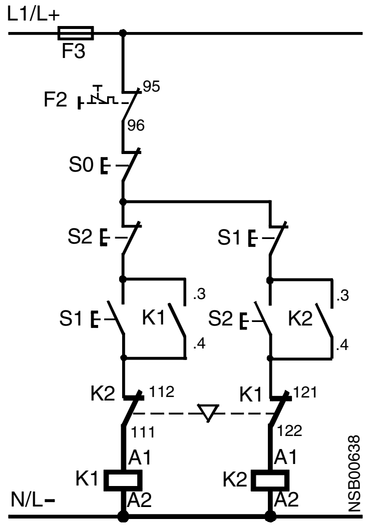
S0 "Off" button
S1 "Clockwise rotation on" button
S2 "Counterclockwise rotation on" button
S "Right/off/left" selector switch

K1 Clockwise rotation contactor
K2 Counterclockwise rotation contactor

F1 Fuses for main circuit
F2 Overload relay
F3 Fuses for control circuit

Control circuit: S0 to S3

Pushbutton switch control



Continuous contacting

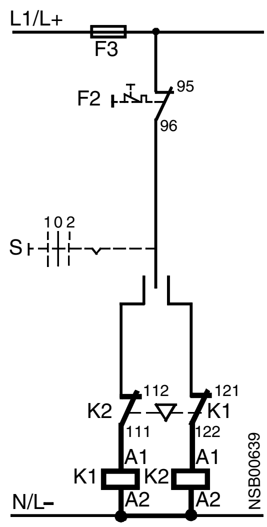


Figure 3-22: Contactor combination for reversing, control circuit (frame sizes S0 to S3)

Technical specifications

The technical specifications of the contactor combinations for reversing correspond to those of the basic units for the corresponding frame size.

3.3.9 Star-delta combinations

The 3RA1 star-delta combinations in frame sizes S00 to S3 are available as follows:

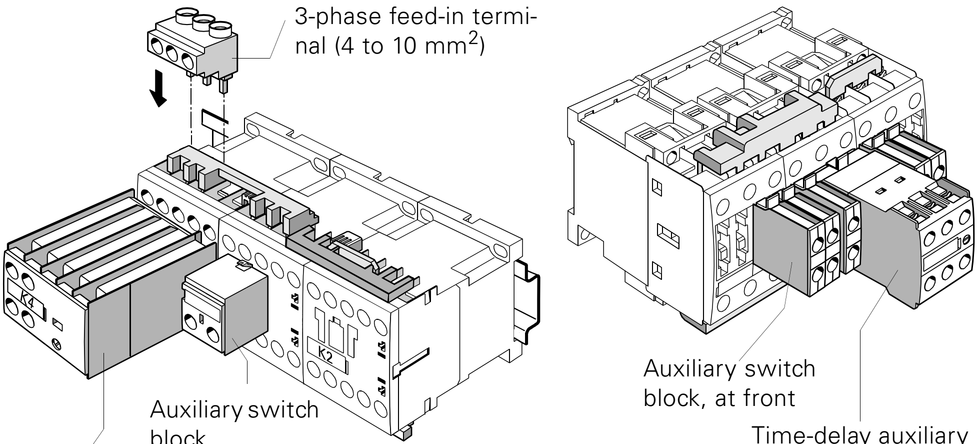
- Fully assembled with the usual auxiliary switches in the following frame sizes:
  - S00-S00-S00
  - S0-S0-S0
  - S2-S2-S0
  - S2-S2-S2
  - S3-S3-S2

  Frame sizes S2 to S3 are delivered already mounted on a base plate.
- As a kit for self-assembly

The same accessories can be used as for the basic units of the corresponding frame size (see Section 3.4, "Contactor accessories").

The following graphics show you the fully assembled star-delta combinations in frame sizes S00 to S2:

Frame size S00



Frame size S2

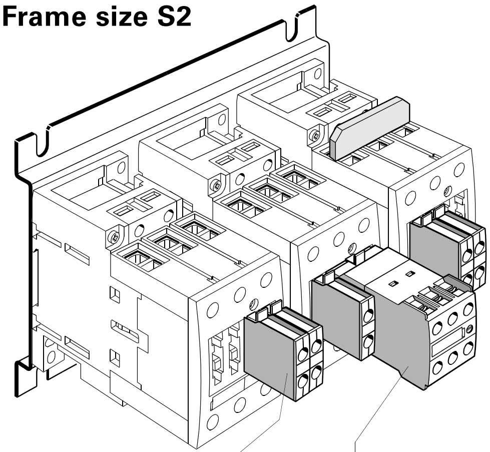


Figure 3-23: Star-delta combinations (frame sizes S00, S0, S3)

Frame size S2

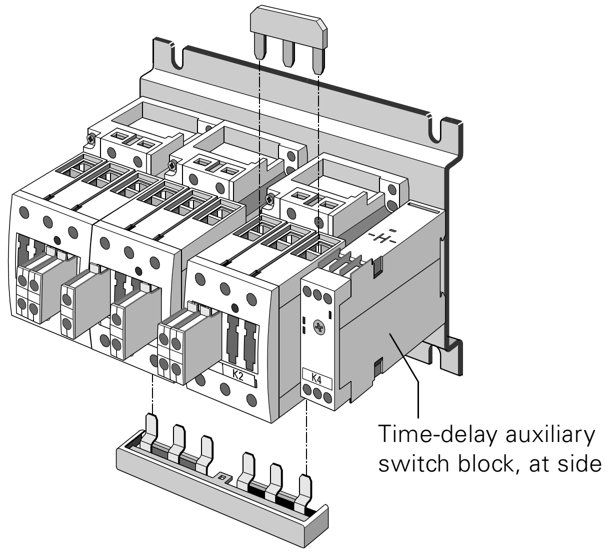


Figure 3-24: Star-delta combination (frame size S2)

Field of application

The star-delta combination is used to start three-phase induction motors which require a low load torque during startup.

Starting current ratio

Star-delta starting can only be used when the motor is switched to delta mode, starts with no load, or if the load torque during the star startup is small and does not increase rapidly.
In the star stage, the motors can be loaded with approximately 50 % (torque class KL16) and 30 % (KL10) of its rated torque.
The tightening torque is reduced to approximately 1/3 of the value at direct power-up.
The starting current is approximately 2 to 2.7 times the rated current for the motor.

Switchover

Switching from the star to the delta stage can only be carried out once the motor has completed startup to the rated speed.
The required switchover pause and interlock is included in the contactor combination.

Important
Drives that require an early switchover are not suitable for star-delta starting.

Overload protection

The fully assembled combinations are not equipped with overload protection. Overload relay (3RU11) and tripping devices for thermistor motor protection must be ordered separately.
The overload relays can be attached to the contactor directly or set up separately. The overload relay is set to 0.58 times the set current I_e. See Chapter 4 on overload relays for further information.

Features of the star-delta combinations

The following table shows you the features of the fully assembled star-delta combinations with time-delay auxiliary switch blocks with the star-delta function (3RT19.6-2B...) and solid-state time relays with semiconductor output and the possible configuration if you use the self-assembly kit:

	Frame size S00	**Frame sizes S0 to S3**
Fully assembled	At front (time-delay auxiliary switch block)	Lateral (time relay)
Kit	At front	• Lateral (time relay) • At front (time-delay auxiliary switch block)

Table 3-19: Configuration of the star-delta combinations

Important
If a time-delay auxiliary switch block is mounted on the front of K3, an auxiliary switch block can only be mounted on the side of K3.

Accessories

The following basic unit accessories can also be used for star-delta combinations:
- Auxiliary switch blocks (front, side)
- Surge suppressors
- Time-delay auxiliary switch blocks with star-delta function

In addition, there are special accessories available for the star-delta combinations:
- 3-phase feed-in terminals
- Star-point links (parallel links)
- Terminals for contactor coils (S2/S3)
- Mechanical connectors
- Wiring modules

Terminal for contactor coils

In order to reach coil terminals A1 and A2 in the star-delta combination better from contactors in frame sizes S2 and S3, terminals for contactor coils can be used.
For each combination, 2 x A1 and 1 x A2 are required.

Infeed

With conductor cross-sections > 2 x 2.5 mm^2 and 1 x > 4 mm^2 , a feed-in terminal block must be used for the star-delta combination in frame size S00. This makes the following conductor cross-sections possible:
- Frame size S00: up to 6 mm^2
- Frame size S0: up to 25 mm^2
- Frame size S2: up to 50 mm^2

Kits

The following table shows you the components of the kit for the star-delta combination in frame size S00 and explains how to put it together:

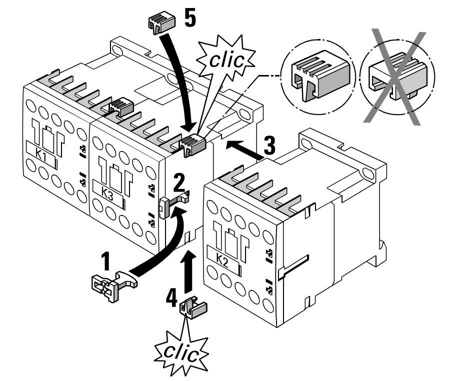
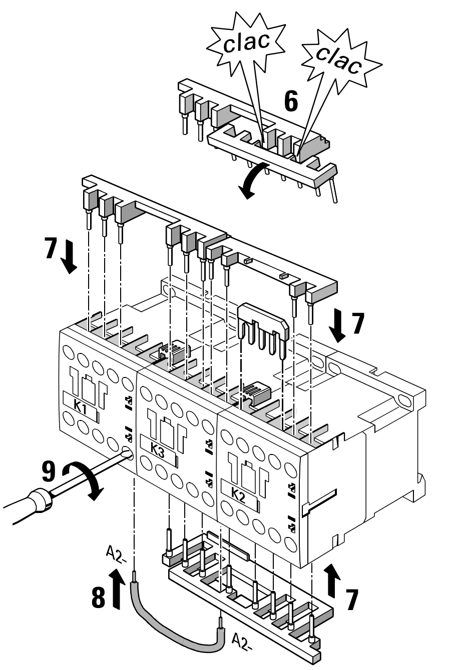
Drawing: frame size S00	Step	Procedure
	**1/2/3**	Mount the mechanical interlocks between the K2 star contactor and the K3 delta contactor **(1, 2)**.
	4/5	Press the two connecting clips from above and below onto the two contactors **(3)**. Make sure the clips are on the correct side.
	**6/7**	Break the upper link module off at the notches **(6)**, and attach the wiring modules **(7)** to connect the main conducting paths (between line contactor K1 and delta contactor (K3) and at the same time to interlock the combination electrically (K3-K2).
	8/9	Wire A2 **(8)**, and tighten the terminal screws **(9)**.

Table 3-20: Assembly of the star-delta combination in frame size S00

The following table shows you the components of the kits for the star-delta combinations in frame sizes S0 to S3 and explains how to put it together:

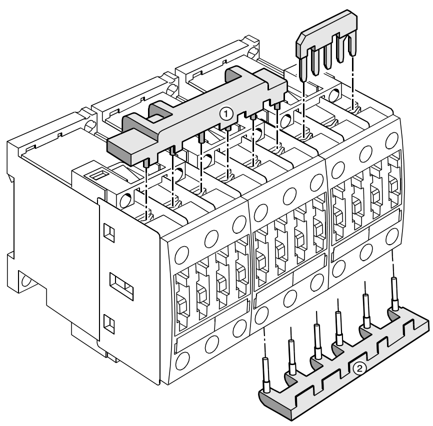
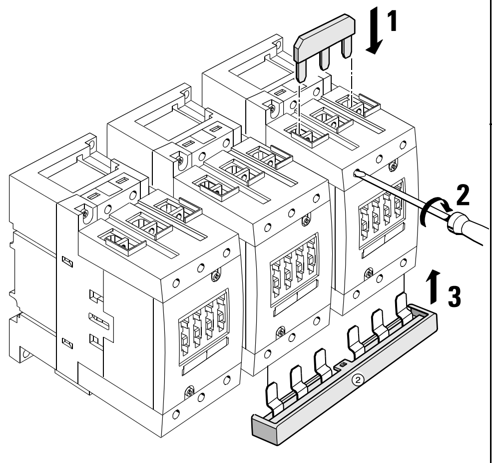
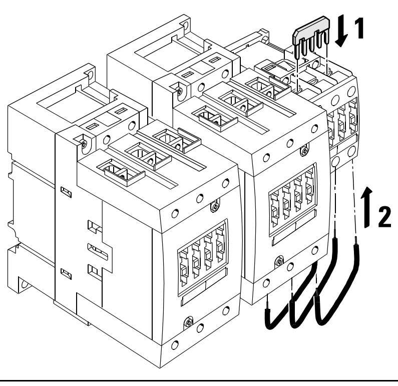
<table>
<tr><th>Drawing: frame size S0</th><th>Step</th><th>Procedure</th></tr>
<tr><td>
</td><td></td><td>Attach the wiring modules and the star-point link in order to connect the main conducting paths and to interlock the combination electrically.</td></tr>
<tr><th>Drawing: frame size S2 (S3)</th><th>Step</th><th>Procedure</th></tr>
<tr><td rowspan="2">
</td><td>1/2</td><td>Place the star-point link on the star contactor (1). Tighten the main connections (2).</td></tr>
<tr><td>3</td><td>Place the wiring module on the contactor undersides (3) to connect the main conducting paths.</td></tr>
<tr><th>Drawing: frame sizes S3-S3-S2</th><th>Step</th><th>Procedure</th></tr>
<tr><td rowspan="2">
</td><td>1</td><td>Attach the star-point link to the star contactor (1).</td></tr>
<tr><td>2</td><td>Attach the wiring module to the contactor undersides (2) to connect the main conducting paths.</td></tr>
</table>

Table 3-21: Assembly of the star-delta combinations in frame sizes S0 to S3

Compensating for different depths

In star-delta combinations with contactors of different frame sizes, it is necessary to compensate for the mounting depth of the smaller contactor.
One frame size is the maximum difference possible.
The following depth compensation must be made for a mechanical interlock attached at the side:

- S2-S2-S0: K3: 1.5 mm; K2: 0 mm
- S3-S3-S2: K3: 0 mm; K2: 27.5 mm

Mounting and connection

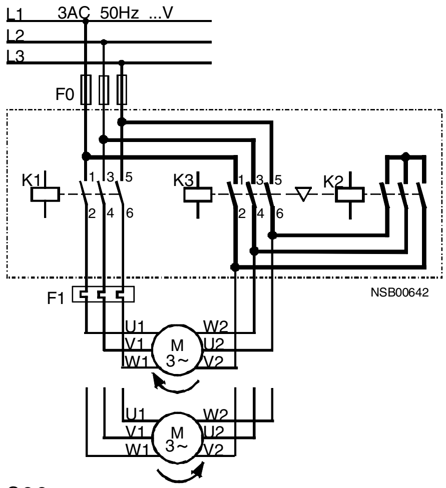
The star-delta combinations have screw-type connections that are suitable for both screw-on and snap-on mounting on the 35 mm rail.

Conductor cross-sections

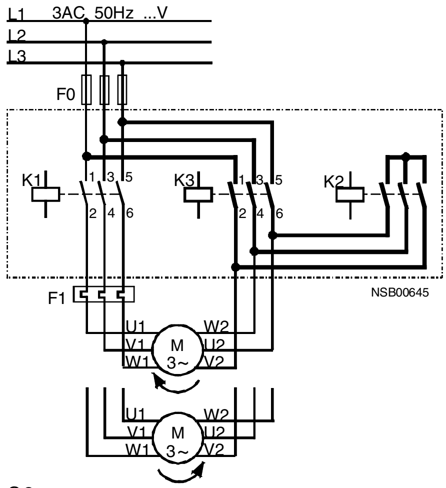
The permissible conductor cross-sections of the star-delta combinations correspond to those of the basic units for the corresponding frame size.

Circuit diagrams

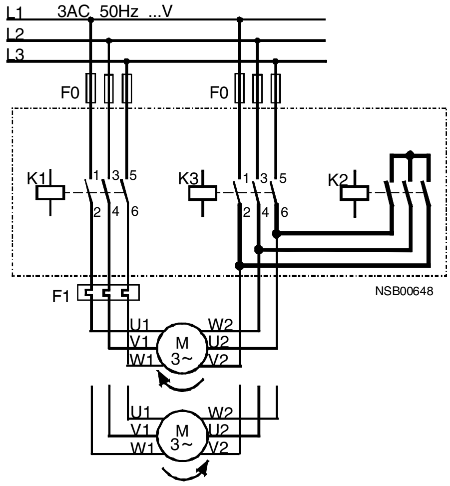
Main circuit: S00, S0, S2, S3



S00



S0

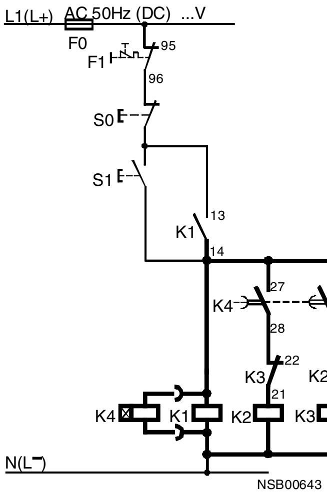


S2 and S3

Figure 3-25: Star-delta combination, main circuit (frame sizes S00 to S3)

Control circuit: S00

Pushbutton switch control



Continuous contacting

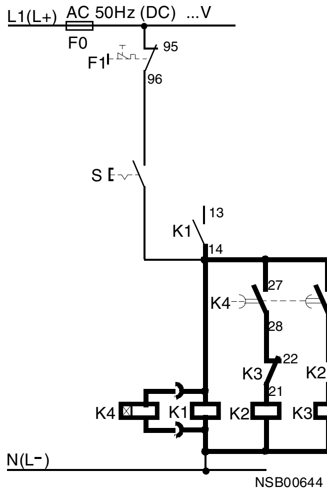
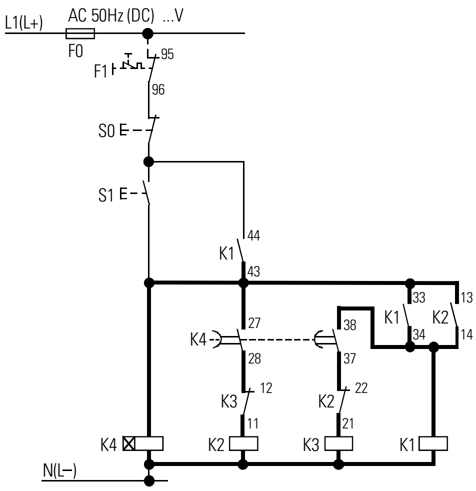


Figure 3-26: Star-delta combination, control circuit (frame size S00)

Control circuit: S0 to S3

Pushbutton switch control



Continuous contacting

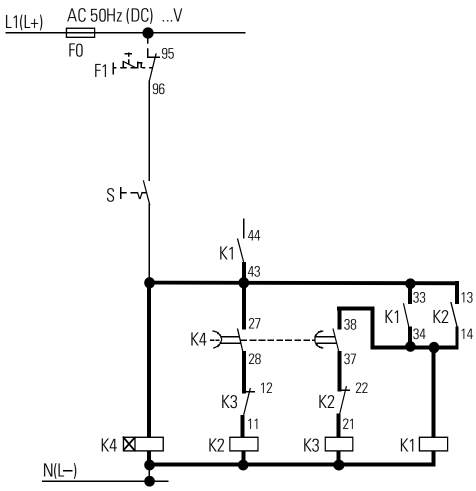


Figure 3-27: Star-delta combination, control circuit (frame sizes S0 to S3)

S0 "Off" button
S1 "On" button
S Continuous contact maker
K1 Line contactor
K2 Star contactor
K3 Delta contactor
K4 Time-delay auxiliary switch block or time relay

F0 Fuses
F1 Overload relay

Technical specifications

The technical specifications of the star-delta combinations correspond to those of the basic units for the corresponding frame size.

3.4 Accessories

Accessories for frame size S00

The accessories for contactors that switch motors and for auxiliary contactors are of the same type. The accessories are attached at the front.

Accessories for frame sizes S0 to S3

The accessories are (with few exceptions) the same for frame sizes S0 to S3. They can be attached in different ways:

- Auxiliary switches can be attached at the front or the side.
- Surge suppressors can be attached at the top or the bottom.

The following graphic shows you the accessories for the contactors that switch motors and for the contactor relays of frame size S00:

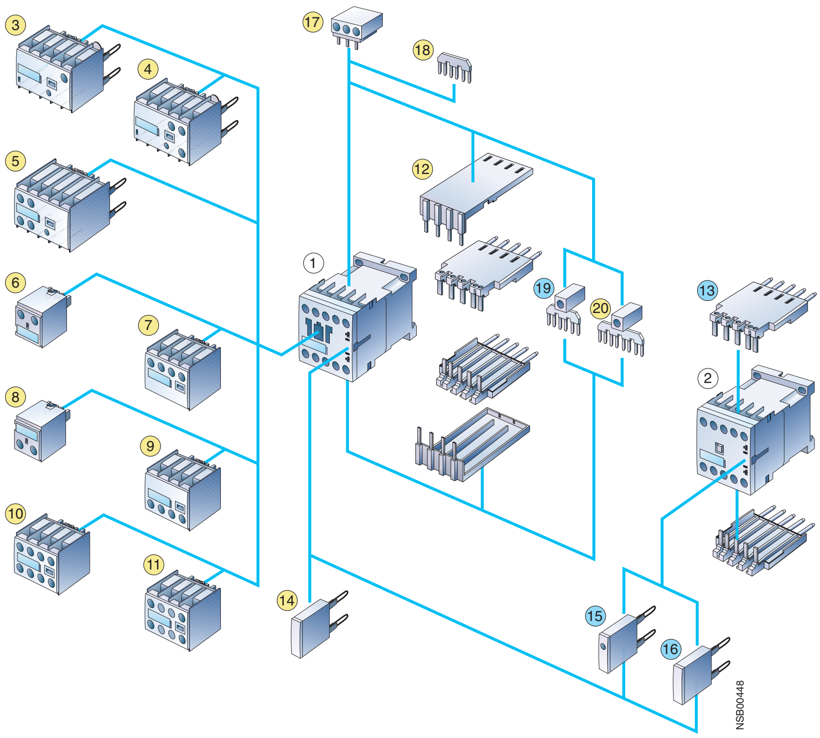


Figure 3-28: Accessories for contactors of frame size S00

1	Contactor, frame size S00
2	Contactor relay
3	Solid-state time relay block, on-delay
4	Solid-state time relay block, off-delay
5	Auxiliary switch block, time-delay (on-delay or off-delay or star-delta function)
6/7	1-pole auxiliary switch block, infeed from above or below
8/9	2-pole auxiliary switch block, infeed from above or below
10	4-pole auxiliary switch block (terminal markings in acc. with EN 50 012 or EN 50 005)
11	2-pole auxiliary switch block, standard or electronic type
12	Soldering pin adapter for contactors with 4-pole auxiliary switch block
13	Soldering pin adapter for contactors and contactor relays
14	Additional load module to increase the permissible residual current
15/16	Surge suppressor with and without LED
17	3-phase feed-in terminal
18	Parallel link (star-point link), 3-pole, without terminal
19	Parallel link, 3-pole, with terminal
20	Parallel link, 4-pole, with terminal

The following graphic shows you the accessories for the auxiliary contactors and contactor relays for auxiliary circuits of frame size S00:

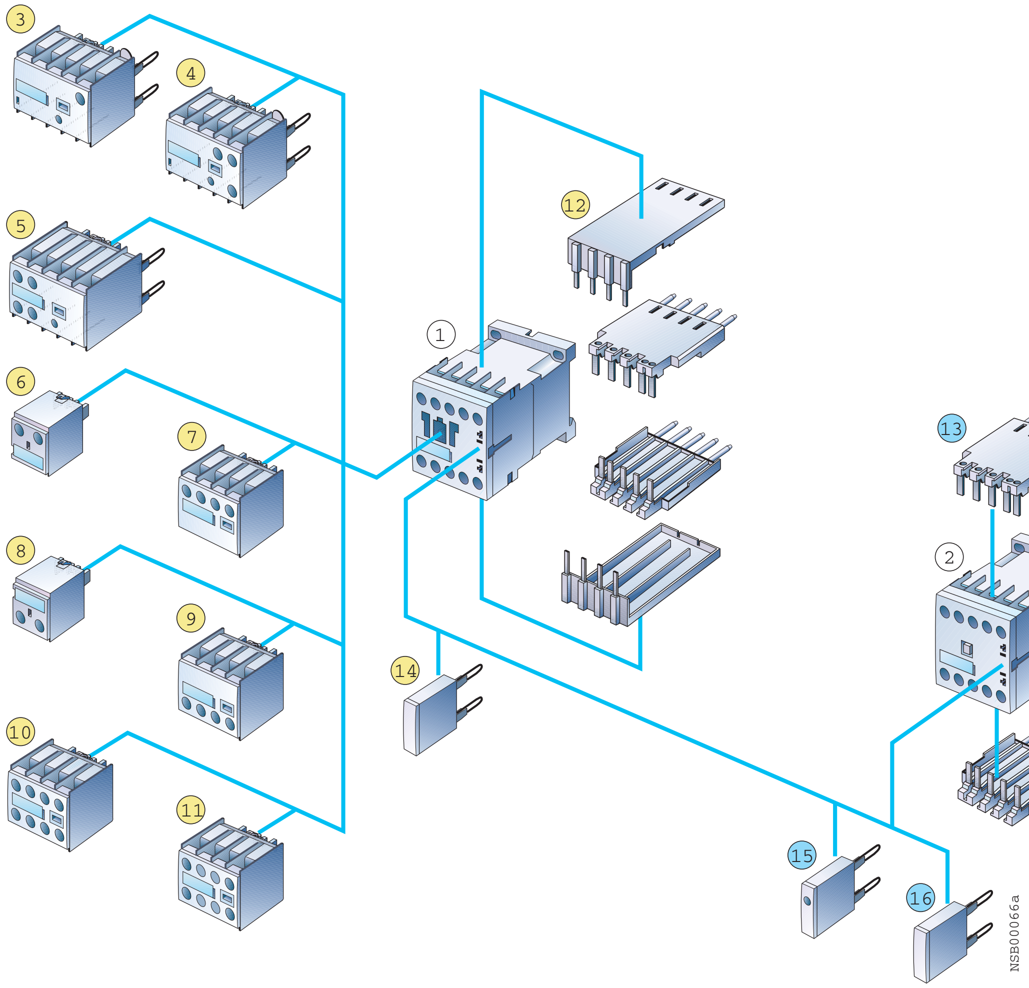


Figure 3-29: Accessories for auxiliary contactors/contactor relays of frame size S00

1 Auxiliary contactor
2 Contactor relay for auxiliary circuits
3 Solid-state time relay block, on-delay
4 Solid-state time relay block, off-delay
5 Auxiliary switch block, time-delay (types: on-delay or off-delay)
6 1-pole auxiliary switch block, infeed from above
7 2-pole auxiliary switch block, infeed from above
8 1-pole auxiliary switch block, infeed from below
9 2-pole auxiliary switch block, infeed from below
10 4-pole auxiliary switch block (terminal markings in acc. with EN 50 011 or EN 50 005)
11 2-pole auxiliary switch block, standard or electronic type
(terminal markings in acc. with EN 50 005)
12 Soldering pin adapter for auxiliary contactors with 4-pole auxiliary switch block
13 Soldering pin adapter for auxiliary contactors and contactor relays
14 Additional load module to increase the permissible residual current
15 Surge suppressor with LED
16 Surge suppressor without LED

The following graphic shows you the accessories for the contactors of frame sizes S0 to S3:

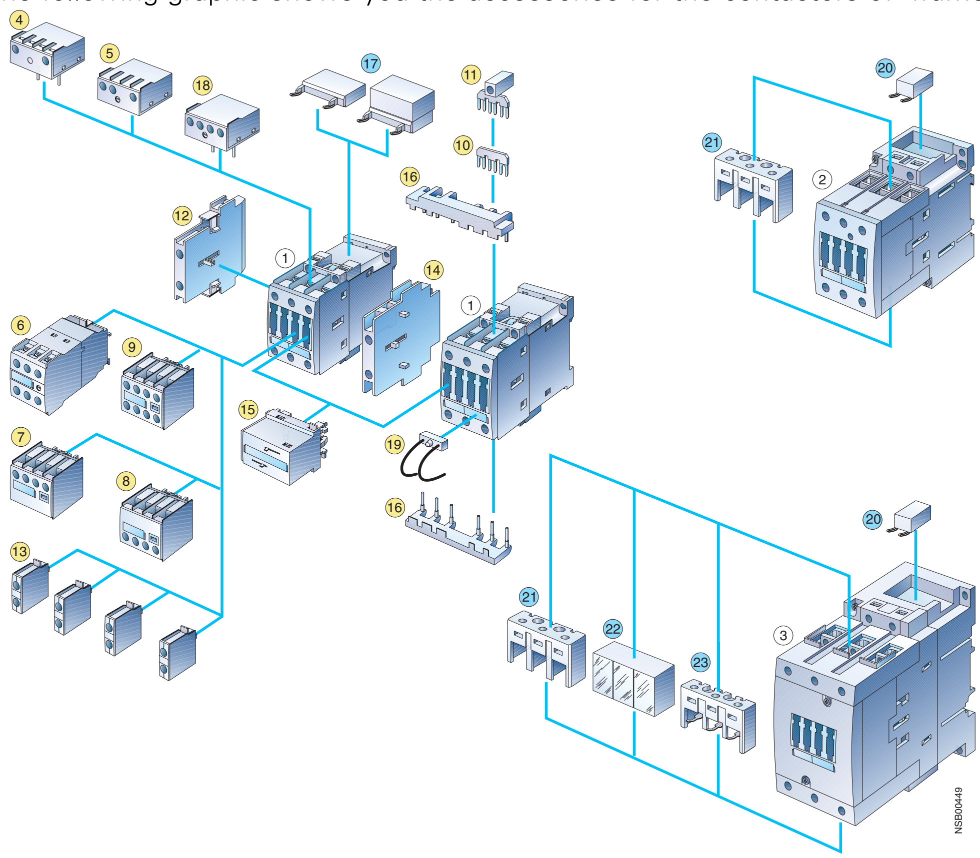


Figure 3-30: Accessories for contactors of frame size S00

1 Contactor, frame size S0
2 Contactor, frame size S2
3 Contactor, frame size S3

For frame sizes S0 to S3:
4 Solid-state time relay block, on-delay
5 Solid-state time relay block, off-delay
6 Auxiliary switch block, time-delay
(on-delay or off-delay or star-delta function)
7 2-pole auxiliary switch block, infeed from above
8 2-pole auxiliary switch block, infeed from below
9 4-pole auxiliary switch block
(Terminal markings in acc. with EN 50 012 or EN 50 005)
10 Parallel link (star-point link), 3-pole without terminal
11 Parallel link, 3-pole, with terminal
12 2-pole auxiliary switch block, attachable on the right or left side
(Terminal markings in acc. with EN 50 012 or EN 50 005)
13 1-pole auxiliary switch block (a maximum of 4 can be snapped on)
14 Mechanical interlock, attachable at the side
15 Mechanical interlock, attachable at the front
16 Wiring modules above and below (reversing operation)
17 Surge suppressor (varistor, RC element, diode combination),
attachable above or below (different for S0 and S2/S3)
18 Coupling link for direct attachment to the contactor coil
19 LED block to display the contactor function
For frame sizes S2 and S3 only:
20 Terminal for contactor coil for assembling contactor combinations
21 Terminal cover for box terminals
For frame sizes S3 only:
22 Terminal cover for lug connection and bar connection
23 Auxiliary connecting lead terminal, 3-pole

3.4.1 Attachable auxiliary switches for extending the auxiliary contacts

Integrated auxiliary contacts

Frame size S00
The contactors of frame size S00 have an auxiliary conducting path integrated in the basic unit.

Frame size S0 to S3
The contactors of frame sizes S0 to S3 do not have an integrated auxiliary conducting path in the basic unit.

Auxiliary switch blocks Formats

Auxiliary switch blocks for extending the auxiliary contacts are available with screw-type or Cage Clamp terminals to attach to contactors to switch motors. They are available in the following formats:
- At the front 1 to 4-pole for frame sizes S00 to S3
- At the side: 2-pole for frame sizes S0 to S3

Different auxiliary switch blocks can be added to the 3RT1 basic units, depending on the application:
The following can be snapped onto the front of the contactors:
- Frame sizes S00 to S3: a 4-pole auxiliary switch block

or
- Frame sizes S0 to S3: up to four 1-pole auxiliary switch blocks

Frame sizes S0 to S3
If the depth of the installation space is limited, 2-pole auxiliary switches can be attached on the right and left side in frame sizes S0 to S3.
If 1-pole auxiliary switch blocks are used, note the location ID on the contactor.

1-pole/2-pole auxiliary switch blocks

1 or 2-pole auxiliary switch blocks that can be connected from above or below make the wiring simple and straightforward when setting up feeders. These auxiliary switch blocks are only available with a screw-type terminal. We recommend with the circuit breaker/contactor combination that you use auxiliary switch blocks that are connected from below. In the case of the contactor/overload relay combination, an auxiliary switch connected from above is more suitable.

Electronically optimized auxiliary switch blocks

The electronically optimized auxiliary switch blocks contain enclosed switching elements that are particularly suitable for switching low voltages and currents (hard gold-plated contacts) as well as for use in dusty atmospheres. The rated operational current is I_e/AC-14 and DC-13: 1 to 300 mA, voltage: 3 to 60 V.
The electronically optimized auxiliary switch blocks are available as screw-type or Cage Clamp terminal types:

- Frame size S00 (3RH1911-.NF..): Has two enclosed auxiliary contacts (1 NO contact + 1 NC contact, 2 NO or 2 NC contacts
- Frame sizes S0 to S3 (3RH1921-.FE22): Has two enclosed auxiliary contacts and two standard auxiliary contacts, each 1 NO contact + 1 NC contact
- The switched current is in acc. with the VDE 0435 regulation for relays.

Auxiliary contacts

The following table gives you an overview of all the available auxiliary contacts:

Auxiliary contacts and attachable accessories	**Frame size S00**	**Frame sizes S0 to S3**
Integrated auxiliary contact	1 integrated auxiliary contact	---
4-pole auxiliary switch	Attachable at the front	Attachable at the front
2-pole auxiliary switch	Attachable at the front	---
1-pole auxiliary switch	---	Attachable at the front
1-pole auxiliary switch (infeed from 1 side)	Attachable at the front	---
2-pole auxiliary switch (infeed from 1 side)	Attachable at the front	Attachable at the front
2-pole auxiliary switch	---	Attachable at the side
Time-delay auxiliary switch blocks	Attachable at the front	Attachable at the front
Electronically optimized auxiliary switches	Attachable at the front	Attachable at the front

Table 3-22: Auxiliary switch blocks

Adding to the auxiliary contacts

- The 3RT10 basic units of frame size S00 with an integrated auxiliary contact can be supplemented with up to 4 contacts using attachable auxiliary switches.
- The basic units of frame sizes S0 to S3 do not have any auxiliary switches, but auxiliary switches can be attached at the front or the side.

The following table shows you the expansion options for the different frame sizes:

Frame size	Auxiliary switch block	Connection
S00	1, 3 and 4-pole (attachable at the front)	Screw-type/Cage Clamp terminal
	Feeder auxiliary switch (attachable at the front): • 1-pole (1 NO or 1 NC contact) • 2-pole (1 NO + 1 NC or 2 NO contacts) Infeed from above or below possible	Screw-type terminal
S0 to S3	1, and 4-pole (attachable at the front) 2-pole (attachable at the side)	Screw-type/Cage Screw-type terminal Clamp terminal
	Feeder auxiliary switch (attachable at the front): • 2-pole (1 NO + I NC contact) • 2-pole (2 NO or 2 NC contacts) Infeed from above or below possible	Screw-type terminal

Table 3-23: Expansion options for auxiliary switch blocks

Auxiliary switch at front

Auxiliary switches that can be attached at the front are hooked into the opening of the contactors and pulled down until they snap into place. They can be removed using the release lever in the middle.

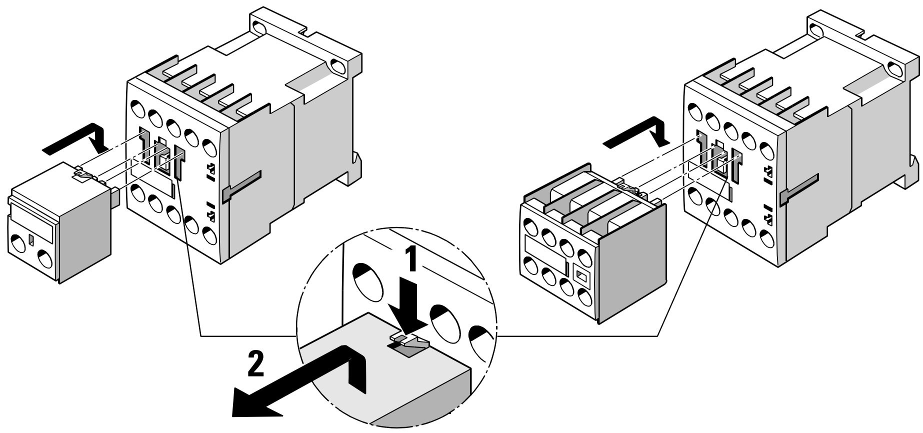


Figure 3-31: Auxiliary switch at front

Auxiliary switches at side (S0 to S3)

The auxiliary switches are hooked onto the left or right side of the contactor and snapped onto it. They are removed again by pressing the ribbed surfaces.

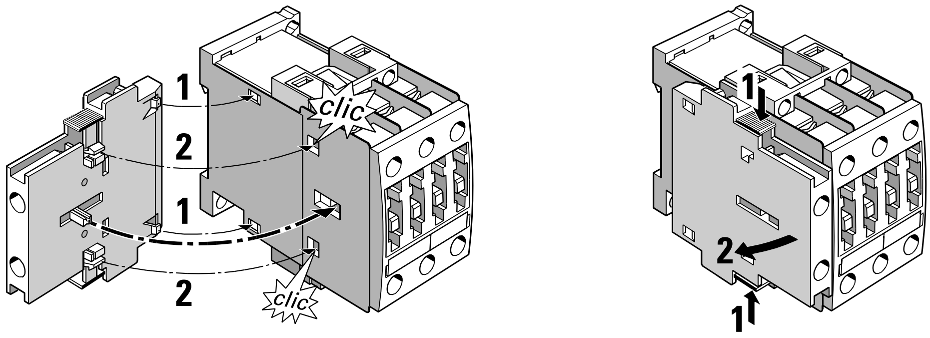


Figure 3-32: Auxiliary switch at side

Note
When you use two 2-pole, auxiliary switches at the side, you must attach an auxiliary switch block on the left and right in the interests of symmetry.

Maximum number of auxiliary switches

The following table shows you the maximum number of auxiliary switches and their combination options:

Frame size S0 and S2 (3RT102./3RT103.)

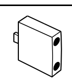
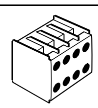
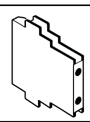
1 auxiliary contact element	4 auxiliary contact elements	2 auxiliary contact elements	A maximum of 4 auxiliary contacts can be attached, and you can use any type of auxiliary switch. When you use two 2-pole, auxiliary switch blocks at the side, you must attach a block on the left and right in the interests of symmetry. In some situations, it is permissible to have more auxiliary contacts in frame size S2 (for more details, please contact Technical Assistance).
			
Max. 4	0	0	
Max. 2	0	1	
0	1	0	
0	0	1+1	

Table 3-24: Possible auxiliary switch combinations (frame size S0/S2)

Frame size S3 (3RT104./3RT14)

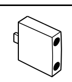
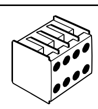
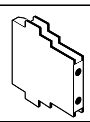
1 auxiliary contact element	4 auxiliary contact elements	2 auxiliary contact elements	A maximum of 8 auxiliary contacts can be attached. Please note the following: Of these 8 auxiliary contacts, a maximum of four can be NC contacts. Symmetry must be preserved in the case of auxiliary switch blocks attached at the side.
			
4	0	1+1	
0	1	1+1	
0	0	2+2	

Table 3-25: Possible auxiliary switch combinations (frame size S3)

Contactors with 4 main contacts and capacitor-switching contactors

	S00	S0	S2/S3
Contactors with 4 main contacts	4 auxiliary contacts	Maximum of 2 auxiliary contacts (attached at the side or snapped on at the top)	Maximum 4 auxiliary contacts (attached at the side or snapped on at the top)
Capacitor-switching contactors	An additional 2-pole auxiliary switch block on each side (3RH1921-1EA..: 2 NO, 2 NC or 1 NO + 1 NC contact)		

Table 3-26: Possible auxiliary switch combinations with 4-pole/capacitor-switching contactors

Switching of the auxiliary contact elements

With the standard type of auxiliary switch, when the contactors are switched on, first the NC contacts are opened and then the NO contacts are closed.

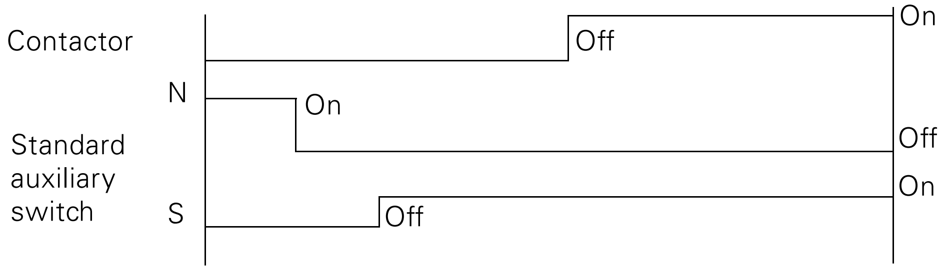


Figure 3-33: Switching of the auxiliary contact elements

Auxiliary contact elements with make-before-break contacting

S00	Auxiliary switch type	**S0 - S3**	Auxiliary switch type
3RH1911-1FC22	22U, 2 NO + 2 NC contacts Screw-type terminal	3RH1921-1FC22	22U, 2 NO + 2 NC contacts Screw-type terminal
3RH1911-1FB11	11U, 1 NO + 1 NC contact Screw-type terminal		
3RH1911-1FB22	11/11U. 1 NO+1 NC+1PS 1)) +1lagging NC contact Screw-type terminal		
3RH1911-2FC22	22U, 2 NO + NC contact Cage Clamp		
3RH1911-2FB11	11U, 1 NO + 1 NC contact Cage Clamp	3RH1921-1CD10	1 NO contact, leading Screw-type terminal
		3RH1921-1CD01	1 NC contact, lagging Screw-type terminal
		3RH1921-2FC22	22 U, 2 NO + 2 NC Cage Clamp

Table 3-27: Auxiliary switches with make-before-break contacting

1) Leading NO contact

3.4.1.1 Terminal markings of the contactors (frame sizes S00 to S3)

In contactors of frame size S00 with an integrated auxiliary contact, the terminal marking complies with EN 50 012. This also applies to contactors of frame sizes S0 to S3 with an attached auxiliary switch block (2 NO + 2 NC contacts) that are available as complete systems.

Expanding the contactors of frame size S00

All the contactors of frame size S00 (3 and 4-pole) can be expanded with auxiliary switch blocks with the identification numbers 40 to 02 in acc. with EN 50 005 as follows:

- Frame size S00 with an integrated auxiliary contact (identification number 10E or 01) for contactors with 3 or 5 auxiliary contacts
- Frame size S00 with 4 main contacts for contactors with 2 or 4 auxiliary contacts

Note
The identification numbers on the auxiliary switch blocks only apply to the attached auxiliary switches.

Expanding the contactors with 1 integrated NO contact, S00 (3RT101.-...01)

Contactors with one NO contact as an auxiliary contact with screw-type or Cage Clamp terminals, identification number 10E, can be expanded with auxiliary switch blocks with terminal markings in acc. with DIN EN 50 012 for contactors with 2, 4, and 5 auxiliary contacts. The terminal markings of the complete contactors comply with EN 50 012. The identification numbers 11E, 22E, 23E, and 32E on the auxiliary switch blocks apply to the complete contactors.

Important
Auxiliary switch blocks in acc. with EN 50 012 can only be combined with contactors of frame size S00 that have 1 NO contact in the basic unit because they are coded. These auxiliary switch blocks cannot be combined with contactors that have an NC contact in the basic unit (identification number 01).

Auxiliary contacts S00

The following graphic shows you the auxiliary contacts that can be used to expand the contactors of frame size S00 (terminal marking in acc. with EN 50 012 or EN 50 005):

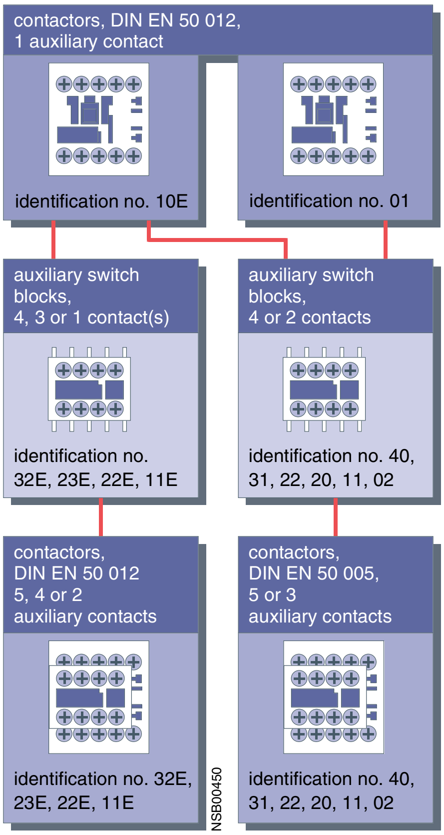


Figure 3-34: Auxiliary contacts, contactors for switching motors (frame size S00)

Expanding the contactors of frame sizes S0 to S3

With contactors of frame sizes S0 to S3, you can also attach 1-pole auxiliary switch blocks instead of 4-pole auxiliary switch blocks.
The terminal markings of the 1-pole auxiliary switch blocks consist of sequence numbers (location ID) on the basic unit and function numbers on the auxiliary switch blocks.

Auxiliary contacts S0 to S3

The following graphic shows you the auxiliary contacts that can be used to expand the contactors of frame sizes S0 to S3 (terminal marking in acc. with EN 50 005 or EN 50 012):

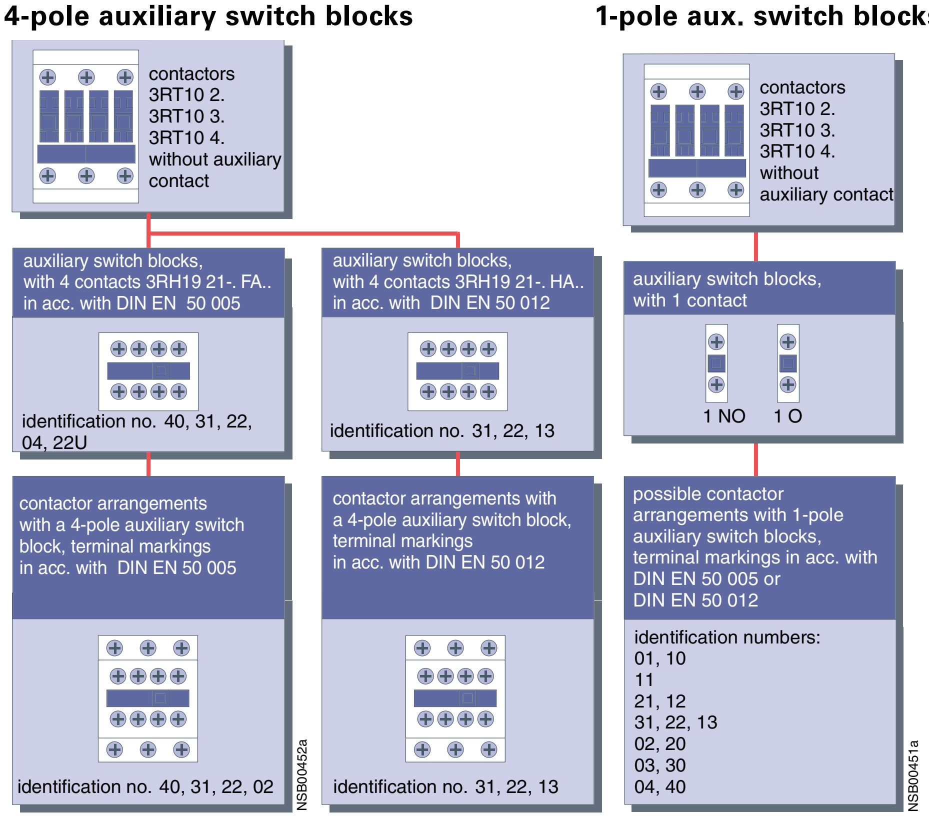


Figure 3-35: Auxiliary contacts, contactors for switching motors (frame sizes S0 to S3)

3.4.1.2 Terminal markings of the contactors and auxiliary contactors combined with auxiliary switch blocks

Terminal markings in acc. with EN 50 005

The terminal markings for contactors are defined in EN 50 005 that contains general directives. The following summarizes the basic rules that apply to switching elements of auxiliary circuits:

- The terminals of auxiliary contact elements are designated by two-digit numbers.
- The digit in the unit place is a function number (NC contact: 1 and 2, NO contact: 3 and 4).
- The digit in the tens place is a sequence number (all the switching elements of the same function must have different sequence numbers).

Identification numbers (DIN EN 50 005)

The identification numbers mean:
Switching devices with a fixed number of auxiliary contact elements (NO contacts or NC contacts) can be assigned a two-digit identification number. The first digit represents the number of NO contacts and the second one the number of NC contacts.
There is no information on the sequence of NO contacts and NC contacts in the contactor/auxiliary contactor.

Note

The identification numbers on the auxiliary switch blocks only apply to the attached auxiliary switches.

EN 50 012/
EN 50 011

For certain equipment such as auxiliary contact elements of contactors and auxiliary contactors, the EN 50 012 and EN 50 011 standards also apply. The EN 50 012 defines the terminal markings and identification numbers for auxiliary contact elements of particular contactors.
The terminal markings of the auxiliary contact elements match the terminal markings of corresponding auxiliary contactors with the ID letter E (in acc. with EN 50 011). For auxiliary contact elements of contactors with the same identification number, the terminal marking must correspond to the sequence defined in the standard.

Graphical symbols for auxiliary contact elements

Below are some examples of graphical symbols for auxiliary contact elements of contactors that comply with EN 50 012:

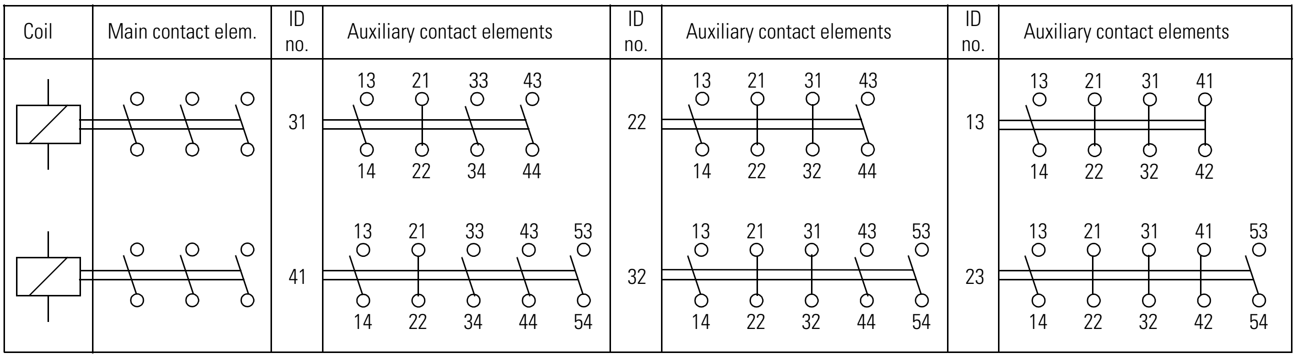


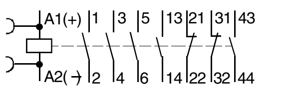
Figure 3-36: Graphical symbols for auxiliary contact elements in acc. with EN 50 012 (excerpt)

Device circuit diagrams

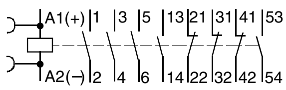
The following device circuit diagrams of the auxiliary switch blocks for contactors that switch motors contain the terminal markings in acc. with EN 50 012:

3RT101 contactors

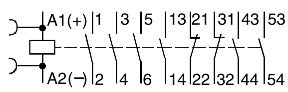
2 NO + 2 NC contacts
Identification number: 22E



2 NO + 3 NC contacts
Identification number: 23E

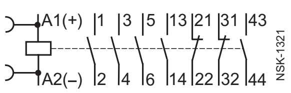


3 NO + 2 NC contacts
Identification number: 32E



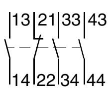
Contactors 3RT102, 3RT103, 3RT104, 3RT1446

2 NO + 2 NC contacts
Identification number: 22

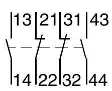


4-pole auxiliary switch blocks 3RH1921-1HA.., can be snapped onto the front

3 NO contacts + 1
Identification no.: 31E



2 NO + 2 NC contacts



1 NO + 3 NC contacts

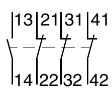


Figure 3-37: Device circuit diagrams of the auxiliary switch blocks (DIN EN 50 012)

3.4.1.3 Auxiliary switches that can be attached to 3RH1 auxiliary contactors

The 3RH1 auxiliary contactors can be expanded by up to 4 contacts using attachable auxiliary switch blocks.

Definition: EN 50 011

The main standard for the designation of switching elements for the auxiliary contactors is EN 50 011, which defines the terminal markings, identification numbers, and identification letters of certain auxiliary contactors using a specific sequence of the switching elements. The number, type, and position of the switching elements must be specified using an identification number followed by an identification letter.
In the case of 8-pole auxiliary contactors, the letter "E" means that four NO contacts have to be arranged on the lower (rear) contact level.

Expansion using auxiliary switch blocks

The following example of an auxiliary contactor with 4 NO contacts (contact designation in acc. with EN 50 011 and EN 50 005) explains how auxiliary switch blocks are added on:

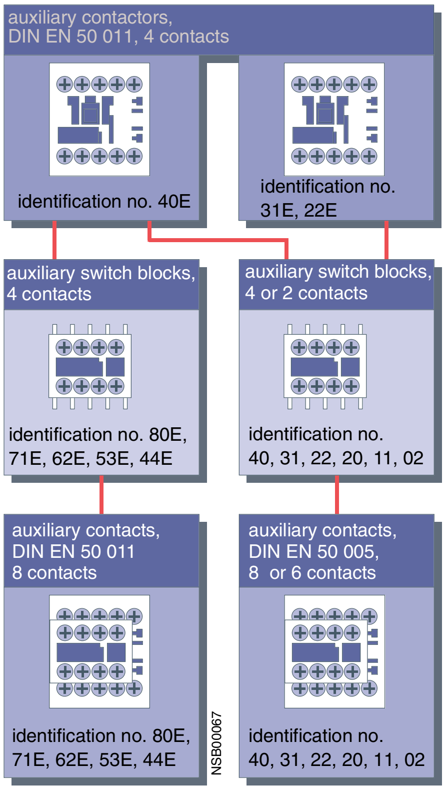


Figure 3-38: Auxiliary contacts for auxiliary contactors

Contact designation

Auxiliary switch blocks - for example, 3RH1911-1GA22 (2 NO + 2 NC contacts) in acc. with EN 50 011 - can only be attached to auxiliary contactors with 4 NO contacts (3RH1140-.....) because they are coded. The identification number (62E) printed on the auxiliary switch block (6 NO + 2 NC contacts) applies to the whole contactor.
NO and NC contacts are in the same position on all the auxiliary contactors with the identification number 62E (DIN EN 50 011).
This means contactors can be replaced without changing the wiring, which therefore makes wiring very easy. You can attach auxiliary switch blocks that comply with EN 50 005 on all 3RH11 auxiliary contactors and 3RT101 motor contactors. For example, the 3RH1911-1FA22 auxiliary switch block (2 NO + 2 NC contacts) has the identification number 22, and this only applies to the attached auxiliary switch block.

Graphical symbols of the auxiliary contactors

Below are some examples of graphical symbols for auxiliary contactors with the identification letter E that comply with EN 50 011:

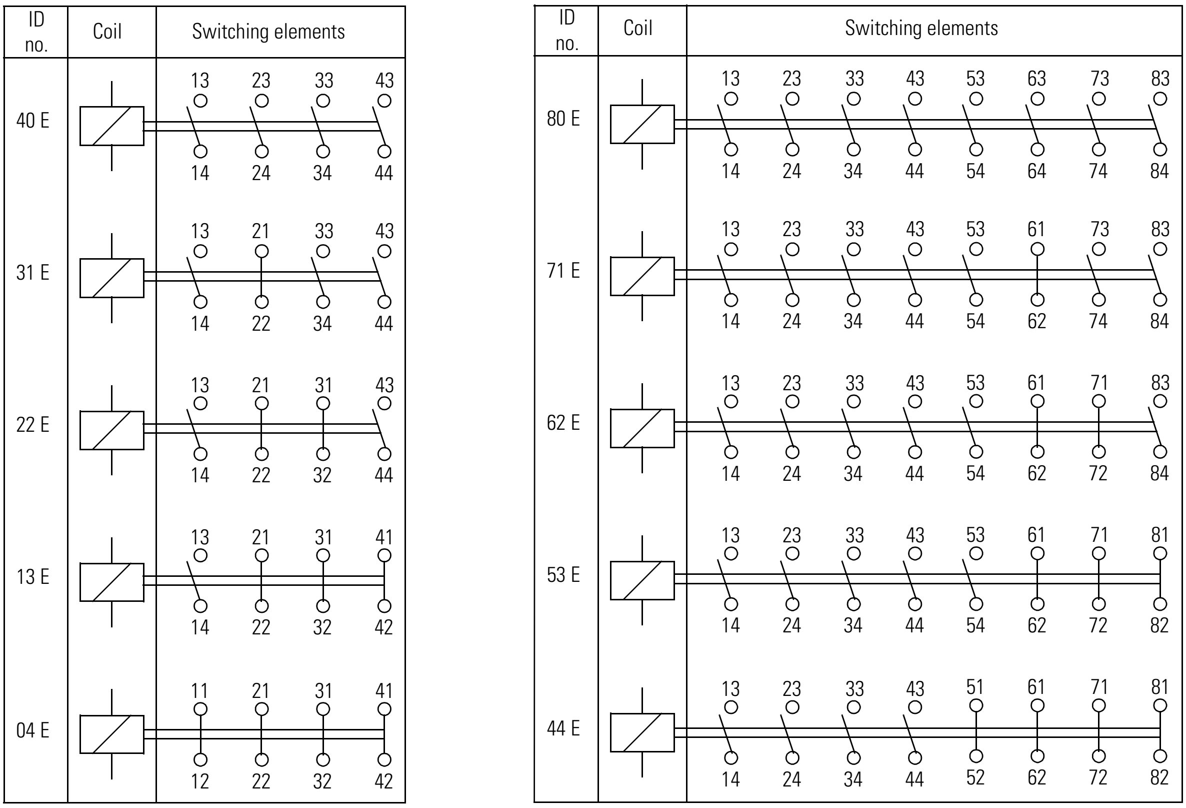


Figure 3-39: Graphical symbols for auxiliary contactors in acc. with EN 50 011 (excerpt)

Device circuit diagrams

The following device circuit diagrams of the auxiliary contactors contain terminal markings in acc. with EN 50 011:

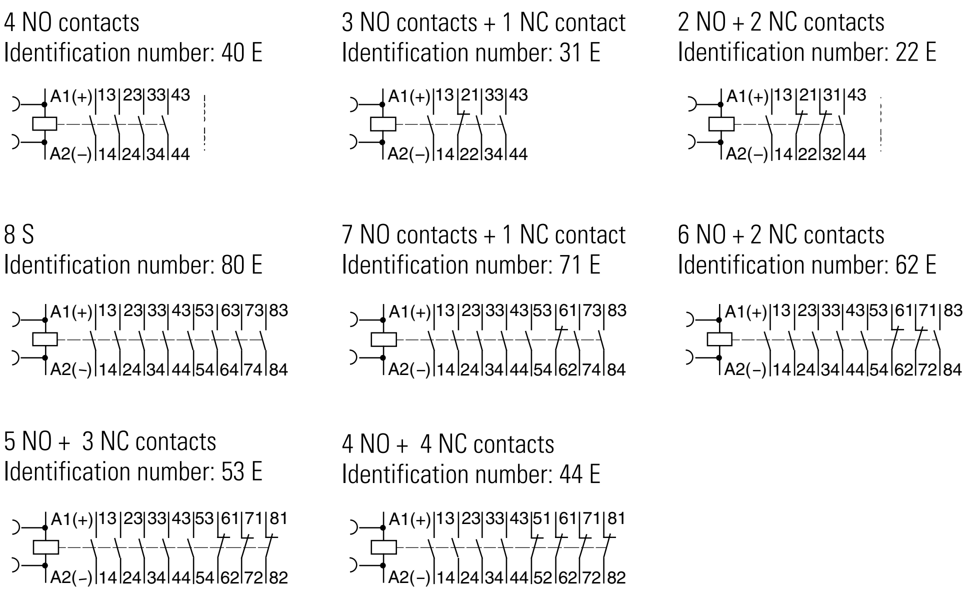


Figure 3-40: Device circuit diagrams

Position diagrams

The following position diagrams of the auxiliary switches of frame sizes S00 to S3 also apply to leading and lagging contacts:

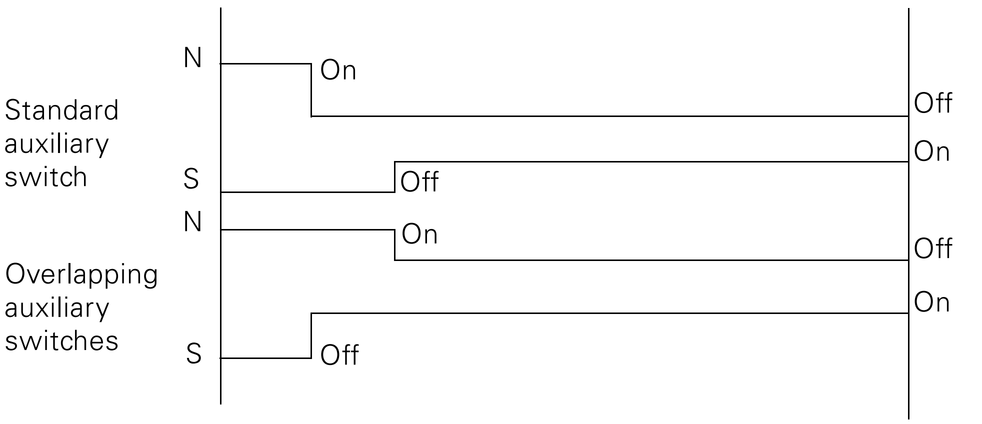


Figure 3-41: Position diagrams of the auxiliary switches (frame sizes S0 to S3)

3.4.2 Time-delay auxiliary switches

Variants

The following variants of the time-delay auxiliary switch are available:
- On-delay
- Off-delay without auxiliary supply
- Star-delta function

On-delay and off-delay functions

The time-delay auxiliary switch in the on-delay or off-delay variants has the following features:
- It facilitates time-delayed functions up to 100 s
- 3 single time areas
- Contains a relay with 1 NO contact and 1 NC contact that switches the on-delay or off-delay depending on the version.

Star-delta function

The time-delay auxiliary switch with star-delta function has the following features:
- Equipped with a delayed and an instantaneous NO contact between which there is an idle time of 50 ms.
- The delay time of the NO contact can be set at between 1.5 s to 30 seconds.
- The contactor on which the time-delay auxiliary switch block is mounted functions instantaneously.

Conductor cross-sections

The permissible conductor cross-sections correspond to the auxiliary conductor terminals of the corresponding frame size.

3.4.2.1 Frame size S00 (3RT1916-2E, -2F, -2G)

Description

The time-delay auxiliary switch of frame size S00 has the following features:
- The power supply is provided using plug-in contacts directly via the coil connections of the contactors, parallel to A1/A2.
- The time function is activated when the contactor that has the auxiliary switch block mounted on it is switched on.
- The off-delay version functions without an auxiliary supply.
- The minimum on-time is 200 ms.
- To dampen switching overvoltages of the contactor coil, a varistor is integrated in the time-delay auxiliary switch of frame size S00.

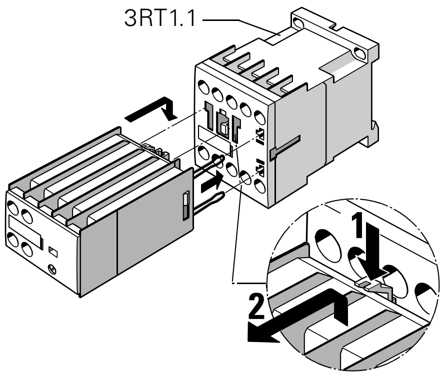
Information on mounting

Note about the off-delay without auxiliary supply function:
The position of the output contacts is not defined at shipment (bistable relay). Apply the control supply voltage once, and then switch it off again to set up the initial state of the contacts.

Important
The time-delay auxiliary switch cannot be built onto contactor relays.

Installation/removal

Caution
Switch off the supply voltage to A1/A2 before you install or remove the time-delay auxiliary switch block.



The time-delay auxiliary switch is attached to the front of the contactor.

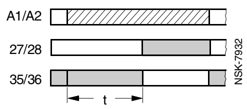
Figure 3-42: Time-delay auxiliary switch block (frame size S00)

Connection

When they are attached, the connections for the rated control supply voltage are connected to the contactor below by the integrated spring contacts of the time-delay auxiliary switch.

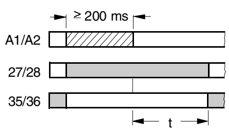
Function diagrams

3RT1916-2E



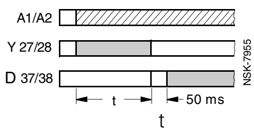
On-delay
1 NO and 1 NC contact

3RT1916-2F



Off-delay
Without auxiliary supply
1 NO and 1 NC contact

3RT1916-2G



Star-delta function
1 NO contact, instantaneous
1 NO contact, delayed

Figure 3-43: Function diagrams of the time-delay auxiliary switches (frame size S00)

3.4.2.2 Frame sizes S0 to S3 (3RT1926-2E, -2F, -2G)

Description

The time-delay auxiliary switch for frame sizes S0 to S3 has the following features:

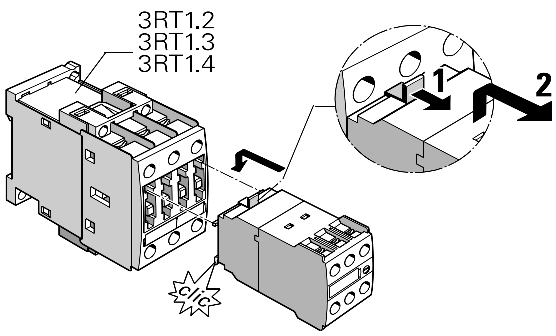
- The power supply of the time-delay auxiliary switch is via 2 terminals (A1/ A2).
- The time delay for the time-delay auxiliary switch can be activated by parallel connection to any contactor coil, or by any source of voltage.
- The off-delay version works without an auxiliary supply.
- The minimum on-time is 200 ms.
- In addition to the time-delay auxiliary switch, a 1-pole auxiliary switch block can be snapped onto the front of the contactor.
- The time-delay auxiliary switch does not have any integrated overvoltage damping for the contacted contactor.

Information on mounting

Note about the off-delay without auxiliary supply function:
The position of the output contacts is not defined at shipment (bistable relay). Apply the control supply voltage once, and then switch it off again to set up the initial state of the contacts.

Installation/removal

.



The time-delay auxiliary switch is attached to the front of the contactor.

Figure 3-44: Time-delay auxiliary switch block (frame sizes S0 to S3)

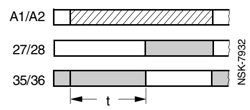
Connection

The A1 and A2 terminals for the rated control supply voltage of the time-delay auxiliary switch are connected to the respective contactor with cables.

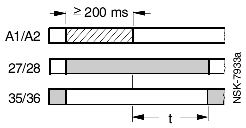
Terminal markings

Because an additional auxiliary switch block can be snapped onto the contactor, the terminals of the delayed contacts have been designated as -5/-6 (NC contact) and -7/-8 (NO contact).

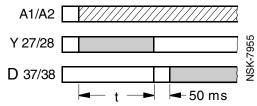
Function diagrams



On-delay
1 NO and 1 NC contact



Off-delay without auxiliary supply
1 NO and 1 NC contact



Star-delta function
1 NO contact, instantaneous
1 NO contact, delayed

Figure 3-45: Time-delay auxiliary switches, function diagrams (frame sizes S0 to S3)

3.4.3 Solid-state time relay blocks with semiconductor output

The solid-state time relay blocks are suitable for AC and DC operation. To dampen switching overvoltages of the contactor coil, a varistor is integrated.

Variants

The following variants of the time-delay auxiliary switch are available:
- On-delay (integrated varistor)
- Off-delay with auxiliary supply (integrated varistor)

On-delay and off-delay functions

The time-delay auxiliary switch in the on-delay or off-delay with an auxiliary supply variants has the following features:
- It facilitates time-delayed functions up to 100 seconds.
- 3 individual time ranges
- Contactors with a solid-state time relay block close and open with a delay according to the time set.

Connection: on-delay time relay block

The on-delay time relay block is connected in series to the contactor coil; the A1 terminal of the contactor coil must not be connected.

Connection: off-delay time relay block

When an off-delay time relay block is attached, the contactor coil is contacted via the time relay block; the A1 and A2 terminals of the contactor coil must not be connected.

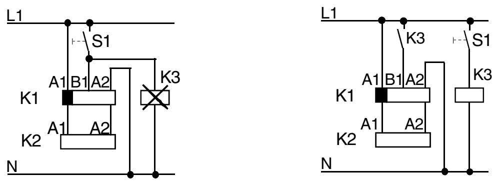
Conductor cross-sections

The permissible conductor cross-sections correspond to the auxiliary conductor terminals of the corresponding frame size.

Notes on configuration

The control of loads parallel to the start input is not permissible in AC operation. See the relevant circuit diagram ① below.
The off-delay solid-state time relay blocks (3RT1916-2D.../3RT1926-2D...) have a live start input (B1). With AC voltage, this can imitate the control of a parallel load on the B1 terminal. In this case, an additional load (contactor K3, for example) should be wired as shown in circuit diagram ②.

① ②



K1 time relay block
K2 contactor

Figure 3-46: Control of loads

3.4.3.1 Frame size S00 (3RT1916-2C, -2D)

Caution
Switch off the supply voltage to A1/A2 before you install or remove the solid-state time relay block.

Installation/removal

Important
The time-delay auxiliary switch cannot be attached to contactor relays.

The solid-state time relay block of frame size S00 is attached to the front of the contactor and latched into place with a pushing movement.

Installation Removal

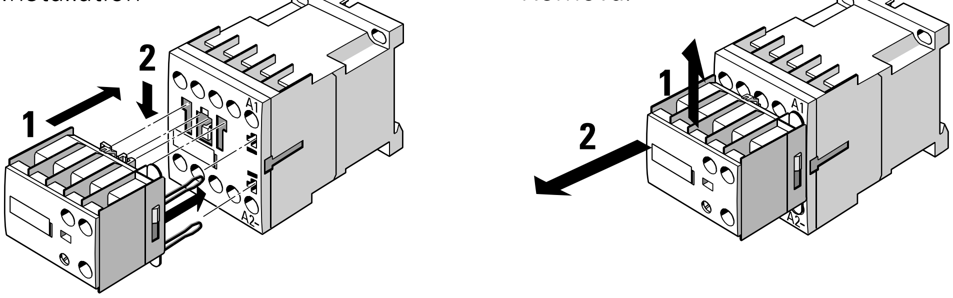


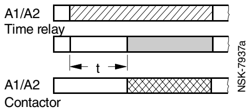
Figure 3-47: Solid-state time relay block with semiconductor output, installation (frame size S00)

Connection

When the solid-state time relay block is installed, it is connected at the same time with the A1 and A2 coil connections of the contactor by the plug-in contacts. Coil connections of the contactor that are not required are covered by covers on the housing of the time relay block, thus preventing inadvertent connection.

Function diagrams

3RT1916-2C, on-delay



3RT1916-2D, off-delay

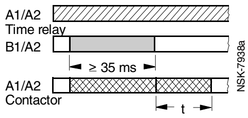
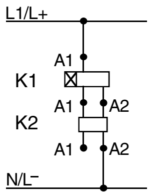


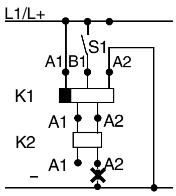
Figure 3-48: Solid-state time relay block with semiconductor output, function diagrams (frame size S00)

Circuit diagrams

3RT1916-2C
on-delay



3RT1916-2D
off-delay with auxiliary supply



K1 Solid-state time relay block
K2 Contactor
✖ Connection prohibited!

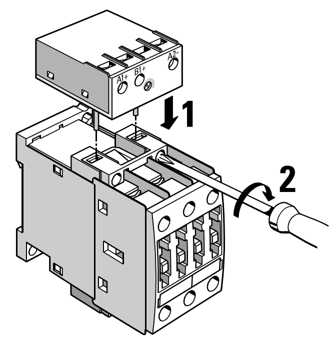
Figure 3-49: Solid-state time relay with semiconductor output, circuit diagrams (frame size S00)

3.4.3.2 Frame size S0 to S3 (3RT1926-2C, -2D)

Note on configuration

Caution
The solid-state time relay block with a semiconductor output (3RT1926-2C, -2D) must not be used for 3RT104 contactors of frame size S3 with $U_S \leq 42$ V because the coil current used for the output semiconductor is too high.
The solid-state time relay block must not be attached to the lower coil connections.

Installation/removal

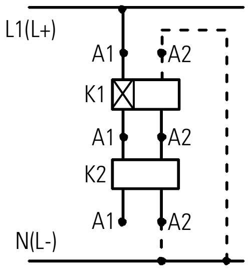


The solid-state time relay block for the contactors of frame sizes S0 to S3 is attached at the top on the A1 and A2 coil connections of each contactor, connecting the time relay electrically and mechanically with pins.

Figure 3-50: Solid-state time relay with a semiconductor output, installation (frame size S00)

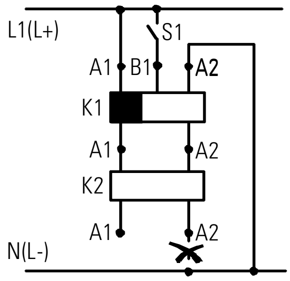
Circuit diagrams

3RT1926-2C
on-delay



K2:3RT102. U_S = 24 V to 240 VAC/DC
3RT103. U_S = 24 V to 240 VAC/DC
3RT104. U_S = 48 V to 240 VAC/DC

3RT1926-2D
off-delay with auxiliary supply



K2:3RT102. U_S = 24 V to 240 VAC/DC
3RT103. U_S = 24 V to 240 VAC/DC
3RT104. U_S = 48 V to 240 VAC/DC

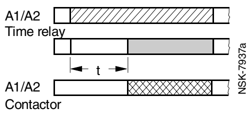
✘ Connection prohibited!

– — – Can be connected if required

Figure 3-51: Solid-state time relay with semiconductor output, circuit diagrams

Function diagrams

3RT1926-2C..1, on-delay



3RT1926-2D..1, off-delay

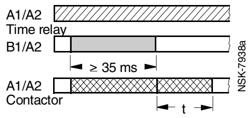


Figure 3-52: Solid-state time relay with semiconductor output, function diagrams

3.4.4 Additional load module (3RT1916-1GA00)

Field of application

The additional load module for the contactors of frame size S00 is used to increase the permissible residual current and to limit the residual voltage of SIMATIC semiconductor outputs.

Mode of operation

Malfunctions can sometimes occur when SIRIUS contactors and auxiliary contactors of frame size S00 work together with SIMATIC output modules whose residual current at signal "0" is higher than is permissible for the contactors of frame size S00. The maximum permissible residual current of the electronic components is 3 mA for contactors of frame size S00 with a 230 VAC drive, and in the case of higher residual currents, the contactors no longer drop down.
The additional load module is used to ensure the safe switching off of S00 contactors in the case of direct control by programmable controllers via 230 VAC semiconductor outputs.
The additional load module takes on the function of overvoltage damping at the same time.

Technical specifications

Rated voltage	AC 50/60 Hz 180 V to 255 V
Rated output power	1.65 W at 230 V
Permissible contactor types	3RT1.1 3RT1.
Associated coil type	P0 (230 V, 50/60 Hz) N2 (220 V, 50/60 Hz) P6 (220 V, 50Hz/240 V, 60 Hz)
Operating range	0.8 to 1.1 Us

Installation

The additional load is connected in parallel to the contactor coil. It has the same construction as the surge suppressor and is attached on the front of the contactors with or without an auxiliary switch block.

3.4.5 Coupling element for frame sizes S0 to S3 (3RH1924-1GP11)

Field of application

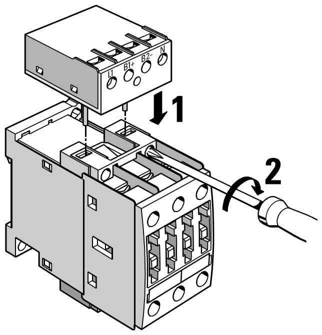
The 3RH1924-1GP11 coupling link is intended for contactors of frame sizes S0 to S3. It can be controlled by a programmable controller output because the operating range of 17 to 30 VDC is permissible.

Mode of operation

A contactor of frame size S0 to S3 can be controlled, for example, at 24 VDC with a low control level (< 0.5 W) from a programmable controller output. The control voltage for the coupling link and the rated control supply voltage for the contactor are electrically isolated. An LED indicates the switching state of the coupling link.
To dampen switching overvoltages of the contactor coil, a varistor is integrated in the coupling link.

Installation

Caution
Switch off the supply voltage applied to L1 and N before installation.



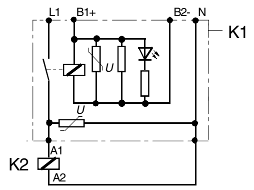
The coupling link is inserted with its two integrated mounting pins directly onto the coil connections of the contactor.

Figure 3-53: Coupling link (frame sizes S0 to S3)

Conductor cross-sections

The permissible conductor cross-sections correspond to the auxiliary conductor terminals of the corresponding frame size.

Circuit diagram



K1 Coupling link
K2 Contactor

B1+/B2-: Control voltage 24 VDC
L1/N: Rated control supply voltage for the selected contactor

Figure 3-54: Coupling link, circuit diagram (frame sizes S0 to S3)

Technical specifications

You can find the technical specifications of the coupling link in Section 3.6, Technical specifications.

3.4.6 Surge suppression

When contactor coils are disconnected, overvoltage occurs (inductive load). Voltage peaks of up to 4 kV with a rate of rise in voltage of 1 kV/ms can result (showering arcs).
The consequences of this are:
- Heavy contact erosion and thus premature wearing of the contacts that switch the coil
- Unwanted signals can occur that may cause false signals in electronic controllers.

All contactor coils, therefore, should be damped against switching overvoltages, particularly when working with electronic controllers.

Oscillograms

The following oscillograms illustrate the behavior at disconnection of contactor coils with and without overvoltage damping:

Unused coil

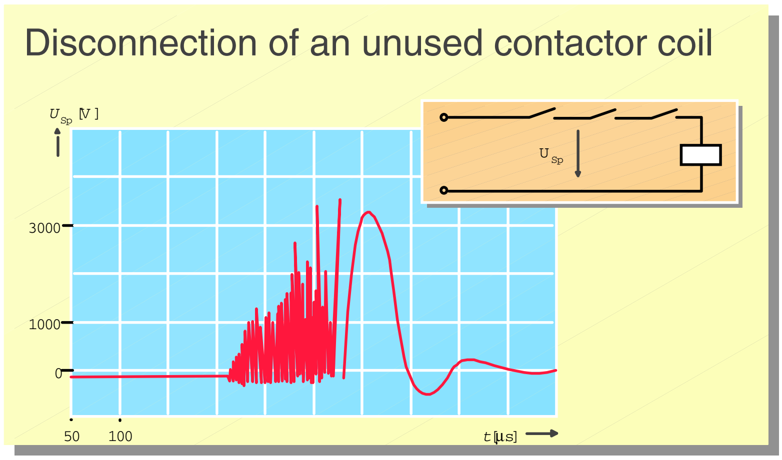


Figure 3-55: Disconnecting an unused contactor coil

Oscillogram of a disconnection of the coil of an auxiliary contactor. The coil is not used:
Showering arcs can be clearly seen (voltage peaks of up to approximately 4 kV). After the disconnection procedure has been started, showering arcs occur for approximately 250 microseconds, and after that the oscillation is merely damped.

Varistor

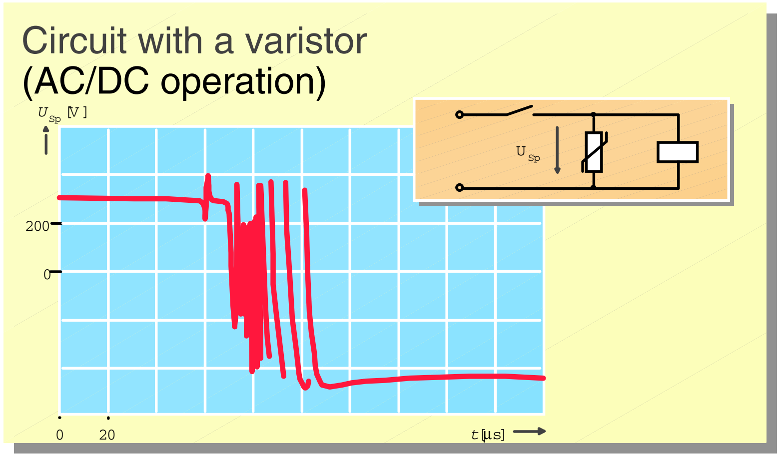


Figure 3-56: Circuit with a varistor (AC/DC operation)

This is what happens when a coil is disconnected that is connected to a varistor (voltage-dependent resistor):
Voltage peaks still occur. They are cut off at approximately 400 V and have a shorter overall duration (approximately 50 microseconds).
(Note: The oscillogram is cut off, and the voltage is reduced to zero after approximately 3 ms.)
A varistor is suitable for AC and DC operation.
The off-delay of the contactor is extended by approximately 2 to 5 ms.

RC element

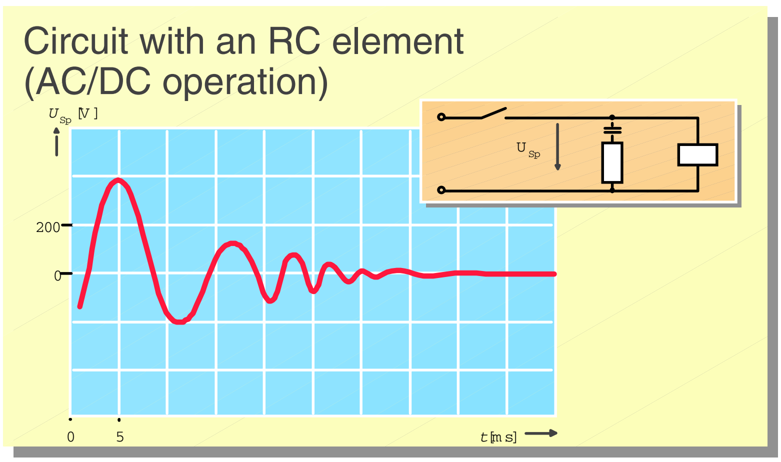


Figure 3-57: Circuit with an RC element (AC/DC operation)

This is what happens when a coil is disconnected that is connected to an RC element:
The amplitude and rate of rise of the switching overvoltage are reduced by the capacitor. Showering arcs no longer occur. The voltage swings briefly to 400 V and then slowly drops down. This represents ideal damping.
Disadvantage: The component is larger and generally more expensive.
RC elements are suitable for AC and DC operation.
Only a minimal off-delay occurs (under 1 ms).

Diode

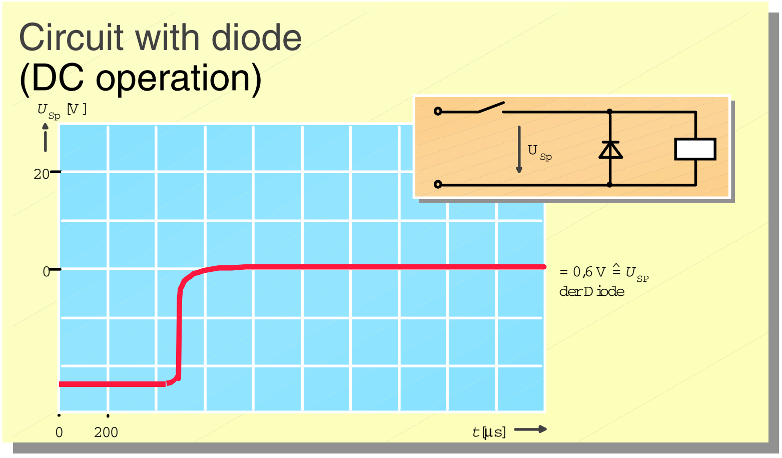


Figure 3-58: Circuit with a diode (AC/DC operation)

This is what happens when a coil is disconnected that is connected to a diode:
Advantages: No overvoltage occurs during disconnection. The diode block becomes effective at 0.6 V.
Disadvantage: The diode can only be used for DC operation.
The break time of the contactor is considerably increased and amounts to 6 to 9 times the off-delay.
This increased break time can be used, if necessary, for control purposes, such as for bridging brief interruptions in voltage.

Zener diodes (diode combinations) are available for shorter break times. The break time then amounts to 2 to 6 times the off-delay.

Surge suppressors

The following surge suppressors are available for the 3RT1 contactors:

Surge suppressor	**With LED**	**Without LED**		
	For S00	**For S00**	**For S0**	**For S2, S3**
Suppression diode	x	x	--	--
Diode combination: suppression diode and Zener diode	--	x	x	x
Varistor	x	x	x	x
RC element	--	x	x	x

Table 3-28: Surge suppressor

Selection aid

The following table gives you a comparison of the effects of the different surge suppressors:

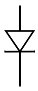
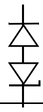
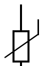
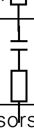
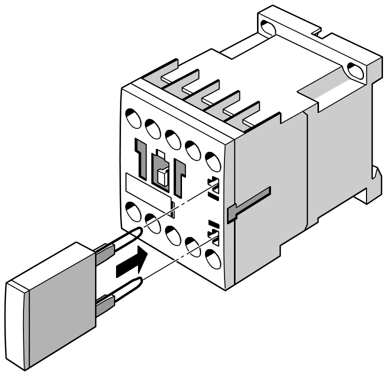
Surge suppressor	**Suitable for control supply voltage**	**Overvoltage is limited**	**Effect**
Suppression diode/ flywheeling diode 	DC	0.6 V	• Off-delay is considerably greater (6 to 10 times) • A two-stage drop[1)] cannot be ruled out in the case of contactors as of frame size S0
Diode combination: suppression diode Zener diode 	DC	To Zener voltage	• Off-delay is greater (2 to 6 times) • A 2-stage drop no longer occurs
Varistor 	AC/DC	To varistor voltage (current-dependent)	• Off-delay is only slightly greater (2 to 5 ms)
RC element 	AC/DC	Corresponds to the dimensioning	• Off-delay remains unchanged • Rate of rise in voltage is damped

Table 3-29: How surge suppressors work

1) The rate of drop is reduced once or twice to zero for a few ms:
- A safe drop is always ensured in the case of switching without current.
- The contact pieces are subjected to a greater thermal load when switching with current. When switching at the upper current limit, this can result in overload.

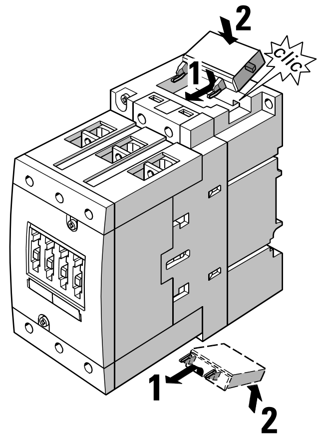
Installation

Frame size S00

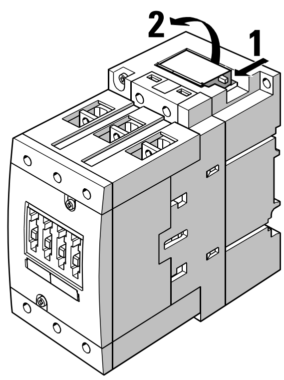


The surge suppressor is attached on the front of the contactors. There is space next to the attached auxiliary switch block. The direction of for attachment is defined by a code.

Frame sizes S0 to S3



Varistors, RC elements, and diode combinations can either be inserted and snapped on from above or below directly onto the coil terminals.



To remove them, press the varistors, RC elements, and diode combinations forwards, and remove them from the recess.

Figure 3-59: Surge suppressors, installation

Installation instructions for frame sizes S0 to S3

Important
The 3RT1926-1E.00 diode combination is inserted from above. The direction of attachment is defined by a code.
Alternatively, the 3RT1926-1T.00 diode combination can be inserted from below. The direction of attachment is not coded, but the terminals are marked with "+" and "-" so that the direction is clear.

Circuit diagrams

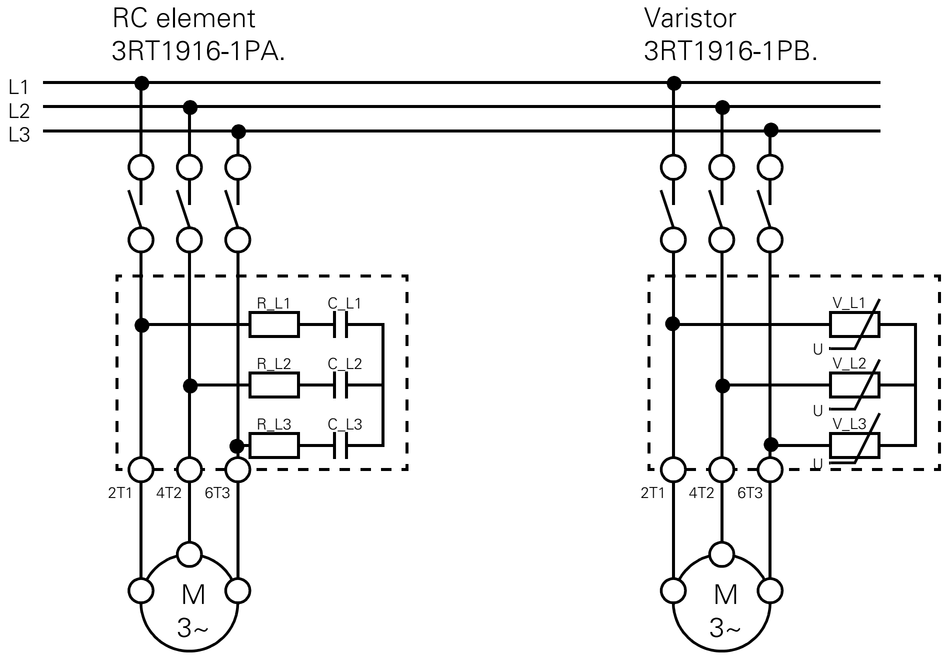


Figure 3-60: RC element/varistor, circuit diagrams

3.4.7 Other accessories

3.4.7.1 LED module for indicating contactor control (3RT1926-1QT00)

Description

The LED module can be connected to the coil terminals of the contactors of frame sizes S0 to S3. It indicates the status of the contactors by means of yellow LEDs.

Mode of operation

The LED module can be used for AC/DC voltages of 24 V to 240 V.
The LEDs are connected bidirectionally to protect against polarity reversal. Both LEDs light up in AC control, and one lights up in DC control, depending on the polarity.

Connection

The LED module is connected to the A1 and A2 coil terminals of the contactor.

Installation

The LED module is snapped onto the front in the openings intended for the inscription plate.

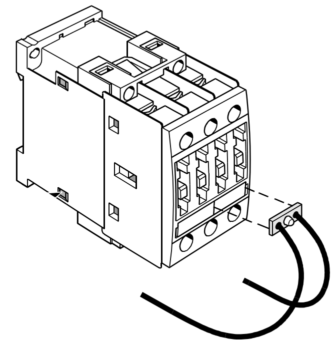


Figure 3-61: LED module

3.4.7.2 Auxiliary connecting lead terminal, 3-pole (for frame size S3)

Using the 3-pole auxiliary lead terminal, auxiliary and control cables can be connected to the main cable terminals.

Conductor cross-sections of auxiliary connecting leads that can be connected:

Screw-type terminals (1 or 2 conductors can be connected)		
Single-core	mm^2	2 x (0.5 to 1.5); 2 x (0.75 to 2.5) in acc. with IEC 60 947; Max. 2 x (0.75 to 4)
Finely stranded with wire end ferrule	mm^2	2 x (0.5 to 1.5); 2 x (0.75 to 2.5)
AWG cables, single- or multi-core	AWG	2 x (20 to 16); 2 x (18 to 4); 1 x 12
Terminal screws		M3
Tightening torque	Nm	0.8 to 1.2 (7 to 10.3 lb.in)

Table 3-30: Conductor cross-sections of 3-pole auxiliary connecting lead terminals (for frame size S3)

3.4.7.3 EMC module (3RT1916-1P..)

In the case of motors or various inductive loads, back-e.m.f (electromotive force) is produced at disconnection. This can produce voltage peaks of up to 4000 V with a frequency range of 1 kHz to 10 MHz and a rate of voltage variation of 0.1 to 20 V/ns.
Capacitive coupling to various analog and digital signals makes suppression necessary in the load circuit.

Description

The connection of the main conducting path to the EMC suppression module reduces the contact sparking that is responsible for contact erosion and many of the clicks, which in turn supports an EMC-compatible configuration.

Mode of operation

The EMV suppression module reduces through 3 phases the radio-frequency parts and the voltage peaks. The advantages of this are as follows:
- Longer service life of the contact pieces
- Higher operational reliability and high system availability

A fine grading within the performance class is not required because smaller motors have greater inductance due to their construction, and one EMC suppression module is thus sufficient for all non-stabilized drives up to 5.5 kW.

Variants

Two electrical variants are available:
- RC circuit
- Varistor switching

Installation

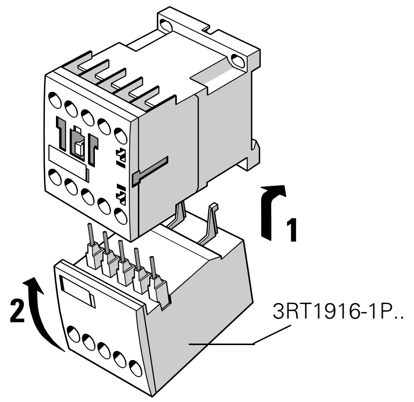


Figure 3-62: EMC suppression module

The EMC suppression module is attached to the underside of the contactor. To do this, hook the EMC suppression module with both hooks onto the contactor, and push it upward until the connection pins of the EMC module are firmly in place in the terminal openings of the contactor.

RC circuit

The RC circuit is suitable:
- For reducing the rate of rise
- In RF damping

Effective suppression can be achieved for a wide range of applications.

Varistor circuit

A varistor circuit can absorb a high level of energy and can be used for frequencies from 10 to 400 Hz (stabilized drives). There is no limit below the buckling stress.

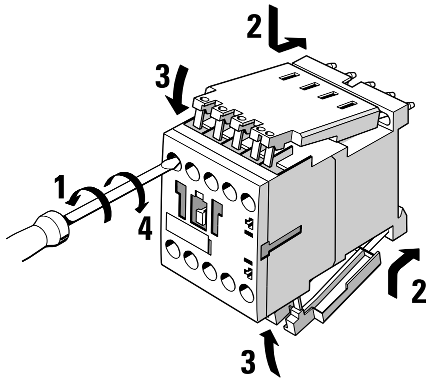
3.4.7.4 Soldering pin connector for frame size S00

Description

The standard contactors of frame size S00 in the SIRIUS range can be soldered onto printed circuit boards by means of the soldering pin adapter. Soldering pin connection is possible:

- For contactors with an integrated auxiliary contact
- For contactors with an attached 4-pole auxiliary switch block
- For the reversing wiring of the S00 contactors. This involves carrying out the reversing wiring before soldering it on the printed circuit board

Mounting main contacts



The soldering pin connectors are inserted above and below in the screw-type terminals of the contactors.

Figure 3-63: Soldering pin connection, mounting

Mounting on 4-pole auxiliary switch block

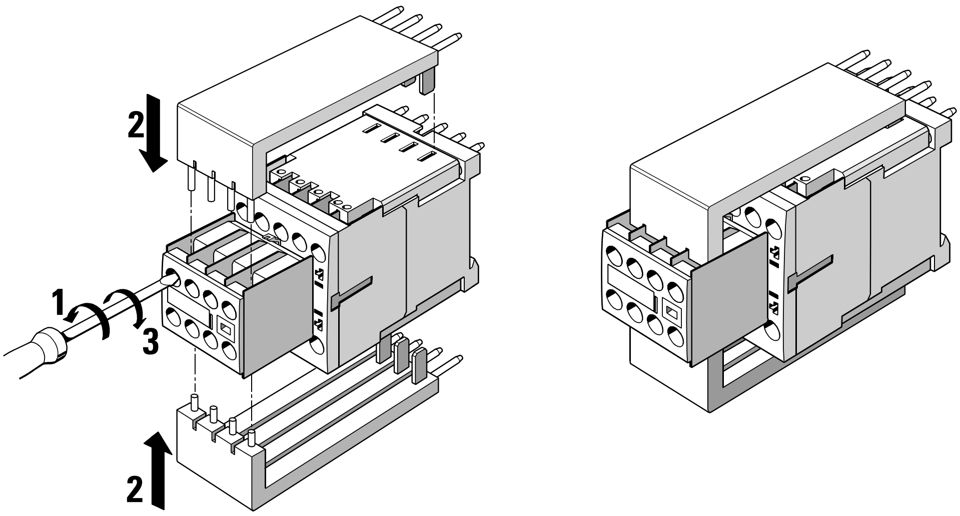


Figure 3-64: Mounting the soldering pin connection on a 4-pole auxiliary switch block

Removing the spring

If necessary, the spring for attachment to the rail can be removed before the soldering pin connection is mounted.

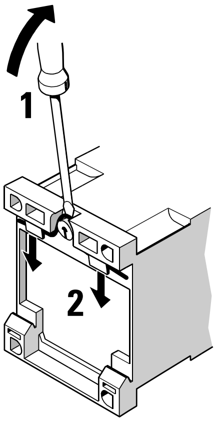


Figure 3-65: Removing the spring from the soldering pin connection

3.4.7.5 Parallel connections

If the conducting paths of multipole switching devices are connected in parallel, the total current is distributed to the individual conducting paths according to their ohmic resistance and the inductive effect they have on each other. The ohmic resistance is mainly formed by the transfer resistance at the contact pieces, the value of which can be changed by contact erosion and oxidation. The distribution of current is therefore neither even or stable: Individual conducting paths can be overloaded and the overload release or overload relay may be prematurely triggered (triggering fault).

Permanent load in parallel connection

The following applies to permanent loads in the case of parallel connection unless specified otherwise in the catalogs:

- When three conducting paths are connected in parallel, 2.5 times the amount of continuous current can be applied, and when two conducting paths are connected in parallel, 1.8 times the continuous current can be applied. Make sure, however, that the making and breaking capacity do not increase because the contact pieces do not close and open at the same time, and therefore the contact pieces in a conducting path have to switch the entire making and breaking current.
- The wiring must be routed in such a way that each conducting path has the same line length.
- Any short-circuit current is distributed in proportion to the conducting path resistances.
  Important: The operating current of electromagnetic, instantaneous short-circuit releases is not reached.

Making/breaking capacity

You can find out the making and breaking capacity of contactors in relation to the load currents in the parallel connection of two or three conducting paths from the following table:

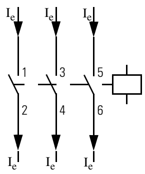
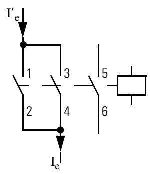
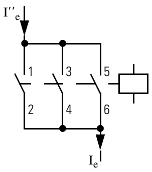
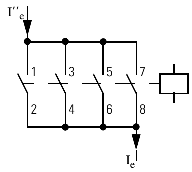
	 3-pole switching[1]	 2 conducting paths in parallel[1]	 3 conducting paths in parallel[1]	 4 conducting paths in parallel[1]
Making capacity:	12 x I_e (utilization category AC -4)	$\frac{12 \cdot I'e}{1,8} = 6,67 \cdot I'e$	$\frac{12 \cdot I''e}{2,5} = 4,8 \cdot I''e$	$\frac{12 \cdot I''e}{3,1} = 3,9 \cdot I''e$
Breaking capacity	10 x I_e (utilization category AC -4)	$\frac{10 \cdot I'e}{1,8} = 5,55 \cdot I'e$	$\frac{10 \cdot I''e}{2,5} = 4,0 \cdot I''e$	$\frac{10 \cdot I''e}{3,1} = 3,2 \cdot I''e$

Table 3-31: Parallel links making and breaking capacity

1) Voltage at each clearance between open contacts:

$$U = \frac{Ue}{\sqrt{3}}$$

Variants

The following variants of parallel connections are available:

Frame size	Variants
S00 to S3	3-pole, without terminal (star-point link)[2)]
S00 to S3	3-pole with terminal
S00	4-pole with terminal

Table 3-32: Parallel connections Variants

2) Accessories for star-delta combinations

Installation

The parallel connections can be each shortened by one pole.

3.4.7.6 Covers for frame sizes S2 and S3

To increase safety, terminal covers are available for contactors of frame sizes S2 and S3:

Variants	Function	Number required
Terminal cover for box terminals 3RT19.6-4EA2	Offers additional shock protection	2 covers per contactor are required (for the upper and lower main terminals)
Terminal cover for lug and bar connection 3RT1946-4EA1	Ensures that voltage intervals are adhered to Provides shock protection when the box terminal is removed	

Table 3-33: Covers

Installation

The following diagrams show you how to mount the covers:

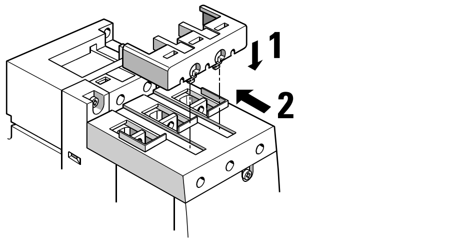
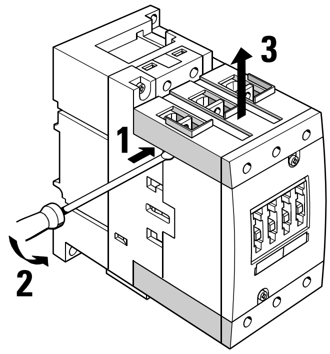
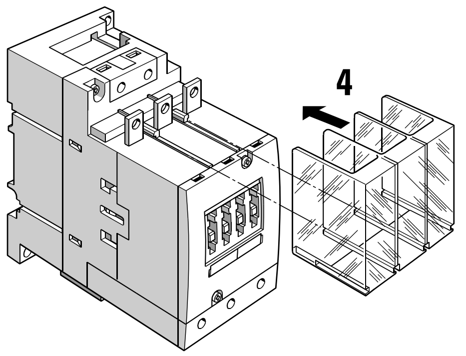
	The cover for box terminals is inserted in the guides on the box terminal block and pushed backwards until it snaps into position.
 	To attach the cover for the lug and bar connection, first remove the box terminal block **(1, 2, 3)**, and then push the cover in the guide rails.

Figure 3-66: Terminal covers

3.5 Mounting and connection

3.5.1 Mounting

Note

Note the following when mounting the cover:
- If foreign bodies, such as wood shavings, can get into the device, the contactors must be covered during installation.
- If there is a danger that dirt or dust could be present, or if there is a corrosive atmosphere, the contactors must be installed in a housing.
- Dust deposits must be vacuum cleaned.

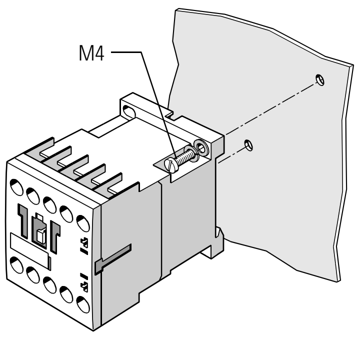
Attachment options

The attachment options for the contactors are uniform.

Frame size	Installation	Removal
S00 to S3	Screw-on attachment	Removed with a screwdriver
S00, S0	Snapped onto a 35 mm rail (in acc. with EN 50 022)	Removed without a tool
S2, S3	Snapped onto a 35 mm rail (in acc. with EN 50 022)	The snap-on spring can be opened with a screwdriver
S3	Snapped onto a 75 mm rail	

Table 3-34: Attachment

Screw-on attachment



The 3RT1 contactors can be screwed onto a flat surface.
- With 2 M4 screws, diagonal
- Maximum tightening torque 2 Nm
- Washers and spring lock washers must always be used
- The distance to grounded parts at the side must be more than 6 mm

Figure 3-67: 3RT: Screw-on attachment (frame size S00)

Snap-on attachment on rails

Snap-on attachment is possible:
- Frame sizes S00 to S3: on 35 mm rail
- Frame size S3: on 75 mm rail. The height of the rail must be at least 15 mm.

The following illustration shows you how to mount the device onto the rail:

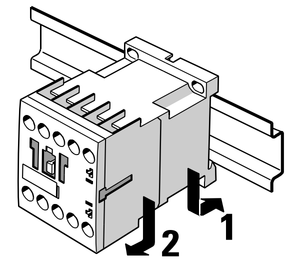
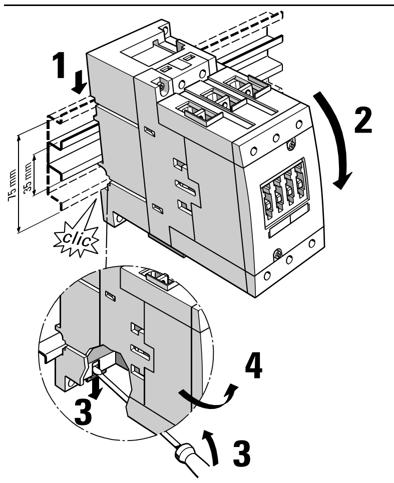
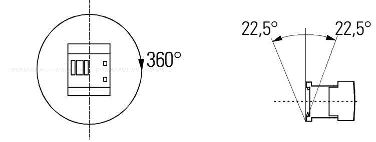
Frame sizes S00 and S0	
	Place the device on the upper edge of the rail, and press it downward until it snaps onto the lower edge of the rail **(1)**. Push the device downward to release the tension of the mounting spring, and remove the device by tilting it **(2)**.
Frame sizes S2 and S3	
	Place the device on the upper edge of the rail, **(1)** and press it downward toward the rail until it snaps onto the lower edge of the rail **(2)**. Using a screwdriver, push the lug on the lower rear side of the device downward to release the tension of the mounting spring **(3)**, and remove the device by tilting it **(4)**.

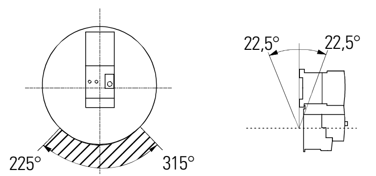
Figure 3-68: Snap-on attachment

Installation positions

The contactors are designed for use on vertical surfaces. The following installation positions are permissible for AC and DC operation:



Without overload relay



With 3RU1 overload relay

Figure 3-69: Installation positions

Vertical installation position

The following table indicates usage in a vertical installation position:

No.	Size	AC/DC	Output power	Measure
1	S00 coupler 3RT10 1.	DC	3 to 5.5 kW	Without restriction
1	S00 coupler 3RH11	DC	I_e/AC-15 6 A/230 V	With 2 NO + 2 NC contacts: stronger springs, otherwise no restriction
2	S00 3RT10 1.	DC	3 to 5.5 kW	Without restriction
2	S00 3RH11	DC	I_e/AC-15 6 A/230 V	Without restriction
3	S00	AC	3 to 5.5 kW/ and I_e/AC-15 6 A/230 V	Special variant
4	S0 coupler	DC	5.5 to 11 kW	Special variant
5	S0	DC	4 to 11 kW	Special variant
6	S0	AC	4 to 11 kW	Without restriction
8	S2	AC	15 to 22 kW	Special variant
9	S2	DC	15 to 22 kW	Vertical installation position not possible.
10	S3	AC	30 to 45 kW	Special variant
11	S3	DC	30 to 45 kW	Vertical installation position not possible.

Table 3-35: Vertical installation position

Motor and auxiliary contacts (including the contactor relay variants) are included in frame size S00.

Installation in series

No derating is necessary up to an ambient temperature of 60 °C for all the contactors, even those in side-by-side installation.
In the case of contactors with an extended operating range (0.7 to 1.25 x U_S) that use a series resistor, installation in series is permissible up to an ambient temperature of +70 °C.

3.5.2 Connection

The SIRIUS contactors are available with the following terminal types:
- Frame sizes S00 to S3: screw-type terminals
- Contactors and auxiliary contactors of frame size S00: All the terminals are also available as Cage Clamp terminals
- Contactors of frame sizes S0 to S3: The auxiliary switches and coil connections are also available with Cage Clamp terminals.
- Accessories: screw-type and (for most of the range) Cage Clamp terminals
- The contactors of frame size S3 have removable box terminals for the main conductor terminals. This enables the connection of ring lugs or busbars.

Screw-type terminals

The devices with screw-type terminals have the following features:

- All the connections have captive screws.
- All the terminal points are delivered in the open position.
- The screwdriver guides allow screwdriving machines to be used.
- In frame size S00, all the terminal screws for the main and auxiliary circuits have a uniform screw size (cross-tip Pozidriv 2 screws) and therefore all require the same torque.
- In all the frame sizes (S00 to S3), the terminal screws are identical for the auxiliary conductor terminals (no bit change and uniform torque).

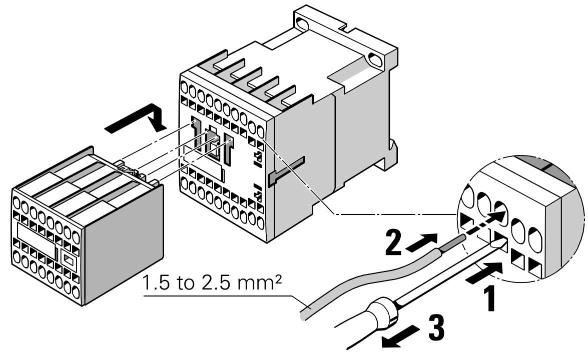
Cage Clamp terminals

In the variant with Cage Clamp terminals, the devices have the following features:

- The contactors are recommended if strong shaking or vibrations can be expected at the installation location.
- The terminals are also suitable for two-conductor connections
- All the terminals are accessible from the front and are easily visible.
- A maximum of two conductors with a cross-section of 0.25 mm^2 up to a maximum 2.5 mm^2 can be used for each terminal point.

Cage Clamp terminals: Procedure

The following illustration shows you how to use the Cage Clamp terminals:



Insert the screwdriver straight into the opening up until the stop **(1)** to open the clamping unit. Insert the conductor in the oval terminal opening **(2)**, and remove the screwdriver **(3)**.

Figure 3-70: Cage Clamp terminals

Insulation stop

With a conductor cross-section of ≤ 1 mm^2, an insulation stop (3RT1916-4JA02) must be used to hold the conductor insulation securely. An insulation stop line consists of 5 pairs of connection terminals. The following illustration demonstrates insertion into the Cage Clamp infeeds.

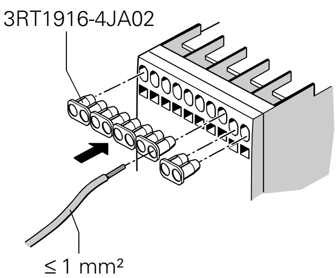


Figure 3-71: Insulation stop with Cage Clamp terminals

Two-conductor connection

It is possible with all the main, auxiliary, and control cable connections to connect two conductor ends. They can also be used to connect untreated conductors with different cross-sections. Box terminals each with 2 terminal points are provided for the main conductor connection in contactors of frame sizes S2 and S3.
This connection method also promises problem-free looping and parallel connection without intermediate terminals.

Conductor cross-sections

Permissible conductor cross-sections for main and auxiliary connections:

S00

	Main and auxiliary conductors	
Ø 5 to 6 mm / PZ2	0.8 to 1.2 Nm 7 to 10.3 lb.in	**Cage Clamp**
10	2 x (0.5 to 1.5 mm^2) 2 x (0.75 to 2.5 mm^2)	2 x (0.25 to 2.5 mm^2)
10	2 x (0.5 to 1.5 mm^2) 2 x (0.75 to 2.5 mm^2)	2 x (0.25 to 1.5 mm^2)
10	---	2 x (0.25 to 2.5 mm^2)
AWG	2 x (18 to 14)	2 x (24 to 14)

S0

	Control conductor: A1/A2 Auxiliary conductor: NO/NC		**Main conductor**
	Screw-type terminal	**Cage Clamp terminal**	**L1 L2 L3 T1 T2 T3**
Ø 5 to 6 mm / PZ2	0.8 to 1.2 Nm 7 to 10.3 lb.in	----	2 to 2.5 Nm 18 to 22 lb.in
10	2 x (0.5 to 1.5 mm^2) 2 x (0.75 to 2.5 mm^2)	2 x (0.25 to 2.5 mm^2)	2 x (1 to 2.5 mm^2) 2 x (2.5 to 6 mm^2)
10	2 x (0.5 to 1.5 mm^2) 2 x (0.75 to 2.5 mm^2)	2 x (0.25 to 1.5 mm^2)	2 x (1 to 2.5 mm^2) 2 x (2.5 to 6 mm^2)
10	----	2 x (0.25 to 2.5 mm^2)	----
AWG	2 x (18 to 14)	2 x (24 to 14)	2 x (14 to 10)

S2

	Control conductor: A1/A2 Auxiliary conductor: NO/NC			**Main conductor**
	Screw-type terminal	**Cage Clamp terminal**		**L1 L2 L3 T1 T2 T3**
Ø 5 to 6 mm / PZ2	0.8 to 1.2 Nm 7 to 10.3 lb.in	----	Ø 5 to 6 mm / PZ2	3 to 4.5 Nm 27 to 40 lb.in
10	2 x (0.5 to 1.5 mm^2) 2 x (0.75 to 2.5 mm^2)	2 x (0.25 to 2.5 mm^2)	13	2 x (0.75 to 16 mm^2)
10	2 x (0.5 to 1.5 mm^2) 2 x (0.75 to 2.5 mm^2)	2 x (0.25 to 1.5 mm^2)	13	2 x (0.75 to 16 mm^2) 1 x (0.75 to 25 mm^2)
10	---	2 x (0.25 to 2.5 mm^2)	13	2 x (0.75 to 25 mm^2) 1 x (0.75 to 35 mm^2)
AWG	2 x (18 to 14)	2 x (24 to 14)	**AWG**	2 x (18 to 3) 1 x (18 to 2)

S3

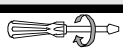
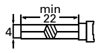
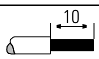
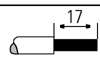
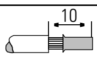
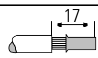
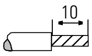
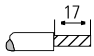
	Control conductor: A1/A2 Auxiliary conductor: NO/NC Screw-type terminal	 Cage Clamp terminal		Main conductor L1 L2 L3 T1 T2 T3
 Ø 5 to 6 mm / PZ2	0.8 to 1.2 Nm 7 to 10.3 lb.in	----		4 to 6 Nm 35 to 53 lb.in
	2 x (0.5 to 1.5 mm²) 2 x (0.75 to 2.5 mm²)	2 x (0.25 to 2.5 mm²)		2 x (2.5 to 16 mm²)
	2 x (0.5 to 1.5 mm²) 2 x (0.75 to 2.5 mm²)	2 x (0.25 to 1.5 mm²)		2 x (2.5 to 35 mm²) 1 x (2.5 to 50 mm²)
	----	----		2 x (10 to 50 mm²) 1 x (10 to 70 mm²)
AWG	2 x (18 to 14)	2 x (24 to 14)	**AWG**	2 x (10 to 1/0) 1 x (10 to 2/0)

Table 3-36: Conductor cross-sections (frame sizes S00 to S3)

3.5.3 Changing the magnet coils

4 coil terminals

Contactors of frame sizes S0 to S3 have 4 coil terminals.
The advantages of this are as follows:
- Variable connection, depending on the amount of space and cable routing
- Easier wiring of feeders

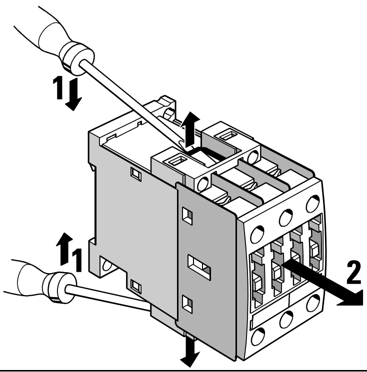
The connection options are:
- From above with in fuseless configuration with circuit breakers connected above
- From below when fuses are used with an overload relay attached directly below
- Diagonal

Changing the magnet coils

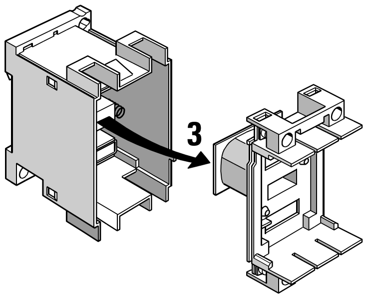
The magnet coils can be replaced in the case of contactors of frame sizes S0 to S3.

S0 - AC operation

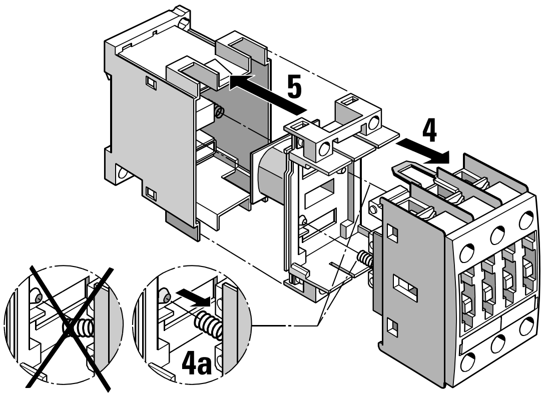
The following illustration shows the replacement of the magnet coil in frame size S0 in AC operation:



Use screwdrivers to lever up the release clips between the rear and front contactor halves and remove the front part of the contactor.



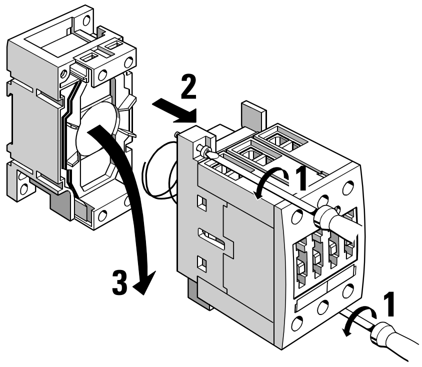
Remove the magnet coil from the rear half of the contactor.



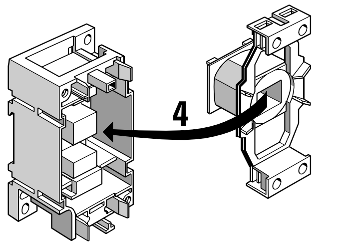
Push in the new magnet coil, and put the front section of the contactor back on again.
Important:
Make sure that the springs between the magnet coil and the front contactor half sit straight on the mounting **(4a)**.

Figure 3-72: Replacing the magnet coil (frame size S0/AC)

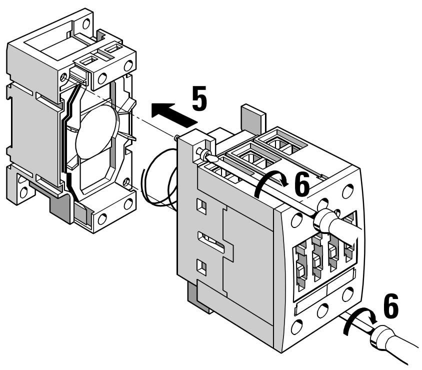
S2 - AC operation



Loosen the 2 screws between the rear and front contactor halves, and remove the magnet coil from the rear part of the contactor.



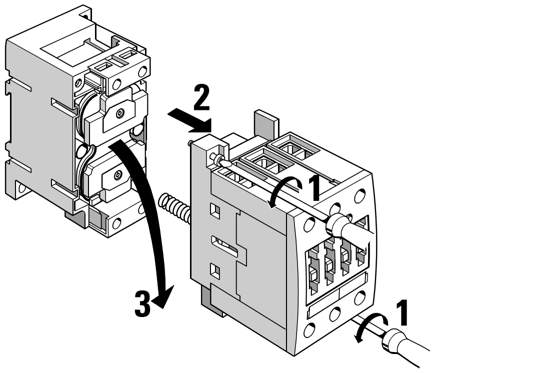
Insert the new magnet coil.



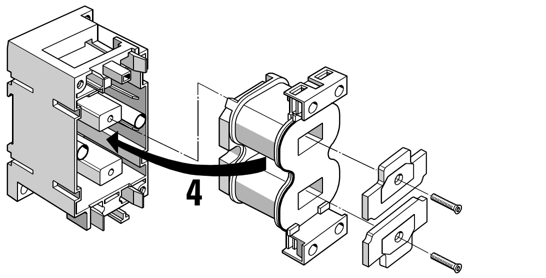
Replace the front half of the contactor, and tighten the 2 screws again.

Figure 3-73: Replacing the magnet coil (frame size S2/AC)

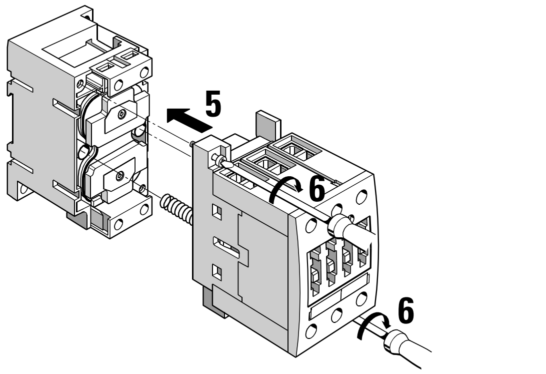
S2 - DC operation



Loosen the 2 screws between the rear and front contactor halves. Loosen the two screws on the plates that attach the magnet coil to the armature, and remove the magnet coil from the rear half of the contactor.



Insert the new magnet coil, and screw on the two plates again with the two screws.



Replace the front half of the contactor, and tighten the 2 screws again.
Make sure the springs are in their correct position.

Figure 3-74: Replacing the magnet coil (frame size S2/DC)

S3 - AC operation

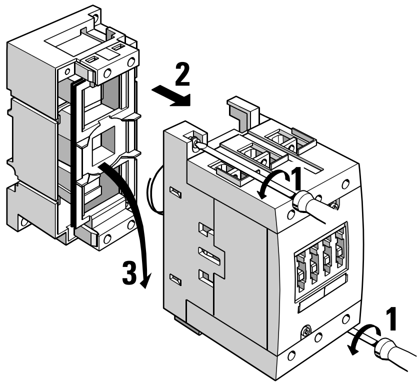
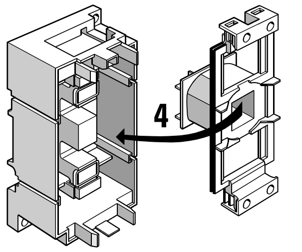
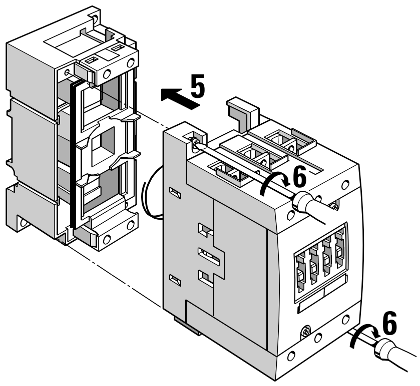
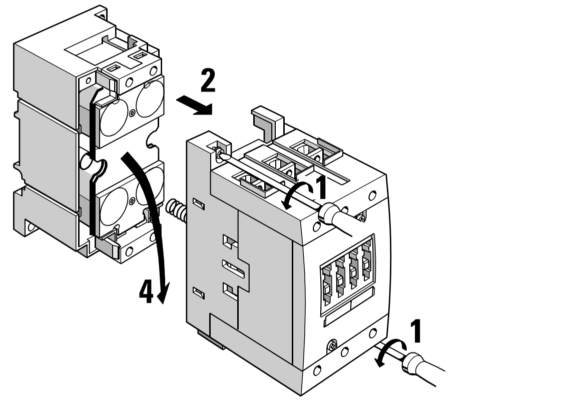
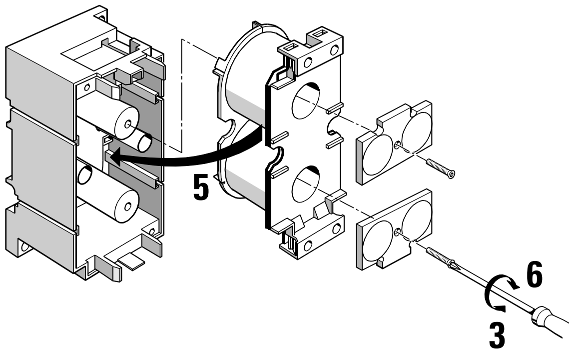
	Loosen the 2 screws between the rear and front contactor halves, and remove the magnet coil from the rear part of the contactor.
	Insert the new magnet coil.
	Replace the front half of the contactor, and tighten the 2 screws again.

Figure 3-75: Replacing the magnet coil (frame size S3/AC)

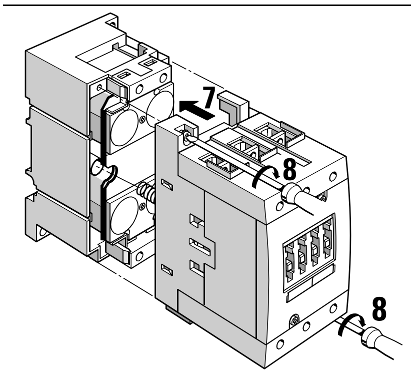
S3 - DC operation



Loosen the 2 screws between the rear and front contactor halves. Loosen the two screws on the plates that attach the magnet coil on the armature, and remove the magnet coil from the rear half of the contactor.



Insert the new magnet coil, and screw on the two plates again with the two screws.



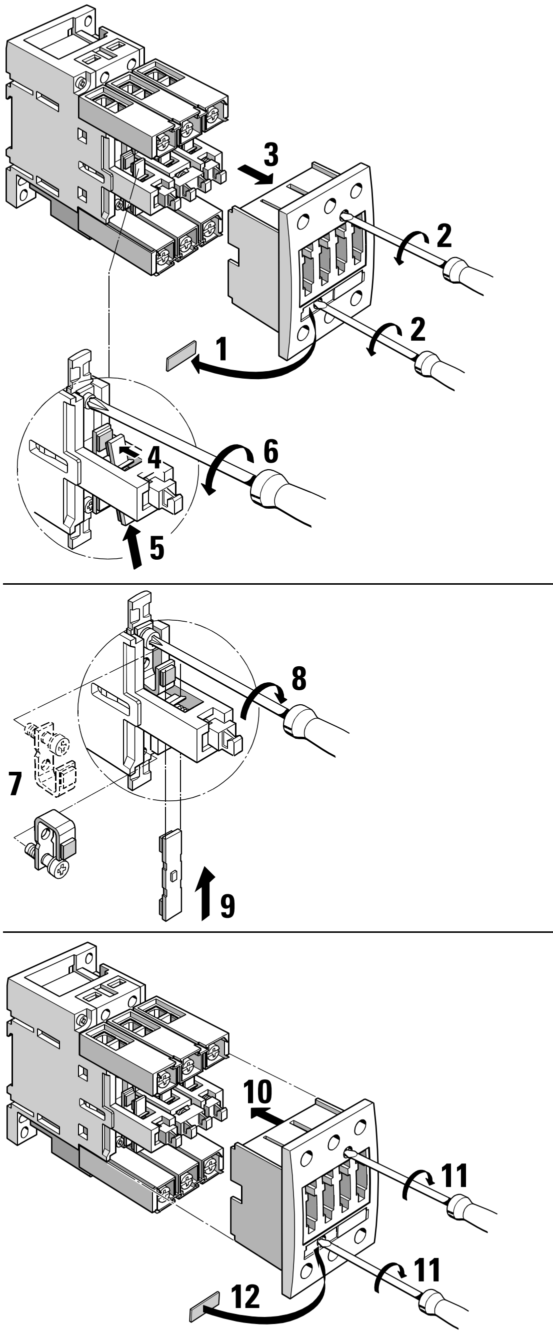
Replace the front half of the contactor, and tighten the 2 screws again.
Make sure the springs are in their correct position.

Figure 3-76: Replacing the magnet coil (frame size S3/DC)

3.5.4 Changing the contact piece

The contact pieces can be replaced in contactors of frame sizes S2 to S3. When they are replaced for the third time, the arcing chamber also has to be replaced.

Frame size S2



Remove the left identification label, loosen the 2 screws on the frontplate of the contactor, and remove the top section of the contactor **(1, 2, 3)**.
Remove the movable contact piece by gently tipping it upward and then pulling it out **(4, 5)**. Loosen the screws that attach the two immovable contact pieces **(6)**.

Remove the old contact pieces **(7)**, and screw on the new contact pieces **(8)**. Push in a new movable contact piece **(9)**.

Replace the top section of the contactor, and tighten the 2 screws on the frontplate. Replace the identification label.

Figure 3-77: Replacing the contact piece (frame size S2)

Frame size S3

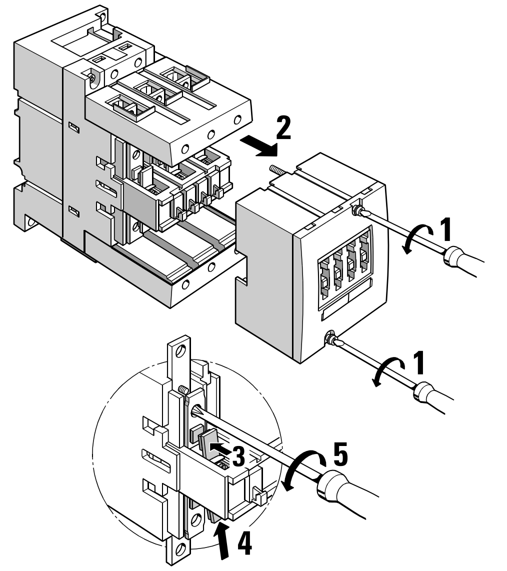
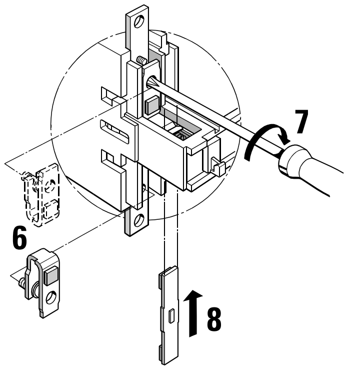
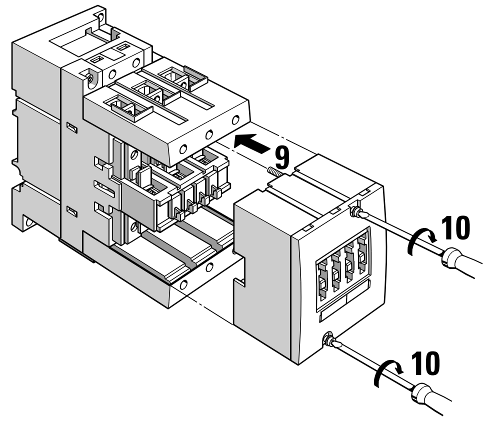
	Loosen the 2 screws on the frontplate of the contactor, and remove the top section of the contactor **(1, 2)**. Remove the movable contact piece by gently tipping it upward and then pulling it out **(3, 4)**. Loosen the screws that attach the two immovable contact pieces **(5)**.
	Remove the old contact pieces **(6)**, and screw on the new contact pieces **(7)**. Push in a new movable contact piece **(8)**.
	Replace the top section of the contactor, and tighten the 2 screws on the frontplate.

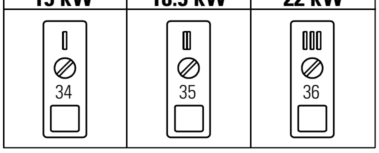
Figure 3-78: Replacing the contact piece (frame size S3)

Contact pieces

The following contact pieces can be used for frame sizes S2 and S3 for the different performance classes:

S2

3RT1034 15 kW	3RT1035 18.5 kW	3RT1036 22 kW



S3

3RT1044 30 kW	3RT1045 37 kW	3RT1046 45 kW	3RT1446 140 A (AC-1)

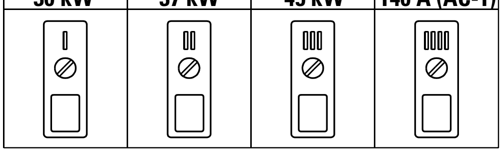


Figure 3-79: Contact pieces (frame sizes S2/S3)

3.6 Dimensioned drawings (dimensions in mm)

3RT1. / 3RH11 contactors, 3-pole

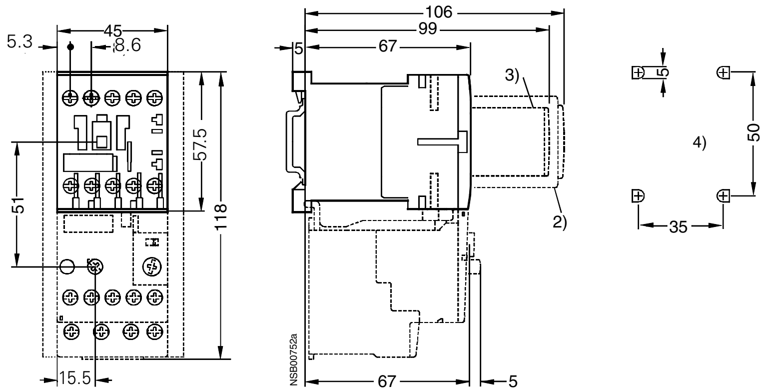


Figure 3-80: 3RT1. 10 1/3RH11 contactors (frame size S00)
Screw-type terminal with surge suppressor, auxiliary switch block, and attached overload relay
Different dimensions for contactors with Cage Clamp terminals: height 60 mm, mounting depth with auxiliary switch block 110 mm
2) Auxiliary switch block (also electronically optimized variant 3RH19 11-11N...)
3) Surge suppressor (also additional load module 3RT19 16-1GA00)
4) Drilling pattern
Distance to grounded parts at the side 6 mm

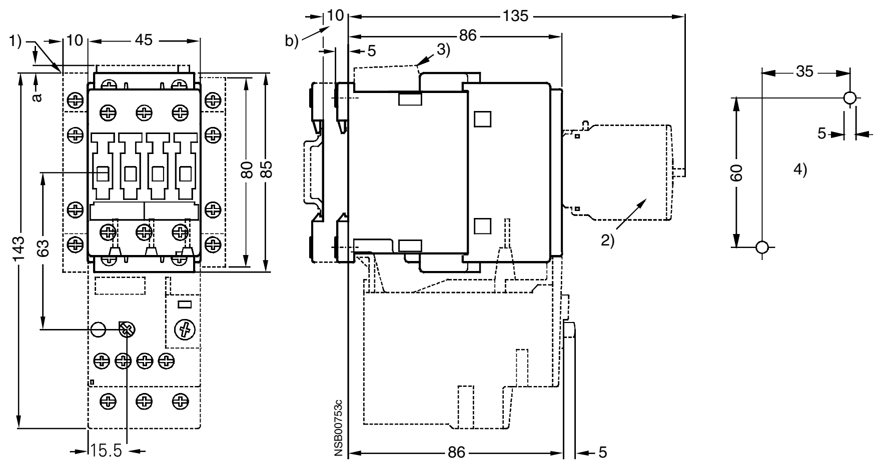


Figure 3-81: 3RT10 2 contactors, 3RT10 2 contactor relays (frame size S0)
with surge suppressor, auxiliary switch block, and attached overload relay

a = 3 mm at < 240 V
a = 7 mm at > 240 V
b = DC 10 mm deeper than AC

1) Auxiliary switch block, attachable at the side
2) Auxiliary switch block, attachable at the front, 1-, 2-, and 4-pole (also electronically optimized variant 3RH1921-.FE22)
3) Surge suppressor
4) Drilling pattern
Distance to grounded parts at the side 6 mm

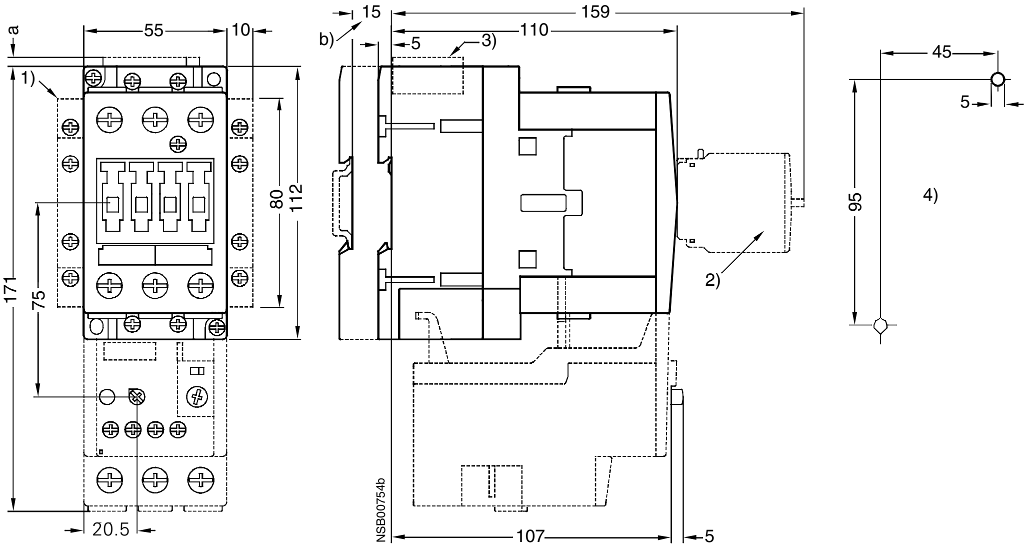


Figure 3-82: 3RT10 3 (frame size S2)
with surge suppressor, auxiliary switch block, and attached overload relay

a = 0 mm with varistor < 240 V, diode combination
a = 3.5 mm with varistor > 240 V
a = 17 mm with RC element
b = DC 15 mm deeper than AC

1) Auxiliary switch block, attachable at the side
2) Auxiliary switch block, attachable at the front (1-, 2-, and 4-pole)
3) Surge suppressor
4) Drilling pattern
Distance to grounded parts at the side 6 mm

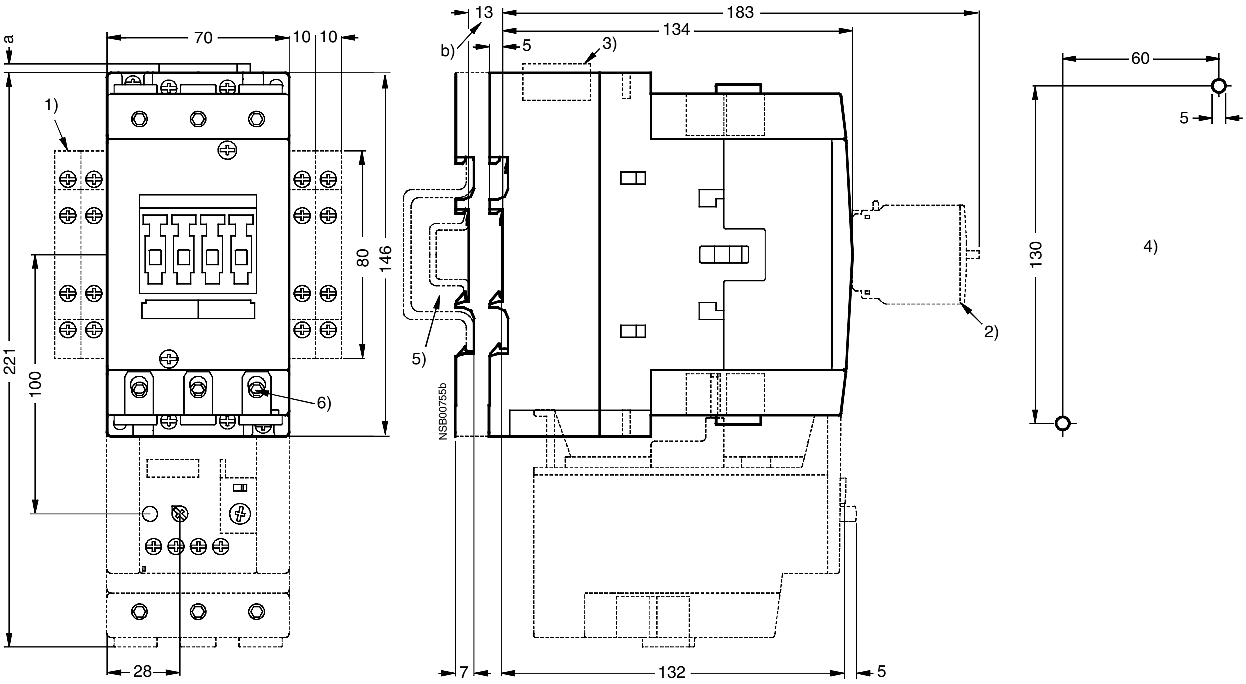


Figure 3-83: 3RT10 4, 3RT14 46 (frame size S3)
with surge suppressor, auxiliary switch block, and attached overload relay
a = 0 mm with varistor, diode combination and < 240 V
a = 3.5 mm with varistor and > 240 V
a = 17 mm with RC element
b = DC 13 mm deeper than AC

1) Auxiliary switch block, attachable at the side
2) Auxiliary switch block, attachable at the front (1-, 2-, and 4-pole)
3) Surge supressor
4) Drilling pattern
5) Attachment to 35 mm rails with 15 mm depth in acc. with EN 50 022 or 75 mm rails in acc. with EN 50 023
6) 4 mm Allen screw
Distance to grounded parts at the side 6 mm

3RT10 contactor relays

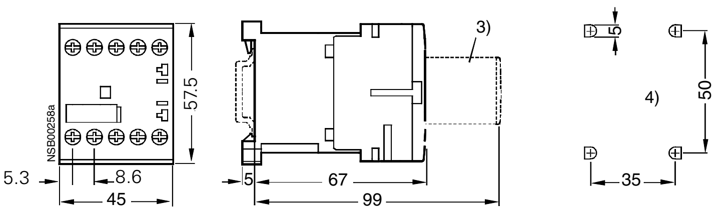


Figure 3-84: 3RT10 1 (frame size S00)
with surge supressor
Different dimensions for contactor relays with Cage Clamp terminal: height 60 mm

3) Surge supressor
4) Drilling pattern
3RT10 2. contactor relay, see Figure 3-80

3RT13 and 3RT15 contactors, 4-pole

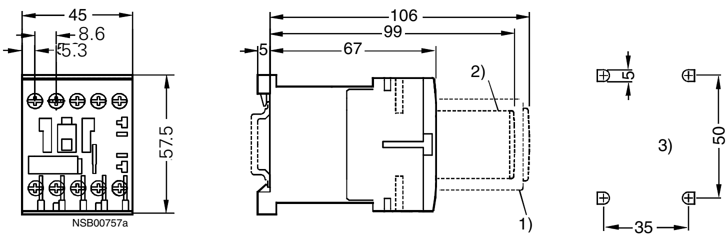


Figure 3-85: 3RT13 1, 3RT15 1 (frame size S00)
Screw-type terminal with surge suppressor, auxiliary switch block
Different dimensions for contactors with Cage Clamp terminals: height 60 mm, mounting depth with auxiliary switch block 110 mm

2) Auxiliary switch block (also electronically optimized variant 3RH19 11-1N...)
3) Surge supressor (also additional load module 3RT19 16-1GA00)
4) Drilling pattern
Distance to grounded parts at the side 6 mm

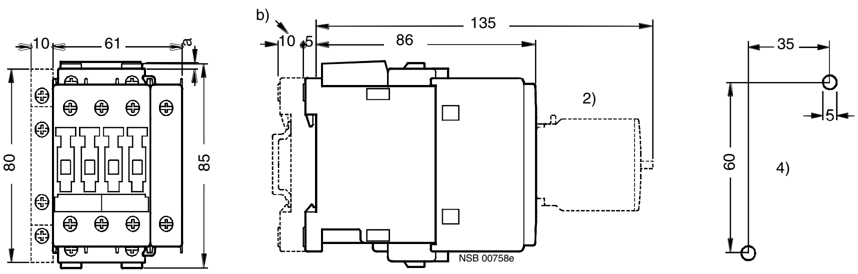


Figure 3-86: 3RT13 2, 3RT15 2 (frame size S0)
with surge supressor and auxiliary switch block

a = 3 mm at < 250 V and attachment of surge suppressor
a = 7 mm at > 250 V and attachment of surge supressor
b = DC 10 mm deeper than AC

1) Auxiliary switch block, attachable at the side (left)
2) Auxiliary switch block, attachable at the front, (max. two 1-pole auxiliary switch blocks)
3) Surge supressor
4) Drilling pattern

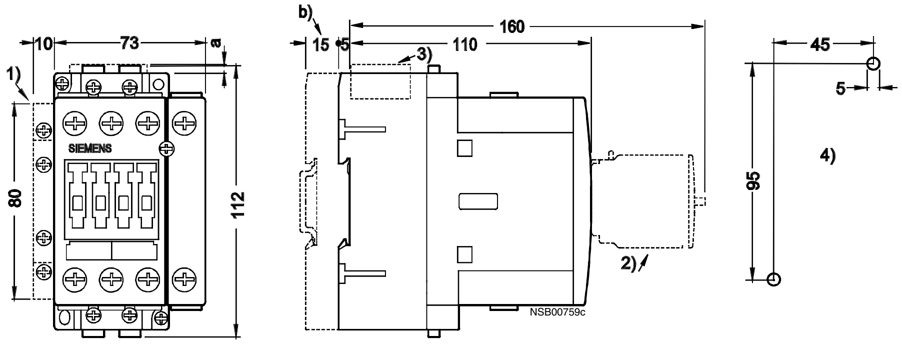


Figure 3-87: 3RT133, 3RT153 (frame size S2)
with surge supressor and auxiliary switch block

a = 0 mm with varistor < 240 V
a = 3.5 mm with varistor > 240 V
a = 17 mm with RC element and diode combination
b = DC 15 mm deeper than AC

1) Auxiliary switch block, attachable at the side (right or left)
2) Auxiliary switch block, attachable at the front, (1-, 2-, and 4-pole, also electronically optimized variant 3RH19 21-1FE22)
3) Surge supressor
4) Drilling pattern
5) Attachment on 35 mm rails (15 mm deep) in acc. with EN 50 022 or 75 mm rails in acc. with EN 50 023
6) 4 mm Allen screw
Distance to grounded parts at the side 6 mm

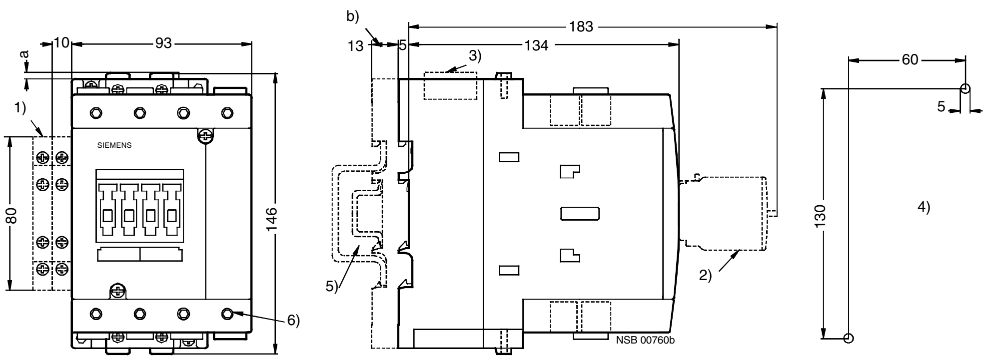


Figure 3-88: 3RT13 4 (frame size S3)
with surge supressor and auxiliary switch block

a = 0 mm with varistor < 240 V
a = 3.5 mm with varistor > 240 V
a = 17 mm with RC element and diode combination
b = DC 13 mm deeper than AC

1) Auxiliary switch block, attachable at the side (right or left)
2) Auxiliary switch block, attachable at the front, (1-, 2-, and 4-pole, also electronically optimized variant 3RH1921-1FE22)
3) Surge supressor
4) Drilling pattern
5) Attachment on 35 mm rails (15 mm deep) in acc. with EN 50 022 or 75 mm rails in acc. with EN 50 023
6) 4 mm Allen screw
Distance to grounded parts at the side 6 mm

3RT16 capacitor-switching contactors

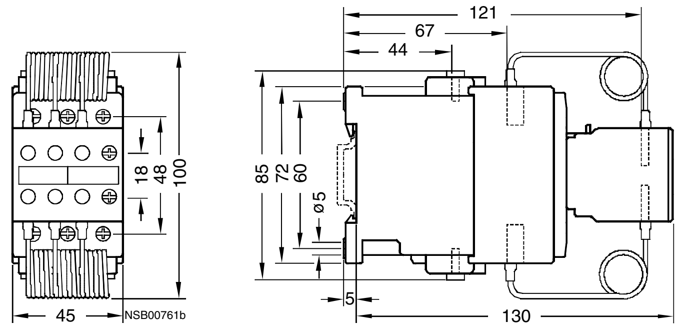


Figure 3-89: 3RT1626 (frame size S0)

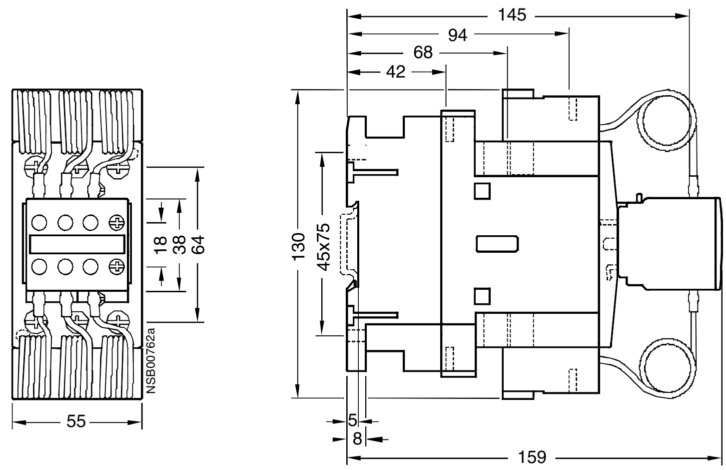


Figure 3-90: 3RT1636 (frame size S2)

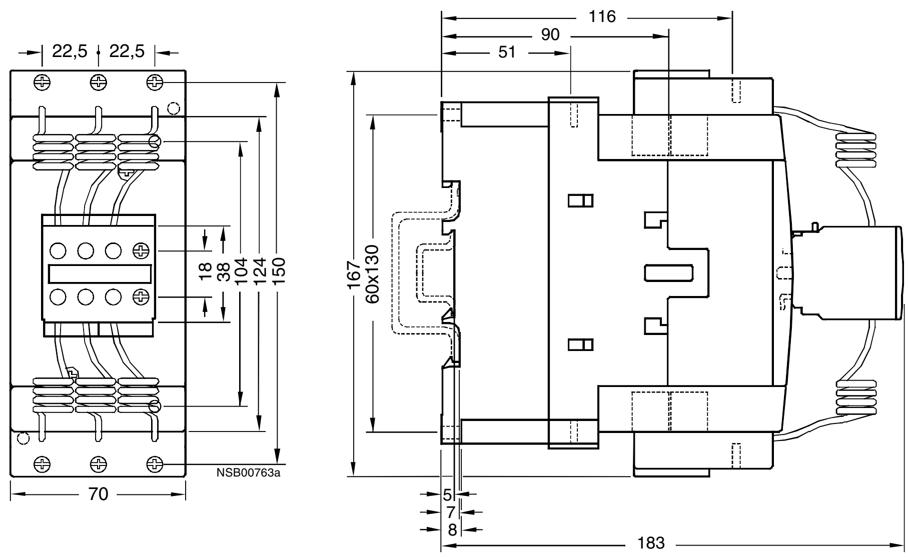


Figure 3-91: 3RT1646 (frame size S3)

Contactors with an extended operating range (3RT1/3RH11)

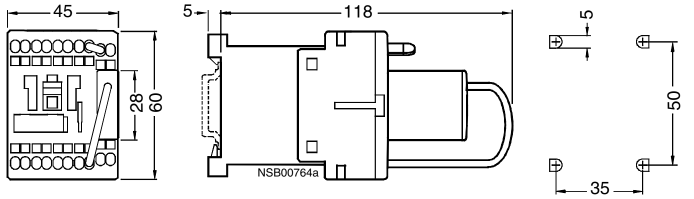


Figure 3-92: 3RT10 17, 3RH 11 (frame size S00)

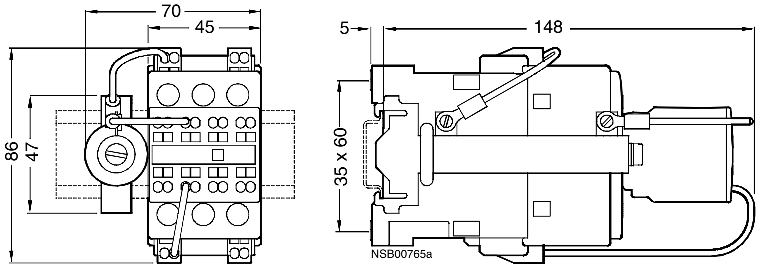


Figure 3-93: 3RT10 2, view from right (frame size S0)

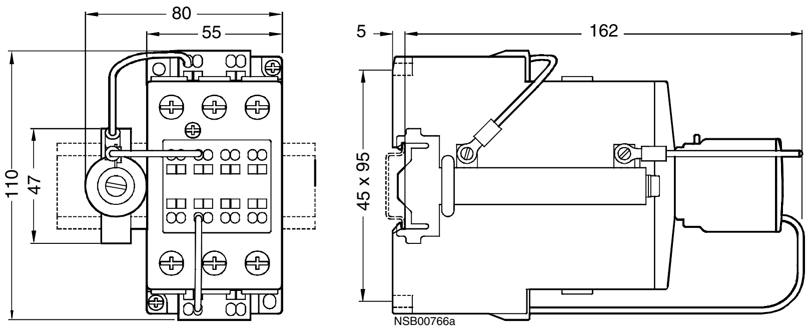


Figure 3-94: 3RT103, view from right (frame size S2)

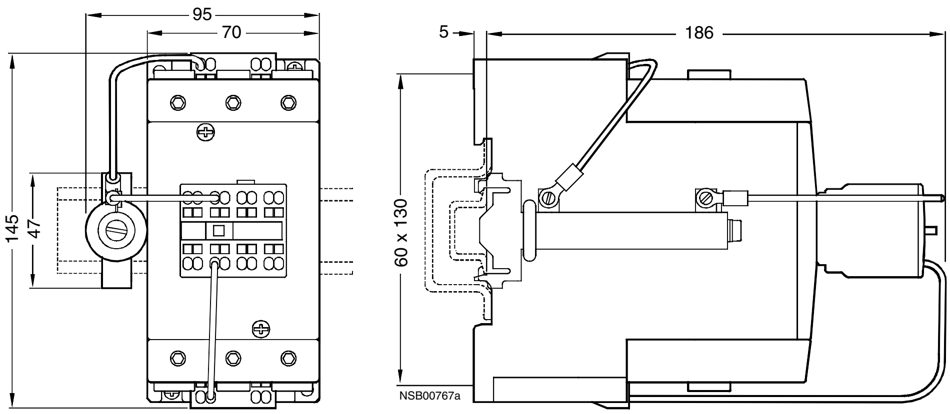


Figure 3-95: 3RT104, view from right (frame size S3)

3RT19 time-delay auxiliary switch block

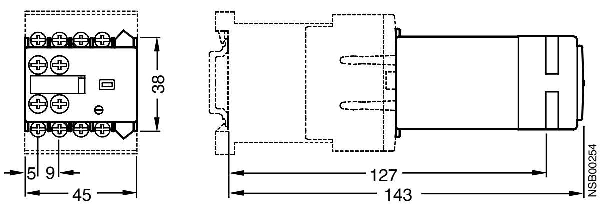
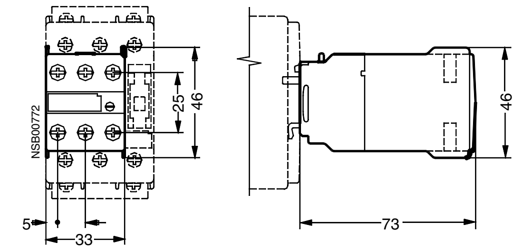


Figure 3-96: 3RT1916-2E.., -2F.., -2G.. (frame size S00)



3RT19 26-2E.., -2F.., -2G.. (frame sizes S0 to S3)

3RT19 time-delay time relay blocks, on-delay

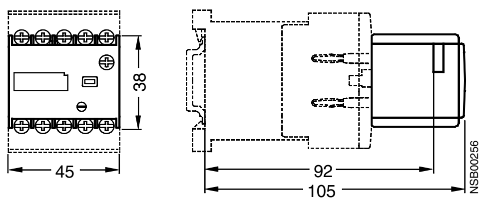
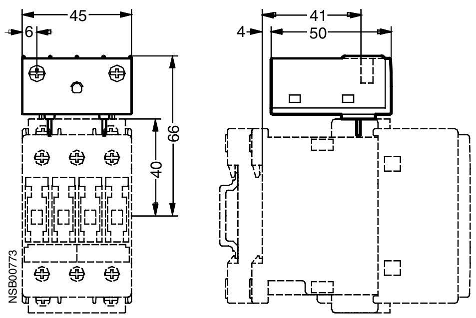


Figure 3-97: 3RT19 16-2 (frame size S00)
For attachment to the front of the contactor
(dimensions also apply to off-delay time relay blocks)



3RT19 26-2 (frame sizes S0 to S3)
Attachable on the top of the contactor
(dimensions also apply to off-delay time relay blocks and to coupling links (3RH19 24-1GP11))

3RH19 11 auxiliary switch block, 1-pole

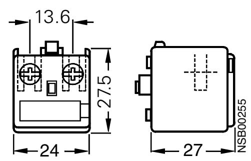
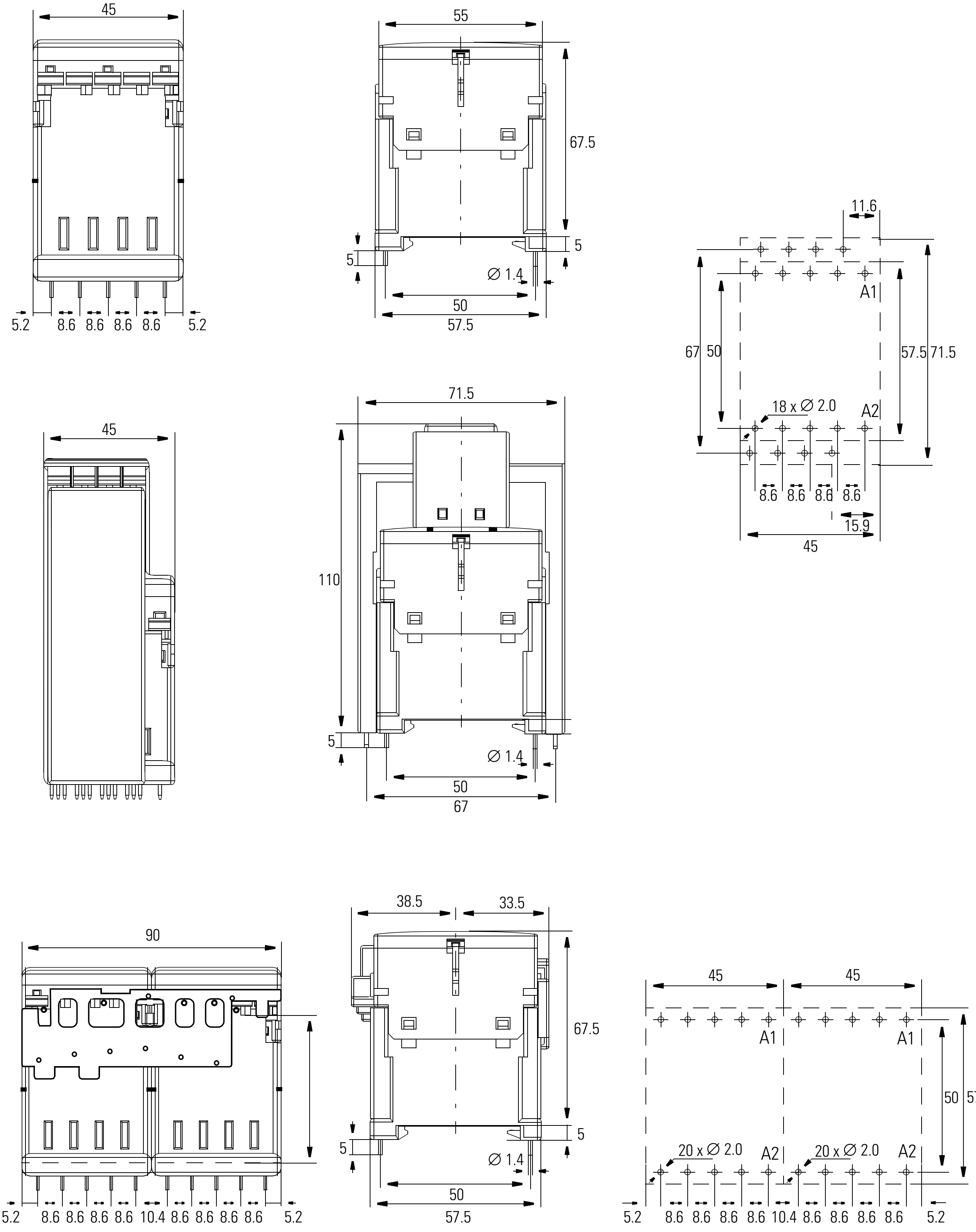


Figure 3-98: 3RH19 11-1AA.., 3RH19 11-1BA..
Infeed from one side

3RT1916 soldering pin connection



3RA13 contactor combinations for reversing

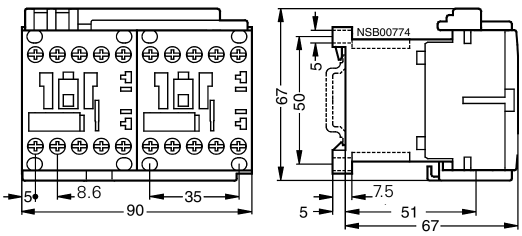
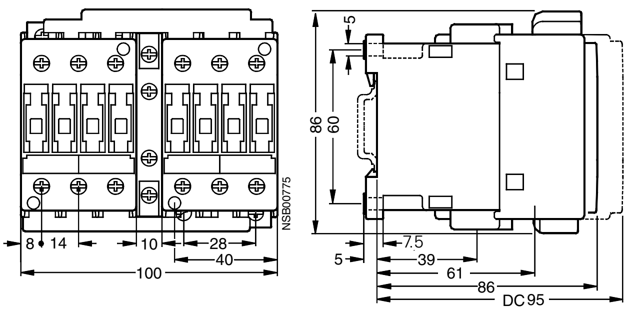


Figure 3-99: Contactor combination for reversing (frame size S00)



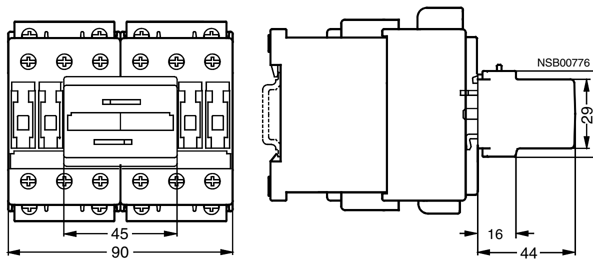


Figure 3-100: Contactor combination for reversing (frame size S0)
with mechanical interlock at the side (3RA19 24-2B)

with mechanical interlock at the front (3RA19 24-1A)

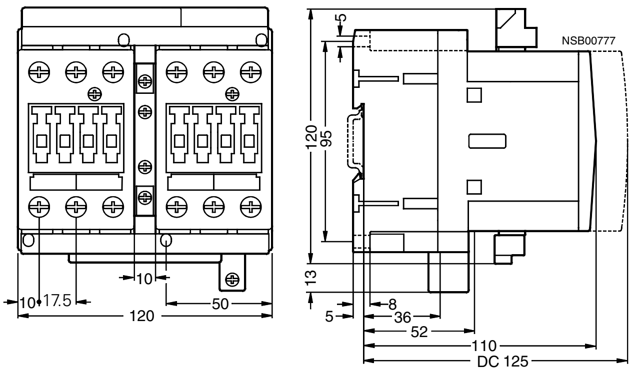


Figure 3-101: Contactor combination for reversing (frame size S2)

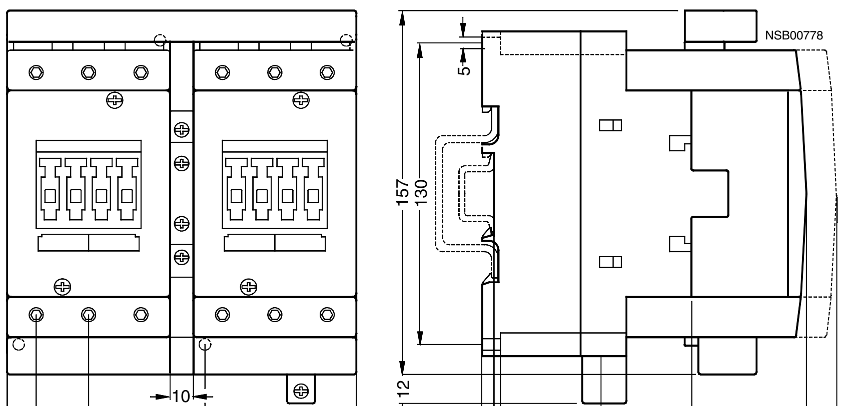


Figure 3-102: Contactor combination for reversing (frame size S3)

Locking device for 3RA reversing switch

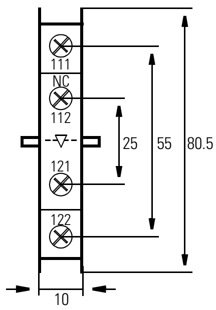
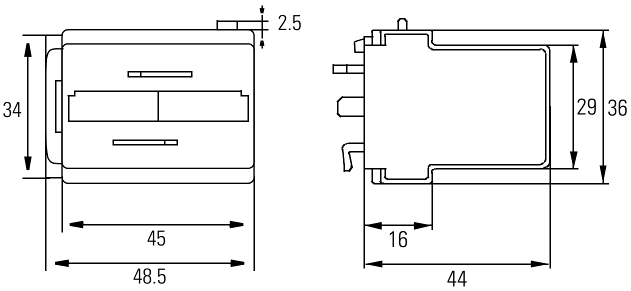


Figure 3-103: 3RA1924-2B (frame sizes S0 to S3)



3RA1924-1A (frame sizes S0 to S3)

3RA14 contactor combinations for star-delta starting

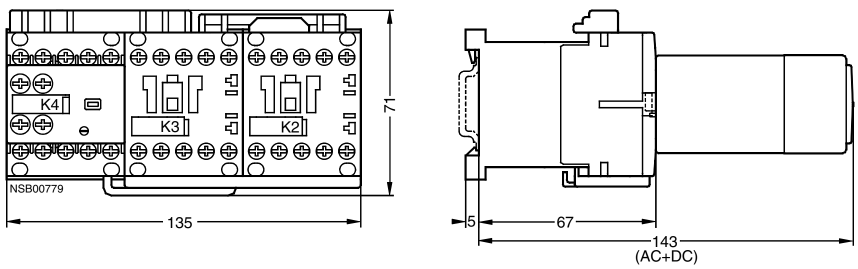


Figure 3-104: Contactor combinations for star/delta (frame sizes S00 - S00 - S00)

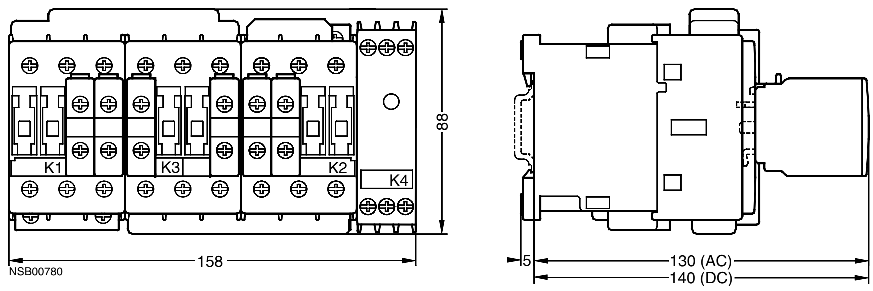


Figure 3-105: Contactor combinations for star/delta (frame sizes S0 - S0 - S0)

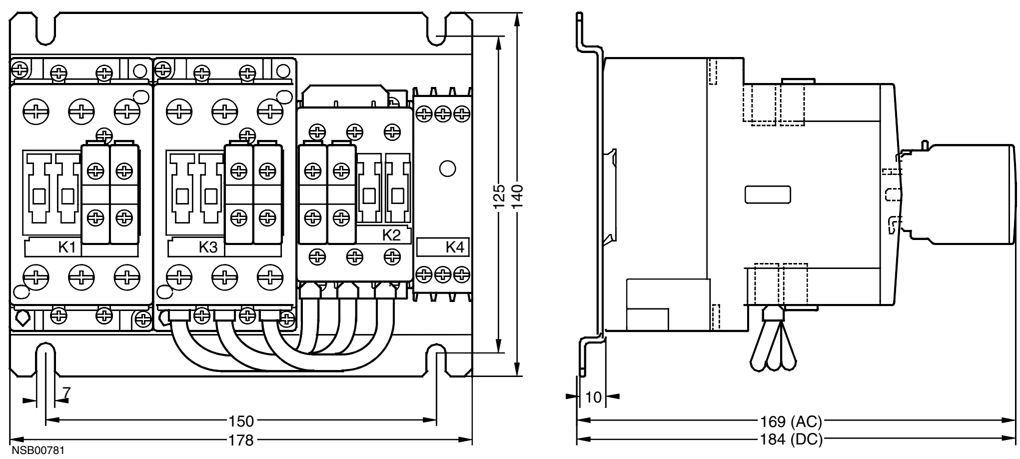


Figure 3-106: Contactor combinations for star/delta (frame sizes S2 - S2 - S0)

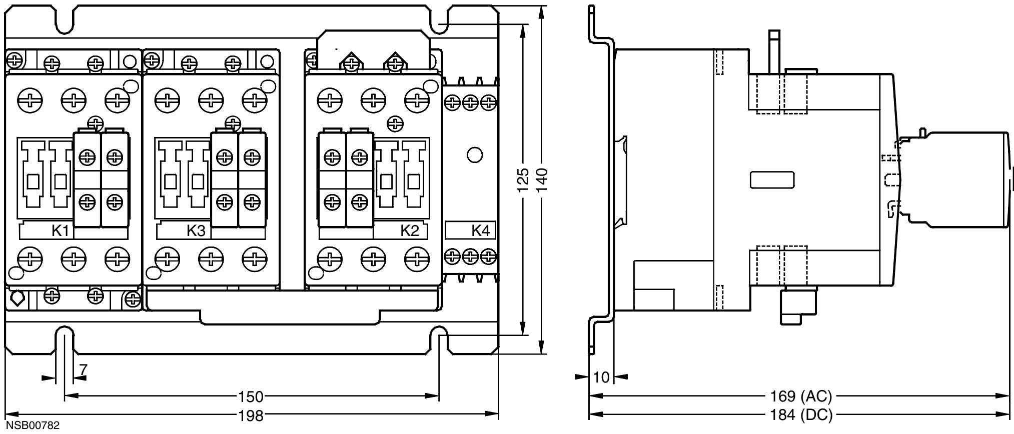


Figure 3-107: Contactor combinations for star/delta (frame sizes S2 - S2 - S2)

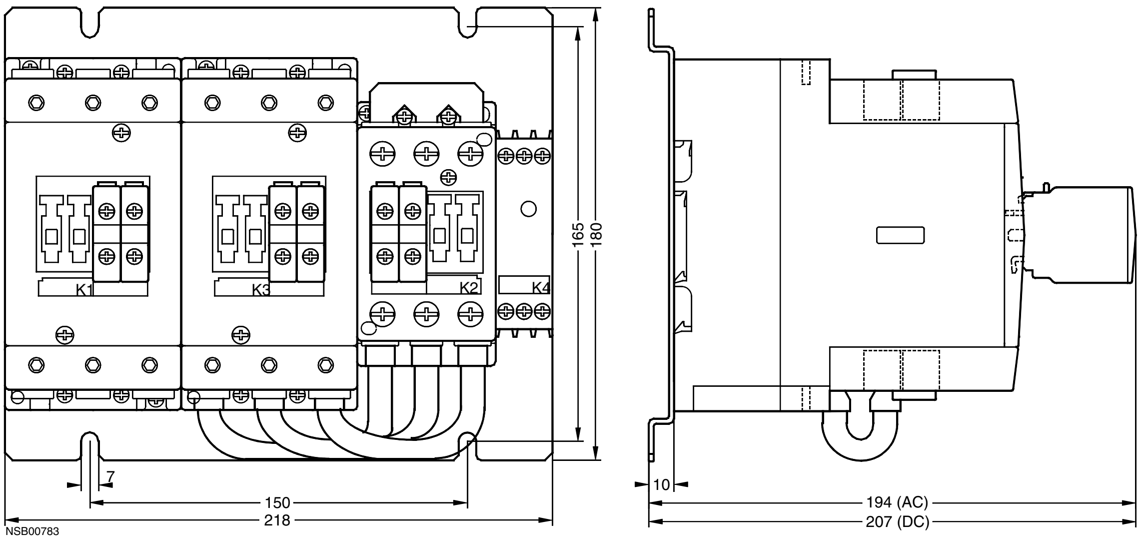


Figure 3-108: Contactor combinations for star/delta (frame sizes S3 - S3 - S3)

3.7 Technical specifications

3RT10 contactors for switching motors

CSA and UL rating data of the contactors

Contactor	Frame size Type		**S00** **3RT10 15**	**S00** **3RT10 16**	**S00** **3RT10 17**	**S0** **3RT10 23/24**	**S0** **3RT10 25**	**S0** **3RT10 26**
Rated insulation voltage		VAC	600	600	600	600	600	600
Continuous current at 40 °C	Open and enclosed	A	20	20	20	35	35	35
Maximum horsepower ratings								
(CSA and UL approved values)								
Rated power	At 200 V	hp	1½	2	3	2/3	5	7½
of three-phase induction motors	230 V	hp	2	3	3	3/3	5	7½
At 50/60 Hz	460 V	hp	3	5	7½	5/7½	10	15
	575 V	hp	5	7½	10	7½/10	15	20
Short-circuit protection		kA	5	5	5	5	5	5
(contactor or overload relay)	Fuse or circuit breaker to UL 489	A A	60 50	60 50	60 50	70 70	70 70	100 100
NEMA/EEMAC ratings	NEMA/EEMAC SIZE		–	–	0	–	–	1
Continuous current	Open	A	–	–	18	–	–	27
	Enclosed	A	–	–	18	–	–	27
Rated power	At 200 V	hp	–	–	3	–	–	7½
of three-phase induction motors	230 V	hp	–	–	3	–	–	7½
At 60 Hz	460 V	hp	–	–	5	–	–	10
	575 V	hp	–	–	5	–	–	10
Overload relay	Type		3RU11 16			3RU11 2		
	Adjustment range	A	0.11 to 12			1.8 to 25		

Contactor	Frame size Type		**S2** **3RT10 34**	**S2** **3RT10 35**	**S2** **3RT10 36**	**S3** **3RT10 44**	**S3** **3RT10 45**	**S3** **3RT10 46**
Rated insulation voltage		VAC	600	600	600	600	600	600
Continuous current at 40 °C	Open and enclosed	A	45	55	50	90	105	105
Maximum horsepower ratings								
(CSA and UL approved values)								
Rated power	At 200V	hp	10	10	15	20	25	30
of three-phase induction motors	230 V	hp	10	15	15	25	30	30
At 50/60 Hz	460V	hp	25	30	40	50	60	75
	575V	hp	30	40	50	60	75	100
Short-circuit protection		kA	5	5	5	10	10	10
(contactor or overload relay)	Fuse or circuit breaker to UL 489	A A	125 125	150 150	200 200	250 250	300 300	350 400
NEMA/EEMAC ratings	NEMA/EEMAC SIZE		–	–	2	–	–	3
Continuous current	Open	A	–	–	45	–	–	90
	Enclosed	A	–	–	45	–	–	90
Rated power	At 200V	hp	–	–	10	–	–	25
of three-phase induction motors	230 V	hp	–	–	15	–	–	30
At 60 Hz	460 V	hp	–	–	25	–	–	50
	575 V	hp	–	–	25	–	–	50
Overload relay	Type		3RU11 3			3RU11 4		
	Adjustment range	A	5.5 to 50			18 to 100		

CSA and UL rating data of the auxiliary contacts

Contactor	Frame size		**S00** **Screw-type terminal and Cage Clamp terminal**	**S0 to S12** **Screw-type terminal and Cage Clamp terminal**	**Screw-type terminal and Cage Clamp terminal**	**Screw-type terminal and Cage Clamp terminal**
			Integrated or snap-on aux. switch block	4-pole snap-on aux. switch block	1-pole snap-on aux.switch block	Laterally attachable aux. switch block
Rated voltage		VAC	600	600	600	600
Switching capacity			A 600, Q 600	A 600, Q 600	A 600, Q 600	A 300, Q 300
	Continuous current at 240 VAC	A	10	10	10	10

3RT1 contactors for switching motors

Auxiliary circuit

Rating of the auxiliary contacts in acc. with IEC 60 947-5-1/DIN EN 60 947-5-1 (VDE 0660 Part 200)
Data apply to integrated auxiliary contacts and contacts in the auxiliary switch blocks for contactors in frame sizes S00 to S12

Contactor	Frame sizes		**S00 to S12**
Rated insulation voltage U_i (pollution degree 3)		V	690
With laterally attachable auxiliary switch blocks 3RH19 21-.EA . . and 3RH19 21-.KA . .		V	Max. 500
Conventional free air thermal current I_{th} = Rated operational current I_e/AC-12		A	10
AC loading **Rated operational current I_e/AC-15/AC-14**			
With rated operational voltage U_e	24 V	A	6
	110 V	A	6
	125 V	A	6
	220 V	A	6
	230 V	A	6
	380 V	A	3
	400 V	A	3
	500 V	A	2
	660 V2)	A	1
	690 V2)	A	1
DC loading **Rated operational current I_e/DC-12**			
With rated operational voltage U_e	24 V	A	10
	60 V	A	6
	110 V	A	3
	125 V	A	2
	220 V	A	1
	440 V2)	A	0.3
	600 V2)	A	0.15
Rated operational current I_e/DC-13			
At rated operational voltage U_e	24 V	A	101)
	60 V	A	2
	110 V	A	1
	125 V	A	0.9
	220 V	A	0.3
	440 V	A	0.14
	600 V2)	A	0.1
Contact reliability at 17 V, 1 mA in acc. with DIN EN 60 947-5-4			Contact fault frequency < 10^{-8} i. e. < 1 fault in 100 mill. operating cycles

1) DC-13: attachable auxiliary switch blocks for frame size S00: 6 A

2) With laterally attachable auxiliary switch blocks: switching capacity only up to 500 V

Contactor	Frame size Type			**S00** **3RT1. 1.**
Rated insulation voltage U_i (pollution degree 3)			V	690
Rated impulse strength U_{imp}			kV	6
Protective separation between the coil and main contacts (in acc. with DIN VDE 0106 Part 101 and A1 [Draft 2/89])			V	400
Permissible ambient temperature		For operation	°C	–25 to +60
		During storage	°C	–55 to +80
Degree of protection in acc. with IEC 60 947-1 and DIN 40 050				IP 20, actuating system IP 40
Shock resistance	Rectangular impulse	AC operation	*g*/ms	7/5 and 4.2/10
		DC operation	*g*/ms	7/5 and 4.2/10
	Sine pulse	AC operation	*g*/ms	9.8/5 and 5.9/10
		DC operation	*g*/ms	9.8/5 and 5.9/10

Short-circuit protection for contactors without overload relay			Short-circuit protection for contactors with overload relay, see Part 4. Short-circuit protection for fuseless load feeders, see Part 5.
Main circuit			
Fuse-links, performance class gL/gG			
NH type 3NA, DIAZED type 5SB, NEOZED type 5SE			
– In acc. with IEC 60 947-4/DIN EN 60 947-4 (VDE 0660 Part 102)	Coordination type "1" 1)	A	35
	Coordination type "2" 1)	A	20
	Unwelded 2)	A	10
Or miniature circuit breaker (up to 230 V) with C characteristic		A	10

(Short-circuit current 1 kA, coordination type 1)

3RT1 contactors for switching motors

Contactor	Frame size Type			S00 **3 RT1.1.**
Auxiliary circuit				
Fuse-links, performance class gL/gG			A	10
DIAZED type 5SB, NEOZED type 5SE (unwelded fuse at $I_k \geq 1$ kA)				
Or miniature circuit breaker (up to 230 V) with C characteristic (short-circuit current $I_k < 400$ A)			A	6

1) Corresponds to section from IEC 60 947-4 (VDE 0660 Part 102):
Coordination type "1":
The destruction of the contactor and the overload relay is permissible.
The contactor and/or overload relay must be replaced, if necessary.

Coordination type "2"
The overload relay must not be damaged.
Contact welding on the contactor is permissible, if it can be easily separated again from the contactor.

2) Test conditions in acc. with IEC 60 947-4-1

Contactor	Frame size Type			**S00** **3 RT1.1.**		
Drive						
Operating range of the magnet coils		AC		At 50 Hz: 0.8 to 1.1 x U_s At 60 Hz: 0.85 to 1.1 x U_s		
		DC		At +50 °C: 0.8 to 1.1 x U_s At +60 °C: 0.85 to 1.1 x U_s		
Power input of the magnet coils (cold coil and at 1.0 x U_s)				**Standard version**	**For USA and Canada**	
AC operation			Hz	50/60	50	60
	Making capacity cos φ		VA	27/24.3 0.8/0.75	26.4 0.81	31.7 0.77
	Holding power cos φ		VA	4.4/3.4 0.27/0.27	4.7 0.26	5.1 0.27
DC operation	Making capacity = holding power		W	3.3		

Contactor	Frame size Type			**S00** **3RT10 15**	**S00** **3RT10 16**	**S00** **3RT10**
Main circuit						
Current carrying capacity with alternating current						
Utilization category AC-1, switching of resistive loads						
Rated operational currents I_e		At 40 °C up to 690 V At 60 °C up to 690 V	A A	18 16	22 20	22 20
Rated power of three-phase loads3) cos φ = 0.95 (at 60 °C)		At 230 V 400 V 500 V 690 V	kW kW kW kW	6.3 11 13.8 19	7.5 13 17 22	7.5 13 17 22
Minimum conductor cross-section loaded with I_e		At 40 °C 60 °C	mm^2 mm^2	2.5 2.5	2.5 2.5	2.5 2.5

3) Resistance-heated industrial furnaces and electric heating appliances, etc. (increased current consumption at startup of heating taken into account).

Contactor	Frame size Type			**S00** **3RT10 15**	**S00** **3RT10 16**	**S00** **3RT10 17**
Main circuit						
Current carrying capacity with alternating current						
Utilization categories AC-2 and AC-3						
Rated operational currents I_e		To 400 V 500 V 690 V	A A A	7 5 4	9 6.5 5.2	12 9 6.3
Rated power of motors with slipring or squirrel-cage rotor at 50 Hz and 60 Hz						
		230 V	kW	2.2	3	3
		400 V	kW	3	4	5.5
		500 V	W	3.5	4.5	5.5
		690 V	kW	4	5.5	5.5
Thermal stress		10-s current1)	A	56	72	96
Power loss per conducting path		At I_e/AC-3	W	0.42	0.7	1.24

3RT1.1 contactors for switching motors

Contactor	Frame size / Type			S00 3RT1. 15	S00 3RT1. 16	S00 3RT1. 17
Main circuit						
Current carrying capacity with alternating current						
Utilization category AC-4 (contact service life of approximately 200,000 operating cycles at $I_a = 6 \times I_e$)						
Rated operational currents I_e		Up to 400 V	A	2.6	4.1	4.1
		690 V	A	1.8	3.3	3.3
Rated power of motors with squirrel-cage rotor at 50 Hz and 60 Hz		At 127 V	kW	0.3	0.5	0.5
		200 V	kW	0.6	1.1	1.1
		220 V	kW	0.6	1.1	1.1
		230 V	kW	0.67	1.1	1.1
		240 V	kW	0.67	1.1	1.1
		380 V	kW	1.15	2	2
		400 V	kW	1.15	2	2
		415 V	kW	1.15	2	2
		440 V	kW	1.15	2	2
		460 V	kW	1.15	2	2
		500 V	kW	1.45	2	2
		575 V	kW	1.45	2	2
		660 V	kW	1.15	2.5	2.5
		690 V	kW	1.15	2.5	2.5

1) In acc. with VDE 0660 Part 102. Rated values for different startup conditions, see Part 4.

Current carrying capacity with direct current

Contactor	Frame size / Type		S00 3RT1. 15			S00 3RT1. 16			S00 3RT1. 17		
Utilization category DC-1, switching of resistive loads (L/R ≤ 1 ms)											
Rated operational current I_e (at 60 °C)											
Number of conducting paths in series connection			1	2	3	1	2	3	1	2	3
	Up to 24 V	A	15	15	15	20	20	20	20	20	20
	60 V	A	15	15	15	20	20	20	20	20	20
	110 V	A	1.5	8.4	15	2.1	12	20	2.1	12	20
	220 V	A	0.6	1.2	15	0.8	1.6	20	0.8	1.6	20
	440 V	A	0.42	1.6	0.9	0.6	0.8	1.3	0.6	0.8	1.3
	600 V	A	0.42	0.5	0.7	0.6	0.7	1	0.6	0.7	1
Utilization categories DC-3 and DC-5, shunt and series motors (L/R ≤ 15 ms)											
Rated operational current I_e (at 60 °C)											
Number of conducting paths in series connection			1	2	3	1	2	3	1	2	3
	Up to 24 V	A	15	15	15	20	20	20	20	20	20
	60 V	A	0.35	3.5	15	0.5	5	20	0.5	5	20
	110 V	A	0.1	0.25	15	0.15	0.35	20	0.15	0.35	20
	220 V	A	–	–	1.2	–	–	1.5	–	–	1.5
	440 V	A	–	–	0.14	–	–	0.2	–	–	0.2
	600 V	A	–	–	0.14	–	–	0.2	–	–	0.2

Switching frequency

Switching frequency *z* in operating cycles/hour			AC/DC operation
Contactors without overload relay	No-load operation frequency	1/h	10,000
Dependency of switching frequency z' on operating current I' and operating voltage U':	Rated operation		
	In acc. with AC-1	1/h	1,000
$z' = z \cdot \frac{I_e}{I'} \cdot \left(\frac{400\ V}{U'}\right)^{1.5}$ 1/h	In acc. with AC-2	1/h	750
	In acc. with AC-3	1/h	750
	In acc. with AC-4	1/h	250
Contactors with overload relay (average value)		1/h	15

3RT10 2. contactors for switching motors

Contactor	Frame size Type			**S0** **3RT10 2.**
Rated insulation voltage U_i (pollution degree 3)			V	690
Protective separation between the coil and main contacts (in acc. with DIN VDE 0106 Part 101 and A1 [Draft 2/89])			V	400
Permissible ambient temperature		For operation During storage	°C °C	–25 to +60 –55 to +80
Degree of protection in acc. with IEC 60 947-1 and DIN 40 050				IP 20, actuating system IP 20
Shock resistance	Rectangular impulse	AC operation	*g*/ms	8.2/5 and 4.9/10
		DC operation	*g*/ms	10/5 and 7.5/10
	Sine pulse	AC operation	*g*/ms	12.5/5 and 7.8/10
		DC operation	*g*/ms	15/5 and 10/10

Short-circuit protection for contactors without overload relay

Short-circuit protection for contactors with overload relay, see Chapter 4.
Short-circuit protection for unwelded contactors, see Chapter 5 (overload and short-circuit protection only with the 3RV10 circuit breaker).
Short-circuit protection for fuseless load feeders, see Chapter 5.

Contactor	Frame size Type			**S0** **3RT10 23, 3RT10 24**	**S0** **3RT10 25**	**S0** **3RT10 26**
Main circuit						
Fuse-links, performance class gL/gG						
NH type 3NA, DIAZED type 5SB, NEOZED type 5SE						
With fuse-links						
– In acc. with IEC 60 947-4/DIN EN 60 947-4 (VDE 0660 Part 102)		Coord. type "1" 1)	A	63	63	100
		Coord. type "2" 1)	A	25	25	35
		Unwelded2)	A	10	10	16
Or miniature circuit breaker with C characteristic			A	25	25	32
(Short-circuit current 3 kA, coordination type 1) 1)						
Auxiliary circuit						
Fuse-links, performance class gL/gG			A	10	10	10
DIAZED type 5SB, NEOZED type 5SE						
(unwelded fuse at $I_k \geq 1$ kA)						
Or miniature circuit breaker with C characteristic (short-circuit current I_k < 400 A)			A	10	10	10

1) Corresponds to section from IEC 60 947-4 (VDE 0660 Part 102):
Coordination type "1":
The destruction of the contactor and the overload relay is permissible. The contactor and/or overload relay must be replaced, if necessary.

Coordination type "2":
The overload relay must not be damaged. Contact welding on the contactor is permissible, if it can be easily separated again from the contactor.

2)Test conditions in acc. with IEC 60 947-4-1.
Unwelded 3RT11 contactors, see Chapter 5 (overload and short-circuit protection only with the 3RV10 circuit breaker).

Contactor	Frame size Type		**S0** **3RT10 2.**			
Drive						
Operating range of the magnet coils	AC/DC		0.8 to 1.1 x U_s			
Power input of the magnet coils (cold coil and at 1.0 x U_s)			**Standard version**		**For USA and Canada**	
AC operation		Hz	50	50/60	50	60
	Making capacity	VA	61	64 /63	61	69
	cos φ		0.82	0.72/ 0.74	0.82	0.76
	Holding power	VA	7.8	8.4 / 6.8	7.8	7.5
	cos φ		0.24	0.24/ 0.28	0.24	0.28
DC operation	making capacity = holding power	W	5.4			

3RT102. contactors for switching motors

Contactor	Frame size Type			S0 3RT10 23, 3RT10 24	S0 3RT10 25	S0 3RT10 26
Main circuit						
Current carrying capacity with alternating current						
Utilization category AC-1, switching resistive loads						
Rated operational currents I_e		At 40 °C up to 690 V	A	40	40	40
		At 60 °C up to 690 V	A	35	35	35
Rated power		At 230 V	kW	13.3	13.3	13.3
of three-phase loads2)		400 V	kW	23	23	23
		500 V	kW	29	29	29
cos φ = 0.95 (at 60 °C)		690 V	kW	40	40	40
Minimum conductor cross-section loaded with I_e		At 40 °C	mm^2	10	10	10
		60 °C	mm^2	10	10	10

2) Resistance-heated industrial furnaces and electric heating appliances, etc. (increased current consumption at startup of heating taken into account).

Contactor	Frame size Type			S0 3RT10 23	S0 3RT10 24	S0 3RT10 25	S0 3RT10 26
Main circuit							
Current carrying capacity with alternating current							
Utilization categories AC-2 and AC-3							
Rated operational currents I_e		Up to 400 V	A	9	12	17	25
		500 V	A	6.5	12	17	18
		690 V	A	5.2	9	13	13
Rated power of motors with slipring or squirrel-cage rotor at 50 Hz and 60 Hz		At 110 V	kW	1.1	1.5	2.2	3
		120 V	kW	1.1	1.5	2.2	3
		127 V	kW	1.1	1.5	2.2	3
		200 V	kW	2.2	3	4	5.5
		220 V	kW	3	3	4	5.5
		230 V	kW	3	3	4	5.5
		240 V	kW	3	3	4	5.5
		380 V	kW	4	5.5	7.5	11
		400 V	kW	4	5.5	7.5	11
		415 V	kW	4	5.5	7.5	11
		440 V	kW	4	5.5	9	11
		460 V	kW	4	5.5	9	11
		500 V	kW	4.5	7.5	10	11
		575 V	kW	4.5	7.5	10	11
		660 V	kW	5.5	7.5	11	11
		690 V	kW	5.5	7.5	11	11
Thermal stress		10-s current1)	A	80	110	150	200
Power loss per conducting path		At I_e/AC-3	W	0.4	0.5	0.9	1.6
Utilization category AC-4 (contact service life of approximately 200,000 operating cycles at $I_a = 6 \times I_e$)							
Rated operational currents I_e		Up to 400 V	A	4.1	5.5	7.7	9
		690 V	A	3.3	5.5	7.7	9
Rated power of motors with squirrel-cage rotor at 50 Hz and 60 Hz		At 110 V	kW	0.5	0.73	1	1.2
		120 V	kW	0.5	0.8	1.1	1.3
		127 V	kW	0.5	0.85	1.15	1.4
		200 V	kW	1.1	1.3	1.8	2.2
		220 V	kW	1.1	1.4	2	2.4
		230 V	kW	1.1	1.5	2	2.5
		240 V	kW	1.1	1.6	2.1	2.6
		380 V	kW	2	2.5	3.5	4.2
		400 V	kW	2	2.6	3.5	4.4
		415 V	kW	2	2.7	3.5	4.6
		440 V	kW	2	2.9	4	4.9
		460 V	kW	2	3	4.2	5.1
		500 V	kW	2	3.3	4.6	5.6
		575 V	kW	2	3.8	5.2	6.4
		660 V	kW	2.5	4.4	6	7.4
		690 V	kW	2.5	4.6	6	7.7

1) In acc. with VDE 0660 Part 102, rated value for different startup conditions, see Chapter 4.

3RT10 2. contactors for switching motors

Current carrying capacity with direct current

Contactor	Frame size Type		S0 **3RT10 23, 3RT10 24**			S0 **3RT10 25**			S0 **3RT10 26**		
Utilization category DC-1, switching of resistive loads (L/R ≤ 1 ms)											
Rated operational current I_e (at 60 °C)											
	Number of conducting paths in series connection		1	2	3	1	2	3	1	2	3
	up to 24 V	A	35	35	35	35	35	35	35	35	35
	60 V	A	20	35	35	20	35	35	20	35	35
	110 V	A	4.5	35	35	4.5	35	35	4.5	35	35
	220 V	A	1	5	35	1	5	35	1	5	35
	440 V	A	0.4	1	2.9	0.4	1	2.9	0.4	1	2.9
	600 V	A	0.25	0.8	1.4	0.25	0.8	1.4	0.25	0.8	1.4
Utilization categories DC-3 and DC-5, shunt and series motors (L/R ≤ 15 ms)											
Rated operational current I_e (at 60 °C)											
	Number of conducting paths in series connection		1	2	3	1	2	3	1	2	3
	Up to 24 V	A	20	35	35	20	35	35	20	35	35
	60 V	A	5	35	35	5	35	35	5	35	35
	110 V	A	2.5	15	35	2.5	15	35	2.5	15	35
	220 V	A	1	3	10	1	3	10	1	3	10
	440 V	A	0.09	0.27	0.6	0.09	0.27	0.6	0.09	0.27	0.6
	600 V	A	0.06	0.16	0.6	0.06	0.16	0.6	0.06	0.16	0.6

Switching frequency

			3RT10 23, 3RT10 24		3RT10 25		3RT10 26	
Switching frequency *z* in operating cycles/hour			AC	DC	AC	DC	AC	DC
Contactors without overload relay	No-load operation frequency	1/h	5000	1500	5000	1500	5000	1500
Dependency of switching frequency *z'* on operating current and operating voltage *U'*:			AC/DC		AC/DC		AC/DC	
	With AC-1	1/h	1000		1000		1000	
$z' = z \cdot \frac{I_e}{I'} \cdot \left(\frac{400\ V}{U'}\right)^{1.5}$ 1/h	With AC-2	1/h	1000		1000		750	
	With AC-3	1/h	1000		1000		750	
	With AC-4	1/h	300		300		250	
Contactors with overload relay (average value)		1/h	15		15		15	

3RT10 3. contactors for switching motors

Contactor	Frame size Type			S2 **3RT10 3.**
Mechanical life	Basic units Basic unit with attached auxiliary switch block Electronically optimized auxiliary switch block		Operating cycles	10 mill. 10 mill. 5 mill.
Rated insulation voltage U_i (pollution degree 3)			V	690
Protective separation between the coil and main contacts (in acc. with DIN VDE 0106 Part 101 and A1 [Draft 2/89])			V	400
Permissible ambient temperature		For operation During storage	°C °C	–25 to +60 –55 to +80
Degree of protection in acc. with IEC 60 947-1 and DIN 40 050				IP 20 (terminal housing IP 00), actuating system IP 40
Shock resistance	Rectangular impulse	AC and DC operation	*g*/ms	10/5 and 5/10
	Sine pulse	AC and DC operation	*g*/ms	15/5 and 8/10

Contactor	Frame size Type		S2 **3RT10 34**	S2 **3RT10 35**	S2 **3RT10 36**
Short-circuit protection for contactors without overload relay			Short-circuit protection for contactors with overload relay, see Chapter 4. Short-circuit protection for unwelded contactors, see Chapter 5 (overload and short-circuit protection only with circuit breaker 3RV10). Short-circuit protection for fuseless load feeders, see Chapter 5.		
Main circuit					
Fuse-links, performance class gL/gG					
NH type 3NA, DIAZED type 5SB, NEOZED type 5SE					
– In acc. with IEC 60 947-4/DIN EN 60 947-4 (VDE 0660 Part 102)	Coordin. type "1" [1])	A	125	125	160
	Coordin. type "2" [1])	A	63	63	80
	Unwelded [2])	A	16	16	50

3RT10 3. contactors for switching motors

Contactor	Frame size Type		S2 **3RT10 34**	S2 **3RT10 35**	S2 **3RT10 36**
Auxiliary circuit					
Fuse applications, performance class gL/gG		A	10	10	10
DIAZED type 5SB, NEOZED type 5SE					
(unwelded fuse at $I_k \geq 1$ kA)					
Or miniature circuit breaker with C characteristic (short-circuit current $I_k < 400$ A)		A	10	10	10

1) Corresponds to section from IEC 60 947-4 (VDE 0660 Part 102):
Coordination type "1":
The destruction of the contactor and the overload relay is permissible. The contactor and/or overload relay must be replaced, if necessary.

Coordination type "2":
The overload relay must not be damaged. Contact welding on the contactor is permissible, if it can be easily separated again from the contactor.

2) Test conditions in acc. with IEC 60 947-4-1.
Unwelded 3RT11 contactors, see Chapter 5 (overload and short-circuit protection only with the 3RV10 circuit breaker).

Contactor	Frame size Type			S2 **3RT10 34**		S2 **3RT10 35**		S2 **3RT10 36**	
Drive									
Operating range of the magnet coils		AC/DC		0.8 to 1.1 x U_s					
Power input of the magnet coils (cold coil and at 1.0 x U_s)				**Standard version**					
AC operation			Hz	50	50/60	50	50/60		
	Making capacity cos φ		VA	104 0.78	127 /113 0.73/ 0.69	145 0.79	170 /155 0.76/ 0.72		
	Holding power cos φ		VA	9.7 0.42	11.3 / 9.5 0.41/ 0.42	12.5 0.36	15 / 11.8 0.35/ 0.38		
				For USA and Canada					
			Hz	50	60	50	60	50	60
	Making capacity cos φ		VA	90 0.76	118 0.8	160 0.82	127 0.85	160 0.82	127 0.85
	Holding power cos φ		VA	11 0.38	12 0.41	13.5 0.34	14.2 0.37	13.5 0.34	14.2 0.37
DC operation	making capacity = holding power		W	13.3		13.3		13.3	
Main circuit									
Current carrying capacity with alternating current									
Utilization category AC-1, switching of resistive loads									
Rated operational currents I_e		At 40 °C up to 690 V At 60 °C up to 690 V	A A	50 45		60 55		55 50	
Rated power of three-phase loads2) cos φ = 0.95 (at 60 °C)		At 230 V 400 V 500 V 690 V	kW kW kW kW	18 31 39 54		22 38 46 66		20 35 43 60	
Minimum conductor cross-section loaded with I_e		At 40 °C 60 °C	mm^2 mm^2	16 10		16 16		16 10	

2) Resistance-heated industrial furnaces and electric heating appliances, etc. (increased current consumption at startup of heating taken into account).

3RT103. contactors for switching motors

Contactor	Frame size Type			S2 3RT10 34	S2 3RT10 35	S2 3RT10 36
Main circuit						
Current carrying capacity with alternating current						
Utilization categories AC-2 and AC-3						
Rated operational currents I_e		Up to 400 V	A	32	40	50
		500 V	A	32	40	50
		690 V	A	20	24	24
Rated power of motors with slipring or squirrel-cage rotor at 50 Hz and 60 Hz		at 127 V	kW	4	5.5	7.5
		200 V	kW	7.5	7.5	11
		220 V	kW	7.5	11	11
		230 V	kW	7.5	11	15
		240 V	kW	7.5	11	15
		380 V	kW	15	18.5	22
		400 V	kW	15	18.5	22
		415 V	kW	15	18.5	22
		440 V	kW	18.5	18.5	22
		460 V	kW	18.5	22	30
		500 V	kW	18.5	22	30
		575 V	kW	18.5	22	22
		660 V	kW	18.5	22	22
		690 V	kW	18.5	22	22
Thermal stress		10-s current[1])	A	320	400	400
Power loss per conducting path		With I_e/AC-3	W	1.8	2.6	5
Utilization category AC-4 (contact service life of approximately 200,000 operating cycles at $I_a = 6 \times I_e$)						
Rated operational currents I_e		Up to 400 V	A	15.6	18.5	24
		690 V	A	15.6	18.5	24
Rated power of motors with squirrel cage rotor at 50 Hz and 60 Hz		At 127 V	kW	2.6	3	3
		200 V	kW	4.1	4.7	4.7
		220 V	kW	4.5	5.2	5.2
		230 V	kW	4.7	5.4	7.3
		240 V	kW	4.9	5.7	5.7
		380 V	kW	7.8	9	9
		400 V	kW	8.2	9.5	12.6
		415 V	kW	8.2	9.5	12.6
		440 V	kW	8.2	9.5	12.6
		460 V	kW	8.2	9.5	12.6
		500 V	kW	9.8	11.8	15.8
		575 V	kW	8.3	11.8	15.8
		660 V	kW	9.6	13.5	18
		690 V	kW	13	15.5	21.8

1) In acc. with VDE 0660 Part 102. Rated values for different startup conditions, see Part 4.

Current carrying capacity with direct current

Contactor	Frame size Type			S2 **3RT10 34**			S2 **3RT10 35**			S2 **3RT10 36**		
Utilization category DC-1, switching of resistive loads (L/R ≤ 1 ms)												
Rated operational current I_e (at 60 °C)												
	Number of conducting paths in series connection			1	2	3	1	2	3	1	2	3
		Up to 24 V	A	45	45	45	55	55	55	50	50	50
		60 V	A	20	45	45	23	45	45	23	45	45
		110 V	A	4.5	45	45	4.5	45	45	4.5	45	45
		220 V	A	1	5	45	1	5	45	1	5	45
		440 V	A	0.4	1	2.9	0.4	1	2.9	0.4	1	2.9
		600 V	A	0.25	0.8	1.4	0.25	0.8	1.4	0.25	0.8	1.4
Utilization categories DC-3 and DC-5, shunt and series motors (L/R ≤ 15 ms)												
Rated operational current I_e (at 60 °C)												
	Number of conducting paths in series connection			1	2	3	1	2	3	1	2	3
		Up to 24 V	A	35	45	45	35	55	55	35	50	50
		60 V	A	6	45	45	6	45	55	6	45	50
		110 V	A	2.5	25	45	2.5	25	55	2.5	25	50
		220 V	A	1	5	25	1	5	25	1	5	25
		440 V	A	0.1	0.27	0.6	0.1	0.27	0.6	0.1	0.27	0.6
		600 V	A	0.06	0.16	0.35	0.06	0.16	0.35	0.06	0.16	0.35

Switching frequency

			3RT10 34		3RT10 35		3RT10 36	
Switching frequency *z* in operating cycles/hour			AC	DC	AC	DC	AC	DC
Contactors without overload relay	No-load operation frequency	1/h	5000	1500	5000	1500	5000	1500
Dependency of switching frequency z'			AC/DC		AC/DC		AC/DC	
on operating current I' and operating voltage U':	With AC-1	1/h	1200		1200		1000	
	With AC-2	1/h	750		600		400	
$z' = z \cdot \frac{I_e}{I'} \cdot \left(\frac{400\ V}{U'}\right)^{1.5}$ 1/h	With AC-3	1/h	1000		1000		800	
	With AC-4	1/h	250		300		300	
Contactors with overload relay (average value)		1/h	15		15		15	

3RT10 4. contactors for switching motors

Contactor	Frame size Type			S3 **3RT10 4.**
Mechanical life	Basic units Basic unit with attached auxiliary switch block Electronically optimized auxiliary switch block		Opera-ting cycles	10 mill. 10 mill. 5 mill.
Rated insulation voltage U_i (pollution degree 3)			V	1000
Protective separation between the coil and main contacts (in acc. with DIN VDE 0106 Part 101 and A1 [Draft 2/89])			V	690
Permissible ambient temperature		For operation During storage	°C °C	–25 to +60 –55 to +80
Degree of protection in acc. with IEC 60 947-1 and DIN 40 050				IP 20 (terminal housing IP 00), actuating system IP 40
Shock resistance	Rectangular impulse	AC and DC operation	g/ms	6.8/5 and 4/10
	Sine pulse	AC and DC operation	g/ms	10.6/5 and 6.2/10

Short-circuit protection for contactors without overload relay

Short-circuit protection for contactors with overload relay, see Part 4.
Short-circuit protection for fuseless load feeders, see Chapter 5.

Contactor	Frame size Type		S3 **3RT10 44**	S3 **3RT10 45**	S3 **3RT10 46**
Main circuit					
Fuse applications, performance class gL/gG					
NH type 3NA, DIAZED type 5SB, NEOZED type 5SE					
– In acc. with IEC 60 947-4/DIN EN 60 947-4 (VDE 0660 Part 102)	Coordin. type "1" 1)	A	250	250	250
	Coordin. type "2" 1)	A	125	160	160
	Unwelded 2)	A	63	100	100
Auxiliary circuit					
Fuse applications, performance class gL/gG		A	10	10	10
(unwelded fuse at $I_k \geq 1$ kA)					
DIAZED type 5SB, NEOZED type 5SE					
Or miniature circuit breaker with C characteristic (short-circuit current I_k < 400 A)		A	10	10	10

1) Corresponds to section from IEC 60 947-4 (VDE 0660 Part 102):
Coordination type "1":
The destruction of the contactor and the overload relay is permissible. The contactor and/or overload relay must be replaced, if necessary.
Coordination type "2":
The overload relay must not be damaged. Contact welding on the contactor is permissible, if it can be easily separated again from the contactor.

2) Test conditions in acc. with IEC 60 947-4-1

Contactor	Frame size Type			S3 **3RT10 44**		S3 **3RT10 45**		S3 **3RT10 46**	
Drive									
Operating range of the magnet coils		AC/DC		0.8 to 1.1 x U_s					
Power input of the magnet coils (cold coil and at 1.0 x U_s)				**Standard version**					
AC operation			Hz	50	50/60	50	50/60	50	50/60
	Making capacity cos φ		VA	218 0.61	247 /211 0.62/ 0.57	270 0.68	298 /274 0.7 / 0.62	270 0.68	298 /274 0.7 / 0.62
	Holding power cos φ		VA	21 0.26	25 / 18 0.27/ 0.3	22 0.27	27 / 20 0.29/ 0.31	22 0.27	27 / 20 0.29/ 0.31
				For USA and Canada					
			Hz	50	60	50	60	50	60
	Making capacity cos φ		VA	218 0.61	232 0.55	270 0.68	300 0.52	270 0.68	300 0.52
	Holding power cos φ		VA	21 0.26	20 0.28	22 0.27	21 0.29	22 0.27	21 0.29
DC operation	making capacity = holding power		W	15		15		15	

3RT10 4. contactors for switching motors

Contactor	Frame size Type			S3 **3RT10 44**	S3 **3RT10 45**	S3 **3RT10 46**
Main circuit						
Current carrying capacity with alternating current						
Utilization category AC-1, switching of resistive loads						
Rated operational currents I_e		At 40 °C up to 690 V	A	100	120	120
		1000 V	A	50	60	70
		At 60 °C up to 690 V	A	90	100	100
		1000 V	A	40	50	60
Rated power		At 230 V	kW	34	38	38
of three-phase loads[2])		400 V	kW	59	66	66
cos φ = 0.95 (at 60 °C)		500 V	kW	74	82	82
		690 V	kW	102	114	114
		1000 V	kW	66	82	98
Minimum conductor cross-section loaded with I_e		At 40 °C	mm^2	35	50	50
		60 °C	mm^2	35	35	35
Utilization categories AC-2 and AC-3						
Rated operational currents I_e		Up to 400 V	A	65	80	95
		500 V	A	65	80	95
		690 V	A	47	58	58
		1000 V	A	25	30	30
Rated power of motors with slipring or squirrel-cage rotor at 50 Hz and 60 Hz		at 230 V	kW	18.5	22	22
		400 V	kW	30	37	45
		500 V	kW	37	45	55
		690 V	kW	55	55	55
		1000 V	kW	30	37	37
Thermal stress		10-s current[1])	A	600	760	760
Power loss per conducting path		With I_e/AC-3	W	4.6	7.7	10.8

Contactor	Frame size Type			S3 **3RT10 44**	S3 **3RT10 45**	S3 **3RT10 46**
Main circuit						
Current carrying capacity with alternating current						
Utilization category AC-4 at $I_a = 6 \times I_e$						
Rated operational current I_e		Up to 400 V	A	55	66	80
Rated power of motors with squirrel-cage rotor at 50 Hz and 60 Hz		At 400V	kW	30	37	45
The following applies for a contact service life of approximately 200,000 operating cycles:						
Rated operational currents I_e		Up to 400 V	A	28	34	42
		690 V	A	28	34	42
		1000 V	A	20	23	23
Rated power of motors with squirrel-cage rotor at 50 Hz and 60 Hz		At 230 V	kW	8.7	10.4	12
		400 V	kW	15.1	17.9	22
		500 V	kW	18.4	22.4	27
		690 V	kW	25.4	30.9	38
		1000 V	kW	22	30	30

1) In acc. with VDE 0660 Part 102, rated values for different startup conditions, see Chapter 4.

2) Resistance-heated industrial furnaces and electric heating appliances, etc. (increased current consumption at startup of heating taken into account).

3RT10 4. contactors for switching motors

Contactor	Frame size Type		S3 **3RT10 44**			S3 **3RT10 45**			S3 **3RT10 46**		
Current carrying capacity with direct current											
Utilization category DC-1, switching of resistive loads (L/R ≤ 1 ms)											
Rated operational current I_e (at 60 °C)											
	Number of conducting paths in series connection		1	2	3	1	2	3	1	2	3
	Up to 24 V	A	90	90	90	100	100	100	100	100	100
	60 V	A	23	90	90	60	100	100	60	100	100
	110 V	A	4.5	90	90	9	100	100	9	100	100
	220 V	A	1	5	70	2	10	80	2	10	80
	440 V	A	0.4	1	2.9	0.6	1.8	1.8	0.6	1.8	4.5
	600 V	A	0.26	0.8	1.4	0.4	1	1	0.4	1	2.6
Utilization categories DC-3 and DC-5, shunt and series motors (L/R ≤ 15 ms)											
Rated operational current I_e (at 60 °C)											
	Number of conducting paths in series connection		1	2	3	1	2	3	1	2	3
	Up to 24 V	A	40	90	90	40	100	100	40	100	100
	60 V	A	6	90	90	6.5	100	100	6.5	100	100
	110 V	A	2.5	90	90	2.5	100	100	2.5	100	100
	220 V	A	1	7	35	1	7	35	1	7	35
	440 V	A	0.15	0.42	0.8	0.15	0.42	0.8	0.15	0.42	0.8
	600 V	A	0.06	0.16	0.35	0.06	0.16	0.35	0.06	0.16	0.35

Switching frequency			3RT10 44		3RT10 45		3RT10 46	
Switching frequency *z* in operating cycles/hour			AC	DC	AC	DC	AC	DC
Contactors without overload relay	No-load operation frequency	1/h	5000	1000	5000	1000	5000	1000
Dependency of switching frequency z' on operating current I' and operating voltage U':			AC/DC		AC/DC		AC/DC	
	With AC-1	1/h	1000		900		900	
$z' = z \cdot \frac{I_e}{I'} \cdot \left(\frac{400\ V}{U'}\right)^{1.5}$ 1/h	With AC-2	1/h	400		400		350	
	With AC-3	1/h	1000		1000		850	
	With AC-4	1/h	300		300		250	
Contactors with overload relay (average value)		1/h	15		15		15	

3RT14 contactors, 3-pole

Contactor	Frame size Type		S3 **3RT14 46**			
Mechanical life		Operating cycles	10 mill.			
Service life Utilization category AC-1 at I_e		Operating cycles	0.5 mill.			
Rated insulation voltage U_i (pollution degree 3)		V	1000			
Rated impulse strength U_{imp}		kV	6			
Protective separation between the coil and main contacts (in acc. with DIN VDE 0106 Part 101 and A1 [Draft 2/89])		V	690			
Permissible ambient temperature	For operation During storage	°C °C	–25 to +60 –55 to +80			
Degree of protection in acc. with IEC 60 947-1 and DIN 40 050			IP 20 (terminal housing IP 00), actuating system IP 40			
Operating range of the magnet coils	AC/DC		0.8 to 1.1 x U_s			
Power input of the magnet coils (cold coil and at 1.0 x U_s)			**Standard version**		**For USA and Canada**	
AC operation		Hz	50	50/60	50	60
	Making capacity cos φ	VA	270 0.68	298 /274 0.7 / 0.62	270 0.68	300 0.52
	Holding power cos φ	VA	22 0.27	27 / 20 0.29/ 0.31	22 0.27	21 0.29
DC operation	making capacity = holding power	W	15			

Shock resistance

Rectangular impulse	With AC and DC operation	*g*/ms	6.8/5 and 4/10
Sine pulse	With AC and DC operation	*g*/ms	10.6/5 and 6.2/10

3RT14 contactors, 3-pole

Contactor	Frame size Type			**S3** **3RT14 46**	
Short-circuit protection for contactors without overload relay					
Main circuit					
Fuse applications, performance class gL/gG	NH	Type 3NA			
	Coordination type "1" 2)		A	250	
Fuse-links, performance class gR	SITOR	Type 3NE			
	Coordination type "2" 2)		A	250	
Control circuit					
Fuse-links, performance class gL/gG	DIAZED	Type 5SB	A	10	
(unwelded fuse at $I_k \geq 1$ kA)	NEOZED	Type 5SE	A	10	
Miniature circuit breaker with C characteristic (I_k < 400 A)			A	10	
Switching frequency					
Switching frequency *z* in operating cycles/hour				AC operation	DC operation
Contactors without overload relay	No-load operation frequency		1/h	5000	1000
Rated operation	In acc. with AC-1		1/h	650	650
	In acc. with AC-3		1/h	1000	1000

Dependency of switching frequency *z'*

on operating current *I'* and operating voltage *U'*:

$$z' = z \cdot \frac{I_e}{I'} \cdot \left(\frac{400\,V}{U'}\right)^{1.5} \text{ 1/h}$$

2) Corresponds to section from IEC 60 947-4 (VDE 0660 Part 102):
Coordination type "1":
The destruction of the contactor and the overload relay is permissible. The contactor and/or overload relay must be replaced, if necessary.

Coordination type "2":
The overload relay must not be damaged. Contact welding on the contactor is permissible, if it can be easily separated again from the contactor.

Contactor	Frame size Type			**S3** **3RT14 46**		
Current carrying capacity with alternating current						
Utilization category AC-1, switching of resistive loads						
Rated operational currents I_e		At 40 °C up to 690 V	A	140		
		At 60 °C up to 690 V	A	130		
		At 1000 V	A	60		
Rated power of three-phase loads cos φ = 0.95 (at 60 °C)		At 230 V	kW	50		
		400 V	kW	86		
		500 V	kW	107		
		690 V	kW	148		
		1000 V	kW	98		
Minimum conductor cross-section loaded with I_e		At 40 °C	mm^2	50		
		At 60 °C	mm^2	50		
Utilization categories AC-2 and AC-3 with an electrical service life of 1.3 mill. operating cycles						
Rated operational current I_e		Up to 690 V	A	44		
Rated power of motors with slipring or squirrel-cage rotor at 50 Hz and 60 Hz (at 60 °C)		At 230 V	kW	12.7		
		400 V	kW	22		
		500 V	kW	29.9		
		690 V	kW	38.2		
Current carrying capacity with direct current						
Utilization category DC-1, switching of resistive loads L/R ≤ 1 ms)						
	Number of conducting paths in series connection			1	2	3
Rated operational currents I_e (at 60 °C)		Up to 24 V	A	130	130	130
		60 V	A	80	130	130
		110 V	A	12	130	130
		220 V	A	2.5	13	130
		440 V	A	0.8	2.4	6
		600 V	A	0.48	1.3	3.4

3RT14 contactors, 3-pole

Contactor	Frame size Type			S3 3RT14 46		
Utilization categories DC-3 and DC-5, shunt and series motors						
	Number of conducting paths in series connection			1	2	3
Rated operational currents I_e (at 60 °C)		Up to 24 V	A	6	130	130
		60 V	A	3	130	130
		110 V	A	1.25	130	130
		220 V	A	0.35	1.75	4
		440 V	A	0.15	0.42	0.8
		600 V	A	0.1	0.27	0.45
Power loss per conducting path		At I_e/AC-1	W	12.5		

3RT13 contactors, 4-pole (4 NO contacts), for switching resistive loads

Technical specifications							
Contactor	Frame size Type		**S00** **3RT13 16/17**	**S0** **3RT13 25/26**	**S2** **3RT13 36**	**S3** **3RT13 44**	**S3** **3RT13 46**
General specifications							
Mechanical life		Opera-ting cycles	30 mill.	10 mill.			
Electrical service life with Ie/AC-1		Opera-ting cycles	Approx. 0.5 mill.				
Rated insulation voltage Ui (pollution degree 3)		V	690				
Permissible ambient temperature	For operation	°C	–25 to +60				
	During storage	°C	–55 to +80				
Degree of protection in acc. with IEC 60 947-1 and DIN 40 050			IP20		IP 20		
	Terminal housing				IP 00		
Short-circuit protection for contactors without overload relay							
Main circuit							
Fuse-links, performance class gL/gG NH type 3NA, DIAZED type 5SB, NEOZED type 5SE – In acc. with IEC 60 947-4/ DIN EN 60 947-4 (VDE 0660 Part 102)	Coord. type "1" 1)	A	35	63	160	250	250
	Coord. type "2" 1)	A	20	25/35	63	125	160
	Unwelded 2)	A	10	16	50	63	100
Drive							
Operating range of the magnet coils	AC	At 50 Hz:	0.8 - 1.1 x U_s	AC/DC: 0.8 - 1.1 x U_s			
		At 60 Hz:	0.85 - 1.1 x U_s				
	DC	At +50 °C:	0.8 - 1.1 x U_s				
		At +60 °C:	0.85 - 1.1 x U_s				

Power input of the magnet coils (cold coil and at 1.0 x U_s)										
AC operation		Hz	50/60	50	50/60	50	50/60	50	50/60	
	Making capacity	VA	26.5/24.3	61	64/ 63	145	170/ 155	270	298/ 274	
	cos φ		0.79/0.75	0.82	0.82 0.74	0.79	0.76/ 0.72	0.68	0.72/ 0.62	
	Holding power	VA	4.4/3.4	7.8	8.4/ 6.8	12.5	15/ 11.8	22	27/ 20	
	cos φ		0.27/0.27	0.24	0.24/ 0.28	0.36	0.35/ 0.38	0.27	0.29/ 0.31	
DC operation	Making capacity = holding power	W	3.3	5.6		13.3		15		

1) Corresponds to section from IEC 60 947-4 (VDE 0660 Part 102):
Coordination type "1":
The destruction of the contactor and the overload relay is permissible. The contactor and/or overload relay must be replaced, if necessary.
Coordination type "2":
The overload relay must not be damaged. Contact welding on the contactor is permissible, if it can be easily separated again from the contactor.
2) Test conditions in acc. with IEC 90 947-4-1.

3RT13 contactors, 4-pole (4 NO contacts), for switching resistive loads

Contactor	Frame size Type			S00 **3RT13 16**	S00 **3RT13 17**	S0 **3RT13 25**	S0 **3RT13 26**	S2 **3RT13 36**	S3 **3RT13 44**	S3 **3RT13 46**
Main circuit										
Current carrying capacity with alternating current										
Utilization category AC-1, switching of resistive loads										
Rated operational currents I_e	(at 40 °C)	Up to 690 V	A	18	22	35	40	60	110	140
	(at 60 °C)	Up to 690 V	A	16	20	30	35	55	100	120
Rated power of three-phase loads cos φ = 0.95 (at 40 °C)		At 230 V	kW	7	8.5	12.5	15	23	42	53
		400 V	kW	12	14.5	22	26	39	72	92
Minimum conductor cross-section loaded with I_e		At 40 °C and 60 °C	mm^2	2.5	2.5	10	10	16	50	50
Utilization categories AC-2 and AC-3										
Rated operational currents I_e	(at 60 °C)	At 400 V	A	9	12	17	25	26		
Rated power of slipring or squirrel-cage motors at 50 Hz and 60 Hz		At 230 V	kW	3	3	4	5.5	5.5		
		400 V	kW	4	5.5	7.5	11	11		

Contactor	Frame size Type		S00 **3RT13 16**				S00 **3RT13 17**				S0 **3RT13 25/26**			
Current carrying capacity with direct current														
Utilization category DC-1, switching of resistive loads (L/R ≤ 1 ms)														
Rated operational currents I_e (at 40 °C)														
Number of conducting paths in series connection			1	2	3	4	1	2	3	4	1	2	3	4
	up to 24 V	A	18	18	18	18	22	22	22	22	35	35	35	35
	60 V	A	18	18	18	18	22	22	22	22	20	35	35	35
	110 V	A	2.1	12	18	18	2.1	12	22	22	4.5	35	35	35
	220 V	A	0.8	1.6	18	18	0.8	1.6	22	22	1	5	35	35
	440 V	A	0.6	0.8	1.3	1.3	0.6	0.8	1.3	1.3	0.4	1	2.9	2.9
Utilization categories DC-3 and DC-5 shunt and series motors (L/R ≤ 15 ms)														
Rated operational currents I_e (at 40 °C)														
Number of conducting paths in series connection			1	2	3	4	1	2	3	4	1	2	3	4
	Up to 24 V	A	18	18	18	18	20	20	20	20	20	35	35	35
	60 V	A	0.5	5	18	18	0.5	5	20	20	5	35	35	35
	110 V	A	0.15	0.35	18	18	0.15	0.35	20	20	2.5	15	35	35
	220 V	A	—	—	1.5	1.5	—	—	1.5	1.5	1	3	10	35
	440 V	A	—	—	0.2	0.2	—	—	0.2	0.2	0.09	0.27	0.6	0.6

Contactor	Frame size Type		S2 **3RT13 36**				S3 **3RT13 44**				S3 **3RT13 46**			
Current carrying capacity with direct current														
Utilization category DC-1, switching of resistive loads (L/R ≤ 1 ms)														
Rated operational currents I_e (at 40 °C)														
Number of conducting paths in series connection			1	2	3	4	1	2	3	4	1	2	3	4
	Up to 24 V	A	50	50	50	50	70	70	70	70	80	80	80	80
	60 V	A	23	45	45	45	23	70	70	70	60	80	80	80
	110 V	A	4.5	45	45	45	4.5	70	70	70	9	80	80	80
	220 V	A	1	5	45	45	1	5	70	70	2	10	80	80
	440 V	A	0.4	1	2.9	2.9	0.4	1	2.9	2.9	0.6	1.8	4.5	4.5
Utilization categories DC-3 and DC-5 shunt and series motors (L/R ≤ 15 ms)														
Rated operational currents I_e (at 40 °C)														
Number of conducting paths in series connection			1	2	3	4	1	2	3	4	1	2	3	4
	Up to 24 V	A	20	45	45	45	20	70	70	70	20	80	80	80
	60 V	A	6	45	45	45	6	70	70	70	6.5	80	80	80
	110 V	A	2.5	25	45	45	2.5	70	70	70	2.5	80	80	80
	220 V	A	1	5	25	45	1	7	35	70	1	7	35	80
	440 V	A	0.1	0.27	0.6	0.6	0.15	0.42	0.8	0.8	0.15	0.42	0.8	0.8

3RT15 contactors, 4-pole (2 NO contacts + 2 NC main contacts)

Contactor	Frame size Type			**S00** **3RT15 16/17**	**S0** **3RT15 26**		**S2** **3RT15 35**	
General specifications								
Mechanical life			Operating cycles	30 mill.	10 mill.		10 mill.	
Electrical service life with I_e/AC-1			Operating cycles	Approx. 0.5 mill.				
Rated insulation voltage U_i (pollution degree 3)			V	690				
Permissible ambient temperature		For operation	°C	–25 to +60				
		During storage	°C	–55 to +80				
Degree of protection in acc. with IEC 60 947-1 and DIN 40 050				IP20			IP 20 (terminal housing IP 00)	
Short-circuit protection for contactors without overload relay								
Main circuit								
Fuse-links, performance class gL/gG NH type 3NA, DIAZED type 5SB, NEOZED type 5SE – In acc. with IEC 60 947-4/ DIN EN 60 947-4 (VDE 0660 Part 102)								
		Coordination type "1" [1])	A	35	63		160	
		Coordination type "2" [1])	A	20	35		80	
		Unwelded [2])	A	10	16		50	
Drive								
Operating range of the magnet coils	AC	at 50 Hz:		0.8 to 1.1 x U_s	AC/DC: 0.8 to 1.1 x U_s			
		at 60 Hz:		0.85 to 1.1 x U_s				
	DC	at +50 °C		0.8 to 1.1 x U_s				
		at +60 °C		0.85 to 1.1 x U_s				
Power input of the magnet coils (cold coil and at 1.1 x U_s)								
AC operation			Hz	50/60	50	50/60	50	50/60
	Making capacity		VA	26.5/24.3	61	64/63	145	170/155
	cos φ			0.79/0.75	0.82	0.82/0.74	0.79	0.76/0.72
	Holding power		VA	4.4/3.4	7.8	8.4/6.8	12.5	15/11.8
	cos φ			0.27/0.27	0.24	0.24/0.28	0.36	0.35/0.38
DC operation	Making capacity = holding power		W	3.3	5.6		13.3	

1) Corresponds to section from IEC 60 947-4 (VDE 0660 Part 102):
Coordination type "1":
The destruction of the contactor and the overload relay is permissible. The contactor and/or overload relay must be replaced, if necessary.

Assignment "2":
The overload relay must not be damaged. Contactwelding on the contactor is permissible, if it can be easily separated again from the contactor.

2) Test conditions in acc. with IEC 60 947-4-1

3RT15 contactors, 4-pole (2 NO contacts + 2 NC main contacts)

Contactor			S00		S00		S0		S2	
Frame size / Type			**3RT15 16**		**3RT15 17**		**3RT15 26**		**3RT15 35**	
Current carrying capacity with alternating current										
Utilization category AC-1, switching of resistive loads										
Rated operational currents I_e (at 40 °C)	Up to 690 V	A	18		22		40		55	
(at 60 °C)	Up to 690 V	A	16		20		35		50	
Rated power of three-phase loads cos φ = 0.95 (at 40 °C)	At 230 V	kW	6.5		7.5		15		20	
	400 V	kW	11		13		26		36	
Minimum conductor cross-section loaded with I_e	At 40 °C and 60 °C	mm^2	2.5		2.5		10		16	
Utilization categories AC-2 and AC-3										
Rated operational currents I_e (at 60 °C)	Up to 400 V	A	9		12		25 1)		40	
Rated power of motors with slipring or squirrel-cage rotor at 50 Hz and 60 Hz and	At 230 V	kW	3		3		5.5		9.5	
	400 V	kW	4		5.5		11		18.5	
Current carrying capacity with direct current										
Utilization category DC-1, switching of resistive loads (L/R ≤ 1 ms)										
Rated operational current I_e (at 60 °C)										
Number of conducting paths in series connection			1	2	1	2	1	2	1	2
	Up to 24 V	A	16	16	20	20	35	35	50	50
	60 V	A	16	16	20	20	20	35	23	45
	110 V	A	2.1	12	2.1	12	4.5	35	4.5	45
	220 V	A	0.8	1.6	0.8	1.6	1	5	1	5
	440 V	A	0.6	0.8	0.6	0.8	0.4	1	0.4	1
Utilization categories DC-3 and DC-5 2), shunt and series motors (L/R ≤ 15 ms)										
Rated operational current I_e (at 60 °C)										
Number of conducting paths in series connection			1	2	1	2	1	2	1	2
	Up to 24 V	A	16	16	20	20	20	35	35	50
	60 V	A	0.5	5	0.5	5	5	35	6	45
	110 V	A	0.15	0.35	0.15	0.35	2.5	15	2.5	25
	220 V	A	0.75	1.5	0.75	1.5	1	3	1	5
	440 V	A	---	---	---	---	0.09	0.27	0.1	0.27

1) With AC drive: 25 A
DC drive: 20 A.

2) At U_s > 24 V the rated operational currents I_e for the conducting paths of the NC contacts are 50% of the values for the conducting paths of the NO contacts.

3RT16 capacitor-switching contactors

The technical specifications for frame size S0 correspond, unless listed below, to those of the 3RT10 26 contactors, for frame size 2 to those of the 3RT10 36 contactors, and for frame size S3 to those of the 3RT10 45 contactors.

Contactor	Frame size Type		**S0** **3RT16 26**	**S2** **3RT16 36**	**S3** **3RT16 46**
Capacitor power at operating voltage	230 V 50/60 Hz 400 V 50/60 Hz 525 V 50/60 Hz 690 V 50/60 Hz	kvar kvar kvar kvar	8.5 15 20 25	14 25 32 32	29 50 65 65
Auxiliary contacts attached (freely available)			1 NO contact		
Additional auxiliary contacts that can be attached (lateral)			2 NC contacts, 2 NO contacts, or 1 NO + 1 NC		
Operating range of the magnet coil			0.85 to 1.1 x U_s		
Max. switching frequency		1/h	180	100	100
Electrical life		Operating cycles	> 100,000		
Ambient temperature		°C	60	55	55
Regulations			IEC 60 947/DIN EN 60 947 (VDE 0660)		

3RT10 contactor relays (interface)

The technical specifications correspond to those of the 3RT10 contactors used to switch motors, unless listed below.
Auxiliary switch blocks cannot be added to 3RT10 1. contactor relays.
Two, 1-pole auxiliary switch blocks can be built on to the 3RT10 2. contactor relays.

Contactor		Frame size Type		**S00** **3RT10 1.-1HB4.**	**S00** **3RT10 1.-1JB4.**	**S00** **3RT10 1.-1KB4.**	**S0** **3RT10 2.-1KB40**
Mechanical life			Operating cycles	30 mill.	30 mill.	30 mill.	10 mill.
Operating range of the magnet coils				0.7 to 1.25 x U_s q (17 V to 30 V)			
Power input of the magnet coil							
(with a cold coil)		With U_s 17 V	W	1.2	1.2	1.2	2.1
		24V	W	2.3	2.3	2.3	4.2
Making capacity = holding power		30V	W	3.6	3.6	3.6	6.6
Permissible residual current of the electronic components (at 0 signal)			mA	$< 10\text{ mA} \times \left(\frac{24\text{ V}}{U_s}\right)$	$< 10\text{ mA} \times \left(\frac{24\text{ V}}{U_s}\right)$	$< 10\text{ mA} \times \left(\frac{24\text{ V}}{U_s}\right)$	$< 6\text{ mA} \times \left(\frac{24\text{ V}}{U_s}\right)$
Suppressor circuit of the magnet coil				Without overvoltage damping	With diode	With varistor U	With varistor U
Switching times of the contactor relays							
Making	At 17 V	On delay Off delay	NO ms NC ms	40 to 120 30 to 70	40 to 120 30 to 70	40 to 120 30 to 70	93 to 270 83 to 250
	At 24 V	On delay Off delay	NO ms NC ms	30 to 60 20 to 40	30 to 60 20 to 40	30 to 60 20 to 40	64 to 87 55 to 78
	At 30 V	On delay Off delay	NO ms NC ms	20 to 50 15 to 30	20 to 50 15 to 30	20 to 50 15 to 30	53 to 64 45 to 56
Breaking	At 17 V to 30 V	On delay Off delay	NO ms NC ms	7 to 17 22 to 30	40 to 60 60 to 70	7 to 17 22 to 30	18 to 19 24 to 25
Protective separation between coil and contacts (in acc. with DIN VDE 0106 Part 101 A1 [Draft 02/89])			V	400	400	400	400

Accessories for 3RT1. contactors

Type			Solid-state time relay blocks with semiconductor output	Time-delay auxiliary switch blocks
			3RT19 .6- 2C 2D	3RT19 .6- 2E 2F 2G
Rated insulation voltage		VAC	250	250
Pollution degree 3 Overvoltage category III in acc. with DIN VDE 0110				
Energizing operating range			0.8 to 1.1 x U_s	0.85 to 1.1 x U_s
			0.95 to 1.05 times the rated frequency	0.95 to 1.05 times the rated frequency
Rated power		W	1	2
Power input at 230 VAC, 50 Hz		VA	1	4
Rated operational currents I_e				
AC-140, DC-13		A	0.3 in the case of the 3RT19 16 0.5 in the case of the 3RT19 26	– –
AC-15 at AC 230 V, 50 Hz		A	–	3
DC-13 at 24 V		A	–	1
DC-13 at 110 V		A	–	0.2
DC-13 at 230 V		A	–	0.1
DIAZED fuse				
Performance class	gL/gG	A	–	4
Switching frequency				
Loaded with I_e 230 VAC		1/h	2500	2500
Loaded with 3RT1016 contactor, 230 VAC		1/h	2500	5000
Recovery time		ms	50	150
Minimum on-time		ms	35	200 (off-delay)
Residual current		mA	≤ 5	–
Voltage drop		V	≤ 3.5	–
in switched state				
Short-term current carrying capacity		A	10 (to 10 ms)	–
Setting accuracy in relation to the value at the end of the scale			≤ ± 15%	≤ ± 15%
Repeatability			≤ ± 1%	≤ ± 1%
Mechanical life	Operating cycles		100 x 10^6	30 x 10^6
Permissible ambient temperature	For operation During storage	°C °C	–25 to +60 –40 to +85	–25 to +60 –40 to +85
Degree of protection in acc. with DIN EN 60 529			IP 40 IP 20 terminals	IP 40 IP 20 terminals
Terminal type	Single-core	mm²	2 x (0.5 to 1.5) 2 x (0.75 to 4)	2 x (0.5 to 1.5) 2 x (0.75 to 4)
	Finely stranded with wire end ferrule:	mm²	2 x (0.5 to 2.5)	2 x (0.5 to 2.5)
	Single or multi-core	AWG	2 x (18 to 14)	2 x (18 to 14)
Terminal screw			M3	M3
Tightening torque		Nm	0.8 to 1.2	0.8 to 1.2
Permissible installation			Any	Any

Accessories for 3RT1. contactors

Type			Solid-state time relay blocks with semiconductor output 3RT19 .6- 2C 2D	Time-delayed auxiliary switch blocks 3RT19 .6- 2E 2F 2G
Shock resistance half-sine in acc. with IEC 60 068-2-27		*g*/ms	15/11	15/11
Vibration resistance in acc. with IEC 60 068-2-6		Hz/mm	10 to 55/0.35	10 to 55/0.35
EMC tests	Basic specification		EN 50081-1; IEC 61 000-6-2	EN 50081-1; IEC 61 000-6-2
Overvoltage protection			Varistor integrated in the time relay	–

3RA13 contactor combinations for reversing

The technical information corresponds to that of the 3RT10 ... contactors.
The CSA and UL approvals only apply to complete contactor combinations and not to combinations you have put together from separate parts.

3RA14 contactor combinations for star-delta starting

The technical specifications correspond to those of the 3RT individual contactor and the 3RU time relay, unless listed below.

starter	Frame sizes S.. - S.. - S.. Type 3RA.. ..		00-00-00 14 15	00-00-00 14 16	0-0-0 14 23	0-0-0 14 25	2-2-0 14 34	2-2-2 14 35	2-2-2 14 36	3-3-2 14 44	3-3-2 14 45
Mechanical life		Operating cycles	3 mill.								
Short-circuit protection without overload relay			Short-circuit protection with overload relay, see Part 4								
Highest rated current of the fuse											
Main circuit[1])											
Fuse-links, performance class gL/gG NH type 3NA, DIAZED type 5SB, NEOZED type 5SE											
Single or double incoming supply											
– In acc. with IEC 60 947-4-1/ DIN VDE 0660 Part 102	Coordination type "1" [1])	A	35	35	63	100	125	125	160	250	250
	Coordination type "2" [1])	A	20	20	25	35	63	63	80	125	160
Control circuit											
Fuse-links, performance class gL/gG DIAZED type 5SB, NEOZED type 5SE		A A	10,								
(Short-circuit current $I_k \geq 1$ kA)			6[2]), if the auxiliary contact of the overload relay is in the circuit of the contactor coil.								
Circuit breaker with C characteristic		A A	10, 6[2]), if the auxiliary contact of the overload relay is in the circuit of the contactor coil.								
Size of the individual contactors	Line contactor K1	Type 3RT	10 15	10 17	10 24	10 26	10 34	10 35	10 36	10 44	10 45
	Delta contactor K3	Type 3RT	10 15	10 17	10 24	10 26	10 34	10 35	10 36	10 44	10 45
	Star contactor K2	Type 3RT	10 15	10 15	10 24	10 24	10 26	10 34	10 34	10 35	10 36
Unassigned auxiliary contacts of the individual contactors	See circuit diagram for the control circuit, page 3/93.										
Current carrying capacity for the AC-3 utilization category **Switchover time up to 10 s**											
Rated operational current	At 400 V	A	12	17	25	40	65	80	86	115	150
	500 V	A	8.7	11.3	20.8	31.2	55.4	69.3	86	112.6	138.6
	690 V	A	6.9	9	20.8	22.5	53.7	69.3	69.3	98.7	138.6
Rated power of three-phase induction motors at 50 Hz and	At 230 V	kW	3.3	4.7	7.2	12	20.4	25.5	27.8	37	49
	400 V	kW	5.8	8.2	12.5	21	35	44	48	65	85
	500 V	kW	5.3	6.9	13	20.5	38	48	60	80	98
	690 V	kW	5.8	7.5	18	20.4	51	66	67	97	136
	1000 V	kW	–	–	–	–	–	–	–	–	–
Switching frequency with overload relay		1/h	15	15	15	15	15	15	15	15	15
Current carrying capacity for utilization category AC-3 **Switchover time to 15 s**											
Rated operational current	At 400 V	A	12	17	25	31	44	57	67	97	106
	500 V	A	8.7	11.3	20.8	31	44	57	67	97	106
	690 V	A	6.9	9	20.8	22.5	44	57	67	97	106
Rated power of three-phase induction motors At 50 Hz and	At 230 V	kW	3.3	4.7	7.2	9.4	13.8	18.2	21.6	32	35
	400 V	kW	5.8	8.2	12.5	16.3	24	31.6	38	55	60
	500 V	kW	5.3	6.9	13	20.4	30	40	47	69	75
	690 V	kW	5.8	7.5	18	20.4	42	55	65	95	104
	1000 V	kW	–	–	–	–	–	–	–	–	–
Switching frequency with overload relay		1/h	15	15	15	15	15	15	15	15	15

3RA14 contactor combinations for star-delta starting

Starter	Frame sizes / Type	S.. - S.. - S.. / 3RA.. ..		00-00-00 14 15	00-00-00 14 16	0-0-0 14 23	0-0-0 14 25	2-2-0 14 34	2-2-2 14 35	2-2-2 14 36	3-3-2 14 44	3-3-2 14 45
Current carrying capacity for the AC-3 utilization category **Switchover time to 20 s**												
Rated operational current		At 400 V	A	12	17	25	28	39	51	57	85	92
		500 V	A	8.7	11.3	20.8	28	39	51	57	85	92
		690 V	A	6.9	9	20.8	22.5	39	51	57	85	92
Rated power of three-phase induction motors at 50 Hz and		At 230 V	kW	3.3	4.7	7.2	8.5	12.2	16.3	18.4	28	30
		400 V	kW	5.8	8.2	12.5	14.7	21.3	28	32	48	52
		500 V	kW	5.3	6.9	13	18.4	26.7	35	40	60	65
		690 V	kW	5.8	7.5	18	20.4	37	49	55	83	90
		1000 V	kW	–	–	–	–	–	–	–	–	–
Switching frequency with overload relay			1/h	15	15	15	15	15	15	15	15	15

1) Corresponds to IEC 60 947-4 (VDE 0660 Part 102):
Coordination type "1":
The destruction of the contactor and the overload relay is permissible. The contactor and/or overload relay must be replaced, if necessary.

Coordination type "2":
The overload relay must not be damaged. Contact welding on the contactor is permissible, if it can easily be separated again from the contactor.

2) Up to $I_k \leq 0.5$ kA; ≤ 260 V.

4

3RU11, 3RB10, and 3RB12 overload relays

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4.1 Specifications/regulations/approvals

Standards

- The 3RU11 thermal overload relays and the 3RB10 and 3RB12 electronic overload relays comply with the following standards:
  IEC 60947-1/DIN VDE 0660 Part 100
  IEC 60947-4-1/DIN VDE 0660 Part 102
  IEC 60947-5-1/DIN VDE 0660 Part 200
  IEC 60801-2, -3, -4, -5; UL 508/CSA C 22.2.
- The 3RB10 and 3RB12 electronic overload relays also comply with the EMC standards.

Tripping classes

The tripping classes describe time intervals within which the overload relays have to trip from a cold state with 7.2 times the set current in the case of a symmetrical, three-pole load. You will find the tripping classes in which the 3RU11, 3RB10, and 3RB12 overload relays are available in Section 4.2. The following table indicates the tripping classes and tripping times in acc. with the IEC 60947-4-1 standard:

Tripping class	Tripping time t_A in sec at 7.2 x I_e from a cold state
10A	$2 < T_A \leq 10$
10	$4 < T_A \leq 10$
20	$6 < T_A \leq 20$
30	$9 < T_A \leq 30$

Table 4-1: Tripping classes/tripping times

Time-delayed overload release

The following table contains the operating limits of time-delayed overload releases in the case of an all-pole load:

Overload release type	Multiple of the set current				Reference ambient temperature
	A	B	C	D	
Ambient temperature-compensated	1.05	1.2	1.5	7.2	+ 20 °C
	Not tripped < 2 h	Tripped < 2 h	Tripped < 4 min	Tripped from a cold state in 4 to 10 sec.	
			CLASS 10		
	< 2 h	< 2 h	< 8 min	6 to 20 sec	
			CLASS 20		

Table 4-2: Operating limits of time-delayed overload releases in the case of an all-pole load

Resistance to extreme climates

The 3RU11, 3RB10, and 3RB12 overload relays are climate-proof in acc. with IEC 721.

Shock protection

The 3RU11, 3RB10, and 3RB12 overload relays are shockproof in acc. with DIN VDE 0106 Part 100.
Depending on assignment to other devices, extended terminal covers are to be attached to the connecting bars.

Ships' systems

The 3RU11, 3RB10, and 3RB12 overload relays are suitable for use in ships' systems.
The overload relays have been submitted to:
- GL (Germany)
- LRS (Great Britain)
- DNV (Norway)

Explosion-proof motors

The 3RU11 thermal overload relays and the 3RB10 and 3RB12 electronic overload relays comply with the regulations for the overload protection of explosion-proof motors of "increased safety" protection types (EEx d and EEx e) in acc. with EN 50 019/DIN VDE 0165 and DIN VDE 0170/0171:
- 3RU11: KEMA test certificate no. Ex-97.Y.3235
  DMT certificate in acc. with directive 94/9/EC: DMT 98 ATEX G001
- 3RB10: PTB test rules: PTB test report no. 3 43-8803/98
- 3RB12: PTB test rules: PTB test report no. 3 53-3907/96
  EC special test certificate in acc. with directive 94/9/EC:
  PTB 01 ATEX 3220

In the case of tripping devices with DC operation, electrical isolation must be secured by means of a battery network or a safety transformer in compliance with DIN VDE 0551.

When the 3RB12..-....1 electronic overload relays (no change to the switching state of the auxiliary contact elements in the event of the failure of the control supply voltage) are used to protect EEx d and EEx e motors, separate monitoring of the control supply voltage is recommended.

4.2 Device description

Overload relays are used to protect electrical equipment such as three-phase induction motors and transformers from overheating. Overheating can be caused by overload, asymmetric current consumption, loss of a phase in the main supply conductor, or a blocked rotor.

Models

There are 3 overload relay models available:

- **3RU11 thermal overload relays**
  The 3RU11 thermal overload relays up to 100 A are designed for the current-dependent protection of loads with normal starting (tripping class 10) against impermissible overheating.
  Impermissible overheating as a result of the above-mentioned causes leads to an increase in the motor current beyond the set rated current for the motor. This increase in current heats up the bimetal strips inside the device by means of heating elements. The strips are deflected and operate the auxiliary contact elements by means of a tripping mechanism. The auxiliary contact elements switch the load off by means of a contactor.

- **3RB10 electronic overload relays**
  The 3RB10 self-supplying electronic overload relays up to 100 A are designed for the current-dependent protection of loads with normal and heavy starting (tripping classes 10 and 20) against impermissible overheating. Impermissible overheating as a result of the above-mentioned causes leads to an increase in the motor current beyond the set rated current for the motor. This increase in current is detected by the current transformers integrated in the devices and evaluated by an appropriate electronic circuit, which then sends a pulse to the auxiliary contact elements. These switch the load off by means of a contactor.

- **3RB12 electronic overload relays**
  The 3RB12 externally supplied electronic overload relays up to 820 A are designed for the current-dependent protection of loads with normal to heavy starting (tripping classes 5, 10, 15, 20, 25, and 30, which can be set on the device) against impermissible overheating. Impermissible overheating as a result of the above-mentioned causes leads to an increase in the motor current beyond the set rated current for the motor. This increase in current is detected by the current transformers integrated in the devices and evaluated by an appropriate electronic circuit, which then sends a pulse to the auxiliary contact elements. These switch the load off by means of a contactor. In addition to the current-dependent protection of the loads against impermissible overheating, the 3RB12 electronic overload relay allows the temperature of the motor winding to be monitored by connecting a PTC thermistor detector circuit in order to protect the load against overtemperature. This can be caused indirectly, for example, if the flow of the coolant is hindered and cannot be detected.

4.2.1 Overload relays in motor feeders

There are two categories of motor feeder:

Fuseless motor feeders

Fuseless motor feeders consist of combinations of circuit breakers for motor protection and contactors. These combinations are described in Chapter 5, "3RA1 fuseless load feeders".

Fused motor feeders

Fused motor feeders consist of combinations of contactors and overload relays, often referred to as starter combinations, with upstream short-circuit protection (e.g. fuses, circuit breakers for starter protection).

The advantages of fused motor feeders are as follows:

- It is easy to distinguish between tripping caused by an overload and tripping caused by a short circuit. In the event of a short circuit, the fuses limit the short-circuit current; in the event of an overload, the overload relay switches off the contactor and thus the motor.
- At voltages > 400 V, fuses have a short-circuit breaking capacity of up to 100 kA. As a result, in 690 V systems, in particular, fused motor feeders are often preferred.
- If automatic RESET is set, the overload relay resets itself automatically and does not have to be switched on again locally.
- A remote reset can be implemented very easily by means of attachable electrical and mechanical RESET modules for the 3RU11 and 3RB10 overload relays. The electrical remote RESET is already integrated in the 3RB12 multifunctional devices.
- Group fusing can be used with a circuit breaker to protect several motor feeders against short circuit simultaneously, which has a positive effect on the costs of a single feeder.
- If there are already outgoing feeders that are protected against short circuits in the cubicle, additional short-circuit protection is often unnecessary.
- Combinations of a circuit breaker for starter protection, a contactor, and an overload relay also have the advantage that the feeder can be easily isolated and that, in the event of a short circuit, it is disconnected in three poles. 3RV13 circuit breakers for started combinations are available in the SIRIUS modular system for building these combinations. These circuit breakers do not have any overload releases.

4.2.2 General device description

The 3RU11 and 3RB10 overload relays are electrically and mechanically compatible with the 3RT10 contactors and 3RW30/31 soft starters in the corresponding frame size.

Frame sizes

The 3RU11 thermal overload relays and the 3RB10 electronic overload relays are available in 4 frame sizes:

- Frame size S00: width 45 mm; up to 12 A
- Frame size S0: width 45 mm; up to 25 A
- Frame size S2: width 55 mm; up to 50 A
- Frame size S3: width 70 mm; up to 100 A

The 3RB12 electronic overload relay is available with the following dimensions:

- 3RB12 46: width 70 mm; up to 100 A
- 3RB12 53: width 120 mm; up to 205 A
- 3RB12 57: width 145 mm; up to 500 A
- 3RB12 62: width 230 mm; up to 820 A

3RU11

S00 **S0** **S2**

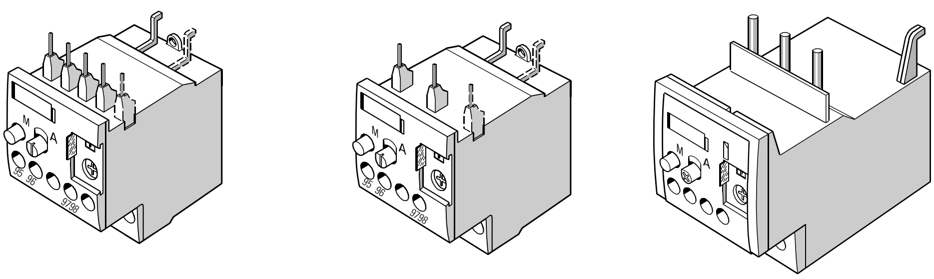


Figure 4-1: 3RU11 overload relays (frame sizes S00 to S2)

S3

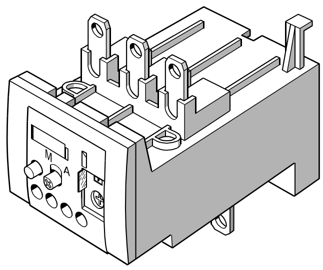


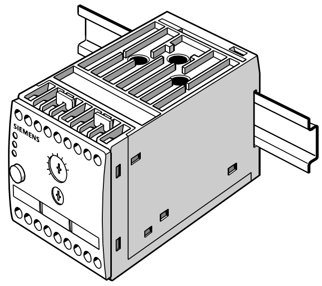
Figure 4-2: 3RU11 overload relay (frame size S3)

3RB10

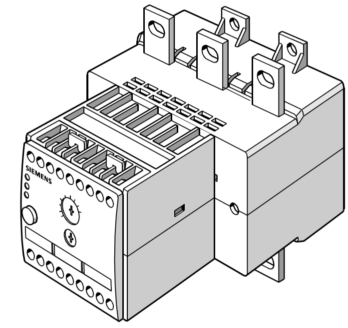
The construction of the 3RB10 is the same as that of the 3RU11.

3RB12

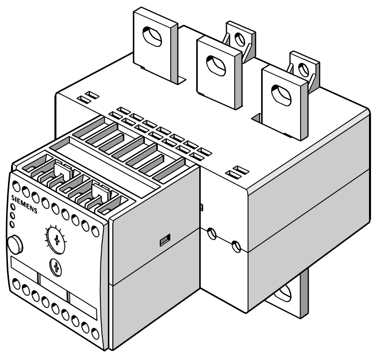
3RB12 46
Stand-alone installation
with bar-type transformer



3RB12 53



3RB12 57



3RB12 62

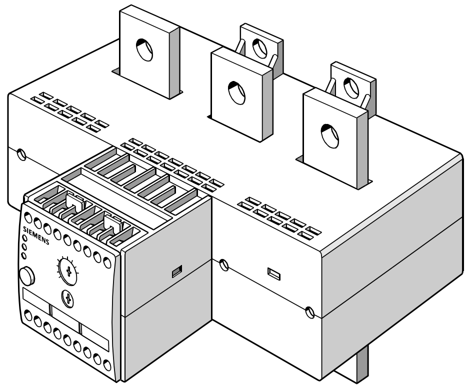


Figure 4-3: 3RB12 electronic overload relay

Overload relay: comparison

The following table compares the thermal and electronic overload relays in terms of their configuration and functionality:

	3RU11	**3RB10**	**3RB12**
Tripping classes	CLASS 10	CLASS 10 or 20	CLASS 5/10/15/20/ 25/30 Switchable
Current range	0.1 to 100 A	0.1 to 100 A	1.25 to 820 A
Permissible operating temperature	-20 to +70 °C[1)] derating	-20 to +70 °C	-25 to +70 °C
Auxiliary contact elements	1 NO + 1 NC	1 NO + 1 NC	1 NO + 1 NC overload 1 NO + 1 NC ground fault
Manual/auto RESET	Switchable	Switchable	Switchable
Electrical remote RESET	Accessories	Accessories	Integrated
Mechan. remote RESET	Accessories	Accessories	No
Stop button (only effects NC contact)	Yes	Yes	No
Test function	Yes	Yes	Yes, electronic
Protection of direct-current machines	Yes	No	No
Protection of single-phase motors	Yes	No	Only in the case of devices without internal ground fault protection
Screw-type terminal	Yes	Yes	Yes
Main conductor connection	Screw-type terminal	Screw-type terminal	Up to 100 A with Bar-type transformer
Cage Clamp terminal	Yes (S00) S0 to S3: auxiliary conducting leads only	No	No

Table 4-3: SIRIUS overload relays, configuration and functions

1)With 13 % current reduction, up to 60 °C without restrictions

Overview: Performance ranges

The following table provides an overview of the assignment of the overload relays to the contactors together with their ratings:

			3RU1116 3RB1016	**3RU1126 3RB1026**	**3RU1136 3RB1036**	**3RU1146 3RB1046**	**3RB1246**	**3RB125 3RB126**
		Max. set current	12A	25 A	50A	100 A	100 A	820 A
	Contactor	Frame size Width	S00 45 mm	S0 45 mm	S2 55 mm	S3 70 mm	70 mm	
3 kW	3RT1015	S00	X				①	
4 kW	3RT1016	S00	X				①	
5.5 kW	3RT1017	S00	X				①	
5.5 kW	3RT1024	S0		X			①	
7.5 kW	3RT1025	S0		X			①	
11 kW	3RT1026	S0		X			①	
15 kW	3RT1034	S2			X		①	
18.5 kW	3RT1035	S2			X		①	
22 kW	3RT1036	S2			X		①	
30 kW	3RT1044	S3				X	①	
37 kW	3RT1045	S3				X	①	
45 kW	3RT1046	S3				X	①	
>45 kW	3TF5/ 3TF6	6-12					①	X

Table 4-4: Assignment of the overload relays to the contactors

X = direct attachment
① = stand-alone installation (device with bar-type transformer)
Snapped onto a 35 mm rail

Fuses

The maximum permissible fuse values for overload relays are dependent on:
- The selected setting range (the smaller the setting range, the lower the fuse value).
- The maximum permissible fusing of the contactor or other devices in the circuit (e.g. soft starter or even the motor supply lead).

In the case of fuse values in acc. with coordination type 2, the contactor and overload relay can be reused after a short circuit.
The type plates on the devices provide information on the permissible fuse values. In addition, you will find detailed information in part 4 of the low-voltage switching technology (NSK) catalog.

Starter protection switch

The operating current of the instantaneous short-circuit release should be 12 times the value of the rated motor current (the current set on the overload relay). The corresponding 3RV13 starter circuit breakers can be selected from part 2 of the low-voltage switching technology (NSK) catalog.

Heavy starting

Heavy starting is when the motor requires longer than 10 seconds to reach the nominal speed. Given such long starting times, the switching devices and capacities have to be configured appropriately because the thermal load increases. The permissible AC-3 currents of motor contactors only take into account 10-second starts. In the case of longer starting times, derating must be carried out or a larger contactor used. You can determine the corresponding configuration on the basis of the tables of different starting times and motor currents in part 4 of the low-voltage switching technology (NSK) catalog.

Setting ranges with thermal overload relays

The setting ranges can be used up to the maximum value when there are temperatures of up to 60 °C inside the cubicle. At temperatures of 60 °C to 70 °C, derating is required. In other words, the maximum permissible set value must be reduced. The reduction at 70 °C is 13 % and thus so negligible that due to the overlapping of the different current setting ranges no gaps occur between the setting ranges. A uniform current range of 0.11 to 87 A can thus also be used at 70 °C.

Overload relays in star-delta combinations

When overload relays are used in star-delta combinations, it must be taken into consideration that only $1/\sqrt{3}$ of the motor current flows through the line contactor. An overload relay built onto the line contactor must be set to this level (i.e. 0.58 of the motor current). A second overload relay must be built onto the star contactor if your load is to receive optimal protection in star operation as well. The star current is $1/3$ of the rated current of the motor. The corresponding overload relay must be set to this current. The 3RB12 electronic overload relays with internal ground fault detection are not suitable for use in star-delta combinations, since transient current spikes occur at switchover from star to delta operation. These can result in the triggering of ground fault detection.

3RU11 thermal overload relays

Description

- Tripping class 10
- For motor currents of up to 100 A
- For three-phase, single-phase, or DC motors
- Insensitive to "untidy" power systems

Thermal, time-delayed overload relays are the usual way of providing motor protection with overload relays. The technology has been tried and tested and continuously improved over a period of decades. They are reasonably priced and provide reliable protection, particularly in the case of normal starting times (class 10) and motor ratings of up to 45 kW (100 A).
Thermal overload relays work with bimetals and heater coils through which the motor current flows. Thermal overload relays record true root-mean-square values and direct currents as a result of their current measuring method (Joule heat). Compatible heating coils and bimetals are used for the different setting ranges. Single-phase and direct-current motors can also be protected against overload by looping the motor line. Thermally time-delayed overload relays can also be used after frequency converters.

3RB10 electronic overload relays

Description

- Tripping classes 10 and 20
- For motor currents of up to 100 A
- Low waste heat, energy-saving
- Wide setting ranges for simple configuration, selection, and less storage
- Extremely low energy requirements: approx. 50 mW

Electronic overload relays work with current transformers that provide a measurement signal that is evaluated by an electronic circuit. They are designed for sinusoidal 50/60 Hz supply voltages.
The 3RB10 electronic overload relay, like the 3RU11 thermal overload relay, can be built directly into the motor feeder but hardly causes any heat loss thanks to the electronic measurement system. The tripping classes 10 (for normal starting) and 20 (for heavy starting) are implemented with the 3RB10 electronic overload relay.
The current range of the electronic overload relays can be set to the motor current at a ratio of 1:4 (lower to upper current mark). Up to 6 motor ratings are covered by a single range, and a current range of 0.1 to 100 A is covered by only 7 setting ranges.

3RB12 electronic overload relays

Description

The 3RB12 electronic overload relays are suitable when there are high motor protection requirements on account of the following features:

- Tripping classes 5/10/15/20/25/30 settable
- For motor currents of up to 820 A
- Evaluation of PTC thermistors
- Analog output signal of 4 mA to 20 mA for current detection (insensitive to harmonics)
- High accuracy of the tripping characteristic with a tolerance of < ± 10 %
- Ground fault detection internally and externally through summation current transformer
- Insensitive to external influences such as vibrations, different cable cross-sections, temperature fluctuations, corrosive environments or aging

The 3RB12 electronic overload relay can be used for everything from easy starting (CLASS 5) to very heavy starting (CLASS 30). The tripping class can be set in steps to the relevant motor starting time. In addition, the 3RB12 is equipped with inputs for PTC thermistors, which make it a fully protected motor device. Additional functions such as ground fault detection and an analog output signal are also possible. It is available in 4 sizes from 1.25 to 820 A.
It is triggered in the event of an overload, current imbalance, phase loss, or a blocked rotor.

Variants

The 3RB12 electronic overload relays are available in the following variants:

- Output relay with monostable behavior
- Output relay with bistable behavior
- For the following control supply voltages: 24 VDC
110 VAC to 120 VAC
220 VAC to 240 VAC

Auxiliary contact elements

The 3RB12 electronic overload relays have electrically isolated auxiliary contact elements with the following functions (depending on the variant):

- 1 NO contact/1 NC contact for overload tripping through current and/or thermistor
1 NO contact/1 NC contact for ground fault tripping
- 1 NO contact/1 NC contact for overload tripping through current and/or thermistor and ground fault; 1 NO contact/1 NC contact for overload warning

Overload protection

The currently flowing motor current is detected in each motor supply line by current transformers and constantly monitored by a microprocessor.
An overload warning occurs as of:

- 1.15 x I_e in the case of a symmetric load
- 0.85 x I_e in the case of an asymmetric load

The overload warning is indicated by the flashing "Overload" LED on the overload relay or externally by means of 1 NO contact/1 NC contact.

Thermistor motor protection

The continuous evaluation of a PTC thermistor detector ensures thermistor motor protection.
Additional thermistor motor protection (full motor protection) is implemented by connecting a PTC thermistor detector (PTC sensor circuit in the motor winding). This is important for stator-critical motors, motors with long starting and braking, and motors with cooling systems problems or with high ambient temperatures.
No additional equipment is required for evaluation purposes.
Full motor protection is deactivated on delivery by means of a wire jumper.
The monitoring of the thermistor is secure against a wire break. In other words, tripping occurs in the event of a wire break.

Ground fault protection

Internal ground fault monitoring

The ground fault protection integrated in the overload relay monitors motors with a three-conductor terminal. Ground faults are detected in the event of fault currents > 30 % of the set current I_e in rated service.

External ground fault monitoring

External ground fault protection is implemented by connecting a 3UL220.-.A summation current transformer and monitors motors with three- and four-conductor terminals. Ground faults are detected reliably in the event of fault currents of 0.3 A, 0.5 A and 1 A. These values refer to sinusoidal fault currents 50/60 Hz.

4.2.3 Operation

Short-circuit protection

For short-circuit protection of starter combinations consisting of a contactor and an overload relay, fuses or 3RV13 circuit breakers are required for starter combinations.

Use with external current transformers

If external current transformers are to be used to operate the 3RB12, the following things should be taken into consideration. The 3RB12 with the current setting range from 1.25 to 6.3 A must be selected.
The secondary current of the 1 A or 5 A current transformer becomes the primary current of the 3RB12. In the case of 5 A current transformers, the 3RB12 can be set from 1.25 to 5 A (i.e. from 1/4 of to 1 times the transformer's rated current). In the case of 1 A current transformers, a signal > 1.25 A must be generated by looping the line. If the line is looped five times, a 5 A signal is generated for the 3RB12.

Environmental conditions

3RU11
The 3RU11 overload relays can be used without restrictions at ambient temperatures of up to 60 °C. This is the result of new bimetals and continuous temperature compensation (up to 70 °C with derating).

3RB10
A special coating on the PCB and the electronic components ensures reliable operation even in corrosive and tropical environmental conditions.

Auxiliary contact elements

The 3RU11 and 3RB10 overload relays are equipped with a normally closed contact for switching off the contactor and a normally open contact for the tripped signal.
The switching contacts have a high switching capacity so that they can switch contactor coils directly. The overload relays are therefore suitable for use with a PLC (17 V, 5 mA).

Coil and auxiliary switch repetition terminal

Frame size S00
In the case of direct mounting onto contactors, the auxiliary switch and coil repeat terminals (A2) are passed through the 3RU1116 and 3RB1016 overload relays. This makes wiring much simpler.

Frame sizes S0 - S3
The contactors of these frame sizes are equipped with 4 coil connections. It is therefore not necessary to pass through the auxiliary switch and coil terminals (A2) of the contactor.

Tripping classes

3RU11
The 3RU11 thermal overload relays are available for normal starting in tripping class 10.

3RB10
The 3RB10 electronic overload relays are available in 2 tripping classes:
Tripping class 10 for normal starting
Tripping class 20 for heavy starting

3RB12
The 3RB12 electronic overload relays can be set to different tripping classes (5/10/15/20/25/30) on the device.

Phase loss sensitivity

The 3RU11/3RB10/3RB12 overload relays are sensitive to phase imbalance.

Note on explosion protection
For releases and relays with current-sensitive delayed tripping, tripping characteristics must be available at the installation location.
The releases or relays for machines with cage rotors must be selected in such a way that the release time in the case of a 3-pole load, which is obtained from the characteristic for the I_A/I_N ratio of the machine to be protected, is not greater than the safe locked-rotor time t_E specified on the machine's test label.
Motors must have equipment that protects them even in the event of the failure of a line conductor.

4.3 Application and use

4.3.1 3RU11 thermal overload relay and 3RB10 electronic overload relay

3RB10

The 3RB10 electronic overload relays are developed for use in sinusoidal 50/60 Hz voltage networks. No additional supply voltage is required for operation. The current transformers are integrated in the devices for the purpose of current detection. An ASIC checks the current values of each phase and causes tripping in the event of an overload or phase loss.

3RU11

3RU11 front view:

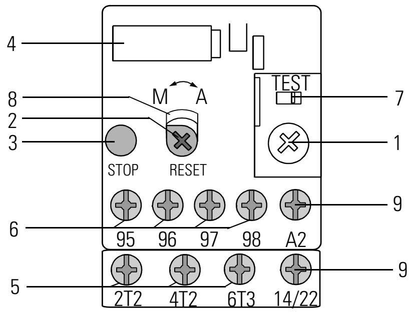


Figure 4-4: 3RU11 front view

Functions

1 Scale for setting the load rated current
2 Reset button (blue):
Press the RESET button to get the relay ready before putting it into operation or after tripping.
3 Stop button (red):
The stop button opens the normally closed contact, which remains open until the button is released again. The downstream contactor and thus the motor can be switched off.
Press the STOP button to switch the relay off when it is in operation. The normally closed contact of the auxiliary switch opens. The relay remains ready for operation.
4 Device type plate
5 Terminals for three motor supply lines
6 Terminals for normally closed/normally open contacts (95/96 for normally closed contacts, 97/98 for normally open contacts)
7 Contact position indicator/test
The slider for the contact position indicator also serves as a test function. When it is operated, tripping of the overload relay is simulated. The normally closed contact (95/96) opens, and the normally open contact (97/98) closes. The switching position is indicated.
8 Switch for manual/auto RESET:
By pressing and turning the blue button you can select automatic or manual reset.
In the case of the relay setting M (manual reset), the switching position of the relay is indicated:
I = ready for operation
O = tripped
9 Only in the case of frame size S00:
Terminal A2: repetition terminal of the contactor coil
Terminal 14/22: repetition terminal of the contactor auxiliary switch

Auxiliary contacts

The following table shows the behavior of the auxiliary contacts when the TEST/STOP and RESET buttons are pressed:

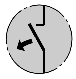
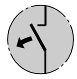
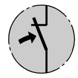
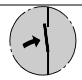
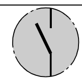
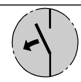
	TEST	STOP	RESET
NC 95/96			
NO 97/98			

Table 4-5: 3RU11/3RB10 auxiliary contacts

Setting the rated current

The following figure shows how the rated current is set, using the example of the 3RU11, frame size S00.

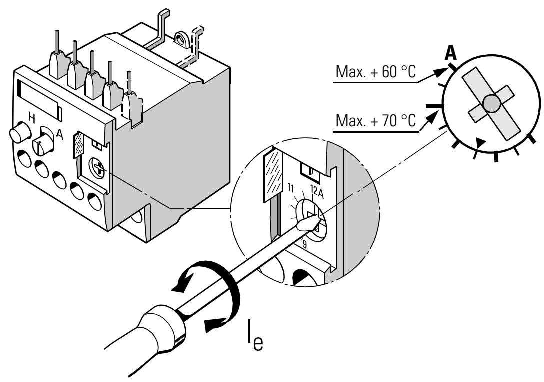


Figure 4-5: Setting the rated current

Important
When the sealing cover (transparent sliding window) is closed (3RU11) or mounted (3RB10), it is not possible to use the blue reset button for a switchover between M (manual reset) and A (automatic reset).

Sealing the adjustment scale

3RU11 **3RB10**

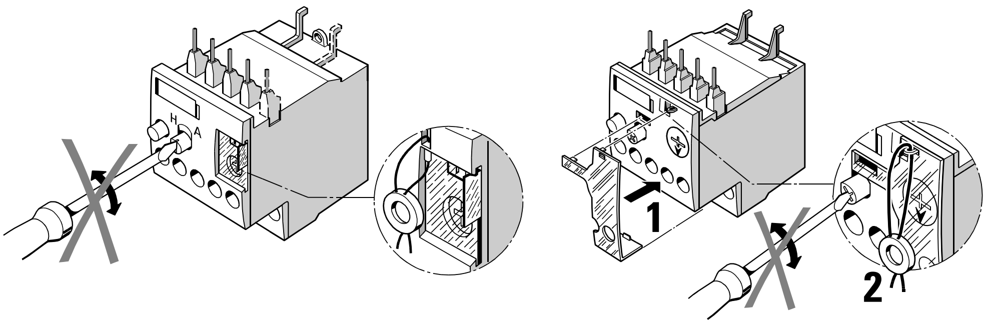


Figure 4-6: Sealing the adjustment scale (frame size S00)

Recovery time

	3RU11	3RB10
Automatic reset	3 to 5 min[1)]	4 min
Manual reset	3 to 5 min[1)]	Immediate

Table 4-6: Recovery time

1) Dependent on the setting range

Manual-automatic

The following figure shows how to switch between manual and automatic for the 3RU11 and 3R10 using the example of the 3RU11, frame size S00:

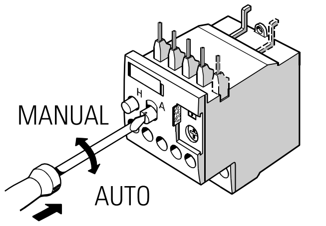


Figure 4-7: Manual/automatic switchover

Resetting

The 3RU11 thermal overload relay can also be reset manually after the bimetals have cooled down (after approx. 3 to 5 minutes), or it can reset itself automatically after this time when the AUTO position is set.
The 3RB10 electronic overload relay can be reset at any time by pressing the RESET button. The recovery time for the automatic reset is 4 minutes.

3RU11

Tripping characteristics

The time-current characteristics show the dependency of the tripping time from a cold state on the multiple of the set current I_e.
When the relay is at operating temperature, preloaded with 1x I_e, the tripping times are reduced to around 25 %. In the case of a single-pole load, the tripping characteristics lie between the characteristics. In normal operation, all three bimetal strips of the overload relay must be heated.
The 3RU overload relays are suitable for protecting motors with phase control.
To protect single-phase or direct current loads, all three main conducting paths must be connected in series. The minimum tripping current in the case of a three-pole symmetric load lies between 105 % and 120 % of the set current.

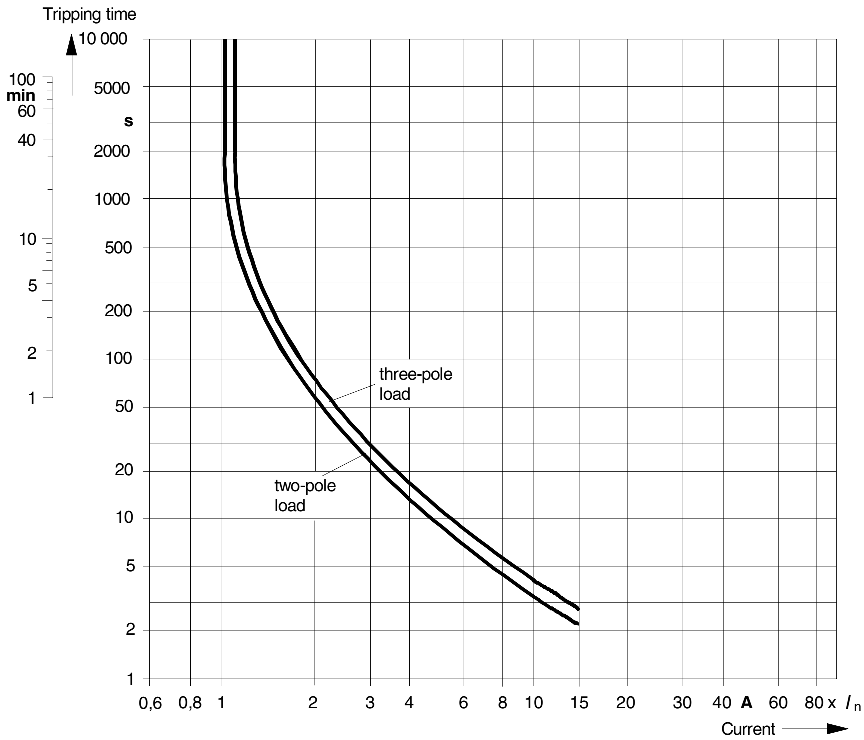
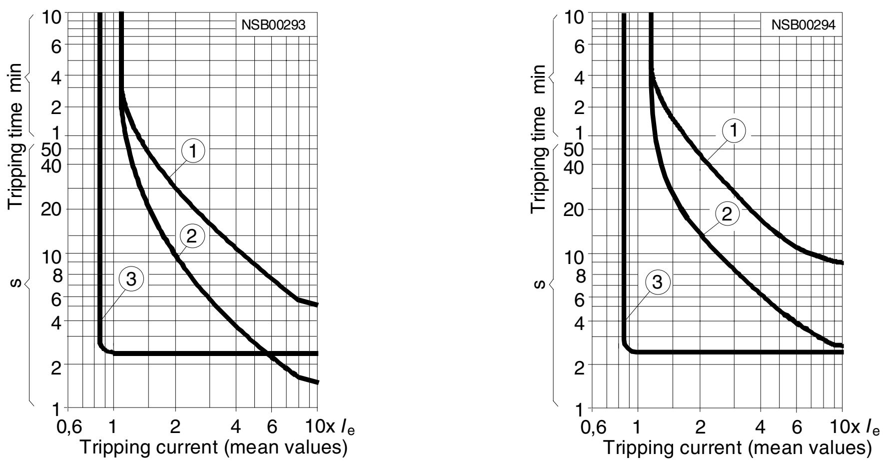


Figure 4-8: Time-current characteristic, chart for the 3RU11

3RB10

Tripping characteristic

The time-current characteristics show the behavior at starting, with a three-pole load
① from a cold state
② from a warm state
③ in the event of phase loss or current imbalance (the phase loss protection function triggers the overload relay after 3 seconds)



CLASS 10 CLASS 20

Figure 4-9: Time-current characteristics for class 10 and class 20, chart for the 3RB10

4.3.2 3RB12 electronic overload relays

3RB12 front view:

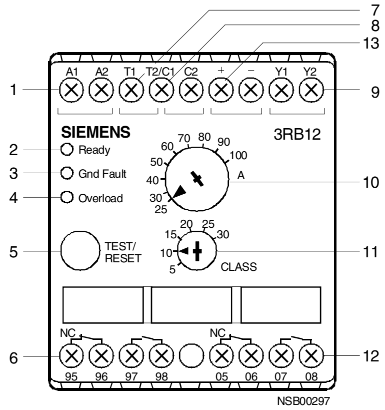


Figure 4-10: Front view of the 3RB12 electronic overload relays

Functions

1 Terminals of the control supply voltage
2 Green "Ready" LED
3 Red "Ground Fault" LED
4 Red "Overload" LED
5 Combined test/reset button with function test
6 1 NO contact/1 NC contact for overload/thermistor tripping or 1 NO contact/1 NC contact for overload/thermistor or ground fault tripping
7 Terminals for thermistor
8 Terminals for external summation current transformer
9 Terminals for remote or automatic reset
10 Rotary switch for current setting
11 Rotary switch for the class
12 1 NO contact/1 NC contact for ground fault tripping or 1 NO contact/1 NC contact for overload warning

Overload

In the event of an overload > 110 % of the current I_e set using the rotary switch on the front of the device, of current imbalance of 40 % I_e, or of phase loss, tripping occurs through the switchover of two auxiliary contact elements (1 NO contact: 97/98 / 1 NC contact: 95/96) after the tripping time set by means of the six-step rotary switch (CLASS 5/10/15/20/25/30).
After overload tripping, the overload relay can be reset either by pressing the test/reset button on the device or by remote or automatic reset after the recovery time of 5 minutes elapses.

Thermistor detector

A tripping operation as a result of the thermistor detector responding takes place via the same auxiliary contact elements as for overload tripping (1 NO contact: 97/98 / 1 NC contact: 95/96), except that it is instantaneous.

The overload relay cannot be reset until the temperature in the motor winding 5 K has sunk to under the operating temperature of the thermistor.

Ground fault

In the event of a ground fault, the device trips instantaneously; depending on the device variant, this may occur via a separate output (1 NO contact/1 NC contact).

Remote/automatic reset

Remote or automatic resetting can be implemented by means of external wiring (Y1-Y2 terminals).

Important
In the case of ground fault tripping, an automatic reset is not possible.

Test

The device functions of current detection, thermistor input, and ground fault input and the tripping functions of the auxiliary contact elements can be tested by pressing the test/reset button.
The device functions can also be tested during operation. The LEDs indicate the status.

Internal failure

Self-monitoring causes the device to trip in the event of an internal fault. In this case, the overload relay cannot be reset.

Failure of the control supply voltage

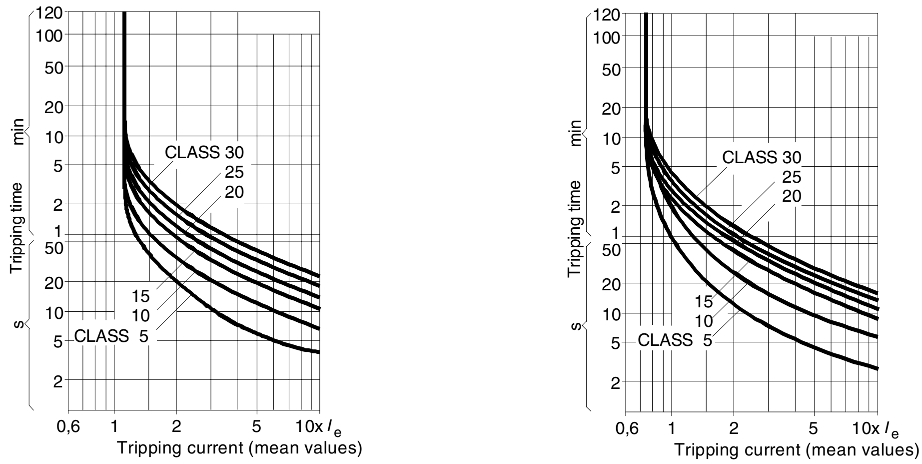
In the event of the failure of the control supply voltage for any length of time (> 0.2 seconds), the output relays respond in either a monostable or bistable manner, depending on the variant involved.
The following table shows the behavior of the output relays in the event of the failure of the control supply voltage:

<table>
<tr><th>Behavior of the output relays given:</th><th>Monostable
3RB12..-....0</th><th>Bistable
3RB12..-....1</th></tr>
<tr><td>Failure of the control supply voltage</td><td>Device trips</td><td rowspan="2">No change to the switching status of the auxiliary contact elements</td></tr>
<tr><td>Return of the control supply voltage without prior tripping</td><td>Device resets</td></tr>
<tr><td>Return of the control supply voltage after prior tripping</td><td colspan="2">Device remains tripped
Reset at:
- Overload tripping after 5 minutes
- Thermistor tripping when 5 K under the operating temperature reached
- Ground fault tripping immediately</td></tr>
</table>

Table 4-7: Failure of the control supply voltage

Tripping characteristics

The time-current characteristic for three-pole symmetric loading shows the dependency of the tripping time from a cold state on the multiple of the set current.
When the overload relay is preloaded with 100 % of the set current, the tripping times are reduced.
In the case of two-pole loading (loss of a phase) or current imbalance > 40 % of the set current, the corresponding characteristic applies.



Three-pole loading   Two-pole loading

Figure 4-11: Time-current characteristics, chart for the 3RB12

3RB12 electronic overload relay with analog output

Field of application

The electronic overload relay with analog output is used for measuring instruments and analog modules with 4 to 20 mA input.

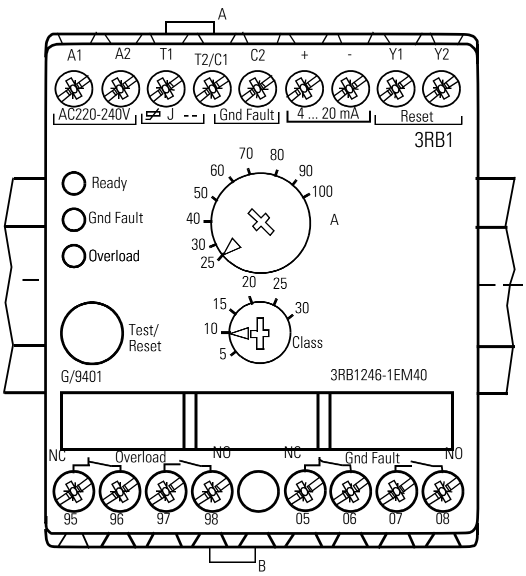


Figure 4-12: Electronic overload relay with analog output, front view

For automatic resetting, jumper B is attached between terminals Y1 and Y2.

Analog output

4 mA to 20 mA
1 % x I_e = 0.128 mA

I/I_e [%] = (I_{out} - 4 mA) / 0.128 mA
I_{Motor} [A] = (I_{out} - 4 mA) x I_e /12.8 mA

I_{out} Output current of the analog output
I_{Motor} Motor current, max. phase
I_e Set current (rated current for motor)

I_{out} [mA]	I/I_e [%]
0	No connection, wire break!
4.000	Device in operation
4.128	
5.280	0
7.200	1
10.40	10
15.52	25
16.80	50
18.08	90
20.00	100
	110
	125

Example: I_{out} = 10.40 mA; I_e = 6.0 A
I = 50% v. I_e
I_{Motor} = 3 A

Technical specifications

Max. output current	23 mA
Terminals	"+" and "-"
Max. load	100 Ω
Accuracy	+/- 10%

Short circuit-proof and idling-proof

4.4 Accessories

4.4.1 Electromechanical remote reset

The electromechanical remote reset is suitable as an accessory for the 3RU11 and 3RB10 overload relays in frame sizes S00 to S3.
It is used to reset the overload relay from control rooms after overload tripping.
The coil of the module is designed for an operation duration of 0.2 to 4 seconds. Maintained-contact control is not permissible.

Installation/removal

The following figure shows how the electrical remote reset is installed and removed, using the example of the 3RU11 in frame size S00.

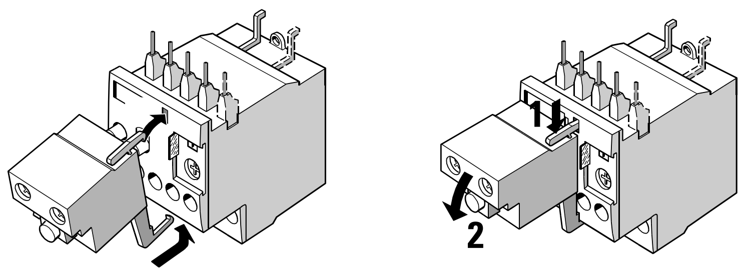


Figure 4-13: Electrical remote reset, installation/removal

Voltages

24 VDC to 30 VDC 50/60 Hz
110 VDC 127 VDC 50/60 Hz
220 VDC to 250 VDC 50/60 Hz

Operating range

The operating range of the coil is: 0.85 to 1.1 x U_S

Power consumption

The power consumption of the electromagnetic remote reset is:
80 VA AC, 70 W DC

Manual reset

A manual reset is possible by means of the blue repeat button on the remote reset module.

Connection cross-sections

The values for the screw-type terminals of terminals E1 and E2 correspond to the cross-sections of the auxiliary connecting leads of the 3RU11/3RB10 overload relays.

4.4.2 Mechanical remote reset

The mechanical remote reset is available in 2 variants:

- A resetting plunger with a support and funnel (3RU1900-1A) for operation from the cubicle door.
  The plunger must be cut to the required length.
- A wire release with a support (3RU1900-1B, -1C) for built-in overload relays that are hard to reach.
  The wire is available in two lengths:
  3RU1900-1B: 400 mm
  3RU1900-1C: 600 mm

Resetting plunger

Installation

The following graphics show how to install and remove the resetting plunger or the wire release for the 3RU11, frame size S00.

Example 3RU11, frame size S00:

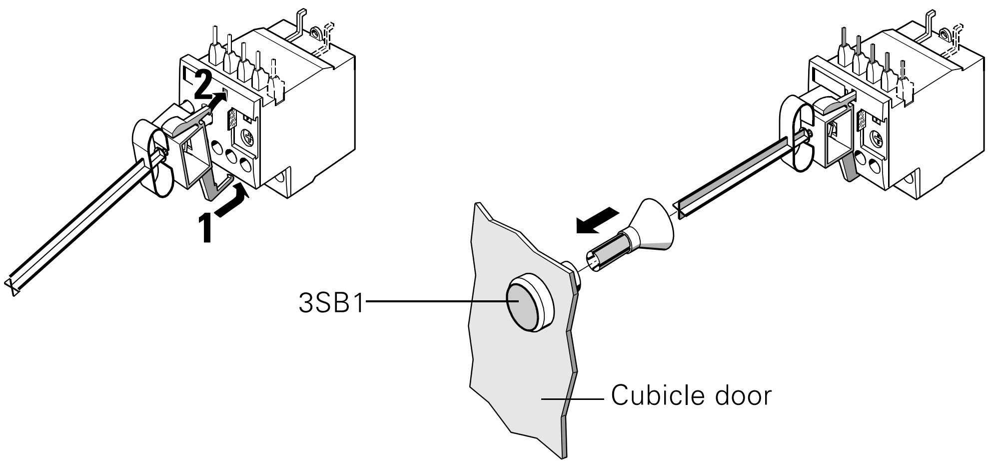


Figure 4-14: Mechanical remote reset: resetting plunger, installation

Removal

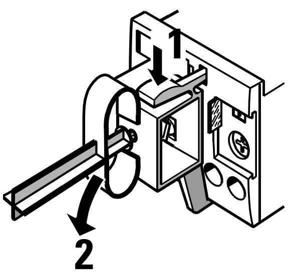


Figure 4-15: Mechanical remote reset: resetting plunger, removal

Wire release

Example 3RU11, frame size S00:

Installation

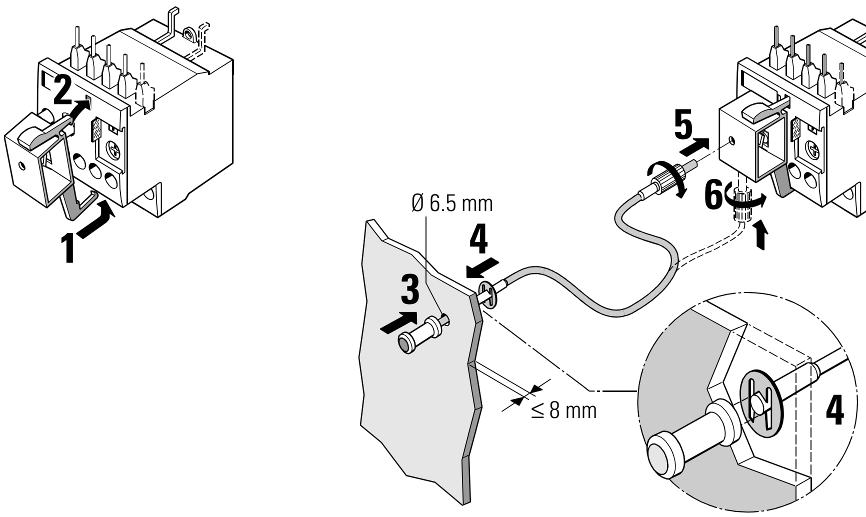


Figure 4-16: Mechanical remote reset: wire release, installation

Removal

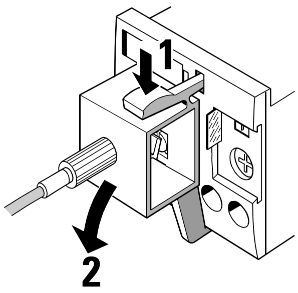


Figure 4-17: Mechanical remote reset: wire release, removal

Sealable cover

A sealable cover is available as an accessory for the 3RB10 electronic overload relay.
In the case of the 3RU11 thermal overload relay, the cover is integrated in the device.

4.5 Mounting and connection

4.5.1 Mounting

3RU11/3RB10

The 3RU11 and 3RB10 overload relays can be attached directly to the 3RT contactors and 3RW30/31 soft starters in the corresponding frame size.
In stand-alone installation they are suitable for being snapped onto a 35 mm rail in acc. with DIN EN 50 022 or for screw-on mounting.
The overload relay in the frame size S3 is suitable for 35 mm and 75 mm rails.

3RB12

70 mm width
The 3RB12 electronic overload relays are either snapped onto a 35 mm rail in acc. with DIN EN 50 022 or screwed onto a mounting plate by means of push-in lugs, which are available as accessories.
The devices with current setting ranges < 100 A are designed for stand-alone installation on account of the bar-type system of the primary current lines.

120 mm/145 mm/230 mm width
In the case of the current setting ranges > 50 A to 820 A of the device widths 120 mm, 145 mm, and 230 mm, the 3RB12 electronic overload relays can be mounted directly onto the contactors by means of connecting bars.
A screw-on attachment is integrated in the housing of these devices.
For the 3RB1253 devices (120 mm width) there is also a base plate available for snap-on attachment to a 75 mm rail.

Mounting onto contactors/soft starters

The following illustration shows how overload relays (in this case the 3RU11) in frame size S00 are attached to the 3RT contactor and the 3RW30/31 soft starter:

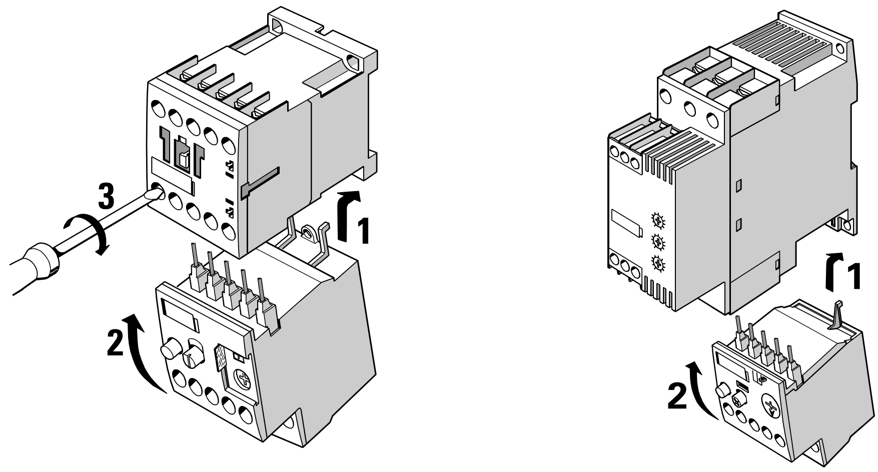


Figure 4-18: Mounting onto the 3RT contactor/3RW3 soft starter

Stand-alone installation

The following illustrations show how the holder for stand-alone installation is mounted.
Frame size S00/S0:

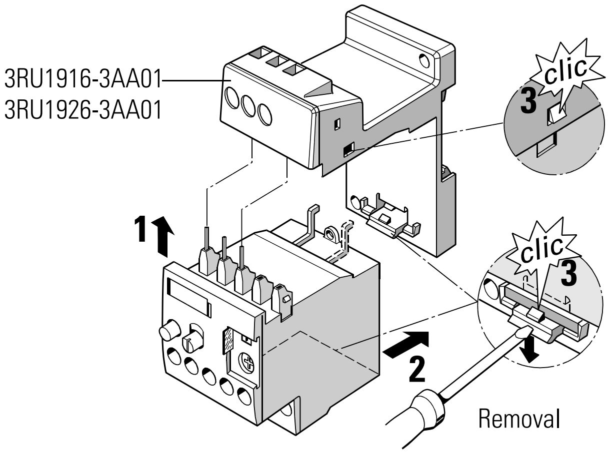


Figure 4-19: Stand-alone holder, example 3RU11 (frame size S00/S0)

Frame size S2/S3:

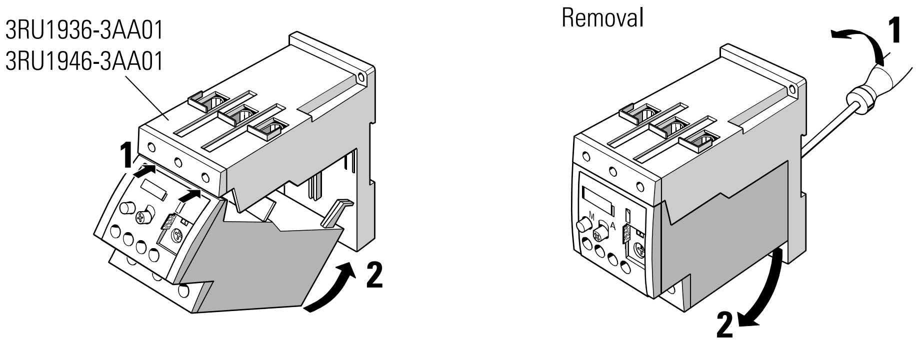


Figure 4-20: Stand-alone holder, example 3RU11 (frame size S2/S3)

Snap-on mounting

The 3RU11 and 3RB10 overload relays can either be mounted onto the contactor or snapped onto a 35 mm rail by means of the holder for stand-alone installation.
The frame size S3 can be snapped onto a 35 mm rail or a 75 mm rail.

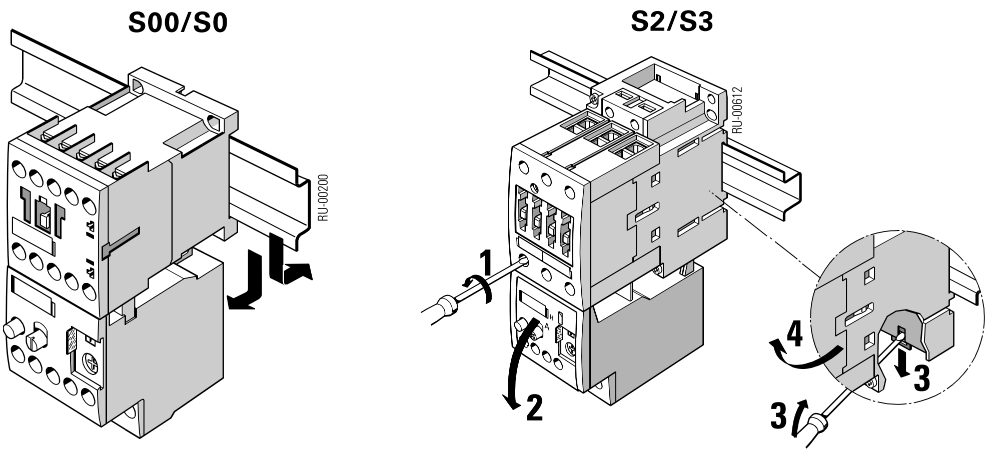


Figure 4-21: Snap-on mounting and removal with the 3RT contactor

Removing the device from the rail

Contactor/overload relay combination

S00/S0:
Push the contactor downward, and swing it forward (without a tool)
S2/S3:

1 Remove the overload relay from the contactor.
2 Use a screwdriver to release the snap-on mounting on the contactor (this is shown in Section 3.5 on the installation and removal of contactors).

Screw-on mounting

Overload relay with holder for stand-alone installation

The overload relay is screwed on by means of 2 M4 screws in the openings in the holder for stand-alone installation using the maximum tightening torque of 1.5 to 2 Nm. The screws are secured with washers and spring lock washers.

Contactor/overload relay combination

1 Mount the contactor on a flat surface with 2 M4 screws.
2 Mount the overload relay on the contactor.

Minimum clearance

Maintain a minimum clearance from grounded parts at the side of > 6.5 mm.

Installation positions

3RU11

The drawings below show the permissible installation positions for the 3RU11 overload relays for mounting on contactors and stand-alone installation. If the installation position is in the shaded area, an adjustment of 10% must be made.

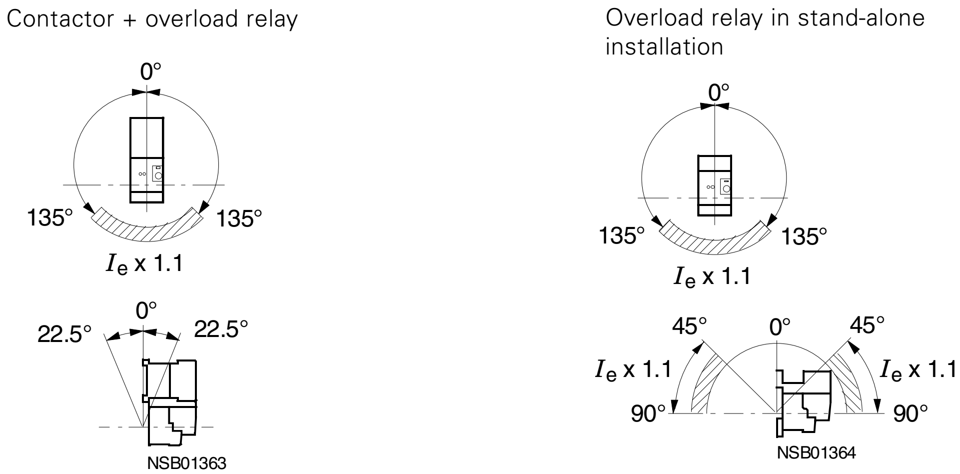


Figure 4-22: Permissible installation positions for the 3RU11

3RB10/3RB12

Any installation position is possible for the 3RB10 and 3RB12.

4.5.2 Connection

3RU11

The 3RU11 overload relays are equipped with the following terminal system:
- S00 to S3: Screw-type terminal for the main and auxiliary connecting leads
- S00: Cage Clamp terminal for the main and auxiliary connecting leads (only stand-alone installation possible)
- S0 to S3: Screw-type terminal for main contacts and Cage Clamp terminal for auxiliary connecting leads (contactor mounting and stand-alone installation possible)

3RB10/3RB12

The 3RB10 and 3RB12 electronic overload relays have screw-type terminals. The 3RB1246 electronic overload relays are equipped with a bar-type transformer.

Bar-type system

In the case of the 3RB1246 electronic overload relays with current setting ranges < 100 A (70 mm width), the main lines are connected in a bar-type system. The main lines are connected through the current transformer integrated in the housing at rated currents for the motor of 1.25 A to 100 A.
The advantages are:
- No additional installation costs
- No power loss at the transfer resistors of the clamping units that would otherwise be necessary

Looping through

At motor rated currents I_N < 1.25 A, the motor supply leads can be fed through the loop-through openings several times (n times) in each phase.
The set current I_e of the device is calculated as follows:
$I_e = 3 \times I_N$
Example:
$I_N = 0.5$ A
n = 3
$I_e = 3 \times 0.5$ A = 1.5 A
n = 5 is recommended as a good upper limit in practice.
The following graphics illustrate the loop-through system:

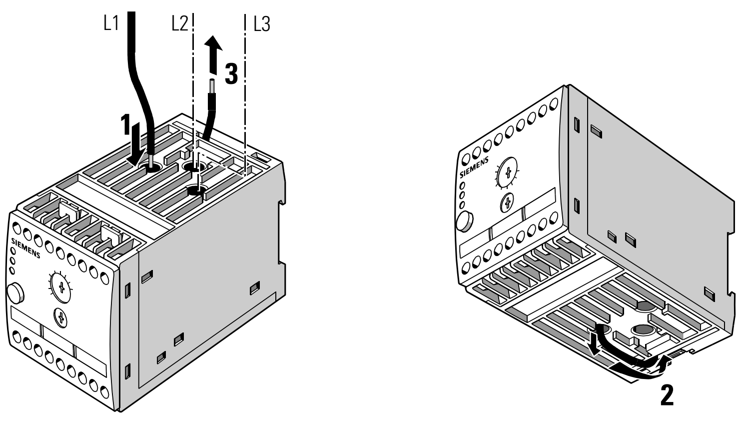


Figure 4-23: Loop-through system, 3RB1246

Screw-type terminal

The screws are captive, and the screwdriver guides allow the use of power screwdrivers.

Cage Clamp terminal

The following illustration shows a Cage Clamp terminal with the 3RU11, using the example of frame size S2:

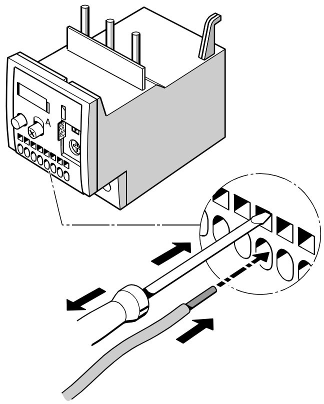


Figure 4-24: 3RU11: Cage Clamp terminal (frame size S2)

Conductors with a cross-section of 0.5 mm^2 (with insulation stop) to 2.5 mm^2 can be used.
1. Insert the screwdriver into the opening until the stop.

Note
The 8WA280 screwdriver is recommended for opening the Cage Clamp terminal.

The screwdriver head automatically keeps the clamp open.

Caution
When clamping and unclamping, the screwdriver must be inserted in the rectangular opening until the stop. You must not make any levering or turning movements, because these might break the cage clamp.

---

2. Insert the conductor in the oval terminal opening.
3. Remove the screwdriver.
The terminal clamp closes, and the conductor is thus securely clamped.

Connection cross-sections

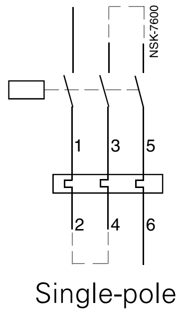
You can obtain the permissible connection cross-sections for the main and auxiliary connections of the overload relays from Section 4.7, "Technical specifications".

4.5.3 Circuit diagrams

Device circuit diagrams

Protection of single-phase and DC motors

3RU11



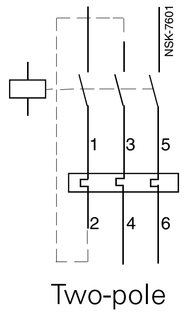
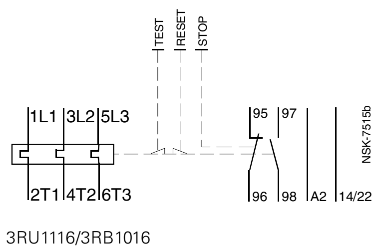


Figure 4-25: 3RU11 circuit diagrams

Circuit diagrams

3RU11 and 3RB10



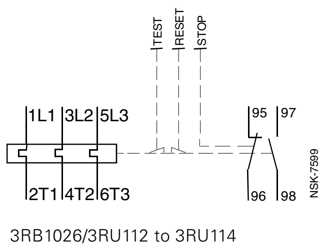


Figure 4-26: 3RU11 and 3RB10 device circuit diagrams

Connection example **3RU11**

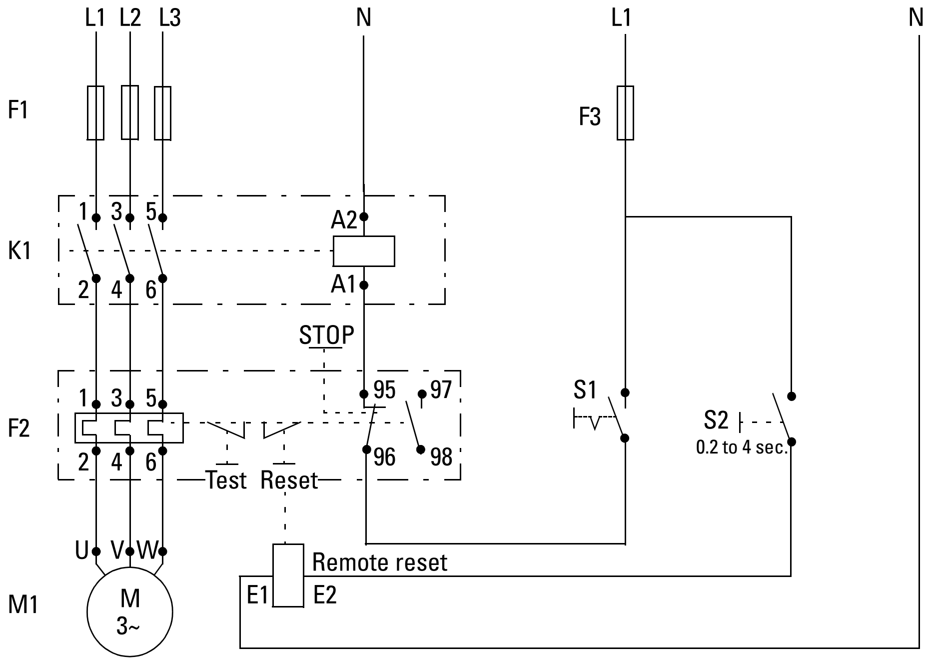


Figure 4-27: Connection example for the 3RU11

In the case of single-pole loads, the 3 main conducting paths must be connected in series.

Warning
In the case of an automatic reset and maintained-contact operation, the motor restarts automatically.

Connection example **3RB10**

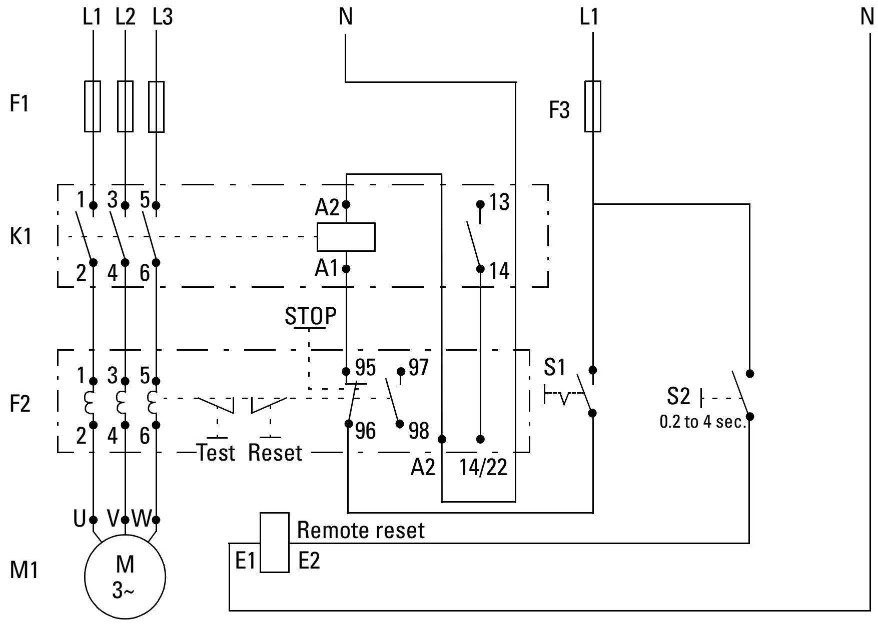


Figure 4-28: Connection example for the 3RU10

3RB12 electronic overload relays

Connection plans for single-phase motors

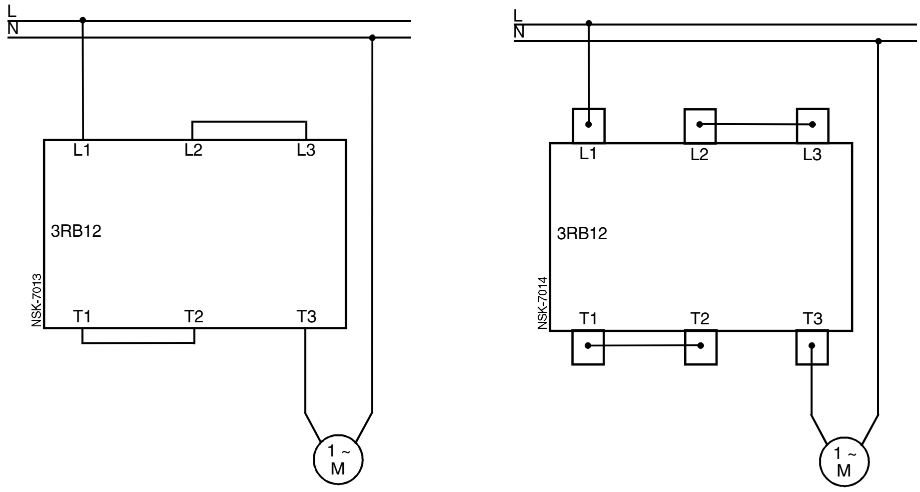


Figure 4-29: Connection plants for 3RB12 single-phase motors

Important
The electronic overload relays with integrated ground fault detection (3RB12..-....2./3RB12..-....3.) are not suitable for use with single-phase motors.

4.6 Dimensioned drawings (dimensions in mm)

3RU11/3RB10/3RB12 overload relays - screw-type terminals

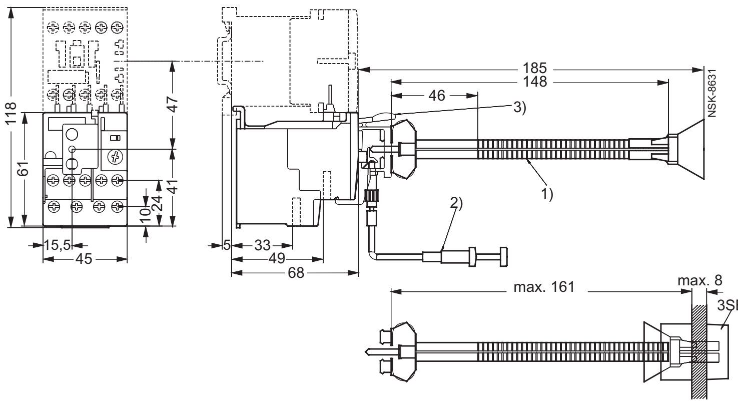
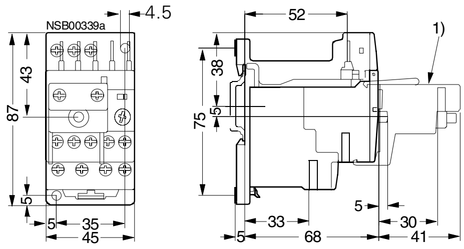


Figure 4-30: 3RU11 16-..B0, (frame size S00)
with accessories



3RU11 16, 3RB10 16, (frame size S00)
with terminal bracket for stand-alone installation with accessories

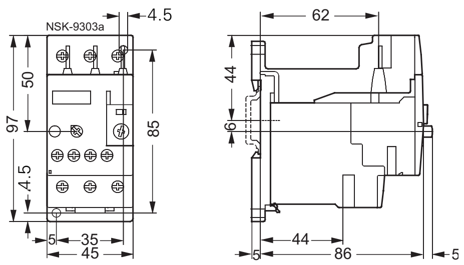
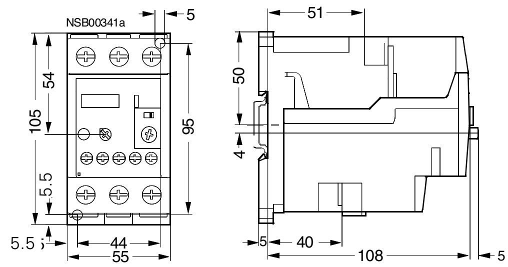


Figure 4-31: 3RU11 26-.B., 3RB10 26, (frame size S0)
with terminal bracket for stand-alone installation



3RU11 36-..B., 3RB10 36, (frame size S2)
with terminal bracket for stand-alone installation

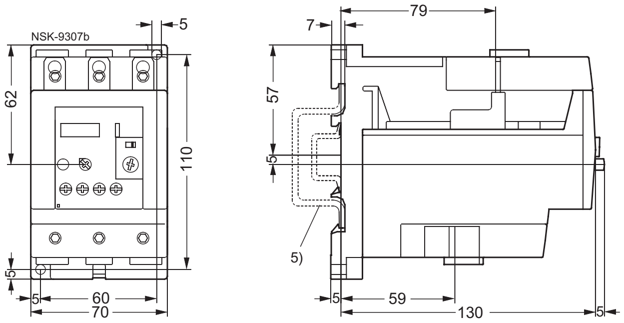
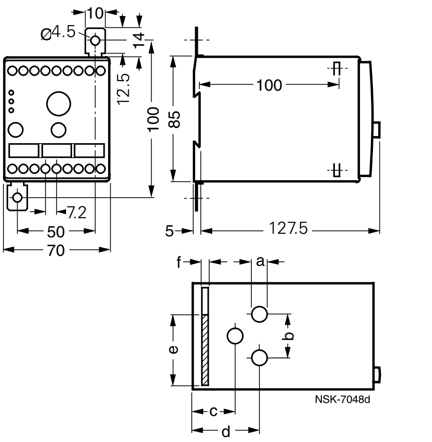


Figure 4-32: 3RU11 46-..B., 3RB10 46
with terminal bracket for stand-alone installation

1) Mechanical reset
2) Wire release (400 mm or 600 mm long, mounting on front or side on bracket)
3) Bracket for reset
4) Module for remote reset
5) Attachment to rail (35 mm, 15 mm depth to DIN EN 50 022 or 75 mm to DIN EN 50 023)
The clearance from grounded parts at the side must be at least 6 mm.



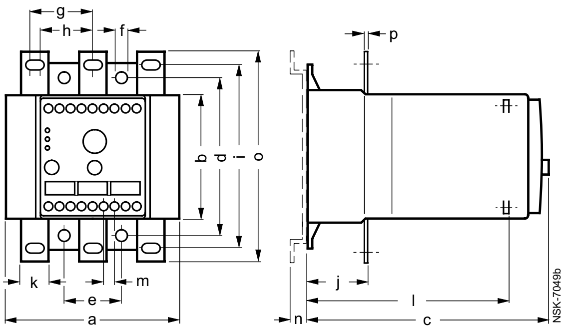


Figure 4-33: 3RB12 46

Overload relay	a	b	c	d	e	
3RB12 46-1E	15	29	24	47	–	–
3RB12 46-1P	10	34	29	46	48	4
3RB12 46-1Q	10	34	29	46	48	4

3RB12 5. / 3RB12 62

Overload relay	a	b	c	d	e		g	h	i	j	k	l	m	n	o	p
3RB12 53-0F	120	85	155	110	40	Ø7	42	37	125	41	20	131	7.2	13	145	4
3RB12 57-0K	145	85	175	105	50	Ø9	52	48	130	46	30	151	7.2	–	160	6
3RB12 62-0L	230	85	190	120	70	Ø1	70	–	135	55	40	166	7.2	–	175	8

3RU11 overload relays - Cage Clamp terminal

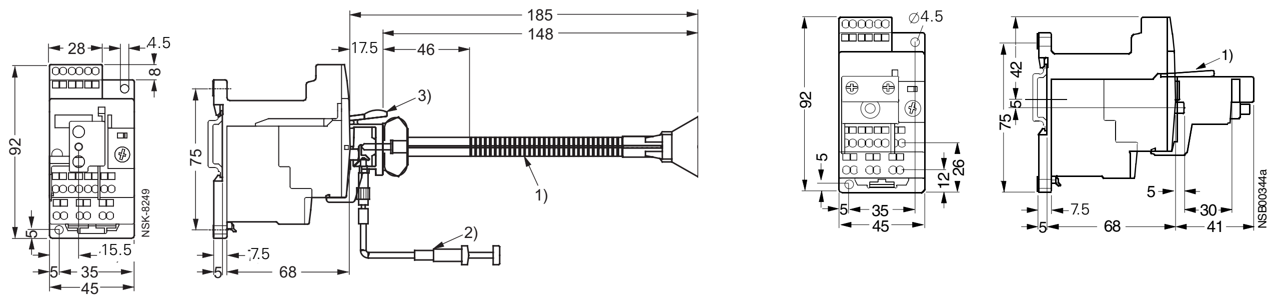


Figure 4-34: 3RU11 16-..C1 (frame size S00)
with accessories (same construction as for frame sizes S00 to S3)

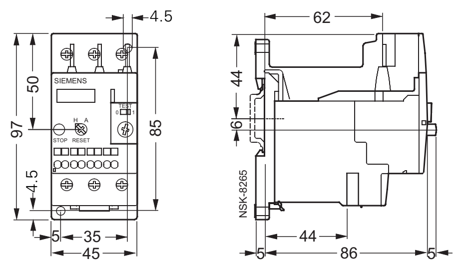
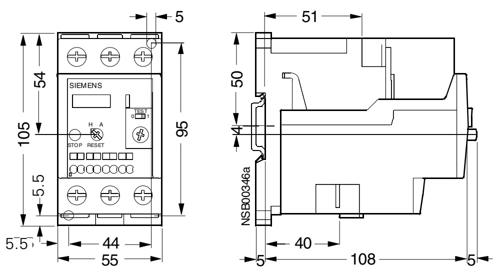


Figure 4-35: 3RU11 26-..D0 (frame size S0)



3RU11 36-..D0 (frame size S2)

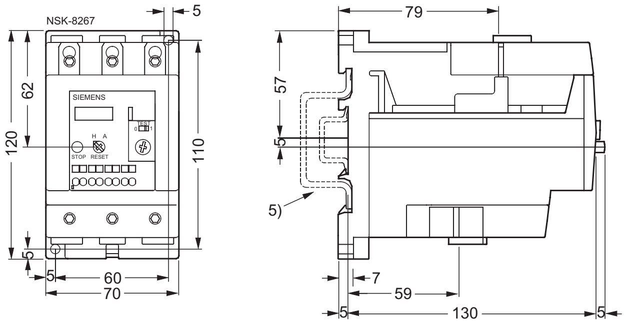


Figure 4-36: 3RU11 46-..D0 (frame size S3)

1) Mechanical reset
2) Wire release (400 mm or 600 mm long, mounted on front or side on bracket)
3) Bracket
4) Remote reset
The clearance from grounded parts at the side must be at least 6 mm.
5) Attached to rail (35 mm, 15 mm depth to DIN EN 50 022 or 75 mm to DIN EN 50 023).

4.7 Technical specifications

4.7.1 3RU11 thermal overload relays

Type			**3RU11 16**	**3RU11 26**	**3RU11 36**	**3RU11 46**
Frame size			**S00**	**S0**	**S2**	**S3**
Width			**45 mm**	**45 mm**	**55 mm**	**70 mm**
General specifications						
Tripped at			Overload and phase loss			
Tripping class	In acc. with IEC 60 947-4-1	CLASS	10			
Phase loss sensitivity			Yes			
Overload warning			No			
Resetting and recovery						
Resetting options after tripping			Manual, remote, and automatic resetting [1])			
Recovery time	With automatic reset	min	Depends on the height of the tripping current and the tripping characteristic			
	With manual reset	min	Depends on the height of the tripping current and the tripping characteristic			
	With remote reset	min	Depends on the height of the tripping current and the tripping characteristic			
Configuration						
Indication of operating status on device			Yes, by means of the "test function/contact position indicator" slider			
Test function			Yes			
Reset button			Yes			
Stop button			Yes			
For the safe operation of motors with increased safety protection	EC special test certificate number in compliance with directive 94/9/EC		KEMA test certificate no. EX-97.Y.3235 DMT 98 ATEX G001			
Ambient temperatures						
Storage/transportation		°C	-55 to +80			
Operation		°C	-20 to +70			
Temperature compensation		°C	To 60			
Permissible rated current at	Internal cubicle temperature of 60 °C	%	100 (current reduction is required at above +60 °C)			
	Internal cubicle temperature of 70 °C	%	87			
Repetition terminals						
Terminal for contactor coil			Yes	Not required		
Auxiliary switch repetition terminal			Yes	Not required		
Degree of protection	In acc. with IEC 60 529/DIN VDE 0470 Part 1		IP 20		IP 20[2])	
Shock protection	In acc. with DIN VDE 0106 Part 100		Protected against touching by fingers			
Sinus shock resistance	In acc. with IEC 68 Part 2-27	*g*/ms	810			
EMC noise immunity						
Conducted disturbance neutralization - burst	In acc. with IEC 61 000-4-4: (corresponds to severity grade 3)	kV	EMC noise immunity is not relevant to thermal overload relays			
Conducted disturbance neutralization - surge	In acc. with IEC 61 000-4-5: (corresponds to severity grade 3)	kV	EMC noise immunity is not relevant to thermal overload relays			
Electrostatic discharge	In acc. with IEC 61 000-4-2: (corresponds to severity grade 3)	kV	EMC noise immunity is not relevant to thermal overload relays			
Field-related disturbance neutralization	In acc. with IEC 61 000-4-3: (corresponds to severity grade 3)	V/m	EMC noise immunity is not relevant to thermal overload relays			
EMC emitted interference			EMC noise immunity is not relevant to thermal overload relays			
Resistance to extreme climates (atmospheric humidity)		%	100			
Site altitude		m	Up to 2000 above sea level; above on request			
Construction type/mounting			Direct mounting [3])/ stand-alone installation with terminal bracket	Direct mounting/stand-alone installation with terminal bracket [4])		

1) Remote reset in conjunction with suitable accessories

2) Terminal compartment: IP 00 degree of protection

3) Only stand-alone installation is possible for the 3RU11 16 overload relay with the Cage Clamp terminal system.

4) For screw-on and snap-on attachment to 35 mm rail
Frame size S3 also for 75 mm rail

Type			**3RU11 16**	**3RU11 26**	**3RU11 36**	**3RU11 46**
Frame size			**S00**	**S0**	**S2**	**S3**
Width			**45 mm**	**45 mm**	**55 mm**	**70 mm**
Main circuit						
Rated insulation voltage U_i (pollution degree 3)		V	690			1000
Rated impulse strength U_{imp}		kV	6			8
Rated operating voltage U_e		V	690			1000
Current type	Direct current		Yes			
	Alternating current		Yes, frequency range up to 400 Hz			
Current setting		A	0.11 - 0.16	1.8 - 2.5	5.5 - 8	18 - 25
			Up to 9 - 12	Up to 20 - 25	Up to 40 - 50	Up to 80 - 100
Power loss per device (max.)		W	3.9 to 6.6	3.9 to 6	6 to 9	10 to 16.5
Short-circuit protection	With fuse, without contactor With fuse and contactor		See the selection and ordering data in the NSK catalog as of page 4/4 See the technical specifications (short-circuit protection with fuses/ circuit breakers for motor feeders)			
Safe isolation between main and auxiliary conducting paths	In acc. with DIN VDE 0106 Part 101 IEC 60 947-1-A1	V	500	690		
Connection of the main circuit						
Connection type			Screw-type terminal/ Cage Clamp terminal[1])	Screw-type terminal	Screw-type terminal with box terminal	Screw-type terminal with box terminal [2])/bar connection
Screw-type terminal						
• Terminal screw			Pozidriv 2			Allen screw 4 mm
• Tightening torque		Nm	0.8 to 1.2	2 to 2.5	3 to 4.5	4 to 6
• Connection cross-section (min./max.), 1 or 2 conductors	Single-core	mm^2	2 x (0.5 to 1.5) 2 x (0.75 to 2.5) max. 2 x (1 to 4)	2 x (1 to 2.5) 2 x (2.5 to 6) max. 2 x (2.5 to 10)	2 x (0.75 to 16) -	2 x (2.5 to 16) -
	Finely stranded without wire end ferrule	mm^2	-			
	Finely stranded with wire end ferrule	mm^2	2 x (0.5 to 1.5)	2 x (1 to 2.5)	2 x (0.75 to 16)	2 x (2.5 to 35)
		mm^2	2 x (0.75 to 2.5)	2 x (2.5 to 6)	1 x (0.75 to 25)	1 x (2.5 to 50)
	Stranded	mm^2	2 x (0.5 to 1.5)	2 x (1 to 2.5)	2 x (0.75 to 25)	2 x (10 to 50)
		mm^2	2 x (0.75 to 2.5) max. 2 x (1 to 4)	2 x (2.5 to 6) max. 2 x (2.5 to 10)	1 x (0.75 to 35)	1 x (10 to 70)
	AWG cables, single- or multi-core	AWG	2 x (18 to 14)	2 x (14 to 10)	2 x (18 to 3)	2 x (10 to 1/0)
		AWG	–	–	1 x (18 to 1)	2 x (10 to 2/0)
	Ribbon cables (number x width x depth)	mm	–	–	2 x (6 x 9 x 0.8)	2 x (6 x 9 x 0.8)
Bar connection						
• Terminal screw						M 6 x 20
• Tightening torque		Nm				4 to 6
• Connection cross-section	Finely stranded with cable lug	mm^2	-			2 x 70
(min./max.)	Stranded with cable lug	mm^2	-			2 x 70
	AWG cables, single-core or stranded with cable lug	AWG	-			2/0
	With connecting bars (max. width)	mm	-			12

1) For the connection cross-sections for the Cage Clamp terminal system, see "Connecting the auxiliary circuit".
2) The box terminal can be removed. After the box terminal has been removed, busbar and cable-lug connections are possible.

Type				**3RU11 16**	**3RU11 26**	**3RU11 36**	**3RU11 46**
Frame size				**S00**	**S0**	**S2**	**S3**
Width				**45 mm**	**45 mm**	**55 mm**	**70 mm**
Auxiliary circuit							
Auxiliary contact elements (number x (variant)				1 x (1 NO contact + 1 NC contact)			
Assignment of the auxiliary contact elements				1 NO contact for the "tripped by overload" signal			
				1 NC contact for switching off the contactor			
Rated insulation voltage U_i (pollution degree 3)			V	690			
Rated impulse strength U_{imp}			kV	6			
Contact rating of the auxiliary contact elements							
NC contact with alternating current AC-14/AC-15	Rated operational current I_e at U_e:						
	• 24 V		A	4			
	• 120 V		A	4			
	• 125 V		A	4			
	• 230 V		A	3			
	• 400 V		A	2			
	• 600V		A	0.6			
	• 690V		A	0.5			
NO contact with alternating current AC-14/AC-15	Rated operational current I_e at U_e:						
	• 24 V		A	3			
	• 120 V		A	3			
	• 125 V		A	3			
	• 230 V		A	2			
	• 400 V		A	1			
	• 600V		A	0.6			
	• 690 V		A	0.5			
NC contact, NO contact with direct current DC-13	Rated operational current I_e at U_e:						
	• 24 V		A	1			
	• 60 V		A	On request			
	• 110 V		A	0.22			
	• 125 V		A	0.22			
	• 220 V		A	0.11			
Conventional free air thermal current I_{th}			A	6			
Contact reliability (suitable for PLC; 17 V, 5 mA)				Yes			
Short-circuit protection							
With fuse	Performance class	gL/gG	A	6			
		rapid	A	10			
With miniature circuit breaker (C characteristic)			A	6[1])			
Safe isolation between auxiliary conducting paths in acc. with DIN VDE 0106 Part 101			V	415			
Connection of the auxiliary circuit							
Connection type				Screw-type terminal or Cage Clamp terminal			
Connection characteristics				Screw-type terminal		Cage Clamp terminal	
•Terminal screw				Pozidriv 2		-	
•Tightening torque			Nm	0.8 to 1.2		-	
•Connection cross-sections (min./max.) 1 or 2 conductors	Single-core		mm^2	2 x (0.5 to 1.5)		2 x (0.25 to 2.5)	
			mm^2	2 x (0.75 to 2.5)			
	Finely stranded without wire end ferrule		mm^2	-		2 x (0.25 to 2.5)	
	Finely stranded with wire end ferrule		mm^2	2 x (0.5 to 1.5)		2 x (0.25 to 1.5)	
			mm^2	2 x (0.75 to 2.5)			
	Stranded		mm^2	2 x (0.5 to 1.5)		-	
			mm^2	2 x (0.75 to 2.5)			
	AWG cables, single- or multi-core		AWG	2 x (18 to 14)		2 x (24 to 14)	
, , rating data							
Auxiliary circuit	Switching capacity			B600, R300			

1) Up to $I_K \leq 0.5$ kA; ≤ 260 V

Terminal bracket for stand-alone installation						
Type			**3RU19 16-3AA01**	**3RU19 26-3AA01**	**3RU19 36-3AA01**	**3RU19 46-3AA01**
For overload relays			**3RU11 16**	**3RU11 26**	**3RU11 36**	**3RU11 46**
Mounting type			For screw-on and snap-on attachment to a 35 mm rail; frame size S3 also on 75 mm rail			
Connection of the main circuit						
Connection type			Screw-type terminal		Screw-type terminal with box terminal	
•Terminal screw			Pozidriv 2			Allen screw 4 mm
•Connection cross-section (min./max.) 1 or 2 conductors	Single-core	mm^2	1 x (0.5 to 2.5) max. 1 x (up to 4)	1 x (1 to 6) max. 1 x (up to 10)	2 x (0.75 to 16)	2 x (2.5 to 16)
	Finely stranded without wire end ferrule	mm^2	-			
	Finely stranded with wire end ferrule	mm^2	1 x (0.5 to 2.5)	1 x (1 to 6)	2 x (0.75 to 16) 1 x (0.75 to 25)	2 x (2.5 to 35) 1 x (2.5 to 50)
	Stranded	mm^2	1 x (0.5 to 2.5) max. 1 x (up to 4)	1 x (1 to 6) max. 1 x (up to 10)	2 x (0.75 to 25) 1 x (0.75 to 35)	2 x (10 to 50) 1 x (10 to 70)
	AWG cables, single- or multi-core	AWG	1 x (18 to 14)	1 x (14 to 10)	2 x (18 to 3) 1 x (18 to 1)	2 x (10 to 1/0) 2 x (10 to 2/0)
	Ribbon cables (number x width x thickness)	mm	-	-	2 x (6 x 9 x 0.8)	2 x (6 x 9 x 0.8)

Short-circuit protection with fuses for motor feeders with short-circuit currents of up to 70 kA at 50/60 Hz 690 VAC
Permissible short-circuit protection for motor starters consisting of an overload relay and a contactor of the coordination type "2"

Adjustment range	**Frame size S00** 3 kW ≙ 3RT10 15 $I_{e\,max}$ = 7 A (at 50 Hz 400 VAC)			4 kW ≙ 3RT10 16 $I_{e\,max}$ = 9 A (at 50 Hz 400 VAC)			5.5 kW ≙ 3RT10 17 $I_{e\,max}$ = 12 A (at 50 Hz 400 VAC)			UL fuse RK5	Circuit breaker for starter protection at I_q = 50 kA / 400 VAC
A	gL/gG	aM	BS88T	gL/gG	aM	BS88T	gL/gG	aM	BS88T	A	
0.11 to 0.16	0.5	–	–	0.5	–	–	0.5	–	–	1	–
0.14 to 0.2	1	–	–	1	–	–	1	–	–	1	3RV1321-0BC10
0.18 to 0.25	1	–	–	1	–	–	1	–	–	1	3RV1321-0CC10
0.22 to 0.32	1.6	–	2	1.6	–	2	1.6	–	2	1	3RV1321-0DC10
0.28 to 0.4	2	–	2	2	–	2	2	–	2	1.6	3RV1321-0EC10
0.35 to 0.5	2	–	2	2	–	2	2	–	2	2	3RV1321-0FC10
0.45 to 0.63	2	–	4	2	–	4	2	–	4	2.5	3RV1321-0GC10
0.55 to 0.8	4	–	4	4	–	4	4	–	4	3	3RV1321-0HC10
0.7 to 1	4	–	6	4	–	6	4	–	6	4	3RV1321-0JC10
0.9 to 1.25	4	–	6	4	–	6	4	–	6	5	3RV1321-0KC10
1.1 to 1.6	6	–	10	6	–	10	6	–	10	6	3RV1321-1AC10
1.4 to 2	6	–	10	6	–	10	6	–	10	8	3RV1321-1BC10
1.8 to 2.5	10	–	10	10	–	10	10	–	10	10	–
2.2 to 3.2	10	–	16	10	–	16	10	–	16	12	–
2.8 to 4	16	–	16	16	–	16	16	–	16	16	–
3.5 to 5	20	6	20	20	6	20	20	6	20	20	–
4.5 to 6.3	20	6	20	20	6	20	20	6	20	25	–
5.5 to 8	20	10	20	20	10	20	20	10	20	30	–
7 to 10				20	16	20	20	16	20	40	–
9 to 12							20	16	25	45	–

Adjustment range	**Frame size S0** 5.5 kW ≙ 3RT10 24 $I_{e\,max}$ = 12 A (at 50 Hz 400 VAC)			7.5 kW ≙ 3RT10 25 $I_{e\,max}$ = 17 A (at 50 Hz 400 VAC)			11 kW ≙ 3RT10 26 $I_{e\,max}$ = 25 A (at 50 Hz 400 VAC)			UL fuse RK5	Circuit breaker for starter protection at I_q = 50 kA / 400 VAC
A	gL/gG	aM	BS88T	gL/gG	aM	BS88T	gL/gG	aM	BS88T	A	
1.8 to 2.5	10	–	10	10	–	10	10	–	10	10	3RV1321-1CC10
2.2 to 3.2	10	–	16	10	–	16	10	–	16	12	3RV1321-1DC10
2.8 to 4	16	–	16	16	–	16	16	–	16	16	3RV1321-1EC10
3.5 to 5	20	6	20	20	6	20	20	6	20	20	3RV1321-1FC10
4.5 to 6.3	20	6	25	20	6	25	20	6	25	25	3RV1321-1GC10
5.5 to 8	25	10	25	25	10	25	25	10	25	30	3RV1321-1HC10
7 to 10	25	16	25	25	16	25	32	16	35	40	3RV1321-1JC10
9 to 12.5	25	20	25	25	20	25	35	20	35	45	3RV1321-1KC10
11 to 16	25	20	25	25	20	25	35	20	35	60	3RV1321-4AC10
14 to 20				25	20	25	35	20	35	80	3RV1321-4BC10
17 to 22							35	20	35	80	3RV1321-4CC10
20 to 25							35	20	35	100	

Short-circuit protection with fuses for motor feeders with short-circuit currents of up to 70 kA at 50/60 Hz 690 VAC

	Frame size S2									UL fuse	Circuit breaker for
Adjustment range	15 kW ≙ 3RT10 34 $I_{e\,max}$ = 32 A (at 50 Hz 400 VAC)			18.5 kW ≙ 3RT10 35 $I_{e\,max}$ = 40 A (at 50 Hz 400 VAC)			22 kW ≙ 3RT10 36 $I_{e\,max}$ = 50 A (at 50 Hz 400 VAC)			RK5	starter protection at I_q = 50 kA / 400 VAC
A	gL/gG	aM	BS88T	gL/gG	aM	BS88T	gL/gG	aM	BS88T	A	
5.5 to 8	25	10	25	25	10	25	25	10	25	30	–
7 to 10	32	16	32	32	16	32	32	16	32	40	–
9 to 12.5	35	16	35	35	16	35	35	16	35	50	–
11 to 16	40	20	40	40	20	40	40	20	40	60	–
14 to 20	50	25	50	50	25	50	50	25	50	80	–
18 to 25	63	32	63	63	32	63	63	32	63	100	3RV1331-4DC10
22 to 32	63	35	63	63	35	63	80	35	80	125	3RV1331-4EC10
28 to 40	63	50	63	63	50	63	80	50	80	150	3RV1331-4FC10
36 to 45				63	50	80	80	50	80	175	3RV1331-4GC10
40 to 50							80	50	80	200	3RV1331-4HC10

	Frame size S3									UL fuse	Circuit breaker for
Adjustment range	30 kW ≙ 3RT10 44 $I_{e\,max}$ = 65 A (at 50 Hz 400 VAC)			37 kW ≙ 3RT10 45 $I_{e\,max}$ = 80 A (at 50 Hz 400 VAC)			45 kW ≙ 3RT10 46 $I_{e\,max}$ = 95 A (at 50 Hz 400 VAC)			RK5	starter protection at I_q = 50 kA / 400 VAC
A	gL/gG	aM	BS88T	gL/gG	aM	BS88T	gL/gG	aM	BS88T	A	
18 to 25	63	32	63	63	32	63	63	32	63	100	–
22 to 32	80	35	80	80	35	80	80	35	80	125	–
28 to 40	80	50	80	80	50	80	80	50	80	150	–
36 to 50	125	50	125	125	50	125	125	50	125	200	–
45 to 63	125	63	125	160	63	160	160	63	160	250	3RV1341-4JC10
57 to 75				160	80	160	160	80	160	300	3RV1341-4KC10
70 to 90							160	100	160	350	3RV1341-4LC10
80 to 100							160	100	160	350	3RV1341-4MC10

4.7.2 3RB10 electronic overload relays

Type			**3RB10 16**	**3RB10 26**	**3RB10 36**	**3RB10 46**
Frame size			**S00**	**S0**	**S2**	**S3**
Width			**45 mm**	**45 mm**	**55 mm**	**70 mm**
General specifications						
Tripped at			Overload, phase loss, and phase imbalance (>40% in acc. with NEMA)			
Tripping class	In acc. with IEC 60 947-4-1	CLASS	10 and 20, depending on the variant			
Phase loss sensitivity			Yes, tripped from a warm state < 3 seconds			
Overload warning			no			
Resetting and recovery						
Resetting options after tripping			Manual, remote, and automatic resetting 1)			
Recovery time	With automatic reset	min	Approx. 4			
	With manual reset	min	Immediate			
	With remote reset	min	Immediate			
Configuration						
Indication of operating status on device			Yes, by means of the "test function/contact position indicator" slider			
Test function			yes			
Reset button			yes			
Stop button			yes			
For the safe operation of motors with increased safety protection	EC special test certificate number in compliance with directive 94/9/EC		On request			
Ambient temperatures						
Storage/transportation		°C	-55 to +80			
Operation		°C	-20 to +70			
Temperature compensation		°C	Up to 70			
Permissible rated current at	Internal cubicle temperature of 60 °C	%	100 (current reduction is required at above +60 °C)			
	Internal cubicle temperature of 70 °C	%	100 (current reduction is required at above +60 °C)			
Repetition terminals						
Terminal for contactor coil			Yes	Not required		
Auxiliary switch repetition terminal			Yes	Not required		
Degree of protection	In acc. with IEC 60 529/DIN VDE 0470 Part 1		IP 20		IP 20 2)	
Shock protection	In acc. with DIN VDE 0106 Part 100		protected against touching by fingers			
Sinus shock resistance	In acc. with IEC 68 Part 2-27	*g*/ms	8/10 and 15/11			
EMC noise immunity						
Conducted disturbance neutralization - burst	In acc. with IEC 61 000-4-4: (corresponds to severity grade 3)	kV	2			
Conducted disturbance neutralization - surge	In acc. with IEC 61 000-4-5: (corresponds to severity grade 3)	kV	2/1 (line to ground/line to line)			
Electrostatic discharge	In acc. with IEC 61 000-4-2: (corresponds to severity grade 3)	kV	6/8 (contact/air discharge)			
Field-related disturbance neutralization	In acc. with IEC 61 000-4-3: (corresponds to severity grade 3)	V/m	3	10 3)	10	
EMC emitted interference			Limit value class B in acc. with CISPR 11			
Resistance to extreme climates (atmospheric humidity)		%	100			
Dimensions			See dimensioned drawings			
Site altitude		m	Up to 2000 above sea level			
Installation position			Any			
Construction type/mounting			Direct mounting/stand-alone installation with terminal bracket 4)			

1) Remote reset in conjunction with suitable accessories

2) Terminal compartment: IP 00 degree of protection

3) For the setting ranges 0.1 to 0.4 A, 0.4 to 1.6 A, and 1.5 to 6 A, it is 3 V/m.

4) For screw-on and snap-on attachment to 35 mm rail
Frame size S3 also for 75 mm rail

Type			**3RB10 16**	**3RB10 26**	**3RB10 36**	**3RB10 46**
Frame size			**S00**	**S0**	**S2**	**S3**
Width			**45 mm**	**45 mm**	**55 mm**	**70 mm**
Main circuit						
Rated insulation voltage U_i (pollution degree 3)		V	690			1000
Rated impulse strength U_{imp}		kV	6			8
Rated operating voltageU_e		V	690			1000
Current type	Direct current		No			
	Alternating current		Yes, 50/60 Hz ± 3 (other frequencies on request)			
Current setting		A	0.1 - 0.4	0.1 - 0.4	6 - 25	13 - 50
			Up to 3 - 12	Up to 6 - 25	Up to 13 - 50	Up to 25 - 100
Power loss per device (max.)		W	Approximately 0.5			
Short-circuit protection	With fuse, without contactor With fuse and contactor		See the selection and ordering data in the NSK catalog as of page 4/4 See the technical specifications (short-circuit protection with fuses for motor feeders)			
Safe isolation between main and auxiliary conducting paths	In acc. with DIN VDE 0106 Part 101 IEC 60 947-1-A1	V	On request			
Connection of the main circuit						
Connection type			Screw-type terminal		Screw-type terminal with box terminal	Screw-type terminal with box terminal [1])/bar connection
Screw-type terminal						
•Terminal screw			Pozidriv 2			Allen screw 4 mm
•Tightening torque		Nm	0.8 to 1.2	2 to 2.5	3 to 4.5	4 to 6
•Connection cross-sections (min./max.), 1 or 2 conductors	Single-core	mm^2	2 x (0.5 to 1.5) 2 x (0.75 to 2.5) max. 2 x (1 to 4)	2 x (1 to 2.5) 2 x (2.5 to 6) max. 2 x (2.5 to 10)	2 x (0.75 to 16) -	2 x (2.5 to 16) -
	Finely stranded without wire end ferrule	mm^2	-			
	Finely stranded with wire end ferrule	mm^2	2 x (0.5 to 1.5)	2 x (1 to 2.5)	2 x (0.75 to 16)	2 x (2.5 to 35)
		mm^2	2 x (0.75 to 2.5)	2 x (2.5 to 6)	1 x (0.75 to 25)	1 x (2.5 to 50)
	Stranded	mm^2	2 x (0.5 to 1.5)	2 x (1 to 2.5)	2 x (0.75 to 25)	2 x (10 to 50)
		mm^2	2 x (0.75 to 2.5) max. 2 x (1 to 4)	2 x (2.5 to 6) max. 2 x (2.5 to 10)	1 x (0.75 to 35)	1 x (10 to 70)
	AWG cables, single- or multi-core	AWG	2 x (18 to 14)	2 x (14 to 10)	2 x (18 to 3)	2 x (10 to 1/0)
		AWG	–	–	1 x (18 to 1)	2 x (10 to 2/0)
	Ribbon cables (number x width x depth)	mm	–	–	2 x (6 x 9 x 0.8)	2 x (6 x 9 x 0.8)
Bar connection						
•Terminal screw						M 6 x 20
•Tightening torque		Nm				4 to 6
•Connection cross-section	Finely stranded with cable lug	mm^2	-			2 x 70
(min./max.)	Stranded with cable lug	mm^2	-			2 x 70
	AWG cables, single-core or stranded with cable lug	AWG	-			2/0
	With connecting bars (max. width)	mm	-			12

1) The box terminal can be removed. After the box terminal has been removed, busbar and cable-lug connections are possible.

3RB10 electronic overload relays

				3RB10 16	3RB10 26	3RB10 36	3RB10 46
Type				**3RB10 16**	**3RB10 26**	**3RB10 36**	**3RB10 46**
Frame size				**S00**	**S0**	**S2**	**S3**
Width				**45 mm**	**45 mm**	**55 mm**	**70 mm**
Auxiliary circuit							
Auxiliary contact elements (number x (variant)				1 x (1 NO contact + 1 NC contact)			
Assignment of the auxiliary contact elements				1 NO contact for the "tripped by overload" signal			
				1 NC contact for switching off the contactor			
Rated insulation voltage U_i (pollution degree 3)			V	690			
Rated impulse strength U_{imp}			kV	6			
Contact rating of the auxiliary contact elements							
NC contact with alternating current AC-14/AC-15	Rated operational current I_e at U_e:						
	• 24 V		A	4			
	• 120 V		A	4			
	• 125 V		A	4			
	• 230 V		A	3			
	• 400 V		A	2			
	• 600V		A	1			
	• 690V		A	1			
NO contact with alternating current AC-14/AC-15	Rated operational current I_e at U_e:						
	• 24 V		A	4			
	• 120 V		A	4			
	• 125 V		A	4			
	• 230 V		A	3			
	• 400 V		A	2			
	• 600V		A	1			
	• 690 V		A	1			
NC contact, NO contact with direct current DC-13	Rated operational current I_e at U_e:						
	• 24 V		A	1			
	• 60 V		A	0.22			
	• 110 V		A	0.22			
	• 125 V		A	0.22			
	• 220 V		A	0.11			
Conventional free air thermal current I_{th}			A	6			
Contact reliability (suitable for PLC; 17 V, 5 mA)				yes			
Short-circuit protection							
With fuse	Performance class	gL/gG	A	6			
		rapid	A	10			
With miniature circuit breaker (C characteristic)			A	6[1])			
Safe isolation between auxiliary conducting paths in acc. with DIN VDE 0106 Part 101			V	300			
Connection of the auxiliary circuit							
Connection type				Screw-type terminal			
Connection characteristics							
•Terminal screw				Pozidriv 2			
•Tightening torque			Nm	0.8 to 1.2			
•Connection cross-sections	Single-core		mm^2	2 x (0.5 to 1.5)			
(min./max.) 1 or 2 conductors			mm^2	2 x (0.75 to 2.5)			
	Finely stranded without wire end ferrule		mm^2	-			
	Finely stranded with wire end ferrule		mm^2	2 x (0.5 to 1.5)			
			mm^2	2 x (0.75 to 2.5)			
	Stranded		mm^2	2 x (0.5 to 1.5)			
			mm^2	2 x (0.75 to 2.5)			
	AWG cables, single- or multi-core		AWG	2 x (18 to 14)			
CSA, UL, UR rating data							
Auxiliary circuit	Switching capacity			B600, R300			

1) Up to $I_K \leq 0.5$ kA; ≤ 260 V

Short-circuit protection with fuses for motor feeders with short-circuit currents of up to 50 kA at 690 VAC

Overload relay Adjustment range	Contactor	CLASS 10 Rated operating current I_e AC-3 in A at			CLASS 20			690 V Fuse links[1] NH / DIAZED / NEOZED Performance class gL/gG Coordination type[2]	Type 3NA / Type 5SB / Type 5SE	NH Type 3ND aM	415 V British Standard Fuses BS88, Type T		600 V U_L-listed fuses CLASS R K5
Type	Type	400 V	500 V	690 V	400 V	500 V	690 V	"1"	"2"	"2"	"1"	"2"	
Frame size S00													
0.1 A to 0.4 A 3RB10 16	3RT10 15[3])	0.4	0.4	0.4	0.4	0.4	0.4	25	2		25	2	1.6
0.4 A to 1.6 A 3RB10 16	3RT10 15[3])	1.6	1.6	1.6	1.6	1.6	1.6	25	6		35	6	6
1.5 A to 6 A	3RT10 15[3])	6	5	4	6	5	4	35	20		35	20	25
3RB10 16	3RT10 17[3])	6	6	6	6	6	6	35	20		35	20	
3 A to 12 A 3RB10 16	3RT10 17[3])	12	9	6.3	10	6	6.3	35	20		35	25	45
Frame size S0													
0.1 A to 0.4 A	3RT10 24[3])	0.4	0.4	0.4	0.4	0.4	0.4	63	2		63	2	1.6
0.4 A to 1.6 A	3RT10 24[3])	1.6	1.6	1.6	1.6	1.6	1.6	63	6		63	6	6
1.5 A to 6 A	3RT10 24[3])	6	6	6	6	6	6	63	25	20	63	25	25
3 A to 12 A 3RB10 26	3RT10 24[3])	12	12	12	12	12	12	63	25	20	63	25	45
6 A to 25 A	3RT10 24[3])	12	12	12	12	12	12	63	25	20	63	25	70
3RB10 26	3RT10 25[3])	17	17	13	16	16	13	63	25	20	63	25	70
	3RT10 26[3])	25	18	13	16	16	13	100	35	20	63	25	100
Frame size S2													
6 A to 25 A	3RT10 34[3])	25	25	25	22	22	22	125	63	50	125	63	100
3RB10 36	3RT10 35[3])	25	25	25	25	25	25	125	63	50	125	63	100
13 A to 50 A	3RT10 34[3])	32	32	31	22	22	22	125	63	50	125	63	125
3RB10 36	3RT10 35[3])	40	40	40	29	29	29	125	63	50	125	80	150
	3RT10 36[3])	50	50	40	32	32	33	160	80	50	125	80	200
Frame size S3													
13 A to 50 A	3RT10 44[3])	50	50	50	49	49	49	250	100	63	250	100	200
3RB10 46	3RT10 45[3])	50	50	50	50	50	50	250	100	80	250	100	200
25 A to 100 A	3RT10 44[3])	65	65	57	49	49	49	250	125	63	250	125	250
3RB10 46	3RT10 45[3])	80	80	80	53	53	53	250	160	80	250	160	350
	3RT10 46[3])	95	95	95	59	59	59	250	160	100	250	160	350

1) Please note the operating voltage.
2) Assignment and short-circuit facilities in acc. with IEC 60 947-4-1/DIN VDE 660 Part 102
Coordination type "1": Contactors or starters must not endanger people or the system in the event of a short circuit. They do not have to be suitable for further operation without repair and part replacement.
Coordination type "2": Contactors or starters must not endanger people or the system in the event of a short circuit and must be suitable for further use. There is a danger of contact welding.
3) Mounting on the contactor is possible after removal of the box terminal block.

4.7.3 3RB12 electronic overload relays

Type			**3RB12 46**	**3RB12 53**	**3RB12 57**	**3RB12 62**
Width			**70 mm**	**120 mm**	**145 mm**	**230 mm**
General specifications						
Tripped at			Overload, phase loss, phase imbalance (>40% in acc. with NEMA), ground fault, and operation of thermistor motor protection[1])			
Tripping class	In acc. with IEC 60 947-4-1	CLASS	5, 10, 15, 20, 25, and 30; adjustable by means of a 6-way rotary switch			
Phase loss sensitivity			Yes			
Overload warning			Yes, as of 1.5 x I_e given a symmetric load, and as of 0.85 x I_e given an asymmetric load			
Resetting and recovery						
Resetting options after tripping			Manual, remote, and automatic resetting [1])			
Recovery time	With automatic reset	min	When tripped by overcurrent: 5 (stored permanently) When tripped by thermistor: time until the motor temperature 5K sinks under the operating temperature When tripped by ground fault: no automatic reset			
	With manual reset	min	When tripped by overcurrent: 5 (stored permanently) When tripped by thermistor: time until the motor temperature 5K sinks under the operating temperature When tripped by ground fault: immediate			
	With remote reset	min	When tripped by overcurrent: 5 (stored permanently) When tripped by thermistor: time until the motor temperature 5K sinks under the operating temperature When tripped by ground fault: immediate			
Configuration						
Indication of operating status on device			Yes, with 3 LEDs; green "Ready" LED, red "Overload" LED, and red "Ground fault" LED [2])			
Test function			Yes, with combined TEST/RESET button [2])			
Reset button			Yes, with combined TEST/RESET button [2])			
Stop button			Yes, with combined TEST/RESET button [2])			
For the safe operation of motors with increased safety protection	EC special test certificate number in compliance with directive 94/9/EC		PTB 01 ATEX 3220			
Ambient temperatures						
Storage/transportation		°C	-40 to +80			
Operation		°C	-25 to +70			
Temperature compensation		°C	Up to 70			
Permissible rated current at	Internal cubicle temperature of 60 °C	%	100 (current reduction is not required at above +60 °C)			
	Internal cubicle temperature of 70 °C	%	100 (current reduction is not required at above +60 °C)			
Repetition terminals						
Terminal for contactor coil			Not required			
Auxiliary switch repetition terminal			Not required			
Degree of protection	In acc. with IEC 60 529/DIN VDE 0470 Part 1		IP 20 (≤ 100 A max. set current I_e IP 00 (≤ 100 A max. set current I_e			
Shock protection	In acc. with DIN VDE 0106 Part 100		Protected against finger touch	Protected against finger touch with cover		
Sinus shock resistance	In acc. with IEC 68 Part 2-27	*g*/ms	15/11			
EMC noise immunity						
Conducted disturbance neutralization - burst	In acc. with IEC 61 000-4-4: (corresponds to severity grade 3)	kV	2			
Conducted disturbance neutralization - surge	In acc. with IEC 61 000-4-5: (corresponds to severity grade 3)	kV	2			
Electrostatic discharge	In acc. with IEC 61 000-4-2: (corresponds to severity grade 3)	kV	8			
Field-related disturbance neutralization	In acc. with IEC 61 000-4-3: (corresponds to severity grade 3)	V/m	10			
EMC emitted interference			Limit value class B in acc. with EN 55 011			
Resistance to extreme climates (atmospheric humidity)		%	100			
Dimensions			See dimensioned drawings			
Site altitude		m	Up to 2000 above sea level			
Construction type/mounting			Stand-alone installation[3])	Direct mounting/stand-alone installation without additional terminal bracket [4])		

1) Tripped at ground fault only in the case of devices with the order number suffixes 20 and 30 or in conjunction with the external summation current transformer

2) For a detailed explanation, see "Description".

3) Snap-on attachment to 35 mm rail or screw-on attachment with accessories

4) For screw-on attachment

Type			3RB12 46	3RB12 53	3RB12 57	3RB12 62
Width			**70 mm**	**120 mm**	**145 mm**	**230 mm**
Main circuit						
Rated insulation voltage U_i (pollution degree 3)		V	690 (for bare/ uninsulated conductors) 1000 (for insulated conductors)	1000		
Rated impulse strength U_{imp}		kV	6	8		
Rated operating voltage U_e		V	690	1000		
Current type	Direct current		No			
	Alternating current		Yes, 50/60 Hz			
Current setting		A	1.25 - 6.3	50 - 205	125 - 500	200 - 820
			Up to 25 - 100			
Power loss per device (max.)		W	Approx. 2			
Short-circuit protection	With fuse, without contactor With fuse and contactor		See the selection and ordering data in the NSK catalog as of page 4/4 See the technical specifications (short-circuit protection with fuses for motor feeders)			
Safe isolation between main and auxiliary conducting paths	In acc. with DIN VDE 0106 Part 101 IEC 60 947-1-A1	V	Up to 690 V (using main circuit cables with an impulse withstand voltage of 6 kV)	Up to 690		
Connection of the main circuit						
Connection type			Bar-type transformer connection	Bar connection		
Screw-type terminal						
• Terminal screw			-			
• Tightening torque		Nm	-			
• Connection cross-section (min./max.), 1 or 2 conductors	Single-core	mm^2	-			
	Finely stranded without wire end ferrule	mm^2	-			
	Finely stranded with wire end ferrule	mm^2	-			
		mm^2	-			
	Stranded	mm^2	-			
		mm^2	-			
	AWG cables, single- or multi-core	AWG	-			
		AWG	-			
	Ribbon cables (number x width x depth)	mm	-			
Bar connection						
• Terminal screw			-	M8	M10	M 10 or M 12
• Tightening torque		Nm	-	10 to 14	14 to 24	14 to 24 (with M10) 20 to 25 (with M12)
• Connection cross-section	Finely stranded with cable lug	mm^2	-	35 to 95	50 to 240	
(min./max.)	Stranded with cable lug	mm^2	-	50 to 120	70 to 240	185 to 240
	AWG cables, single-core or stranded with cable lug	AWG	-	1/0 to 250 kcmil	2/0 to 500 kcmil	2/0 to 500 kcmil
	With connecting bars (max. width)	mm	-	20 x 4	30 x 6	40 x 8
Bar-type transformer connection						
• Opening diameter		mm	10 (devices ≤ 25 A max. set current I_e) 15 (devices with max. 100 A set current I_e)	-		
• Conductor cross-section	NYY	mm^2	-	-		
•	H07RN-F		10/16	-		

Type				3RB12 46	3RB12 53	3RB12 57	3RB12 62
Width				**70 mm**	**120 mm**	**145 mm**	**230 mm**
Auxiliary circuit							
Auxiliary contact elements: number x (variant)				2 x (1 NO contact + 1 NC contact)			
Assignment of the auxiliary contact elements				1 NO contact for the "tripped by overload and/or thermistor" signal 1 NC contact for tripping the contactor 1 NO contact for the "tripped by ground fault" signal 1 NC contact for tripping the contactor Or[1]) 1 NO contact for the "tripped by overload and/or thermistor and/or ground fault" signal 1 NC contact for switching off the contactor 1 NO contact for the "tripped by ground fault" signal 1 NC contact for tripping the contactor			
Rated insulation voltage U_i (pollution degree 3)			V	300			
Rated impulse strength U_{imp}			kV	4			
Contact rating of the auxiliary contact elements							
NC contact with alternating current AC-14/AC-15	Rated operational current I_e at U_e:						
	• 24 V		A	6			
	• 120 V		A	6			
	• 125 V		A	2)			
	• 230 V		A	3			
	• 400 V		A	1.5			
	• 600V		A	2)			
	• 690V		A	2)			
NO contact with alternating current AC-14/AC-15	Rated operational current I_e at U_e:						
	• 24 V		A	6			
	• 120 V		A	6			
	• 125 V		A	2)			
	• 230 V		A	3			
	• 400 V		A	1.5			
	• 600 V		A	2)			
	• 690 V		A	2)			
NC contact, NO contact with direct current DC-13	Rated operational current I_e at U_e:						
	• 24 V		A	2			
	• 60 V		A	0.55			
	• 110 V		A	0.25			
	• 125 V		A	0.25			
	• 220 V		A	0.14			
Conventional free air thermal current I_{th}			A	6			
Contact reliability (suitable for PLC; 17 V, 5 mA)				2)			
Short-circuit protection							
With fuse	Performance class	gL/gG	A	6			
		flink	A	10			
With miniature circuit breaker (C characteristic)			A	1.6[3])			
Safe isolation between auxiliary conducting paths in acc. with DIN VDE 0106 Part 101			V	300			

Connection of the auxiliary circuit			
Connection type			Screw-type terminal
Connection characteristics			
•Terminal screw			Pozidriv 2
•Tightening torque		Nm	0.8 to 1.2
•Connection cross-sections	Single-core	mm^2	1 x (0.5 to 4)
(min./max.) 1 or 2 conductors		mm^2	2 x (0.5 to 2.5)
	Finely stranded without wire end ferrule	mm^2	1 x (0.5 to 2.5)
		mm^2	2 x (0.5 to 1.5)
	Finely stranded with wire end ferrule	mm^2	1 x (0.5 to 2.5)
		mm^2	2 x (0.5 to 1.5)
	Stranded	mm^2	-
	AWG cables, single- or multi-core	AWG	Without wire end ferrule 2 x (20 to 14) 1 x (20 to 12)
			With wire end ferrule: 2 x (20 to 15) 1 x (20 to 14)
CSA, UL, UR rating data			
Auxiliary circuit	Switching capacity		B600, R300

1) The assignment of the auxiliary contact elements depends on the order number suffix
2) On request
3) Up to $I_K \leq 1000$ A

Short-circuit protection with fuses for motor feeders for short-circuit currents of up to 50 kA at 690 V for 3RB12 and 3UF50

Overload relay	Contactor	CLASS															690 V Fuse links 1)			415 V	600 V
Adjustment range		5 and 10 Rated operating current I_e AC-3 in A at			15			20			25			30			NH DIAZED NEOZED Performance class gL (gG) Coordination type 2)	Type 3NA Type 5SB Type 5SE	NH Type 3ND aM	British standards fuses BS88 Type T	U_L-listed fuses RK5
(Type)		400 V	500 V	690 V	400 V	500 V	690 V	400 V	500 V	690 V	400 V	500 V	690 V	400 V	500 V	690 V	1	2	2	2	
1.25 - 6.3 A																					
3RB1246-1P	3RT1015	6.3	5	4	6.3	5	4	6.3	5	4	6.3	5	4	6.3	5	4	35	20	-	20	25
	3RT1016	6.3	6.3	5.2	6.3	6.3	5.2	6.3	6.3	5.2	6.3	6.3	5.2	6.3	6.3	5.2	35	20	-	20	25
	3RT1017	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	35	20	-	20	25
6.3 - 25 A																					
3RB1246-1Q	3RT1015	7	—	—	7	—	—	7	—	—	7	—	—	7	—	—	35	20	-	20	60
	3RT1016	9	6.5	—	9	6.5	—	9	6.5	—	9	6.5	—	9	6.5	—	35	20	-	20	60
	3RT1017	12	9	6.3	11	9	6.3	10	9	6.3	9.5	9	6.3	9	9	6.3	35	20	-	20	60
	3RT1024	12	12	9	12	12	9	12	12	9	12	12	9	12	12	9	63	25	20	25	70
	3RT1025	17	17	13	17	17	13	16	16	13	15	15	13	14	14	13	63	25	20	25	70
	3RT1026	25	18	13	18	18	13	16	16	13	15	15	13	14	14	13	100	25	20	25	100
	3RT1034	25	25	25	25	25	25	22.3	22.3	22.3	20.3	20.3	20.3	19.1	19.1	19.1	125	63	50	63	100
	3RT1035	-	-	-	-	-	-	25	25	25	25	25	25	25	25	25	125	63	50	63	100
25 - 100 A																					
3RB1246-1E	3RT1034	32	32	–	25	25	-	-	-	-	-	-	-	-	-	-	125	63	50	63	125
	3RT1035	40	40	-	33	33	–	29	29	–	28	28	-	26	26		125	63	50	63	150
	3RT1036	50	50	–	38	38	–	32	32	–	29	29	–	26	26	–	160	80	50	80	200
	3RT1044	65	65	47	56	56	47	49	49	47	45	45	45	41	41	41	250	125	63	125	250
	3RT1045	80	80	58	61	61	58	53	53	58	47	47	47	45	45	45	250	160	80	160	250
	3RT1046	95	95	58	69	69	58	59	59	58	53	53	53	50	50	50	250	160	100	160	350
50 - 205 A																					
3RB1253-0F	3RT1054	115	115	115	93	93	93	81	81	81	74	74	74	69	69	69	355	315	160	250	450
	3RT1055	150	150	150	121	121	121	106	106	106	97	97	97	90	90	90	355	315	200	315	500
	3RT1056	185	185	185	149	149	149	131	131	131	120	120	120	111	111	111	355	315	200	315	500
125 - 500 A																					
3RB1257-0K	3RT1064	225	225	225	182	182	182	159	159	159	146	146	146	135	135	135	500	400	250	-	700
	3RT1065	265	265	265	214	214	214	188	188	188	172	172	172	159	159	159	500	400	315	-	800
	3RT1066	300	300	280	243	243	243	213	213	213	195	195	195	180	180	180	500	400	315	-	800
	3RT1075	400	400	400	324	324	324	284	284	84	260	260	260	240	240	240	630	400	400	-	800
	3RT1076	500	500	450	405	405	405	355	355	355	325	325	325	300	300	300	630	500	500	-	1200
	3RT1264	225	225	225	225	225	225	225	225	225	193	193	193	173	173	173	500	500	400	-	800
	3RT1265	265	265	265	265	265	265	265	265	265	227	227	227	204	204	204	500	500	400	-	800
	3RT1266	300	300	300	300	300	300	300	300	300	258	258	258	231	231	231	500	500	400	-	800
	3RT1275	400	400	400	400	400	400	400	400	400	344	344	344	308	308	308	800	800	630	-	1200
	3RT1276	500	500	500	500	500	500	500	500	500	430	430	430	385	385	385	800	800	630	-	1200
	3TF68	500	500	500	500	500	500	440	440	440	408	408	408	376	376	376	800	500 3)	630	500	1200
	3TF69	-	-	-	-	-	-	500	500	500	500	500	500	500	500	500	800	630 3)	630	500	2000
200 - 820 A																					
3RB1262-0L	3TF68 4)	630	630	630	502	502	502	440	440	440	408	408	408	376	376	376	1000	500 3)	630	500	1200
	3TF69 4)	820	820	820	662	662	662	572	572	572	531	531	531	500	500	500	1250	630 3)	630	630	2000

1) Please note the operating voltage
3) Please ensure that the safety clearance between the max. 3 AC operating current and the fuse rated current is maintained.
4) Mounting onto contactor possible

2) Assignment and short-circuit facilities in acc. with IEC 60947-4-1/DIN VDE 660 Part 102
Coordination type "1": The contactor or starter must not endanger people or the system in the event of a short circuit. They do not have to be suitable for further operation without repair and part replacement.
Coordination type "2": The contactor or starter must not endanger people or the system in the event of a short circuit and must be suitable for further operation. There is a danger of contact welding.

3RA1 fuseless load feeders

5

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5.1 Specifications/regulations/approvals

Coordination types

The fuseless load feeders are manufactured and tested in acc. with IEC 60947 Part 1 and Part 2.
An important selection criterion for the fuseless load feeders are the coordination types.
IEC 60947-4-1/DIN VDE 0660 Part 102 draws a distinction between two coordination types, known as coordination type 1 and coordination type 2. They describe what happens at a short circuit and the device status after a short circuit. In both coordination types, the short circuit to be dealt with is reliably disconnected. There must be no damage to systems or injury to persons. The differences lie only in the degree to which the device is damaged after the short circuit.

Coordination type 1

The fuseless load feeder can be inoperable after each short-circuit disconnection. Damage to the contactor and the circuit breaker is permissible.

Coordination type 2

After a short-circuit disconnection, there must not be any damage to the overload release or any other part. The 3RA1 fuseless load feeder can be put into operation again without the need for replacement. Only welding of the contactor contacts is permissible if they can be separated easily without any significant deformation.

Approvals/test reports

All the approvals and test certificates of the individual devices used in the feeders are valid.

5.2 Device descriptions

Fuseless load feeders are combinations of devices consisting of a circuit breaker for overload and short-circuit protection and a contactor for normal switching duty.

The 3RA fuseless feeders of SIRIUS are used to switch loads of up to 100 A and protect them against overload and short circuits.

The feeders always consist of a SIRIUS 3R circuit breaker for motor protection (3RV) and a motor contactor (3RT).
The different devices can be set up separately and connected electrically by means of cables. It is simpler to connect the circuit breakers and contactors mechanically and electrically using ready-made kits.

The circuit breaker and contactor in the combination must be compatible with each other. It is not permissible to combine contactors and circuit breakers that are not compatible.
The combinations described below have been tested individually in order to verify that the specified performance data are correct.

The 3RV circuit breaker provides overload and short-circuit protection; upstream protective devices are not required for short-circuit currents of up to 50 kA / 400 V.
The 3RT contactor takes on the normal switching of loads.
Depending on which device combination is selected, coordination type "1" or "2" is reached.
Coordination type "2", which is the more stringent test, always includes coordination type "1".
The specifications apply to direct starters and reversing starters.

Device variants

The fuseless load feeders can be set up in 4 frame sizes:

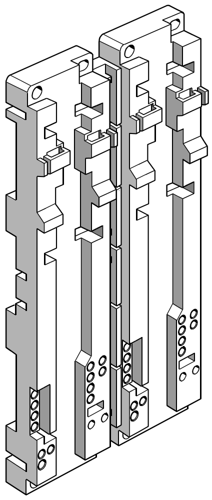
- Frame size S00: width 45 mm; for three-phase induction motors up to 0.75 kW / 400 V, coordination type "2" and 5.5 kW / 400 V, coordination type "1"
- Frame size S0: width 45 mm; for three-phase induction motors up to 7.5 kW / 400 V, coordination type "2" and 11 kW / 400 V, coordination type "1"
- Frame size S2: width 55 mm; for three-phase induction motors up to 22 kW / 400 V, coordination type "2" and coordination type "1"
- Frame size S3: width 70 mm; for three-phase induction motors up to 45 kW / 400 V, coordination type "2" and coordination type "1"

5.2.1 Mounting systems

The possible types of mounting are as follows:
- On a 35 mm rail in acc. with DIN EN 50 022
- Screw-on attachment by means of the attachment openings integrated in the rail adapter
- On busbar systems with a busbar center-to-center clearance of 40 mm or 60 mm

The following illustrations show the adapters for rail and busbar mounting:

Rail adapter



Busbar adapter

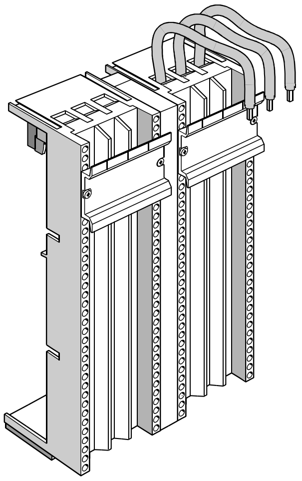


Figure 5-1: Rail adapter/busbar adapter

5.2.2 Mounting kits for self-assembly

Because SIRIUS is a modular system, the standard devices fit together optimally both mechanically and electrically. The fuseless load feeders can therefore be assembled quickly and easily in all four frame sizes. To this end, the circuit breaker and the contactor are connected to the corresponding kit.

Kits

There are kits for reversing feeders for mounting on:
- Rail, frame sizes S0, S2, S3: mounting kit for reversing operation; frame size S00: wiring kit for reversing operation
- Busbars, frame sizes S00, S0, S2: mounting kit for reversing operation

The following illustration shows how to assemble the fuseless load feeder of frame size S00 for reversing operation and rail mounting:

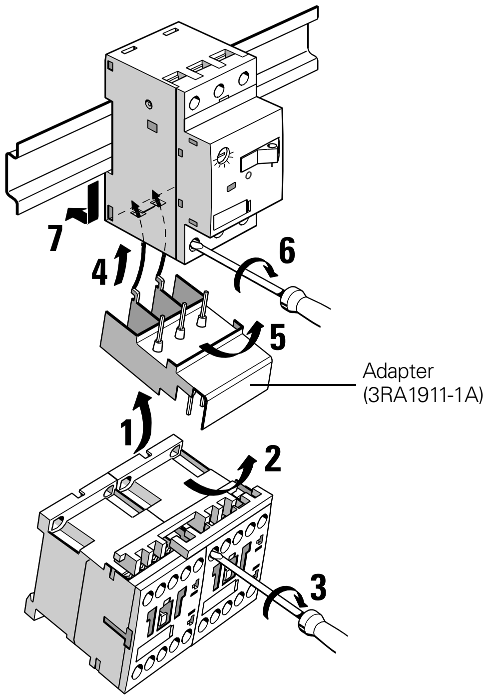


Figure 5-2: Self-assembly of a fuseless load feeder (frame size S00)

5.2.3 Complete devices

The fuseless load feeders are also available fully assembled:
- Up to 22 kW in the case of direct starters
- Up to 11 kW in the case of reversing starters

Control supply voltage

For control voltages of:
- 230 VAC / 50 Hz
- 24 VDC

Self-assembly on rails or busbar systems is recommended for other control voltages.

Auxiliary contact elements

- Direct feeders
  The contactors of frame size S00 contain a free normally open contact
- Reversing feeders
  S00/S0: electrical and mechanical interlocking

5.3 Application and areas of use

The fuseless load feeders can be used in electrical installations wherever combinations of fuses, contactors, and overload relays have been used up to now. The greater functionality of the circuit breaker over fuses, and their suitability as emergency-stop and disconnecting switches, means that many requirements can be met more easily with a fuseless load feeder.

5.4 Accessories

5.4.1 Accessories for the individual devices

The accessories for the individual devices can also be used in the load feeder.
You will find information on the accessories of the contactors in Chapter 3, "Contactors" (Section 3.4, "Accessories").

You will find information on the accessories of the circuit breakers in Chapter 2, "Circuit breakers" (Section 2.4, "Accessories").

5.4.2 Accessories specifically for the SIRIUS 3RA fuseless load feeder

The following accessories facilitate the setup and wiring of the fuseless load feeder:

Accessory	Description
Auxiliary switch for the circuit breaker	• Transverse and connectable from above • 1 changeover contact, 1 normally open contact + 1 normally closed contact or 2 normally open contacts
Auxiliary switch blocks for the contactor	Snap-on and connectable from below
Link modules	• Provide electrical connections between circuit breakers and link modules • Also provide a mechanical connection in frame sizes S00 and S0
Wiring kits	• Electrical and mechanical connection for reversing combinations • The wiring kit can be combined with the link module • In the case of frame size S00, the wiring module contains integrated cables for electrical interlocking

Table 5-1: Fuseless load feeder, accessories

5.4.3 Instructions for self-assembly

Fuseless load feeder for rail mounting

Assembly

The following illustration and the table below it show how to assemble the fuseless load feeder:

- Rail mounting
- Frame size S00
- Reversing operation

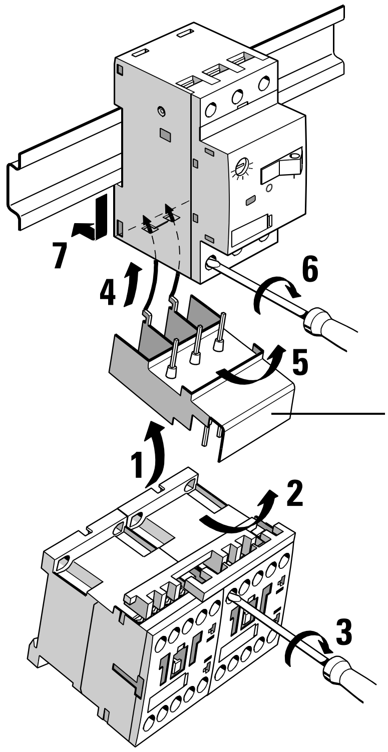


Figure 5-3: Self-assembly, rail, reversing operation (frame size S00)

Step	Procedure
1	Hook the back of the right contactor of the contactor combination onto the link module
2	With a tilting movement, insert the connecting pins of the link module into the upper terminal openings of the contactor
3	Tighten the upper terminal screws of the contactor
4	Hook the link module onto the back of the circuit breaker
5	With a tilting movement, insert the connecting pins of the link module into the lower terminal openings of the circuit breaker
6	Tighten the lower terminal screws of the circuit breaker
7	Snap the circuit breaker and thus the feeder onto the rail

Table 5-2: Self-assembly of the reversing starter for rail (frame size S00)

The following illustrations show how to assemble the fuseless load feeder:

- Rail mounting
- Frame sizes S00 to S3
- Direct starters

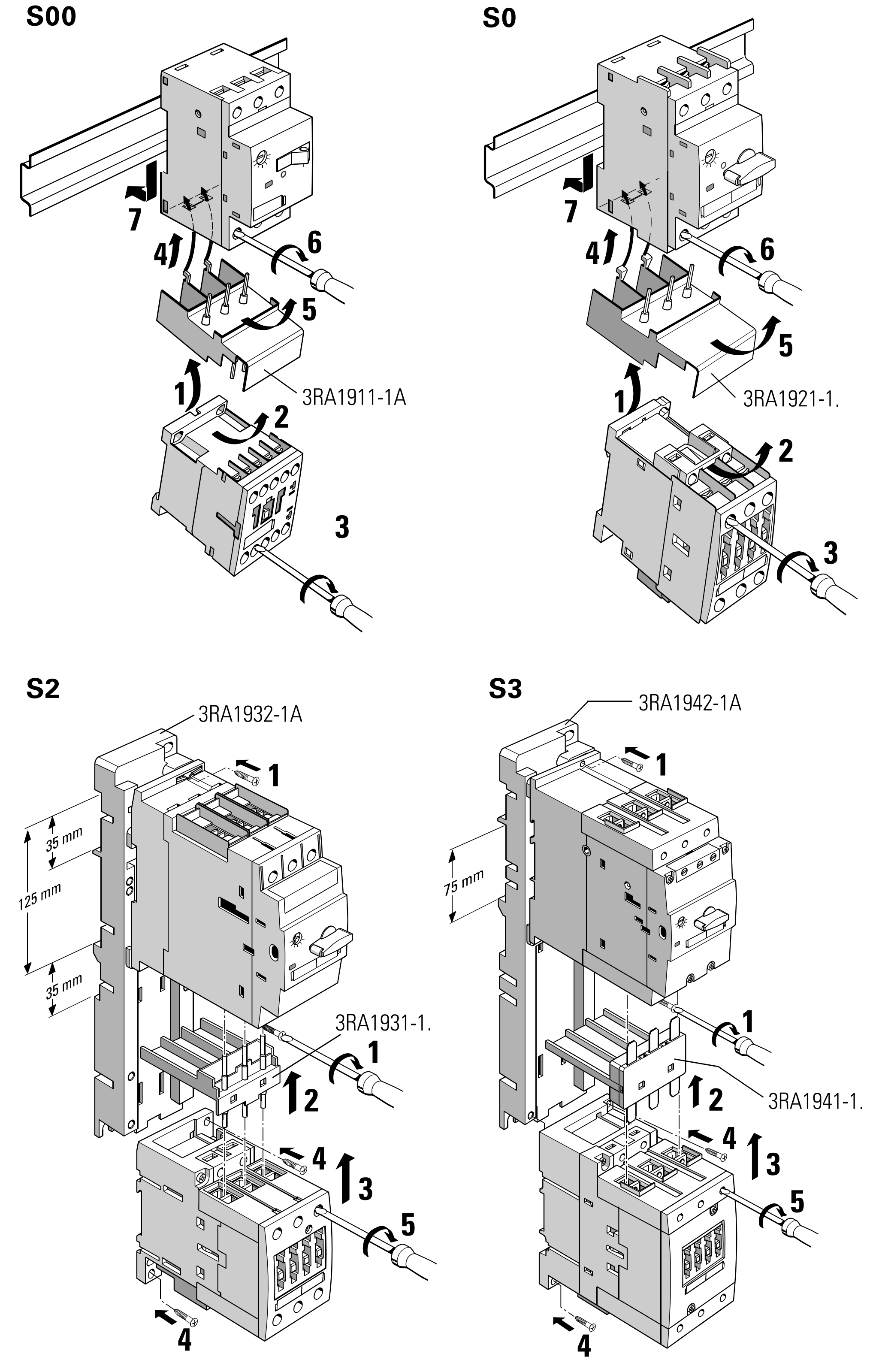


Figure 5-4: Self-assembly, rail, direct starter (frame sizes S00 to S3)

The following illustrations show how to assemble the fuseless load feeder:

- Rail mounting
- Frame sizes S00 with Cage Clamp terminal system

Direct starter

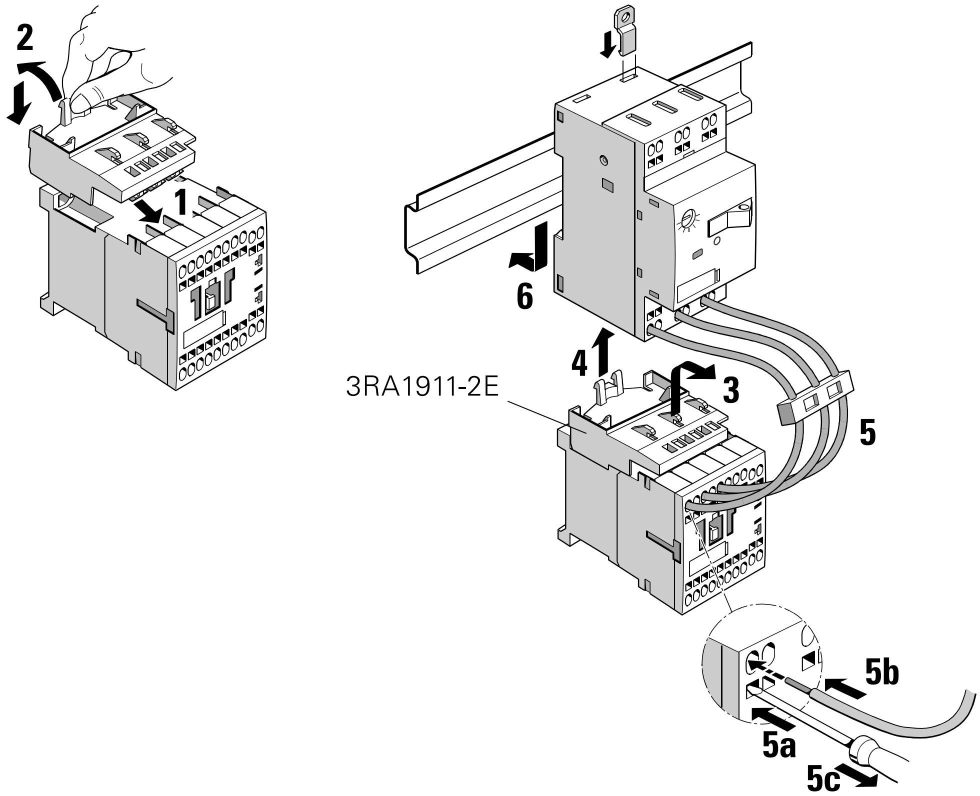


Figure 5-5: Self-assembly, rail, direct starter (frame size S00, Cage Clamp)

The following illustrations show how to assemble the fuseless load feeder:
- Rail adapter
- Reversing operation
- Frame size S0

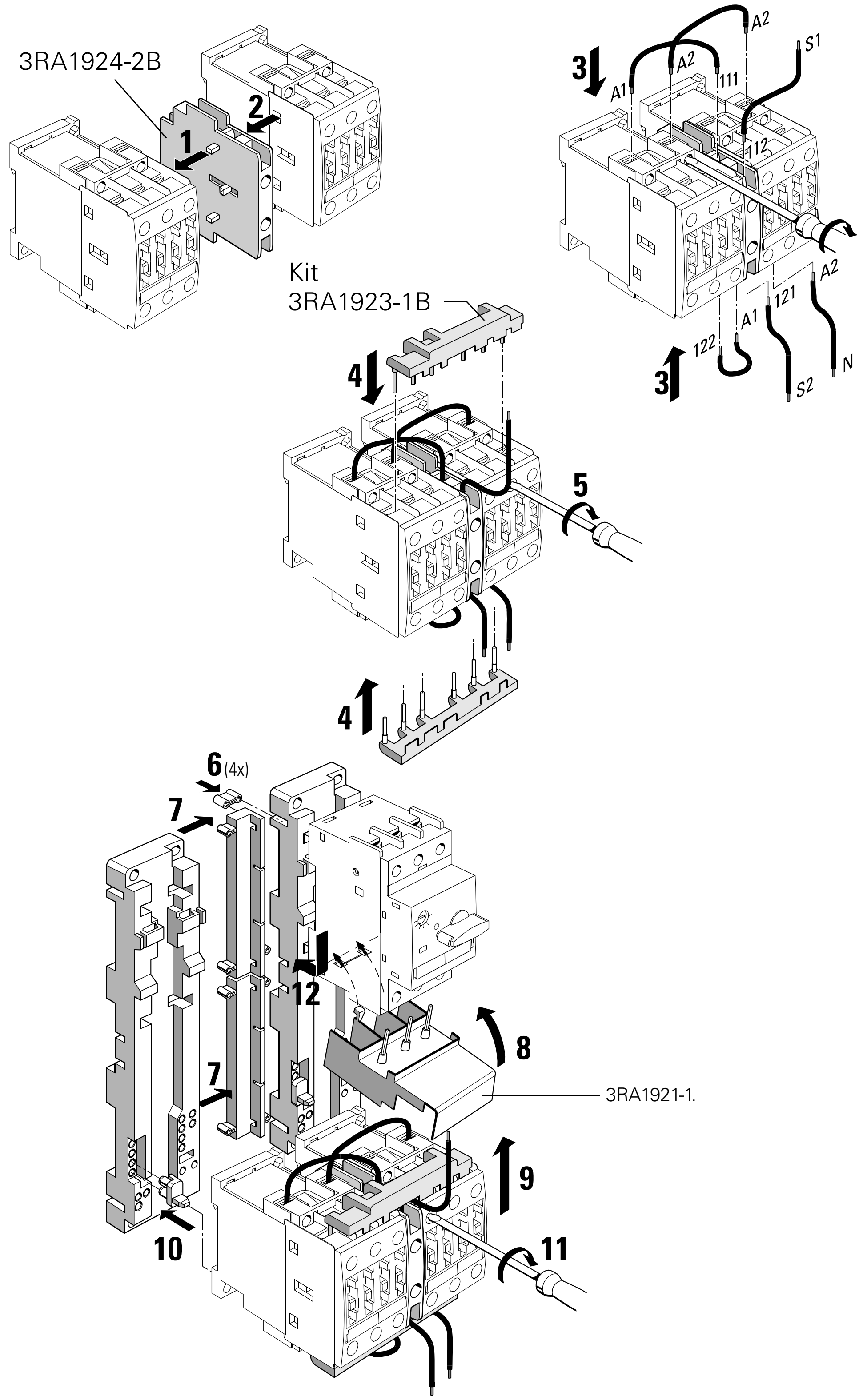


Figure 5-6: Self-assembly, rail, reversing operation (frame size S0)

The following illustrations show how to assemble the fuseless load feeder:

- Rail adapter
- Reversing operation
- Frame size S2 (assembly of frame size S3 is analogous)

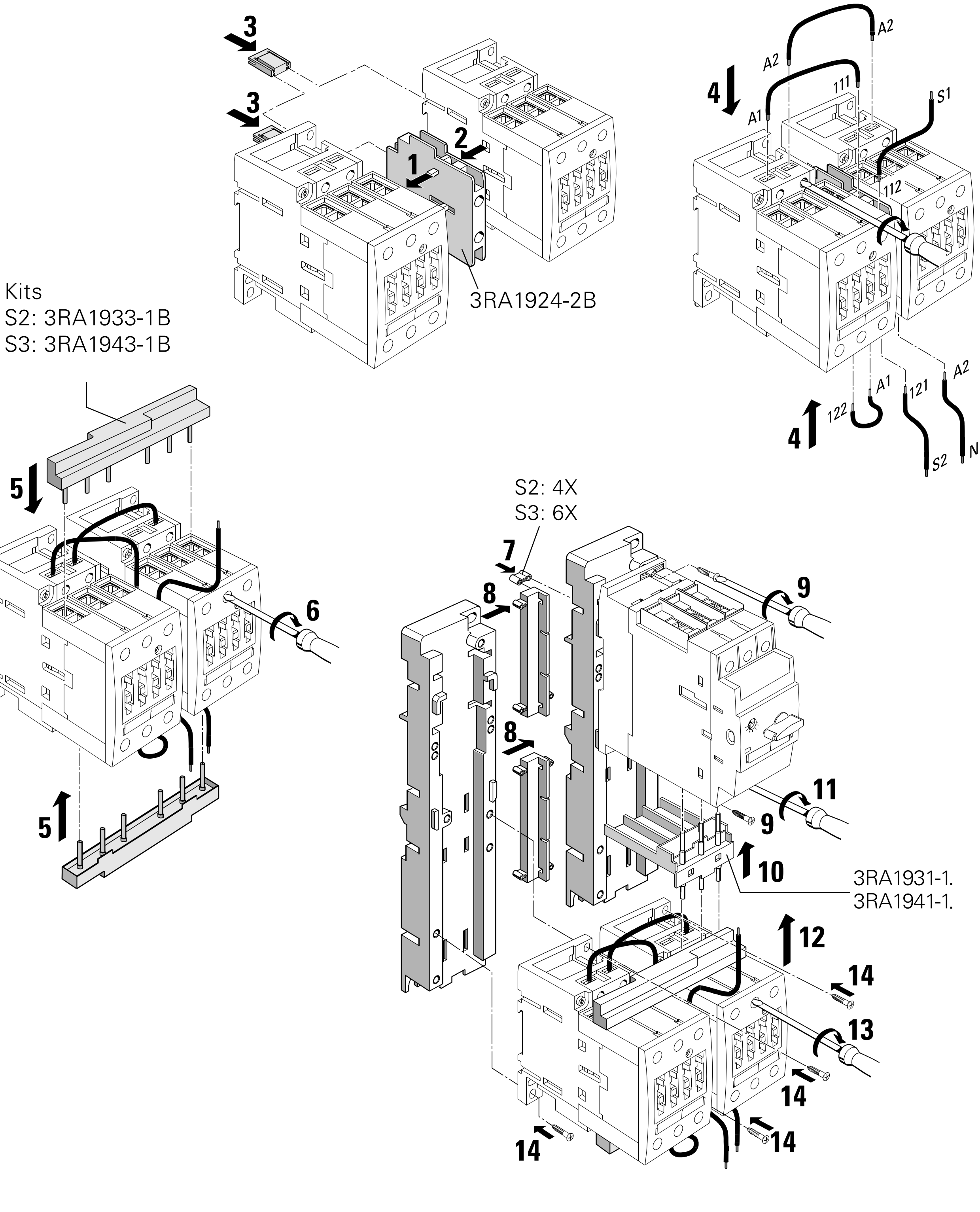


Figure 5-7: Self-assembly, rail, reversing operation (frame sizes S2 and S3)

Fuseless feeders for busbar mounting

There are kits available for reversing operation for frame sizes S00 to S2. The fuseless load feeders of frame size S3 are not suitable for busbar mounting.

Direct starters of frame sizes S00 to S2

The following illustrations show how to assemble the fuseless load feeder:

- Busbar adapter
- Direct starters
- Frame sizes S00 to S2

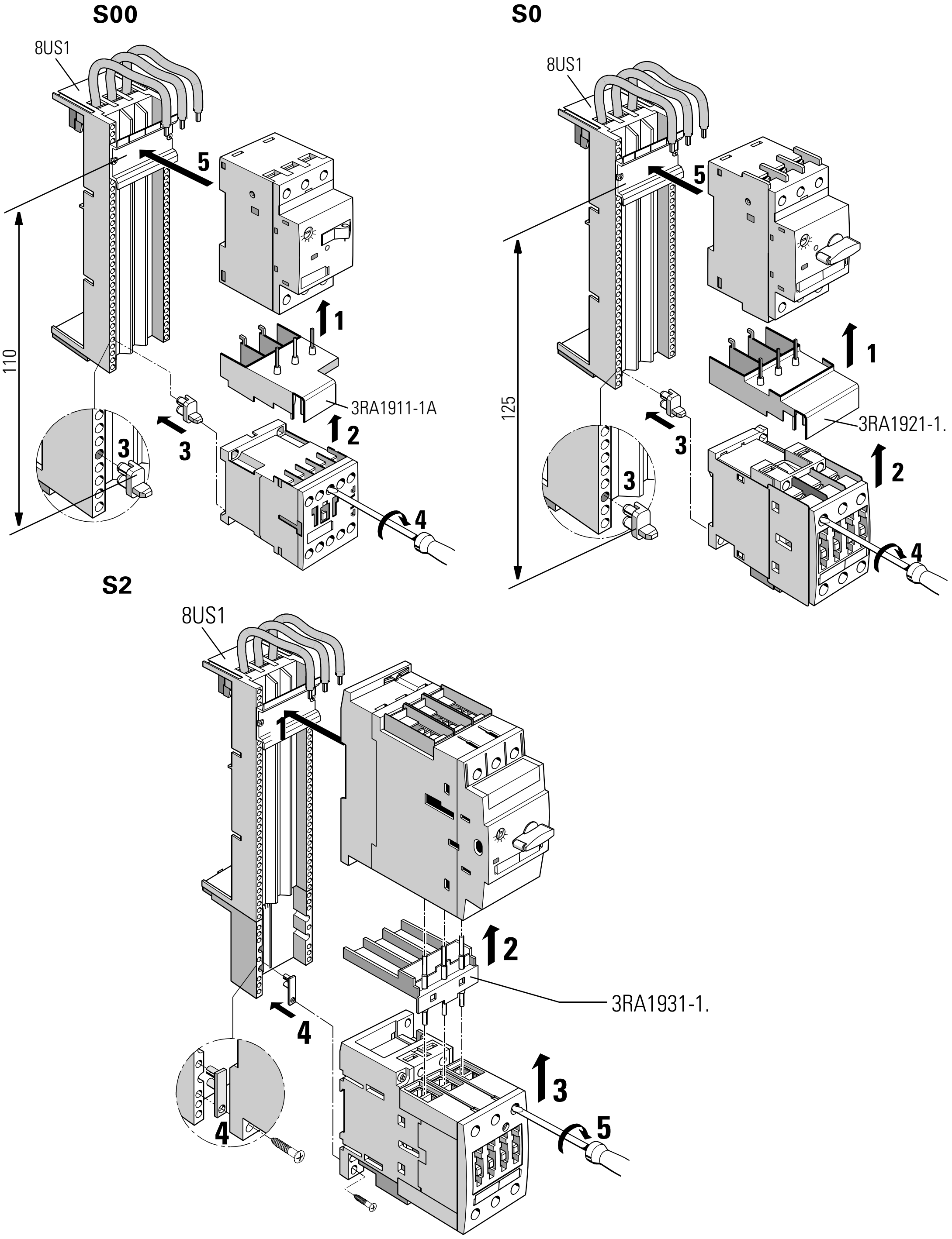


Figure 5-8: Self-assembly, busbars, direct starters (frame sizes S00 and S2)

The following illustrations show how to assemble the fuseless load feeder:
- Busbar adapter
- Direct starters
- Frame sizes S00 and S0 with Cage Clamp terminal system

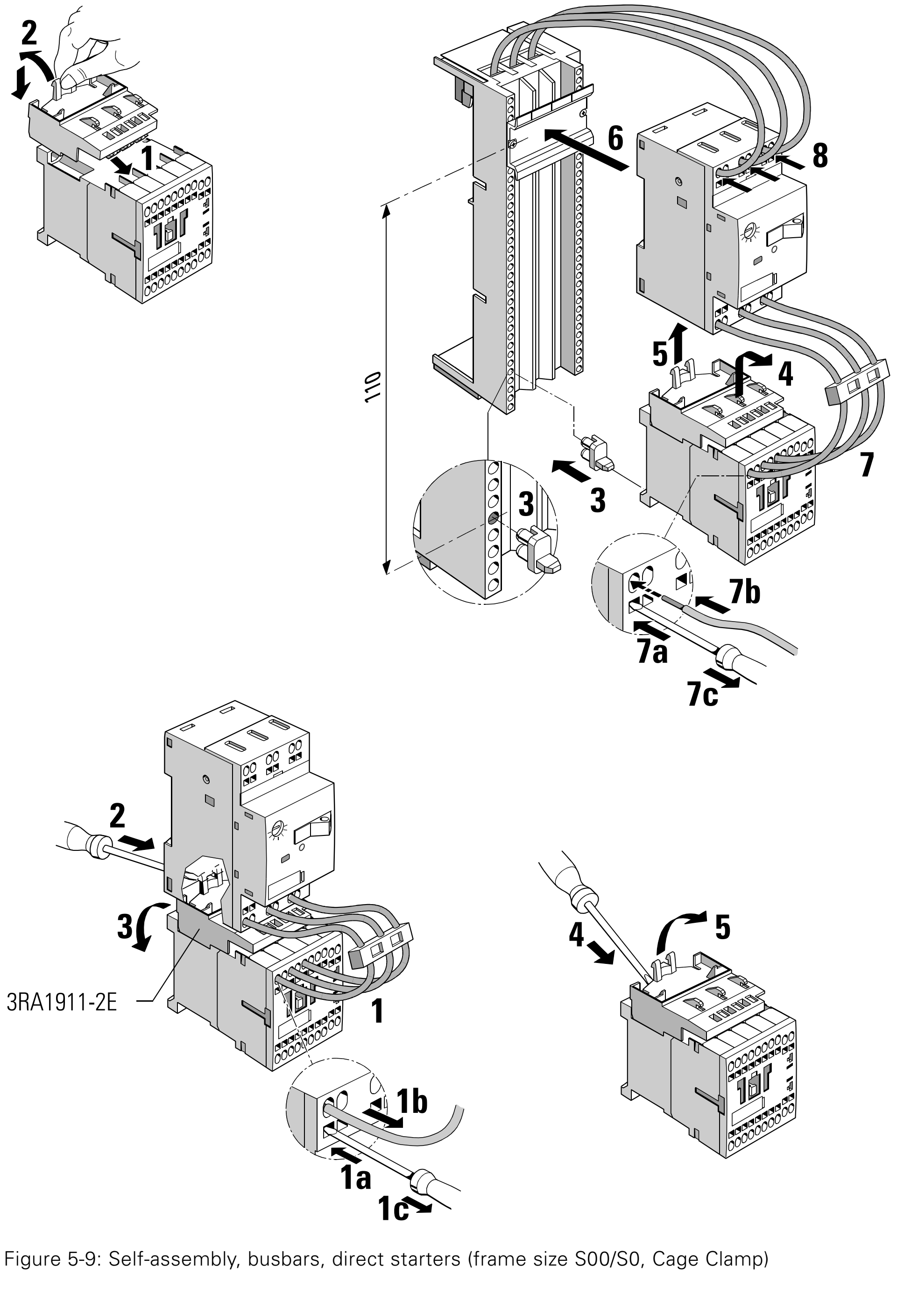
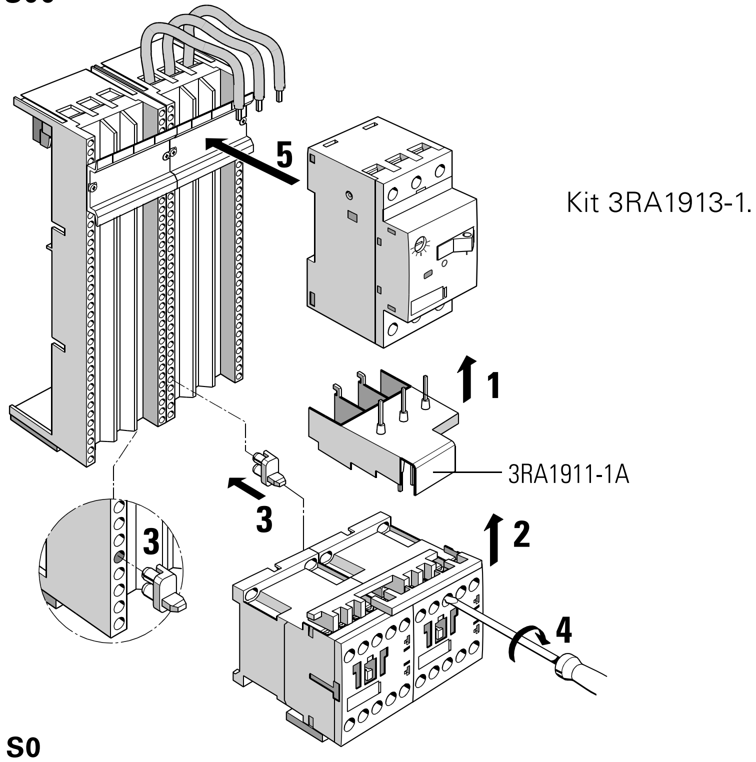


Figure 5-9: Self-assembly, busbars, direct starters (frame size S00/S0, Cage Clamp)

Reversing operation of frame sizes S00 to S2

The following illustrations show how to assemble the fuseless load feeder:
- Busbar adapter
- Reversing operation
- Frame sizes S00 to S2

S00



S0

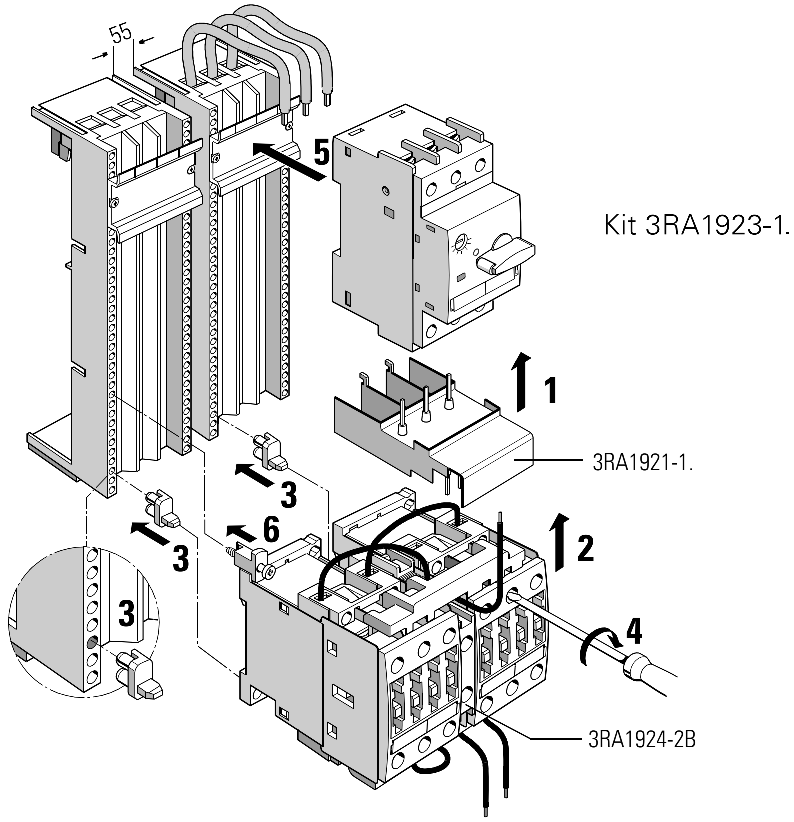


Figure 5-10: Self-assembly, busbars, reversing operation (frame sizes S00 and S0)

S2

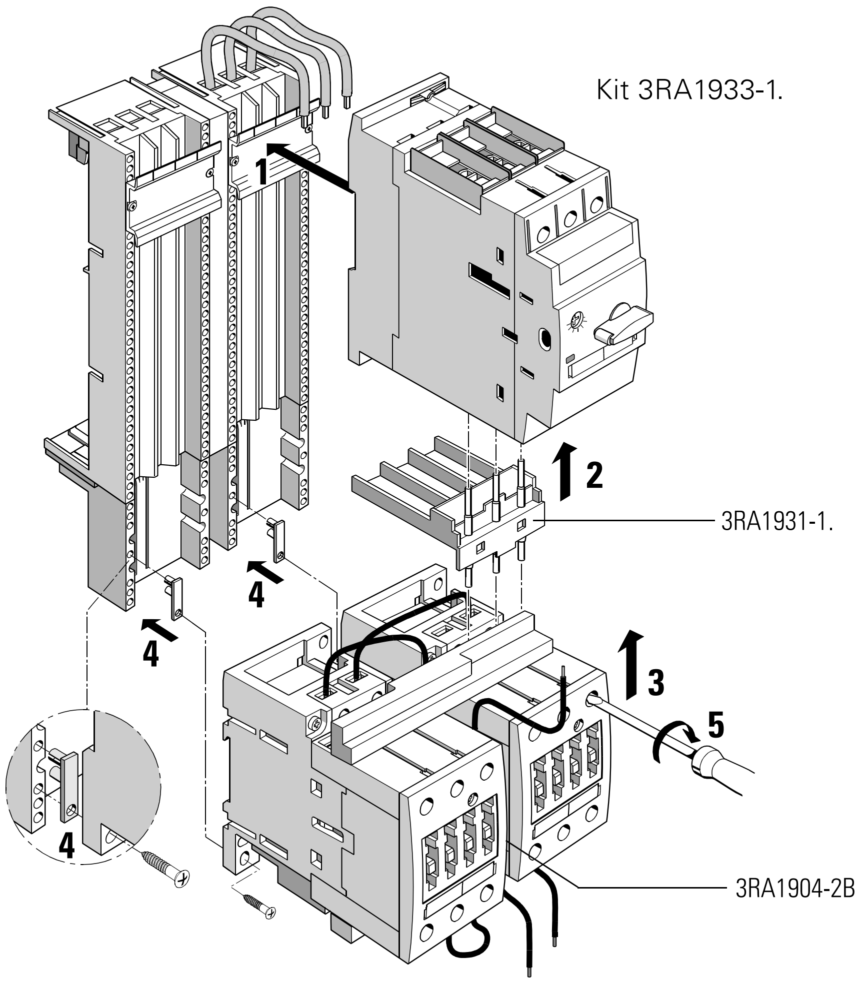


Figure 5-11: Self-assembly, busbars, reversing operation (frame size S2)

5.5 Mounting and connection

5.5.1 Mounting

Snap-on attachment

The fuseless load feeders can be snapped onto a 35 mm rail in acc. with DIN EN 50 022.

Rail mounting without adapter

The fuseless direct feeders of frame sizes S00 and S0 and reversing feeders S00 can be snapped onto the rail without an adapter with the circuit breaker. No tools are required for either mounting or removal.
A rail adapter is available as an accessory for frame sizes S00/S0. The reversing feeders of frame sizes S2/S3 are mounted with a rail adapter.

Rail mounting with adapter

To mount frame sizes S2 and S3 and reversing feeders S0 on a rail, adapters must be used for stability reasons. These are available as accessories. To remove them, the rail adapter is unlocked with a screwdriver. You will find information on this in Section 2.5.1 on how to mount circuit breakers.

All feeders can be mounted with a rail adapter.

Screw-on attachment

Screw-on attachment is implemented in the case of sizes S00 and S0 by means of push-in lugs (see Section 2.4 for information on circuit-breaker accessories).
In the case of sizes S2 and S3, the holes for screw-on attachment are integrated in the mandatory rail adapter.
The following illustration shows screw-on attachment by means of push-in lugs in the case of the fuseless load feeder of frame size S00:.

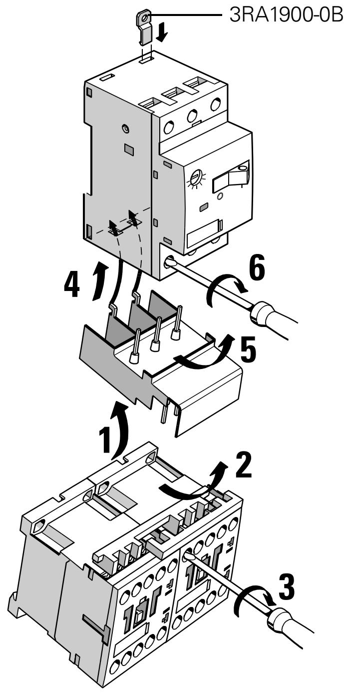


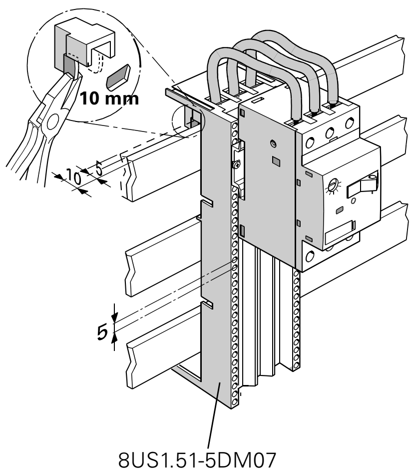
Figure 5-12: Screw-on attachment, fuseless load feeder (frame size S00)

Important
In the case of screw-on attachment without a rail adapter, the feeder must not be screwed onto a conductive surface. Insulation is necessary so that, in the event of a short circuit of the circuit breaker, there is no short circuit to the base plate.

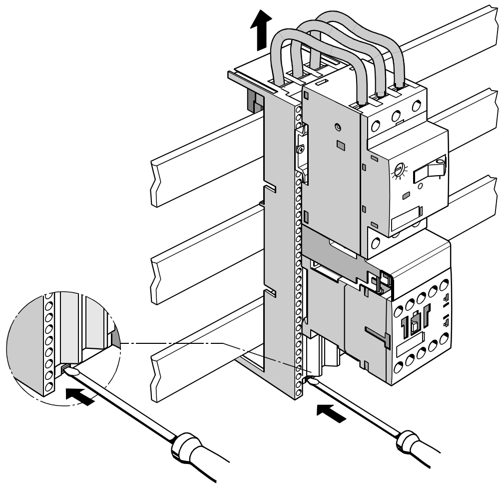
Busbar mounting

The following illustrations show busbar mounting and removal of the fuseless load feeders S00 to S2.

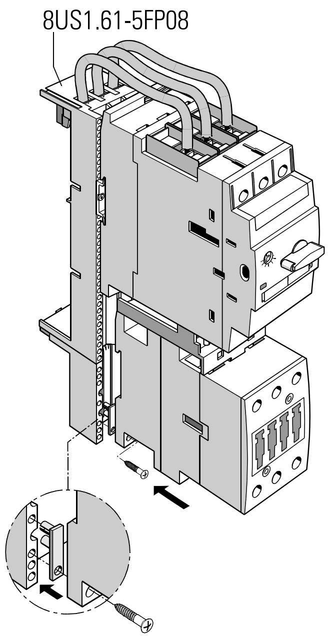
S00 (S0): Mounting



S00 (S0): Removal



S2: Mounting



Removal of the extension piece

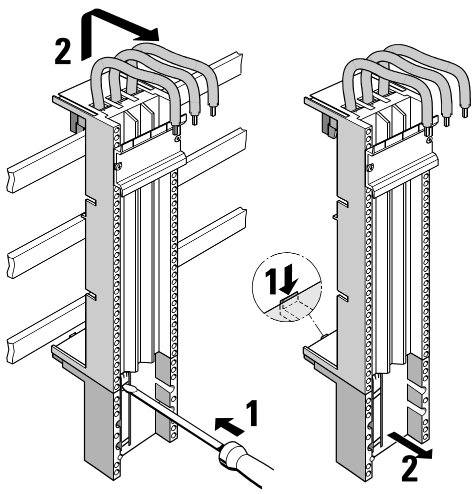


Figure 5-13: Busbar system, mounting/removal (frame sizes S00 to S2)

5.5.2 Connection

The fuseless load feeders are available with the SIGUT® terminal system.

Conductor cross-sections

The following table gives the permissible conductor cross-sections for fuseless load feeders. The specifications apply to main and auxiliary connections.

Frame sizes S00 and S0:

	S00 A1/A2; NO/NC L1 L2 L3 T1 T2 T3	S0 A1/A2; NO/NC	S0 L1 L2 L3 T1 T2 T3
Ø 5 ... 6 mm / PZ2	0.8 to 1.2 Nm 7 to 10.3 lb.in	0.8 to 1.2 Nm 7 to 10.3 lb.in	2 to 2.5 Nm 18 to 22 lb.in
10	2 x (0.5 to 1.5 mm²) 2 x (0.75 to 2.5 mm²)	2 x (0.5 to 1.5 mm²) 2 x (0.75 to 2.5 mm²)	2 x (1 to 2.5 mm²) 2 x (2.5 to 6 mm²)
10	2 x (0.5 to 2.5 mm²)	2 x (0.5 to 2.5 mm²)	2 x (1 to 2.5 mm²) 2 x (2.5 to 6 mm²)
AWG	2 x (18 to 14)	2 x (18 to 14)	2 x (14 to 10)

Table 5-3: Conductor cross-sections (frame size S00/S0)

Frame size S2:

S2			
A1/A2; NO/NC		**L1 L2 L3 T1 T2 T3**	
Ø 5 ... 6 mm / PZ2	0.8 to 1.2 Nm 7 to 10.3 lb.in	Ø 5 ... 6 mm / PZ2	3 to 4.5 Nm 27 to 40 lb.in
10	2 x (0.5 to 1.5 mm²) 2 x (0.75 to 2.5 mm²)	13	2 x (0.75 to 16 mm²)
10	2 x (0.5 to 2.5 mm²)	13	2 x (0.75 to 16 mm²) 1 x (0.75 to 25 mm²)
----	----	13	2 x (0.75 to 25 mm²) 1 x (0.75 to 35 mm²)
AWG	2 x (18 to 14)	**AWG**	2 x (18 to 3) 1 x (18 to 2)

Table 5-4: Conductor cross-sections (frame size S2)

Frame size S3:

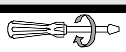
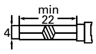
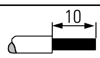
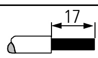
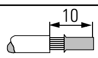
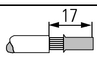
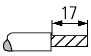
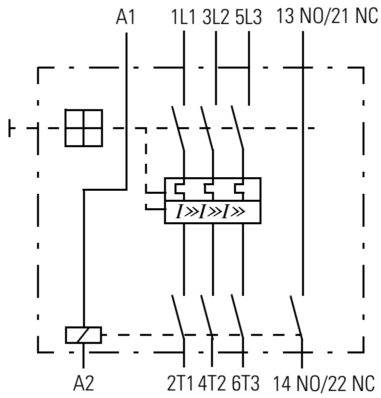
S3			
A1/A2; NO/NC		**L1, L2, L3 T1,T2,T3**	
 ∅ 5 ... 6 mm / PZ2	0.8 to 1.2 Nm 7 to 10.3 lb.in		4 to 6 Nm 35 to 53 lb.in
	2 x (0.5 to 1.5 mm²) 2 x (0.75 to 2.5 mm²)		2 x (2.5 to 16 mm²)
	2 x (0.5 to 2.5 mm²)		2 x (2.5 to 35 mm²) 1 x (2.5 to 50 mm²)
----	----		2 x (10 to 50 mm²) 1 x (10 to 70 mm²)
AWG	2 x (18 to 14)	**AWG**	2 x (10 to 1/0) 1 x (10 to 2/0)

Table 5-5: Conductor cross-sections (frame size S3)

5.5.3 Circuit diagrams

Direct starters

S00



S0 to S3

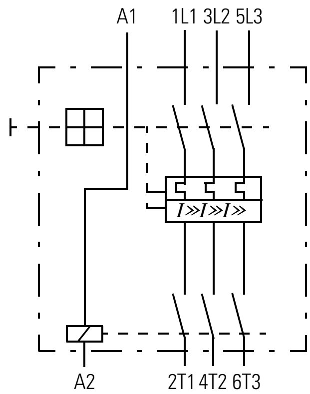
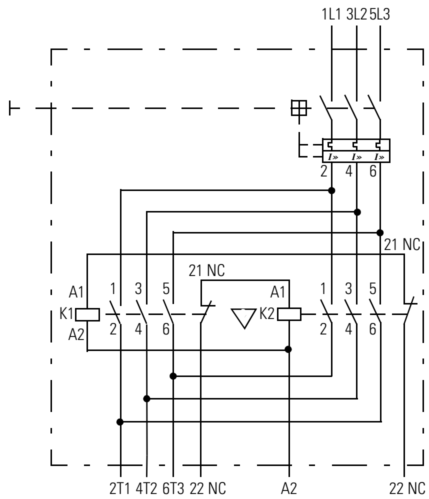


Figure 5-14: Circuit diagrams, direct starters (frame sizes S00 to S3)

Reversing starters

S00



S0 to S3

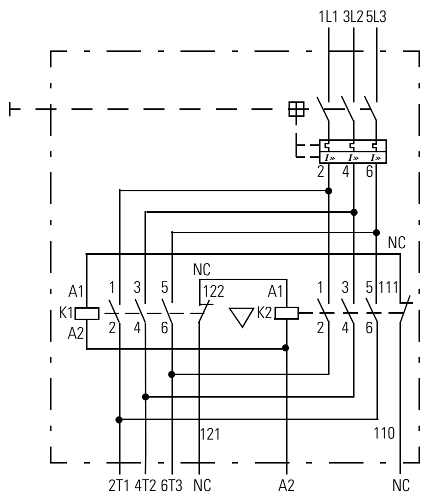


Figure 5-15: Circuit diagrams, reversing starters (frame sizes S00 to S3)

5.6 Dimensioned drawings (dimensions in mm)

3RA1 fuseless load feeders - frame size S00 for rail

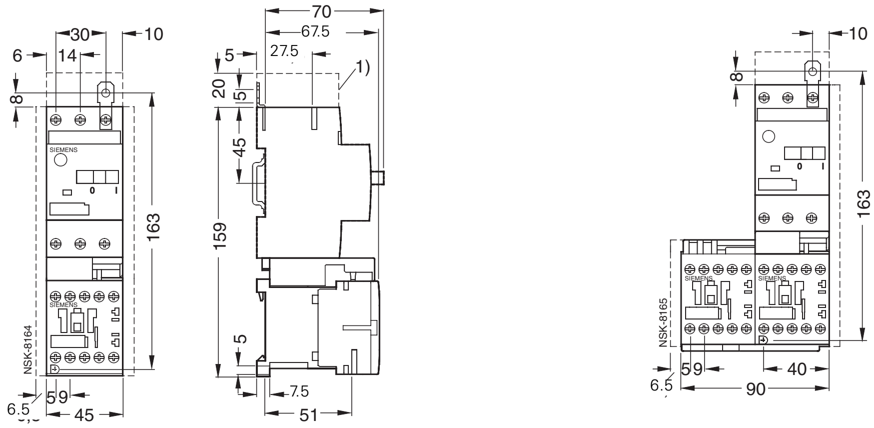


Figure 5-16: 3RA11 10-..A.. for direct-on-line starting 3RA12 10-..A.. for reversing operation
1) Space above the arc chute
Clearance to grounded parts at the side at least 6 mm

3RA1 fuseless load feeders - frame size S00 for 40 mm and 60 mm busbar systems

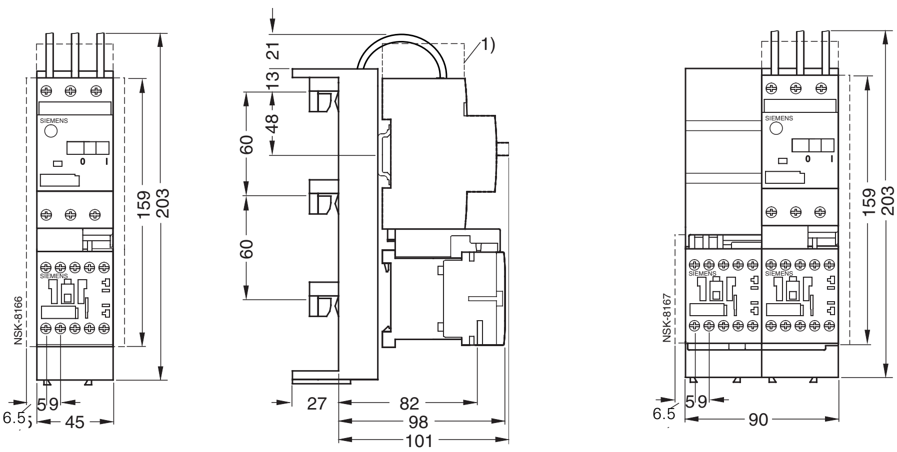


Figure 5-17: 3RA11 10-..C.., 3RA11 10-..D.. for direct-on-line starting 3RA12 10-..C.., 3RA12 10-..D.. for reversing operation
1) Space above the arc chute
Clearance to grounded parts at the side at least 6 mm

3RA1 fuseless load feeders - frame size S0 for rail

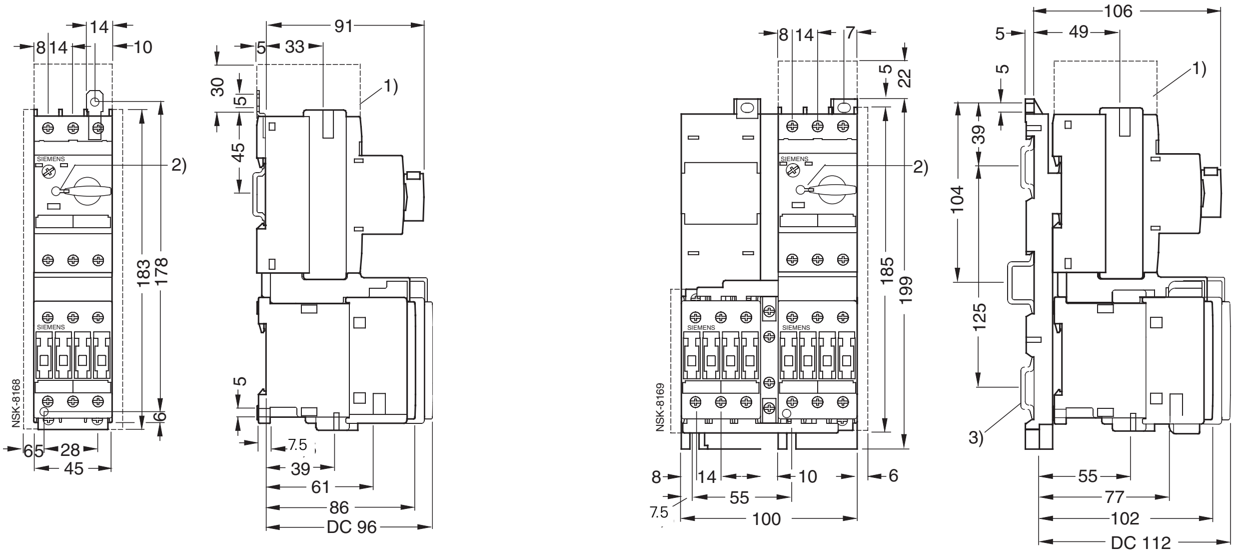


Figure 5-18: 3RA11 20-..A.. for direct-on-line starting 3RA12 20-..B.. for reversing operation
1) Space above the arc chute
2) Lockable in zero position with a shackle diameter of 5 mm
3) Attached using two 35 mm rails with a depth of 7.5 mm in acc. with EN 50 022 or one 75 mm rail in acc. with EN 50 023.
Clearance to grounded parts at the side at least 6 mm

3RA1 fuseless load feeders - frame size S0 for 40 mm and 60 mm busbar systems

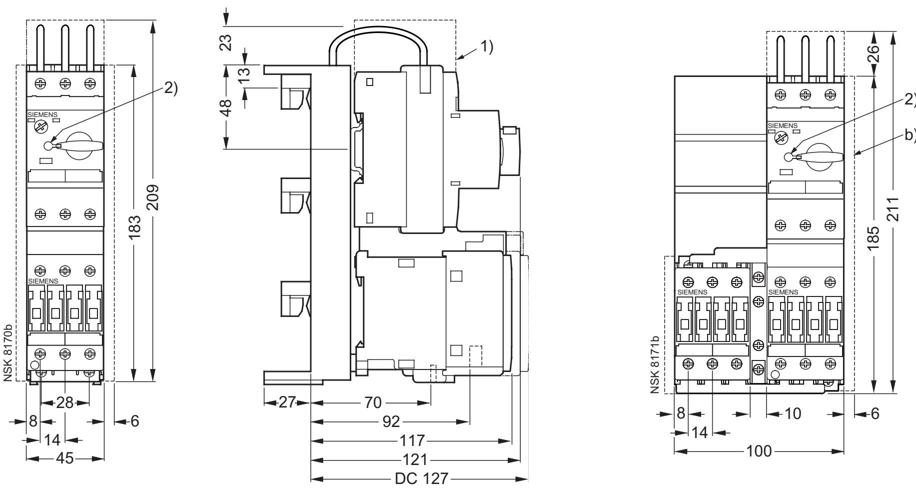
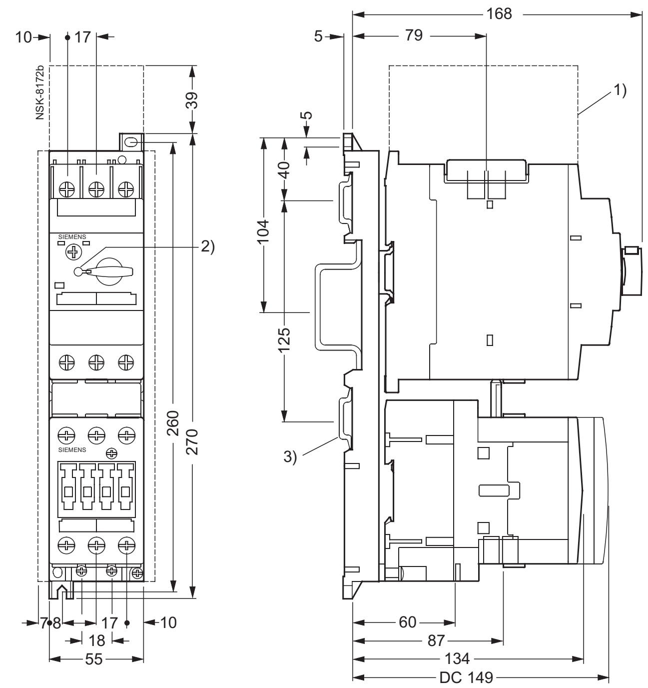


Figure 5-19: 3RA11 20-..C.., 3RA11 20-..D.. for direct-on-line starting 3RA1220-..C.., 3RA1120-..D.. for reversing operation
1) Space above the arc chute
2) Lockable in zero position with a shackle diameter of 5 mm
Clearance to grounded parts at the side at least 6 mm

3RA1 fuseless load feeders - frame size S2 for rail



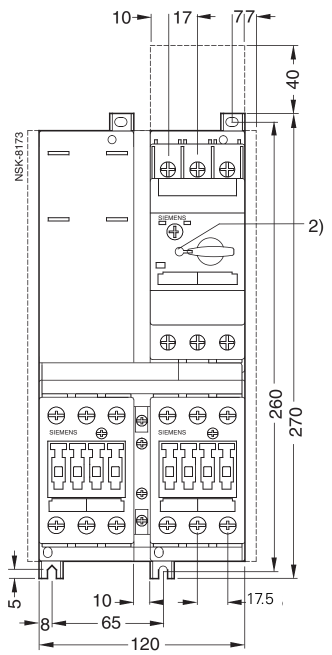
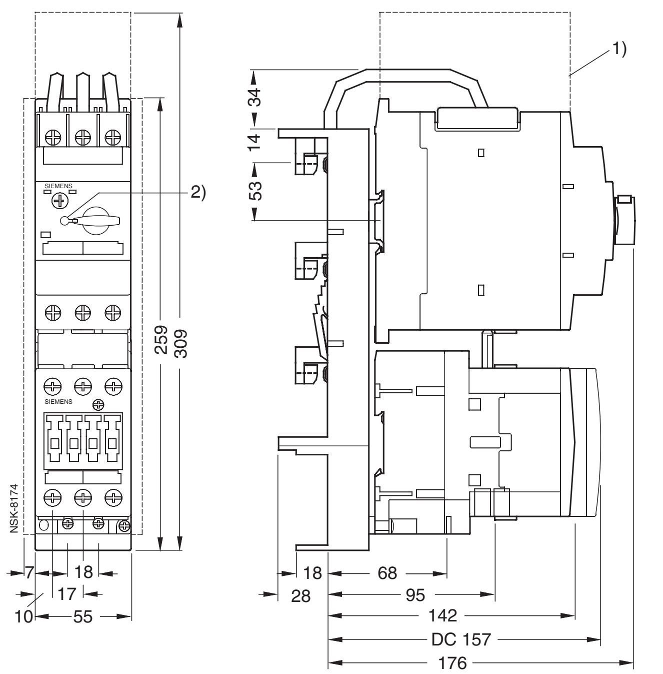


Figure 5-20: 3RA1 direct-on-line starting (frame size S2) 3RA1 reversing operation (frame size S2)
1) Space above the arc chute
2) Lockable in zero position with a shackle diameter of 5 mm
3) Attached using two 35 mm rails with a depth of 7.5 mm in acc. with EN 50 022 or one 75 mm rail in acc. with EN 50 023.
Clearance to grounded parts at the side at least 6 mm

3RA1 fuseless load feeders - frame size S0 for 40 mm and 60 mm busbar systems



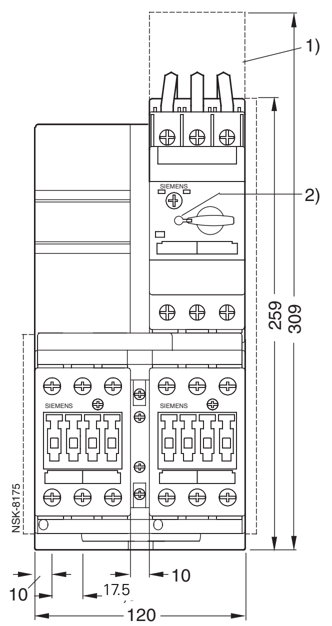


Figure 5-21: 3RA1 direct-on-line starting (frame size S0) 3RA1 reversing operation (frame size S0)
1) Space above the arc chute
2) Lockable in zero position with a shackle diameter of 5 mm
Clearance to grounded parts at the side at least 6 mm

3RA1 fuseless load feeders - frame size S3 for rail

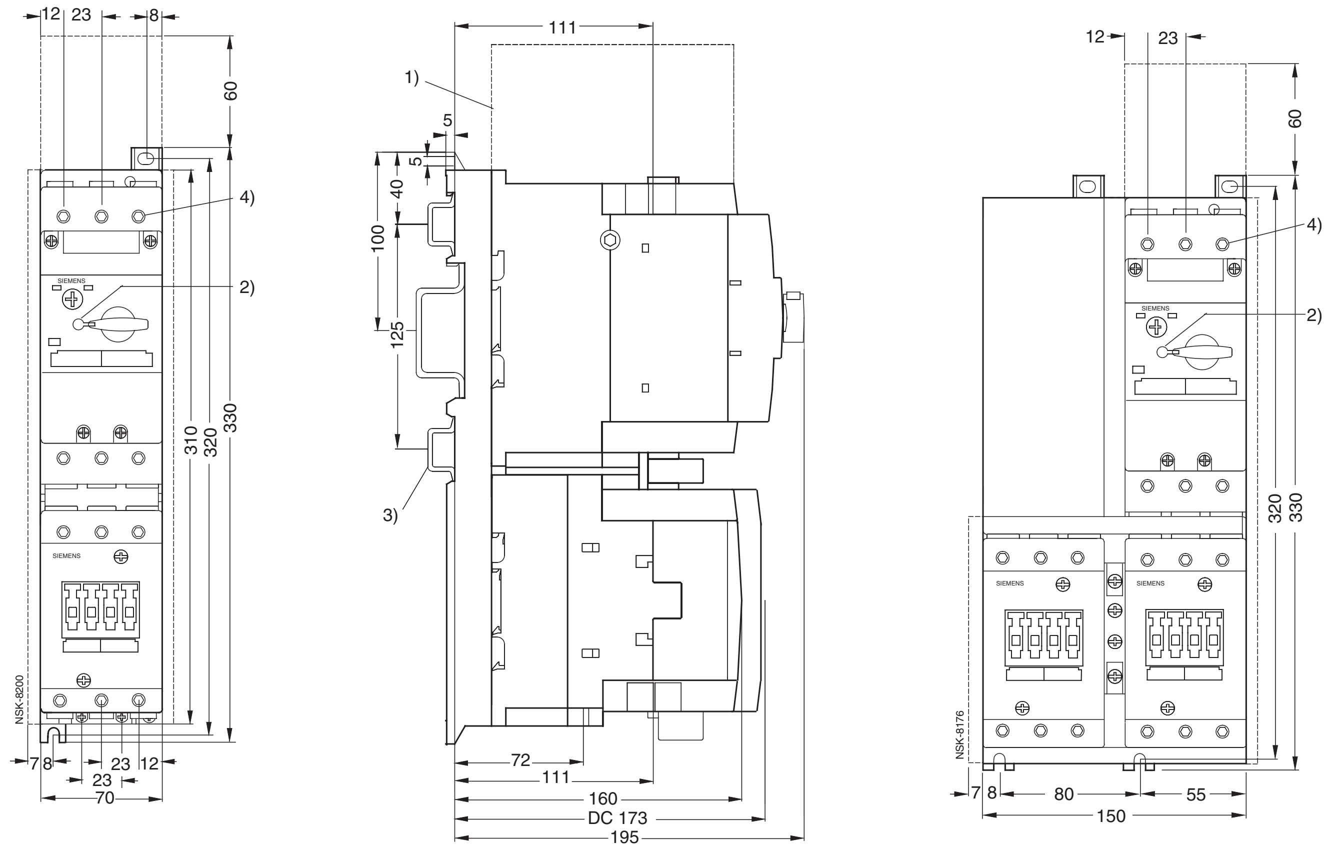


Figure 5-22: 3RA1 direct-on-line starting (frame size S3) 3RA1 reversing operation (frame size S3)

1) Space above the arc chute
2) Lockable in zero position with a shackle diameter of 5 mm
3) Attached using two 35 mm rails with a depth of 7.5 mm in acc. with EN 50 022 or one 75 mm rail in acc. with EN 50 023.
4) Hexagonal socket 4 mm

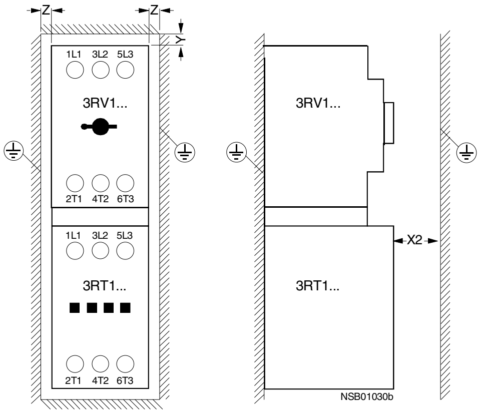
Clearance to grounded parts at the side at least 6 mm

5.7 Technical specifications

Installation regulations for 400/500 VAC

When installing the combinations, the following clearances must be maintained to grounded parts:

Circuit breakers combined with contactors			Clearances to grounded or live parts		
Circuit breaker	Contactor	Rated operational voltage	Y mm	X2[1]) mm	Z mm
3RV1. 1 with	3RT10 1	400/500 V	20	10	9
3RV1. 2 with	3RT10 1	400/500 V	30	10	9
	3RT1 .2	400/500 V	30	10	9
	3RT1 .3	400/500 V	30	10	9
3RV1. 3 with	3RT10 2	400/500 V	50	10	10
	3RT1 .3	400/500 V	50	10	10
	3RT10 4	400/500 V	50	10	10
3RV1. 4 with	3RT10 4	400 V	90	10	12
	3RT10 4	500 V	220	10	20



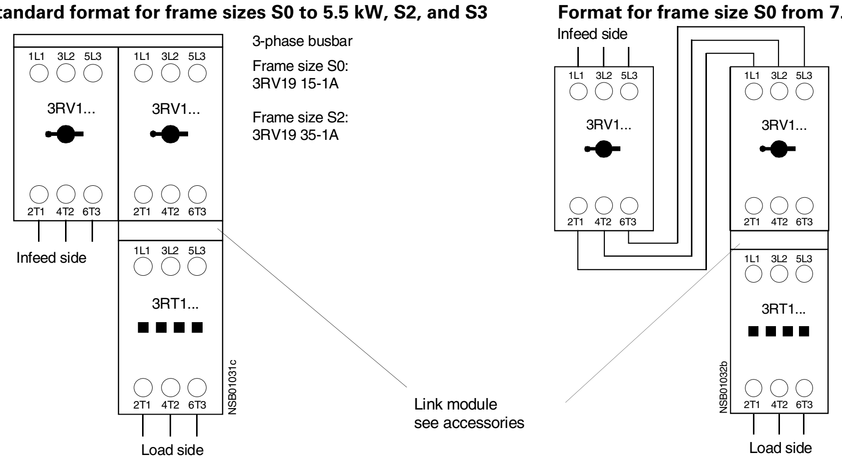
1) Minimum clearance to the contactor at the front. A minimum clearance at the front is not required for a circuit breaker.

Installation regulations for 690 VAC

Frame size	Format
S0	Mounted on an insulated base plate. In screw-on mounting, the screws must not be grounded. Alternatively, the rail adapter can be used without restrictions.
S2/S3	Mounted on an insulated base plate. Alternatively, the rail adapter can also be used.

Standard format for frame sizes S0 to 5.5 kW, S2, and S3

Format for frame size S0 from 7.5 to 11 kW

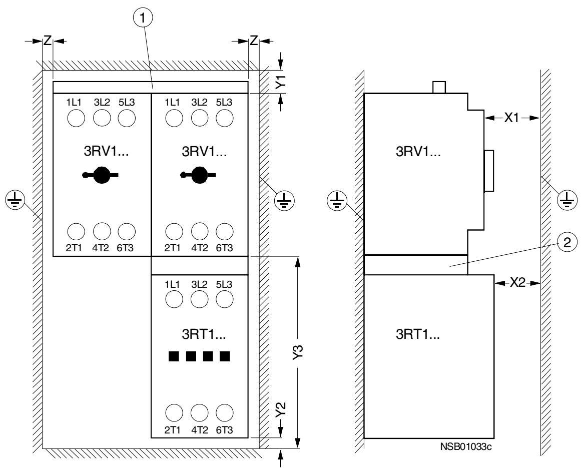


When installing the combination, the following clearances must be maintained to grounded parts:

2 circuit breakers combined with contactors			Clearance to grounded or live parts					
Circuit breaker	Contactor	Rated operational voltage	Y1 mm	Y2 mm	Y3 mm	X1 mm	X2 mm	X3 mm
3RV1. 2 with	3RT10 1	690 V	80	10	95	20	14	20
3RV1. 3 with	3RT10 3	690 V	50	10	120	10	32	10
	3RT10 4	690 V	50	10	120	10	40	10

1 3-phase busbar

S0: 3RV19 15-1A
S2: 3RV19 35-1A

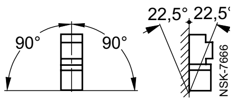


2 In a combination involving a circuit breaker of frame size S2 and a contactor of frame size S3, a clearance of 10 cm must be maintained

General specifications

Specifications			IEC 60 947-1, EN 60 947-1 (VDE 0660 Part 100) IEC 60 947-2, EN 60 947-2 (VDE 0660 Part 101) IEC 60 947-4-1, EN 60 947-4-1 (VDE 0660 Part 102)			
Type Frame size Number of poles			**3RA1. 1** **S00** 3	**3RA1. 2** **S0** 3	**3RA1. 3** **S2** 3	**3RA11 4** **S3** 3
Max. rated current I_{nmax} (= max. rated operational current I_e)		A	12	25	50	100
Permissible ambient temperature		°C °C	–55 to +80 for storage/transportation –20 to +70 for operation (above +60 °C with restrictions)			
Rated operating voltage U_e		V	690			
Rated frequency		Hz	50/60			
Rated insulation voltage U_i		V	690			
Rated impulse strength U_{imp}		kV	6			
Tripping class (CLASS)	In acc. with IEC 60 947-4-1, EN 60 947-4-1 (VDE 0660 Part 102)		10			
Rated short-circuit current I_q at 50/60 Hz 400 VAC in acc. with IEC 60 947-4-1, EN 60 947-4-1 (VDE 0660 Part 102)		kA	50			
Coordination types in acc. with IEC 60 947-4-1, EN 60 947-4-1 (VDE 0660 Part 102)			[1])			
Power loss $P_{v\ max}$ of all main conducting paths depending on the rated current I_n (upper setting range)	• Up to 1.25 A	W	6			
	• 1.6 to 6.3 A	W	7			
	• 8 to 12 A	W	10.5			
	• 2 to 6.3 A	W		7		
	• 8 to 16 A	W		9.5		
	• 20 to 25 A	W		13		
	• 25 to 32 A	W			19	
	• 40 A	W			28	
	• 45 to 50 A	W			35	
	• 63 A	W				29
	• 75 to 90 A	W				45
	• 100 A	W				60
Power input of the magnet coils with contactors (given a cold coil and U_s, 50 Hz)						
• AC operation	Making capacity	VA	27	61	127	270
	cos φ		0.8	0.82	0.82	0.68
	Holding power	VA	4.6	7.8	13.5	22
	cos φ		0.27	0.24	0.34	0.27
• DC operation	Making capacity = holding power	W	3.2	5.4	11.50	15
Operating range of the magnet coils with contactors			0.8 to 1.1 x U_s			
	Lower limit at 55 °C		0.8 x U_s	–		
	Lower limit at 60 °C		0.85 x U_s	–		
Service life of circuit breakers						
• Mechanical life		Operating cycles	100,000		50,000	
• Electrical life		Operating cycles	100,000		50,000	
• Max. switching frequency per hour (motor startups)		1/h	15		15	
Service life of contactors						
• Mechanical life		Operating cycles	30 million	10 million		
• Electrical life		Operating cycles	See the service life characteristic of the contactors (part 3).			
Shock resistance (sinus)	In acc. with IEC 60 068 Part 2-27	*g*	Up to 9.8	Up to 12.5	Up to 8	Up to 6
Degree of protection	In acc. with IEC 60 947-1		IP 20		IP 20 IP 00 terminal housing	
Shock protection	In acc. with DIN VDE 0106 Part 100		Protected against touching by fingers			
Phase loss sensitivity of the circuit breaker	In acc. with IEC 60 947-4-1, EN 60 947-4-1 (VDE 0660 Part 102)		Yes			
Disconnector properties of the circuit breaker	In acc. with IEC 60 947-2, EN 60 947-2 (VDE 0660 Part 101)		Yes			
Main and emergency-stop switch properties of the circuit breaker and accessories	In acc. with IEC 60 204-1, EN 60 204-1 (VDE 0113 Part 1)		Yes, with undervoltage release to category 1 in the case of proper use			
Safe isolation between the main and auxiliary circuits	In acc. with DIN VDE 0160 Part 101		Up to 400 V			
Positively driven operation with contactors			Yes	Yes, from the main contact to the auxiliary normally closed contact		

Conductor cross-sections - main circuit

Specifications		IEC 60 947-1, EN 60 947-1 (VDE 0660 Part 100) IEC 60 947-2, EN 60 947-2 (VDE 0660 Part 101) IEC 60 947-4-1, EN 60 947-4-1 (VDE 0660 Part 102)			
Type		**3RA1.1**	**3RA1. 2**	**3RA1. 3**	**3RA11 4**
Frame size		**S00**	**S0**	**S2**	**S3**
Number of poles		3	3	3	3
Connection type		Screw-type terminal	Screw-type terminal	Box terminal	Box terminal
Terminal screw		Pozidriv 2	Pozidriv 2	Pozidriv 2	Allen screw
Minimum/maximum conductor cross-sections					
• Finely stranded with wire end ferrule					
- 1-wire	mm^2	0.5/2.5	1/6	0.75/25	2.5/50[1])
- 2-wire	mm^2	0.5/2.5	1/2.5 to 2.5/6	0.75/16	2.5/35[1])
• Single- or multi-core					
- 1-wire	mm^2	0.5/4	1/6 (max. 10)	0.75/35	2.5/70[1])
- 2-wire	mm^2	0.75/2.5 (max. 4)	1/2.5 to 2.5/6	0.75/25	2.5/50[1])
Ribbon conductor		–	–	yes	yes
Bar connection		–	–	–	yes
• Single- or multi-core	AWG	2 x (18 to 14)	2 x (14 to 10)	2 x (30 to 2)	–
• Multi-core	AWG	–	–	–	2 x (10 to 1/0)
Connection type		Cage Clamp terminal			
	mm^2	2 x (0.5 to 2.5)	–		
	AWG	2 x (18 to 14)			
Permissible installation position		 Important: In acc. with DIN 43 602 Start command "**I**" right or above			

1) After the box terminals have been removed, lug or busbar connections are possible.

6

3RH, 3TX, LZX coupling links

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6.1 Specifications/regulations

Degrees of protection offered by housing	EN 60 529
I/O interfaces	EN 61 131-2
Connection designations	EN 50 005
DIN standard rail	EN 50 022
Coordination of insulation	VDE 0110
Electrical relays, all-or-nothing relays	DIN VDE 0435 Part 201/IEC 60255-1-00
Control devices and switching elements	DIN VDE 0660 Part 200/IEC 60947-5-1
Optocoupler	DIN VDE 0884
Equipment of high-voltage installations	DIN VDE 0160
Shock protection	DIN VDE 0106 Part 100
Safe isolation	DIN VDE 0106 Part 101
Environmental conditions	IEC 60721
EMC emission immunity	 EN 50081 EN 50082
General information	VDE 0660 Part 100/IEC 60947-1
Specifications for industrial control systems	UL 508
Specifications for industrial equipment	CSA C22.2-14

Table 6-1: Regulations and specifications

6.2 Device description

Coupling links are interface modules that enable optimal adaptation between electronic controllers and I/O devices, both on the sensor and the actuator side.
They also provide electrical isolation.

Overview

The following table offers an overview of the device groups and their distinguishing features:

Device group	Distinguishing features
Two-tier coupling links 3TX7004/3TX7005	Relay couplers: 6.2 to 22.5 mm width, contact elements: 1 to 3 normally open contacts, 1 to 2 changeover contacts Multi-channel devices Semiconductor couplers: 6.2 to 12.5 mm width Long service life, high switching frequency Screw-type terminal (3TX7004) Cage Clamp terminal (3TX7005)
Box terminals 3TX7002/3TX7003	Relay couplers: Contact elements: 1 to 2 normally open contacts, 1 to 2 changeover contacts, low device height Semiconductor couplers: Long service life, high switching frequency Screw-type terminal (3TX7002) Cage Clamp terminal (3TX7003)
Plug-in relay coupling links LZX: RT/PT/MT	Plug-in relays (1 to 4 changeover contacts) High switching currents, prewiring possible
Coupling links for direct attachment to contactor coils 3RH1924/3TX4090/3TX7090	Space-saving, adapted to contactor type, reduced wiring 3RH1924 for frame sizes S0 to S3 3TX4090 for 3TH42/43 auxiliary contactors 3TX7090 for frame sizes 3 to 14
SIRIUS contactor relays3RT10 3RH11	For main circuits: switching from motors to 11 kW directly For main circuits: up to 4 auxiliary switches

Table 6-2: 3RH, 3TX, LZX coupling links - overview of the device groups with their distinguishing features

Contact material

Relay coupling links are offered with AgNi and hard gold-plated contacts. Hard gold-plated contacts have greater contact reliability at low voltages and currents. They can be used as of mV or µA. They can be used to switch low levels of power, such as those involved in measurement and control signals. In the case of input coupling links, they are to be recommended on account of the low currents of the input modules of controllers.

6.2.1 Relay coupling modules versus semiconductor coupling modules

Models	Advantages	Disadvantages
Relay coupling modules **6.2 mm** • Single-channel • 1NO/1W **12.5** • Single-channel • Multi-channel • With/without M-O-A switch • 1W/1NO/2NO **17.5** • Single-channel • Multi-channel • Without switch • 3NO **22.5** • Single-channel • Multi-channel • Without switch • 2W	• Suitable for direct and alternating voltage • High switching capacity without heat generation • Virtually no transfer resistance (suitable as measured value transfer switch) • Electrical isolation • Safe isolation between contact and coil sides • No leakage current • High electromagnetic compatibility • High noise immunity • Insensitive to overloads and voltage peaks • Several switching levels	• Lower switching frequency • Contact erosion, particularly in the case of inductive loads • Inductivity of the coil (disturbance) • Mechanical wear (service life) • Low direct-current switching capacity • Bounce time of the relay contact • Danger of contact microwelding in the case of capacitive loads
Semiconductor coupling modules **6.2 mm** • Single-channel **12.5** • Single-channel • With M-O-A switch • Without switch	• No contact welding in the case of capacitive loads • High switching frequencies • High direct-current switching capacity • Long service life • Bounce-free switching • Insensitive to vibrations and impact • Defined transfer resistance and volume resistance • Safe isolation between drive circuit and load in acc. with DIN VDE 0884 • Silent switching operation	• High temperature rise in the case of high loads • Leakage current at output • Sensitive to peaks in the power system • Not suitable as measured value transfer switch because of a voltage drop at the switching transistor

Table 6-3: Comparison: Relay coupling modules and semiconductor coupling modules

6.2.2 Coupling links in two-tier and box terminal format

Features

- Connections at two levels
- Very narrow design, as of 6.2 mm
- Terminal system: screw-type and Cage Clamp
- Labeling strip to identify equipment

Models

The 3TX70 coupling links for SIRIUS are available as both input couplers and output couplers, which have their terminals in different positions:

Figure 6-1: Output couplerInput coupler

Input coupling links have hard gold-plated contacts for greater contact reliability at low voltages and currents.

Status indication

A yellow status LED on the drive circuit side indicates whether there is any control supply voltage applied to the coupler.

Protective circuit

There is an integrated rectifier at the input of each coupler. As a result, they are protected against polarity reversal. The rectifiers function as flywheeling diodes at disconnection. Semiconductor outputs are protected by suppressor or Zener diodes.

Manual-0-automatic

Some coupling links are equipped with a manual-0-automatic switch that makes it easier to switch the system on and is used for test purposes.

- Manual: Relay is always on
- O (zero): Relay is always off
- Automatic: Relay follows the control supply voltage

Power consumption

Following on from the technical specifications of the electronic systems, the coupling links have low power consumption. They can be controlled from a programmable controller and are suitable for continuous duty.

Accessories

The following accessories are available for two-tier coupling links:

- 24-pole connecting lead or connection comb
- Screwdriver for Cage Clamp terminal system
- End holder and end plate

6.2.3 Plug-in relay coupling links

The Plug-in relay coupling links are modular coupling links. The plug-in format means the relays can be easily replaced.

Models

There are complete modules for 1 and 2 changeover contacts and individual modules for 1, 2, 3 or 4 changeover contacts for a rated control supply voltage of either 24 VDC or 230 VAC.

Widths

Plug-in relay coupling links are available in 3 widths:
- 15.5 mm print relays, LZX: RT variants
- 27 mm mini-industrial relays, LZX: PT variants
- 38 mm industrial relays, LZX: MT variants

Installation

The plug-in relay coupling links are plugged into the associated bases, and these are snapped onto a 35 mm rail in acc. with EN 50 022.

Surge suppression

To avoid high breaking voltage peaks, LZX: RT and PT plug-in relay coupling links are available for a rated control supply voltage of 24 VDC, with 1, 2, or 4 changeover contacts (Ws) and integrated surge suppression (flywheeling diode). RC elements are available for AC voltages.

Connection

The standard polarity must be taken into consideration when connecting up:
- At A1: positive voltage supply (+)
- At A2: negative voltage supply (-)

Test button

The LZX: PT and MT variants are equipped with a test button. The plug-in relay coupling link can thus be brought into the switching state and locked without the need for electrical triggering. When the test button is protruding, this indicates the locked switching position.

LED

An LED is available either as an individual plug-in module or is integrated in the relay, depending on the variant involved.

Power consumption

Following on from the technical specifications of the electronic systems, the coupling links have low power consumption.

Safe isolation

The drive circuit and contacts are electrically isolated. Safe isolation can also be achieved for the print relays (LZX:RT series) by means of a special base.

6.2.4 Coupling links for direct attachment

Contactors S0 to S3

The 3RH1924-1GP11 coupling relay, which is screwed directly onto the coil terminals, is available for direct attachment to the contactors of frame sizes S0 to S3.
The 3TX4090-0C/-0D coupling links are suitable for attachment to 3TH42/43 auxiliary contactors.

Contactors of up to 450 kW

In the case of the large contactors of up to 450 kW (size 14), the 3TX7090 coupling link can be snapped on at the side like an auxiliary switch block, and the wires are connected to the contactor coil terminals.

Variants

There are variants with one normally open contact, 24 VDC, with and without surge suppression.
The operating range is 17 to 30 VDC.

Installation

The 3TX 4090 and 3RH1924-1GP11 coupling links are screwed directly onto the contactor coil terminals, and the 3TX7090 coupling links are snapped on at the side like the auxiliary switches.

Surge suppression

The following coupling links have an integrated surge suppressor (varistor) for the contactor coil to be switched:
- 3RH1924-1GP11
- 3TX4090-0D
- 3TX7090-0D

Power consumption

Following on from the technical specifications of the electronic systems, the coupling links have low power consumption.

LED

An LED is integrated in the coupler.

6.2.5 SIRIUS contactor relays

The SIRIUS 3RT10/3RH11 contactor relays are described in Chapter 3, "Contactors".

6.2.6 Installation

Attachment

Snap-on attachment
The coupling links can be snapped onto a 35 mm rail in acc. with DIN EN 50 022.
Screw-on attachment is not possible.

Connection

Screw-type terminals
The two-tier coupling links are fitted with slotted screws for a maximum screwdriver blade width of 4 mm.
Plug-in relay couplers have plus-minus POZIDRIV 2 screw-type terminals.

Cage Clamp terminals
The two-tier coupling links described in Section 6.2.1 are available with Cage Clamp terminals as well as screw-type terminals.

6.2.7 Notes on configuration

Contact microwelding

When capacitive loads are switched, a short-circuit current briefly occurs (for a period lasting only microseconds) if the capacitor is not connected in series with a resistor. This can result in contact microwelding and the contact being unable to open after the control supply voltage is removed. To prevent this from happening, a resistor can be connected in series, or a coupling link with a semiconductor output and short-circuit protection can be used.

Switching inductive loads

The contacts are tested in acc. with EN 60947-5-1, utilization category AC-15 and DC-13. Going beyond the requirements of the standard, a continuous test was carried out on the contacts with an AC-15 load for 100,000 operating cycles. The electrical service life of the contacts was thus tested over 100,000 operating cycles at the specified current under normal conditions. A lower load on the contacts or a protective circuit for the inductive load increases the service life of the contacts. If this service life is insufficient, a semiconductor coupler with an unlimited service life must be used.

Max. line length in AC operation

Each wire has a line capacitance that works like a capacitor connected in series to the coupling link. The effect of this in operation with alternating current is that so much current may flow due to the line capacitance that the coupling link does not fall in spite of a switch being open. To remedy this, a parallel resistor can be fitted to A1/A2 of the coupling link, or an RC combination can be used. Both of these measures change the performance and switching times of the coupling link.
The following basic circuit diagram shows the line capacitance:

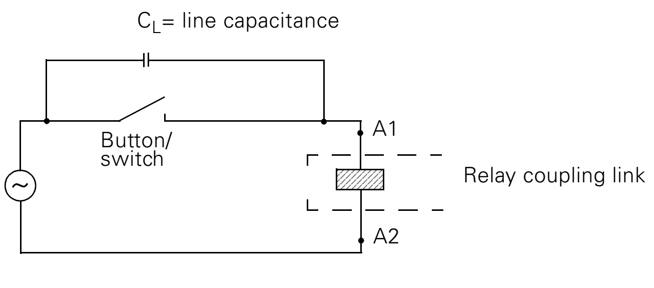


Figure 6-2: Basic circuit diagram, line capacitance

The line lengths specified in the NSK catalog were calculated for a line capacitance of 0.3 nF/m. This depends on the wire used.

6.2.8 Explanation of terms

Electrical isolation

There is no conductive connection between the input circuit and the output circuit. Electrical isolation is ensured by the in-built relay and, in the case of semiconductor outputs, by means of optocouplers.

Safe isolation

Safe isolation provides protection against shock currents in different circuits. It is implemented by means of increased creepages and clearances.

Distinction between terms

Electrical isolation is not necessarily safe isolation.
Safe isolation is a protective measure against shock current, the primary purpose of which is to prevent injury. It prevents the voltage of one circuit crossing over into another.

For the insulation coordination of equipment, the standard specifies values for the rating of the creepages and clearances.

In the case of safe isolation, these values must be selected by means of double or reinforced insulation.

6.3 Application and areas of use

6.3.1 General information

Advantages

The use of coupling links offers the following advantages:
- Galvanic isolation between two circuits
- Current gain
- Protects the controller from interference and overvoltage
- Substantially reduces the power input of switchgear
- Permits power gain or level adaptation

Applications

Coupling links are used in:
- Production engineering
- Machine setup
- Process control in power distribution
- Building services automation
- Process engineering

Usage

Coupling links are used for:
- Floating signal transmission
- Linking of different voltages (AC/DC) and currents
- Power gain
- Level adaptation
- Protection of the controller against EMC noise from the I/O
- Contact multiplication

Application example

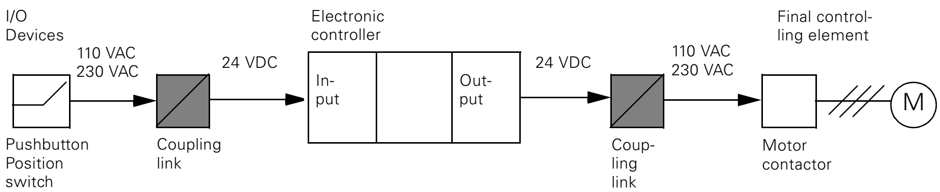


Figure 6-3: Application example, coupling links in box terminal format

6.3.2 Criteria for selection

Coupling links are selected on the basis of a number of criteria:

Technical specifications

See Section 6.7:
- Rated control supply voltage U_s
- Typical power input
- Output elements
- Rated operational currents I_e
- Permissible line length

Mechanical require-ments

- Construction type, width
- Mounting type
- Indicators
- Connection type
- Replaceability

Selection table

The following table provides an overview of the main criteria for selection from different device groups:

Device group	Criteria for selection
Two-tier coupling links	• Space-saving due to narrow housing width • Test switches
Coupling links in box terminal format	• Low device height • For installation given narrow tier spacing
Contactor relays for switching main and auxiliary circuits	• High switching currents • Direct switching of motors up to 11 kW • Up to 4 auxiliary contacts
Plug-in relay coupling links	• High switching currents • Quickly interchangeable • Up to 4 changeover contacts
Coupling links for attachment to contactors	• Attachable directly onto the contactor • Technical specifications of the contactor to be con-trolled

Table 6-4: Selection criteria for the 3RH, 3TX, and LZX coupling links

6.4 Accessories

6.4.1 Accessories for two-tier coupling links

Connecting lead

The 24-pole connecting lead 3TX7004-8BA00 can be used for all two-tier coupling links both with screw-type and Cage Clamp terminals:

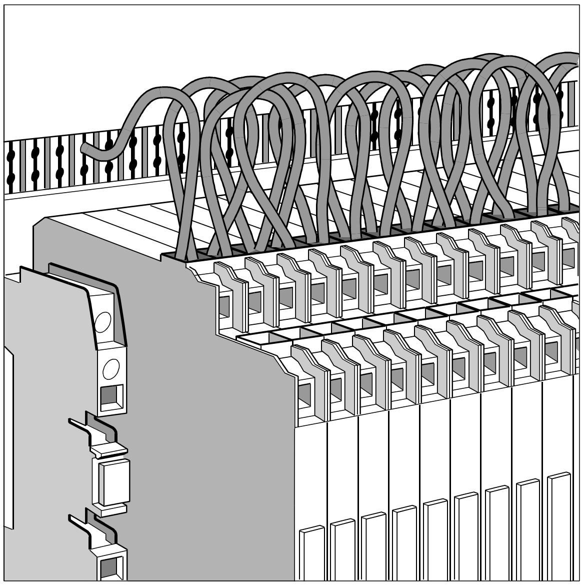


Figure 6-4: 24-pole connection lead for two-tier coupling links

Connection comb

The 24-pole connection comb 3TX7004-8AA00 can be used for the 6.2 mm wide two-tier coupling links with screw-type terminals:

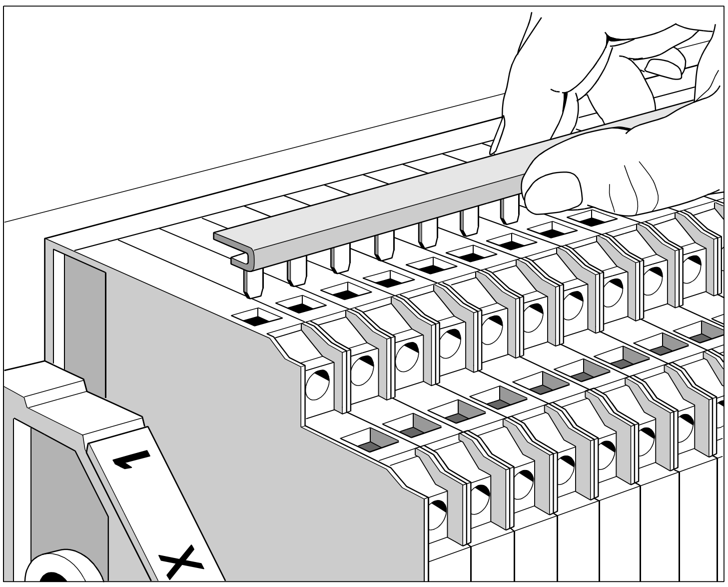


Figure 6-5: 24-pole connection comb for two-tier coupling links

End holder
The end holder 8WA2808 is snapped onto the rail (EN 50 022) without screws.

Screwdriver for Cage Clamp terminal system
The screwdriver 8WA2804 is suitable when wiring coupling links with Cage Clamp terminals.

End plate
In order to ensure shock protection in the case of the two-tier optocouplers having a width of 6.2 mm and with a housing opening (e.g. 3TX7 004-3AB04), the individual module or last module in a series must be fitted with an end plate 3TX7004-8CE00.

Labeling strip
Each coupling link has a labeling strip for the purpose of identification.

6.4.2 Accessories for LZX plug-in relay coupling links

Retainer
In situations where there is increased mechanical stress, a retainer can be fitted to plug-in relay coupling links to provide stability.

LED module
An LED can be fitted as an individual plug-in module with the variants LZX: RT and LZX:PT.

Module with flywheeling diode
A flywheeling diode for surge suppression can be fitted as a module (for DC voltages) with the variants LZX:RT and LZX:PT.

RC module
For AC voltages, there is a plug-in RC module available with the series LZX:RT and LZX:PT for surge suppression.

6.5 Mounting and connection

6.5.1 Mounting

Snap-on attachment

The coupling links are snapped onto 35 mm rails in acc. with EN 50 022.
With a vertical rail and tightly packed devices, the permissible ambient temperature T_U is 60° C.
Any installation position is possible.

6.5.2 Connection

The coupling links are available with the SIGUT® terminal system, with screw-type terminals, or with Cage Clamp terminals.

Cage Clamp terminals

Important
Risk of injury
When making connections using the Cage Clamp terminal system, you should support your screwdriver with your finger to prevent the screwdriver slipping.

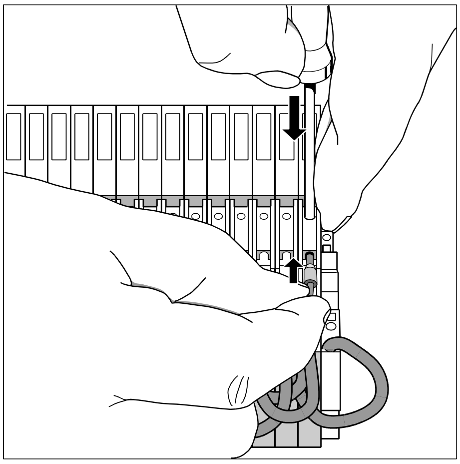


Figure 6-6: Cage Clamp terminals, coupling links

Conductor cross-sections

The following table shows the permissible conductor cross-sections for the coupling links. The specifications apply to main and auxiliary connections.

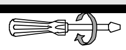
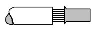
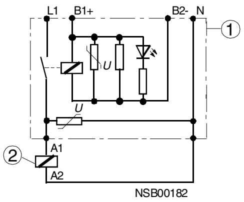
	3TX7004 **3TX7002** **screw-type terminals**	**3TX7005** **3TX7003** **Cage Clamp terminals**	**LZX:** **RT/ZT/MT**	**3RH1924** **3TX7090** **Screw-type terminals**
 ∅ 5 to 6 mm / PZ2	M3	------	------	M3
	1 x 0.25 to 4 mm²	1 x 0.08 to 2.5 mm²	2 x 2.5 mm²	2 x (0.5 to 2.5) mm²
	1 x 0.5 to 2.5 mm²	1 x 0.25 to 2.5 mm²	2 x 1.5 mm²	2 x (0.5 to 1.5) mm²

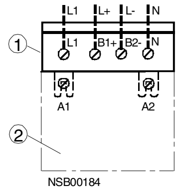
Table 6-5: Conductor cross-sections for the 3RH, 3TX, and LZX coupling links

6.5.3 Device circuit diagrams

The following circuit diagrams are examples:

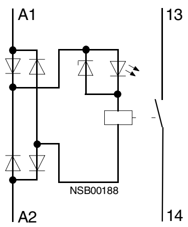
3RH1924



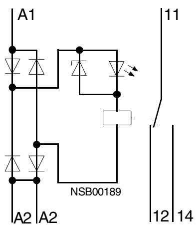


3RH1924-1GP11 with surge suppressor
① coupling link
② contactor

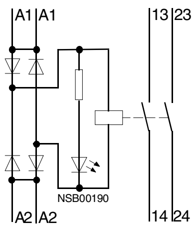
Relay coupling modules 3TX7002/3TX7003



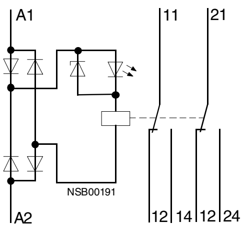
3TX7002-.A.00
-1AB00
-2AF00
3TX7003-1AB00



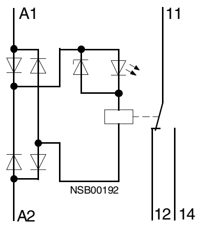
-1B.00



-1CB00

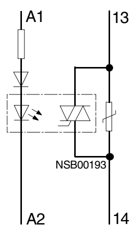


-1FB00

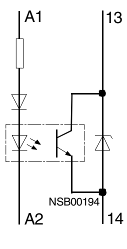


-2BF02

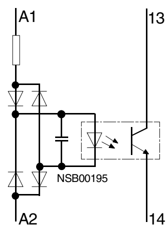
Semiconductor coupling modules 3TX7002



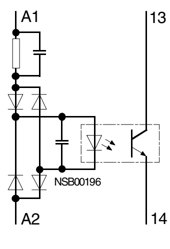
3TX7002-0AB00



-3AB01

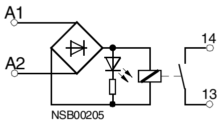


-4AB00

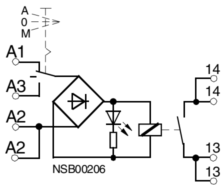


4AG0.

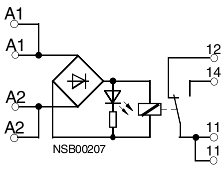
Relay coupling modules
3TX7004/3TX7005
Output coupling links



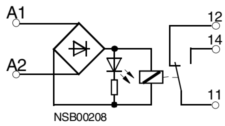
3TX700.-1M.00



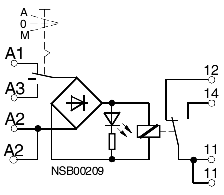
3TX700.-1AB10



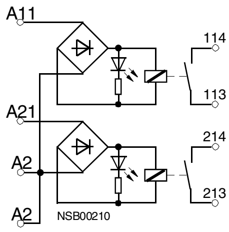
3TX700.-1BB00



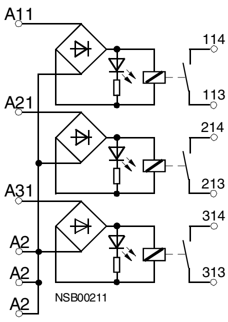
3TX700.-1L.0.



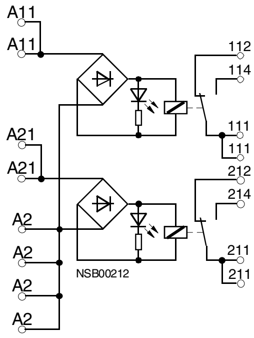
3TX700.-1BB10



3TX700.-1CB00

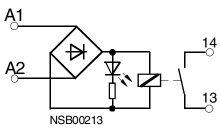


3TX700.-1HB00



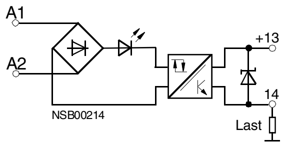
3TX700.-1GB00

Relay coupling modules
3TX7004/3TX7005
Input coupling links

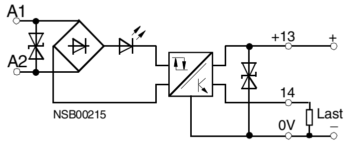


3TX700.-2M.02

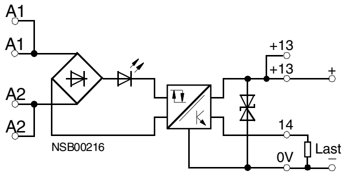
Semiconductor coupling modules 3TX7004/3TX7005 Output coupling links



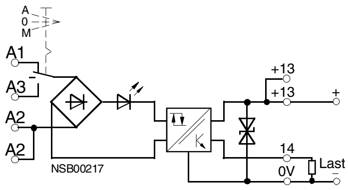
3TX700.-3AB04



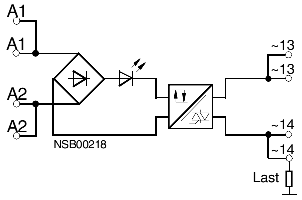
3TX700.-3PB54



3TX700.-3AC04

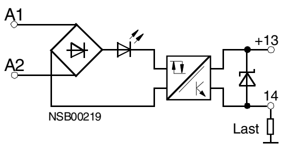


3TX700.-3AC14



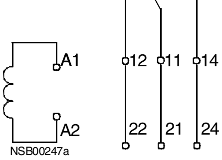
3TX700.-3AC03

Semiconductor coupling modules 3TX7004/7005 Input coupling links

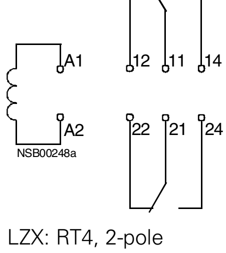


3TX700.-4AB04

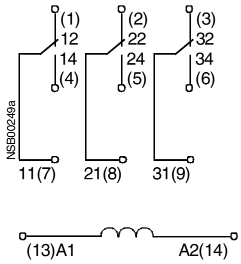
Relay couplers LZX: RT/PT/MT



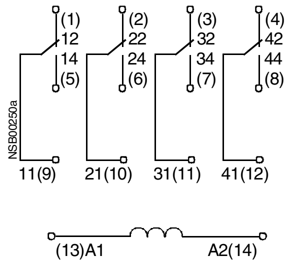
LZX: RT3, 1-pole



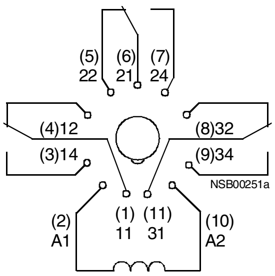
LZX: RT4, 2-pole



LZX: PT370, 3-pole



LZX: PT570, 4-pole

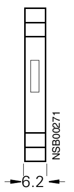


LZX: MT32, 3-pole

Values in brackets:	Plug-in base designations
Values without brackets:	Contact/coil designations

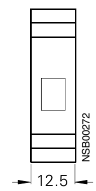
6.6 Dimensioned drawings (dimensions in mm)

Two-tier coupling links 3TX7 004/3TX7 005

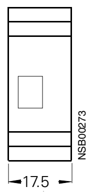


Relay couplers
3TX7 00.-1MB00
3TX7 00.-1MF00
3TX7 00.-1L . 0 .
3TX7 00.-2M...

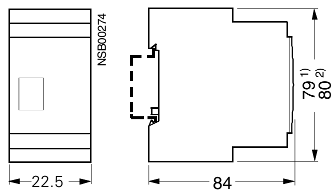
Optocouplers
3TX7 00.-3AB04
3TX7 00.-4AB04
3TX7 00.-3PB..
3TX7 00.-3PG74
3TX7 00.-3RB43
3TX7 00.-4P . 24



Relay couplers
3TX7 00.-1AB10
3TX7 00.-1BB00
3TX7 00.-1BB10
3TX7 00.-1CB00
3TX7 00.-1BF05
Optocouplers
3TX7 00.-3AC04
3TX7 00.-3AC14
3TX7 00.-3AC03



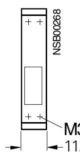
Relay couplers
3TX7 00.-1HB00



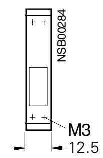
Relay couplers
3TX7 00.-1GB00

1) Dimension 3TX7 004 coupling links (screw-type terminals)
2) Dimension 3TX7 005 coupling links (Cage Clamp terminals)

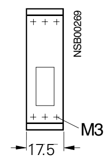
Coupling links in box terminal format 3TX7 002/3TX7 003



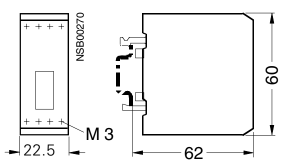
3TX7 00.-1AB..
3TX7 00.-2A...
3TX7 002-3AB01



3TX7 002-3AB00
3TX7 002-4A...

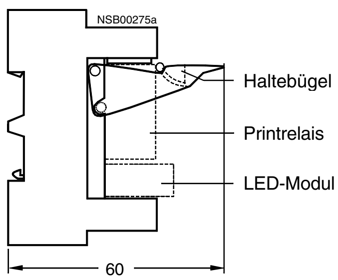


3TX7 00.-1BB00
3TX7 00.-1BF00
3TX7 002-2BF02

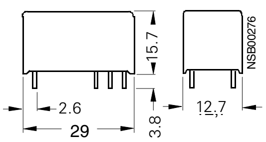


3TX7 00.-1CB00
3TX7 002-1BF02

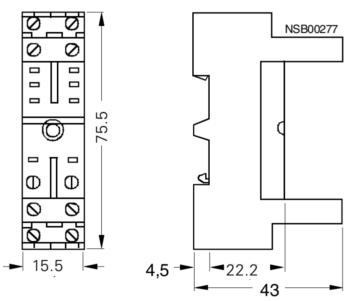
Plug-in relay coupling links LZX: RT



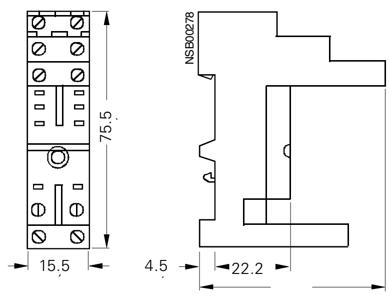
Complete device LZX: RT3/RT4



Print relay LZX: RT3/RT4

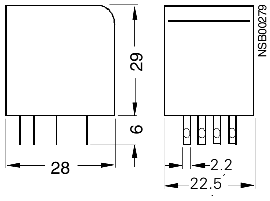


Plug-in base LZX: RT78625 for print relays

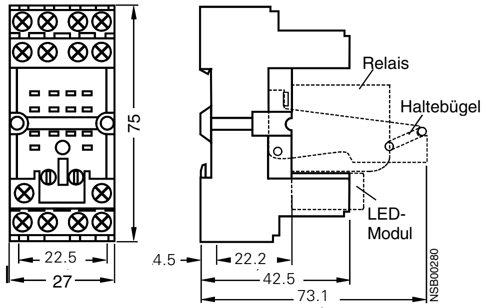


Plug-in base LZX: RT78626 with safe isolation for print relays

Plug-in relay coupling links LZX: PT

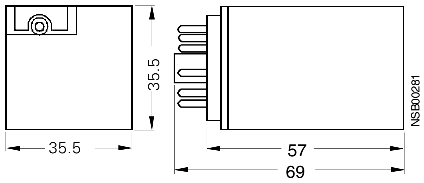


Industrial relay LZX: PT570

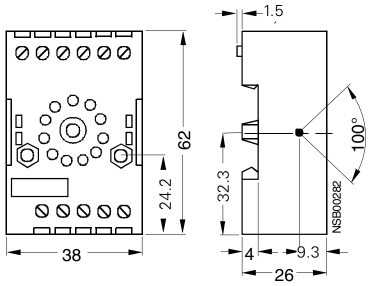


Plug-in base LZX: PT78703 for industrial relays

Plug-in relay coupling links LZX: MT/MR

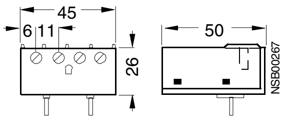


Industrial relay LZX: MT32

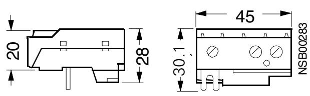


Plug-in base LZX: MR78750 for industrial relays

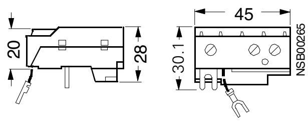
Coupling links 3RH/3TX



3RH1924-1GP11



3TX4090-0C



3TX4090-0D

6.7 Technical specifications

3TX70 relay coupling links

Load side						
Rated currents			**3TX7 00 .-1A/-1B/-1C/-1H/-1G**		**3TX7 00 .-. L/- .M**	
Conventional free air thermal current I_{th}		A	6		6	
Rated operational current I_e by utilization categories (DIN VDE 0660)			AC-15	DC-13	AC-15	DC-13
	At 24 V	A	3	1.0	2	1.0
	110 V	A	3	0.2	2	0.2
	230 V	A	3	0.1	2	0.1
Current switched			AC-12	DC-12	AC-12	DC-12
For resistive load	At 24V	A	6	6	6	6
In acc. with DIN VDE 0435 (relay standard)	110 V	A	6	0.3	6	0.3
and DIN VDE 0660		A	6	0.2	6	0.2
Min. contact loading for 3TX7 00 . -1 . . 00			17 VAC/VDC, 5 mA		17 VAC/VDC, 5 mA	
Min. contact loading for 3TX7 00 . -. . . 02 (hard gold-plating)			1 VAC/VDC, 0.1 mA		1 VAC/VDC, 0.1 mA	
Performance limit/hard gold-plating			30 V/20 mA		30 V/20 mA	
Switching voltage			17 to 250 VAC/VDC		17 to 250 VAC/VDC	
Mechanical life			20 x 10^6 operating cycles		20 x 10^6 operating cycles	
Electrical service life at I_e			1 x 10^5 operating cycles		0.5 x 10^5 operating cycles	
Switching frequency		1/h	5000 operating cycles		5000 operating cycles	

Table 6-6: Technical specifications, 3TX70 relay coupling links

3TX7004/3TX7005 semiconductor coupling links

Load side							
Type	**3TX7 004-/ 3TX7 005-**		**3AB04/ 4AB04**	**3AC.4**	**3AC03**	**4AB04**	**3PB54**
Rated operating current I_e		A	0,5	5	2	0,5	1.5
Short-term current carrying capacity		A ms	1.5 20	Short circuit-proof	100 20	1.5 20	Short circuit-proof
Contact elements			1 NO contact Transistor	1 NO contact Transistor	1 NO contact Triac	1 NO contact Transistor	1 NO contact Transistor
Switching voltage (operating range)			DC ≤ 48 V	DC ≤ 30 V	AC 50/60Hz 24 to 250 V	DC ≤ 48 V	DC ≤ 30 V
Minimum load current		mA	–	–	50	–	–
Voltage drop switched through		V	1	0,5	1.6	1	0,5
Leakage current of the electronics (at 0 signal)		mA	< 0.1	< 0.1	< 6	< 0.1	< 0.1
Switching frequency For resistive load		Hz	50	50	1	50	500

Table 6-7: Technical specifications, 3TX7004/3TX7005 semiconductor coupling links

3TX7002/3TX7003 semiconductor coupling links

Load side						
Type	**3TX7 002-**		**3AB00**	**3AB01**	**4AB00**	**4AG00**
Rated operating current I_e		A	1.8	1.5 (See derating diagram)	0.1	0.1
Short-term current carrying capacity		A ms	20 20	4 0.2	1 20	1 20
Contact elements			1 NO contact Triac	1 NO contact Transistor	1 NO contact Transistor	1 NO contact Transistor
Switching voltage (operating range)			Effective 50/60 Hz 48 to 264 VAC	≤ 60 VDC	≤ 30 VDC	≤ 60 VDC
Minimum load current		mA	60	–	–	–
Voltage drop switched through		V	≤ 1.5	≤ 1.1	≤ 1.7	≤ 0.3
Leakage current of the electronic components (at 0 signal)		mA	<5	<0.1	<0.1	0.001
Switching frequency at I_e			1 Hz	1 Hz	5 Hz	5 Hz

Table 6-8: Technical specifications, 3TX7002/3TX7003 semiconductor coupling links

LZX: RT/PT

Relay type	Print relay RT, 8-pole (12.7 mm) 1 W/2 W		Industrial relay PT, 14-pole (22.5 mm) 3 W/4 W
Load side			
Switching voltage	24 to 250 VAC/VDC		24 to 250 VAC/VDC
Rated currents Conventional free air thermal current I_{th}	16 A/8 A (1 W/2 W)		10 A/6 A (3 W/4 W)
Rated operating current I_e by utilization categories (DIN VDE 0660)	AC-15	DC-13	–
at 24 V	6 A/3 A	2 A	–
230 V	6 A/3 A	0.27 A	–
Short-circuit protection Fuse links, performance class gL/gG DIAZED	10 A		–
Min. contact loading (reliability: 1 ppm)	12 VDC/10 mA		–
Mechanical life	30×10^6 operating cycles	10×10^6	10×10^6
Electrical life (resistive load at 250 VAC)	1×10^5 operating cycles	1×10^5	1×10^5

Table 6-9: Technical specifications, LZX: RT/PT

LZX: MT

Relay type	Industrial relay MT, 11-pole (35.5 mm) 3 W	
Load side		
Switching voltage	24 to 250 VAC/VDC	
Rated currents Conventional free air thermal current I_{th}	10A	
Rated operating current I_e by utilization categories (DIN VDE 0660)	AC-15	AC-13
at 24 V	5 A	2 A
230 V	5 A	0.27 A
Short-circuit protection **Fuse links, performance class gL/gG DIAZED**	10A	
Min. contact loading (reliability: 1 ppm)	12 VDC/10 mA	
Mechanical life	20×10^6 operating cycles	
Electrical service life (resistive load at 250 VAC)	4×10^5 operating cycles	

Table 6-10: Technical specifications, LZX: MT

3RH1924/3TX7090

Short-circuit protection				
(unwelded fuse at I_k W 1 kA)				
Fuse links, performance class gL/gG		A	6	
NH Type 3NA				
DIAZED Type 5SB				
NEOZED Type 5SE				
Load side				
Mechanical life		Operating cycles	20×10^6	
Electrical service life at I_e		Operating cycles	1×10^5	
Switching voltage		V	24 to 250 VAC/VDC	
Rated currents				
Conventional free air thermal current I_{th}		A	6	
			AC-15	DC-13
Rated operating current I_e	At 24 V	A	3	1.0
by utilization categories	110 V	A	3	0.2
(DIN VDE 0660)	230 V	A	3	0.1

Table 6-11: Technical specifications, 3RH1924/3TX7090

7

3RP10, 3RP15 solid-state time relays

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7.1 Specifications/regulations/approvals

Standards

The time relays comply with the following standards:

- IEC 61812-1/DIN VDE 0435 Part 2021 on electrical relays and time relays
- IEC 61000 on electromagnetic compatibility
- IEC 60947-5-1; DIN VDE 0660 Part 200 on low-voltage switchgear
- IEC 60721-3-1/-3 on environmental conditions
- IEC 60529 on degree of protection

Electromagnetic compatibility

The time relays are tested in acc. with EN 50 081-1 (emission) and EN 50 082-2 (immunity) and are thus noise-free and surge-proof.

Switching capacity

The switching capacity complies with IEC 60947-5-1

- In the case of utilization category AC-15 and 230 VAC: 3 A
- In the case of utilization category DC-13 and 24 VDC: 1 A
- In the case of utilization category DC-13 and 48 VDC: 0.45 A
- In the case of utilization category DC-13 and 60 VDC: 0.35 A
- In the case of utilization category DC-13 and 110 VDC: 0.2 A
- In the case of utilization category DC-13 and 230 VDC: 0.1 A

UL/CSA/marine approval

The SIMIREL time relays are approved by UL and CSA for use worldwide and tested by the GL, LRS, DM marine authorities.

Approvals/ test reports

Confirmation of approvals, test certificates, and the declaration of conformity can be obtained on the Internet/intranet.

7.2 Device description

Time relays are used for different control tasks in automatic production lines and for processing machines.
They are suitable for all time-delayed switching operations in control, starting, protective, and regulating circuits and ensure high repeatability of the set run times.

7.2.1 Device types

Device types

The SIMIREL 3RP1 time relays are available in the following forms:
- Single-function devices, such as the on-delay function
- Multifunctional devices

Frame sizes

The SIMIREL 3RP1 time relays are available in two widths:
- 3RP10: 45 mm

The width, height, and depth of time relays and contactors of frame size S00 (3RT/3RH10) are identical. The terminals are therefore on the same level, and the tier spacing in the cubicle can be kept correspondingly low.
- 3RP15: 22.5 mm

Time relays with 1 changeover contact are 82 mm in height and have six possible terminals
Time relays with 2 changeover contacts are 102 mm in height and have a possible twelve terminals

View of the 3RP10

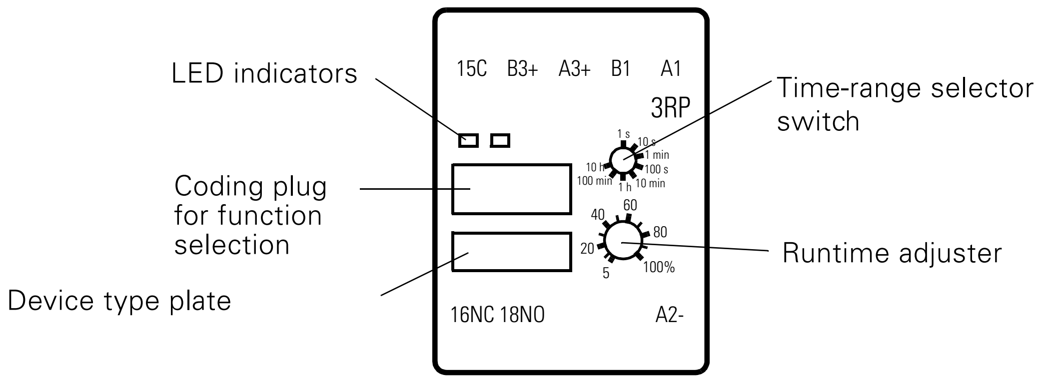


Figure 7-1: 3RP1000 solid-state time relay, multifunctional

3RP10 features

The features of the 3RP10 solid-state time relay:
- 1 changeover contact
- Eight selectable time ranges
- Adjustable runtime from 0.05 s to 10 hr
- Contact position and voltage indication by means of LED
- Safe isolation between the control and load sides in acc. with DIN VDE 0106 Part 101
- Combination voltage 24 VAC/VDC / 200-240 VAC and 24 VAC/VDC / 100-127 VAC
- Single-function device for the on-delay function
- Multifunctional device with 7 functions

View of the 3RP15

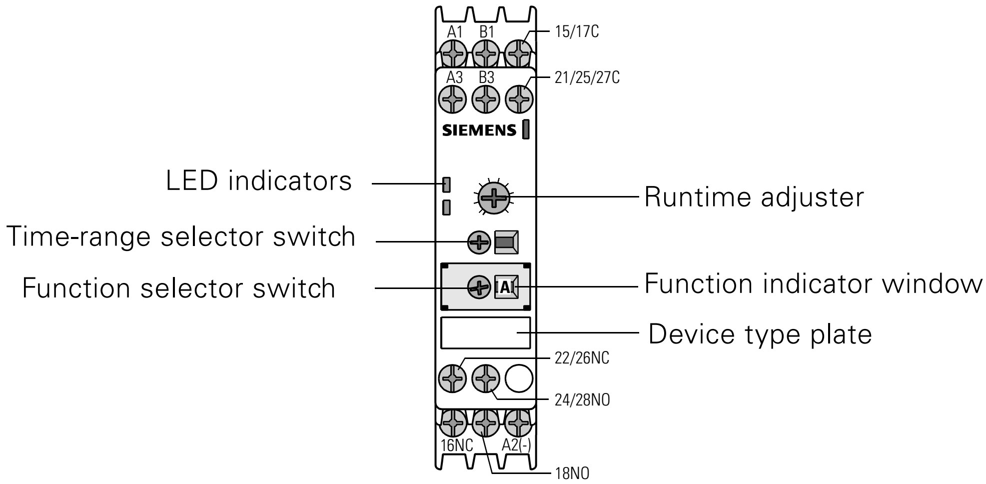


Figure 7-2: 3RP15 solid-state time relay, multifunctional with 2 changeover contacts

3RP15 features

The features of the 3RP15 solid-state time relays are:
- 1 changeover contact (8 functions)
- 2 changeover contacts (16 functions)
- Single or up to 15 selectable time ranges
- Contact position and voltage indication by means of LEDs
- Combination voltage 24 VAC/VDC / 200-240 VAC, and 24 VAC/VDC / 100-127 VAC
- Wide-range voltage variant for 24-240 VAC/VDC
- Single-function devices for the following functions:

- On-delay with 1 or 2 changeover contacts
- Off-delay with auxiliary supply and 1 changeover contact
- Off-delay without auxiliary supply and 1 or 2 changeover contacts
- Clock pulse generator with 1 changeover contact
- Star-delta with 2 NO contacts
- 2-wire, on-delay with semiconductor output

- Multifunctional time relay with 8 (1 changeover contact) or 16 functions (2 changeover contacts)

Accessories

3RP10
Coding plug set for the multifunctional time relay with 7 functions

3RP15
- Label sets for the multifunctional time relay with 8 or 16 functions
- Sealable cap
- Push-in lugs for screw-type terminal

7.2.2 Installation

Attachment

Snap-on attachment
All the time relays can be snapped onto 35 mm rails and removed without tools in acc. with EN 50 022.
Screw-on attachment
3RP10: attachment openings are integrated in the device
3RP15: push-in lugs for screw-type attachment are available as accessories

Connection

The terminals of the 3RP1 time relays are designed for connections of the control cables with a maximum stripped length of 10 mm. Cross-sections of 2 x 0.5 to 2.5 mm^2 (single-coil) and 2 x 0.5 to 1.5 mm^2 (single-coil) can be clamped with a wire end ferrule.

Screw-type terminal (SIGUT® terminal)

The 3RP10 and 3RP15 time relays are available with plus-minus Pozidriv 2 screw-type connections.

Cage Clamp terminal

The 3RP10 and 3RP15 time relays are available with Cage Clamp terminals.

7.2.3 Special features

Operating temperature

There are no restrictions on the control supply voltage, switching current, or duty cycle for operation between -25 °C to +60 °C.

Time ranges

There are up to 15 time settings, ranging from 0.05 s to 100 hr. The 3RP15 has additional time settings between the decade scales (1/10/100 s/min/h) that make high setting accuracy possible.

Wide-range voltage

There are multifunctional relays with a wide voltage range of 24 VAC/VDC to 240 VAC/VDC.

Electrical service life

The electrical service life with contactor load (e.g. 3RT1016 contactor) is 10 million operating cycles.
The electrical service life at AC voltage of 230 V, utilization category AC-15/3 A, and at DC voltage, utilization category DC-13/1 A, is 100,000 operating cycles.

Start contact

In the case of functions that require a continuous auxiliary supply to terminals A1/A2 and A3/A2, the time function can be started by a control supply voltage to terminal B1 or B3.

7.2.4 Notes on configuration

The following specifications must be complied with to ensure error-free operation of the solid-state time relays:

Start input

Only apply the control supply voltage from start input B1 or B3 once the supply voltage has already been applied to A1/A2 or A3/A2.

Identical potential

Identical potential must be applied to terminals A1 and B1 or A3 and B3.

Combination voltage

In the case of combination voltage types, only one voltage range can be connected. Never apply the two control supply voltages simultaneously.

Parallel load at the start contact

The start contact is under voltage and rectified. There is a connection in the time relay to the A1 and A2 terminals. The control of loads parallel to the start input is therefore not permissible at AC 50/60 Hz control supply voltage.

The following information facilitates configuration of SIMIREL 3RP time relays:

Combination/wide-range voltages

80% of the time relay types are combination and wide-range voltage types because they are flexible in their uses:
– Combination voltage: two operating voltage ranges (e.g. 24 VAC/VDC and 200 to 240 VAC) at different terminals
– Wide-range voltage: one operating voltage range from 24 VAC/VDC to 240 VAC/VDC at the same terminals

Two-wire time relay

Two-wire time relays have the following advantages over conventional time relays in connection with contactors:
– Reduced wiring
– Bounce-free control
– The electronic output increases service life because no mechanical wear occurs.
– Greater switching frequency

Special functions

- Pulsing function: pulse and idle time can be set separately.
- Flashing: the pulse/break ratio is 1:1.
- The timing period starts with the "off-delay without auxiliary supply" function if the time relay is separated from the supply voltage.
- In the case of the 3RP15 time relay with 15 selectable time settings, there is a ∞ switch position. This means an endless timing period. If this setting is chosen for the on-delay function, the output relay never switches through after the supply voltage has been applied (off function). In the case of the "making pulse contact" function, the output relay always remains on (on function). This can be used for test purposes.
- In the case of the "additive on-delay with auxiliary supply" function, the time is added for as long as the start contact is activated. If the start contact is interrupted, the timing period stops and is then continued once the start contact is closed again.
  This function is not non-volatile and requires a continuous auxiliary power supply.
- In the case of the "shaping pulse contact with auxiliary supply" function, an activated start contact triggers a timing period that can be set. The control signal for this can be shorter or longer than the desired runtime.

Cable ducts

If you use cable ducts for wiring, the position and dimensions of the terminal blocks must be taken into consideration (see pages 7-27).

7.2.5 Explanation of terms

Setting accuracy

Setting accuracy is the accuracy in relation to the end value of the scale in line with the specified tolerance.

Repeatability

Repeatability describes the accuracy with which the set value can be reproduced with the specified tolerance.

7.3 Applications and uses (types of function)

7.3.1 Multifunction (3RP10 00 solid-state time relay)

The time relay contains a changeover contact.

Operating time adjustment

Eight time ranges can be set by means of a rotary switch.
The desired runtime can be set accurately by means of a potentiometer (rotary switch for fine adjustment).

Important
Changes to the time range are only effective if they are made in a deenergized state.

Example

You want to set a duration of 5 seconds:

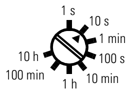
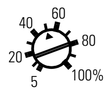
Step	Procedure
1	 Rotate the time range selector switch to 10 s. This means runtimes of up to 10 seconds can be set.
2	 Rotate the potentiometer to 50% for fine adjustment. In other words, 50% (= 5 seconds) of the maximum value (10 seconds) is set.

Table 7-1: 3RP10 00 (multifunctional) operating time adjustment

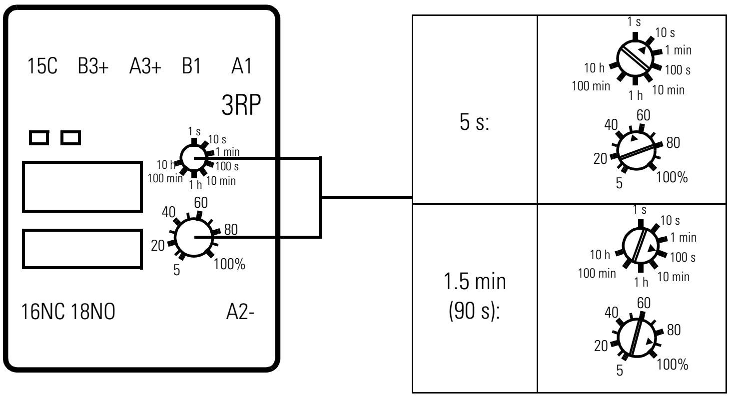


Figure 7-3: 3RP10 00 (multifunctional) operating time adjustment

Functions

You can select 7 different functions with the coding plug set (7PX9904) provided.

Important
Changes to the function are only effective if they are made in a deenergized state.
Without the coding plug the multifunctional time relay (3RP10 00) is programmed for the on-delay.

Function setting

The connector with the function you want is removed from the coding plug set and put on the time relay as shown in the following diagram:

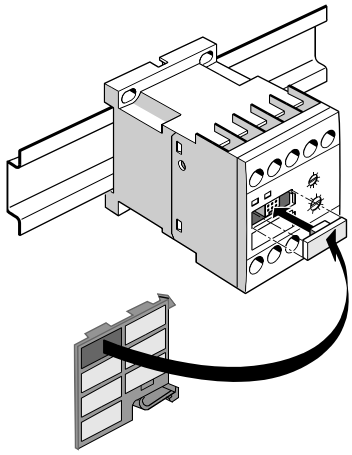


Figure 7-4: 3RP10 00 (multifunctional) function setting

The name of the function and the corresponding circuit diagram are printed on the coding plugs in German and English.

Function diagrams

The coding plug set contains the functions for the 3RP1000 solid-state time relay listed in the following table:

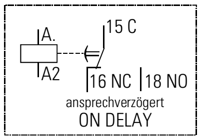
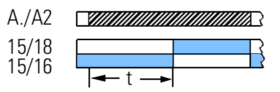
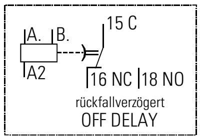
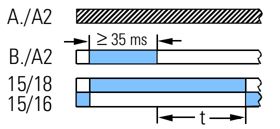
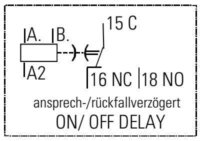
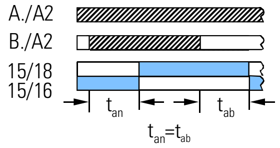
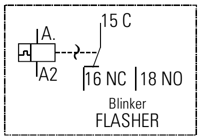
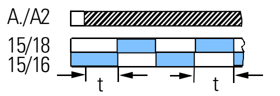
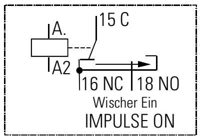
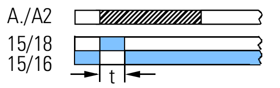
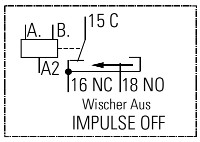
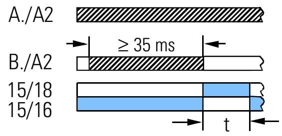
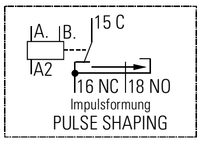
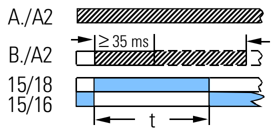
Function	Circuit diagram	Function diagram
On-delay		
Off-delay with auxiliary supply		
On-delay and off-delay with auxiliary supply		
Flashing, start with break		
Making pulse contact		
Breaking pulse contact with auxiliary supply		
Shaping pulse contact with auxiliary supply		

Table 7-2: 3RP10 00 (multifunctional) circuit diagrams and function diagrams

Important
The same potential must be applied to terminals A and B.

A./A2 ≙ A1/A2 or A3/A2, depending on the voltage level connected
B./A2 ≙ B1/A2 or B3/A2, depending on the voltage level connected

7.3.2 Multifunctional (3RP15 05 solid-state time relay)

Operating time adjustment

Fifteen time ranges can be set using a rotary switch, ensuring very precise adjustment. The set time range is displayed in a window next to the rotary switch.
The desired runtime can be set accurately by means of a potentiometer (rotary switch for fine adjustment).
In the time range position ∞ the function is executed with an endless time period. This means, for example, that the output relay never switches through when "on-delay" is set and the supply voltage is applied or that the output relay remains continuously on when "making pulse contact" is set.

Important
Changes to the time range are only effective if they are made in a deenergized state.

Example

You want to set a 90 second period:

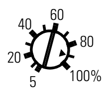
Step	Procedure	
1		Rotate the time range selector switch until 100 s appears in the adjacent window. This means runtimes of up to 100 seconds can be set.
2		Rotate the potentiometer to 90%. In other words 90% (= 90 seconds) of the maximum value (= 100 seconds) is set.

Table 7-3: 3RP15 05 (multifunctional) operating time adjustment

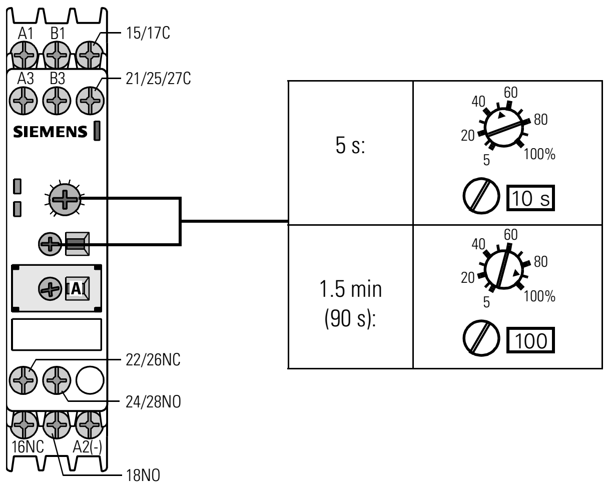


Figure 7-5: 3RP15 05 (multifunctional) operating time adjustment

Functions

The following can be set by means of a rotary switch.
- Time relay with 1 changeover contact: 8 functions
- Time relay with 2 changeover contacts: 16 functions

Important
Changes to the function are only effective if they are made in a deenergized state.

Function setting

The function is set using a rotary switch and is indicated by an identifying letter in the adjacent window.
The set function can be labeled distinctly with an identification plate with the corresponding function diagram. At the same time, a mechanical code ensures that the correct function is set by ensuring that a label can only be clipped on if the corresponding function is set using the rotary switch.
A label set with function diagrams of all the functions that can be set for the time relay is available as an accessory.
Break the label of the set function out of the label set, and snap it firmly onto the time relay as shown in the following diagram:

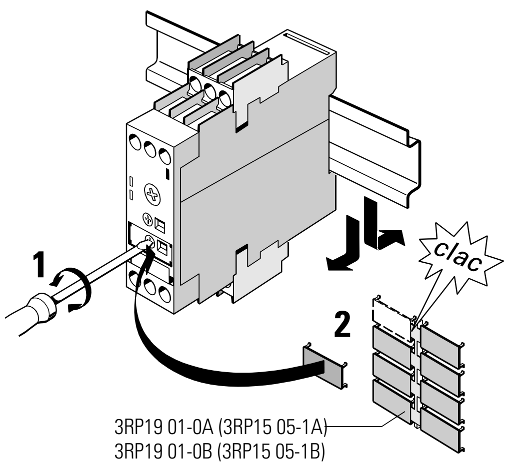


Figure 7-6: 3RP15 05 (multifunctional) function identification

Identifying letters

The following table lists the identifying letters for the 8 or 16 functions of the solid-state multifunctional 3RP15 05 time relay:

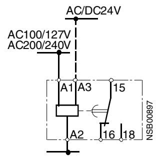
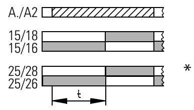
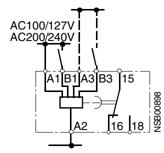
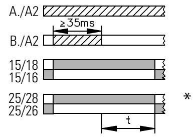
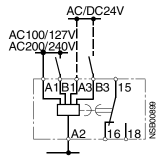
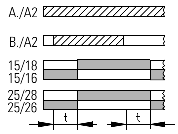
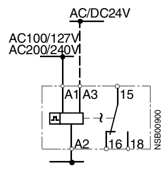
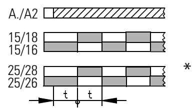
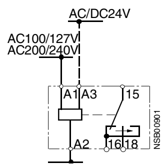
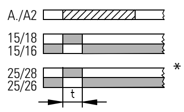
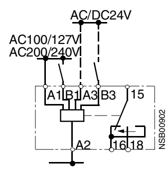
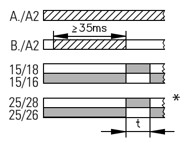
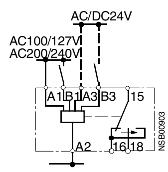
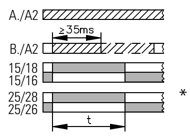
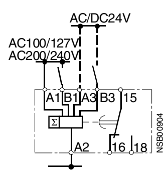
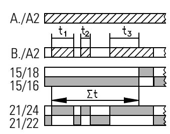
Function	Identifying letter with time relay with 1 changeover contact	Identifying letter with time relay with 2 changeover contacts
On-delay	A	A
Off-delay with auxiliary supply	B	B
On-delay and off-delay with auxiliary supply	C	C
Flashing, start with break	D	D
Making pulse contact	E	E
Breaking pulse contact with auxiliary supply	F	F
Shaping pulse contact with auxiliary supply	G	G
Additive on-delay with auxiliary supply (and immediate switching only H•)	H	H•
On-delay and immediate switching		A•
Off-delay with auxiliary supply		B•
On-delay and off-delay with auxiliary supply and immediate switching		C•
Flashing, start with break, and immediate switching		D•
Making pulse contact and immediate switch-ing		E•
Breaking pulse contact with auxiliary supply and immediate switching		F•
Shaping pulse contact with auxiliary supply and immediate switching		G•
Star-delta function		Y△

Table 7-4: 3RP15 05 (multifunctional) assignment of the identifying letters

The • after the identifying letter indicates that the second changeover contact present reacts as an immediate switching contact (controlled by the supply voltage or the start contact depending on the function). If this • is not present, the second changeover contact reacts with a time delay like the first changeover contact.

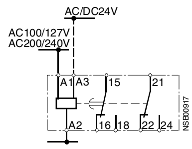
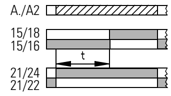
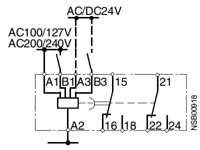
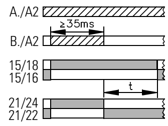
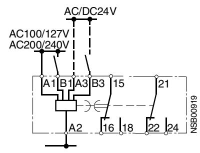
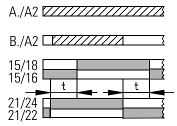
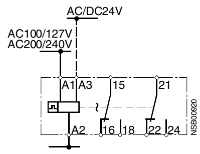
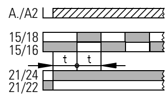
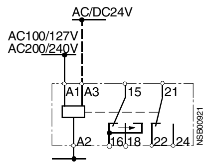
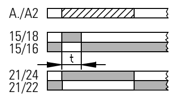
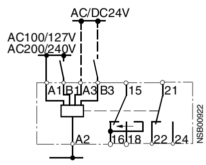
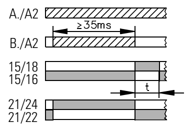
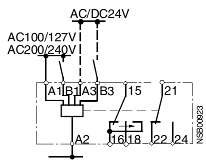
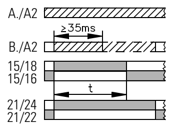
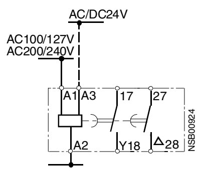
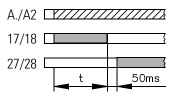
Function diagrams
Circuit diagrams

The following table explains the 8 or 16 functions of the solid-state multi-functional 3RP15 05 time relay using circuit diagrams and function diagrams:

Identifying letter	Device circuit diagrams	Function diagram
A **On-delay**		
B **Off-delay with auxiliary supply**		
C **On-delay and off-delay with auxiliary supply ($t=t_{on}=t_{off}$)**		
D **Flashing, start with break (pulse/break 1:1)**		
E **Making pulse contact**		
F **Breaking pulse contact with auxiliary supply**		
G **Shaping pulse contact with auxiliary supply** **(creates a pulse at the output irrespective of the length of excitation)**		
H• **Additive on-delay with auxiliary supply and immediate switching**		

* Only with devices with 2 changeover contacts

Table continued: Function diagrams (3RP15)

Identifying letter	Device circuit diagrams	Function diagram
A• **On-delay and immediate switching**		
B• **Off-delay with auxiliary supply and immediate switching**		
C• **On-delay and off-delay with auxiliary supply and immediate switching** **($t=t_{on}=t_{off}$)**		
D• **Flashing, start with break (pulse/break 1:1) and immediate switching**		
E• **Making pulse contact and immediate switching**		
F• **Breaking pulse contact with auxiliary supply and immediate switching**		
G• **Shaping pulse contact with auxiliary supply and immediate switching** **(creates a pulse at the output irrespective of the duration of excitation)**		
Y△ **Star-delta function**		

* Only with devices with 2 changeover contacts

Table 7-5: Function diagrams and circuit diagrams

7.3.3 On-delay

The 3RP10 20 solid-state time relay

The time relay contains 1 changeover contact.

Time ranges

Eight time ranges can be set by means of a rotary switch.

Important
Changes to the time range are only effective if they are made in a deenergized state.

Function diagram

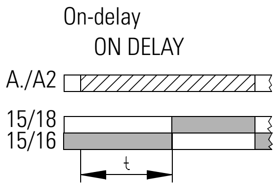


Figure 7-7: 3RP10 function diagram

The 3RP15 11/12/13 solid-state time relay

The time relay contains 1 changeover contact.

Time ranges

Fixed time ranges are offered: 10 s, 30 s, 100 s

Function diagram

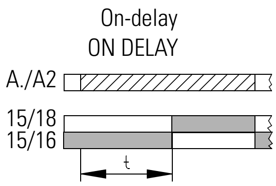


Figure 7-8: 3RP15 1. function diagram

The 3RP15 25 solid-state time relay

The time relay is available with either 1 or 2 changeover contacts.

Time ranges

Fifteen time ranges can be set by means of a rotary switch.

Important
Changes to the time range are only effective if they are made in a deenergized state.

The function diagram for the time relay with 1 changeover contact and with 2 changeover contacts:

Function diagrams

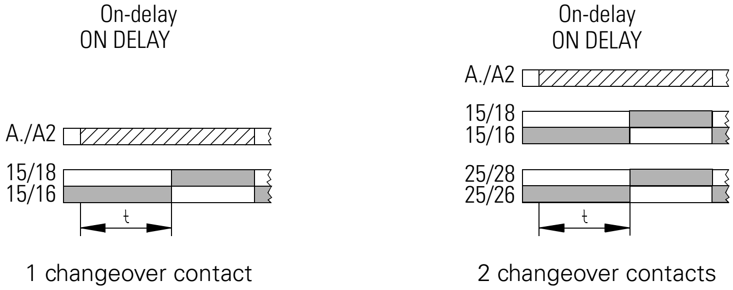


Figure 7-9: 3RP15 25 function diagram

The 3RP15 27 solid-state time relay (two-wire time relay)

The two-wire time relay is connected in series with the load. The timing period begins after the control supply voltage has been applied. The semiconductor output then becomes live, and voltage is applied to the load.

Time ranges

Four time ranges can be set by means of a rotary switch.

Important
Attention must be paid to the rated operational current, residual current with unswitched output, and voltage drop in the case of a switched output.

Function diagram

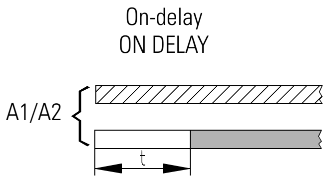


Figure 7-10: 3RP15 27 function diagram

7.3.4 Off-delay

The 3RP15 31/32/33 solid-state time relay with auxiliary supply

The time relay contains 1 changeover contact.

Time ranges

Fixed time ranges are offered: 10 s, 30 s, 100 s

Function diagram

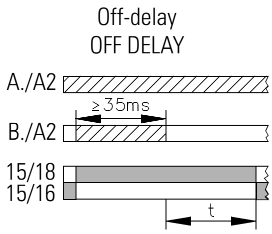


Figure 7-11: 3RP15 3. function diagram

There is continuous auxiliary voltage (A./A2) at the time relay. If a control supply voltage is applied to the start contact, the output relay switches over. After the start contact is disconnected, the set runtime starts. The minimum on-time of ≥ 35 ms must be adhered to.

The 3RP15 40 solid-state time relay without auxiliary supply

The time relay is available with either 1 or 2 changeover contacts.

Time ranges

Seven time ranges can be set by means of a rotary switch. Times ranging from 0.05 to 100 s are possible.

Important
Changes to the time range are only effective if they are made in a deenergized state.

The function diagram for the time relay with 1 changeover contact and with 2 changeover contacts:

Function diagrams

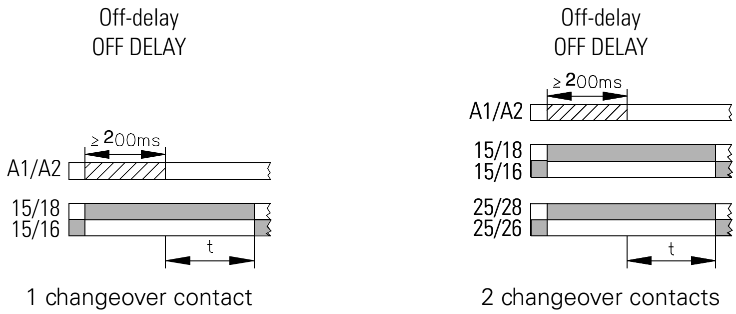


Figure 7-12: 3RP15 40 function diagram

Mode of operation

When the rated control supply voltage is applied, the time relay switches over. After the rated control supply voltage has been disconnected, the runtime t starts. After t has finished, the relay switches back to the quiet state.
If the minimum on-time is not adhered to, it is ensured that either the timing period will not start or that a started timing period will always be properly completed.
Intermediate states in the function process, such as the relay getting stuck, are successfully prevented.

7.3.5 Clock pulse generator (3RP15 55 solid-state time relay)

Description

The idle time and the pulse time of the clock pulse generator and the time ranges must be set separately.
The pulsing function begins with the break.

The time relay contains a changeover contact.

Time ranges

Fifteen time ranges can be set by means of a rotary switch.

Important
Changes to the time range are only effective if they are made in a deenergized state. A pulse, for example, can be output cyclically for 1 second after a break of 1 hour.

Function diagram

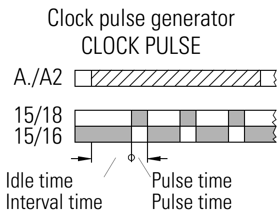


Figure 7-13: 3RP15 55 function diagram

7.3.6 Star-delta function (3RP15 74/76 solid-state time relay)

Description

The instantaneous star contact and the time-delayed delta contact have a shared contact root.
To avoid phase short circuits, the switchover break from star to delta is 50 ms.

Time ranges

The time relay offers a fixed time range: 20 s, 60 s

Function diagram

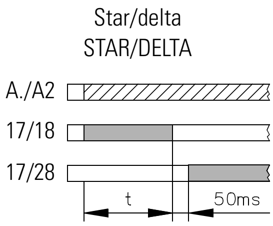


Figure 7-14: 3RP15 7. function diagram

7.3.7 Star-delta function with overtravel (3RP15 60 solid-state time relay)

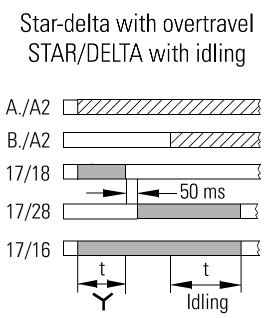
Description

Supply voltage is applied to A./A2 and there is no control signal at B./A2. This starts the ϒΔ timing period. By applying the control signal to B./A2, the idling time (overtravel time) is started. When the set time t_{Idling} (30 s to 600 s) is completed, the output relays (17/16 and 17/28) are reset. If the control signal is switched off at B./A2 (minimum off-time 270 ms), a new timing period is started.

Time ranges

Star-delta time 1 s to 20 s
Overtravel time: 30 s to 600 s

Function diagram



7.4 Accessories

7.4.1 Accessories for 3RP10

Coding plug set

Included with the 3RP10 00 solid-state time relay is a coding plug set for 7 functions. The function is set by clipping on a label with that function on it. The following diagrams show you how to affix the coding labels:

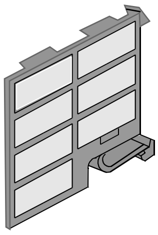


Figure 7-15: Coding plug set (3RP10 00)

This coding plug set is also available separately as 7PX9904.

7.4.2 Accessories for 3RP15 05

Label set

Two label sets are available to the 3RP15 05 solid-state time relay, multi-function device for labeling, depending on the version (8 functions with 1 changeover contact, 16 functions with 2 changeover contacts):

- 3RP19 01-0A for the 3RP15 05-1A electronic relay, 1 changeover contact
- 3RP19 01-0B for the 3RP15 05-1B electronic relay, 2 changeover contacts

The following table shows you how to set the function on the time relay and put on the label:

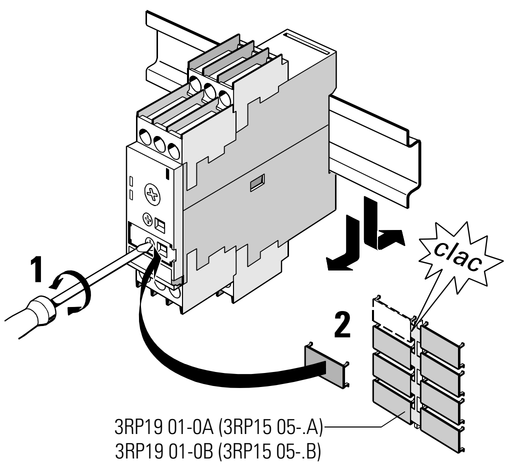
Illustration	Procedure
	**1** The desired function is set on the potentiometer of the time relay using a screwdriver. **2**The corresponding label identifying the set function is clipped on.

Figure 7-16: Label set (3RP15)

Sealable cover

All 3RP15 solid-state time relays can be secured against unauthorized adjustment by means of a sealable cover (3RP19 02). The following table and illustration explain how to do this:

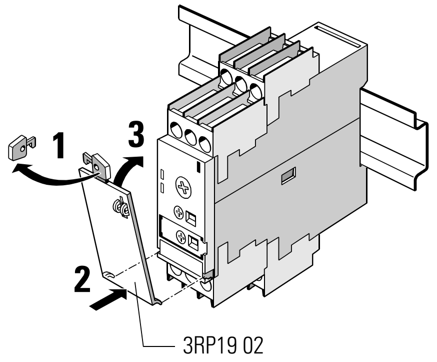
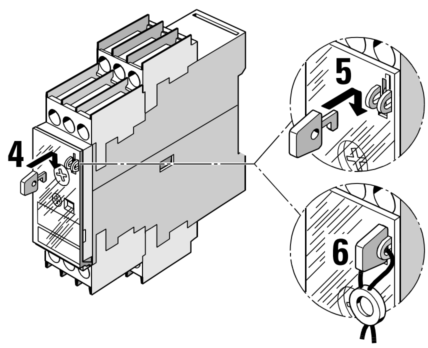
Illustration	Procedure
	**1**Break off the key for interlocking from the upper edge of the cover. **2**Use the hook to put the cover in the openings to the side of the device identification label. **3**Move the cover toward the time relay.
	**4**Hook the key onto the time relay through the slit in the cover to attach the cover to the time relay. **5/6** Pull the seal through the opening of the key.

Table 7-6: Sealable cover

Push-in lugs for screw-type attachment

Push-in lugs (3RP19 03) are available for the screw-type attachment:

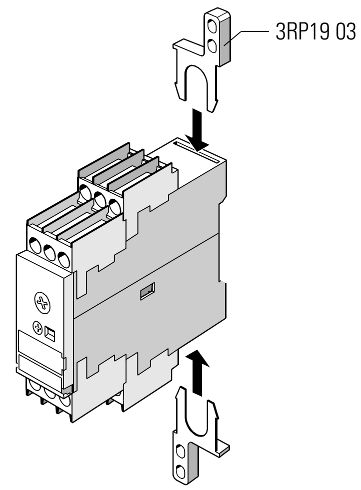


Figure 7-17: Screw-on attachment

7.5 Mounting and connection

7.5.1 Mounting

3RP10

Snap-on attachment

The 3RP10 time relays can be snapped onto the 35 mm rails and removed without tools in acc. with EN 50 022.
Place the time relay on the upper edge of the rail, and press it downward until it snaps onto the lower edge of the rail. To remove the time relay, press it downward to release the tension of the spring, and the time relay can be removed.

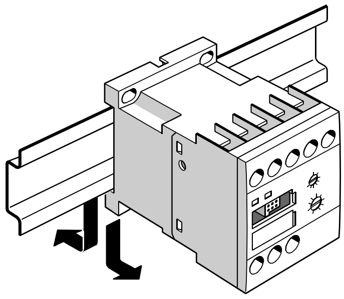


Figure 7-18: 3RP10: mounting on and removal from a 35 mm rail

Screw-on attachment

The following is required for screw-type attachment of the 3RP10 time relay:
- 2 M4 screws, diagonal
- Maximum tightening torque of 10.5 Nm
- Washers and spring lock washers must always be used
- The distance to grounded parts at the side must be more than 6 mm

3RP15

Snap-on attachment

The 3RP15 time relays can be snapped onto the 35 mm rails and removed without tools in acc. with EN 50 022.
Place the time relay on the upper edge of the rail, and press it downward until it snaps onto the lower edge of the rail. To remove the time relay, press it downward to release the tension of the spring, and the time relay can be removed.

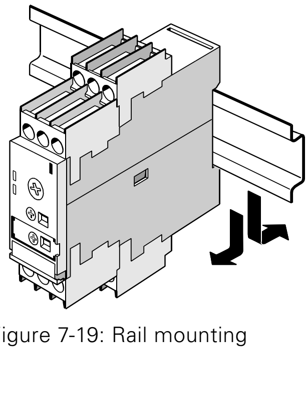


Figure 7-19: Rail mounting

Screw-on attachment

Screw-on attachment is possible by means of push-in lugs for M4 screws (application, see under Section 7.4 Accessories)

7.5.2 Connection

The 3RP10 solid-state time relays are available with SIGUT® terminals with plus/minus Pozidriv 2 screws and also with Cage Clamp terminals.
The 3RP15 solid-state time relays are available:
- With SIGUT® terminals with plus/minus Pozidriv 2 screws
- With Cage Clamp terminals

Conductor cross-sections

The following table lists the permissible conductor cross-sections for the 3RP1 solid-state time relays. The specifications apply to control and load current connections.

	3RP10.0-1	3RP10.0-2 (Cage Clamp)	3RP15	3RP15..-2 (Cage Clamp)
∅ 5 to 6 mm / PZ2	0.8 to 1.2 Nm 7 to 10.3 lb.in	------	0.8 to 1.2 Nm 7 to 10.3 lb.in	------
10	2 x (0.5 to 1.5 mm²) 2 x (0.75 to 4 mm²)	2 x (0.25 to 2.5 mm²)	1 x (0.5 to 4 mm²) 2 x (0.5 to 2.5 mm²)	2 x (0.25 to 1.5 mm²)
10	2 x (0.5 to 2.5 mm²)	2 x (0.25 to 1 mm²)	1 x (0.5 to 2.5 mm²) 2 x (0.5 to 1.5 mm²)	2 x (0.25 to 1 mm²)
10	------	2 x (0.25 to 1.5 mm²)	------	2 x (0.25 to 1.5 mm²)
AWG	2 x (18 to 14)	2 x (24 to 14)	2 x (20 to 14)	2 x (24 to 16)

Table 7-7: Permissible conductor cross-sections for control and load current connections:

The following illustration shows you the Cage Clamp terminal:

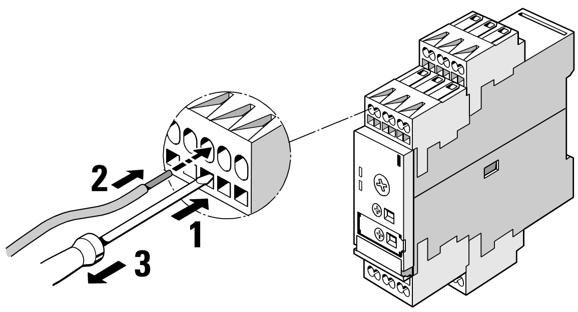
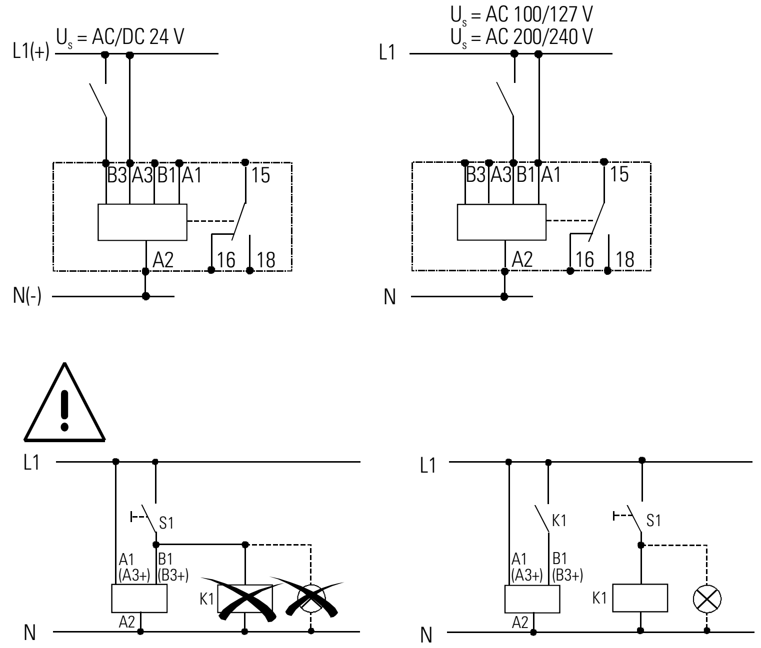


Figure 7-20: Cage Clamp terminals

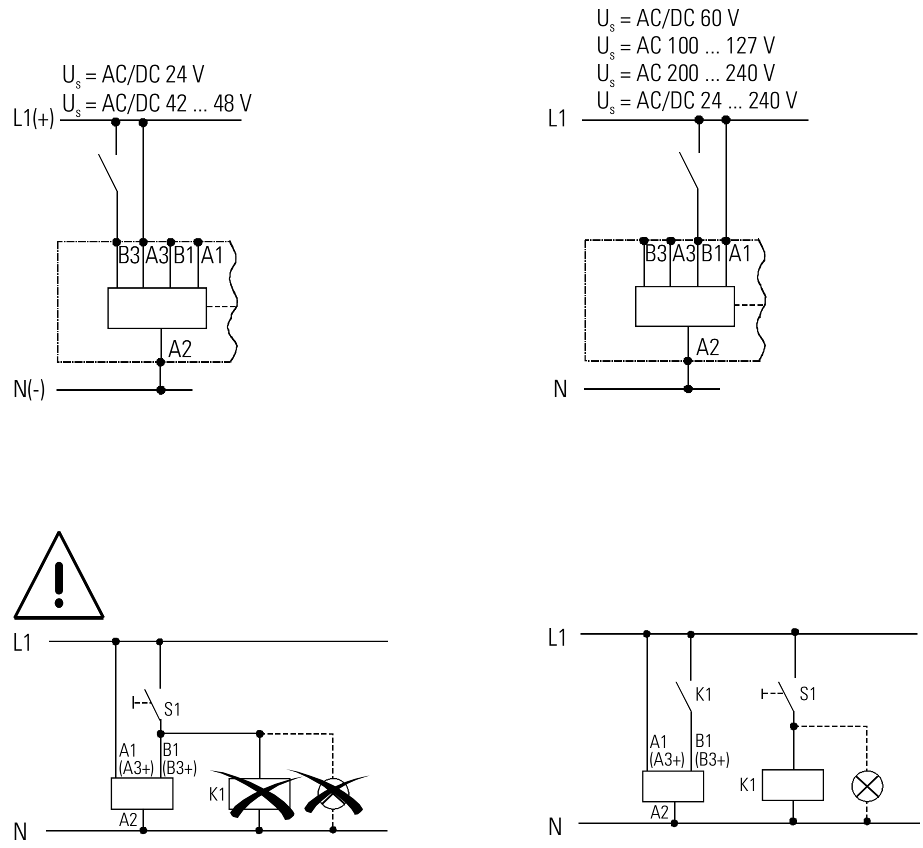
7.5.3 Circuit diagrams

3RP10



3RP10 circuit diagrams

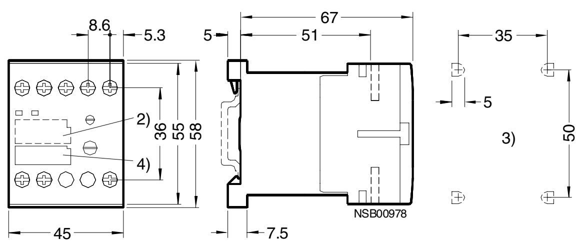
3RP15



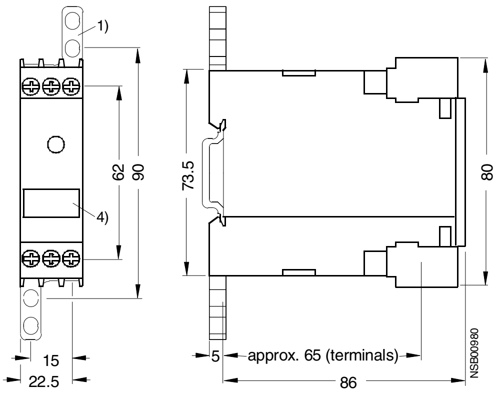
3RP15 circuit diagrams

7.6 Dimensioned drawings (dimensions in mm)

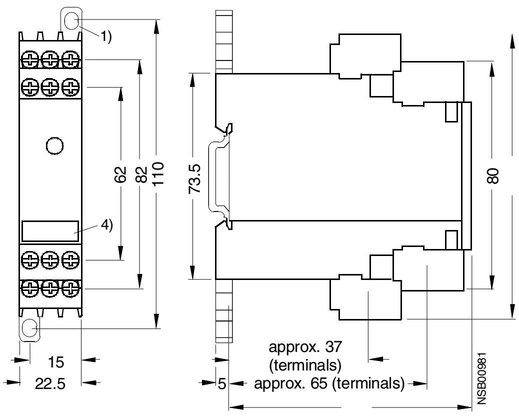
3RP1 time relay



3RP10



3RP15, 1 changeover contact without auxiliary supply5) , clock pulse generator, star-delta function



3RP15 1 and 2 changeover contact devices with auxiliary supply

1) Push-in lug for screw-type attachment
3) Coding plug (with 3RP10) or identification label
4) Drilling pattern
5) Except 3RP15 05-1A.30 two-wire design
6) Identification label

7.7 Technical specifications

Technical specifications in acc. with IEC 61812-1/DIN VDE 0435 Part 2021

Type			**3RP10 00**	**3RP15 05**	**3RP15 11**	**3RP15 40**	**3RP15 60**	**3RP15 74**	**3RP15 27**
			3RP10 20	**3RP15 31**	**3RP15 12**			**3RP15 76**	
				3RP15 32	**3RP15 13**				
				3RP15 33	**3RP15 25**				
					3RP15 55				
Rated insulation voltage		VAC	300; 500 with 3RP1505-1BT20						
Pollution degree 3 Overvoltage category III in acc. with DIN VDE 0110									
Excitation operating range [1]			0.85 to 1.1 x U_s with AC; 0.8 to 1.25 x U_s with DC						
			0.95 to 1.05 times the rated frequency						
Rated power		W	1	2	2	2	2	2	1
Power input at 230 VAC, 50 Hz		VA	4	6	6	2 [2]	6	6	1
Rated operational currents I_e									
AC-15 at 230 VAC, 50 Hz		A	3 [3]						–
AC-14; DC-13			–						0.01 to 0.6
DC-13 at 24 V			1						–
DC-13 at 48 V			0.45						–
DC-13 at 60 V			0.35						–
DC-13 at 110 V			0.2						–
DC-13 at 230 V			0.1						–
DIAZED fuse [4]									
Performance class	gL/gG	A	4						–
Switching frequency									
• Loaded with I_e 230 VAC		1/h	2500						5000
• Loaded with 3RT10 16 contactor, 230 VAC		1/h	5000						5000
Recovery time		ms	150 [5]				300	150	50
Minimum on-time		ms	35	35 [6]	–	200 [7]	–		
Residual current		mA							≤ 5
With output not switched through									
Voltage drop		V							≤ 3.5
Switched through									
Short-term current-carrying capacity		A							10 (to 10 ms)
Setting accuracy			Typically ±5%						
Related to the end of scale value									
Repeatability			≤ ±1%						
Mechanical service life	Operating cycles		30 x 10^6						100 x 10^6
Permissible ambient temperature	In operation	°C	-25 to +60						
	During storage	°C	-40 to +85						
Degree of protection			IP 40 lid						
In acc. with EN 60 529			IP 20 terminals						
Shock resistance		g/ms	15/11						
Half-sine in acc. with IEC 60 068-2-27									
Vibration resistance in acc. with IEC 60 068-2-6		Hz/mm	10-55/0.35						
EMC tests		IEC 61 000-6-2/EN 50 081-1							
In acc. with the basic specification									

Table 7-8: Technical specifications for the time relay

1) If not specified otherwise
2) Maximum making current peak 1 A/100 ms
3) With 3RP15 05-.R: NC contact –> I_e = 1 A
4) Without any welding in acc. with IEC 60 947-5-1.
5) With RP15 05.-BW30/ .AW30/ .RW30 and 3RP15 25-.BW30 voltage-dependent 10 to 250 ms.
6) Minimum on-time with 3RP15 00-. BW30 150 ms until instantaneous contact is switched.
7) Adhere to minimum on-time for problem-free functioning.

8

3RW3 semiconductor motor control unit (soft starter)

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8.1 Specifications/regulations/approvals

The 3RW3 semiconductor motor control units, referred to below more succinctly as soft starters, meet the UL and CSA requirements.

UL/CSA	UL 508
Degrees of protection offered by housings	EN
DIN standard rail	EN 50 022
Electronic Motor control units	IEC 60947 - 4-2
Shock protection	IEC 60947 - 1 and DIN 40050
EMC	IEC 60801 - 4 -2 (draft)
General specifications	EN 602 69 - 1A1
Control devices and switching elements	EN 602 69 - 1A1
Gost	Approved by Gost
CTic	EMC compliance marking for Australia (similar to CE marking)

Table 8-1: Standards, certificates, and approvals, 3RW3

Normal switching duty

The 3RW3 soft starters can be used for normal switching duty in acc. with DIN VDE 0100 Part 460:
A switch for normal switching duty must be provided for all circuits that are to be switched independently of other parts. Switches for normal switching duty do not **necessarily all switch active conductors** of a circuit.

Isolation

The soft starters do not meet the requirements for isolation in acc. with DIN VDE 0100 Part 460 and EN 60 947-1:
Every circuit must be capable of being isolated from the active conductors of the power supply.
Circuit groups can be isolated by a common device if this is permitted by the operating conditions. In the open position, devices with an isolating function must have a corresponding isolating distance and an indicator showing the positions of the moving contacts.

Warnings

⚠ Caution

The devices are all carefully tested at the factory and are not shipped unless they are found to be in proper working order. However, they may be subjected to stresses during transportation over which we have no control.

Consequently, the impulse series relays in the main circuit may be in an undefined switching state.

In the interests of complete safety, the following procedure should be used at commissioning or after the replacement of the SIRIUS soft starter:

First, apply the supply voltage in order to put the impulse series relays in a defined switching state.

Then, switch the main circuit on.

If you deviate from this procedure, the motor can be switched on inadvertently and cause damage to people or parts of the system.

⚠ Important

The 3RW3...-1.B1. soft starter was built as a class A device. Using this product in residential buildings could cause radio interference.

8.2 Device description

The SIRIUS 3RW3 soft starters are part of the SIRIUS modular system. They are compatible with the other SIRIUS switching devices.

The possible combinations are:
- 3RW3 soft starter + 3RV circuit breaker
- 3RW3 soft starter + 3RU/3RB overload relay + 3RT contactor

The link modules used for combinations of contactors and circuit breakers are used for this (see Section 8.3.2, "Installation guidelines").

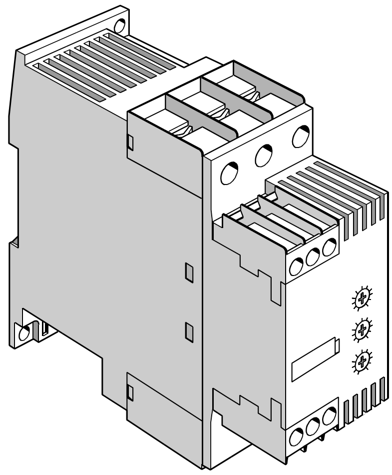

Figure 8-1: 3RW3 soft starter

3RW30/31 frame sizes

The 3RW30 soft starter is available in four frame sizes: S00, S0, S2, and S3. The 3RW31 soft starter is available in frame size S0.
The following table contains the power ranges of the various frame sizes (all specifications apply to U_N = 400 V and 40° C ambient temperature):

Frame size S00	**Frame size S0**	**Frame size S2**	**Frame size S3**
1.1 - 4 kW	5.5 - 11 kW	15 - 22 kW	30 - 55 kW
6 - 9 A	12.5 - 25 A	32 - 45 A	63 - 100 A
(W x H x D) (mm) 45 x 97.5 x 93	(W x H x D) (mm) 45x125x119	(W x H x D) (mm) 55 x 160 x 143	(W x H x D) (mm) 70x170x178

Table 8-2: 3RW3, frame sizes

8.2.1 Physical principles

Starting current

Three-phase current asynchronous motors have a high inrush current $I_{(starting)}$. This inrush current can be between three and fifteen times as high as the rated operational current, depending on the type of motor. A figure between seven and eight times the rated operational current can be postulated as typical.

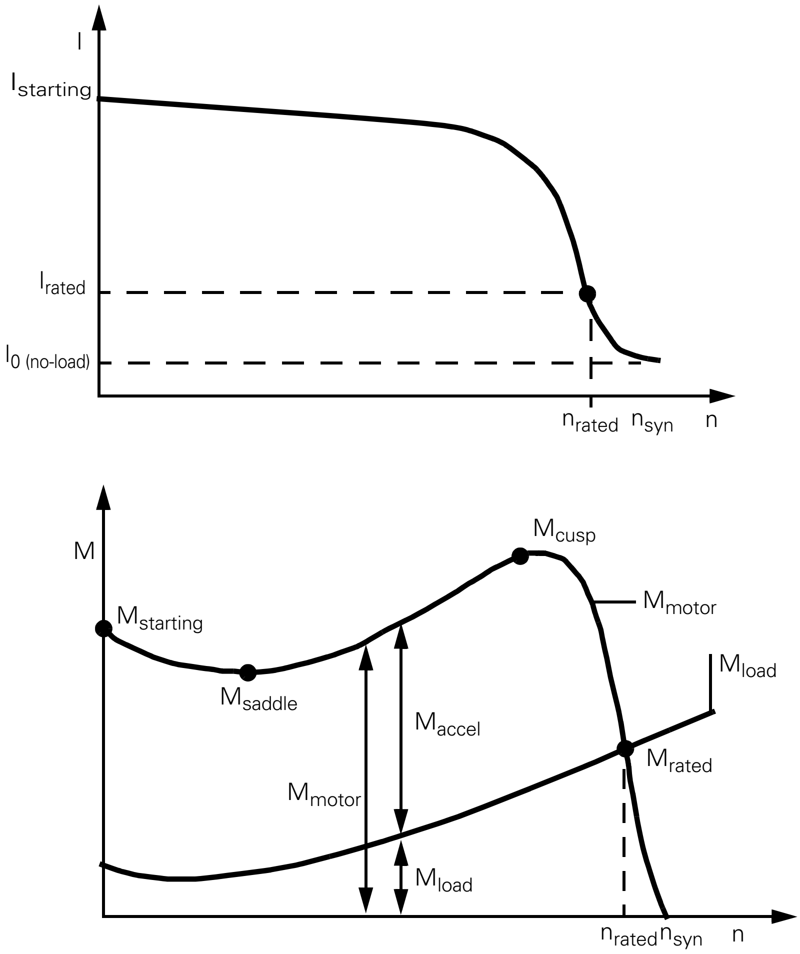

Figure 8-1: Typical current and torque curve of a three-phase asynchronous motor

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Important
This starting current must be taken into consideration in the design of the supply network, among other things by adapting the supply (high heat development) and the fusing (inadvertent tripping of the fuses).

Reducing the starting current

There are various ways of reducing the starting current:

- By star-delta starter
- By frequency converter
- By soft starter

Star-delta starter

After a delay, the motor windings are switched from a star to a delta configuration. The motor current for star starting is only about 1/3 of that required for delta starting (motor torque, too, is reduced to approximately 1/3 of the delta torque).

Disadvantages:
- 6 motor cables are necessary
- Switching surges occur (in the current and torque transients)
- The startup cannot be adapted to the system environment
- Installation is relatively complicated and time-consuming
- More space is needed in the cubicle

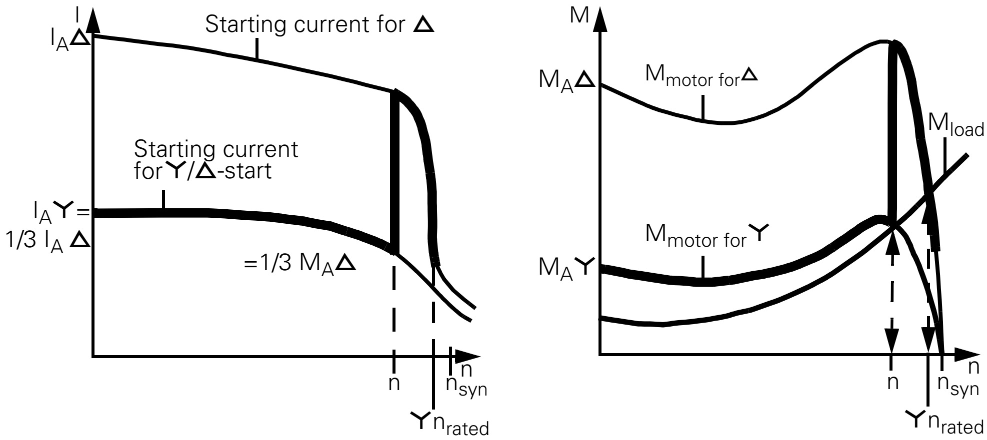


Figure 8-2: Current and torque curves for star-delta starting

Frequency converter

A frequency converter converts the AC voltage from the grid to direct voltage, which can then be converted to any voltage and frequency.
The illustration below shows how a frequency converter works:

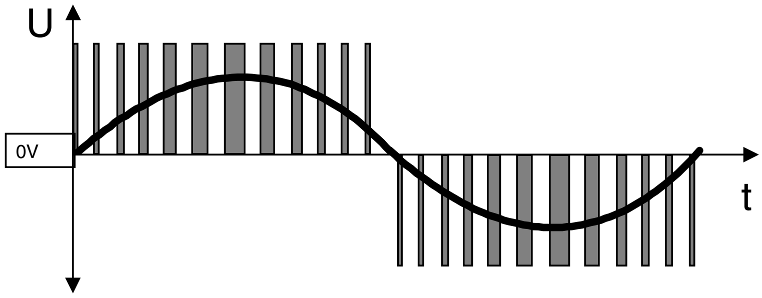


Figure 8-3: Method of operation of a frequency converter

Disadvantages:
- Relatively complicated wiring needed in order to meet radio interference suppression requirements; filters are often essential
- Line capacitances limit the lengths of motor feeder cables; it may be necessary to use chokes, sinus filters, or even dV/dt filters.
- Expensive
- System startup is complex and time-consuming on account of the multiplicity of operating parameters
- It can be necessary to use shielded motor feeder cables

Advantages:
- Motor speed is variable; speed can be accurately pegged at constant levels.

The U/f ratio remains virtually constant. It is therefore possible to achieve high torques at relatively low currents.

Soft starter

With a soft starter, motor voltage is increased from a selectable starting voltage to the rated voltage by phase firing within a defined starting time. Motor current is proportional to the motor voltage, so the starting current is reduced by the factor of the defined starting voltage.
The illustration below shows how the 3RW3 soft starter works:

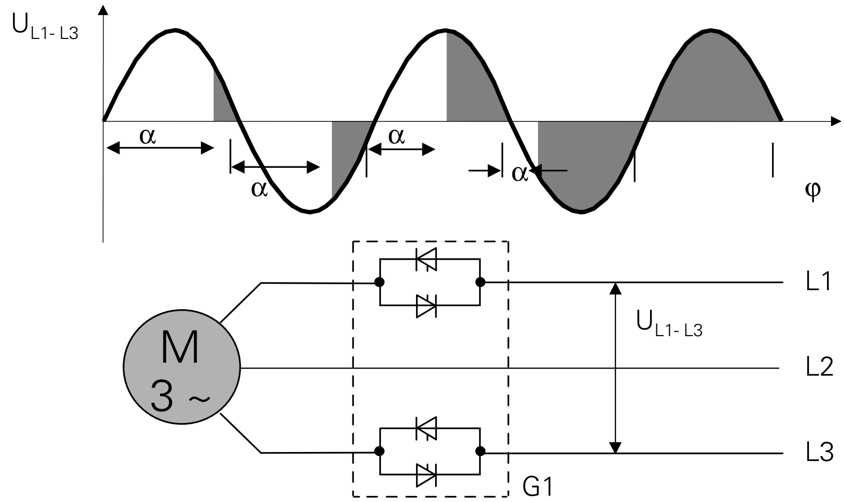


Figure 8-4: Phase firing of the supply voltage by semiconductor elements in the 3RW3 soft starter

Example:
Starting voltage 50% of U_e => starting current equals 50% of the motor starting current for direct-on-line starting.

A soft starter also reduces motor torque. This is the reason why a soft-started motor does not jerk into action.
The relationship is as follows: The motor torque is proportional to the square of the motor voltage.

Example:
Starting voltage 50% of U_e => starting torque 25% of the starting torque for direct-on-line starting.

Advantages:
- Less space needed in the cubicle
- No protective circuits (e.g. filters) necessary to comply with the radio interference suppression specifications (class A; in UC 24 V control voltage version also class B)
- Lower installation costs
- Straightforward system startup
- Only 3 motor feeder cables, half as many as are needed for a star-delta starter
- Adjustment options permit adaptation to the system.

Disadvantages:
- Long-term speed settings not possible.
- Lower torque at reduced voltage

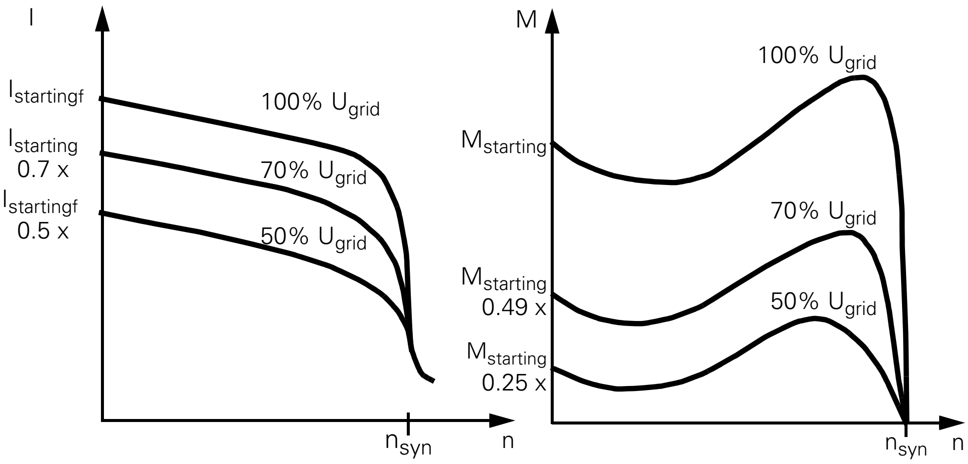


Figure 8-5: Current and torque curves for a soft starter

8.2.2 General device description

The SIRIUS modular system offers a variety of alternatives for load feeders. In addition to the star-delta starters (see Chapter 5, "3RA fuseless load feeders"), the SIRIUS 3RW3 soft starters are also available.
The 3RW3 soft starters can be combined with the following SIRIUS devices:

- 3RT contactors
- 3RV circuit breakers
- 3RU thermal overload relays
- 3RB10 electronic overload relays

They are all mounted and connected up in the same way.
Please note the relevant guidelines in Section 8.3.2.

Functions of the load feeder

Normal switching duty

Normal switching duty of a circuit can, according to the definitions of isolation and normal switching data in DIN VDE 0100 (see Section 8.1), be implemented with a contactor or a soft starter alone.

Isolation

According to DIN VDE 0100, isolation from the supplying network cannot be provided by a semiconductor element (i.e. soft starter, frequency converter, contactor, or similar).
To implement isolation from the supplying network, a 3RV circuit breaker (or another isolating device that fulfills the requirements of DIN VDE 0100) must be used in addition to the contactor or soft starter. A contactor alone in combination with the soft starter is not enough.
Both isolation and normal switching duty can be implemented quickly and easily with the 3RW3 soft starter in combination with the modules from the SIRIUS modular system.

Variants

The electronic soft starters are available in two variants:

Standard 3RW30 variant
The standard 3RW30 variant is used for single-speed motors. This variant is available in all four frame sizes. The starting voltage U_s, starting time t_{Ron}, and coasting-down time t_{Roff} can be set independently of each other on the device. The device is switched on by means of a cycling contact IN.

3RW31 special variant
The 3RW31 special variant cycles pole-changing motors (Dahlander winding). The following can be set independently of each other:

- Starting voltage U_s
- Starting time of initial speed t_{R1}
- Starting time of second speed t_{R2}

The device does not have a coasting-down function. The set starting voltage applies to both ramp times t_{R1} and t_{R2}.
The ramp time is selected by means of two inputs, IN1 and IN2, that switch the soft starter on.
The devices of the 3RW31 series are only available in frame size S0.

Settings

The devices can be set as follows:
3RW30
By means of 3 potentiometers for setting:

- Starting time in the range from 0 to 20 seconds
- Starting voltage in the range from approx. 30 to 100% of the rated voltage of the motor
- Coasting-down time in the range from 0 to 20 seconds

3RW31
By means of 3 potentiometers for setting:

- Starting time 1 in the range from 0 to 20 seconds
- Starting voltage in the range from approx. 30 to 100% of the rated voltage of the motor
- Starting time 2 in the range from 0 to 20 seconds

A special software program ensures that progressive ramp times are set. Short times of up to 5 seconds can thus be set very precisely.

Auxiliary contacts

3RW30
In the case of frame sizes S0 to S3, the following auxiliary contacts are integrated:

- "ON": When triggered, the latching signal is used for locking by means of a simple on/off pushbutton (contact designation 13/14).
- "BYPASSED": With the end-of-startup signal, control valves can be addressed after soft starting of a pump, for example, in order to enable pumping (contact designation 23/24).

The devices of frame size S00 do not have any auxiliary switches.

3RW31
The 3RW31 does not have any auxiliary contacts.

Soft starting function

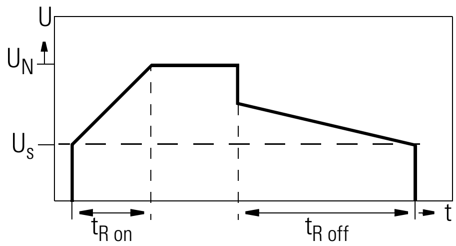
Torque-reduced start for three-phase asynchronous motors:
Triggering is two-phase, which means that the current is kept low throughout the run-up phase. Current peaks such as those that occur in a star-delta start at the changeover from star to delta are prevented by continuous voltage management.
Transient current peaks (inrush peaks) are automatically avoided in each switch-on procedure by a special control function of the power semiconductors.

Soft coasting-down function

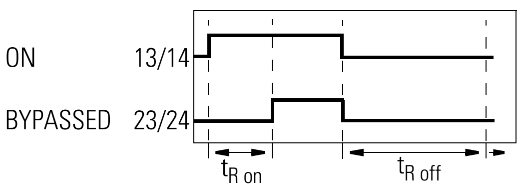
The integrated soft coasting-down function prevents the drive coming to an abrupt halt when the motor is switched off.

3RW30 time ramps

The following graphics show the time ramp of the 3RW30 and the timing diagram of the auxiliary contacts:



3RW30: Time ramp



Timing diagram of the auxiliary contacts

Figure 8-6: Time ramp/timing diagram, 3RW30

The graphic below shows the time ramp of the 3RW3:

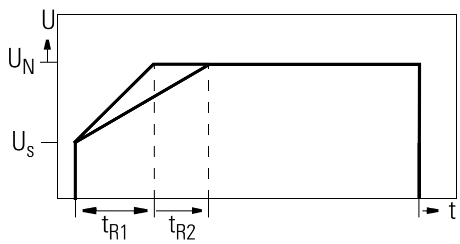


Figure 8-7: Time ramp, 3RW31

Accessories

A fan can be snapped into the soft starter housing of frame sizes S0 to S3 from below. This brings the following benefits:
- Improved range of options for the installation position
- Increase in the switching frequency (see Section 8.3.2, "Installation guidelines")

In the case of frame sizes S0 and S2, extended terminal covers can be mounted on the box covers in order to cover the cable ends and keep them safe from fingers. These are identical to the extended terminal covers of the SIRIUS 3RT contactors of the same frame sizes.
In the case of frame size S3, terminal covers are available for lug connection or bar connection. These, too, are identical to the accessory parts of the corresponding SIRIUS contactor size.
See Section 8.4 for details of other accessories.

Mounting

The devices are attached to the 3RV circuit breakers by means of a link module and are thus connected mechanically and electrically. This link module is identical to the one that is used for the corresponding contactor/circuit-breaker combinations. This installation variant offers all the advantages of a fuseless load feeder.

Link modules

The following link modules are used to combine 3RW3 soft starters and 3RV1 circuit breakers:

Frame size	Link module
S00	3RA1911-1A
S0	3RA1921-1A
S2	3RA1931-1A
S3	3RA1941-1A

Table 8-3: Link modules

Connection

The 3RW3 electronic soft starters are available with screw-type terminals. Plus-minus POZIDRIV 2 screws are used.
The SIGUT terminal system is used (captive screws, contacts open on delivery, etc.).

8.2.3 Comparison of the 3RW3 semiconductor motor control unit (soft starter) with the SIKOSTART 3RW22 and SIKOSTART 3RW34 motor control units

Soft starters are available for different applications.
The following graphic provides an overview of the different soft starters:

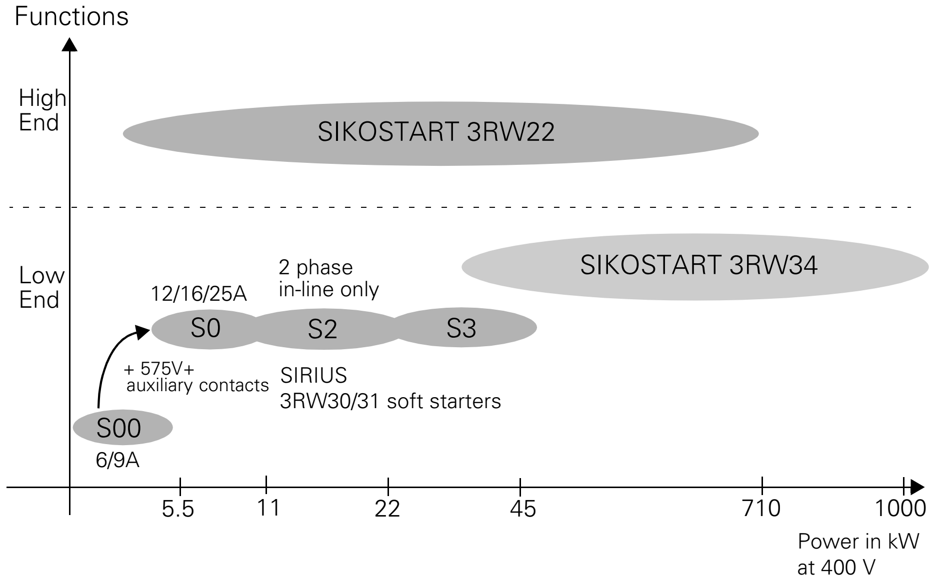


Figure 8-8: Overview of soft starters

SIKOSTART 3RW22

The SIKOSTART 3RW22 is suitable for drives that place high demands on the functionality of the starter. It covers a power range from 3 kW to 710 kW (at 400 V).

SIKOSTART 3RW22 offers the following:
- Soft starting and soft coasting down
- Break-loose torque
- DC brakes
- Energy-saving operation
- Temperature monitoring
- Operation using a PC and an RS232 interface
- Selection and configuration program
- Current and voltage limitation
- Pump functionalities (e.g. pump coasting down)
- Startup detection
- Three parameter sets
- Different coasting-down types
- Electronic device overload protection

The SIKOSTART 3RW22 application manual presents the various application areas and circuit variants (order no. E20001-P285-A484-V3).

SIKOSTART 3RW34

The SIKOSTART 3RW34 is suitable for drives with low demands in terms of the functionality of the soft starter. The SIKOSTART 3RW34 is very similar to the SIRIUS 3RW3 soft starter in terms of its operation and configuration. It covers a power range of up to 1000 kW (400 V).
The functions of the 3RW34 are as follows:

- Soft starting and soft coasting down
- 2 circuit variants: standard and root 3 circuits
- Three-phase control
- Optional AS-i bus control

You will find the technical specifications and a detailed description of the 3RW34 in the document describing SIKOSTART 3RW22/3RW34 solid-state motor controllers (order no.: E20001-A200-P302).

SIRIUS 3RW3 soft starter

The SIRIUS 3RW3 soft starter covers the power range from 1.5 kW to 45 kW.
Power semiconductors always exhibit power loss. This manifests itself in heat generation. In order to keep this power loss as low as possible, the semiconductors are bypassed by relay contacts after the motor has started up. The device's heat sink and its dimensions can thus be smaller than they otherwise would be. In addition, it is necessary to use a bypass contactor, which bypasses the line semiconductors in the conventional configuration.
For further processing in the system controller, the device offers two relay outputs:

- "ON" contact (terminals 13/14), which can be used, for example, to control the soft starter by button (locking)
- "BYPASSED" contact (terminals 23/24), which signals the completion of startup (e.g. in order to switch a solenoid valve after a soft-started pump has started up)

For drives in this power range, good motor startups can be achieved with a two-phase controller.
In the case of a two-phase controller, semiconductor elements are only used in two phases in order to reduce motor current and motor voltage in all three phases. The third phase is bypassed internally in the soft starter.

8.2.4 Comparison of the 3RW3 semiconductor motor control unit (soft starter) with the 3RA star-delta combination

The comparison of soft starter and star-delta combinations shows that the 3RW3 has the following advantages (example here 22 kW):

3RW3 soft starter	3RA star-delta starter
Width: 55 mm	Width: 165 mm
Wiring: 3 motor supply leads	Wiring: 6 motor supply leads
Selectable startup parameters	None
Minimum current values at startup	Fixed current ratios ($I_{Y} = 1/3 I_{\Delta}$)
No dangerous switchover current peaks	Switchover current peaks when switching from star to delta
Special variant for Dahlander motors	-----
Soft coasting-down function	-----

Table 8-4: Comparison of 3RW3/3RA

8.2.5 Notes on configuration

In order for a motor to reach its rated speed, motor torque at any given time during startup must be greater than the torque needed by the load, since otherwise a stable operating point would be reached before the motor achieved its rated speed (the motor would "drag to a stop"). The difference between motor torque and load torque is the accelerating torque that is responsible for the increase in the speed of the drive. The lower the accelerating torque, the longer the motor needs to run up to its operating speed.

Starting torque

Reducing the terminal voltage of a three-phase asynchronous motor reduces the motor's starting current and the starting torque.
Current is directly proportional to voltage, whereas voltage is proportional to the square root of motor torque.

Example:
Motor = 55 kW, rated current = 100 A, starting current = 7 x rating current, motor torque = 355 Nm, starting torque = 2.4 x rated torque
Settings for the soft starter: starting voltage 50% of rated voltage for motor
The reductions are thus as follows:

- The starting current is reduced to half the starting current for a direct start: 50% of (7 x 100 A) = 350 A
- Starting torque is reduced to 0.5 x 0.5 = 25% of the starting torque for a direct start: 25% of 2.4 x 355 Nm = 213 Nm

Note

On account of the fact that the starting voltage is proportional to the square root of the motor torque, it is important to ensure that the starting voltage is not too low. This applies particularly for a pronounced saddle torque, the lowest motor torque that occurs during run-up to rated speed.

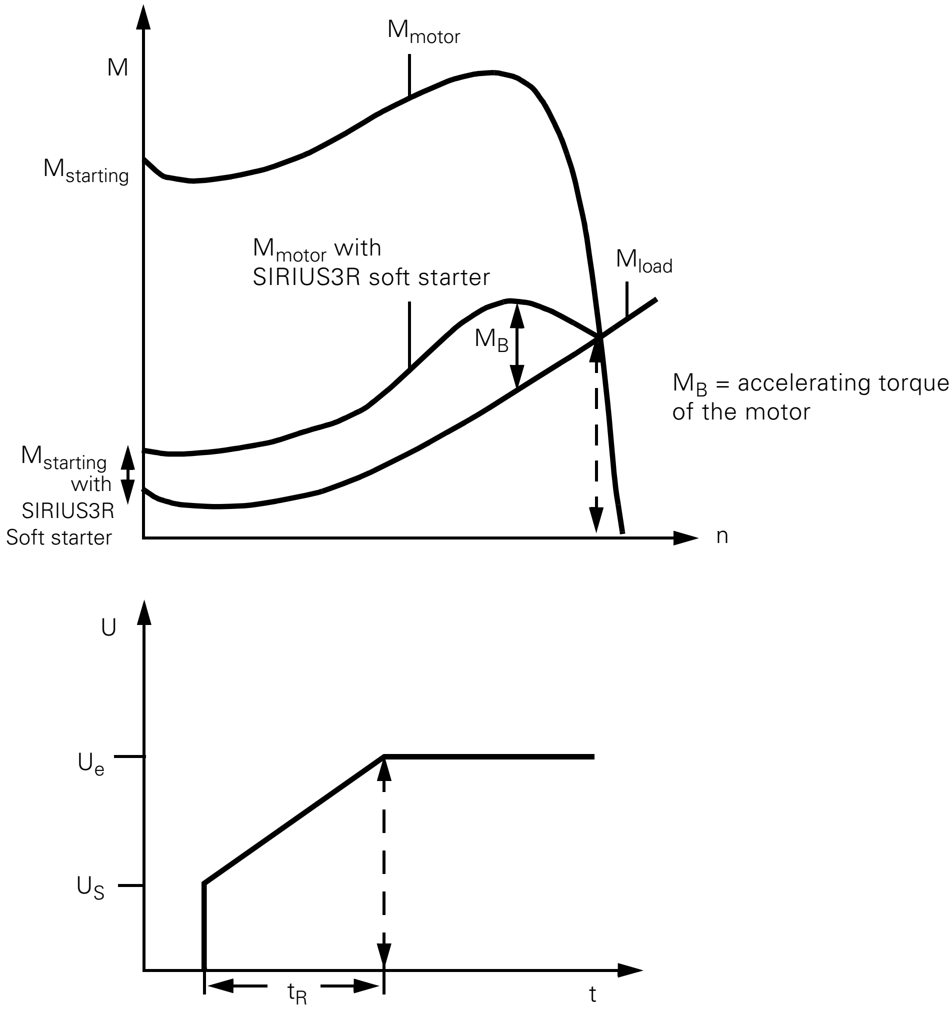


Figure 8-9: Load and motor torques and motor terminal voltage for operation with soft starter

Criteria for selection

Note

In the case of the SIRIUS 3RW30/31 soft starters, the corresponding soft starter must be selected on the basis of the rated current for the motor (the rated current of the soft starter must be ≥ the rated current for the motor).

The 3 potentiometers on the starter are for setting the starting voltage, the starting time, and the coasting-down time.

The soft starter is correctly set when the motor starts smoothly and runs up rapidly to its rated speed.

Ramp times of up to 20 seconds can be set.

8.3 Application and use

8.3.1 Areas of application and criteria for selection

The SIRIUS 3RW3 soft starters offer an alternative to star-delta starters (see Section 8.2.4 for a comparison and the advantages).
The most important advantages are soft starting and soft coasting-down, interruption-free switching without current spikes that could interfere with the supply system, and compact dimensions.
Many drives that needed frequency converters in the past can be changed to soft-start operation with the 3RW3, if the applications do not call for variations in speed.

Applications

Typical applications include, for example:

Conveyor belts, conveyor systems:
- Smooth starting
- Smooth slowing
- Use of better-value conveyor material

Rotary pumps, piston-type pumps
- Avoidance of pressure surges
- Extended service life of the piping system

Agitators, mixers:
- Reduced starting current

Fans:
- Less strain on gearing and drive belts

Cooling time

Note:
The cooling time must be taken into consideration in the starting frequency.

8.3.2 Installation guidelines

On account of the heat generated, certain installation guidelines must be adhered to when combining 3RW30/31 soft starters with other SIRIUS switching devices.

Stand-alone installation

Stand-alone installation is when minimum vertical **and** lateral clearances between the mounted devices are not violated. This applies both to individual devices and complete load feeders.
The following minimum clearances must be adhered to in stand-alone installation (these minimum clearances depend on the frame size):

Frame size	Minimum clearance on both sides in mm
S00	15
S0	20
S2	30
S3	40

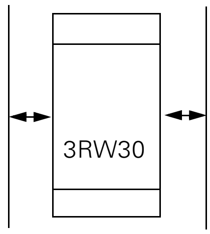


Table 8-5: Stand-alone installation, minimum clearances at the side, 3RW3

Frame size	Vertical clearance a	Vertical clearance b
S00	50	50
S0	60	40
S2	50	30
S3	60	30

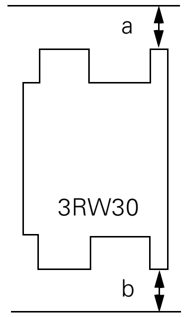


Table 8-6: Stand-alone installation, minimum clearances at the side, 3RW3

Line lengths for the drive circuit

The control inputs for starting and stopping are not rated for longer distances. This means:

- In the case of a drive circuit that goes beyond the control cubicle, coupling relays must be used.
- The control cables in the cubicle should not be laid together with main circuit cables.

When electronic output modules are used in the drive circuit (e.g. Triac outputs at 230 VAC), RC elements (e.g. 3TX7462-3T or similar with C > 100 nF) may be required at the control inputs under certain circumstances.

Correction factors

If the minimum clearances are violated, in a combination of a soft starter with a circuit breaker, fixed correction factors must be used to determine the rated current for the device and the switching frequency.
The following variables can be modified by means of correction factors:

- Rated current for the device
- Switching frequency
- Current setting of the circuit breaker
- Current setting of the overload relay

Correction factor for the rated current of the device

A factor is specified by which the device rated current of the soft starter is reduced.

Example:
Correction factor for the rated current of the device = 0.9
Selected device = 3RW3014-1CB14 (under normal conditions at 40 °C a device rated current of 6 A)
This results in an actual device rated current of:
0.9 x 6 A = 5.4 A

Correction factor for switching frequency

The switching frequency is the maximum permissible number of starts per hour. This value must be adjusted by the specified correction factor. The number of permissible starts per hour is given in Table 8.7.1, Control electronics/power electronics, in Section 8.7, Technical specifications.
The specified correction factors refer to the following operating conditions: S4 operation, 40 °C ambient temperature, 30% duty cycle

Example:
Correction factor for the switching frequency = 1.5
Selected device = 3RW3014-1CB14 (has a maximum switching frequency of 30 starts per hour under the conditions specified above)
This results in a corrected switching frequency of:
1.5 x 30 = 45 starts per hour

To increase the switching frequency, it is also possible to use a larger device.

Correction factor for the current setting of the circuit breaker

In combinations of a 3RW30 soft starter and a 3RV1 circuit breaker, the set value of the circuit breaker may have to be corrected appropriately. The correction factor specifies the extent of the change.

Example:
Correction for the current setting of the circuit breaker: 1.1
Selected device = 3RW3014-1CB14
The connected motor has a motor rated current of 5 A.
The set value of the circuit breaker must be changed to:
1.1 x 5 A = 5.5 A

Correction factor for the current setting of the overload relay

In combinations of a 3RW30 soft starter + 3RU1 thermal overload relay or 3RW30 software starter + 3RB10 electronic overload relay, the set value of the overload relay must be corrected appropriately. The correction factor specifies the extent of the change.

Example:
Correction factor for the current setting of the overload relay 0.9
Selected device = 3RW3014-1CB14
The connected motor has a motor rated current of 5 A.
The set value of the overload relay now has to be changed to:
0.9 x 5 A = 4.5 A

8.3.3 Overview tables: correction factors

The tables below give the correction factors for the circuit-breaker current setting, the device rated current, and the switching frequency.
The values indicate the difference between use with a fan (accessory) and use without a fan.
All correction fans apply throughout the entire temperature range (i.e. for 40 °C, 50 °C, and 60 °C).
The various tables specify the values in turn for the following:
3RW30/31 soft starters in a stand-alone installation
3RW30/31 soft starter + 3RV1 circuit breaker
3RW30/31 soft starter + 3RT1 contactor + 3RU1 thermal overload relay
3RW30/31 soft starter + 3RT1 contactor + 3RB10 electronic overload relay

8.3.3.1 3RW30/31 soft starters in a stand-alone installation

Minimum clearance

In the case of frame size S00 (3RW301..), the following applies to stand-alone, vertical installation without directly attached switching devices:
In order to maintain the required space above the arc chute, clearance of at least 50 mm must be maintained to grounded parts above and below.

3RW30/31 correction factors

3RW30/31 soft starters not combined with any other switching devices:

			Without fan				With fan	
			Stand-alone installation		Installed side by side		Stand-alone installation or side by side	
			Correction factor		Correction factor		Correction factor	
Order number	Frame size	Device rated current in A at 40 °C	Rated current for the device	Switching frequency	Rated current for the device	Switching frequency	Rated current for the device	Switching frequency
3RW3014-1CB..	S00	6	1	1	1	0,75	- 1)	- 1)
3RW3016-1CB..	S00	9	1	1	1	0.75	- 1)	- 1)
3RW3.24-1AB..	S0	12.5	1	1	1	0.65	1	1.8
3RW3.25-1AB..	S0	16	1	1	1	0.65	1	1.8
3RW3.26-1AB..	S0	25	1	1	1	0.65	1	1.8
3RW3034-1AB..	S2	32	1	1	1	0.65	1	1.8
3RW3035-1AB..	S2	38	1	1	1	0.65	1	1.8
3RW3036-1AB..	S2	45	1	1	1	0.65	1	1.8
3RW3044-1AB..	S3	63	1	1	1	0.8	1	1.6
3RW3045-1AB..	S3	75	1	1	1	0.75	1	1.6
3RW3046-1AB..	S3	100	1	1	1	0.7	1	1.6

Table 8-7: Correction factors, 3RW30/31

1) The SIRIUS 3RW301.. soft starters cannot be operated with a fan.

8.3.3.2 3RW30/31 soft starters in combination with the 3RV1 circuit breaker

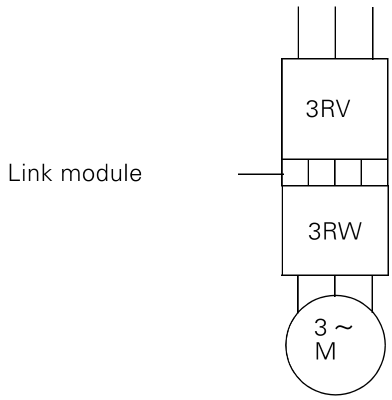


Figure 8-10: 3RW3 soft starter + 3RV1 circuit breaker

Dimensioning of the circuit breaker

The frame size selected for the circuit breaker should be large enough so that the current value calculated can just be set.
In the event of current values that are lower than can be set for the specified circuit breaker, the next smaller circuit breaker must be used.

Correction factors: 3RV1 + 3RW30/31

Combination of a 3RV1 circuit breaker + 3RW30/31 soft starter:

Order number	Frame size	Device rated current in A at an ambient temperature of 40 °C	Order number Circuit breaker	Adjustment range Circuit breaker	Without fan, Stand-alone installation: Correction factor Rated current for the device	Without fan, Stand-alone installation: Correction factor Switching frequency	Without fan, Stand-alone installation: Correction factor Current setting of the circuit breaker	Without fan, Installed side by side: Correction factor Rated current for the device	Without fan, Installed side by side: Correction factor Switching frequency	Without fan, Installed side by side: Correction factor Current setting of the circuit breaker	With fan, Stand-alone installation: Correction factor Rated current for the device	With fan, Stand-alone installation: Correction factor Switching frequency	With fan, Stand-alone installation: Correction factor Current setting of the circuit breaker	With fan, Installed side by side: Correction factor Rated current for the device	With fan, Installed side by side: Correction factor Switching frequency	With fan, Installed side by side: Correction factor Current setting of the circuit breaker
3RW3014-1CB..	S00	6	3RV1011-1GA10	(4.5 - 6.3) A	1	0.9	1	1	0.5	1.	- 1)	- 1)	- 1)	- 1)	- 1)	- 1)
3RW3016-1CB..	S00	9	3RV1011-1JA10	(7 - 10) A	1	0.9	1	1	0.5	1.	- 1)	- 1)	- 1)	- 1)	- 1)	- 1)
3RW3.24-1AB..	S0	12.	3RV1021-1KA10	(9 - 12.) A	1	0.5	1	1	0.5	1.	1	1.	1	1	1.7	1.1
3RW3.25-1AB..	S0	16	3RV1021-4AA10	(11 - 16) A	1	0.5	1	1	0.5	1.	1	1.	1	1	1.7	1.1
3RW3.26-1AB..	S0	25	3RV1021-4DA10	(20 - 25) A	1	0.75	1	0.	0.5	1.	1	1.	1	1	1.7	1.1
3RW3034-1AB..	S2	32	3RV1031-4EA10	(22 - 32) A	1	0.65	1	0.9	0.45	1.1	1	2.2	1	1	1.9	1.1
3RW3035-1AB..	S2	38	3RV1031-4FA10	(28 - 40) A	1	0.85	1	0.95	0.35	1.1	1	1.8	1	1	1.7	1.1
3RW3036-1AB..	S2	45	3RV1031-4GA10	(36 - 45) A	1	0.85	1	0.9	0.4	1.1	1	1.8	1	1	1.7	1.1
3RW3044-1AB..	S3	63	3RV1041-4JA10	(45 - 63) A	1	0.85	1	0.95	0.6	1.1	1	1.6	1	1	1.3	1.1
3RW3045-1AB..	S3	75	3RV1041-4KA10	(57 - 75) A	1	0.8	1	0.9	0.5	1.1	1	1.6	1	1	1.3	1.1
3RW3046-1AB..	S3	100	3RV1041-4MA10	(80 - 100) A	1	0.75	1	0.85	0.55	1.1	1	1.6	1	1	1.2	1.1

1) = SIRIUS 3RW301 .. soft starters cannot be used with a fan

Table 8-8: Correction factors: 3RV1 circuit breaker + 3RW3 soft starter

8.3.3.3 Combining the 3RT contactor with the 3RU1 thermal overload relay and 3RW3 soft starter

Frame size of the overload relay

The frame size selected for the overload relay should be large enough so that it is just possible to set the current value calculated.
In the event of current values that are lower than can be set for the specified overload relay, the next smaller overload relay must be used.

Important
It is not permissible to mount the thermal overload relay under the contactor/connecting lead/soft starter combination.
The overload relay must be integrated in the feeder before the contractor/ connecting lead/soft starter combination. The specified correction factors apply only to this permissible mounting sequence.

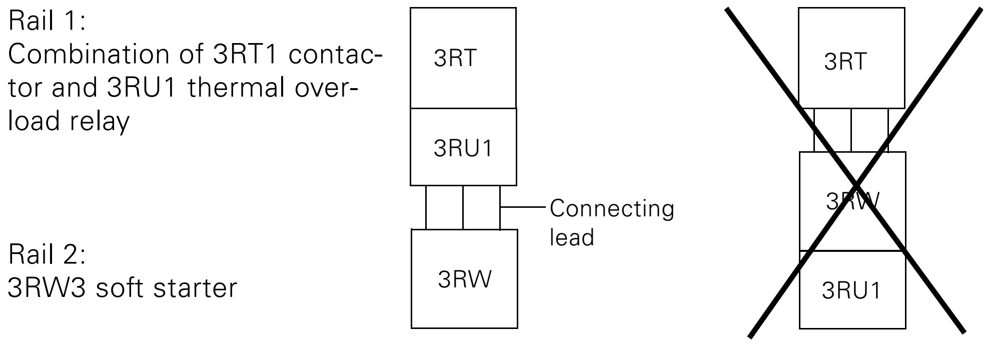


Figure 8-11: 3RT+3RU1+3RW3 combination

Minimum clearance

For thermal reasons, a minimum clearance is necessary between the contactor/overload relay combination and the soft starter, as is a minimum length of the connecting leads.
The following table specifies the minimum clearances and minimum lengths of the connecting leads for the various frame sizes:

Frame size	Minimum clearance between rail 1 and rail 2 (center to center) in mm	Minimum length of the connecting lead in mm
S00	160	100
S0	200	150
S2	240	200
S3	300	250

Table 8-9: 3RW3 installation guidelines, minimum clearances/lengths

Correction factors: 3RT + 3RU1 + 3RW30/31

Combination of the 3RT1 contactor with an attached 3RU1 thermal overload relay/connecting lead/3RW30/31 soft starter:

						Without fan Stand-alone installation			Without fan Installed side by side			With fan Stand-alone installation			With fan Installed side by side		
Order number	Frame size	Device rated current in A at an ambient temperature of 40 °C	Contactor order number	Order number Therm. overload relay	Setting range of the overload relay	Correction factor Rated current for the device	Correction factor for switching frequency	Correction factor Set value for th. overload relay	Correction factor Rated current for the device	Correction factor for switching frequency	Correction factor Set value for th. overload relay	Correction factor Rated current for the device	Correction factor for switching frequency	Correction factor Current setting of the circuit breaker	Correction factor Rated current for the device	Correction factor for switching frequency	Correction factor Set value for th. overload relay
3RW3014-1CB..	S00	6	3RT1015-1A..	3RU1116-1GBO	(4.5 - 6.3) A	0.95	1	1	0.9	0.75	1	- 1)	- 1)	- 1)	- 1)	- 1)	- 1)
3RW3016-1CB..	S00	9	3RT1016-1A..	3RU1116-1JBO	(7 - 10) A	0.9	0.95	1	0.8	0.8	1	- 1)	- 1)	- 1)	- 1)	- 1)	- 1)
3RW3.24-1AB..	S0	12.5	3RT1024-1A..	3RU1126-1KBO	(9-12.5)A	0.95	0.9	1	0.9	0.55	1	1	1.8	0.95	1	1.7	0.95
3RW3.25-1AB..	S0	16	3RT1025-1A..	3RU1126-4ABO	(11-16)A	0.95	0.9	1	0.9	0.55	1	1	1.8	0.95	1	1.7	0.95
3RW3.26-1AB..	S0	25	3RT1026-1A..	3RU1126-4DBO	(22-25)A	0.9	0.8	1	0.8	0.55	1	1	1.8	0.95	1	1.7	0.95
3RW3034-1AB..	S2	32	3RT1034-1A..	3RU1136-4EBO	(22-32)A	0.95	0.7	1	0.9	0.45	1	1	2.2	0.92	1	1.9	0.92
3RW3035-1AB..	S2	38	3RT1035-1A..	3RU1136-4FBO	(28-40)A	0.95	0.9	1	0.9	0.35	1	1	1.8	0.92	1	1.7	0.92
3RW3036-1AB..	S2	45	3RT1036-1A..	3RU1136-4HBO	(36-45)A	0.9	0.95	1	0.8	0.45	1	1	1.8	0.92	1	1.7	0.92
3RW3044-1AB..	S3	63	3RT1044-1A..	3RU1146-4JBO	(45-63) A	0.95	0.9	1	0.9	0.65	1	1	1.6	0.92	1	1.5	0.92
3RW3045-1AB..	S3	75	3RT1045-1A..	3RU1146-4KBO	(57-75) A	0.95	0.85	1	0.9	0.5	1	1	1.6	0.92	1	1.5	0.92
3RW3046-1AB..	S3	100	3RT1046-1A..	3RU1146-1MBO	(80-100) A	0.9	0.8	1	0.8	0.55	1	1	1.6	0.92	1	1.5	0.92

1) = SIRIUS 3RW301 .. soft starters cannot be used with a fan.

Table 8-10: Correction factors, 3RT contactor + 3RU therm. overload relay + 3RW soft starter

8.3.3.4 Combining the 3RT contactor with the 3RB10 electronic overload relay and 3RW3 soft starter

The contactor, electronic overload relay, and soft starter can be connected in two ways:
- Combining a 3RT1 contactor with an attached 3 RB10 electronic overload relay, a connecting lead, and a 3RW30/31 soft starter
- Combining a 3RT1 contactor with a connecting lead and a combination of a 3RW30/01 soft starter with an attached 3RB10 electronic overload relay

3RT + 3RB10 + connecting lead + 3RW3

Rail 1:
Combination of a 3RT1 contactor and a 3RB10 electronic overload relay

Rail 2:
3RW30/31 soft starter

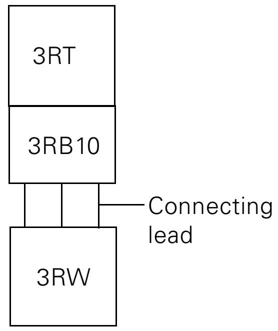


Figure 8-12: 3RT+3RB10+3RW3 combination

Minimum clearance

For thermal reasons, a minimum clearance is necessary between the contactor/overload relay combination and the soft starter, as is a minimum length of the connecting leads.
The following table specifies the minimum clearances and minimum lengths of the connecting leads for the various frame sizes:

Frame size	Minimum clearance between rail 1 and rail 2 (center to center) in mm	Minimum length of the connecting lead in mm
S00	160	100
S0	200	150
S2	240	200
S3	300	250

Table 8-11: 3RT + 3RB10 + 3RW3 installation guidelines, minimum clearances/minimum lengths

3RT + connecting lead + 3RB10 + 3RW3

Rail 1:
3RT1 contactor

Rail 2:
Combination of 3RW30/31 soft starter and 3RB10 electronic overload relay

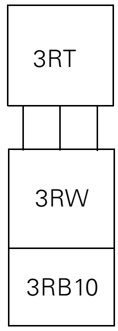


Figure 8-13: 3RT+3RW3+3RB10 combination

Minimum clearances

Frame size	Minimum clearance between rail 1 and rail 2 (center to center) in mm	Minimum length of the connecting lead in mm
S00	100	100
S0	140	150
S2	180	200
S3	240	250

Table 8-12: 3RT1 + 3RW30/31 + 3RB10 installation guidelines, minimum clearances/minimum lengths

Correction factors: 3RT + 3RB10 + 3RW3

Combining a 3RT1 contactor with an attached 3RB10 electronic overload relay, a connecting lead, and a 3RW30/31 soft starter

Order number	Frame size	Device rated current in A at an ambient temperature of 40 °C	Contactor order number	Order number of electronic overload relay	Setting range of the overload relay	Without fan, Stand-alone installation: Correction factor Rated current for the device	Without fan, Stand-alone installation: Correction factor for switching frequency	Without fan, Stand-alone installation: Correction factor Set value of the el. overload relay	Without fan, Installed side by side: Correction factor Rated current for the device	Without fan, Installed side by side: Correction factor for switching frequency	Without fan, Installed side by side: Correction factor Set value of the el. overload relay	With fan, Stand-alone installation: Correction factor Rated current for the device	With fan, Stand-alone installation: Correction factor for switching frequency	With fan, Stand-alone installation: Correction factor Current setting of the circuit breaker	With fan, Installed side by side: Correction factor Rated current for the device	With fan, Installed side by side: Correction factor for switching frequency	With fan, Installed side by side: Correction factor Set value of the el. overload relay
3RW3014-1CB..	S00	6	3RT1015-1A..	3RB1016-1SBO	(3-12)A	1	0.95	1	1	?	1	- 1)	- 1)	- 1)	- 1)	- 1)	- 1)
3RW3016-1CB..	S00	9	3RT1016-1A..	3RB1016-1SBO	(3-12)A	1	0.95	1	1	?	1	- 1)	- 1)	- 1)	- 1)	- 1)	- 1)
3RW3.24-1AB..	S0	12.5	3RT1024-1A..	3RB1026-1QBO	(6-25)A	1	0.85	1	1	0.5	1	1	1.8	1	1	1.7	1
3RW3.25-1AB..	S0	16	3RT1025-1A..	3RB1026-1QBO	(6-25)A	1	0.85	1	1	0.5	1	1	1.8	1	1	1.7	1
3RW3.26-1AB..	S0	25	3RT1026-1A..	3RB1026-1QBO	(6-25)A	1	0.75	1	1	0.45	1	1	1.8	1	1	1.7	1
3RW3034-1AB..	S2	32	3RT1034-1A..	3RB1036-1UBO	(15-50)A	1	0.65	1	1	0.4	1	1	2.2	1	1	1.9	1
3RW3035-1AB..	S2	38	3RT1035-1A..	3RB1036-1UBO	(15-50)A	1	0.85	1	1	0.35	1	1	1.8	1	1	1.7	1
3RW3036-1AB..	S2	45	3RT1036-1A..	3RB1036-1UBO	(15-50)A	1	0.85	1	1	0.35	1	1	1.8	1	1	1.7	1
3RW3044-1AB..	S3	63	3RT1044-1A..	3RB1046-1EBO	(25-100)A	1	0.85	1	1	0.6	1	1	1.6	1	1	1.5	1
3RW3045-1AB..	S3	75	3RT1045-1A..	3RB1046-1EBO	(25-100)A	1	0.8	1	1	0.5	1	1	1.6	1	1	1.5	1
3RW3046-1AB..	S3	100	3RT1046-1A..	3RB1046-1EBO	(25-100)A	1	0.75	1	1	0.55	1	1	1.6	1	1	1.5	1

1) = SIRIUS 3RW301 .. soft starters cannot be used with a fan.

Table 8-13: Correction factors, 3RT contactor + 3RB10 electronic overload relay + 3RW soft starter

8.3.4 Circuit example

Circuit example (variant with UC110-230 V):

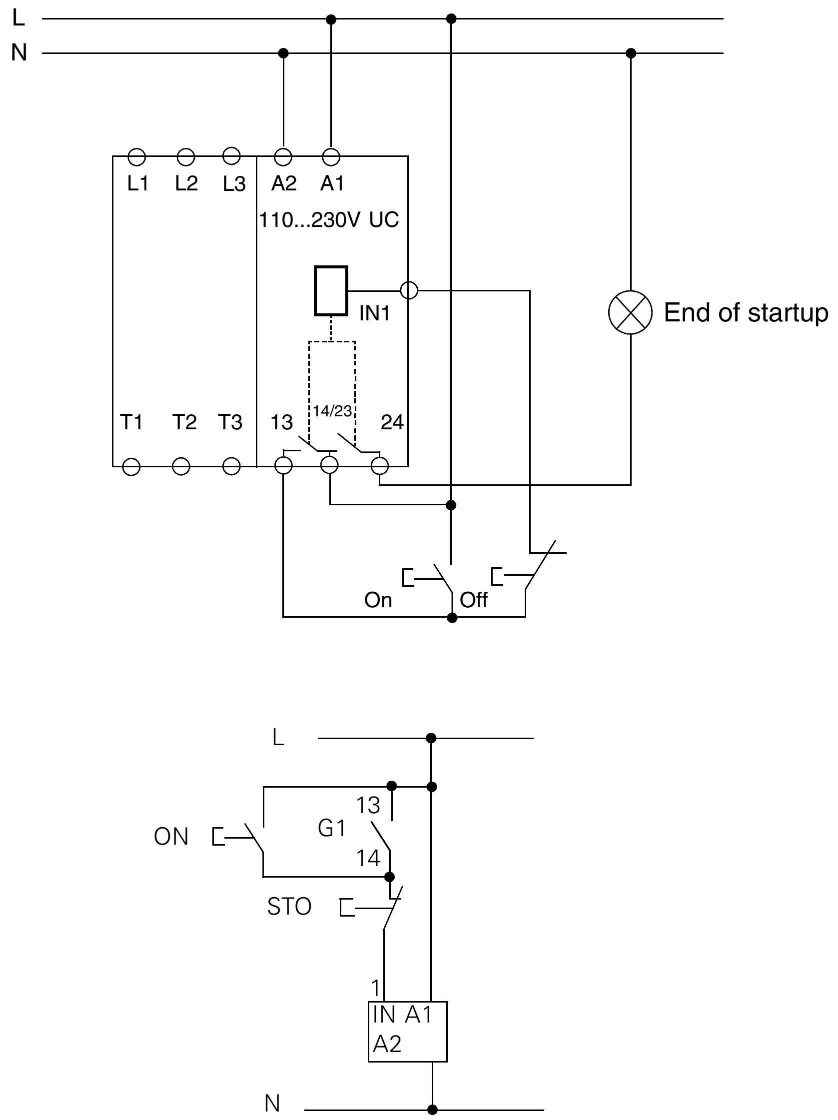


Figure 8-14: Circuit example, 3RW3

8.3.5 Commissioning

Every SIRIUS 3RW soft starter comes with the following warning, which it is imperative to heed:

Caution
This device has been tested carefully at the factory and found to be in working order.
During transportation, however, it may have been subject to stresses over which we have no control. The bypass relays in the main circuit may be in an undefined state.
In the interests of complete safety, the following procedure should be used at commissioning or after the replacement of the SIRIUS soft starter:

First, apply the supply voltage to A1/A2 in order to put the impulse series relays in a defined switching state.

Then, switch on the main circuit (L1/L2/L3).

If you do not do this, the motor can be switched on inadvertently and cause damage to people or parts of the system.

Settings

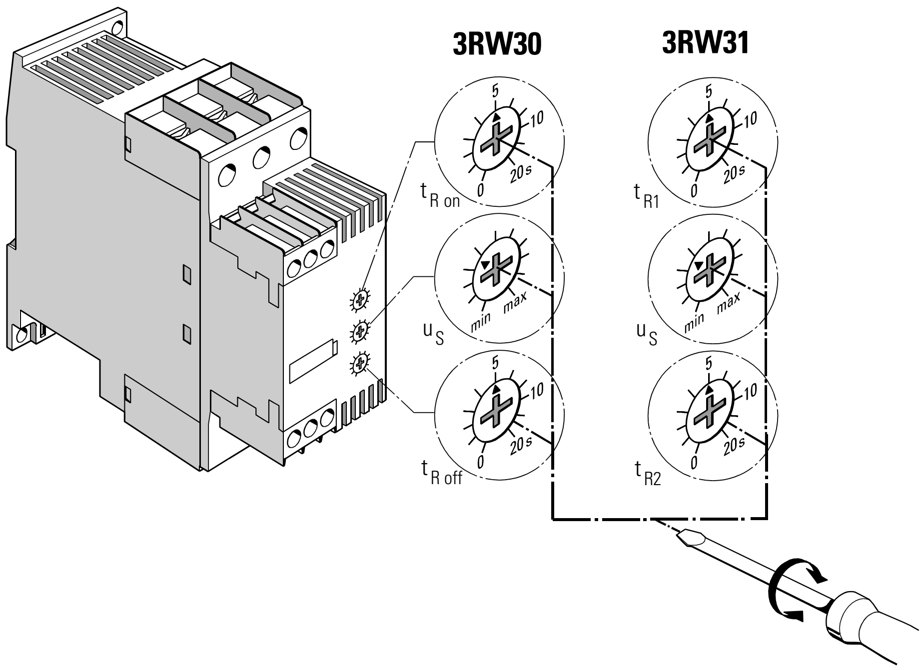


Figure 8-15: Settings, 3RW3

Note
At commissioning, the settings of the potentiometers for the ramp time and the starting voltage should remain unchanged. These set values must be obtained in a trial.

Changing settings

The potentiometer settings are scanned before each switching operation ("ON" or "OFF").
If, for example, the setting of the potentiometer for starting time is changed while the motor is running up, the change does not come into effect until the next start.

Starting voltage

The starting voltage should be set to a value at which the motor starts rapidly.

Ramp time

The ramp time should be set such that the motor can run up within the time defined in this way.
If the star time for star-delta starting is known, the ramp time can be set to this value.

Coasting-down time

The potentiometer for the coasting-down time is for setting the duration of the voltage ramp for coasting down. This parameter can be used to make the motor run-down longer than it would be if the motor were merely to coast to a stop.
The motor coasts to a stop on its own if this potentiometer is set to a value of 0.

Switching frequency

To prevent thermal overloading of the devices, the maximum permissible switching frequency must be adhered to and the correction factor tables must be used (see the installation guidelines in Section 8.3.2).

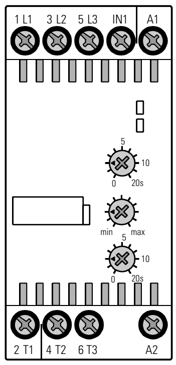
Starting time

In order to obtain optimum operating conditions for the 3RW3 soft starter, the setting for the starting time should be approx. 1 second longer than the resultant motor run-up time, in order to ensure that the internal jumpering contacts do not have to carry the starting current. This protects the internal jumpering contacts and increases their service life. Longer starting times increase the thermal load on the devices and the motor unnecessarily and lead to a reduction in the permissible switching frequency.

Position of the terminals

3RW30
The following graphic illustrates the position of the terminals and the potentiometers for adjustment.

Frame size S00
3RW301.



Frame size S0 to S3
3RW302./303./304.

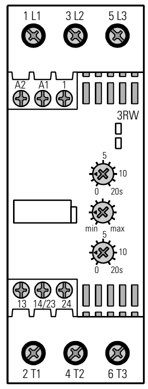


Figure 8-16: Position of the terminals and the potentiometers for adjustment

3RW31
The 3RW31 soft starters are available in frame size S0. Outwardly, they differ from the 3RW30 in the labeling of the contacts and the terminals:

- There is no BYPASSED auxiliary contact. The free contact is used to enable the necessary drive contact IN2 to switch between the ramp times t_{R1} and t_{R2}.
- The 3RW31 does not have a coasting-down ramp. The potentiometer with which the coasting-down time is adjusted on the 3RW30 is used here to set the second ramp time t_{R2}.
- There is no ON auxiliary contact.

Line length of the control cable

To eliminate problems with the cable coupler capacitances, the control cable should be shorter than 15 m. (This is based on devices with a rated control supply voltage of UC 24 V to 50 m.)
To eliminate problems in control cables that are fed out of the cubicle, coupling links must be used.

8.3.6 Event messages and diagnostics

Event messages

READY LED	Continuous Flashing	Ready for operation while starting up or coasting down
BYPASSED LED	Continuous	Bypassed

Table 8-14: 3RW30/31 event messages

Diagnostics

Malfunction	Possible cause	Remedy
READY LED off	• Supply voltage too low	• Check and adapt the supply voltage at A1, A2
No reaction to control input IN (READY LED on)	• No supply voltage	• Check fuses/line contactor
	• Phase loss	• Check fuses/line contactor • Check voltages at L1 to L3
	• Wrong cable connected to IN	• Connect to IN as shown in the graphic of the terminals
	• No load	• Connect the motor
Start the motor directly (BYPASSED LED on)	• The line voltage is switched off and on in continuous operation without operation of the control input IN	• Always switch the line contactor off and on in conjunction with control input IN

Table 8-15: 3RW30/31 diagnostics

8.3.7 Timing diagram

Starting and coasting-down behavior

The following timing diagram shows the switchover times when the device is switched on/off:

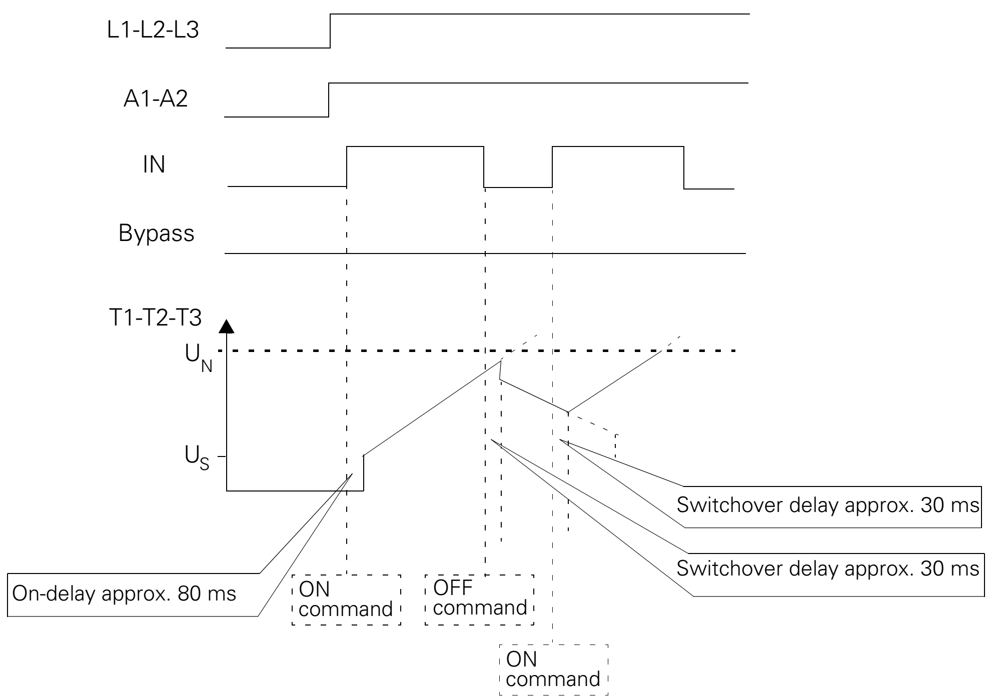


Figure 8-17: Starting and coasting-down behavior

Supply interruption in bypassed state

If the load voltage is switched off in the bypassed state while the auxiliary supply continues to be applied at terminals A1/A2, the soft starter performs a direct start of the motor after the load voltage is switched on again. To prevent this, the "on" command must be removed in the event of the loss of the main voltage.
The following graphic illustrates what happens when the supply is interrupted in the bypassed state:

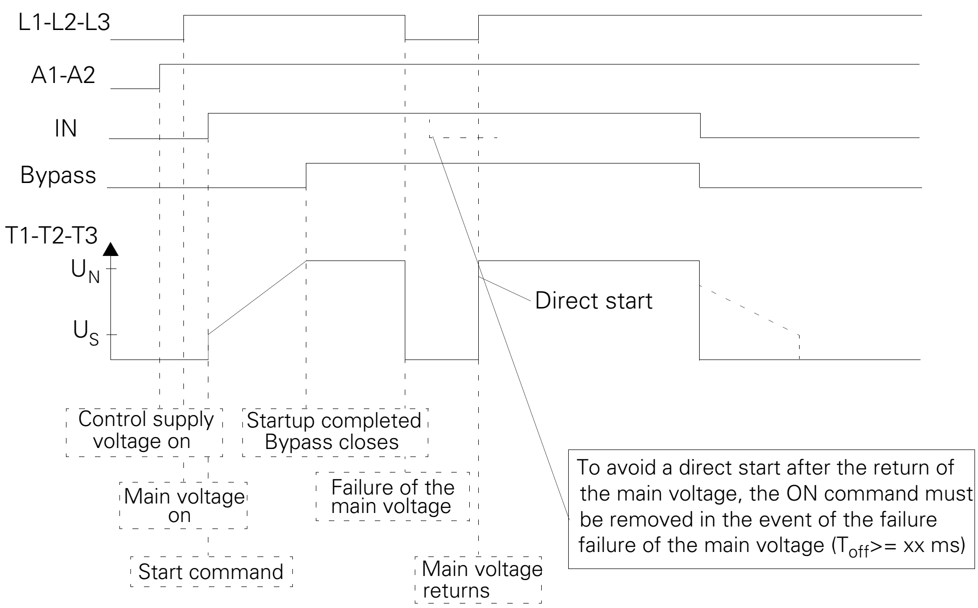


Figure 8-18: Supply interruption in the bypassed state

8.4 Accessories

The following accessories are available for the 3RW3 soft starters:

Description	Order number
Fan for 3RW3.2..	3RW3926-8A
Fan for 3RW303.. and 3RW304..	3RW3936-8A
Terminal covers for box covers for 3RW303..	3RT1936-4EA2
Terminal covers for box covers for 3RW304..	3RT1946-4EA2
Terminal cover for bar connection for 3RW304..	3RT1946-4EA1
Link modules for combination with 3RV1 circuit breaker	3RA19.1-1A (frame sizes S00 to S3)
RC element for control from PLC	3TX7462-3T

Table 8-16: Accessories, 3RW30/31

Control of the fan

The fan is controlled by the control electronics of the soft starter.
It runs at the following times:

- When the fan is switched on: approx. 0.5 seconds after the bypass contacts close (end-of-startup signal)
- When the fan is switched off: approx. 0.5 hours after the soft starter is switched off

Attachment of the fan

The fan is snapped into the recess provided on the underside of the soft starter, and the plug-in cable is inserted in the corresponding connector. The direction of installation is indicated on the fan by an arrow.
Additional parameter assignment is not necessary.
These fan modules mean that the starter can be installed in any position. The only exception to this is when the fan cannot blow against the convection downward from above.

Attachment of the fan

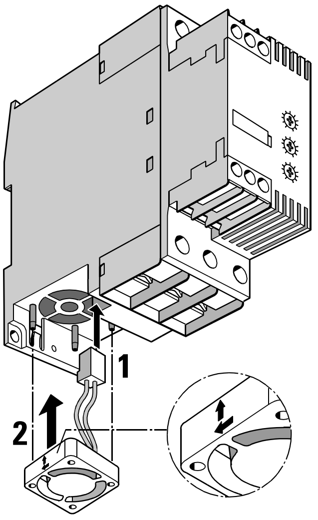


Figure 8-19: Accessories: attachment of the fan

Terminal covers

To provide additional finger protection, for frame sizes S2 and S3 the terminal covers of the 3RT1 contactors of the same frame sizes can be used. Installation on the soft starter is analogous to that on the contactors.

Link modules

The same link modules are available for building fuseless feeders (soft starter + 3RV circuit breaker) as are used for the 3RT contactor + 3RV circuit breaker combinations.
Refer to the information and assignment tables in Section 8.3.2, "Installation guidelines".

RC element

If the 3RW30/31 soft starter is to be controlled from a PLC with a Triac or thyristor output, malfunctioning can be avoided with an RC element. If there is leakage current of more than 1 mA, without an RC element the soft starter may interpret the drop in voltage that occurs at the input as an "ON" command.

Connection example for an RC element

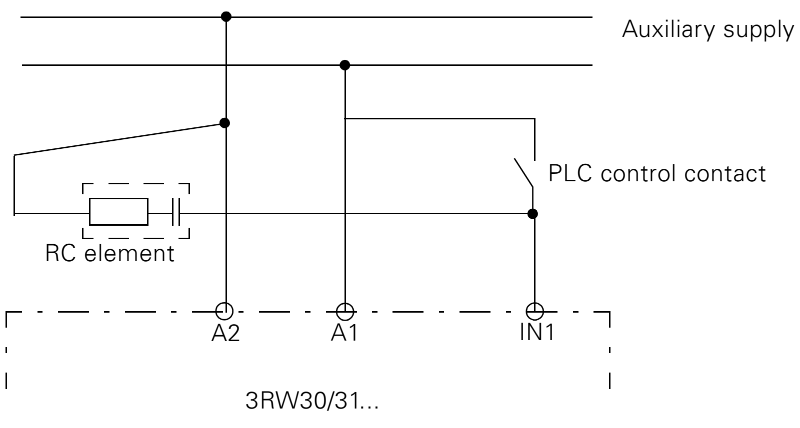


Figure 8-20: Connection example with an RC element

8.5 Mounting and connection

8.5.1 Mounting

Snap-on attachment

The 3RW30 soft starters are snapped onto 35 mm rails in acc. with DIN EN 50 022 without a tool.
The starter is placed on the upper edge of the rail and pressed downward until it snaps onto the lower edge of the rail.
Frame sizes S00 and S0 can be removed just as easily: The starters are pressed downward so that the tension of the attachment springs is loosened, and the starters can be removed.
In the case of frame sizes S2 and S3, these attachment springs are released by a lug on the underside of the starter that can be moved using a screwdriver.

8.5.2 Connection

Screw-type terminals

The 3RW3 electronic soft starters are available with the SIGUT’ terminal system and plus-minus POZIDRIV 2 screws.

Conductor cross-sections

The following table shows the permissible conductor cross-sections for the 3RW30 electronic soft starters:

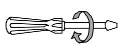
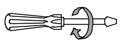
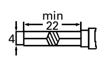
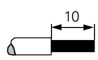
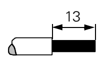
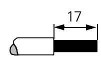
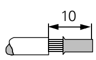
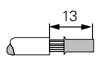
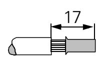
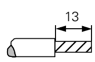
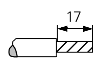
	3RW301. L1 L2 L3 A1/A2; NO/NC	3RW302. 3RW312. L1 L2 L3		3RW303. L1 L2 L3		3RW304.. L1 L2 L3
 ∅ 5 ... 6 mm / PZ2	0.8 to 1.2 Nm 7 to 10.3 lb.in	2 to 2.5 Nm 18 to 22 lb.in	 ∅ 5 ... 6 mm / PZ2	3 to 4.5 Nm 27 to 40 lb.in		4 to 6 Nm 35 to 53 lb.in
	2 x (0.5 to 1.5 mm²) 2 x (0.75 to 2.5 mm²)	2 x (1 to 2.5 mm²) 2 x (2.5 to 6 mm²)		2 x (0.75 to 16 mm²)		2 x (2.5 to 16 mm²)
	2 x (0.5 to 2.5 mm²)	2 x (1 to 2.5 mm²) 2 x (2.5 to 6 mm²)		2 x (0.75 to 16 mm²) 1 x (0.75 to 25 mm²)		2 x (2.5 to 35 mm²) 1 x (2.5 to 50 mm²)
----	----	----		2 x (0.75 to 25 mm²) 1 x (0.75 to 35 mm²)		2 x (10 to 50 mm²) 1 x (10 to 70 mm²)
AWG	2 x (18 to 14)	2 x (14 to 10)	**AWG**	2 x (18 to 3) 1 x (18 to 2)	**AWG**	2 x (10 to 1/0) 1 x (10 to 2/0)

Table 8-17: Conductor cross-sections, 3RW30/31

8.5.3 Circuit diagrams

There are two ways to connect up the 3RW3 soft starter:

- Control by button and locking of the ON button via the "ON" auxiliary contact of the 3RW3
- Control by switch

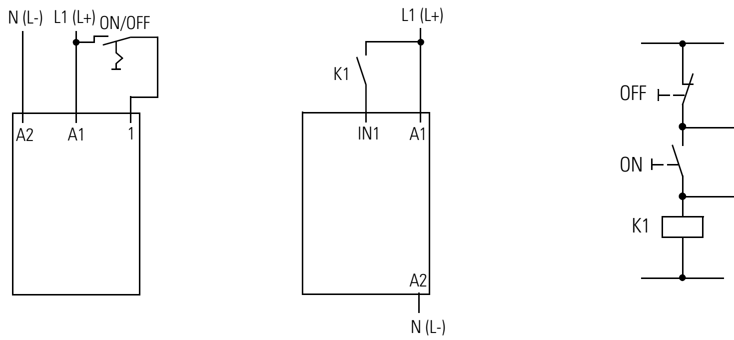


Figure 8-21: Circuit diagrams, 3RW3

L3RW30

3RW302.
3RW303./3RW304

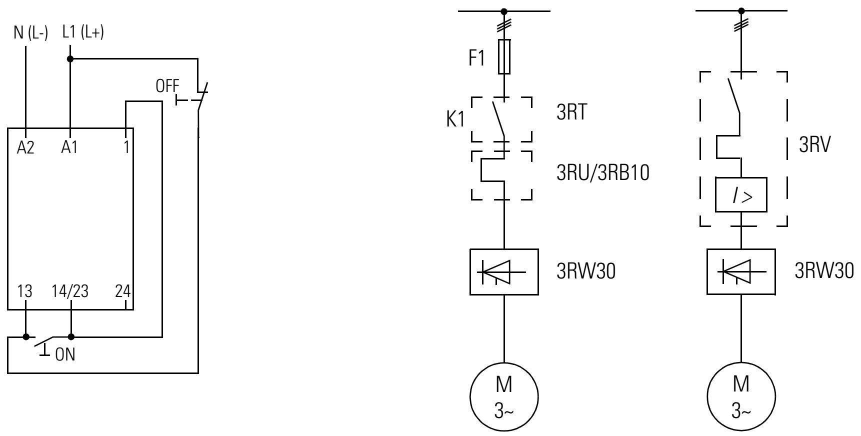


Figure 8-22: Circuit diagrams, 3RW30

3RW31

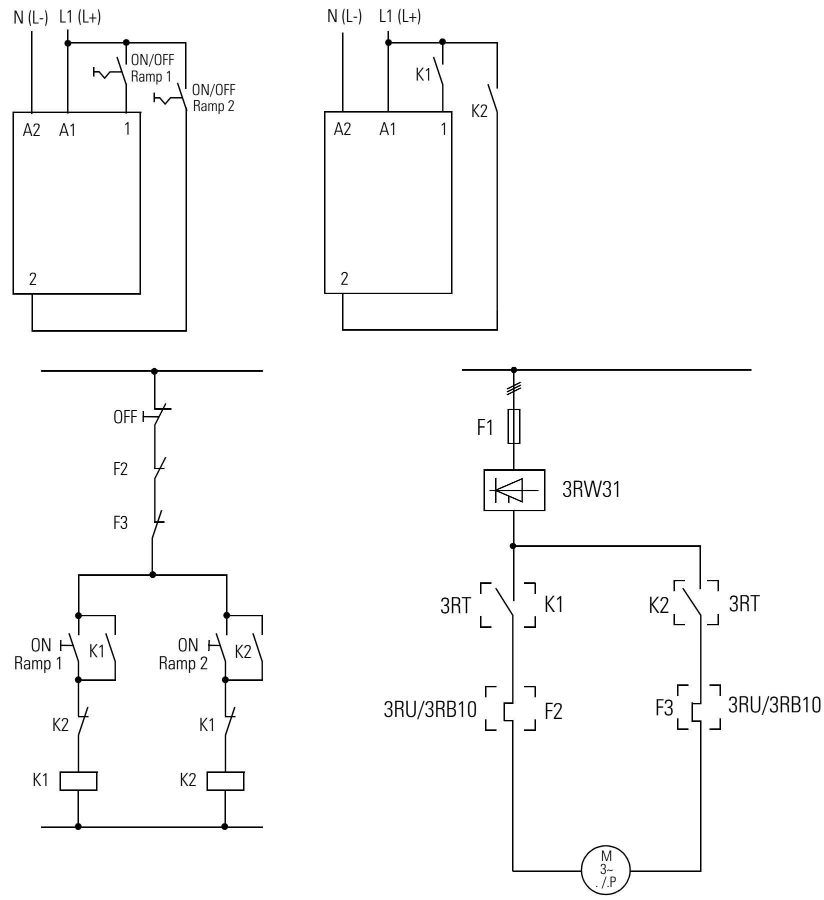


Figure 8-23: Circuit diagrams, 3RW31

Automatic operation

Direct starting of the soft starter is possible as long as the auxiliary supply is applied at terminals A1 and A2. To this end, a jumper is required between the auxiliary supply contact A1 and the control contact IN.
The following must be taken into consideration:

- An on delay of up to 4 seconds can occur, depending on the frame size.
- Soft coasting down is no longer possible after the auxiliary supply is switched off.

Control via PLC

The 3RW3 soft starter can be controlled by means of a programmable controller (PLC). It is connected up in the same way as for control via switch.

Important
Always ensure that A1 and A2 are connected up correctly. Although polarity reversal cannot damage the device, it can lead to malfunctioning.

Control of a motor with an electromechanical brake

An electromechanical brake with infeed from the main voltage (L1/L2/L3) should not be connected directly to the output of the soft starter. An electromechanical brake should be controlled by means of a separate contactor (K1 in the circuit diagram below):

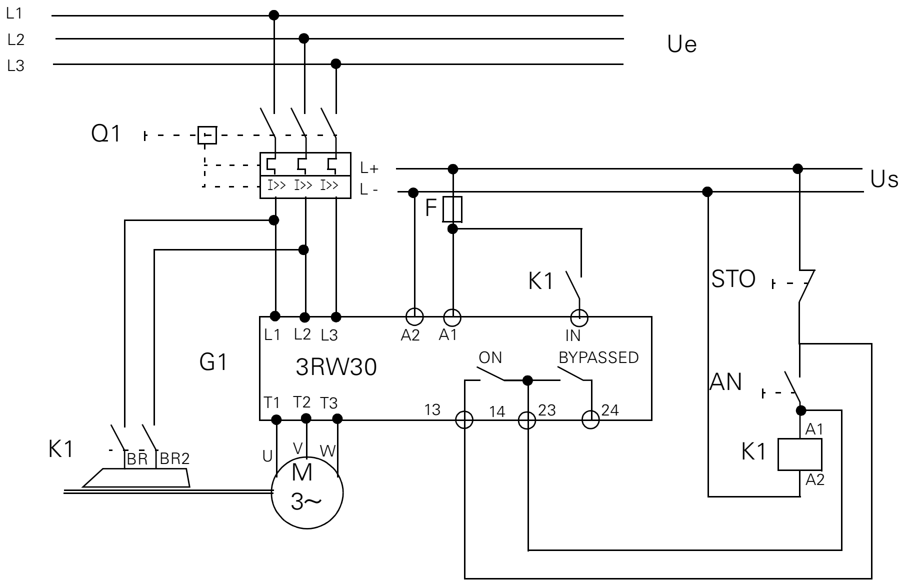
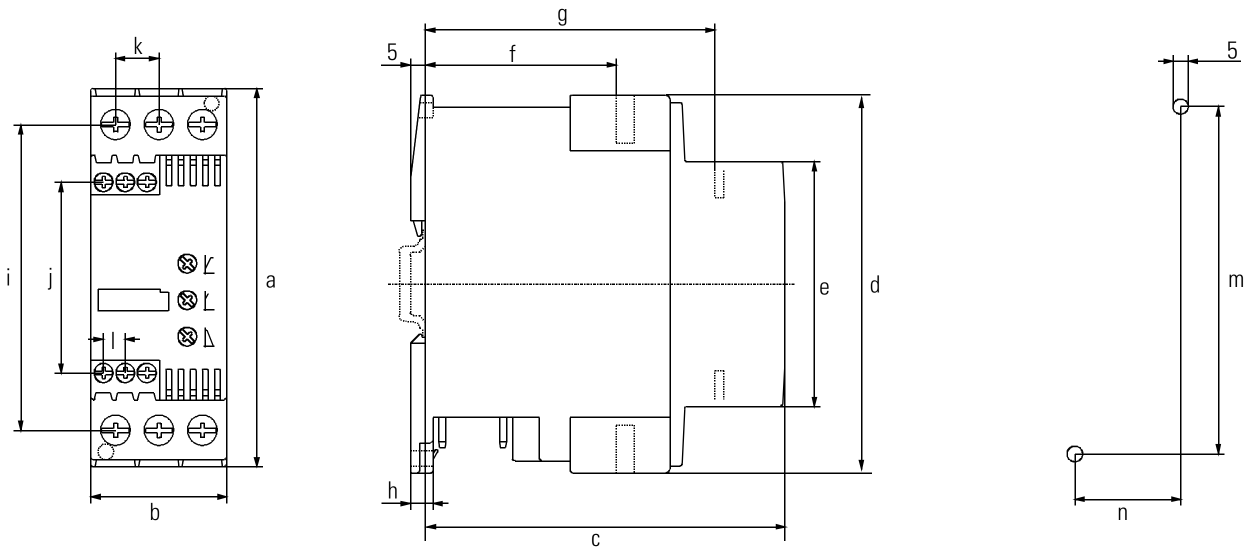


Figure 8-24: Motor control with an electromechanical brake

8.6 Dimensioned drawings (dimensions in mm)



mm	a	b	c	d	e	f	g	h	i	j	k	l	m	n
3RW301.	97.5	45	93	95	66	51	--	7.5	76	--	86	--	90	35
3RW302./3RW312.	125	45	119	125	81	63	96	7	101	63	14	7	115	35
3RW303.	160	55	143	141	95	63	115	8	119	77	18	7	150	30
3RW304.	170	70	183	162	108	87	156	8	132	87	22.5	7	160	60

8.7 Technical specifications

8.7.1 Control electronics/power electronics

Control electronics

Type			**3RW3. ..-1.B0.**	**3RW3. ..-1.B1.**
Rated control supply voltage		V	UC 24	UC 110 to 230
Rated control supply current		mA	Approx. 50	Approx. 25 to 20
Rated frequency at AC		Hz	50/60 ± 10%	

Power electronics

Type			**3RW3. ..-1.B.4**	**3RW3. ..-1.B.5**	**3RW30 ..-1AA12**
Voltage operating range		V	200 AC to 460 AC, three-phase (± 10%)	460 AC to 575 AC, three phase (± 10% - 15%)	115 AC to 240 AC, single-phase (±10%)
Rated frequency		Hz	50/60 ± 10%		
Permissible site altitude	Reduction of I_E • Up to 1000 m above sea level • Up to 2000 m above sea level • Up to 3000 m above sea level • Up to 4000 m ab. sea level[1]		 100% 92% 85% 78%		
Installation position	Without additional fan With additional fan [3]		The soft starters are designed for operation when mounted in a vertical position. Any installation position (except vertical rotated by 180 °)		

Type			**3RW30 1.**	**3RW3. 2.**	**3RW30 3.**	**3RW30 4.**
Frame size			**S00**	**S0**	**S2**	**S3**
Continuous operation (% of I_e)		%	100			
Minimum load[2] (% of I_e); At 40 °C		%	4			
Permissible ambient temperature		°C	–25 to +60 (derating as of 40 °C, see below)			
Switching capacity of the auxiliary contacts	230 V/AC-15 230 V/DC-13 24 V/DC-13	A A A	[4] [4] [4]	3 0.1 1	3 0.1 1	3 0.1 1

Type			**3RW30 14**	**3RW30 16**	**3RW30 24**	**3RW30 25**	**3RW30 26**
Current-carrying capacity							
Rated operational current I_e in acc. with IEC	At 40/50/60 °C, AC-53b	A	6/5/4	9/8/7	12.5/11/9	16/14/12	25/21/18
Rated operational current I_e in acc. with UL/CSA	At 40/50/60 °C, AC-53b	A	4.8/4.8/4	7.8/7.8/7	11/11/9	17.5/14/12	25/21/18
Power loss at continuous rated operational current (40 °C) approx.		W	5	7	7	9	13
Power loss when the max. switching frequency is exploited		W	5	6	7	8	9
Permissible starts per hour without the use of a fan							
Given intermittent duty S4, T_u = 40 °C		1/h	60	40	30		12
Duty cycle = 30%; stand-alone installation		%	250 x I_e, 2 s		300 x I_e, 2 s		
Permissible starts per hour with the use of a fan							
Given intermittent duty S4, T_u = 40 °C		1/h	–[3]		54		21
Duty cycle = 30%; stand-alone installation							
Idle time after continuous operation		s	0				200
With I_e before a new start							
Degree of protection	In acc. with IEC 60 529		IP 20 (terminal housing IP 00)				

Conductor cross-sections							
Screw-type terminals	**Auxiliary conductors:**						
(1 or 2 conductors connectable)	• Single-core	mm^2	2 x (0.5 to 1.5); 2 x (0.75 to 2.5) in acc. with IEC 60 947; max. 2 x (0.75 to 4)				
for standard screwdrivers	• Finely stranded with wire end ferrule	mm^2	2 x (0.5 to 1.5); 2 x (0.75 to 2.5)				
size 2 and Pozidriv 2	• AWG cables, single- or multi-core	AWG	2 x (18 to 14)				
	- Terminal screws		M 3, PZ2				
	- Tightening torque	Nm lb.in	0.8 to 1.0 7.1 to 8.9		0.8 to 1.0 7.1 to 8.9		
	Main conductors:						
	• Single-core	mm^2	2 x (0.5 to 1.5); 2 x (0.75 to 2.5)		2 x (1 to 2.5) 2 x (2.5 to 6)		
	• Finely stranded with wire end ferrule	mm^2	2 x (0.5 to 2.5)		2 x (1 to 2.5) 2 x (2.5 to 6)		
	• Multi-core	mm^2	–		–		
Type			**3RW30 14**	**3RW30 16**	**3RW30 24**	**3RW30 25**	**3RW30 26**
	• AWG cables, single- or multi-core	AWG	2 x (18 to 14)		2 x (14 to 10)		
	- Terminal screws		M 3, PZ2		M 4, PZ2		
	- Tightening torque	Nm lb.in	0.8 to 1.2 7 to 10.3		2 to 2.2 18 to 22		

1) Over 4000 m on request

2) The rated current for the motor (specified on the motor's type plate) should amount at least to the specified percentage of the SIRIUS soft starter's device rated current I_e.

3) In the case of frame size S00, it is not possible to install the fan provided as an accessory.

4) Frame size S00 does not have any auxiliary contacts.

Power electronics								
Type			**3RW30 34**	**3RW30 35**	**3RW30 36**	**3RW30 44**	**3RW30 45**	**3RW30 46**
Current-carrying capacity								
Rated operational current I_e in acc. with IEC	At 40/50/60 °C, AC-53b	A	32/27/23	38/32/27	45/38/32	63/54/46	75/64/54	100/85/72
Rated operational current I_e in acc. with UL/CSA	At 40/50/60 °C, AC-53b	A	27/27/23	34/32/27	42/38/32	62/54/46	68/64/54	99/85/72
Power loss at continuous rated operational current (40 °C) approx.		W	10	13	17	13	16	26
Permissible starts per hour								
Given interm. duty S4, T_u = 40 °C		1/h	20	15	5	20	30	15
Duty cycle = 30%		%	300 x I_e, 3 s			300 x I_e, 4s		
Permissible starts per hour with the use of a fan								
Given interm. duty S4, T_u = 40 °C		1/h	44	27	9	32	48	24
Duty cycle = 30%; stand-alone installation								
Idle time after cont. operation		s	0		400	0		
with I_e before a new start								
Degree of protection	In acc. with IEC 60 529		IP 20 (terminal housing IP 00)			IP 20[1])		

Conductor cross-sections

Screw-type terminals	**Auxiliary conductors:**			
(1 or 2 conductors connectable)	• Single-core	mm^2	2 x (0.5 to 1.5); 2 x (0.75 to 2.5) in acc. with IEC 60 947; max. 2 x (0.75 to 4)	
for standard screwdrivers	• Finely stranded with wire end ferrule	mm^2	2 x (0.5 to 1.5); 2 x (0.75 to 2.5)	
size 2 and Pozidriv 2	• AWG cables, single- or multi-core	AWG	2 x (18 to 14)	
	- Terminal screws		M 3	
	- Tightening torque	Nm lb.in	0.8 to 1.0 7.1 to 8.9	
	Main conductors:			
	• Single-core	mm^2	2 x (0.75 to 16)	
	• Finely stranded with wire end ferrule	mm^2	2 x (0.75 to 16) 1 x (0.75 to 25)	
	• Multi-core	mm^2	2 x (0.75 to 25) 1 x (0.75 to 35)	2 x (10 to 50) 1 x (10 to 70)
	• AWG cables, single- or multi-core	AWG	2 x (18 to 3) 1 x (18 to 2)	2 x (10 to 1/0) 1 x (10 to 2/0)
	- Terminal screws		M 6, box terminal, PZ2	M6 (Allan screw)
	- Tightening torque	Nm lb.in	3 to 4.5 27 to 40	4 to 6 35 to 53

General specifications	Standard	Parameters
EMC noise immunity		
Electrostatic discharge (ESD)	IEC 1000-4-2,	Severity 3: 6/8 kV
El. magn. RF fields	IEC 1000-4-3	Frequency range: 80 to 1000 MHz with 80% at 1 kHz Severity 3, 10 V/m
Conducted RF disturbance	IEC 61000-4-6 EN 60 947-4-2 SN-IACS	Frequency range: 80 MHz to 1000 MHz with 80 % at 1 kHz 10 V at 0.15 MHz to 80 MHz 3 V at 10 kHz to 80 MHz
Burst	IEC 1000-4-4	Severity 3: 1/2 kV
Surge	IEC 1000-4-5	Severity 3: 1/2 kV
EMC emitted interference		
EMC radio interference intensity	CISPR 11/09.1990	Limit value of class B at 30 MHz to 1000 MHz
Radio interference voltage	CISPR 11/09.1990 EN 60 947-4-2	(0.15 MHz to 30 MHz): device class A (industry)

[1]) IP 20 only with attached box terminal (delivery state). Without box terminal IP 00.

[2]) Device class B (public power supply networks) is complied with only in the case of variants 3RW3.-1AB0. with control supply voltage UC of 24 V. For the 3RW3.-1A.1. variants with a control supply voltage UC of 110 V to 230 V, single-stage filters (e.g. type B84143-A...) must be connected upstream.

8.7.2 Short-circuit protection and fuse coordination

IEC 60947-4-1/DIN VDE 0660 Part 102 draws a distinction between two coordination types, known as coordination type 1 and coordination type 2. In both coordination types, the short circuit to be dealt with is reliably disconnected. The differences lie only in the degree to which the device is damaged after a short circuit.

Coordination type 1

The motor feeder can be operable after each short-circuit disconnection. Damage to the soft starter is possible. The circuit breaker itself always attains coordination type 1.

Coordination type 2

After a short-circuit event there must be no damage to the soft starter or any other switching device; only the backup fuse may be destroyed. The actual motor feeder can be put into operation again immediately once the short circuit fuse has been replaced.

Maximum short-circuit current

All the specified fuse configurations are designed for a maximum short-circuit current of 50 kA. This ensures that short circuits of 50 kA can be disconnected without posing a threat to persons or the system.

Motor feeder: coordination type 1

Note on configuration
A fuseless configuration is recommended for motor feeders (i.e. the combination of a 3RV circuit breakers and a 3RW30 soft starter). Coordination type 1 is thus attained.

Motor feeder: coordination type 2

To set up a motor feeder of coordination type 2, the feeder must be fused (i.e. the motor must be provided with overload protection).
The following can be used:

- The 3NE1 all-range fuse, which unifies line protection and semiconductor protection
- The 3NE8 semiconductor protection fuse, in which case additional protection must be provided for the line

Comparison of coordination types 1 and 2

The configuration variant on the basis of coordination type 2 is associated with higher costs than that of coordination type 1, which is why the fuseless configuration (coordination type 1) is recommended. The advantages are:

- Fewer components in the cubicle
- Less effort required for wiring
- Less cubicle space required
- Lower price

Fuse configurations with SITOR 3NE1..-0

The following table specifies the fuse configuration (coordination type 2) for 3RW30/31 with SITOR fuses 3NE1..-0 (short-circuit and line protection); max. short-circuit current 50 kA:

Order number Soft starter	Order number of the fuse	Rated current of the fuse	Frame size of the fuse
MLFB	MLFB	A	
3RW3014	3NE1814-0[1)]	20	000
3RW3016	3NE1815-0[1)]	25	000
3RW3024/3RW3124	3NE1815-0[2)]	25	000
3RW3025/3RW3125	3NE1815-0[2)]	25	000
3RW3026/3RW3126	3NE1802-0[2)]	40	000
3RW3034	3NE1818-0[2)]	63	000
3RW3035	3NE1820-0[2)]	80	000
3RW3036	3NE1820-0[2)]	80	000
3RW3044	3NE1820-0[2)]	80	000
3RW3045	3NE1021-0[2)]	100	00
3RW3046	--[3)]	--	--

Table 8-18: Fuse configurations (SITOR)

1) Fuse coordination for max. 400 V
2) Fuse coordination for max. 500 V
3) Fuse coordination with all-range fuses not possible; pure semiconductor protection fuses plus circuit breakers can be used instead (see following table)

Fuse configurations with SITOR 3NE8

The following table specifies the fuse configuration (coordination type 2) for 3RW30/31 with SITOR fuses 3NE8 (semiconductor protection is provided by the fuse; line protection and overload protection are provided by the circuit breaker); max. short-circuit current 50 kA/400 V:

Order number Soft starter	Order number of the fuse	Rated current of the fuse	Frame size of the fuse	Order number of the circuit breaker 2)	Link module 3RW - 3RV
MLFB	MLFB	A	Size	MLFB	MLFB 3)
3RW3014	3NE8003	35	00	3RV1011	3RA1911-1A
3RW3016	3NE8003	35	00	3RV1011	3RA1911-1A
3RW3024/3RW3124	3NE8003	35	00	3RV1021	3RA1921-1A
3RW3025/3RW3125	3NE8003	35	00	3RV1021	3RA1921-1A
3RW3026/3RW3126	-- 1)	--	--	--	--
3RW3034	3NE8022	125	00	3RV1031	3RA1931-1A
3RW3035	3NE8024	160	00	3RV1031	3RA1931-1A
3RW3036	3NE8024	160	00	3RV1031	3RA1931-1A
3RW3044	3NE8024	160	00	3RV1041	3RA1941-1A
3RW3045	3NE8024	160	00	3RV1041	3RA1941-1A
3RW3046	3NE8024	160	00	3RV1041	3RA1941-1A

Table 8-19: Fuse configurations (SITOR)

1) Coordination with pure semiconductor protection fuses is not possible; all-range fuses 3NE1..-0 can be used (see the table above)
2) The selection and setting of the circuit breaker is based on the rated current for the motor
3) Note the unit of quantity

If the motor is to be configured to meet UL requirements, the order number of the fuse must be specified (3NE80..-1).

Fuseless configuration The following table specifies the components of the fuseless configuration (coordination type 1) for 3RW30/31; short-circuit current of 50 kA/400 V:

Order number of the soft starter	Order number of the circuit breaker[1)]	Link module
MLFB	MLFB	MLFB[3)]
3RW3014	3RV1011[2)]	3RA1911-1A
3RW3016	3RV1011[2)]	3RA1911-1A
3RW3024/3RW3124	3RV1021	3RA1921-1A
3RW3025/3RW3125	3RV1021	3RA1921-1A
3RW3026/3RW3126	3RV1021	3RA1921-1A
3RW3034	3RV1031	3RA1931-1A
3RW3035	3RV1031	3RA1931-1A
3RW3036	3RV1031	3RA1931-1A
3RW3044	3RV1041	3RA1941-1A
3RW3045	3RV1041	3RA1941-1A
3RW3046	3RV1041	3RA1941-1A

Table 8-20: Motor feeder: fuseless configuration

1) The selection and setting of the circuit breaker is based on the rated current for the motor
2) 50 mm clearance is required above and below between the 3RW and grounded parts
3) Note the unit of quantity

Fused configuration

The following table specifies the components of the fused configuration (coordination type 1) for 3RW30/31; short-circuit current of 50 kA/400 V:

Order number of the soft starter	Order number of the fuse	Fuse rated current/ frame size	Order number of the therm. overload relay[1)]	Order number of the elec-tron. over-load relay[1)]	Order number of the contactor
MLFB	MLFB	A / size	MLFB	MLFB	MLFB
3RW3014	3NA3810	25 / 00	3RU1116[2)4)]	3RB1016[2)4)]	3RT1015
3RW3016	3NA3810	25 / 00	3RU1116[2)4)]	3RB1016[2)4)]	3RT1016
3RW3024/ 3RW3124	3NA3822	63 / 00	3RU1126[3)]	3RB1026[3)]	3RT1024
3RW3025/ 3RW3125	3NA3822	63 / 00	3RU1126[3)]	3RB1026[3)]	3RT1025
3RW3026/ 3RW3126	3NA3824	80 / 00	3RU1126[3)]	3RB1026[3)]	3RT1026
3RW3034	3NA3830	100 / 00	3RU1136[3)]		3RT1034
3RW3035	3NA3830	100 / 00	3RU1136[3)]		3RT1035
3RW3036	3NA3830	100 / 00	3RU1136[3)]		3RT1036
3RW3044	3NA3144	250 / 1	3RU1146[3)]		3RT1044
3RW3045	3NA3144	250 / 1	3RU1146[3)]		3RT1045
3RW3046	3NA3144	250 / 1	3RU1146[3)]		3RT1046

Table 8-21: Motor feeder: fused configuration

1) The selection and setting of the overload relay is based on the rated current for the motor
2) Short-circuit current of 50 kA to max. 400 V
3) Short-circuit current of 50 kA to max. 500 V
4) 50 mm clearance is required above and below between the 3RW and grounded parts

8.7.3 Site altitude

If the site altitude is above 1000 m, the following are necessary:
- A reduction in the rated current for thermal reasons
- A reduction in the rated voltage on account of the diminished dielectric strength

Reductions as a function of site altitude

The diagram below plots the reductions in rated current and rated operating voltage as a function of site altitude:

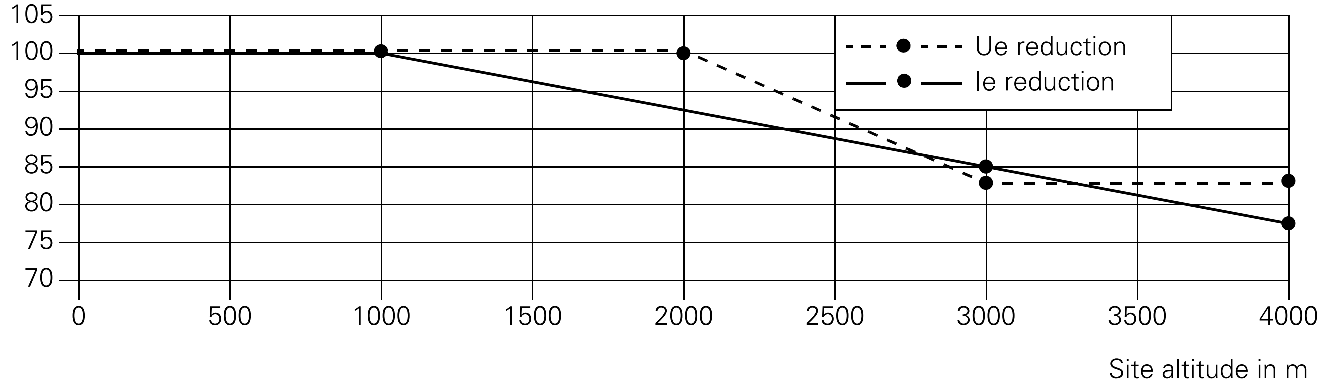


Figure 8-25: Reductions as a function of site altitude

8.7.4 Specifications in acc. with IEC

The specified motor ratings are guide values.
The soft starter must be selected on the basis of the rated current I_e.
The motor ratings are based on the values specified in DIN 42 973 (kW) and NEC 96 / UL 508 (hp).

Ambient temperature = 40 °C

230 V	400 V	I_e	Order number	500 V	I_e	Order number
Pe in kW	**Pe in kW**	**In A**	**MLFB**	**Pe in kW**	**In A**	**MLFB**
1.5	3	6	3RW3014-1CB.4	-	-	-
2.2	4	9	3RW3016-1CB.4	-	-	-
3	5.5	12.5	3RW3024-1AB.4	7.5	12.5	3RW3024-1AB.5
4	7.5	16	3RW3025-1AB.4	7.5	16	3RW3025-1AB.5
5.5	11	25	3RW3026-1AB.4	15	25	3RW3026-1AB.5
7.5	15	32	3RW3034-1AB.4	18.5	32	3RW3034-1AB.5
11	18.5	38	3RW3035-1AB.4	22	38	3RW3035-1AB.5
11	22	45	3RW3036-1AB.4	30	45	3RW3036-1AB.5
19	30	63	3RW3044-1AB.4	37	63	3RW3044-1AB.5
22	37	75	3RW3045-1AB.4	45	75	3RW3045-1AB.5
30	55	100	3RW3046-1AB.4	70	100	3RW3046-1AB.5

Table 8-22: 3RW3 motor ratings in acc. with IEC at 40° C

Ambient temperature = 50 °C

230 V	400V	I_e	Order number	500 V	I_e	Order number
Pe in kW	**Pe in kW**	**In A**	**MLFB**	**Pe in kW**	**In A**	**MLFB**
1.1	2.2	5	3RW3014-1CB.4	-	-	-
1.5	4	8	3RW3016-1CB.4	-	-	-
3	5.5	11	3RW3024-1AB.4	5.5	11	3RW3024-1AB.5
4	5-5	14	3RW3025-1AB.4	7.5	14	3RW3025-1AB.5
5.5	11	21	3RW3026-1AB.4	11	21	3RW3026-1AB.5
7.5	11	27	3RW3034-1AB.4	15	27	3RW3034-1AB.5
7.5	15	32	3RW3035-1AB.4	18.5	32	3RW3035-1AB.5
11	18.5	38	3RW3036-1AB.4	22	38	3RW3036-1AB.5
15	22	54	3RW3044-1AB.4	30	54	3RW3044-1AB.5
18.5	30	64	3RW3045-1AB.4	37	64	3RW3045-1AB.5
22	45	85	3RW3046-1AB-4	55	85	3RW3046-1AB.5

Table 8-23: 3RW3 motor ratings in acc. with IEC at 50° C

Ambient temperature = 60 °C

230 V	400 V	I_e	Order number	500 V	I_e	Order number
Pe in kW	**Pe in kW**	**In A**	**MLFB**	**Pe in kW**	**In A**	**MLFB**
0.75	1.5	4	3RW3014-1CB.4	-	-	-
1.5	3	7	3RW3016-1CB.4	-	-	-
2.2	4	9	3RW3024-1AB.4	5.5	9	3RW3024-1AB.5
3	5.5	12	3RW3025-1AB.4	7.5	12	3RW3025-1AB.5
4	7.5	18	3RW3026-1AB.4	11	18	3RW3026-1AB.5
5.5	11	23	3RW3034-1AB.4	15	23	3RW3034-1AB.5
7.5	11	27	3RW3035-1AB.4	15	27	3RW3035-1AB.5
7.5	15	32	3RW3036-1AB.4	18.45	32	3RW3036-1AB.5
11	22	46	3RW3044-1AB.4	30	46	3RW3044-1AB.5
15	22	54	3RW3045-1AB.4	30	54	3RW3045-1AB.5
18.5	37	72	3RW3046-1AB.4	45	72	3RW3046-1AB.5

Table 8-24: 3RW3 motor ratings in acc. with IEC at 60° C

8.7.5 Specifications in acc. with NEMA

The specified motor ratings are guide values.
The soft starter must be selected on the basis of the rated current I_e.
The motor ratings are based on the values specified in DIN 42 973 (kW) and NEC 96 / UL 508 (hp).

Ambient temperature = 40 °C

200V	230 V	460V	I_e	Order number	460V	575V	I_e	Order number
Pe in hp	Pe in hp	Pe in hp	In A	MLFB	Pe in hp	Pe in hp	In A	MLFB
1	1	3	4.8	3RW3014-1CB.4	-	-	-	-
2	2	5	7.8	3RW3016-1CB.4	-	-	-	-
3	3	7.5	11	3RW3024-1AB.4	7.5	10	11	3RW3024-1AB.5
5	5	10	17.5	3RW3025-1AB.4	10	15	17.5	3RW3025-1AB.5
7.5	7.5	15	25.3	3RW3026-1AB.4	15	20	25.3	3RW3026-1AB.5
7.5	7.5	20	27	3RW3034-1AB.4	20	25	27	3RW3034-1AB.5
10	10	25	34	3RW3035-1AB.4	25	30	34	3RW3035-1AB.5
10	15	30	42	3RW3036-1AB.4	30	40	42	3RW3036-1AB.5
20	20	40	62.1	3RW3044-1AB.4	40	60	62.1	3RW3044-1AB.5
20	25	50	68	3RW3045-1AB.4	50	60	68	3RW3045-1AB.5
30	30	75	99	3RW3046-1AB.4	75	100	99	3RW3046-1AB.5

Table 8-25: 3RW3 motor ratings in acc. with NEMA at 40° C

Ambient temperature = 50 °C

200V	230 V	460V	I_e	Order number	460V	575V	I_e	Order number
Pe in hp	Pe in hp	Pe in hp	In A	MLFB	Pe in hp	Pe in hp	In A	MLFB
1	1	3	4.8	3RW3014-1CB.4	-	-	-	-
2	2	5	7.8	3RW3016-1CB.4	-	-	-	-
3	3	7.5	11	3RW3024-1AB.4	7.5	10	11	3RW3024-1AB.5
3	3	10	14	3RW3025-1AB.4	10	10	14	3RW3025-1AB.5
5	5	15	21	3RW3026-1AB.4	15	15	21	3RW3026-1AB.5
7.5	7.5	20	27	3RW3034-1AB.4	20	25	27	3RW3034-1AB.5
7.5	10	20	32	3RW3035-1AB.4	20	30	32	3RW3035-1AB.5
10	10	25	38	3RW3036-1AB.4	25	30	38	3RW3036-1AB.5
15	20	40	54	3RW3044-1AB.4	40	50	54	3RW3044-1AB.5
20	20	40	64	3RW3045-1AB.4	40	60	64	3RW3045-1AB.5
25	30	60	85	3RW3046-1AB.4	60	75	85	3RW3046-1AB.5

Table 8-26: 3RW3 motor ratings in acc. with NEMA at 50° C

Ambient temperature = 60 °C

200 V	230 V	460 V	I_e	Order number	460 V	575 V	I_e	Order number
Pe in hp	Pe in hp	Pe in hp	In A	MLFB	Pe in hp	Pe in hp	In A	MLFB
0.75	0.75	2	4	3RW3014-1CB.4	-	-	-	-
1.5	1.5	3	7	3RW3016-1CB.4	-	-	-	-
2	2	5	9	3RW3024-1AB.4	5	7.5	9	3RW3024-1AB.5
3	3	7.5	12	3RW3025-1AB-4	7.5	10	12	3RW3025-1AB.5
5	5	10	18	3RW3026-1AB.4	10	15	18	3RW3026-1AB.5
5	7.5	15	23	3RW3034-1AB.4	15	20	23	3RW3034-1AB.5
7.5	7.5	20	27	3RW3035-1AB.4	20	25	27	3RW3035-1AB.5
7.5	10	20	32	3RW3036-1AB.4	20	30	32	3RW3036-1AB.5
10	15	30	46	3RW3044-1AB.4	30	40	46	3RW3044-1AB.5
15	20	40	54	3RW3045-1AB.4	40	50	54	3RW3045-1AB.5
20	25	50	72	3RW3046-1AB.4	50	60	72	3RW3046-1AB.5

Table 8-27: 3RW3 motor ratings in acc. with NEMA at 60° C

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