Protection devices

SIRIUS Innovations
SIRIUS 3RV2 Motor Starter Protectors

Manual · 11/2011

Industrial Controls

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Protection devices SIRIUS Innovations - SIRIUS 3RV2 motor starter protectors

Manual

11/2011

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE

indicates that an unintended result or situation can occur if the relevant information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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℗ 11/2011 Technical data subject to change

Table of contents

Introduction

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Purpose of the manual

This manual describes the 3RV2 motor starter protector and provides the following information:

- Information on integrating the motor starter protector into the system environment.
- Information on necessary hardware components.
- Information on installing, connecting and operating the motor protector starter.
- Technical information such as dimension drawings and unit wiring diagrams.

The information in this manual enables you to configure and commission the motor starter protectors.

Required basic knowledge

To understand these operating instructions you should have a general knowledge of automation engineering and low-voltage switchgear.

Scope of the manual

The manual is valid for these motor starter protectors. It contains a description of the devices that is valid at the time of publication.

Further documentation

To install and connect the motor starter protectors, you require the operating instructions of the motor starter protectors used.

You can find a list of operating instructions and an overview of the manuals pertaining to SIRIUS Innovations in the appendix "References (Page 137)".

Recycling and disposal

These devices can be recycled thanks to their low pollutant content. For environmentally-friendly recycling and disposal of your electronic waste, please contact a company certified for the disposal of electronic waste.

Up-to-the-minute information

You can obtain further assistance by calling the following numbers:

Technical Assistance:

Telephone: +49 (0) 911-895-5900 (8 a.m. to 5 p.m. CET)

Fax: +49 (0) 911-895-5907

or on the Internet at:

E-mail: (mailto:technical-assistance@siemens.com)

Internet: (www.siemens.com/industrial-controls/technical-assistance)

Correction sheet

A correction sheet is included at the end of the manual. Please use it to record your suggestions for improvements, additions and corrections, and return the sheet to us. This will help us to improve the next edition of the manual.

Standards

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Applicable standards

3RV2 motor starter protectors meet the requirements of the following standards:

Table 2- 1 Applicable standards

Applications	Applicable standards
3RV2 motor starter protectors	IEC 60947-1, EN 60947-1 (VDE 0660 Part 100) IEC 60947-2, EN 60947-2 (VDE 0660 Part 101)
3RV2 motor starter protectors[1)]	UL 508
3RV27/28 circuit breakers	UL 489
Motor starter protectors	IEC 60947-4-1, EN 60947-4-1 (VDE 0660 Part 102)
Auxiliary switches	IEC 60947-5-1/VDE 0660 Part 200
Terminal designations	DIN EN 50 011
Isolating function according to features of main and EMERGENCY OFF switches	• IEC 60947-2 • IEC 60204 (VDE 0113 Part 1)
Isolating features	DIN EN 60947-1
Touch protection finger-safe	DIN EN 50274
Degree of protection IP20	IEC 60529

1) Without 3RV27/28

Reference

Other standards that 3RV2 motor starter protectors conform to are listed in the chapter titled Technical data (Page 103). SIRIUS components have been approved by a whole range of bodies for various sectors (shipbuilding, etc.). An up-to-date list of approvals is provided in Chapter 13 of the Siemens catalog IC 10 - "SIRIUS Industrial Controls". You will find more information and an option to download certificates on the Internet (http://www.siemens.com/automation/service&support).

Product description

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3.1 Introduction

Applications

3RV2 motor starter protectors are compact current-limiting devices which have been optimized for load feeders. They are used for switching and protecting three-phase motors and other loads. The scalable setting ranges mean that a suitable motor starter protector can provide protection for all standard motors, even at ambient temperatures of > 60 °C. All 3RV2 motor starter protectors are fitted with a rotary operating mechanism.

Functions

The motor starter protectors protect loads against overloads and short circuits. They also feature a lockable switch to facilitate manual switching on and off (e.g. in the event of repair work).

System integration

In both electrical and mechanical terms the motor starter protectors are compatible with 3RT contactors, 3RF solid-state contactors, and 3RW soft starters. They can be integrated in the feeder by means of direct mounting. 3RV2 motor starter protectors are available in two sizes, S00 and S0.

Connection systems

The motor starter protectors are available with the following connection system options:

- Screw-type connection system (up to 40 A)
- Spring-loaded connection system (up to 32 A)
- Ring cable lug connection system (up to 32 A)

Accessories

The accessories have been tailored to the motor starter protectors; they can be mounted easily and without the need for tools.

3.2 Versions

Device versions

- Motor starter protectors, standard version (3RV20)

  Overload and short-circuit protection
- Motor starter protectors with relay function (3RV21)

  Short-circuit protection and auto-RESET in the event of overload in one device
- MSP for starter combinations (3RV23)

  Short-circuit protection only

  Combined with solid-state overload relay, large setting ranges and auto-RESET
- MSP for transformer protection (3RV24)

  Standard version for transformers
- Circuit breakers in accordance with UL489 (3RV27/3RV28)
  Overload protection, short-circuit protection, and transformer protection

Sizes

3RV2 motor starter protectors are available in two sizes, S00 and S0.

The table below lists the sizes and the corresponding maximum rated current at a voltage of 400 V AC. The last column of the table indicates the maximum power of the three-phase motor which is suitable for the relevant size.

Table 3- 1 Motor starter protector sizes

Size	Width	Max. rated current	Power of three-phase motor
S00	45 mm[1)]	16 A	7.5 kW
S0	45 mm[1)]	40 A[2)]	18.5 kW

1) 3RV21: 65 mm

2) 3RV20 and 3RV23 only

Number of poles

3RV2 motor starter protectors have 3 poles.

3.3 Applications

General

3RV2 motor starter protectors are used for switching and protecting the following loads:

- Three-phase motors up to 18.5 kW at 400 V AC
- Loads with rated currents of up to 40 A

Special applications

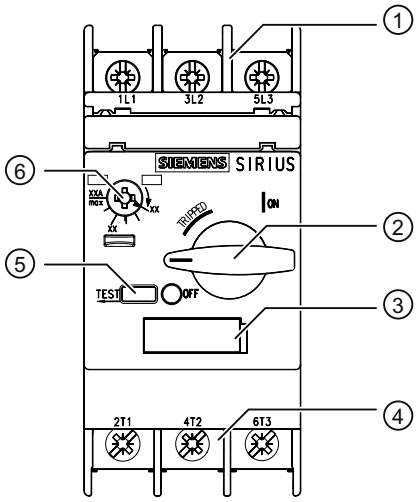
The various 3RV2 motor starter protectors are suitable for:

- Short-circuit protection
- Motor protection (also with overload relay function)
- System protection
- Short-circuit protection for starter combinations
- Transformer protection
- As main and EMERGENCY OFF switches
- Use in IT systems
- Switching direct current
- Hazardous areas (ATEX)
- Use as Branch Circuit Protection Device (BCPD) according to UL (3RV27/28)

Reference

More information ...	Can be found in the chapter titled ...
About application areas	Configuration (Page 27)

3.4 Motor starter protectors



1 Terminals:

Up to two conductors with different cross-sections can be connected for the main and auxiliary circuits. The auxiliary circuit can be connected using either screw terminals or spring-loaded terminals. Some device versions are also available with ring cable lug connection.

2 Rotary operating mechanism:

For switching on and off, displaying a possible tripping operation, integrated locking device

3 Label

4 Connection for mounting contactors, solid-state contactors, and soft starters in various connection systems:

- Direct mounting using link modules
- Separately using connecting cables

5 TEST function:

Facilitates the testing of the release mechanism.

6 Motor current setting:

The large rotary button provides an easy means of setting the device to the rated motor current.

Figure 3-1 Equipment, 3RV20 motor starter protectors

A sealable transparent cover can be optionally mounted (accessory). The cover prevents the motor setting being adjusted (this option is not available for 3RV23/3RV27/3RV28).

3.5 Performance features

SIRIUS motor starter protectors boast the following technical advantages:

Technical highlights	Customer benefits
10-20% less power consumption than previous solutions	• Reduced temperature rise in the control cabinet • Cost savings during operation
Uniform connection systems: • Screw connection • Spring-loaded connection • Ring cable lug connection	The right connection for every application (e.g. operational reliability (vibration-resistant, non-temperature-specific, etc.) and less wiring thanks to spring-loaded connection system)
Link modules for any device combination from the SIRIUS modular system	Fast, error-free installation for screw-type connection system and spring-loaded connection system
Motor starter protectors up to 40 A (18.5 kW) in 45 mm width	Space and cost savings
Motor starter protector combined with undervoltage release and contactor can be used as a Cat. 3 feeder in accordance with EN 951-1, SIL 2 in accordance with IEC 62061 or PL d 13849-1	Safety solution can be implemented with just one switching device
Factory-fitted integrated auxiliary switches	Reduced installation complexity
Joint range of accessories for size S00 and S0	Easy to configure, reduced stockkeeping
Current values graded in accordance with all standard motors	• The right motor starter protector for every standard motor • Integrated protection even for ambient temperatures > 60 °C
Bimetals with extreme long-term stability	Operational reliability over many years
Compatible for use in all infeed systems (combs, 3RA6, 3RV29 infeed, 8US)	Maximum flexibility in terms of power infeed

Product combinations

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Since the products from the innovative SIRIUS modular system are matched to one another both electrically and mechanically, they can be combined quickly and easily.

Typical combinations for fuseless and fused designs have been fully tested and approved.

Reference

More information ...	Can be found in the appendix ...
About the possible combinations of standard products from the SIRIUS modular system	"References" under "SIRIUS Innovations manuals (Page 137)"

Functions

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3RV2 motor starter protectors meet the requirements for motor and system protection according to IEC 60947-2 / DIN VDE 0660-101.

Motor and system protection is achieved using the following functions:

- Overload protection
- Short-circuit protection
- Phase loss sensitivity

5.1 Overload and short-circuit protection

Overload protection

The current of the motor requiring protection is set on the setting scale. This sets the integrated overload protection to the motor current.

Short-circuit protection

The short-circuit release is factory-set to a value that is 13 times the rated current of the motor starter protector (upper setting scale). This ensures problem-free ramping-up and safe protection for the motor.

Release

3RV2 motor starter protectors are fitted with the following releases:

- Inverse-time delayed thermal overload release (except for the 3RV23)
- Instantaneous short-circuit release

The overload releases can be set to the load feeder.

Note

Motor starter protectors for transformer protection

The motor starter protectors and circuit breakers for transformer protection (3RV24, 3RV28) are set to 20 times the rated current to prevent undesirable tripping due to the high inrush current.

5.1.1 Tripping classes

3RV20/3RV21 motor starter protectors conform to CLASS 10 according to IEC 60947-4-1.

The tripping times according to IEC 60947-4-1 are as follows:

Table 5- 1 Tripping times dependent upon tripping classes according to standard IEC 60947-4-1

Tripping class	Tripping time t_A in s at 7.2 x I_e from cold
CLASS 10 A	$2 < t_A \leq 10$
CLASS 10	$4 < t_A \leq 10$
CLASS 20	$6 < t_A \leq 20$
CLASS 30	$9 < t_A \leq 30$

5.1.2 Tripping characteristics

The time-current characteristic, the current-limiting characteristics, and the I^2t characteristics have been determined according to DIN VDE 0660/IEC 60947.

In the case of the time-current characteristic, the tripping characteristic of the inverse-time delayed overload release (thermal overload release) applies for direct current and alternating current with frequencies from 0 Hz up to 400 Hz.

The characteristics apply to the cold state; at operating temperature, the tripping times of the thermal releases drop to approximately 25%.

In normal operation the device must be loaded at 3 poles. You are recommended to switch all 3 main current paths in series to protect single-phase or DC loads.

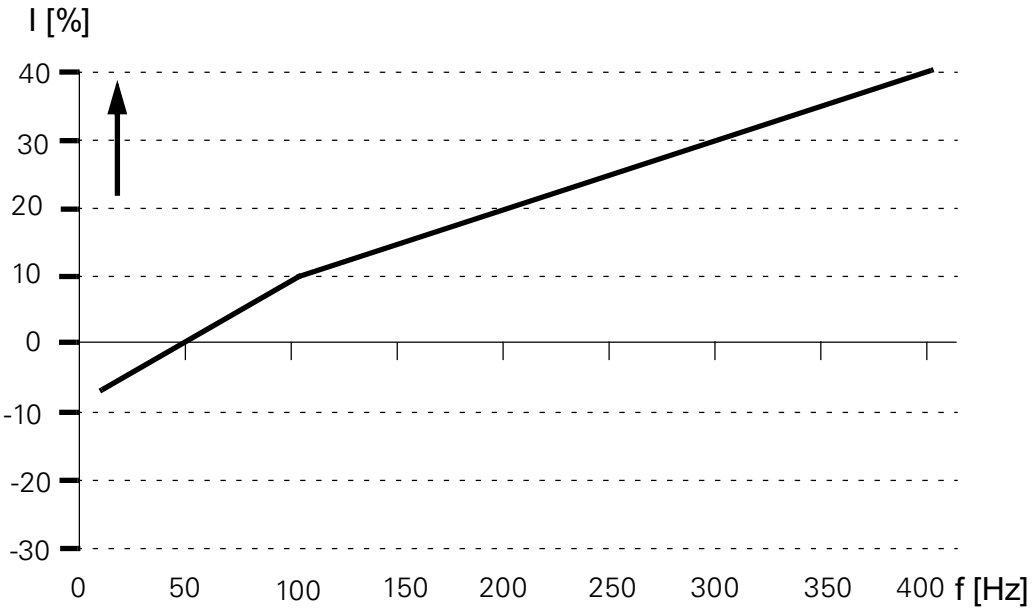
With both 2- and 3-pole loading, the maximum deviation of the tripping times at and above 3 times the current setting is ± 20% and thus meets the requirements of DIN VDE 0165.

The tripping characteristics for the instantaneous, electromagnetic overcurrent releases (short-circuit releases, 'n' releases) are based on the rated current I_n that is also the upper value of the setting range for motor starter protectors with adjustable overcurrent releases. If the current is set to a lower value the tripping current of the 'n' release is increased by a correspondingly higher multiple.

Frequency dependence of the short-circuit release

The characteristics of the electromagnetic overcurrent release apply for frequencies of 50 Hz/60 Hz. For lower frequencies up to 16 2/3 Hz, for higher frequencies up to 400 Hz, and for direct current, correction factors have to be taken into account accordingly.

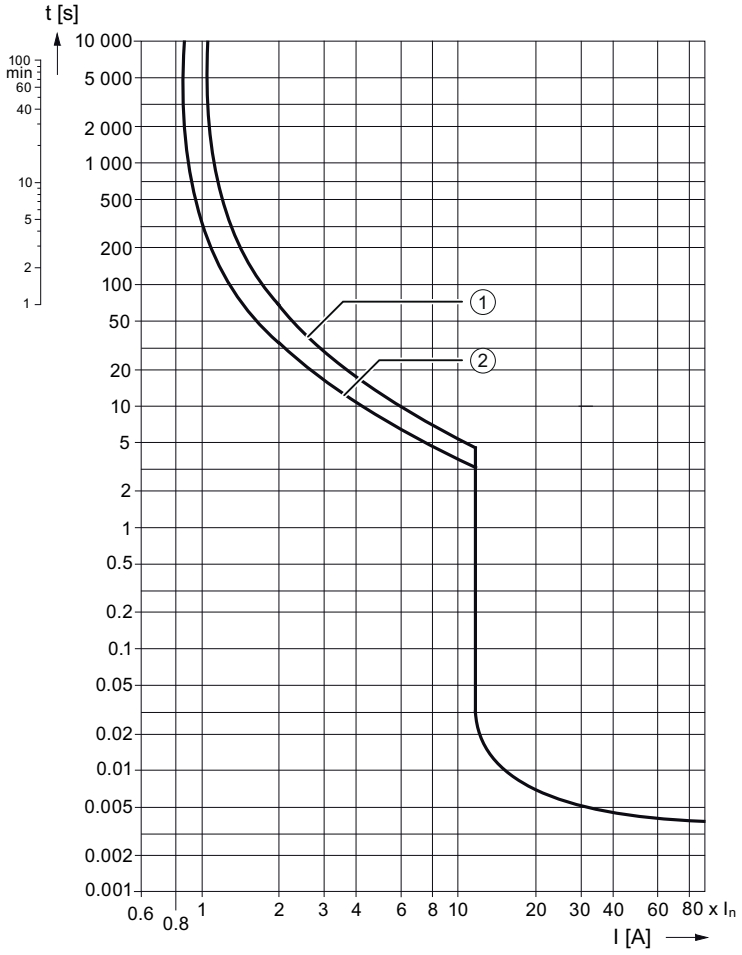
The following characteristic curve shows the frequency dependence of the short-circuit release.



Δ I Change in operating current

f Frequency

The operating current increases by approx. 40% in the case of direct voltage.



t Opening time

I Current

① 3-pole load CLASS 10

② 2-pole load CLASS 10

Figure 5-1 Schematic circuit diagram of the time-current characteristic curve for 3RV20

The characteristic curve reproduced above for the motor starter protector relates to a specific setting range. It is, however, also valid as a schematic circuit diagram for motor starter protectors with other current ranges.

Reference

Time-current characteristics, current-limiting characteristics, and I^2t characteristics can be requested on the Internet (http://www.siemens.com/automation/service&support) via "Technical Assistance".

5.2 Phase loss sensitivity

The phase loss sensitivity of the motor starter protector ensures that it trips in good time in the event of a phase failure or significant phase unbalance. The motor starter protector tripping prevents overcurrents from occurring in the remaining phases.

5.3 Protecting single-phase loads or DC loads

Under normal operating conditions, the three poles of the device are loaded. You are recommended to switch all 3 main current paths of the motor starter protector in series to protect single-phase or DC loads.

5.4 Test function

The TEST slide can be used to check whether the operational motor starter protector is working correctly (not on the 3RV23/3RV27/3RV28). The tripping of the motor starter protector can be simulated by moving the slide.

Configuration

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6.1 SIRIUS Innovations system configurator

Reference

To assist you with configuration, the "SIRIUS Innovations system configurator" is at your disposal on the Internet. Here, you can gather together all necessary products before the actual configuration process and you can realize complete projects virtually.

You can find the "SIRIUS Innovations system configurator" on the Internet (www.siemens.com/industrial-controls/configurators).

6.2 Short-circuit protection

The short-circuit releases on 3RV2 motor starter protectors isolate the faulty load feeder from the supply system (three phases) in the event of a short circuit, thereby preventing further damage.

With a short-circuit breaking capacity of 55 kA or 100 kA in the case of a voltage of 400 V AC, the motor starter protectors count as short-circuit-proof as long as higher short-circuit currents are not anticipated in their installation location.

Backup fuses are only necessary if the short-circuit current at the installation location exceeds the motor starter protectors' short-circuit breaking capacity.

The short-circuit breaking capacity in the case of different voltages and the dimensioning of a fuse (if it is required) are described in the chapter titled Short-circuit breaking capacity (Page 113).

6.3 Motor protection

The tripping characteristic of 3RV20/3RV21 motor starter protectors is primarily designed for protecting three-phase motors.

The rated current I_n of the motor to be protected is set on the setting scale. The short-circuit release is factory-set to a value that is 13 times the rated current of the motor starter protector. This ensures problem-free ramping-up and safe protection for the motor.

The phase loss sensitivity of the motor starter protector ensures that it trips at the right time in the event of phase loss and the resulting overcurrents in the other phases.

6.4 System protection

3RV20 and 3RV21 motor starter protectors are also suitable for protecting systems.

To prevent premature tripping caused by phase loss sensitivity, the load applied to each of the three current paths must always be the same. With single-phase loads, the current paths must be connected in series.

3RV27 und 3RV28 circuit breakers are also suitable for system protection; they also have approval according to UL 489 or CSA C22.2 No.5-02.

6.5 Motor protection with overload relay function

3RV21 motor starter protectors with overload relay function have the same overload and short-circuit release characteristic as 3RV20 motor starter protectors. However, the overload releases have no effect on the motor starter protectors' breaker latching mechanism. In the event of an overload, the motor starter protector remains on.

The overload release is linked to two auxiliary contacts (1 NO contact + 1 NC contact) mounted on the side; these are switched in the event of an overload. The auxiliary contacts can be evaluated or can be used to disconnect a downstream contactor. The auxiliary contacts are reset automatically once the motor starter protector has cooled down.

⚠ CAUTION
In the overload range the motor starter protector with overload relay function does not protect itself. Provision has to be made, therefore, to ensure that the current is safely disconnected by a downstream switching device such as a contactor.

Note

Fixed connection: Auxiliary contacts with motor starter protector

The auxiliary contacts are connected to the right-hand side of the motor starter protector. The connection is fixed and cannot be removed.

This means that auxiliary releases cannot be mounted on the right-hand side of 3RV21 motor starter protectors with overload relay function.

Reference

More information ...	Can be found in the chapter titled ...
About motor starter protector operation	Operation (Page 49)

6.6 Short-circuit protection for starter combinations

3RV23 MSP for starter combinations

3RV23 MSPs for starter combinations are motor starter protectors without overload releases. They are always used in conjunction with a contactor and overload relay, as the motor starter protector alone is not able to protect the motor and itself against overloads.

Function

In the event of an overload, the overload relay trips the contactor. The motor starter protector remains on. The motor starter protector will only trip as well in the event of a short circuit in the feeder.

Like the motor starter protectors for motor protection, the short-circuit releases are set to a fixed value of 13 times the rated current of the device.

Advantage

In the event of tripping due to overload, an automatic or manual reset can be performed without having to open the control cabinet.

6.7 Transformer protection

Protection against inrush currents

When control transformers are protected on the primary side, the high inrush currents generated at the time the transformers are switched on often cause spurious tripping in the protective devices. 3RV24 MSPs for transformer protection therefore have short-circuit releases which are factory-set to a fixed value of approx. 20 times the rated current (upper value on the setting scale). This enables transformers whose inrush current peak values can reach up to 30 times the rated current to be protected on the primary side by means of motor starter protectors.

4 AM control transformers

This version of motor starter protector is not necessary in the case of 4 AM control transformers with low inrush current (e.g. Siemens control transformers). In such cases 3RV20 motor starter protectors can be used for motor protection.

6.8 Main switch

3RV2 motor starter protectors satisfy the features of main switches according to IEC 60947-2.

3RV20 and 3RV21 motor starter protectors are also suitable for protecting systems.

To prevent premature tripping caused by phase loss sensitivity, the load applied to each of the three current paths must always be the same. With single-phase loads, the current paths must be connected in series.

6.9 Use in IT systems

3RV2 motor starter protectors are suitable for use in IT systems according to IEC 60947-2. In the event of a 3-pole short circuit, they respond in exactly the same way as other systems: For this reason, the same short-circuit breaking capacity I_{cu} and I_{cs} applies.

Function

In the case of IT systems the first fault (ground fault) does not necessarily lead to the immediate disconnection of the system. A second unrelated fault (ground fault) can reduce the switching capacity of the motor starter protector.

This is the case specifically if both ground faults occur in different phases and if one of the two ground faults is on the motor starter protector's input side and the other is on its outgoing side.

To maintain the motor starter protector's short-circuit-protection function even in the case of two separate ground faults (known as a double line-to-ground fault), the reduced short-circuit breaking capacity for double ground faults in IT systems I_{cuIT} has to be taken into account. Detecting a ground fault when it occurs (ground-fault monitoring) and dealing with it quickly can significantly reduce the risk of a double ground fault and, as a result, that of a reduced short-circuit breaking capacity I_{cuIT}.

Reference

More information ...	Can be found in the chapter titled ...
About short-circuit breaking capacity	Technical data (Page 103)

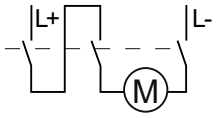
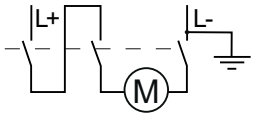
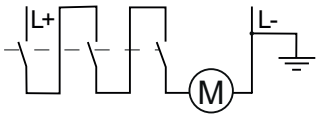
6.10 Switching direct current

3RV2 motor starter protectors for AC current are also suitable for switching direct current. When used for this purpose, however, the maximum permissible DC voltage per current path must be observed. With higher voltages, series connection of 2 or 3 current paths is required.

Response values

The response values of the overload releases remain unchanged, while the response values of the short-circuit releases increase by up to 40% with a DC current. The following table contains suggested circuits for switching direct current:

Table 6- 1 Switching direct current, suggested circuits

Suggested circuit	Motor starter protector	Size	Max. permissible direct voltage U_e	Meaning
	3RV2.	S00/S0	150 V DC	2-pole switching, non-grounded system (see also Note) If there is no possibility of a ground fault occurring, or if any ground fault which does occur is dealt with immediately (ground-fault monitoring), then the max. permissible direct voltage can be tripled.
	3RV2.	S00/S0	300 V DC	2-pole switching, grounded system The grounded pole always has to be assigned to the individual current path, so that in the event of a ground fault there are always 2 current paths in series.
	3RV2.	S00/S0	450 V DC	1-pole switching, grounded system 3 current paths in series The grounded pole has to be assigned to the current path which is not connected.

Note

Double ground fault

In the case of the "2-pole switching, non-grounded system" circuit, it is assumed that safe tripping will follow even in the event of a double ground fault which short-circuits two contacts.

6.11 Devices for North America (UL/CSA)

6.11.1 Approved according to UL 508/CSA C22.2 No. 14

The motor starter protectors in the 3RV2 series are approved for UL/CSA and can be used conforming to UL 508 and CSA C22.2 No.14 individually or as load feeders in conjunction with a contactor.

These motor starter protectors can be used as "Manual Motor Controller" for "Group Installations", as "Manual Motor Controller Suitable for Tap Conductor Protection in Group Installations", and as "Self-Protected Combination Motor Controller (Type E)".

6.11.1.1 "Manual motor controller", group installation

3RV2 motor starter protector as "Manual Motor Controller"

Upstream short-circuit protection is always implemented if the motor starter protector is used as a "Manual Motor Controller". This requires approved fuses (according to UL 248) or a circuit breaker (according to UL 489/CSA C22.2 No. 5-02). These devices must be dimensioned according to the National Electrical Code (UL) or Canadian Electrical Code (CSA) installation regulation respectively.

The file numbers for the approval of the 3RV as a manual motor controller are as follows:

- UL File No. 47705, CCN: NLRV
- CSA Master Contract 165071, Product Class: 3211 05

6.11.1.2 "Manual motor controller suitable for tap conductor protection in group installations" (up to 32 A)

3RV20 motor starter protector as "Manual Motor Controller Suitable for Tap Conductor Protection in Group Installations"

The "Manual Motor Controller Suitable for Tap Conductor Protection in Group Installations" application is only applicable in the case of UL.

The CSA does not recognize this approval! Upstream short-circuit protection is always implemented if the motor starter protector is used as a "Manual Motor Controller Suitable for Tap Conductor Protection in Group Installations". This requires approved fuses (according to UL 248) or a circuit breaker (according to UL 489).

These devices must be dimensioned according to the National Electrical Code installation regulation.

3RV20 motor starter protectors are approved as "Manual Motor Controller Suitable for Tap Conductor Protection in Group Installations" under the following file number:

- UL File No. 47705, CCN: NLRV

6.11.1.3 "Self-protected combination motor controller (type E)" (up to 32 A)

3RV20 motor starter protector as "Self-Protected Combination Motor Controller (Type E)"

For approval according to UL 508, a clearance of 1 inch and a creepage distance of 2 inches are required on the line side for a "Self-Protected Combination Motor Controller".

Therefore, 3RV20 motor starter protectors in size S00/S0 are approved according to UL 508 together with the terminal block (order no. 3RV29 28-1H) or phase barriers (order no. 3RV2928-1K).

CSA approval does not require extended clearances and creepage distances. The terminal blocks or phase barriers can, therefore, be omitted for use as a "Self-Protected Combination Motor Controller" according to the CSA.

3RV20 motor starter protectors are approved as "Self-Protected Combination Motor Controller" under the following file numbers:

- UL File No. E156943, CCN: NKJH.
- CSA Master Contract 165071, Product Class: 3211 08.

6.11.2 Approval as "circuit breaker" according to UL 489/CSA C 22.2 No. 5-02

3RV27 and 3RV28 as "Circuit Breaker"

These devices are approved as Circuit Breaker according to UL 489 or CSA C22.2 No.5-02 with 100% rated current ("100 %-rated breaker"). As such they can be used as upstream short-circuit protection devices for "Manual Motor Controller" and "Manual Motor Controller Suitable for Tap Conductor Protection in Group Installations".

3RV27 and 3RV28 are approved as "Circuit Breaker" under the following file numbers:

- UL File No. E235044, CCN: DIVQ.
- CSA Master Contract 165071, Product Class: 1432 01.

6.12 Application environment

Introduction

The following information must be taken into account when planning applications involving 3RV2 motor starter protectors.

Installation altitude

The motor starter protectors are approved for installation altitudes up to 2,000 m. The reduced air density at altitudes higher than 2,000 meters affects the motor starter protectors' electrical characteristics. The reduction factors which have to be taken into account when using motor starter protectors at altitudes higher than 2,000 m can be obtained on request on the Internet (http://www.siemens.com/automation/service&support).

Operating conditions

3RV2 motor starter protectors are climate-proof. They are intended for use in enclosed spaces in which no severe operating conditions prevail (e.g. dust, caustic vapors, hazardous gases). If they are to be installed in dusty and damp spaces, suitable enclosures must be provided.

3RV2 motor starter protectors can be supplied from above or below.

Ambient temperatures/Derating

The permissible ambient temperatures, maximum switching capacity, tripping currents, and other limiting conditions relevant to application are listed in the technical data. Technical information is available on the Internet (http://www.siemens.com/automation/service&support).

3RV2 motor starter protectors are temperature-compensating according to IEC 60947-4-1/VDE 0660 Part 102 in the temperature range from –20 °C to +60 °C. At temperatures from +60 °C to +80 °C, the upper set value of the setting range has to be reduced by a specific factor in accordance with the table below.

Table 6- 2 Ambient temperatures for 3RV2 motor starter protectors

Ambient temperature in °C	Reduction factor for the upper set value	
	Current ranges 0.11 to 20 A	Current ranges 17 to 32 A
+60	1.0	1.0
+65	0.94	0.97
+70	0.87	0.94
+75	0.81	0.90
+80	0.73	0.86

In accordance with the table, the reduction factor is 13% at 70 °C. This factor is so low that due to the overlapping of the current setting ranges there are no gaps before the next setting range. This means that at 70 °C the available current range goes from 0.11 A to 32 A.

Note

Ambient temperatures > 40 A

The 36 A and 40 A versions are compatible for use in ambient temperatures of up to 40° C maximum.

Special application environments

SIRIUS components have been approved by a whole range of bodies for various sectors (shipbuilding, etc.). An up-to-date list of approvals appears in Chapter 16 of the Siemens Industrial Controls IC 10 Catalog, and more information, as well as an option to download certificates, can be obtained on the Internet (http://www.siemens.com/automation/service&support).

6.13 Selecting the motor starter protectors

Since the inrush current can cause the operational currents, the starting currents, and the current peaks to be at different levels, even where motors with the same power are being used, the motor power values in the selection tables should be viewed as guide values only. The actual starting characteristics and rated data of the motor to be protected are always the decisive factors in selecting the right motor starter protectors. The same applies for motor starter protectors to be used for transformer protection.

Explosion protection

Note

In the case of 2- and 3-pole loading, the permissible deviation of the tripping time with 300% to 800% current setting is up to ± 20% maximum and as such meets the requirements of DIN VDE 0165 and EN 50019.

3RV20, CLASS 10 motor starter protectors have ATEX approval according to EU Directive 94/9/EC (DMT certificate).

3RV20 motor starter protectors are suitable for overload protection of explosion-protected motors with "increased safety" type of protection EEx e.

6.14 Project guidelines for use downstream of frequency converters/inverters with pulsed voltage

Using thermal motor protection devices downstream of frequency converters/inverters with pulsed voltage affects switching devices and can cause them to trip undesirably. Practical configuration guidelines for such applications are given below.

6.14.1 The effects of high-frequency currents on the thermal overload release

The thermal overload release on motor starter protectors and overload relays usually comprises a bimetal and a heating coil through which the motor current flows, causing heat rise. Excessive deflection of the bimetal (caused by the motor current being too high) will cause the motor current to be disconnected.

Releases of this type are adjusted with a 50 Hz alternating current. As such, the tripping point will only be in the required normal range range for currents whose effective heat value is the same as or similar to this adjustment current. This is the case for alternating currents from 0 to 400 Hz and for direct currents.

Where high-frequency currents such as those occurring downstream of converters are concerned, there is additional heat rise of the bimetal. This can be attributed on the one hand to eddy currents induced by harmonics and on the other to the skin effect in the heating coil. Both cause the overload release to trip, even at reduced currents (undesirable premature tripping!).

The effects are dependent upon the frequency of the current. The higher the frequency of the converter and the lower the setting range/rated current, the more the tripping current will drop.

To return the tripping limits to the normal range, the setting of the overload release has to be corrected. The following table shows the adjustment correction factors for the various setting ranges dependent upon the converter's pulse frequency.

Table 6- 3 Adjustment correction factors for different setting ranges

Setting range/rated current	Pulse frequency [kHz]								
	0	2	4	6	8	10	12	14	16
3.2 to 40 A	1.00	1.07	1.12	1.16	1.18	1.19	1.21	1.22	1.23
0.5 to 2.5 A	1.00	1.08	1.13	1.17	1.21	1.24	1.26	1.28	1.29
0.32 to 0.4 A	1.00	1.09	1.15	1.21	1.25	1.29	1.33	1.35	1.37
0.16 to 0.25 A	1.00	1.10	1.17	1.24	1.28	1.33	1.38	1.42	1.46

Application example

Motor starter protector with setting range 1.1 to 1.6 A downstream of a frequency converter with a pulse frequency of 8 kHz and motor current rms value at rated load: 1.2 A.

Setting: 1.2 A x 1.21 = 1.45 A

Making this adjustment compensates the high-frequency currents. The tripping current is in the normal range.

NOTICE
Harmonics The harmonics can cause the rms value of the motor current to be higher than the motor rated current. In such cases, undesirable tripping can occur in spite of a correction being made. To rectify the situation, the rms value of the motor current has to be determined at rated load and used as the base current for the correction described above. Only measuring instruments which are able to reproduce the true rms value up to the prevailing frequencies are suitable for determining the values. Good examples include hot-wire instruments. Although moving-iron measuring instruments are in principle also rms instruments, they can only be used for frequencies up to 1 kHz and, therefore, are not compatible with the majority of the scenarios described above. Commercially available multimeters or clip-on ammeters are generally not suitable for taking measurements in these cases.

6.14.2 Capacitive leakage currents

Despite adjustment correction undesirable tripping can occur in individual systems. Extensive tests have shown that in systems with pulsed voltages other effects can transpire which reduce the tripping current of the overload release or increase the current flowing through the release.

Practical example

In a system supplied by an inverter with a 3 kHz pulse frequency, the motors are connected with cables measuring 80 m in length. An analysis of the actual current flow shows that very high-frequency currents (up to 150 kHz) are superimposed on the motor current with a peak value of 1.5 A. In the case of these frequencies, the effect on the thermal overload release is significantly greater than described in The effects of high-frequency currents on the thermal overload release (Page 36). Furthermore, capacitive leakage currents occur in this system due to the cable length and the high frequency. These increase the current flowing through the release and cause undesirable tripping.

An alternative approach is described below for cases in which high-frequency currents significantly higher than 16 kHz occur and the procedure described in The effects of high-frequency currents on the thermal overload release (Page 36) no longer rectifies the problem. When the motor is operating without overload, the overload release has to be set so high that it will not trip. Once the motor has been running for approx. 1.5 hours at full load, the overload release has to be reduced to the tripping limit and then this limit set value has to be increased by approx. 10%. This compensates the effects on the system. The value hereby obtained can also be used as the correction factor for similar systems.

6.14.3 Speed control of motors with characteristic-controlled frequency converters

With adjustment to linear voltage frequency characteristic and continuous boost, a reduction in speed (< 50 Hz) combined with constant load torque can cause the motor current to increase. The reason for this is that in the case of this adjustment the reduction in the output voltage of the frequency converter is not in line with the output frequency.

Should this lead to undesirable tripping, and if this cannot be compensated by adjusting this release to a higher value (taking the motor overload into account), minimizing boost or switching to a quadratic voltage frequency characteristic may provide a remedy.

Mounting

7

7.1 Standard mounting

7.1.1 Minimum clearances and mounting position

Minimum clearances

The following clearances from grounded or live parts and from cable ducts made of molded plastic must be observed in compliance with IEC 60947-2 when mounting motor starter protectors.

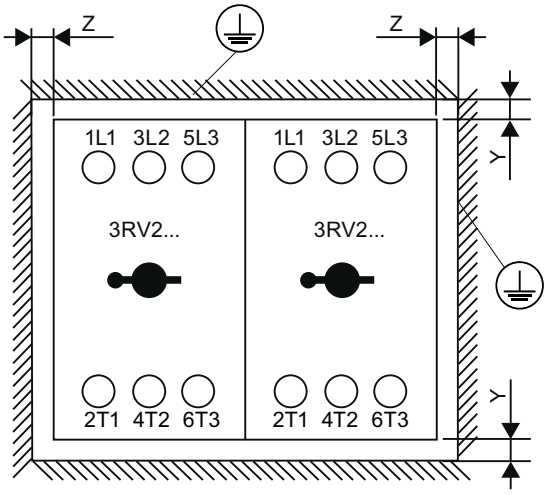


Figure 7-1 Clearances from grounded or live parts

Table 7- 1 Installation guidelines for motor starter protectors

U_e [V]	Y [mm]	Z [mm]
240	30	9
400	30	9
440	30	9
500	30	9
690	50 / 70[1)]	30

1) Up to and including the setting range of 32 A, the required clearance above and below is 50 mm; for the 36/40 A setting range, the clearance is 70 mm.

Note

Terminal block type E

In conjunction with type E terminal block 3RV2928-1H the applicable lateral clearance is 30 mm for all voltages.

Mounting position

The mounting position of 3RV2 motor starter protectors can be selected at will.

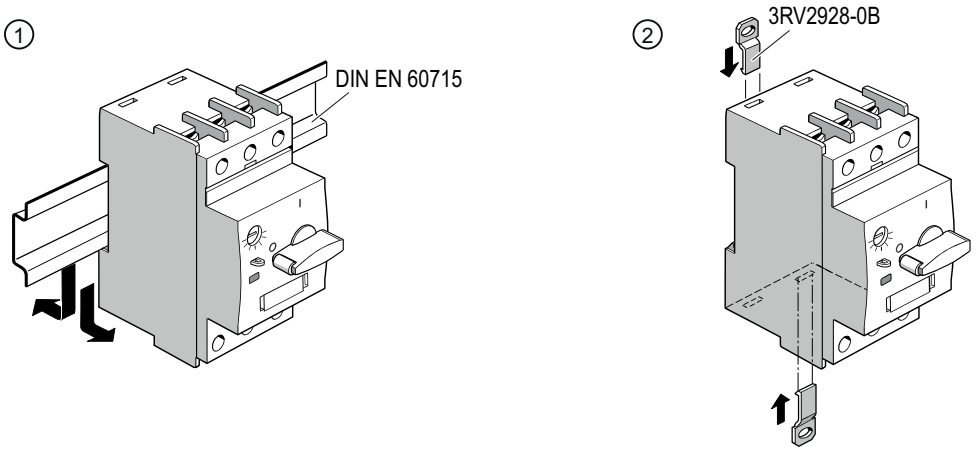
7.1.2 Mounting

Mounting options

The motor starter protectors are mounted by

- Snapping them onto a 35 mm DIN rail conforming to DIN EN 60715 or
- Screwing them to a base plate

Mounting



① Mounting on a DIN rail
② Mounting on base plate

Figure 7-2 Motor starter protector mounting

Note

Push-in lugs

The motor starter protectors can be mounted on a level surface with 2 screws. In the case of size S00 and S0 motor starter protectors, 2 push-in lugs (3RV2928-0B) (supplied in packs of 10) are also required.

Reference

More information ...	Can be found in the chapter titled ...
About the drilling plan	Dimension drawings for 3RV2 motor starter protectors (Page 141)

7.2 Mounting in limiter circuit

Installation guidelines for motor starter protectors with limiter function

When installing the motor starter protectors, the following clearances must be observed from grounded or live parts, and from cable ducts:

Table 7- 2 Minimum clearances for 3RV2321-4EC10 and 3RV2.1./3RV2.2.

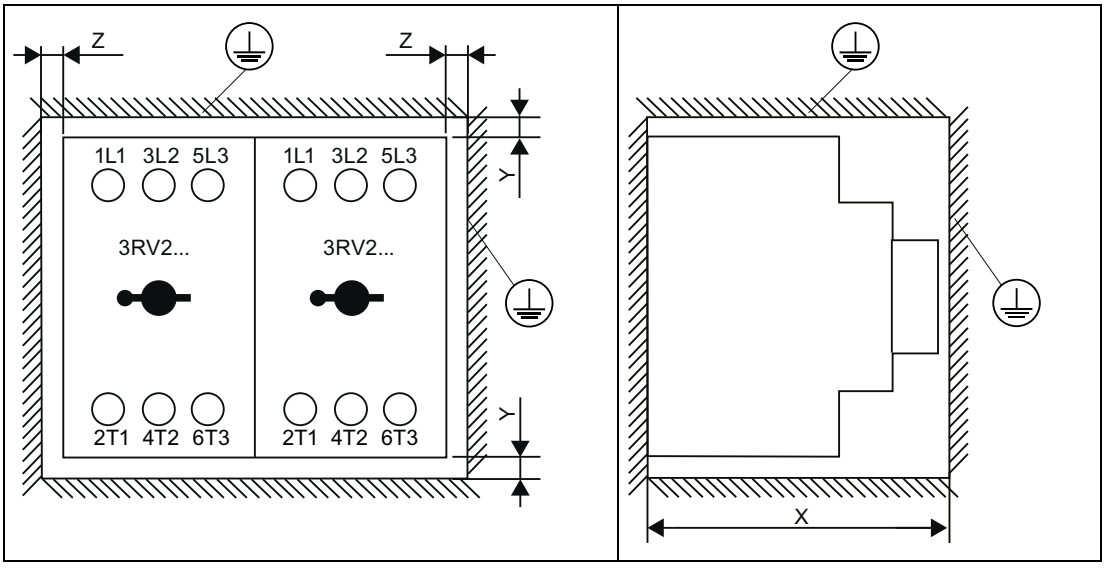
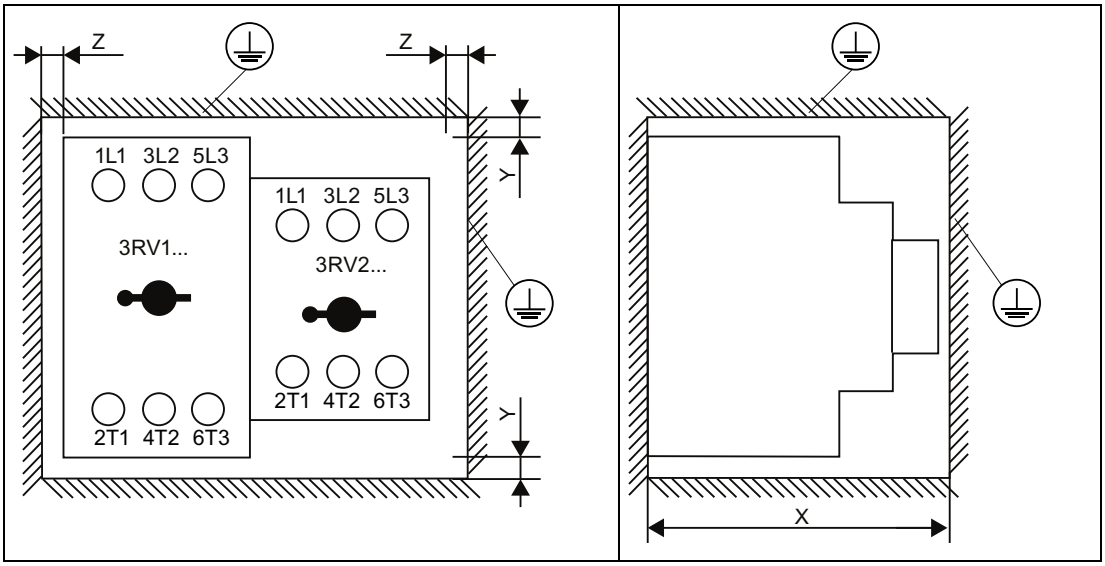


Table 7- 3 Minimum clearances for 3RV1331-4HC10 and 3RV2.1./3RV2.2.



Type			Clearance		
Limiter	Circuit breaker	Ue [V]	X [mm]	Y [mm]	Z [mm]
3RV2321-4EC10	3RV2.1./3RV2.2.	500	90	40	10
		690	90	60	30
3RV1331-4HC10	3RV2.1./3RV2.2.	690	140	60	10

Connection

8

Infeed

3RV2 motor starter protectors can be supplied from above or below.

Connection types

The motor starter protectors are available with the following connection types:

- Screw-type connection system
- Spring-loaded connection system
- Ring cable lug connection system

Connection of terminals

Within the SIRIUS modular system, the conductor cross-sections are matched to one another dependent upon size.

Reference

More information ...	Can be found ...
About connecting the SIRIUS modular system	In the "References" appendix under "SIRIUS Innovations manuals (Page 137)".
About conductor cross-sections and tightening torques	In the chapter titled "Conductor cross-sections main circuit (Page 109)".

8.1 Conductor cross-sections

8.1.1 Conductor cross-sections

Conductor cross-sections

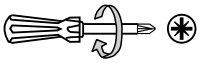
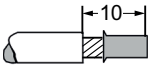
Due to SIRIUS being a modular system, the conductor cross-sections of all the devices of one size are identical.

8.1.2 Conductor cross-sections for screw-type connection systems

Conductor cross-sections for screw-type connection systems

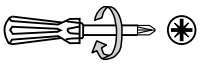
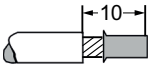
The tables below define the permissible conductor cross-sections for main terminals and auxiliary conductor connections in sizes S00 and S0 for screw-type connection systems.

Table 8- 1 Main conductors of size S00 with M3 combination screws *)

		Motor starter protector
Tool		Pozidriv size PZ 2, Ø 5 to 6 mm
Tightening torque		0.8 to 1.2 Nm
Solid and stranded		
		2 x (0.75 to 2.5) mm²
		Max. 2 x 4 mm²
Finely stranded with end sleeve (DIN 46 228 Part 1)		2 x (0.5 to 1.5) mm²
		2 x (0.75 to 2.5) mm²
AWG		
		2 x (18 to 14)
		2 x 12

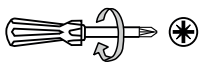
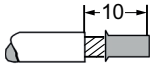
*) The conductor cross-sections do not apply for the devices 3RV27 and 3RV28

Table 8- 2 Main conductors of size S0 with M4 combination screws *)

		Motor starter protector
Tool		Pozidriv size PZ 2, Ø 5 to 6 mm
Tightening torque		2.0 to 2.5 Nm
Solid and stranded		2 x (1.0 to 2.5) mm²
		2 x (2.5 to 10) mm²
Finely stranded with end sleeve (DIN 46 228 Part 1)		2 x (1 to 2.5) mm²
		2 x (2.5 to 6) mm²
		Max. 1 x 10 mm²
AWG		2 x (16 to 12)
		2 x (14 to 8)

*) The conductor cross-sections do not apply for the devices 3RV27 and 3RV28

Table 8- 3 Auxiliary conductors of size S00/S0 with M3 combination screws *)

		Accessories for motor starter protectors
Tool		Pozidriv size PZ 2, Ø 5 to 6 mm
Tightening torque		0.8 to 1.2 Nm
Solid and stranded		2 x (0.5 to 1.5) mm² 2 x (0.75 to 2.5) mm²
Finely stranded with end sleeve (DIN 46 228 Part 1)		2 x (0.5 to 1.5) mm² 2 x (0.75 to 2.5) mm²
AWG		2 x (20 to 16) 2 x (18 to 14)

*) The conductor cross-sections do not apply for the devices 3RV27 and 3RV28

Reference

You can find further information on the conductor cross-sections of the devices 3RV27 and 3RV28 in the chapters titled Conductor cross-sections main circuit (Page 109) and Conductor cross-sections auxiliary and control circuits (Page 111) .

8.1.3 Conductor cross-sections for spring-loaded connection systems

Conductor cross-sections for spring-loaded connection systems

The tables below define the permissible conductor cross-sections for main terminals and auxiliary conductor connections in sizes S00 and S0 for spring-loaded connection systems.

Table 8- 4 Main conductors of size S00

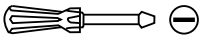
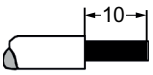
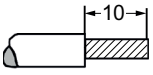
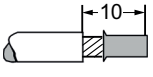
		Motor starter protector
Tool		Ø 3.5 x 0.5 (8WA2880/8WA2803) Ø3.0 x 0.5 (3RA2908-1A)
Solid and stranded		2 x (0.5 to 4.0) mm²
Finely stranded without end sleeve		2 x (0.5 to 2.5) mm²
Finely stranded with end sleeve (DIN 46 228 Part 1)		2 x (0.5 to 2.5) mm²
AWG		2 x (20 to 12)

Table 8- 5 Main conductors of size S0

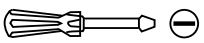
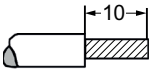
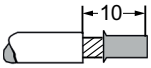
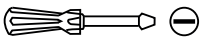
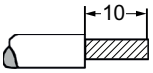
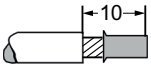
		Motor starter protector
Tool		Ø 3.5 x 0.5 (8WA2880/8WA2803) Ø3.0 x 0.5 (3RA2908-1A)
Solid and stranded		2 x (1.0 to 10) mm²
Finely stranded without end sleeve		2 x (1.0 to 6.0) mm²
Finely stranded with end sleeve (DIN 46 228 Part 1)		2 x (1.0 to 6.0) mm²
AWG		2 x (18 to 8)

Table 8- 6 Auxiliary conductors of size S00/S0

		Accessories for motor starter protectors
Tool		Ø 3.5 x 0.5 (8WA2880/8WA2803) Ø3.0 x 0.5 (3RA2908-1A)
Solid and stranded		2 x (0.5 to 2.5) mm²
Finely stranded without end sleeve		2 x (0.5 to 2.5) mm²
Finely stranded with end sleeve (DIN 46 228 Part 1)		2 x (0.5 to 1.5) mm²
AWG		2 x (20 to 14)

8.1.4 Conductor cross-sections for ring cable lug connection system

Conductor cross-sections for ring cable lug connection system

The tables below define the permissible conductor cross-sections for main terminals and auxiliary conductor connections in sizes S00 and S0 for ring cable lug connection systems.

Table 8- 7 Main conductors and auxiliary conductors of size S00 with M3 combination screws

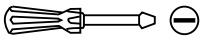
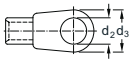
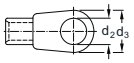
		SIRIUS devices
Tool		Pozidriv size 2, Ø 5 to 6 mm
Tightening torque		0.8 to 1.2 Nm
Ring cable lug [1]		d_2 = min. 3.2 mm d_3 = max. 7.5 mm

Table 8- 8 Main conductors and auxiliary conductors of size S0 with M4 combination screws

		SIRIUS devices
Tool		Pozidriv size 2, Ø 5 to 6 mm
Tightening torque		2.0 to 2.5 Nm
Ring cable lug [1]		d_2 = min. 4.3 mm d_3 = max. 12.2 mm

[1] The following ring cable lugs are approved for achieving the required clearances and creepage distances:

- For applications according to IEC 60947-1:
  - DIN 46237 (with insulating sleeve)
  - JIS CS805 type RAV (with insulating sleeve)
  - JIS CS805 type RAP (with insulating sleeve)
- For applications according to UL 508:
  - DIN 46 234 (without insulating sleeve)
  - DIN 46225 (without insulating sleeve)
  - JIS CS805 (without insulating sleeve)

A shrink-on sleeve must be used to insulate ring cable lugs without an insulating sleeve. The following conditions must be met:

- Application temperature: -55 °C to +155 °C
- UL 224 approved
- Flame-protected

⚠ DANGER

Hazardous voltage.

Will cause death or serious injury.

Only use approved ring cable lugs to meet the required clearances and creepage distances.

Operation

9

9.1 Setting the current

Procedure

Use a screwdriver to set the load's rated current (current setting) I_e on the scale on the motor starter protector.

In the context of this setting, a distinction is made between two fundamental designs:

1. Stand-alone assembly: No directly mounted contactor and clearance of at least 10 mm to left and right.
2. Side-by-side design: Directly mounted contactor or clearance to left and right of less than 10 mm (commonly used design).

Note the two possible setting marks on the adjusting knob:

- Dash marking: Setting mark for the motor starter protector in stand-alone design.
- Triangular marking: Setting mark for the motor starter protector in side-by-side design.

In both cases you can use the full current range up to the scale mark at the top for size S00/S0 motor starter protectors at ambient temperatures of up to + 60 °C.

Note

Restrictions in the case of motor starter protectors 3RV2.21-4PA10 (30 to 36 A) and 3RV2.21-4FA10 (34 to 40 A)

In the case of motor starter protectors with 30 to 36 A and 34 to 40 A, the maximum permissible ambient temperature is 40 °C.

These motor starter protectors must not be operated side-by-side. A clearance of 9 mm at the side must be observed. Direct mounting of contactors with link module is not permitted.

The motor starter protectors with 30 to 36 A and 34 to 40 A have only one setting mark (= dash).

Set the relevant setting mark (dash or triangle) to the load current.

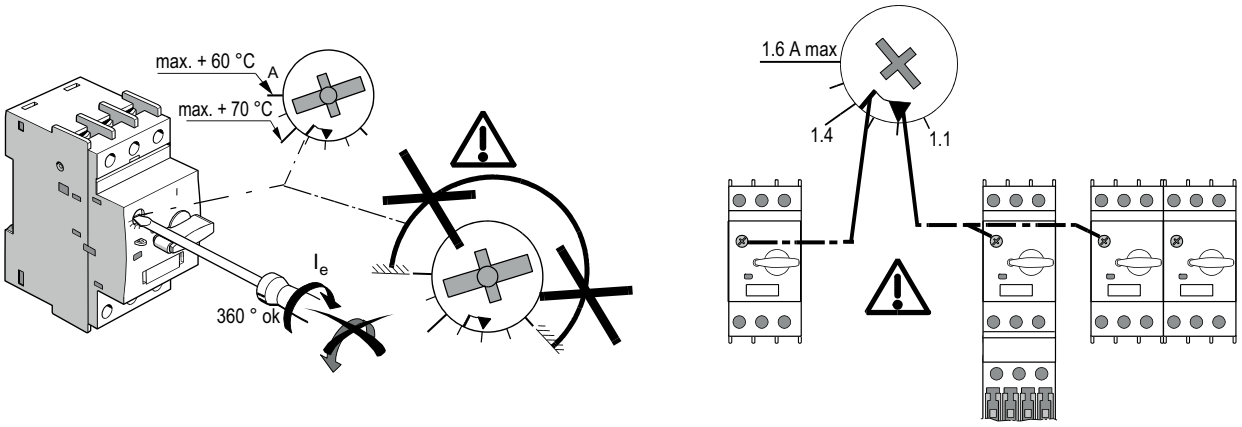


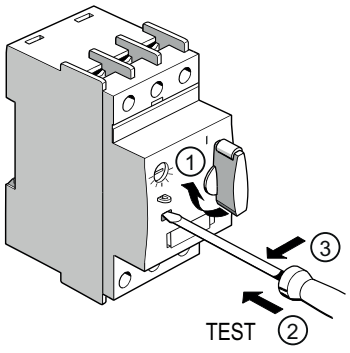
Figure 9-1 Making the current setting I_e

Current reduction

Current reduction is required at ambient temperatures above +60 °C. The maximum permissible current setting for an ambient temperature of +70 °C is indicated on the scale by a slightly longer mark on the scale. You can find more information about derating in the chapter titled Application environment (Page 34).

9.2 Testing the overload release

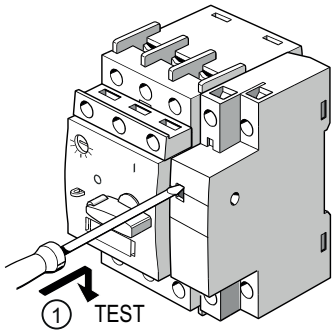
The table below shows the procedure for testing the motor starter protector's overload release:

Step	Operating instruction	Figure
1	Turn the rotary button from O to I.	
2 / 3	Insert a screwdriver into the test opening and push it to the left.	

Result

If the rotary button snaps into the tripped setting, the test was successful.

9.3 Testing the overload relay function (3RV21)

Step	Operating instruction	Figure
1	The control circuit must be energized. Insert a screwdriver into the test opening and push it down.	

Result

The connected contactor disconnects.

9.4 Securing

Function

You can secure the motor starter protector against unauthorized closing, for example, if repair work needs to be carried out.

Procedure

Move the rotary switch to the OFF position. Take the cylinder out of the rotary lever. (This locks the rotary operating mechanism.) Secure the motor starter protector against unauthorized closing by locking the rotary switch with a padlock (shackle diameter 3.5 to 4.5 mm).

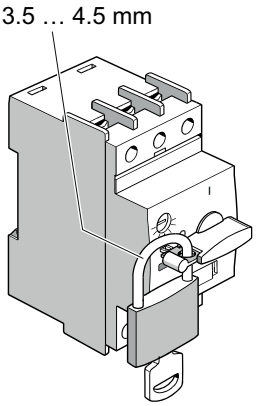


Figure 9-2 Securing the rotary switch

9.5 Reclosing after tripping

Tripping

When the motor starter protector trips, the rotary switch moves to the tripped setting to indicate that it has tripped.

An option is available (in the form of an accessory) to have a signaling switch report tripping electrically.

Reclosing

Reclosing takes place directly on the switch. The rotary operating mechanism has to be set to O first before reclosing, to return the mechanism to readiness for operation. The motor starter protector can then be reclosed.

Accessories

10

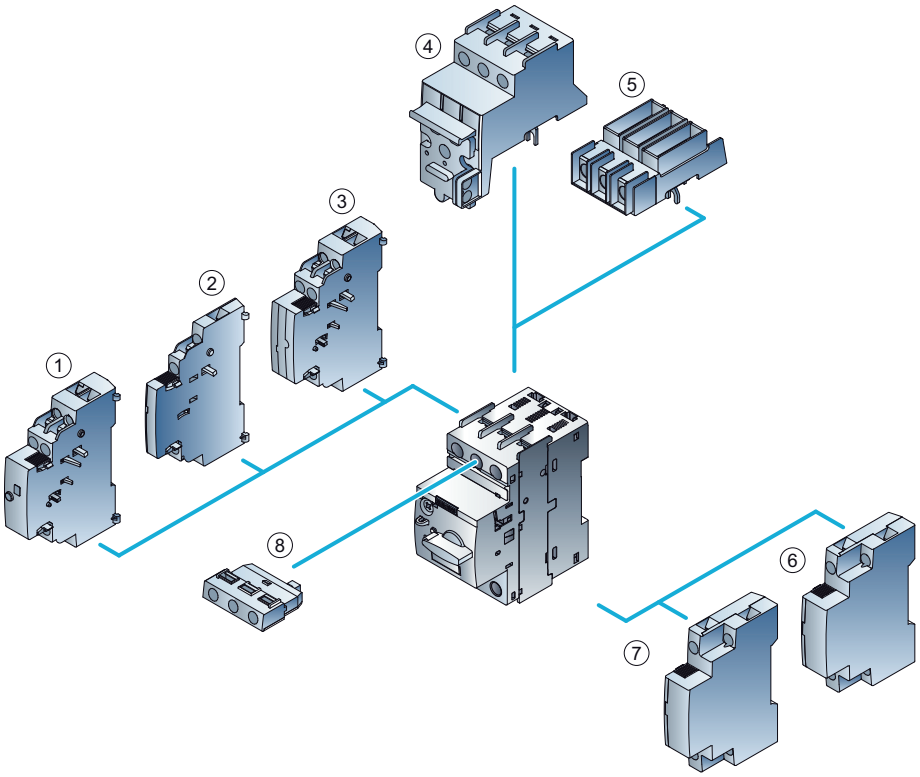
10.1 Accessories overview

Accessories

For maximum flexibility, accessories can be added to the motor starter protector as required, easily, and without the need for tools.

Mountable accessories

The mountable accessories for size S00/S0 3RV2 motor starter protectors are illustrated below.



1 Signaling switch
2 Lateral auxiliary switch with 2 contacts
3 Lateral auxiliary switch with 4 contacts
4 Disconnector module
5 Terminal block type E
6 Undervoltage release
7 Shunt release
8 Transverse auxiliary switch

Figure 10-1 Motor starter protector size S00/S0 with mountable accessories

Further accessories

- Phase barriers
- Door-coupling rotary operating mechanism
- Enclosures and mounting accessories
- Sealable cover
- Insulated 3-phase busbar system
- 8US busbar adapter
- 3RV2917 infeed system
- Link modules for the installation of contactors, solid-state contactors or soft starters

For maximum flexibility, accessories can be added to the motor starter protector as required, easily, and without the need for tools.

Accessories	3RV20	3RV21	3RV23	3RV24	3RV27	3RV28
Auxiliary switch	✓	✓	✓	✓	✓	✓
Signaling switch	✓	✓	✓	✓	-	-
Undervoltage release	✓	-	✓	✓	✓	✓
Shunt release	✓	-	✓	✓	✓	✓
Disconnector module	✓	✓	✓	✓	-	-
Insulated 3-phase busbar system	✓	-	✓	✓	-	-
Busbar adapter	✓	✓	✓	✓	-	-
Door-coupling rotary operating mechanism	✓	✓	✓	✓	✓	✓
Link modules	✓	✓	✓	✓	-	-
Surface-mounting enclosure	✓	✓	✓	✓	-	-
Flush-mounting enclosure	✓	✓	✓	✓	-	-
Front plate	✓	✓	✓	✓	-	-
Infeed system	✓	-	✓	✓	-	-

10.2 Installation rules/Component rules

Maximum expansion

The maximum expansion of the 3RV2 motor starter protector is one transverse auxiliary switch, one lateral auxiliary switch with 2 contacts, one signaling switch, and one auxiliary release.

The lateral auxiliary switch 2 NO contacts + 2 NC contacts can also be used as an alternative to a transverse auxiliary switch and a lateral auxiliary switch with 2 contacts. However, in this case it will not be possible to add a signaling switch. Accordingly, a maximum of 4 auxiliary contacts with auxiliary switches may be mounted on each motor starter protector.

Possible combinations

The following auxiliary/signaling switch and auxiliary switch combinations are possible:

- The lateral auxiliary switch must be mounted to the left of the signaling switch.
- Transverse and lateral auxiliary switches can be combined.
- A maximum of 4 auxiliary contacts may be added.
- One auxiliary release can be mounted on the right of each motor starter protector. An auxiliary release cannot be mounted on the 3RV21 motor starter protector.
- The signaling switch must be selected before the auxiliary switch.
- Once a signaling switch has been selected, only one lateral auxiliary switch with 2 contacts can be selected. It is not possible to select the lateral auxiliary switch with 4 contacts.
- The total number of auxiliary switch contacts must not exceed 4.

10.3 Auxiliary switch

10.3.1 Description

Function

The contacts of the auxiliary switch open and close along with the main contacts on the motor starter protector.

Versions

Table 10- 1 Auxiliary switch versions

Auxiliary switch	Versions	Connection system	Width	Mountable
Transverse auxiliary switch	1 CO contact	Screw connection	45 mm	Front side
	1 NO contact + 1 NC contact	Screw-type/spring-loaded connection, ring cable lug		
	2 NO contacts	Screw-type/spring-loaded connection		
Solid-state compatible transverse auxiliary switch for operation in dusty atmosphere and in solid-state circuits with low operational currents	1 CO contact	Screw connection	45 mm	Front side
Cover caps for transverse auxiliary switch to ensure finger-safety	-	Screw connection	45 mm	Front side
Lateral auxiliary switch	1 NO contact + 1 NC contact	Screw-type/spring-loaded connection, ring cable lug	9 mm	Left-hand side
	2 NO contacts	Screw-type/spring-loaded connection	9 mm	
	2 NC contacts	Screw-type/spring-loaded connection	9 mm	
	2 NO contacts + 2 NC contacts	Screw connection	18 mm	

Note

- A maximum of four auxiliary contacts with auxiliary switches can be mounted on each motor starter protector.
- Auxiliary switches (2 contacts) and signaling switches can be mounted individually or together.

10.3.2 Mounting

Note

The auxiliary switches are mounted in the same way for all sizes.

Mounting auxiliary switches

Table 10- 2 Mounting a transverse auxiliary switch

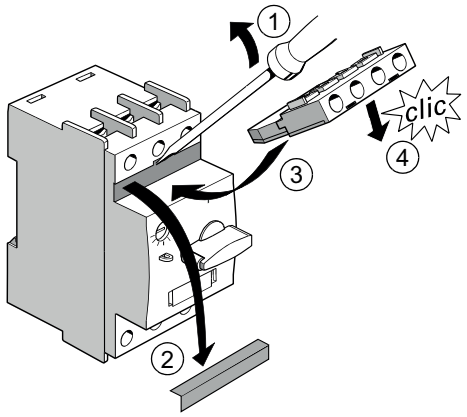
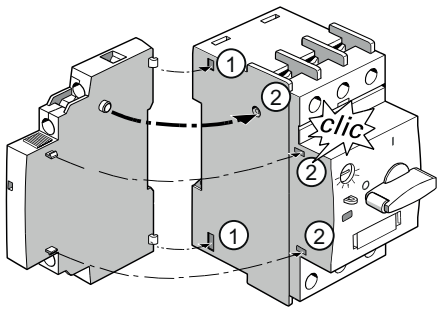
Step	Operating instruction	Figure
1 / 2	Using a screwdriver, carefully force off the cover.	
3	Slant the transverse auxiliary switch and push it into the opening on front of the motor starter protector.	
4	Press the transverse auxiliary switch down until you hear it engage.	

Table 10- 3 Mounting a lateral auxiliary switch

Step	Operating instruction	Figure
1	Attach the lateral auxiliary switch to the rear of the motor starter protector.	
2	Press the auxiliary switch to the motor starter protector until you hear it engage.	

Reference

More information ...	can be found in the chapter titled ...
About connection	Circuit diagrams (Page 131)

10.3.3 Disassembly

Note

The auxiliary switches are disassembled in the same way for all sizes.

Disassembling auxiliary switches

Table 10- 4 Disassembling a transverse auxiliary switch

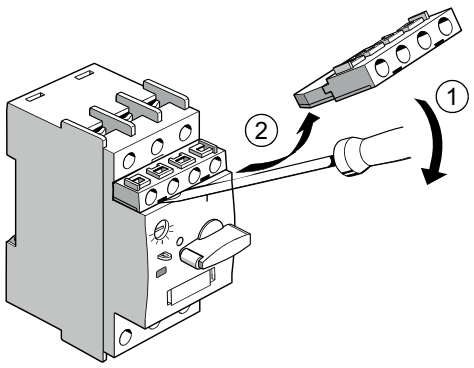
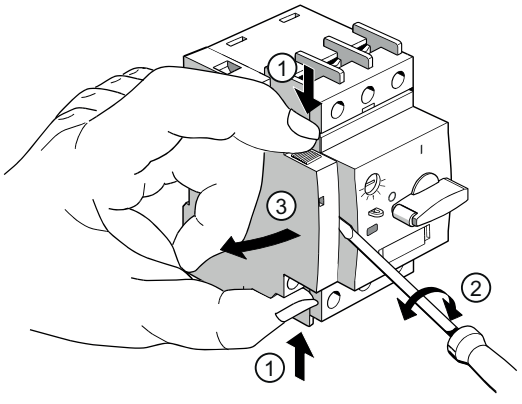
Step	Operating instruction	Figure
1	Slide a screwdriver underneath the transverse auxiliary switch. Using the screwdriver, carefully dislodge the auxiliary switch.	
2	Pull the transverse auxiliary switch out at an angle and remove it from the motor starter protector.	

Table 10- 5 Disassembling a lateral auxiliary switch

Step	Operating instruction	Figure
1	Press the clips on the top and bottom of the lateral auxiliary switch together.	
2	Run a screwdriver between the motor starter protector and the lateral auxiliary switch. Dislodge the auxiliary switch from the motor starter protector by carefully turning the screwdriver.	
3	Remove the lateral auxiliary switch from the side of the motor starter protector.	

10.4 Signaling switch

10.4.1 Description

Function

The signaling switch has two contact systems:

- One contact system (1 NO contact + 1 NC contact) signals general tripping irrespective of whether this was caused by a short circuit, an overload, or an auxiliary release.
- The other contact system (1 NO contact and 1 NC contact) only switches in the event of short-circuit release.

To be able to reclose the motor starter protector after a short circuit, once the cause of the error has been dealt with, the signaling switch has to be reset by hand.

Versions

Signaling switch	Versions	Connection system	Width	Mountable
Signaling switch	2 contact systems each with 1 NO contact and 1 NC contact	Screw-type/spring-loaded connection, ring cable lug	18 mm	Left-hand side

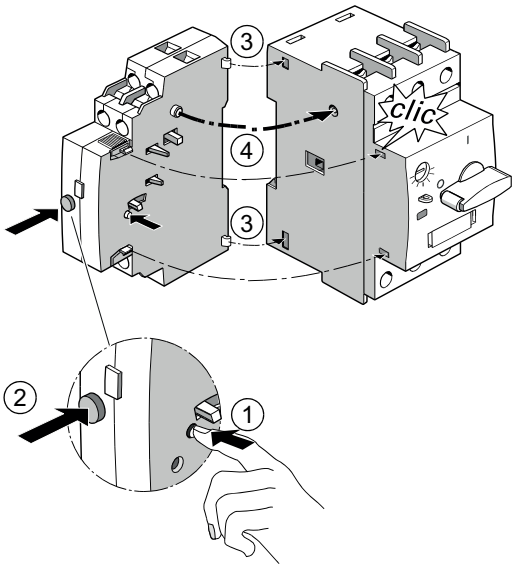
Note

- A signaling switch can be mounted on the side of the motor starter protector.
- An auxiliary switch (2 contacts) and a signaling switch can be mounted individually or together.
- The signaling switch cannot be used with 3RV27 and 3RV28 circuit breakers.

10.4.2 Mounting

Mounting signaling switches

Table 10- 6 Mounting a signaling switch

Step	Operating instruction	Figure
1	Press and hold down the transport lock on the inside of the signaling switch.	
2	Then also press the blue RESET button on the front of the signaling switch until it engages.	
3	Attach the signaling switch to the rear of the motor starter protector.	
4	Press the signaling switch to the motor starter protector until you hear it engage.	

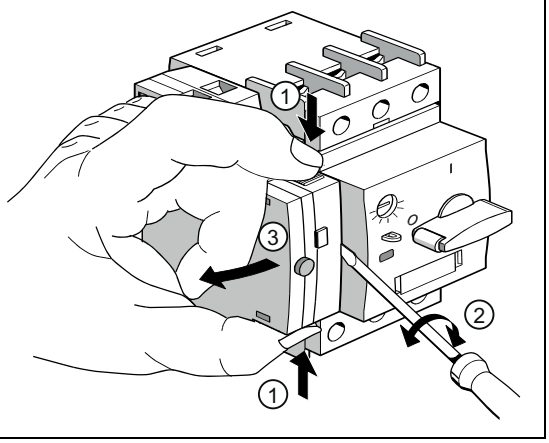
Reference

More information ...	can be found in the chapter titled ...
About connection	Circuit diagrams (Page 131)

10.4.3 Disassembly

Disassembling signaling switches

Table 10- 7 Disassembling a signaling switch

Step	Operating instruction	Figure
1	Press the clips on the top and bottom of the signaling switch together.	
2	Run a screwdriver between the motor starter protector and the signaling switch. Dislodge the signaling switch from the motor starter protector by carefully turning the screwdriver.	
3	Remove the signaling switch from the side of the motor starter protector.	

10.4.4 Operation and diagnostics

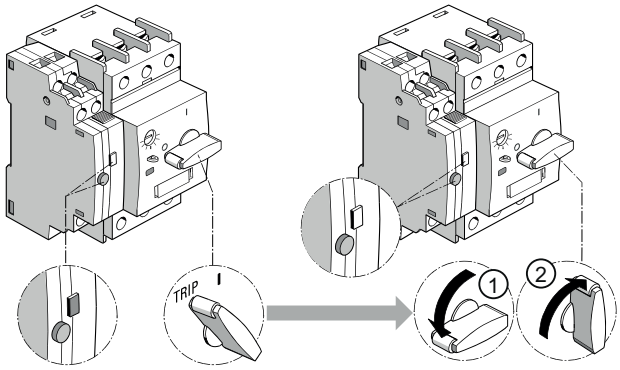
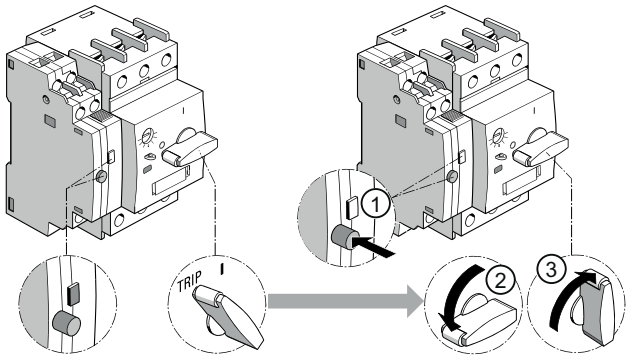
Overview

The signaling switch supplies two signals:

- A tripped signal (short circuit, overload or tripping by shunt release)
- A short-circuit signal (short circuit only)

Signaling switch display

Table 10- 8 Signaling switch with tripped and short-circuit signal

Figure	State	Procedure following tripping
	**Tripped signal** • Motor starter protector – In tripped setting • Signaling switch – Display is red – RESET button (blue) remains pressed down	Open (move to O) and then reclose (move to I) the motor starter protector.
	**Short-circuit signal** • Motor starter protector – In tripped setting • Signaling switch – Display is red – RESET button (blue) is not pressed down	Press the RESET button (blue) on the signaling switch, then open the motor starter protector (move to O) before reclosing it (move to I).

10.5 Auxiliary release

10.5.1 Description

Auxiliary release

The releases, which are not size-specific, are available in three versions:

- Undervoltage release
- Undervoltage release with leading auxiliary contacts (2 NO contacts)
- Shunt release

The releases are mounted on the right-hand side of the motor starter protector and have a width of 18 mm. They are available for all commonly used voltages all over the world. They can be installed inside molded-plastic enclosures.

Note

- One auxiliary release can be mounted on each motor starter protector.
- No accessories can be mounted on the right-hand side of 3RV21 motor starter protectors with overload relay function.

⚠ WARNING

Hazardous Voltage. Risk of death or serious injury.

The function of the undervoltage release may be restricted following a short-circuit release.

Following a short-circuit release, check that the undervoltage release is correctly mounted and carry out the function test for 3RV2902-1A..., 3RV2902-1C... again.

Shunt release

For remote-controlled tripping of the motor starter protector

- Via PLC: The release's coil should only be energized for a brief period.

Undervoltage release

The undervoltage release trips the motor starter protector in the event of voltage interruption (e.g. if the power supply fails) and prevents the motor from being unintentionally restarted when the voltage is restored. The motor starter protector then has to be reclosed by hand. Particularly suitable for EMERGENCY OFF disconnection via corresponding EMERGENCY OFF pushbutton according to IEC 60204-1 (VDE 0113)

Undervoltage release with leading auxiliary contacts

The undervoltage release with leading auxiliary contacts has the same function as the undervoltage release without auxiliary contacts.

Additional functions:

- The auxiliary contacts ensure that the undervoltage release is only energized during the motor starter protector's ON time.
- The auxiliary contacts isolate the overvoltage release from the line on both sides when the voltage is disconnected or in the event of tripping, thereby preventing vagabond voltages from getting into the control circuit when the switch is set to OFF. This requires a conductive connection between outputs D2 and 08.
- Because the contacts are leading contacts, the power supply to the undervoltage release is assured before the remaining steps involved in switching on are carried out.

10.5.2 Auxiliary release voltage ranges

Table 10- 9 Undervoltage release voltage ranges

Auxiliary release	Frequency		
	DC	50 Hz AC	60 Hz AC
Undervoltage release	24 V *)	24 V	-
		110 V	120 V
		-	208 V
		230 V	240 V
		400 V	440 V
		415 V	480 V
		500 V	600 V
Undervoltage release with leading auxiliary contacts	-	230 V	240 V
		400 V	440 V
		415 V	480 V

*) A break of at least 2.5 s must be observed between the trip and switching the undervoltage release back on again.

Table 10- 10 Shunt release voltage ranges

Auxiliary release	Frequency	
	50/60 Hz AC 100% ED [1]	50/60 Hz AC; DC 5 s ED [2]
Shunt release	20 to 24 V	20 to 70 V
	90 to 110 V	70 to 190 V
	210 to 240 V	190 to 330 V
	350 to 415 V	330 to 500 V
	500 V	500 V

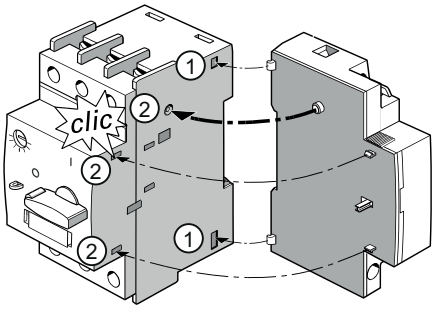
1) The voltage range is valid for 100% (infinite) ON period. The response voltage lies at 0.9 of the lower limit of the voltage range.

2) The voltage range is valid for 5 s ON period at 50 Hz/60 Hz AC and DC. The response voltage lies at 0.85 of the lower limit of the voltage range.

10.5.3 Mounting

Mounting the shunt release

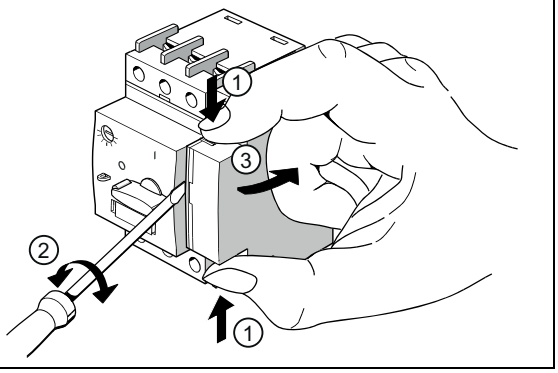
Table 10- 11 Mounting a shunt release

Step	Operating instruction	Figure
1	Attach the shunt release to the rear of the motor starter protector.	
2	Press the shunt release to the motor starter protector until you hear it engage.	

10.5.4 Disassembly

Disassembling the shunt release

Table 10- 12 Disassembling a shunt release

Step	Operating instruction	Figure
1	Press the clips on the top and bottom of the shunt release together.	
2	Run a screwdriver between the shunt release and the motor starter protector. Dislodge the shunt release from the motor starter protector by carefully turning the screwdriver.	
3	Remove the shunt release from the side of the motor starter protector.	

10.6 Disconnector module

10.6.1 Description

Disconnector module

The disconnector module is mounted on the motor starter protector on the infeed side. The disconnector module can be used to form a visible isolating distance. To set up the isolating distance, the plug connector is removed from the enclosure. The isolating plug can only be removed with the supply disconnected.

The touch-proof isolating point is clearly visible and is secured with a padlock so that the plug connector cannot be inserted during maintenance work, for example.

The disconnector module can be used for size S00 and size S0.

Note

- The disconnector module cannot be used with 3RV27 and 3RV28 circuit breakers.
- The disconnector module covers the connection screws on the transverse auxiliary switch. Therefore, if you are using the disconnector module, we recommend that you use the lateral auxiliary switches or wait until the transverse auxiliary switches have been wired before mounting the disconnector module.
- The disconnector module must not be used in conjunction with the 3-phase busbar 3RV1915.

10.6.2 Mounting

Mounting sequence

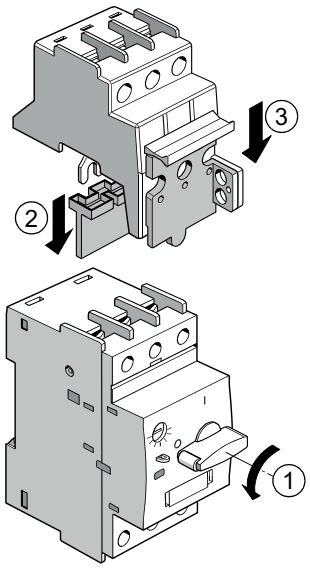
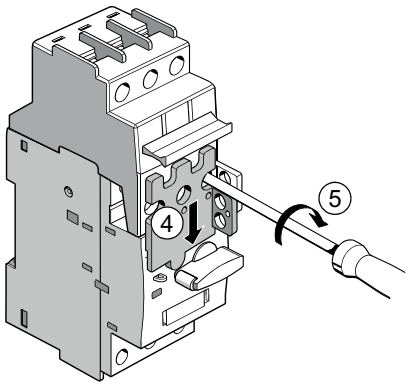
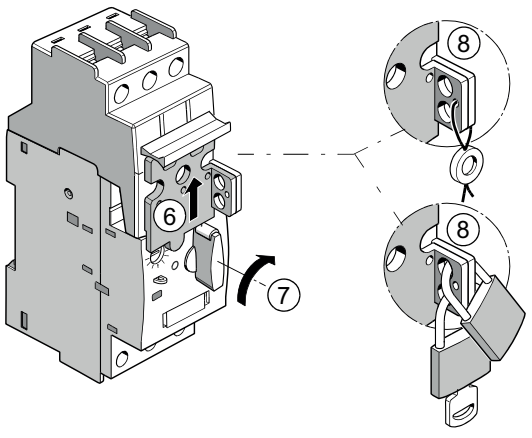
Note

Mounting sequence for disconnector module and transverse auxiliary switch

The disconnector module covers the connection screws on the transverse auxiliary switch. Therefore, we recommend that you use the lateral auxiliary switches or wait until the transverse auxiliary switches have been wired before mounting the disconnector module.

Mounting the disconnector module

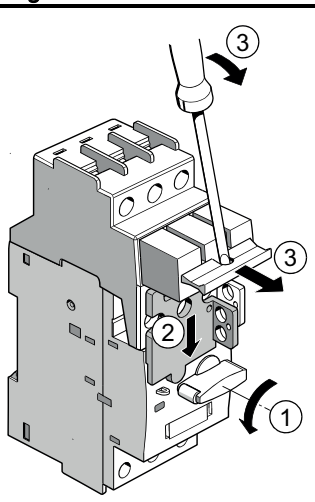
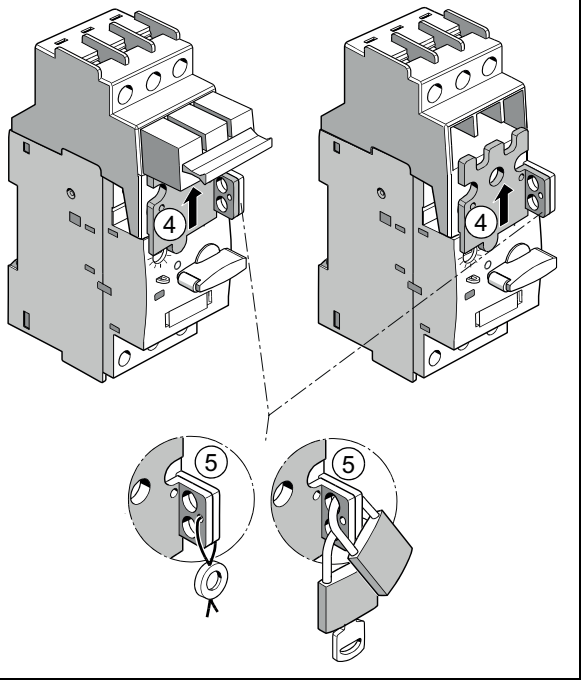
Table 10- 13 Mounting the disconnector module

Step	Operating instruction	Figure
1	Set the rotary button on the motor starter protector to O.	
2	Remove the protective cover from the terminal lugs on the disconnector module.	
3	Set the disconnector module down on the motor starter protector. Make sure that the terminal lugs on the disconnector module slot into the corresponding openings.	
4	Slide the closing lockout down.	
5	Screw the main conductor terminals tight on the motor starter protector.	
6	Slide the closing lockout up.	
7	Set the rotary button on the motor starter protector to I.	
8	Secure the disconnector module so that the isolating plug cannot be removed when the motor starter protector is active.	

10.6.3 Isolation and shut-off

Creating and securing the isolating distance

Table 10- 14 Creating and securing the isolating distance

Step	Operating instruction	Figure
1	Set the rotary button on the motor starter protector to O.	
2	Slide the closing lockout down.	
3	Slide the isolating plug forward and out of the disconnector module.	
4	Slide the closing lockout up.	
5	Secure the closing lockout so that the isolating plug cannot be inserted or pushed further in.	

10.7 Phase barriers/UL 508 "type E" terminals

10.7.1 Description

"Self-protected combination motor controller (type E)" according to UL 508

3RV20 motor starter protectors are approved as "Self-Protected Combination Motor Controller" (Type E) according to UL508.

The increased clearances and creepage distances required for this application on the input side of the device (1 inch and 2 inches respectively) are achieved by adding terminal blocks.

1. The 3RV29 28-1H terminal block is screwed to the basic device.
2. The 3RV2928-1K phase barriers are connected to the device.

The terminal block is recommended for the connection of larger conductor cross-sections.

Note

CSA

CSA approval does not require extended clearances and creepage distances.

Function

To ensure optimum protection against flashover between the connected conductors in the event of a short circuit, phase barriers/terminals can be used. The phase barriers/terminals are required to increase the clearances and creepage distances in conjunction with prevailing switching overvoltages during motor starter protector switching. The phase barriers/terminals increase the insulation strength between the motor starter protector's connection contacts.

Restriction

The terminal block and the phase barriers cannot be used simultaneously with 3RV19.5 3-phase busbars. If phase barriers are being used, the motor starter protectors can only be mounted on DIN rails.

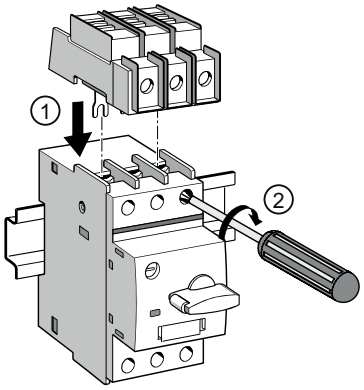
Versions

The terminal block and the phase barriers are only available in screw designs. They can only be mounted on the motor starter protector using screw-type connection systems.

10.7.2 Mounting UL 508 "type E" terminals

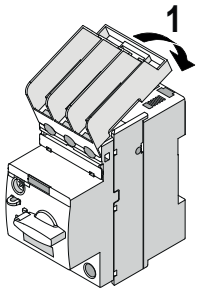
The 3RV2928-1H terminal block can only be mounted on a motor starter protector using screw-type connection system.

Table 10- 15 Mounting a UL 508 "type E" terminal

Step	Operating instruction	Figure
1	Attach the terminal to the motor starter protector from above.	
2	Screw the terminal tight by screwing the main conductor terminals of the motor starter protector tight.	

10.7.3 Mounting phase barriers

Table 10- 16 Mounting phase barriers

Step	Operating instruction	Figure
1	Attach the phase barriers to the motor starter protector from the front. Tilt the phase barriers back and down until they snap onto the motor starter protector.	

10.8 Door-coupling rotary operating mechanism

10.8.1 Description

Door-coupling rotary operating mechanism

The 3RV2 motor starter protectors can be installed in the control cabinet and operated externally by means of a door-coupling rotary operating mechanism. The mechanism engages when the control cabinet door closes. If the motor starter protector is active, the coupling locks, thereby preventing the door opening unintentionally. This lock can be deactivated by maintenance personnel. In the OFF setting, the rotary operating mechanism can be secured against reclosing with up to 3 padlocks. The padlocks prevent the door from opening unintentionally.

Door-coupling rotary operating mechanisms

The door-coupling rotary operating mechanisms comprise a knob, a coupling driver, and an extension shaft 130/330 mm in length (6 x 6). The door-coupling rotary operating mechanisms are dimensioned for IP64 degree of protection. The interlocking of the door prevents the unintentional opening of the control cabinet door when the switch is set to ON. The OFF setting can be locked with up to 3 padlocks.

Door-coupling rotary operating mechanism for arduous conditions

The door-coupling rotary operating mechanisms comprise a knob, a coupling driver, and an extension shaft 300 mm in length (8 x 8 mm), a spacer and two metal brackets, which are used to mount the motor starter protector.

The door-coupling rotary operating mechanisms are dimensioned for IP65 degree of protection. The interlocking of the door reliably prevents the unintentional opening of the control cabinet door when the switch is set to ON. The OFF setting can be locked with up to 3 padlocks.

Laterally mountable auxiliary releases and 2-pole auxiliary switches can be used. The door-coupling rotary operating mechanisms meet the requirements for isolating function according to IEC 60947-2.

Versions

Door-coupling rotary operating mechanism	Versions	Width	Mountable
Door-coupling rotary operating mechanisms (IP64 degree of protection)			
Door-coupling rotary operating mechanism	Black	Depending on version	Depending on version
EMERGENCY STOP door-coupling rotary operating mechanism	Red/yellow	Depending on version	Depending on version
Door-coupling rotary operating mechanism for arduous conditions (IP65 degree of protection)			
Door-coupling rotary operating mechanism	Gray	Depending on version	Depending on version
EMERGENCY STOP door-coupling rotary operating mechanism	Red/yellow	Depending on version	Depending on version

10.8.2 Mounting

Mounting the door-coupling rotary operating mechanism

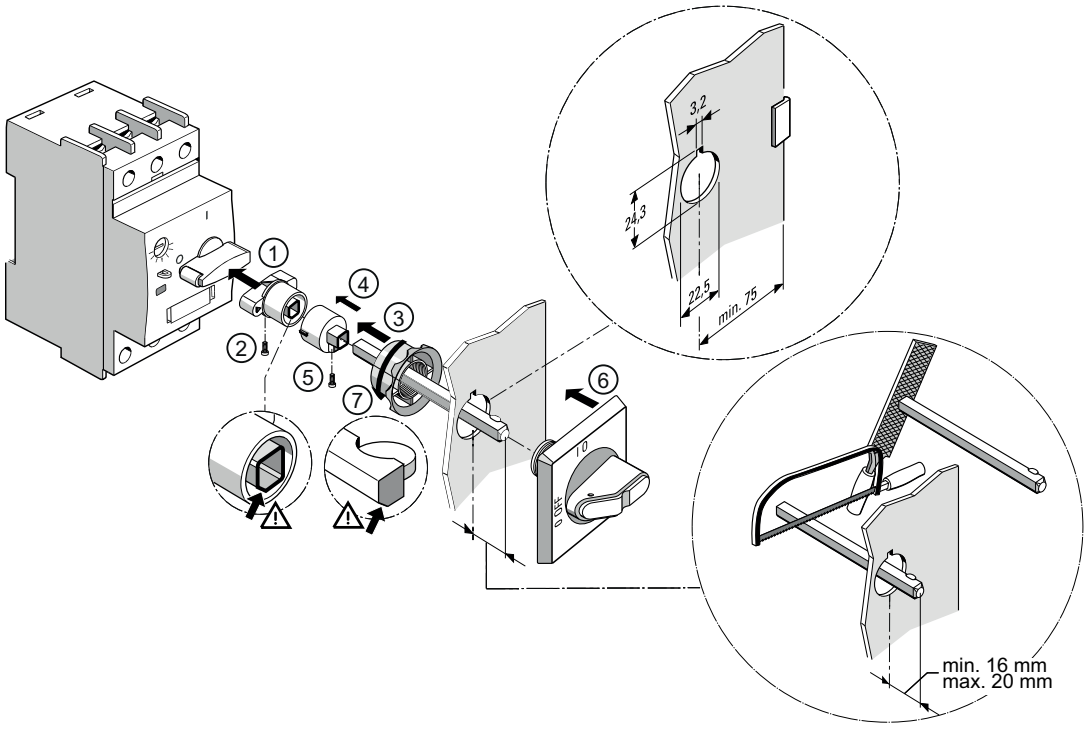


Figure 10-2 Mounting the door-coupling rotary operating mechanism

Note

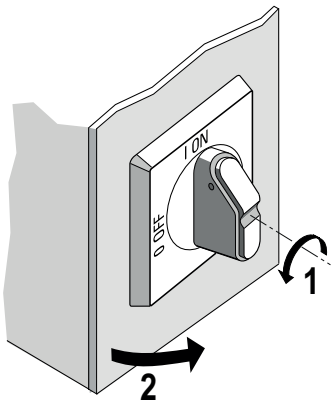
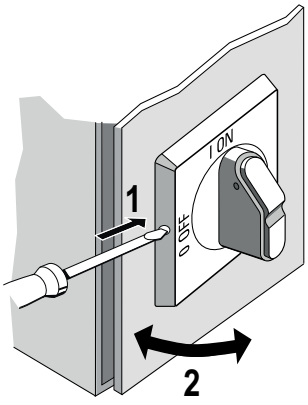
Remember to observe the mechanical coding of the connecting rod!

10.8.3 Operating the door-coupling rotary operating mechanism

Opening the door

The following table shows how to open the control cabinet door with the door-coupling rotary operating mechanism:

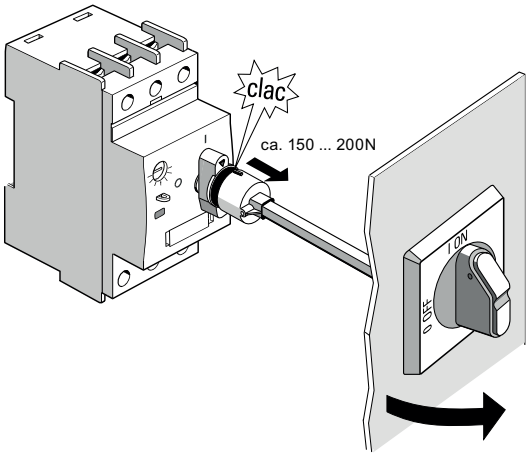
Table 10- 17 Opening control cabinet doors with door-coupling rotary operating mechanism

Diagram	Procedure
	To open the control cabinet door, set the motor starter protector to O (OFF). This will release the extension shaft from the rotary operating mechanism so that you can open the door.
	If you need to open the control cabinet door during operation, press the knob next to the rotary knob to "override" the interlock (Step 1). To close the door during operation, press this knob again so that the extension shaft can re-engage.

Opening the door with significant force

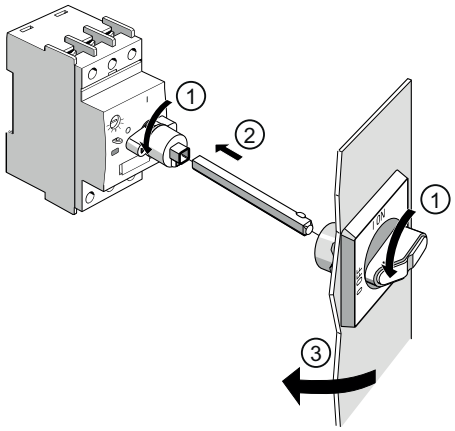
Note

If the motor starter protector is set to ON and the door is opened with a force of > 150 to 200 N, the extension shaft cap will break away from the rotary switch on the motor starter protector to prevent irreparable damage to the motor starter protector. The motor starter protector remains set to ON.



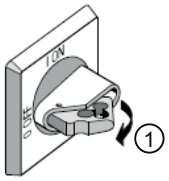
The extension shaft then needs to be re-attached to the motor starter protector and the door-coupling rotary operating mechanism as described below:

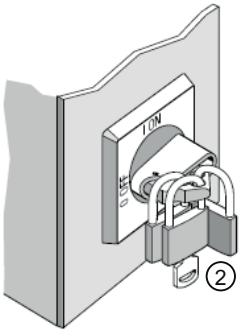
Table 10- 18 Attaching the extension shaft

Diagram	Procedure
	Switch off the motor starter protector (O) and turn the rotary switch on the door-coupling rotary operating mechanism to OFF.
	Attach the extension shaft cap to the rotary switch on the motor starter protector and then insert the extension shaft into the cap.
	Close the control cabinet door.

Locking

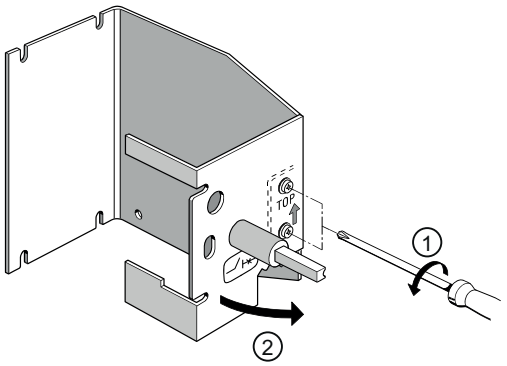
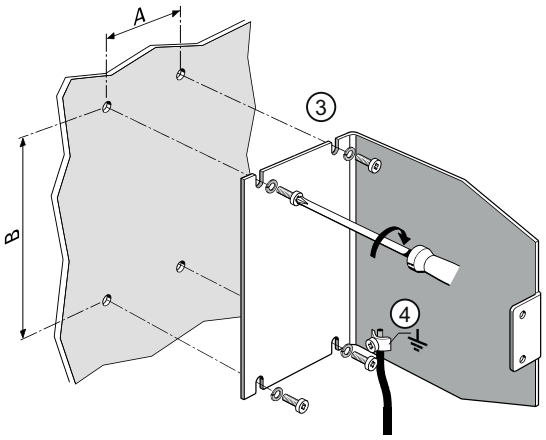
In the OFF position, the rotary operating mechanism can be secured by attaching up to 3 locks to the handle outside of the control cabinet, e.g. while maintenance work is carried out on the system. In this case too, the motor starter protector must be set to the O position first, before the locks are attached. The locking device on the handle is then pulled forward. Up to three padlocks with a maximum shackle diameter of 8 mm can be attached to this locking device.

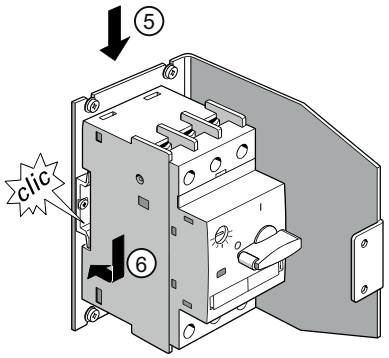
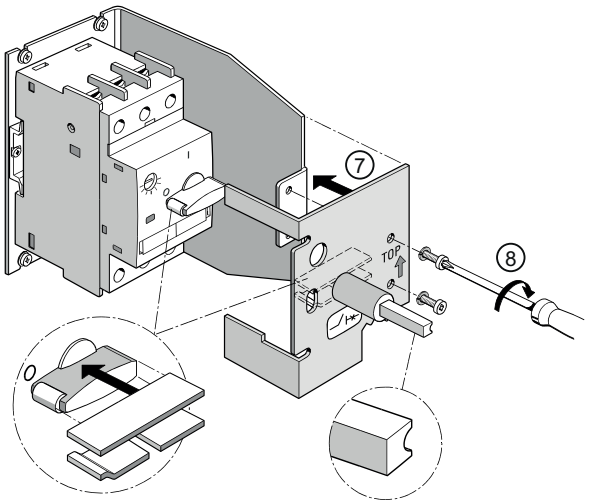




10.8.4 Operating the door-coupling rotary operating mechanism for arduous conditions

Mounting the door-coupling rotary operating mechanisms for arduous conditions

Step	Operating instruction	
1 / 2	Unscrew the cover from the door-coupling rotary operating mechanism and remove the cover.	
3 / 4	Screw the base of the door-coupling rotary operating mechanism tight to a level surface and connect to ground.	

Step	Operating instruction	
5 / 6	Mount a DIN rail in the center of the base of the door-coupling rotary operating mechanism. Attach the deactivated motor starter protector to the DIN rail from above and snap the motor starter protector onto the DIN rails.	
7 / 8	Replace the cover on the base of the door-coupling rotary operating mechanism. When doing this, make sure that the motor starter protector is set to "OFF" and that the shaft slot is on the right.	

Opening the door

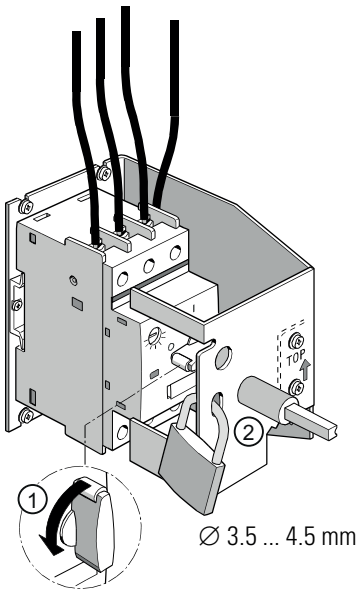
To open the control cabinet door, set the motor starter protector to O. This will release the extension shaft from the rotary operating mechanism so that you can open the door.

Opening the door with significant force

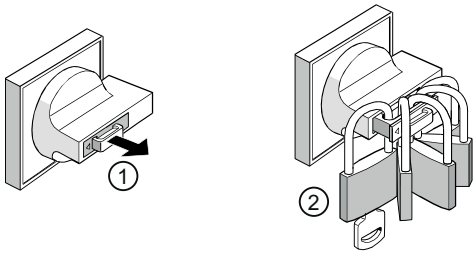
Note

Opening the door with a force of ≥ 800 N when the motor starter protector is set to I can damage the mechanism beyond repair. The motor starter protector remains active. The mechanism will keep the door closed up to a force of 800 N.

Locking



The mechanism can be locked inside the control cabinet with a padlock. The motor starter protector must be set to the O position first, before the lock is attached.



The mechanism can also be locked outside the control cabinet via the handle.

In this case too, the motor starter protector must be set to the O position first, before the locks are attached. The locking device on the handle is then pulled forward. Up to five padlocks with a maximum shackle diameter of 6 mm or three padlocks with a maximum shackle diameter of 8.5 mm can be attached to this locking device.

10.9 Enclosures and mounting accessories

10.9.1 Description

General

Plastic enclosures for surface mounting and molded-plastic enclosures for flush mounting are available in various dimensions for the stand-alone assembly of size S00 ($I_{n\ max}$ = 16 A) and S0 ($I_{n\ max}$ = 32 A) motor starter protectors.

In the case of installation in molded-plastic enclosures the rated operational voltage U_e of the motor starter protectors is 500 V.

The enclosures for surface mounting have IP55 degree of protection and those for flush mounting also meet the requirements for IP55 degree of protection at the front (the flush-mounted section complies with IP20).

When installing motor starter protectors with spring-loaded connections in enclosures for surface mounting, the rear cable entries cannot be used.

Motor starter protectors with spring-loaded connections cannot be used in enclosures for flush mounting.

Enclosures

All enclosures are equipped with N and PE terminals. They have 2 knockout cable entry openings for cable glands at the top and 2 at the bottom, along with corresponding cable entries scored on the rear. There is a knockout on the top of the enclosure for indicator lights which are available as accessories.

The slim-line enclosure can accommodate a motor starter protector without accessories, with transverse and lateral auxiliary switches. There is no provision for installing a motor starter protector with signaling switch.

In the case of size S00 and S0 motor starter protectors, the molded-plastic enclosures are fitted with a rotary operating mechanism.

The enclosures are available either with a black rotary operating mechanism or with an EMERGENCY STOP rotary operating mechanism with red/yellow handle.

In the OFF setting, all rotary operating mechanisms can be locked with up to three padlocks.

Front plates

Many applications require motor starter protectors to be actuated in any type of enclosure. Front plates equipped with a rotary operating mechanism are available for size S00 and S0 motor starter protectors for this purpose.

A holder for size S00 and S0 motor starter protectors is available for the front plates (the motor starter protectors snap into the holder).

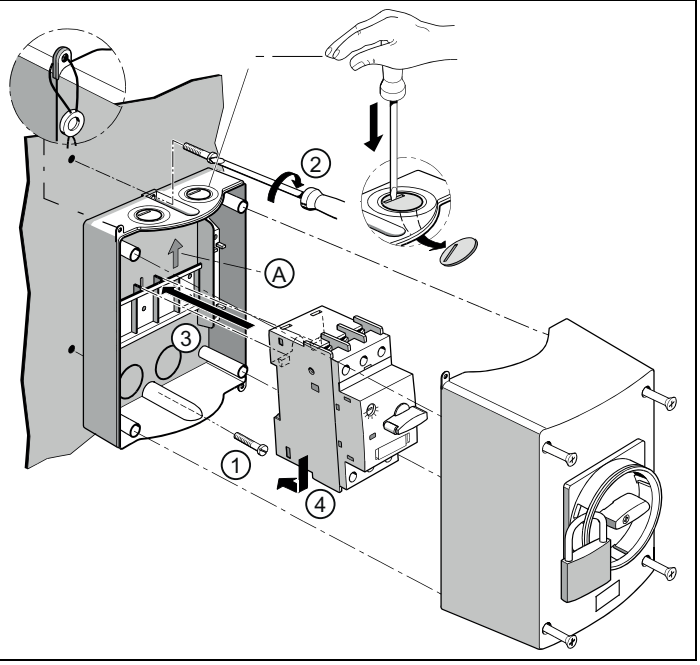
The front plates can also be used for 3RV2 motor starter protectors with spring-loaded connection.

10.9.2 Mounting

Various enclosures are available for the motor starter protectors.

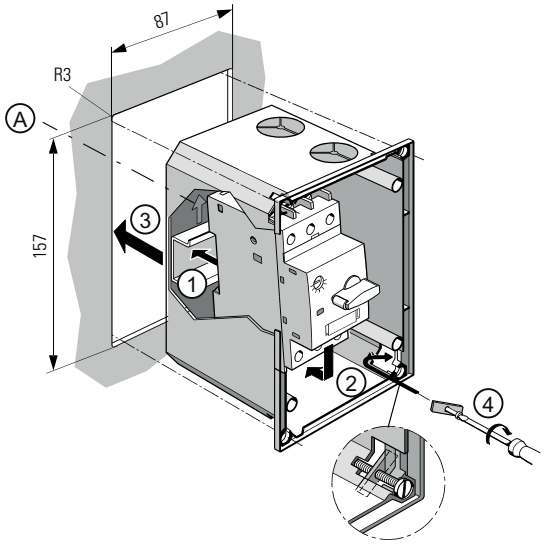
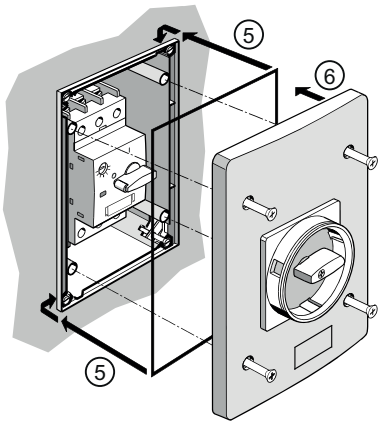
Enclosure mounting

Table 10- 19 Mounting the enclosure

Step	Operating instruction	Figure
1 / 2	Mount the lower part of the enclosure on a level surface. Make sure that the arrow (A) is pointing up.	
3 / 4	Snap the motor starter protector onto the rail in the enclosure as illustrated in the diagram. Next, screw the enclosure top part to the lower part of the enclosure (tightening torque 1.2 to 1.5 Nm). The enclosure can also be sealed with leads on the bottom right and/or top left.	

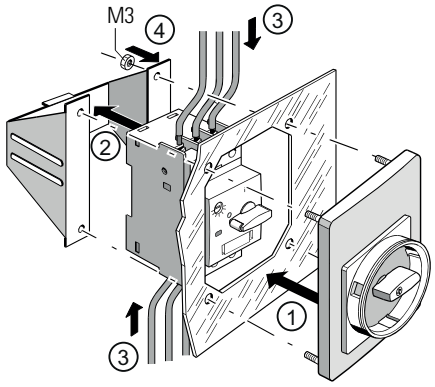
Mounting flush-mounting enclosures

Table 10- 20 Mounting the flush-mounting enclosure

Step	Operating instruction	Figure
1 / 2	A cutout measuring 157 x 87 mm and with a radius of the corners of R3 is required to mount the flush-mounting enclosure. The enclosure is 96 mm deep. Snap the motor starter protector onto the rail in the enclosure as illustrated in the diagram. Make sure that the arrow (A) is pointing up.	
3	Position the lower part of the enclosure in the cutout.	
4	Secure the enclosure as shown in the zoom view to prevent it from sliding out.	
5	Position the seal between the enclosure and the mounting surface as illustrated in the diagram.	
6	Next, screw the enclosure top part to the lower part of the enclosure (tightening torque 1.2 to 1.5 Nm).	

Mounting front plates

Table 10- 21 Mounting front plates

Step	Operating instruction	Figure
1	Insert the rotary operating mechanism into the front plate.	
2	Snap the motor starter protector onto the holder.	
3	Connect the motor starter protector.	
4	Screw the front plate and the rotary operating mechanism tight to the holder (use M3 screws).	

10.10 Sealable cover

10.10.1 Description

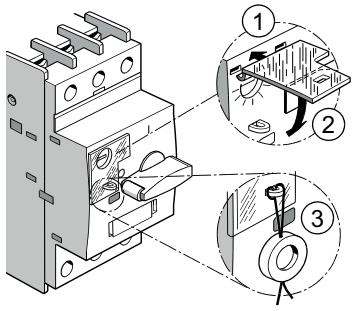
3RV2908-0P sealable cover

A sealable cover compatible for use with all sizes is available for the motor starter protectors. This cover can also be used for the 3RU21 thermal overload relay.

The sealable cover can be used to secure the rotary button for setting the rated motor current against unauthorized manipulation.

10.10.2 Mounting

Table 10- 22 Mounting the sealable cover on the motor starter protector

Step	Operating instruction	Figure
1 / 2	Attach the hooks on the cover to the openings on the motor starter protector and fold the cover down.	
3	Seal the cover to secure it against unauthorized removal.	

10.11 Insulated 3RV1915 3-phase busbar system

10.11.1 Description

Insulated 3-phase busbar system

The 3-phase busbar systems provide a straightforward, time-saving, and transparent means of supplying power to 3RV2 motor starter protectors with screw terminals. They can be used for the various types of motor starter protector.

Note

Exceptions

The 3RV19 15 3-phase busbar systems are generally unsuitable for 3RV21 motor starter protectors with overload relay function and for 3RV27 and 3RV28 circuit breakers conforming to UL 489/CSA C22.2 No.5-02. Neither can they be used with the 3RV2928-1A disconnector module.

Extending the busbars

The busbars are designed for between 2 and 5 motor starter protectors. They can be extended at will by clamping the terminal lugs of a second busbar (rotated by 180°) underneath the terminals of the last respective motor starter protector on the first busbar.

Combination of sizes S0 and S00

It is possible to combine motor starter protectors of different sizes. Power is fed in via corresponding infeed terminals.

Touch protection and short-circuit stress

The 3-phase busbar systems have finger-safe shock protection. They have been dimensioned to withstand the level of short-circuit stress that can occur on the output side of the connected motor starter protectors.

Type E starters

The 3-phase busbar systems can also be used to build "type E starters" in size S00, S0 according to UL/CSA. However, special infeed terminals have to be used for this purpose.

10.11.2 Versions

3-phase busbar versions

For the infeed of several motor starter protectors with screw terminals for side-by-side mounting on DIN rails, insulated, with touch protection

Table 10- 23 3-phase busbars[1)]

Order no.	Number of motor starter protectors that can be connected			Incl. auxiliary release	Rated current I_n at 690 V
	Modular spacing [mm]	Without lateral accessories	Incl. lateral auxiliary switch		
3RV19 15-1..	45	2 / 3 / 4 / 5	-	-	63
3RV19 15-2..	55	-	2 / 3 / 4 / 5	-	63
3RV19 15-3..	63	-	-	2 / 4	63

1) Not suitable for 3RV21 motor starter protectors for motor protection with overload relay function and for 3RV27 and 3RV28 circuit breakersconforming to UL 489/CSA C22.2 No.5-02.

3-phase infeed terminal:

The infeed terminal supports larger conductor cross-sections than is the case with direct connection on the motor starter protector.

- Infeed terminal from above
- Infeed terminal from below

Note

Space requirements of the infeed terminal

The infeed terminal with connection from below is connected instead of a motor starter protector. You will, therefore, need to take the space requirements into account when configuring the 3-phase busbars.

Order no.	Conductor cross-section			Tightening torque	For motor starter protector size
	Solid or stranded	Finely stranded with end sleeve	AWG cables, solid or stranded		
	mm²	mm²	AWG	Nm	
	Connection from above				
3RV29 25-5AB	2.5 to 16	2.5 to 16	10-4	3 to 4	S00, S0
	Connection from below[1)]				
3RV29 15-5B	2.5 to 16	2.5 to 16	10-4	Input: 4, Output: 2 to 2.5	S00, S0

1) This terminal is connected in place of a switch, please take the space requirement into account.

3-phase infeed terminal for installing "type E starters"

- Infeed terminal from above

Order no.	Conductor cross-section			Tightening torque	For motor starter protector size
	Solid or stranded	Finely stranded with end sleeve	AWG cables, solid or stranded		
	mm²	mm²	AWG	Nm	
	Connection from above				
3RV29 25-5EB	2.5 to 16	2.5 to 16	10-4	3-4	S00, S0

Cover cap for terminal lugs

Cover caps provide touch protection for reserve slots in sizes S00 and S0 (order no. 3RV19 15-6AB). These cover caps need to be removed before extending the busbars.

10.11.3 Mounting

Mounting with 3-phase busbars

NOTICE
Current carrying capacity
When extending the busbars, please take their current carrying capacity into account.

The diagrams below illustrate the mounting procedure for the 3-phase busbar system:

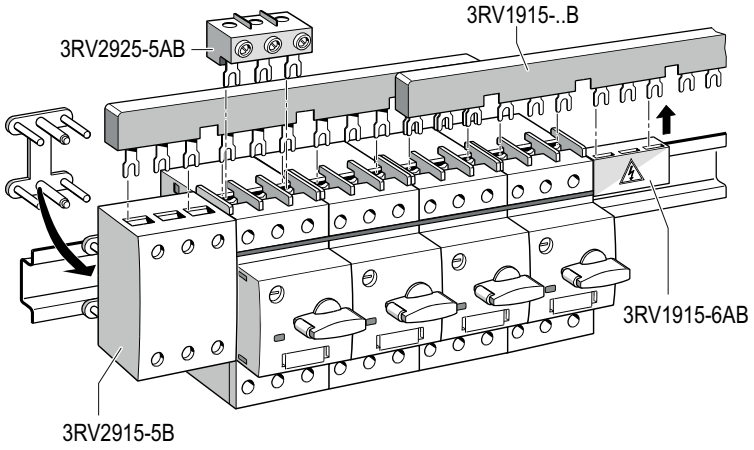


Figure 10-3 Mounting with 3-phase busbar

10.12 8US busbar adapter

10.12.1 Description

8US 3-phase busbar adapter

To save space when installing the motor starter protectors and to save time and money when implementing the infeed, busbar adapters are used to attach the motor starter protectors directly to busbar systems with center-to-center clearance of 60 mm.

The busbar adapters for busbar systems with a center-to-center clearance of 60 mm are suitable for copper busbars in widths of 12 mm through 30 mm. The busbars can be 5 mm or 10 mm thick.

The motor starter protectors snap onto the adapter and are connected at the input side. This ready-to-use unit plugs directly onto the busbar systems, thereby taking care of mechanical fastening and electrical connection at the same time.

Reference

For other busbar adapters, see the Catalog Siemens Low-Voltage Power Distribution LV10.1.

10.12.2 Versions

Busbar systems for 60 mm system

For copper busbars according to DIN 46433:

- Width: 12 mm and 30 mm
- Thickness: 5 mm and 10 mm
- and for T and I special profiles

Order no.	Size	Rated current	Connecting cable	Adapter length	Adapter width	Rated voltage
		A	AWG	mm	mm	V
for motor starter protectors with screw terminals						
8US1251-5DS10	S00/S0	25	12	200	45	690
8US1251-5NT10	S0	32	10	260	45	690
for motor starter protectors with spring-loaded terminals						
8US1251-5DS11	S00/S0	25	12	200	45	690
8US1251-5DT11	S00/S0	25	12	260	45	690
8US1251-5NT11	S0	32	10	260	45	690

Accessories

The following accessories are available for busbar adapters:

- Device holder for lateral mounting on busbar adapters

Order no.	Adapter length	Adapter width
	mm	mm
8US12 50-5AS10	200	45
8US12 50-5AT10	260	45

- Lateral modules that can be attached on both sides for widening adapters

Order no.	Adapter length	Adapter width
	mm	mm
8US19 98-2BJ10	200	9

- Spacer to fix the feeder onto the busbar adapter (order no. 8US19 98-1BA10)
- Vibration and shock kit for increased vibration and shock load (order no. 8US19 98-1CA10)

Reference

More information ...	Can be found in the chapter titled ...
About load feeders on busbar systems	Fuseless load feeders (Page 11)

10.12.3 Mounting

Prerequisites

DANGER

Hazardous voltage!

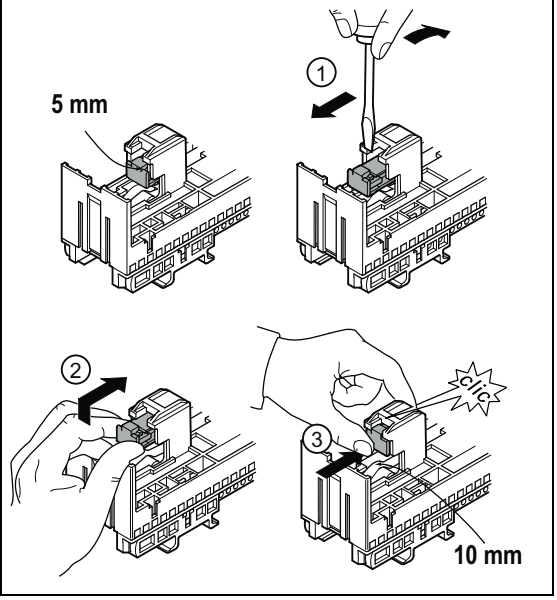
Electrical voltage can cause electric shocks or burns.

Before starting work, disconnect the systems and devices from the power supply.

Adjusting the 8US busbar adapter for the busbar system

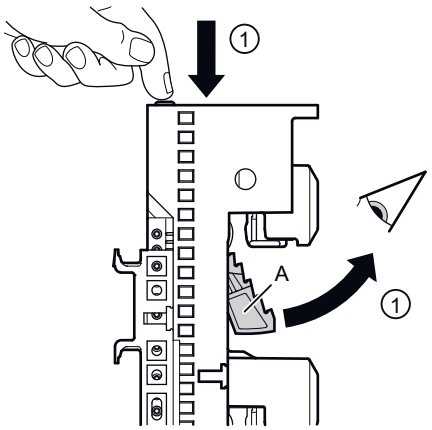
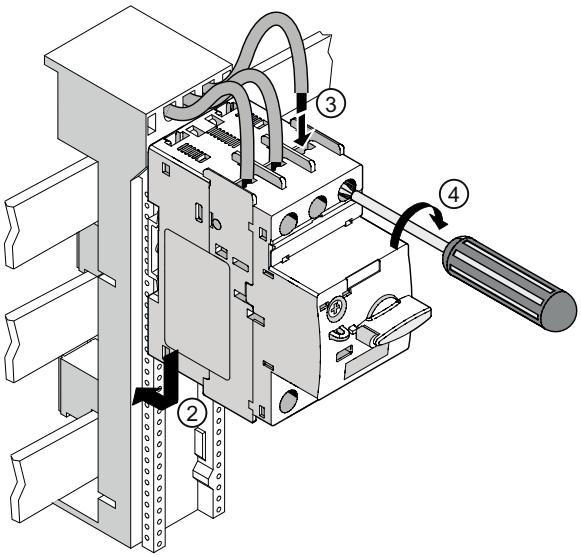
The busbar adapter can be adjusted to suit the following busbar thicknesses:

- 5 mm (delivery condition)
- 10 mm

Step	Operating instruction	Figure
1	Push the 3 fastening blocks down.	
2	Adjust the fastening blocks in accordance with the busbar thickness (5 mm/10 mm).	
3	Push the fastening blocks up until they engage.	

Mounting the motor starter protector on the busbar adapter

The diagrams below illustrate how the motor starter protector is mounted on the busbar adapter (8US) based on the example of a motor starter protector with screw-type terminals:

Step	Operating instruction	Figure
1	Press the button on the top of the busbar adapter to release the holder. The holder (A) should flip out from the front of the busbar adapter.	
2	Snap the motor starter protector onto the DIN rail, connecting it to the busbar adapter.	
3	Connect the wiring from the busbar adapter to the motor starter protector's main circuit terminal.	
4	Tighten the screw on the screw terminal. Check that the cable is clamped tight.	

10.12.4 Disassembly

Prerequisites

⚠ DANGER

Hazardous voltage!

Electrical voltage can cause electric shocks or burns.

Before starting work, disconnect the systems and devices from the power supply.

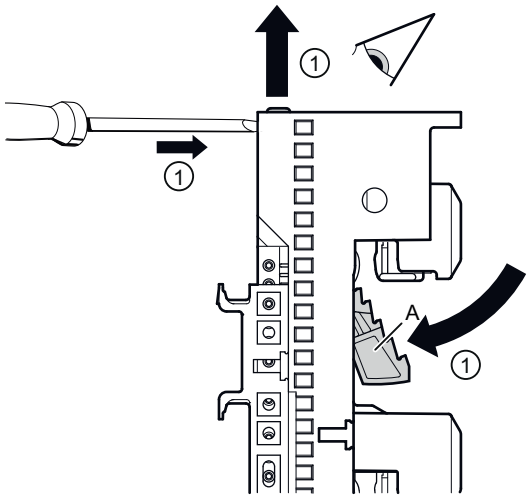
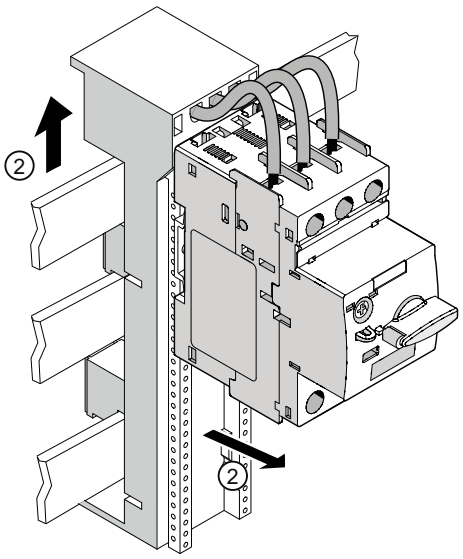
Mounting sequence

Note

The motor starter protector/feeder can be disassembled from the 8US busbar adapter either before or after the 8US busbar adapter has been removed from the busbars.

Disassembly of the busbar adapter from the busbar system

The diagrams below illustrate how the busbar adapter is disassembled from the busbar system:

Step	Operating instruction	Figure
1	From the front, insert a screwdriver into the right-hand opening on the busbar adapter and lock the holder (A). The button on the top of the busbar adapter should spring up.	
2	Remove the busbar adapter from the busbars. To do this, you will first need to push it up slightly so that you can remove it by pulling it off toward you.	

10.13 3RV2917 infeed system

10.13.1 Description

Overview

The 3RV29 infeed system provides a convenient means of feeding in and distributing power for a group of several motor starter protectors or complete load feeders with screw and spring-loaded connections in size S00 and S0 (exception: this system cannot be used with 3RV21 motor starter protectors and 3RV27 and 3RV28 circuit breakers). .

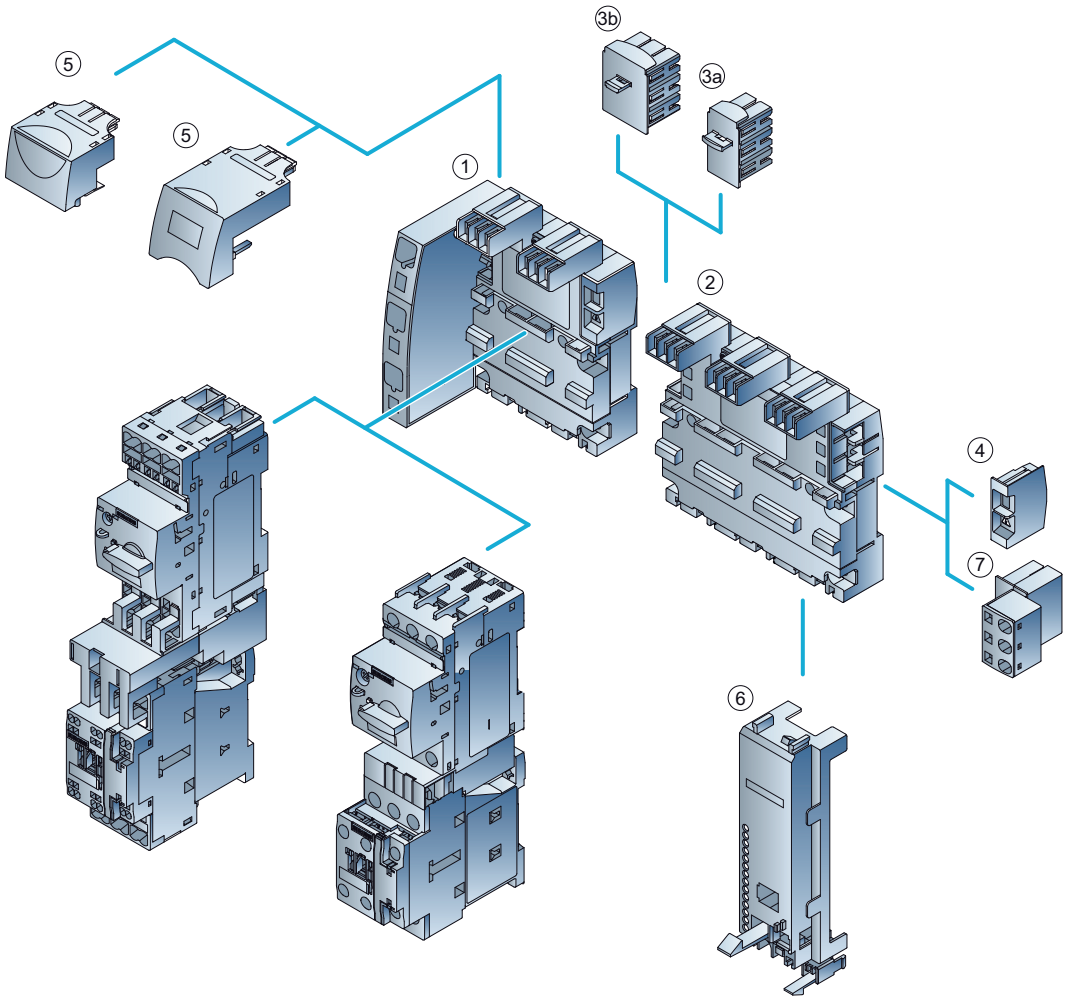
The system is based on a basic module complete with a lateral infeed (3-phase busbar with infeed). This infeed with spring-loaded connections is attached on the left or right depending on the version and can be fed in with a maximum conductor cross-section of 25 mm2 (with end sleeve). A basic module has two slots onto each of which a motor starter protector can be snapped.

Expansion modules (3-phase busbars for system expansion) are available for expanding the system. An expansion plug is used to connect the individual modules.

The electrical connection between the 3-phase busbars and the motor starter protectors is established using connectors. The complete system can be installed on a TH 35 DIN rail conforming to DIN EN 60715 and can be expanded at will up to the maximum current carrying capacity of 63 A.

The simple and time-saving plug-in connections mean that the system can be set up easily and in next to no time. The lateral infeed means that the system does not take up as much space in the control cabinet either. The additional overall height required for the infeed is just 30 mm. The option to have the infeed on both sides maximizes flexibility where the configuration of the control cabinet is concerned: Infeed on left-hand or right-hand side as well as infeed on one side and outfeed on the other side to supply further loads with power are all possible. As well as the integration of SIRIUS motor starter protectors, a terminal block with spring-loaded-connections in conjunction with a DIN rail also supports the integration of 1-/2-/3-phase components such as 5SY miniature circuit breakers or SIRIUS relay components.

The 3RV29 infeed system has UL approval, and is approved for assembling both the "Self-Protected Combination Motor Controller" (type E starter), and the "Type F-Starter" (type E and contactor).



3-phase busbars with infeed (3RV2917-1A, 3RV2917-1E) ①

A 3-phase busbar with infeed is required for connecting the energy supply. These modules comprise an infeed module and 2 slots for each motor starter protector. A choice of two versions with infeed on the left- or right-hand side is available. Power is fed in via spring-loaded connections. The spring-loaded terminals support an infeed of up to 25 mm2 with end sleeve. An end cover is also supplied with every module.

3-phase busbars for system expansion (3RV2917-4A, 3RV2917-4B) ②

The 3-phase busbars for system expansion enable the system to be expanded. Users can choose modules with 2 or 3 slots. The system can be expanded as required up to a maximum current carrying capacity of 63 A. An expansion plug is also supplied with each module.

Expansion plug (3RV2917-5BA00) ③a

The expansion plug is used to establish the electrical connection of adjacent 3-phase busbars. The current carrying capacity of this plug is 63 A. An expansion plug is also supplied with each 3-phase busbar for system expansion. Additional expansion plugs are, therefore, only required as spare parts.

Extra-wide expansion plug (3RV2917-5E) ③b

The extra-wide expansion plug establishes the electrical connection between two 3-phase busbars. As such, it performs the same function as the 3RV2917-5BA00 expansion plug; the electrical characteristics (e.g. current carrying capacity 63 A) are identical.

This 3RV2917-5E expansion plug is 10 mm wider than the 3RV2917-5BA00 expansion plug and as such there is a distance of 10 mm between the connected 3-phase busbars when the plug is connected. This distance can be used to lay the auxiliary and control current wiring ("wiring duct"). Motor starter protectors and contactors can be wired from below, which means that the complete cable duct above the system can be omitted.

End cover (3RV2917-6A) ④

The end cover is used to cover the 3-phase busbars at the open end of the system. This cover is therefore only required one for each system. An end cover is supplied with each 3-phase busbar with infeed. Additional end covers are, therefore, only required as spare parts.

Connector ⑤

The connectors are used to establish the electrical connection between the 3-phase busbar and the 3RV2 motor starter protector. There are various versions:

- 3RV2 motor starter protector, size S00
  - With screw terminals (3RV2917-5CA00)
  - With spring-loaded terminals (3RV2917-5AA00)
- 3RV2 motor starter protector, size S0
  - With screw terminals (3RV1927-5AA00)
  - With spring-loaded terminals (3RV2927-5AA00)

Contactor base (3RV2927-7AA00) ⑥

The contactor bases can be used to install load feeders in the system. The contactor bases are suitable for size S00 and S0 contactors with spring-loaded terminals and screw terminals and are simply snapped onto the 3-phase busbars. Both direct-on-line and reversing starters are possible. One contactor base is required for direct-on-line starters and two for reversing starters.

To assemble load feeders for reversing feeders, the contactor bases can be arranged next to one another (overall width 90 mm). (In this case, mechanical interlocking of the contactors is possible.) The contactor bases are also suitable for soft starters in sizes S00 and S0 with screw connection.

The infeed system has been designed for installation on a 35 mm DIN rail with 7.5 mm overall depth. These DIN rails provide the contactor base with a stable mounting surface. When using DIN rails with a depth of 15 mm, the spacer connected to the underside of the contactor base has to be knocked out and attached to the counterpart, which is also located on the underside. This stabilizes the contactor base on the mounting surface. When using DIN rails with a depth of 7.5 mm, the spacer has no function and can be removed.

The link modules are used for direct feeders, so it is not absolutely necessary to use a contactor base. The motor starter protector and contactor assemblies can then be snapped directly onto the slots in the 3-phase busbars. The corresponding link modules (3RA19 21-1...., 3RA29 21-1...., 3RA29 11-2. or 3RA29 21-2....) should generally be used for size S00 and S0 feeders.

Terminal block (3RV2917-5D) ⑦

The 3RV2917-5D terminal block can be used to integrate additional 1-, 2-, and 3-phase components alongside the SIRIUS motor starter protector. With the aid of the terminal block, the 3 phases can be fed out of the system, thereby enabling even single-phase loads to be integrated into the system. As the terminal block plugs into the slot on the expansion plug, the outfeed can be positioned in the center or at the end of the infeed system. The terminal block can be rotated through 180° and interlocked with the infeed system's support modules. So that the 1-, 2-, and 3-phase components can be plugged into the infeed system, the 45 mm 3RV1917-7B DIN rail (which is screwed onto the support plate) is available.

The short-circuit protection device connected downstream from the 3RV2917-5D terminal block must be configured in accordance with the conductor cross-section on the terminal block according to the table below.

Table 10- 24 Conductor cross-section on the terminal block

Conductor cross-section on the terminal block		Downstream short-circuit protection device (e.g. 5SY)		
		$I_{d\ max}$		
1.5	mm^2	< 7.5	kA	Short-circuit-proof routing of the cables from the terminal block to the downstream short-circuit protection device (e.g. 5SY) must be ensured.
2.5	mm^2	< 9.5	kA	
4	mm^2	< 9.5	kA	
6	mm^2	< 12.5	kA	

10.13.2 Installation guidelines

When installing, the clearance in the Y direction from live, grounded or insulated parts in accordance with IEC 60947-4 is: 10 mm. The installation guidelines for motor starter protectors or fuseless load feeders must also be observed along with the associated clearances.

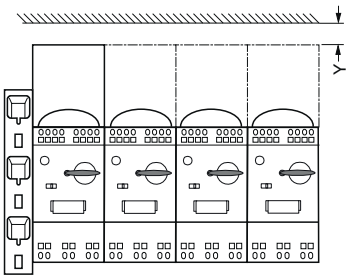


Figure 10-4 Installation guidelines

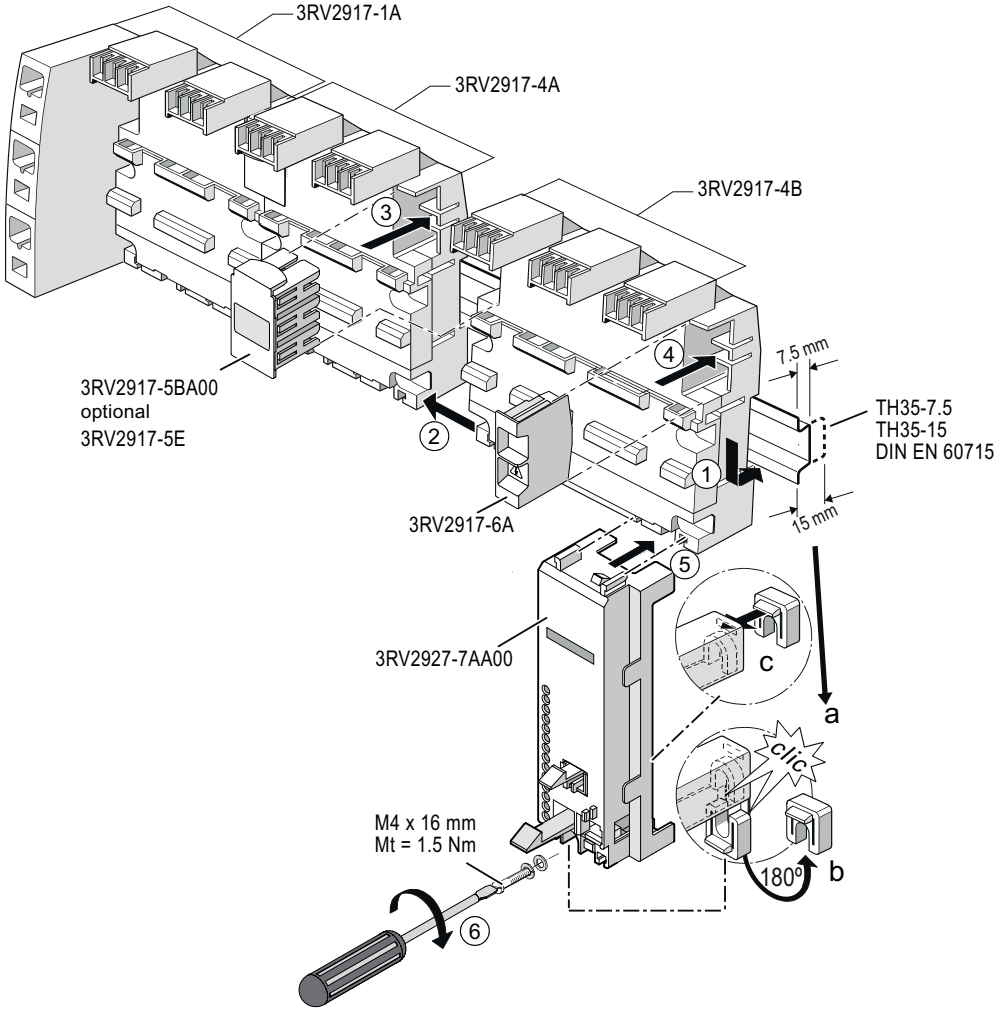
10.13.3 Derating

Derating for fuseless load feeders S00/S0 in the 3RV (63 A) CC infeed system

Size	Rated current I_e [A]	Max. permissible rated operating current I_e [%]	Max. ambient temperature T [°C]
S00	≤ 14	100	60
	> 14 ... 16	87	60
	> 14 ... 16	100	40
S0	≤ 16	100	60
	> 16 ... 25	87	60
	> 16 ... 25	100	40
	> 25 ... 32	87	40
	> 32	Not permissible	

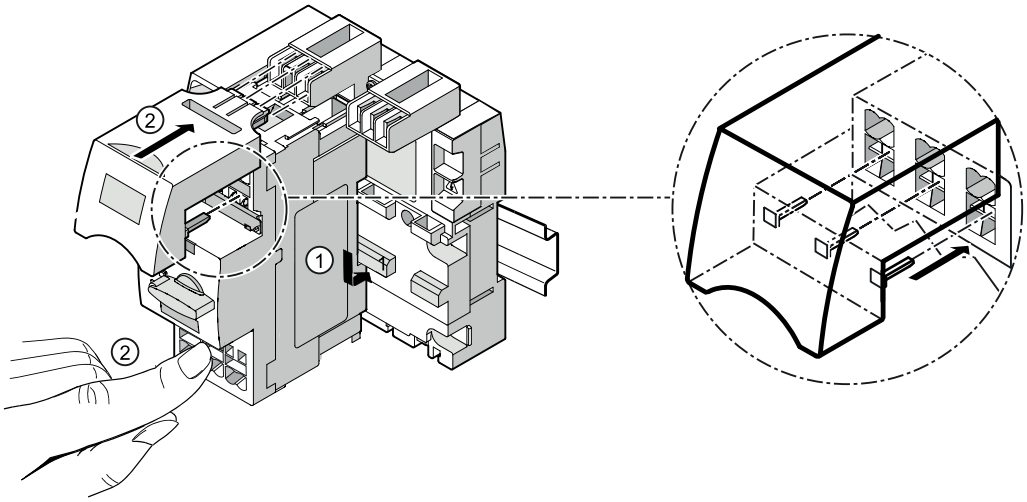
10.13.4 Mounting

Mounting the 3RV2917 infeed system



Step	Operating instruction
1	Snap the busbar onto the DIN rail.
2	Slide the individual busbars together.
3	Connect the individual busbars with the expansion plug to establish an electrical connection between the busbars.
4	Fit the end cover to cover the terminal connections at the end of the busbars.
5	You need the contactor base to mount load feeders. Connect this to the underside of the busbar, as illustrated in the diagram. If you are using DIN rails with a depth of 15 mm, spacers are attached to the contactor base (a). Remove the spacer (b) and attach it to the designated opening (c).
6	Screw the contactor base tight with M4 screws, tightening torque 1.5 Nm.

The diagram below shows an example mounting scenario based on the attachment of the 3RV2 motor starter protector with spring-loaded terminals, size S0, to the 3RV2917 infeed system.



Step	Operating instruction
1	Snap the motor starter protector onto the infeed system.
2	Establish the electrical connection between the infeed system and the motor starter protector by inserting the connector into the corresponding socket contacts as shown in the zoom view. Keep hold of the device as you do this.

10.14 Link module for attaching a contactor

10.14.1 Description

Link module for motor starter protector - contactor

Link modules to establish the electrical and mechanical connections between motor starter protector and contactor/solid-state contactor or soft starter are required if you wish to use load feeders.

Function of link modules

The link modules have the following functions:

- Electrical connection between motor starter protector and contactor/solid-state contactor or soft starter
- Mechanical connection between motor starter protector and contactor/solid-state contactor or soft starter

Depending on the connection system of the individual parts there are three different types of link module for load feeders:

- Link modules with screw-type connection system

  The motor starter protector and the contactor/contactors have a screw connection.
- Link modules for individual devices with spring-loaded connection system

  The motor starter protector and the contactor/contactors have a spring-loaded connection.
- Link modules for hybrid connection

  The motor starter protector has a screw connection and the contactor/contactors have a spring-loaded connection.

10.14.2 Mounting

Reference

More information ...	Can be found in the appendix ...
About mounting link modules	"References" under "SIRIUS Innovations manuals (Page 137)" in the "SIRIUS Innovations - SIRIUS 3RA21 / 22 load feeders" manual

Technical data

11

11.1 Performance features

Table 11- 1 Performance features of 3RV2 motor starter protectors

Feature		3RV20	3RV21	3RV23	3RV24	3RV27	3RV28
Applications							
• System protection		✓[1)]	✓[1)]	--	--	✓	✓
• Motor protection		✓	--	--	--	--	--
• Motor protection with overload relay function		--	✓	--	--	--	--
• Starter combinations		--	--	✓	--	--	--
• Transformer protection		--	--	--	✓	✓	✓
Size		S00, S0	S00, S0	S00, S0	S00, S0	S00	S00
Rated current I_n							
• Size S00	A	Up to 16	Up to 16	Up to 16	Up to 16	Up to 15	Up to 15
• Size S0	A	Up to 40	Up to 32	Up to 40	Up to 25	--	--
Rated operational voltage U_e acc. to IEC	V	690 AC[2)]	690 AC[2)]	690 AC[2)]	690 AC[2)]	AC 690	AC 690
Rated frequency	Hz	50 / 60	50 / 60	50 / 60	50 / 60	50 / 60	50 / 60
Tripping class		CLASS 10	CLASS 10	--	CLASS 10	--	--
Thermal overload release	A	0.11 to 0.16 to 34 to 40	0.11 to 0.16 to 27 to 32	Without[3)]	0.11 to 0.16 to 20 to 25	0.16 ... 15 fixed setting	0.16 to 15 fixed setting
Overcurrent release Multiple of the rated current		13x	13x	13x	20x	13x	20x
Short-circuit breaking capacity I_{cu} at 400 V AC	kA	20 / 55 / 100	55 / 100	20 / 55 / 100	55 / 100	[4)]	[4)]

✓ = Supports this function

-- = Does not support this function

1) If all 3 phases are under symmetrical load

2) With molded-plastic enclosure 500 V AC

3) Appropriate overload relays must be provided for motor overload protection

4) Acc. to UL 489 at 480 V/277 V AC: 65 kA

11.2 3RV2 motor starter protectors

Type			3RV2.1.	3RV2711, 3RV2811	3RV2.2.
Size			S00	S00	S0
Width			45 mm	45 mm	45 mm
Standards					
• IEC 60947-1, EN 60947-1 (VDE 0660 Part 100)			Yes	Yes	Yes
• IEC 60947-2, EN 60947-2 (VDE 0660 Part 101)			Yes	Yes	Yes
• IEC 60947-4-1, EN 60947-4-1 (VDE 0660 Part 102)			Yes	--	Yes
• UL 508, CSA C22.2 No. 14			Yes	--	Yes
• UL 489, CSA C22.2 No. 5-02			--	Yes	--
Number of poles			3		
Max. rated current In max (= max. rated operational current I_e)		A	16	15	40
Permissible ambient temperature					
• Storage/transport		°C	-50 … +80		
• Operation	I_n: 0.16 to 32 A	°C	-20 … +70 [1]		
	I_n: 36 to 40 A	°C	-20 … +40 [2]		
Permissible rated current at internal control cabinet temperature					
• +60 °C		%	100		
• +70 °C		%	87		
Motor starter protector in enclosure ≤ 32 A Permissible rated current at enclosure ambient temperature					
• +35 °C		%	100		
• +60 °C		%	87		
Rated operational voltage U_e					
• acc. to IEC		V AC	690 [3]		
• acc. to UL/CSA		V AC	600		
Rated frequency		Hz	50/60		
Rated insulation voltage U_i		V	690		
Rated impulse withstand voltage U_{imp}		kV	6		
Utilization category					
• IEC 60947-2 (motor starter protectors)			A		
• IEC 60947-4-1 (motor starters)			AC-3		
Trip class CLASS	According to IEC 60947-4-1		10		

Type			**3RV2.1.**	**3RV2711, 3RV2811**	**3RV2.2.**
Size			S00	S00	S0
Width			45 mm	45 mm	45 mm
Direct current short-circuit breaking capacity(time constant t = 5 ms)					
• 1 current path 150 V DC		kA	10		
• 2 current paths in series 300 V DC		kA	10		
• 3 current paths in series 450 V DC		kA	10		
Power loss P_v per motor starter protector dependent upon rated current I_n (upper setting range) $R_{per\ current\ path} = P/(I^2 \times 3)$	In: 0.16 to 0.63 A	W	5		
	In: 0.8 to 6.3 A	W	6		
	In: 8 to 16 A	W	7		
	In: 16 A	W	--		7
	In: 20 to 25 A	W	--		8
	In: 28 to 32 A	W	--		11
	In: 36 to 40 A	W	--		14
Shock resistance	To IEC 60068-2-27	g/ms	25/11 (rectangular pulse and sine pulse)		
Degree of protection	To IEC 60529		IP20		
Touch protection	To DIN EN 50274		Finger-safe		
Temperature compensation	To IEC 60947-4-1	°C	-20 … +60		
Phase loss sensitivity	To IEC 60947-4-1		Yes		
Explosion protection – safe operation of motors with "increased safety" explosion protection type			Yes for 3RV20		
• EC type examination certificate number conforming to Directive 94/9)EC (ATEX)			On request		
Isolating function	To IEC 60947-2		Yes		
Main and EMERGENCY OFF switch characteristics[4)]	To IEC 60204-1 (VDE 0113)		Yes		
Protective separation between the main circuit and the auxiliary circuit necessary for PELV applications acc. to DIN EN 60947-1					
• Up to 400 V + 10%			Yes		
• Up to 415 V + 5% (higher voltage on request)			Yes		
Permissible mounting position			Any, acc. to IEC 60447 start command "I" right or top		
Mechanical endurance	Operating cycles		100,000		
Electrical durability	Operating cycles		100,000		
Max. switching frequency per hour (motor starts)		1/h	15		

1) Current reduction above +60 °C

2) Devices must not be mounted side-by-side, nor with link modules with contactors. A clearance of 9 mm at the side must be observed.

3) With molded-plastic enclosure 500 V

11.3 Rated data for auxiliary and signaling switches

Type 3RV29		Lateral auxiliary switch with 1 NO contact + 1 NC contact, 2 NO contacts, 2 NC contacts, 2 NO contacts + NC contacts;	Signaling switch	Transverse auxiliary switch with	
				1 CO contact	1 NO contact + 1 NC contact, 2 NO contacts
Max. rated voltage					
• Acc. to NEMA (UL)	V AC	600	600	600	250
• Acc. to NEMA (CSA)	V AC	600	600	600	250
Continuous current	A	10	10	5	2.5
Switching capacity		1 NO contact + 1 NC contact, 2 NO contacts, 2 NC contacts: A600, Q300; 2 NO contacts + 2 NC contacts: A300, Q300	A600, Q300	B600, R300	C300, R300

11.4 Auxiliary switches, front-mounted, transverse

		Switching capacity for different voltages	
		1 CO contact	1 NO contact + 1 NC contact, 2 NO contacts
Rated operational current I_e			
• AC-15, alternating voltage			
- 24 V	A	4	2
- 230 V	A	3	0.5
- 400 V	A	1.5	--
- 690 V	A	0.5	--
• AC-12 = I_{th}, alternating voltage			
- 24 V	A	10	2.5
- 230 V	A	10	2.5
- 400 V	A	10	--
- 690 V	A	10	--
• DC-13, direct voltage L/R 200 ms			
- 24 V	A	1	1
- 48 V	A	--	0.3
- 60 V	A	--	0.15
- 110 V	A	0.22	--
- 220 V	A	0.1	--
Minimum load capacity	V	17	
	mA	1	

11.5 Auxiliary switches, transverse, solid-state compatible

		1 CO contact
Rated operational voltage U_e alternating voltage	V	125
Rated operational current I_e/AC-14 at U_e = 125 V	A	0.1
Rated operational voltage U_e direct voltage L/R 200 ms	V	60
Rated operational current I_e /DC-13 at U_e = 60 V	A	0.3
Minimum load capacity	V	5
	mA	1

11.6 Auxiliary switches, lateral and signaling switches

		Switching capacity for different voltages: Lateral auxiliary switch 1 NO contact + 1 NC contact, 2 NO contacts, 2 NC contacts, 2 NO contacts + 2 NC contacts; signaling switch
Rated operational current I_e		
• AC-15, alternating voltage		
- 24 V	A	6
- 230 V	A	4
- 400 V	A	3
- 690 V	A	1
• AC-12 = I_{th}, alternating voltage		
- 24 V	A	10
- 230 V	A	10
- 400 V	A	10
- 690 V	A	10
• DC, direct voltage *L/R* 200 ms		
- 24 V	A	2
- 110 V	A	0.5
- 220 V	A	0.25
- 440 V	A	0.1
Minimum load capacity	V	17
	mA	1

11.7 Auxiliary releases

		Undervoltage release	Shunt release
Power input			
• During pick-up			
- Alternating voltages	VA/W	20.2 / 13	20.2 / 13
- Direct voltages	W	20	13 ... 80
• During continuous operation			
- Alternating voltages	VA/W	7.2 / 2.4	--
- Direct voltages	W	2.1	--
Response voltage			
• Tripping	V	0.35 to 0.7 x U_s	0.7 to 1.1 x U_s
• Pick-up	V	0.85 to 1.1 x U_s	--
Maximum opening time	ms	20	

11.8 Short-circuit protection for auxiliary and control circuits

		Undervoltage release	Shunt release
gL/gG melting fuses	A	10	
Miniature circuit breaker, C characteristic	A	6[1)]	

[1)] Prospective short-circuit current < 0.4 kA

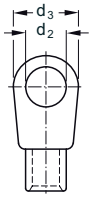
11.9 Conductor cross-sections main circuit

Type			**3RV2.11**	**3RV2.21**	**3RV27 11, 3RV28 11**
Size			**S00**	**S0**	**S00**
Width			**45 mm**	**45 mm**	**45 mm**
Connection type			**Screw connection**		
• Connection screw			M3, Pozidriv size 2	M4, Pozidriv size 2	M4 Pozidriv size 2
• Operating tool		mm	∅ 5 to 6	∅ 5 to 6	∅ 5 to 6
• Specified tightening torque		Nm	0.8 to 1.2	2 to 2.5	2.5 to 3
• Conductor cross-sections (min./max.), 1-wire or 2-wire connection possible					
	- Solid	mm^2	2 x (0.75 to 2.5)[1], 2 x 4	2 x (1 to 2.5)[1], 2 x (2.5 to 10)[1]	1 ... 10, max. 2 x 10
	- Stranded	mm^2	2 x (0.75 to 2.5)[1], 2 x 4	2 x (1 to 2.5)[1], 2 x (2.5 to 10)[1]	1.5 ... 25, max. 10 + 25
	- Finely stranded with end sleeve (DIN 46228 Part 1)	mm^2	2 x (0.5 to 1.5)[1], 2 x (0.75 to 2.5)[1]	2 x (1 to 2.5)[1], 2 x (2.5 to 6)[1] 1 x 10	1 ... 16, max. 6 + 16
	- AWG cables, solid or stranded	AWG	2 x (18 to 14)[1], 2 x 12	2 x (16 to 12)[1], 2 x (14 to 8)[1]	2 x (14 to 10)
Connection type			**Spring-loaded terminals**		
• Operating tool		mm	∅ 3.0 x 0.5; ∅ 3.5 x 0.5		
• Conductor cross-sections (min./max.), 1-wire or 2-wire connection possible					
	- Solid	mm^2	2 x (0.5 to 4)	2 x (1 to 10)	--
	- Finely stranded with end sleeve	mm^2	2 x (0.5 to 2.5)	2 x (1 to 6)	--
	- Finely stranded without end sleeve	mm^2	2 x (0.5 to 2.5)	2 x (1 to 6)	--
	- AWG cables, solid or stranded	AWG	2 x (20 to 12)	2 x (18 to 8)	--
Max. outer diameter of the conductor insulation		mm	3.6	3.6	--

Type		3RV2.11	3RV2.21	3RV27 11, 3RV28 11
Size		**S00**	**S0**	**S00**
Width		**45 mm**	**45 mm**	**45 mm**
Connection type		**Ring cable lug connection**		
• Connection screw		M3, Pozidriv size 2	M4, Pozidriv size 2	--
• Operating tool	mm	∅ 5 to 6	∅ 5 to 6	--
• Specified tightening torque	Nm	0.8 to 1.2	2 to 2.5	--
Usable ring cable lugs	mm	d_2[2)] = min. 3.2, d_3[2)] = max. 7.5	d_2[2)] = min. 4.3, d_3[2)] = max. 12.2	--
• DIN 46234 without insulating sleeve				
• DIN 46225 without insulating sleeve				
• DIN 46237 with insulating sleeve				
• JIS C2805 type R without insulating sleeve				
• JIS C2805 type RAV with insulating sleeve				
• JIS C2805 type RAP with insulating sleeve				

1) If two different conductor cross-sections are being connected to one clamping point, both cross-sections must be located in the range indicated. If identical cross-sections are used, this restriction does not apply.

2)



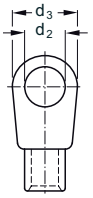
11.10 Conductor cross-sections auxiliary and control circuits

Type		**3RV2.11**	**3RV2.21**	**3RV27 11, 3RV28 11**
Size		**S00**	**S0**	**S00**
Width		**45 mm**	**45 mm**	**45 mm**
Connection type		**Screw connection**		
Connection screw		M3, Pozidriv size 2		
Operating tool	mm	∅ 5 ... 6		
Specified tightening torque	Nm	0.8 to 1.2		
Conductor cross-sections (min./max.), 1-wire or 2-wire connection possible				
• Solid or stranded	mm^2	2 x (0.5 to 1.5)[1], 2 x (0.75 to 2.5)[1]		
• Finely stranded with end sleeve (DIN 46228 Part 1)	mm^2	2 x (0.5 to 1.5)[1], 2 x (0.75 to 2.5)[1]		
• AWG cables, solid or stranded	AWG	2 x (18 to 14)[1], 2 x (20 to 16)[1]		
Connection type		**Spring-loaded terminals**		
Operating tool	mm	∅ 3.0 x 0.5 ∅ 3.5 x 0.5		
Conductor cross-sections (min./max.), 1-wire or 2-wire connection possible				
• Solid	mm^2	2 x (0.5 to 2.5)		
• Finely stranded without end sleeve	mm^2	2 x (0.5 to 1.5)		
• Finely stranded with end sleeve (DIN 46228 Part 1)	mm^2	2 x (0.5 to 1.5)		
• AWG cables, solid or stranded	AWG	2 x (20 to 14)		
Max. outer diameter of the conductor insulation	mm	3.6		

Type		**3RV2.11**	**3RV2.21**	**3RV27 11, 3RV28 11**
Size		**S00**	**S0**	**S00**
Width		**45 mm**	**45 mm**	**45 mm**
Connection type		**Ring cable lug connection**		
Connection screw		M3, Pozidriv size 2		
Operating tool	mm	∅ 5 to 6		
Specified tightening torque	Nm	0.8 to 1.2		
Usable ring cable lugs	mm	d_2[2] = min. 3.2, d_3[2] = max. 7.5		
• DIN 46234 without insulating sleeve				
• DIN 46225 without insulating sleeve				
• DIN 46237 with insulating sleeve				
• JIS C2805 type R without insulating sleeve				
• JIS C2805 type RAV with insulating sleeve				
• JIS C2805 type RAP with insulating sleeve				

1) If two different conductor cross-sections are being connected to one clamping point, both cross-sections must be located in the range indicated. If identical cross-sections are used, this restriction does not apply.

2)



11.11 Short-circuit breaking capacity

11.11.1 Short-circuit breaking capacity for motor starter protectors

Short-circuit breaking capacity I_{cu}, I_{cs} acc. to IEC 60947-2

The table lists the rated ultimate short-circuit breaking capacity I_{cu} and the rated service short-circuit breaking capacity I_{cs} for 3RV2 motor starter protectors at different operating voltages dependent on the rated current In of the protectors.

Power can be fed in to the motor starter protectors via the terminals at the top or at the bottom without restricting the rated data. If the short-circuit current at the installation location exceeds the motor starter protector's specified rated service short-circuit breaking capacity, you will need to use a backup fuse. It is also possible to install an upstream motor starter protector with a limiter function.

The maximum rated current of this backup fuse is indicated in the tables. The rated ultimate short-circuit breaking capacity then applies as specified on the fuse.

Table 11- 2 Short-circuit breaking capacity I_{CU}, I_{CS} acc. to IEC 60947-2 - Part 1

Motor starter protector	Rated current I_n	Up to 240 V AC[1]			Up to 400 V AC[1] / 415 V AC[2]		
		Icu	Ics	Max. fuse (gL/gG)	Icu	Ics	Max. fuse (gL/gG)[3]
Type	A	kA	kA	A	kA	kA	A
Size S00							
3RV2.1	0.16 to 1.25	100	100	-	100	100	-
	1.6	100	100	-	100	100	-
	2	100	100	-	100	100	-
	2.5	100	100	-	100	100	-
	3.2	100	100	-	100	100	-
	4	100	100	-	100	100	-
	5	100	100	-	100	100	-
	6.3	100	100	-	100	100	-
	8	100	100	-	100	100	-
	10	100	100	-	100	100	-
	12.5	100	100	-	100	100	-
	16	100	100	-	55	30	100

Motor starter protector	Rated current I_n	Up to 240 V AC[1]			Up to 400 V AC[1] / 415 V AC[2]		
		Icu	Ics	Max. fuse (gL/gG)	Icu	Ics	Max. fuse (gL/gG)[3]
Type	A	kA	kA	A	kA	kA	A
Size S0							
3RV2.2	16	100	100	-	55	25	100
	20	100	100	-	55	25	125
	22	100	100	-	55	25	125
	25	100	100	-	55	25	125
	28	100	100	-	55	25	125
	32	100	100	-	55	25	125
	36	100	100	-	20	10	125
	40	100	100	-	20	10	125

1) 10% overvoltage

2) 5% overvoltage

3) Fuse only required if short-circuit current at installation location is > I_{CU}

Table 11- 3 Short-circuit breaking capacity I_{CU}, I_{CS} acc. to IEC 60947-2 - Part 2

Motor starter protector	Rated current I_n	Up to 440 V AC[1] / 460 V AC[2]			Up to 500 V AC[1] / 525 V AC[2]			Up to 690 V AC[1]		
		I_{cu}	I_{cs}	Max. fuse (gL/gG)[3]	I_{cu}	I_{cs}	Max. fuse (gL/gG)[3]	I_{cu}	I_{cs}	Max. fuse (gL/gG)[3]
Type	A	kA	kA	A	kA	kA	A	kA	kA	A
Size S00										
3RV2.1	0.16 to 1.25	100	100	-	100	100	-	100	100	-
	1.6	100	100	-	100	100	-	100	100	-
	2	100	100	-	100	100	-	10	10	25
	2.5	100	100	-	100	100	-	10	10	25
	3.2	100	100	-	100	100	-	10	10	32
	4	100	100	-	100	100	-	6	4	32
	5	100	100	-	100	100	-	6	4	32
	6.3	100	100	-	100	100	-	6	4	50
	8	50	50	63	42	42	63	6	4	50
	10	50	50	80	42	42	63	6	4	50
	12.5	50	50	80	42	42	80	6	4	63
	16	50	10	80	10	5	80	4	4	63

Motor starter protector	Rated current I_n	Up to 440 V AC[1] / 460 V AC[2]			Up to 500 V AC[1] / 525 V AC[2]			Up to 690 V AC[1]		
		I_{cu}	I_{cs}	Max. fuse (gL/gG)[3]	I_{cu}	I_{cs}	Max. fuse (gL/gG)[3]	I_{cu}	I_{cs}	Max. fuse (gL/gG)[3]
Type	**A**	**kA**	**kA**	**A**	**kA**	**kA**	**A**	**kA**	**kA**	**A**
Size S0										
3RV2.2	16	50	10	80	10	5	80	4	2	63
	20	50	10	80	10	5	80	4	2	63
	22	50	10	100	10	5	80	4	2	63
	25	50	10	100	10	5	80	4	2	63
	28	30	10	125	10	5	100	4	2	100
	32	30	10	125	10	5	100	4	2	100
	36	12	8	125	6	3	100	3	2	100
	40	12	8	125	6	3	100	3	2	100

1) 10% overvoltage

2) 5% overvoltage

3) Fuse only required if short-circuit current at installation location is > I_{CU}

11.11.2 Short-circuit breaking capacity for motor starter protectors in the IT system

Short-circuit breaking capacity I_{cuIT} in the IT system

3RV2 motor starter protectors are suitable for use in IT systems. The values of I_{cu} and I_{cs} apply for the three-pole short circuit. In the case of a double ground fault in different phases (input and output side of a motor starter protector), the special short-circuit breaking capacity I_{cuIT} applies. The specifications listed in the table below apply for 3RV2 motor starter protectors.

In some ranges I_{cuIT} is 100 kA and 50 kA respectively. As such the motor starter protectors are short-circuit-proof in this range.

If the short-circuit current at the installation location exceeds the motor starter protector's specified rated service short-circuit breaking capacity, you will need to use a backup fuse. The maximum rated current of this backup fuse is indicated in the tables. The rated short-circuit breaking capacity then applies as specified on the fuse.

Table 11- 4 Short-circuit breaking capacity I_{cuIT} in the IT system part 1

Rated current I_n	Up to 240 V AC		Up to 400 V[2]/415 V[3] AC	
	I_{cuIT}	Max. fuse (gL/gG)[4]	I_{cuIT}	Max. fuse (gL/gG)[4, 5]
A	kA	A	kA	A
Size S00				
0.16 ... 0.4	100	[1]	100	[1]
0.5	100	[1]	100	[1]
0.63	100	[1]	100	[1]
0.8	100	[1]	100	[1]
1	100	[1]	100	[1]
1.25	100	[1]	100	[1]
1.6	100	[1]	100	[1]
2	100	[1]	8	25
2.5	100	[1]	8	25
3.2	100	[1]	8	32
4	100	[1]	4	32
5	100	[1]	4	32
6.3	100	[1]	4	50
8	100	[1].	4	50
10	100	[1]	4	50
12.5	100	[1]	4	63
16	55	80	4	63

Rated current I_n	Up to 240 V AC		Up to 400 V[2]/415 V[3] AC	
	I_{cuIT}	Max. fuse (gL/gG)[4]	I_{cuIT}	Max. fuse (gL/gG)[4], [5]
A	kA	A	kA	A
Size S0				
16	55	80	4	63
20	55	80	4	63
22	55	80	4	63
25	55	80	4	63
28	55	80	2	63
32	55	80	2	63
36	20	80	2	63
40	20	80	2	63

1) No backup fuse required, as short-circuit-proof up to 100 kA

2) 10 % overvoltage

3) 5 % overvoltage

4) Backup fuse only required if short-circuit current at installation location is > I_{cuIT}

5) Alternatively, fuseless limiter combinations can be used for 690 V AC

Table 11- 5 Short-circuit breaking capacity I_{cuIT} in the IT system part 2

Rated current I_n	Up to 440 V[2]/460 V[3] AC		Up to 500 V[2]/525 V[3] AC		Up to 690 V[6] AC	
	I_{cuIT}	Max. fuse (gL/gG)[4], [5]	I_{cuIT}	Max. fuse (gL/gG)[4], [5]	I_{cuIT}	Max. fuse (gL/gG)[4]
A	kA	A	kA	A	kA	A
Size S00						
0.16 ... 0.4	100	[1]	100	[1]	100	[1]
0.5	100	[1]	100	[1]	0.5	4
0.63	100	[1]	100	[1]	0.5	6
0.8	100	[1]	100	[1]	0.5	6
1	8	10	8	10	2	10
1.25	8	16	8	16	2	16
1.6	8	20	8	20	2	16
2	8	25	8	25	2	20
2.5	8	25	8	25	2	20
3.2	8	32	8	32	2	25
4	2	32	2	32	2	25
5	2	32	2	32	2	25
6.3	2	40	2	40	1.5	35
8	2	40	2	40	1.5	35
10	2	40	2	40	1.5	40
12.5	2	50	2	50	1.5	40
16	2	50	2	50	1.5	40
Size S0						
16	2	50	2	50	1.5	40
20	2	50	2	50	1.5	50
22	2	50	2	50	1.5	50
25	2	50	2	50	1.5	50
28	2	63	2	63	1.5	63
32	2	63	2	63	1.5	63
36	2	63	2	63	1.5	63
40	2	63	2	63	1.5	63

[1] No backup fuse required, as short-circuit-proof up to 100 kA

[2] 10 % overvoltage

[3] 5 % overvoltage

[4] Backup fuse only required if short-circuit current at installation location is > I_{cuIT}

[5] Alternatively, fuseless limiter combinations can be used for 690 V AC

[6] Overvoltage category II applies for applications in IT systems > 600 V

11.11.3 Short-circuit breaking capacity for motor starter protectors with limiter function

Short-circuit breaking capacity for motor starter protectors with limiter function for 500 V AC and 690 V AC according to IEC 60947-2

Table 11- 6 Short-circuit breaking capacity for motor starter protectors with limiter function

Type			500 V AC		690 V AC	
Limiter	Motor starter protector	In [A]	Icu [kA]	Ics [kA]	Icu [kA]	Ics [kA]
3RV2321-4EC10	3RV2.1.	2	-	-	50	25
or		2.5	-	-	50	25
3RV2321-4EC15		3.2	-	-	50	25
		4	-	-	50	25
		5	-	-	50	25
		6.3	-	-	50	25
		8	100	50	50	25
		10	100	50	20*	10*
		12.5	100	50	20*	10*
		16	100	50	20*	10*
	3RV2.2.	16	100	50	20*	10*
		20	100	50	20*	10*
		22	100	50	20*	10*
		25	100	50	20*	10*
		28	100	50	20*	10*
		32	100	50	20*	10*
3RV1331-4HC10	3RV2.1.	10	-	-	50	25
		12.5	-	-	50	25
		16	-	-	50	25
	3RV2.2.	16	-	-	50	20
		20	-	-	50	20
		22	-	-	50	20
		25	-	-	50	20
		28	-	-	50	20
		32	-	-	50	20

* Infeed to the limiter is always on the side 1L1 / 3L2 / 5L3.

11.12 Permissible rated data of approved devices for North America (UL/CSA)

11.12.1 Approved according to UL 508/CSA C22.2 No. 14

The motor starter protectors in the 3RV2 series are approved for UL/CSA and can be used conforming to UL 508 and CSA C22.2 No.14 individually or as load feeders in conjunction with a contactor.

These motor starter protectors can be used as "Manual Motor Controller" for "Group Installations", as "Manual Motor Controller Suitable for Tap Conductor Protection in Group Installations", and as "Self-Protected Combination Motor Controller (Type E)".

11.12.1.1 Horsepower data

Operating current	Voltage									
	115 V		200/208 V		230/240 V		460/480 V		575/600 V	
	1-phase	3-phase	1-phase	3-phase	1-phase	3-phase	1-phase	3-phase	1-phase	3-phase
3RV2011/3RV2111/3RV2311/3RV2411 size S00										
0.11...0.16	-	-	-	-	-	-	-	-	-	-
0.14...0.2	-	-	-	-	-	-	-	-	-	-
0.18...0.25	-	-	-	-	-	-	-	-	-	-
0.22..0.32	-	-	-	-	-	-	-	-	-	-
0.28...0.4	-	-	-	-	-	-	-	-	-	-
0.35...0.5	-	-	-	-	-	-	-	-	-	-
0.45...0.63	-	-	-	-	-	-	-	-	-	-
0.55...0.8	-	-	-	-	-	-	-	-	-	-
0.7...1	-	-	-	-	-	-	-	-	-	1/2
0.9...1.25	-	-	-	-	-	-	-	1/2	-	1/2
1.1...1.6	-	-	-	-	1/10	-	-	3/4	-	3/4
1.4...2	-	-	-	-	1/8	-	-	3/4	-	1
1.8...2.5	-	-	1/6	1/2	1/6	1/2	-	1	-	1 1/2
2.2...3.2	1/10	-	1/6	1/2	1/4	3/4	-	1 1/2	-	2
2.8...4	1/8	-	1/4	3/4	1/3	3/4	-	2	-	3
3.5...5	1/6	1/2	1/3	1	1/2	1	-	3	-	3
4.4...6.3	1/4	1/2	1/2	1	1/2	1 1/2	-	3	-	5
5.5...8	1/3	3/4	3/4	2	1	2	-	5	-	5
7...10	1/2	1	1	2	1 1/2	3	-	5	-	7 1/2
9...12.5	1/2	1 1/2	1 1/2	3	2	3	-	7 1/2	-	10
11...16	1	2	2	3	2	5	-	10	-	-

Operating current	Voltage									
	115 V		200/208 V		230/240 V		460/480 V		575/600 V	
	1-phase	3-phase	1-phase	3-phase	1-phase	3-phase	1-phase	3-phase	1-phase	3-phase
3RV2021/3RV2121/3RV2321/3RV2421 size S0										
11...16	1	2	2	3	2	5	-	10	-	-
14...20	1 1/2	3	3	5	3	5	-	10	-	-
17...22	1 1/2	3	3	5	3	7 1/2	-	15	-	-
20...25	2	3	3	5 (200 V) 7 1/2 (208 V)	3	7 1/2	-	15	-	-
23...28	2	3	3	7 1/2	5	10	-	20	-	-
27...32	2	5	3 (200 V) 5 (208 V)	7 1/2 (200 V) 10 (208 V)	5	10	-	20	-	-
30...36	3	5	5	10	5	10	-	25	-	-
34...40	3	5	5	10	7 1/2	10	-	30	-	-

11.12.1.2 "Manual motor controller", group installation

3RV2 motor starter protector as "Manual Motor Controller"

Upstream short-circuit protection is always implemented if the motor starter protector is used as a "Manual Motor Controller". This requires approved fuses (according to UL 248) or a circuit breaker (according to UL 489/CSA C22.2 No. 5-02). These devices must be dimensioned according to the National Electrical Code (UL) or Canadian Electrical Code (CSA) installation regulation respectively.

The file numbers for the approval of the 3RV as a manual motor controller are as follows:

- UL File No. 47705, CCN: NLRV
- CSA Master Contract 165071, Product Class: 3211 05

Motor starter protector		hp-rating[1] for FLA[2] max.	
Type	V	1-phase	3-phase
Size S00			
3RV20 11, 3RV21 11, 3RV23 11, 3RV24 11			
FLA[2] max. 16 A, 480 V 12.5 A, 600 V	115	1	2
	200	2	3
	230	2	5
	460	--	10
	575/600	--	10

Motor starter protector		hp-rating[1] for FLA[2] max.	
Type	**V**	**1-phase**	**3-phase**
Size S0			
3RV20 21, 3RV21 23, 3RV23 21, 3RV 21, 3RV24 21			
FLA[2] max. 40 A, 480 V	115	3	5
	200	5	10
	230	7 1/2	10
	460	--	30
	575/600	--	--

1) hp-rating= power in horse power(maximum motor power).

2) FLA= Full Load Amps/motor full-load current

Rated current	240 V AC		480 V AC		600 V AC	
	UL	CSA	UL	CSA	UL	CSA
In	Ibc	Ibc	Ibc	Ibc	Ibc	Ibc
A	kA	kA	kA	kA	kA	kA
Size S00						
0.16 ... 1.25	65	65	65	65	30	30
1.6	65	65	65	65	30	30
2	65	65	65	65	30	30
2.5	65	65	65	65	30	30
3.2	65	65	65	65	30	30
4	65	65	65	65	30	30
5	65	65	65	65	30	30
6.3	65	65	65	65	30	30
8	65	65	65	65	30	30
10	65	65	65	65	30	30
12.5	65	65	65	65	30	30
16	65	65	65	65	-	-
Size S0						
20	65	65	65	65	-	-
22	65	65	65	65	-	-
25	65	65	65	65	-	-
28	65	65	50	50	-	-
32	65	65	50	50	-	-
36	65	65	12	12	-	-
40	65	65	12	12	-	-

11.12.1.3 "Manual motor controller suitable for tap conductor protection in group installations" (up to 32 A)

3RV20 motor starter protector as "Manual Motor Controller Suitable for Tap Conductor Protection in Group Installations"

The "Manual Motor Controller Suitable for Tap Conductor Protection in Group Installations" application is only applicable in the case of UL.

The CSA does not recognize this approval! Upstream short-circuit protection is always implemented if the motor starter protector is used as a "Manual Motor Controller Suitable for Tap Conductor Protection in Group Installations". This requires approved fuses (according to UL 248) or a circuit breaker (according to UL 489).

These devices must be dimensioned according to the National Electrical Code installation regulation.

3RV20 motor starter protectors are approved as "Manual Motor Controller Suitable for Tap Conductor Protection in Group Installations" under the following file number:

- UL File No. 47705, CCN: NLRV

Motor starter protector		hp-rating[1] for FLA[2] max.	
Type	**V**	**1-phase**	**3-phase**
Size S00			
3RV20 11			
FLA[2] max. 16 A; 480 V 12.5 A; 600 V	115	1	2
	200	2	3
	230	2	5
	460	--	10
	575/600	--	10
Size S0			
3RV20 21			
FLA[2] max. 32 A, 480 V	115	2	5
	200	3	7 1/2
	230	5	10
	460	--	20
	575/600	--	--

1) hp-rating= power in horse power (maximum motor power).

2) FLA= Full Load Amps/motor full-load current

Rated current	240 V AC	480 V/277 V AC	600 V/347 V AC
	UL	UL	UL
I_n	I_{bc}	I_{bc}	I_{bc}
A	kA	kA	kA
Size S00			
0.16 ... 1.25	65	65	30
1.6	65	65	30
2	65	65	30
2.5	65	65	30
3.2	65	65	30
4	65	65	30
5	65	65	30
6.3	65	65	30
8	65	65	30
10	65	65	30
12.5	65	65	30
16	65	65	-
Size S0			
20	65	65	-
22	65	65	-
25	65	65	-
28	50	50	-
32	50	50	-

11.12.1.4 "Self-protected combination motor controller (type E)" (up to 32 A)

3RV20 motor starter protector as "Self-Protected Combination Motor Controller (Type E)"

For approval according to UL 508, a clearance of 1 inch and a creepage distance of 2 inches are required on the line side for a "Self-Protected Combination Motor Controller".

Therefore, 3RV20 motor starter protectors in size S00/S0 are approved according to UL 508 together with the terminal block (order no. 3RV29 28-1H) or phase barriers (order no. 3RV2928-1K).

CSA approval does not require extended clearances and creepage distances. The terminal blocks or phase barriers can, therefore, be omitted for use as a "Self-Protected Combination Motor Controller" according to the CSA.
3RV20 motor starter protectors are approved as "Self-Protected Combination Motor Controller" under the following file numbers:

- UL File No. E156943, CCN: NKJH.
- CSA Master Contract 165071, Product Class: 3211 08.

Motor starter protector		hp-rating[1] for FLA[2] max.	
Type	**V**	**1-phase**	**3-phase**
Size S00			
3RV20 11			
FLA[2] max. 16 A, 480 V 12.5 A, 600 V	115	1	2
	200	2	3
	230	2	5
	460	--	10
	575 / 600	--	10
Size S0			
3RV20 21			
FLA[2] max. 32 A, 480 V	115	2	5
	200	3	7 1/2
	230	5	10
	460	--	20
	575/600	--	--

[1] hp-rating= power in horse power(maximum motor power).

[2] FLA= Full Load Amps/motor full-load current

Rated current	240 V AC		480 V/277 V AC		600 V/347 V AC	
	UL	CSA	UL	CSA	UL	CSA
I_n	I_{bc}	I_{bc}	I_{bc}	Ibc	Ibc	Ibc
A	kA	kA	kA	kA	kA	kA
Size S00						
0.16 ... 1.25	65	65	65	65	30	30
1.6	65	65	65	65	30	30
2	65	65	65	65	30	30
2.5	65	65	65	65	30	30
3.2	65	65	65	65	30	30
4	65	65	65	65	30	30
5	65	65	65	65	30	30
6.3	65	65	65	65	30	30
8	65	65	65	65	30	30
10	65	65	65	65	30	30
12.5	65	65	65	65	30	30
16	65	65	65	65	-	-
Size S0						
20	65	65	65	65	-	-
22	65	65	65	65	-	-
25	65	65	65	65	-	-
28	50	50	50	50	-	-
32	50	50	50	50	-	-

11.12.1.5 Connection data for 3RV29 28-1H terminal blocks

Table 11- 7 Connection data for 3RV29 28-1H terminal blocks

Type		3RV29 28-1H
Specified tightening torque	Nm	2.5 to 3
Conductor cross-sections		
Front clamping point connected		
• Solid	mm²	1 to 10
• Finely stranded with end sleeve	mm²	1 to 16
• Stranded	mm²	2.5 to 25
• AWG cables, solid or stranded	mm²	14 to 3
Connection screw		M4

Type		3RV29 28-1H
Rear clamping point connected		
• Solid	mm²	1 to 10
• Finely stranded with end sleeve	mm²	1 to 16
• Stranded	mm²	1.5 to 25
• AWG cables, solid or stranded	mm²	16 to 3
Connection screw		M4
Both clamping points connected		
• Front clamping point:		
- Solid	mm²	1 to 10
- Finely stranded with end sleeve	mm²	1 to 10
- Stranded	mm²	2.5 to 10
- AWG cables, solid or stranded	mm²	14 to 6
- Connection screw		M4
• Rear clamping point:		
- Solid	mm²	1 to 10
- Finely stranded with end sleeve	mm²	1 to 10
- Stranded	mm²	5 to 25
- AWG cables, solid or stranded	mm²	16 to 3
- Connection screw		M4

Reference

More information about accessories is available in the chapter titled Phase barriers/UL 508 "type E" terminals (Page 71).

11.12.2 Approval as "circuit breaker" according to UL 489/CSA C 22.2 No. 5-02

3RV27 and 3RV28 as "Circuit Breaker"

These devices are approved as Circuit Breaker according to UL 489 or CSA C22.2 No.5-02 with 100% rated current ("100 %-rated breaker"). As such they can be used as upstream short-circuit protection devices for "Manual Motor Controller" and "Manual Motor Controller Suitable for Tap Conductor Protection in Group Installations".

3RV27 and 3RV28 are approved as "Circuit Breaker" under the following file numbers:

- UL File No. E235044, CCN: DIVQ.
- CSA Master Contract 165071, Product Class: 1432 01.

3RV2711

Rated current	480 V/277 V AC		600 V/347 V AC	
	UL	CSA	UL	CSA
I_n	I_{bc}	I_{bc}	I_{bc}	I_{bc}
A	kA	kA	kA	kA
0.16 ... 1.25	65	65	10	10
1.6	65	65	10	10
2	65	65	10	10
2.5	65	65	10	10
3.2	65	65	10	10
4	65	65	-	-
5	65	65	-	-
6.3	65	65	-	-
8	65	65	-	-
10	65	65	-	-
12.5	65	65	-	-
15	65	65	-	-

3RV2811

Rated current	480 V/277 V AC		600 V/347 V AC	
	UL	CSA	UL	CSA
I_n	I_{bc}	I_{bc}	I_{bc}	I_{bc}
A	kA	kA	kA	kA
0.16 ... 1.25	65	65	10	10
1.6	65	65	10	10
2	65	65	10	10
2.5	65	65	10	10
3.2	65	65	-	-
4	65	65	-	-
5	65	65	-	-
6.3	65	65	-	-
8	65	65	-	-
10	65	65	-	-
12.5	65	65	-	-
15	65	65	-	-

11.13 Accessories

11.13.1 General data - 3RV29 infeed system

Table 11- 8 General data of the 3RV29.7 infeed system

Type			**3RV29.7**
			Infeed system
General data			
Standards			IEC 60947-2
			IEC 60947-4-1
Rated operational voltage U_e			
IEC	• 10% overvoltage	V	500
	• 5% overvoltage	V	525
UL/CSA		V	600
Rated insulation voltage U_i (pollution degree 3)		V	500
Rated impulse withstand voltage U_{imp}		kV	6
Rated frequency		Hz	50/60
Rated current I_n		A	63
Permissible ambient temperature	• Operation	°C	-20 … + 60
	• Storage/transport	°C	-50 … + 80
Permissible rated current of the 3RV2.11 (S00) motor starter protectors up to and including 14 A at internal control cabinet temperature			
• 60 °C		A	100%
Permissible rated current of the 3RV2.11 (S00) motor starter protector greater than 14 A to 16 A at internal control cabinet temperature			
• 40 °C		A	100%
• 60 °C		A	87%
Permissible rated current of the 3RV2.21 (S0) motor starter protector up to and including 16 A at internal control cabinet temperature			
• 60 °C		A	100%
Permissible rated current of the 3RV2.21 (S0) motor starter protector greater than 16 A to 25 A at internal control cabinet temperature			
• 40 °C		A	100%
• 60 °C		A	87%

Type		3RV29.7
		Infeed system
General data		
Permissible rated current of the 3RV2.21 (S0) motor starter protector greater than 25 A to 32 A at internal control cabinet temperature		
• 40 °C	A	87%
Short-circuit strength		corresponds to the mounted motor starter protector or load feeder
Degree of protection according to IEC 60529		IP20[1)]
Touch protection according to DIN VDE 0106, Part 100		Finger-safe
Connection cross-sections, 3-phase busbar with infeed 3RV2917-1A / 3RV2917-1E		
• Solid, stranded	mm^2	4 … 25
• Finely stranded with end sleeve	mm^2	4 … 25
• Finely stranded without end sleeve	mm^2	6 … 25
• AWG cables	AWG	10 … 3
Connection cross-sections, terminal block 3RV2917-5D		
• Solid	mm^2	1.5 … 6
• Finely stranded with end sleeve	mm^2	1.5 … 4
• Finely stranded without end sleeve	mm^2	1.5 … 6
• AWG cables	AWG	15 … 10

1) In the terminal compartment of the infeed without connected IP00 conductor.

Circuit diagrams

12

Internal circuit diagrams

You can find the internal circuit diagrams for SIRIUS Innovations products online in the image database (www.siemens.com/industrial-controls/bilddb).

Enter the order number of the device in the "Order number" field and, in the "Type of object" selection menu on the left-hand side, select "Unit wiring diagram".

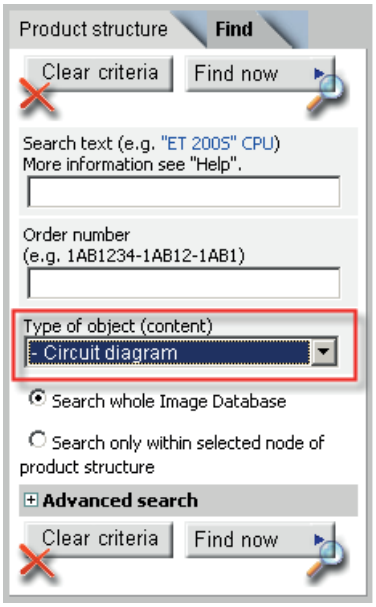
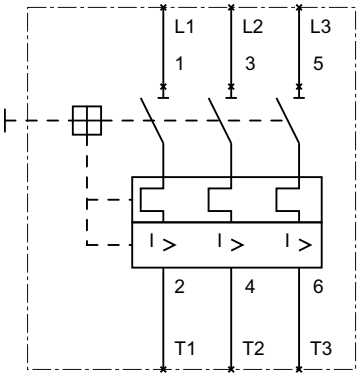


Figure 12-1 Image database

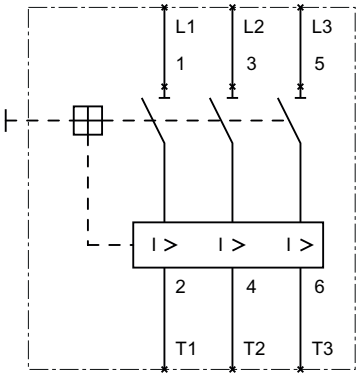
3RV2 motor starter protectors/circuit breakers acc. to UL 489

3RV20.1-...0, 3RV24.1-...0, 3RV27.1-...0, 3RV28.1-...0



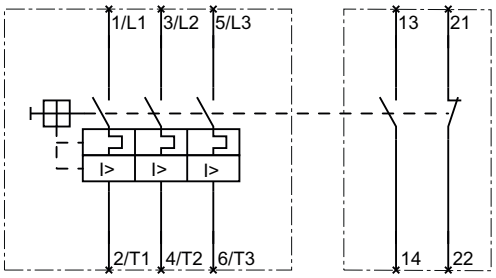
Motor starter protectors for motor protection/transformer protection/system protection

3RV23.1-...0



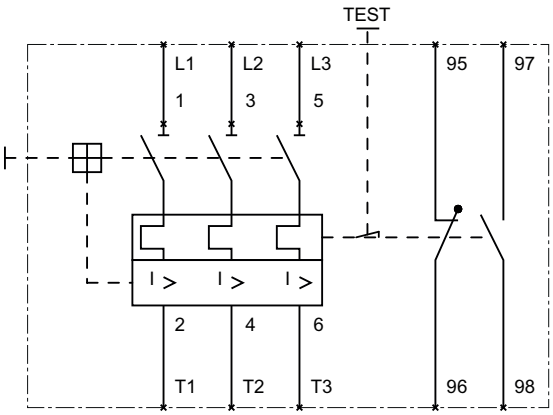
Motor starter protector for starter protection

3RV20.1-...5, 3RV24.1-...5



Motor starter protectors for motor protection/transformer protection with transverse auxiliary switch

3RV21.1-...0

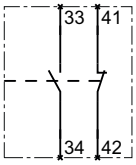


Motor starter protectors for motor protection with overload relay function

3RV29 auxiliary switches

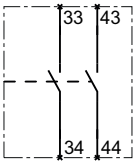
Lateral auxiliary switches

3RV2901-.A



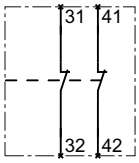
1 NO contact, 1 NC contact

3RV2901-.B



2 NO contacts

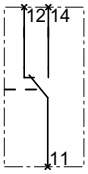
3RV2901-.C



2 NC contacts

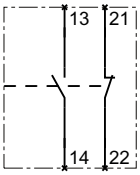
Transverse auxiliary switches

3RV2901-1D



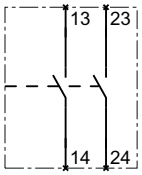
1 CO contact

3RV2901-.E



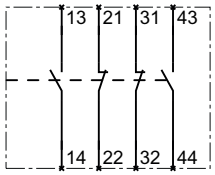
1 NO contact, 1 NC contact

3RV2901-.F



2 NO contacts

3RV2901-.J

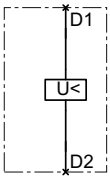


2 NO contacts, 2 NC contacts

Auxiliary releases and signaling switches

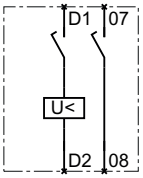
Auxiliary release

3RV2902-.A..



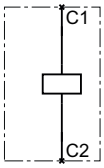
Undervoltage release

3RV2922-.C..



Undervoltage release with leading auxiliary contacts, 2 NO

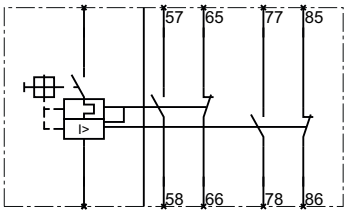
3RV2902-.D..



Shunt release

Signaling switch

3RV2921-.M



Signaling switch

Types of coordination

A

A.1 Types of coordination

Types of coordination

Standard DIN EN 60947-4-1 (VDE 0660 Part 102) or IEC 60947-4-1 distinguishes between two types of coordination (type of coordination), which are referred to as coordination type "1" and coordination type "2". The short circuit that needs to be dealt with is cleared reliably and safely with both types of coordination; the only differences are in the extent of the damage sustained by the device following a short circuit.

Type of coordination 1

It is permissible for the fuseless load feeder to be incapable of functioning after each short-circuit disconnection. Damage to the contactor and the overload release is also permissible. For 3RA2, the motor starter protector alone always achieves type of coordination "2".

Type of coordination 2

After short-circuit disconnection, there must be no damage to the overload release or to any other part. The 3RA2 fuseless load feeder can resume operation without any parts having to be repaired or replaced. Welding of the contactor contacts only is permitted if these can be separated easily without significant deformation.

References

B

B.1 References

Further references

You will find further information about the 3RV2 motor starter protectors on the Internet (http://support.automation.siemens.com/WW/view/en/20358027/133300).

In addition to this manual, please refer to the operating instructions and manuals for any accessories. You can download the relevant documentation from the Internet (www.siemens.com/industrial-controls/manuals). Simply enter the order number of the relevant item into the search field.

Operating instructions

Title	Order number
SIRIUS motor starter protectors S00 / S0 (3RV2.1 and 3RV2.2)	3ZX1012-0RV21-1AA1

B.2 SIRIUS Innovations manuals

SIRIUS Innovations manuals

You can download the SIRIUS Innovations manuals from the Internet (www.siemens.com/industrial-controls/manuals).

Simply enter the order number of the relevant item into the search field.

Information about ...	Is available in ...
• SIRIUS Innovations - System Overview	• "SIRIUS Innovations - System Overview" manual (Order number: 3ZX1012-0RA01-5AC1)
• 3RT2, 3RH2, and 3RA23/24 contactors and contactor assemblies	• "SIRIUS Innovations - SIRIUS 3RT2 Contactors/Contactor Assemblies" manual (Order number: 3ZX1012-0RT20-5AB1)
• 3RF34 solid-state switching devices	• "SIRIUS Innovations - SIRIUS 3RF34 solid-state switching devices" manual (Order number: 3ZX1012-0RF34-5AC1)

Information about ...	Is available in ...
• 3RW soft starters	• "SIRIUS 3RW30/3RW40 Soft Starters" (http://support.automation.siemens.com/WW/view/en/38752095) manual (Order number: 3ZX1012-0RW30-1AC1) • "SIRIUS 3RW44 Soft Starters" (http://support.automation.siemens.com/WW/view/en/21772518) manual (Order number.: 3ZX1012-0RW30-1AC1)
• 3RV2 motor starter protectors	• "SIRIUS Innovations - SIRIUS 3RV2 motor starter protector" manual (Order number: 3ZX1012-0RV20-5AC1)
• 3RU2, 3RB30/31 overload relays	• "SIRIUS Innovations - SIRIUS 3RU2/3RB3 overload relays" manual (Order number: 3ZX1012-0RU20-5AC1)
• 3RB24 electronic overload relay	• "3RB24 electronic overload relay for IO-Link" manual (Order number: 3ZX1012-0RB24-0AC0)
• 3UG4 monitoring relay/ 3RR2 current monitoring relay	• "3UG4/3RR2 monitoring relays" manual (Order number: 3ZX1012-0UG40-0AC0)
• 3RS1/3RS2 temperature monitoring relays	• "3RS1/3RS2 temperature monitoring relays" manual (Order number: 3ZX1012-0RS10-1AC1)
• 3UG48 monitoring relays	• "3UG48 monitoring relay for IO-Link" manual (Order number: 3ZX1012-0UG48-0AC1)
• 3RS14/3RS15 temperature monitoring relays	• "3RS14/3RS15 temperature monitoring relay for IO-Link" manual (Order number: 3ZX1012-0RS14-0AC0)
• 3RA21/22 load feeders	• "SIRIUS Innovations - SIRIUS 3RA21/3RA22 load feeders" manual (Order number: 3ZX1012-0RA21-5AC1)
• 3RA6 compact starters	• "SIRIUS 3RA6 Compact Starter" (http://support.automation.siemens.com/WW/view/en/27865747) manual (order number: 3RA6992-0A)
• 3RA28 function modules for mounting on contactors	• "SIRIUS Innovations - SIRIUS 3RA28 function modules for mounting on 3RT2 contactors" (Order number: 3ZX1012-0RA28-5AC1)
• 3RA27 function modules for connection to the higher-level control	• "Function Modules for AS-Interface" (http://support.automation.siemens.com/WW/view/en/39318922) manual (order number: 3ZX1012-0RA27-0AC0) • "Function Modules for IO-Link" (http://support.automation.siemens.com/WW/view/en/39319600) manual (order number: 3ZX1012-0RA27-1AC1)

Information about ...	Is available in ...
• 4SI SIRIUS electronic module (3RK1005-0LB00-0AA0)"	• "4SI SIRIUS electronic module (3RK1005-0LB00-0AA0)" manual (Order number: 3ZX1012-0LB00-0AA1)

B.3 More information

More information

More information is available from Siemens on the Internet via the following links.

- **Product documentation**
  You will find a list of manuals/operating instructions, characteristic curves, and certificates on the Internet (www.siemens.com/industrial-controls/support).
- **Product information**
  Catalogs and other informative documents can be obtained from the Information Center and Download Center (www.siemens.com/industrial-controls/infomaterial).
- **Online ordering system**
  You will find the online ordering system with all the latest data on the ordering and information platform (www.siemens.com/industrial-controls/mall).
- **Technical Assistance**
  Siemens supports you with all technical product and system enquiries – both before and after delivery. You can access our Service & Support Portal on the Internet (www.siemens.com/industrial-controls/technical-assistance). You can also submit your question directly to a technical consultant using our support request service.

Dimension drawings (dimensions in mm)

C

Note

All dimensions are specified in mm.

C.1 Dimension drawings for 3RV2 motor starter protectors

Motor starter protector with screw-type connection system

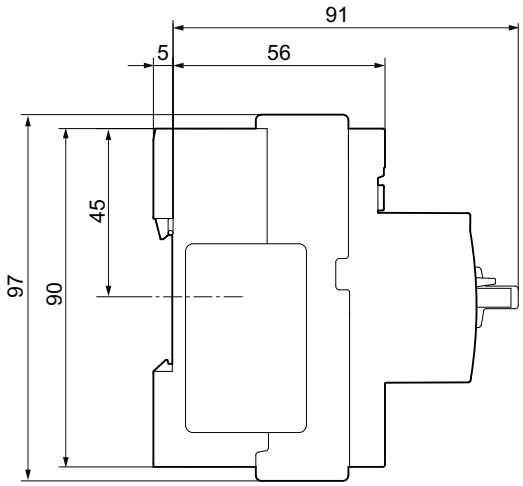


Figure C-1 Motor starter protector with screw-type connection system S00

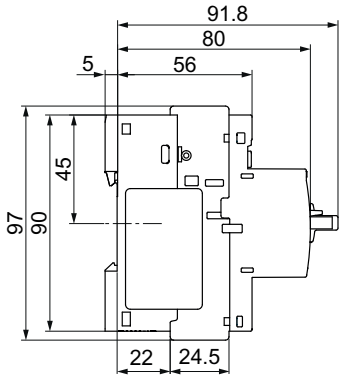


Figure C-2 Motor starter protector with screw-type connection system S0

Motor starter protector with spring-loaded connection system

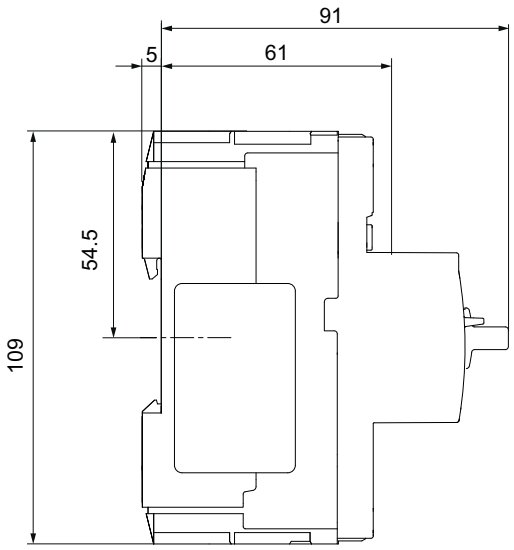


Figure C-3 Motor starter protector with spring-loaded connection system S00

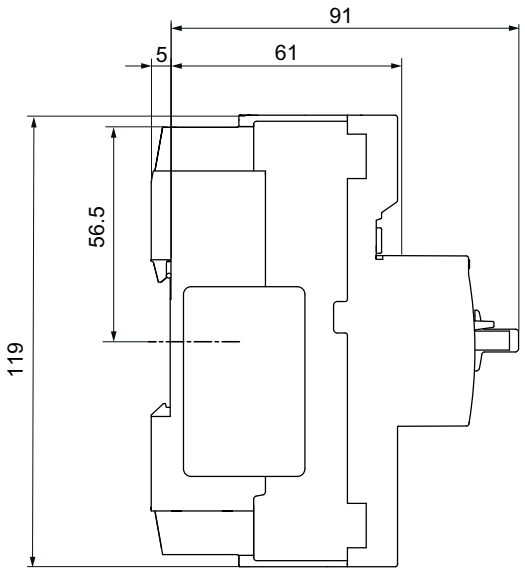


Figure C-4 Motor starter protector with spring-loaded connection system S0

Motor starter protector with ring cable lug connection system

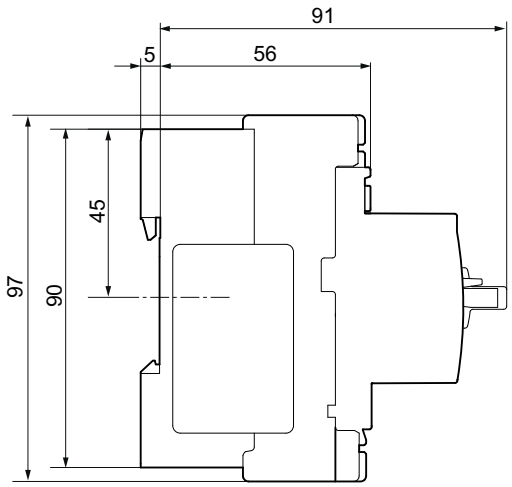


Figure C-5 Motor starter protector with ring cable lug connection system

Circuit breaker acc. to UL 489

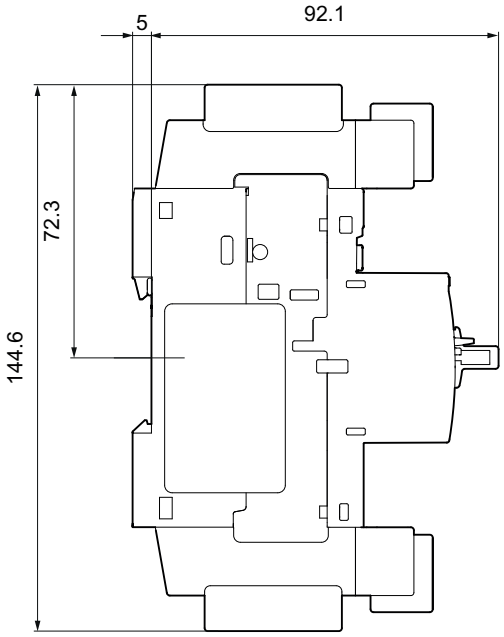


Figure C-6 Circuit breaker acc. to UL 489

Drilling plan

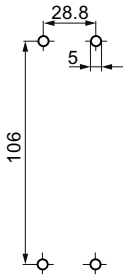


Figure C-7 Drilling plan

C.2 Dimension drawings for disconnector modules

3RV2928-1A disconnector module

For motor starter protectors sizes S00 and S0

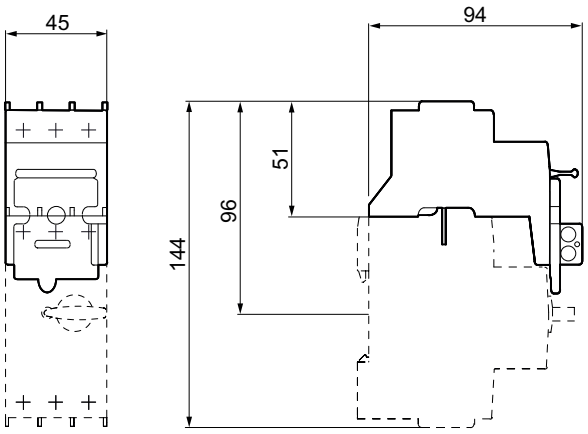
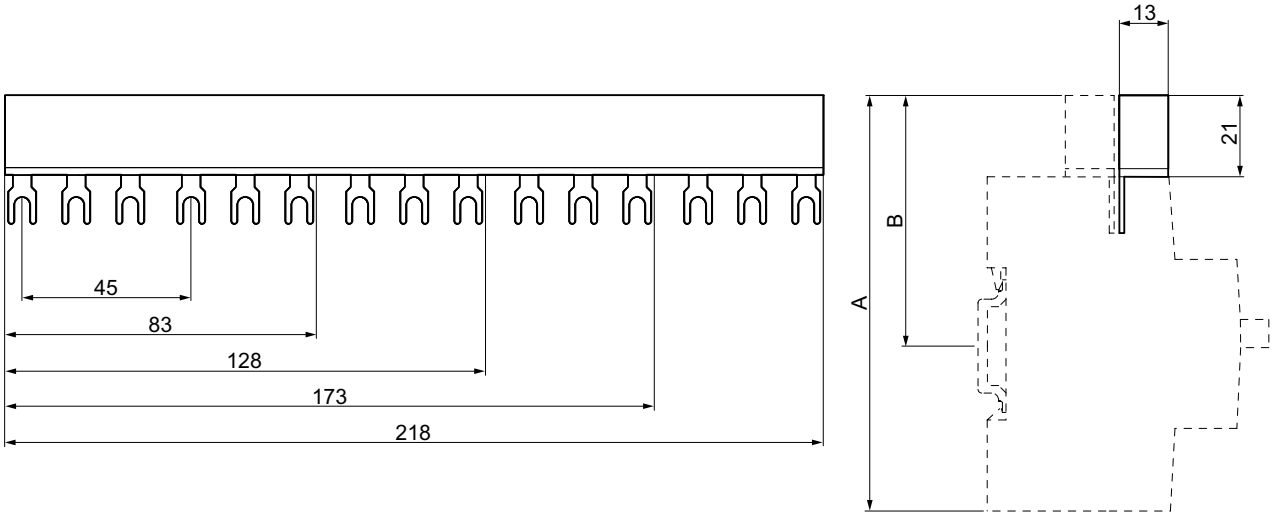


Figure C-8 3RV2928-1A

C.3 Dimension drawings for busbars

3RV1915-1.. 3-phase busbar system

For motor starter protectors sizes S00 and S0, modular spacing 45 mm
for 2 3RV1915-1AB motor starter protectors
for 3 3RV1915-1BB motor starter protectors
for 4 3RV1915-1CB motor starter protectors
for 5 3RV1915-1DB motor starter protectors

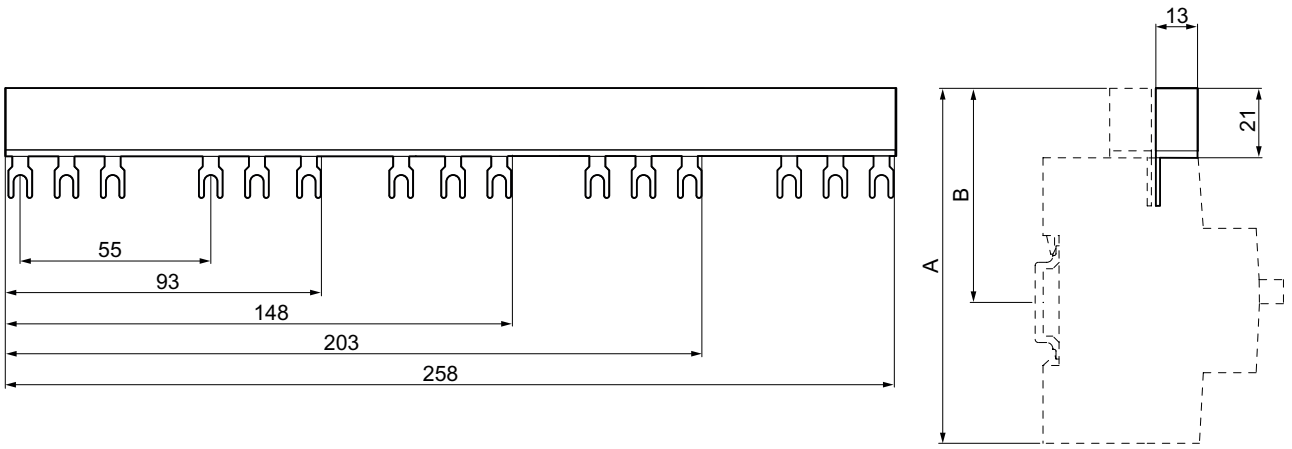


Size	A	B
S00/S0	119	70

Figure C-9 3RV1915-1..

3RV1915-2.. 3-phase busbar system

For motor starter protectors sizes S00 and S0, modular spacing 55 mm
for 2 3RV1915-2AB motor starter protectors with accessories
for 3 3RV1915-2BB motor starter protectors with accessories
for 4 3RV1915-2CB motor starter protectors with accessories
for 5 3RV1915-2DB motor starter protectors with accessories

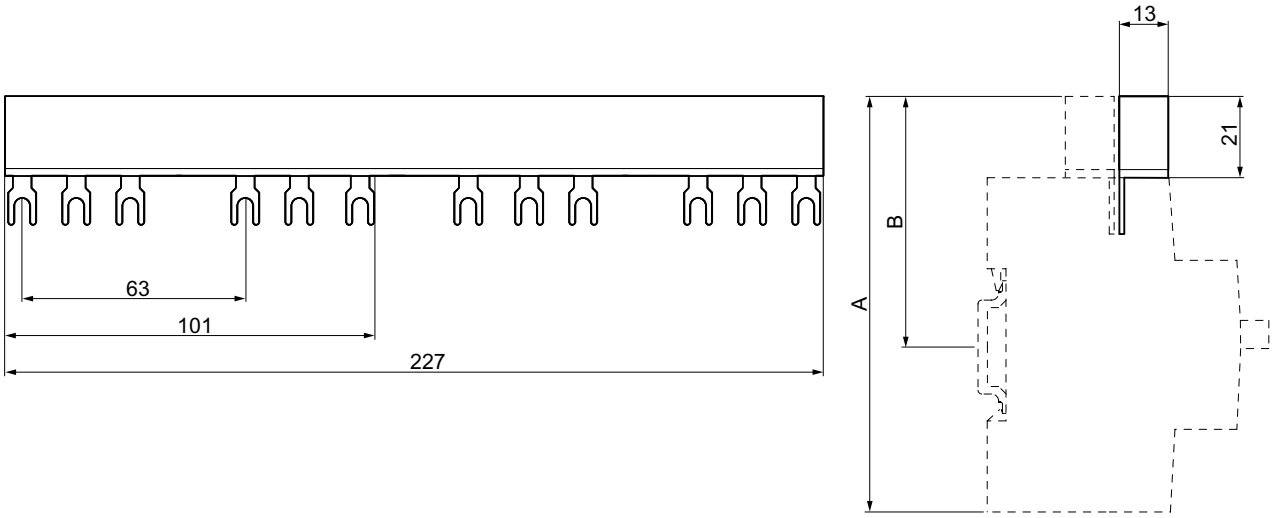


Size	A	B
S00/S0	119	70

Figure C-10 3RV1915-2..

3RV1915-3.. 3-phase busbar system

For motor starter protectors sizes S00 and S0, modular spacing 63 mm
for 2 3RV1915-3AB motor starter protectors with accessories
for 4 3RV1915-3CB motor starter protectors with accessories



Size	A	B
S00/S0	119	70

Figure C-11 3RV1915-3..

3RV29.5 3-phase infeed terminals

3RV2925-5AB

Connection from above,
for motor starter protectors sizes S00 and S0

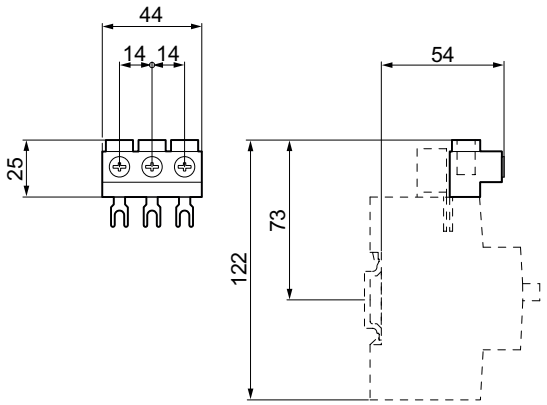


Figure C-12 3RV2925-5AB

3RV2925-5EB

For installing "type E starters"
Connection from above,
for motor starter protectors sizes S00 and S0

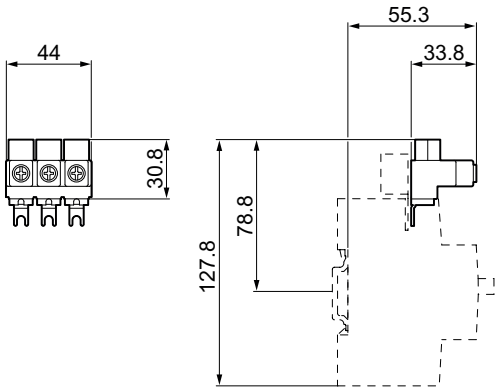
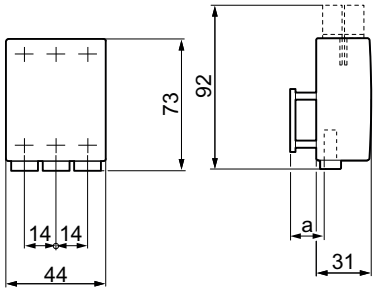


Figure C-13 3RV2925-5EB

3RV2935-5B

Connection from below,
for motor starter protectors sizes S00 and S0



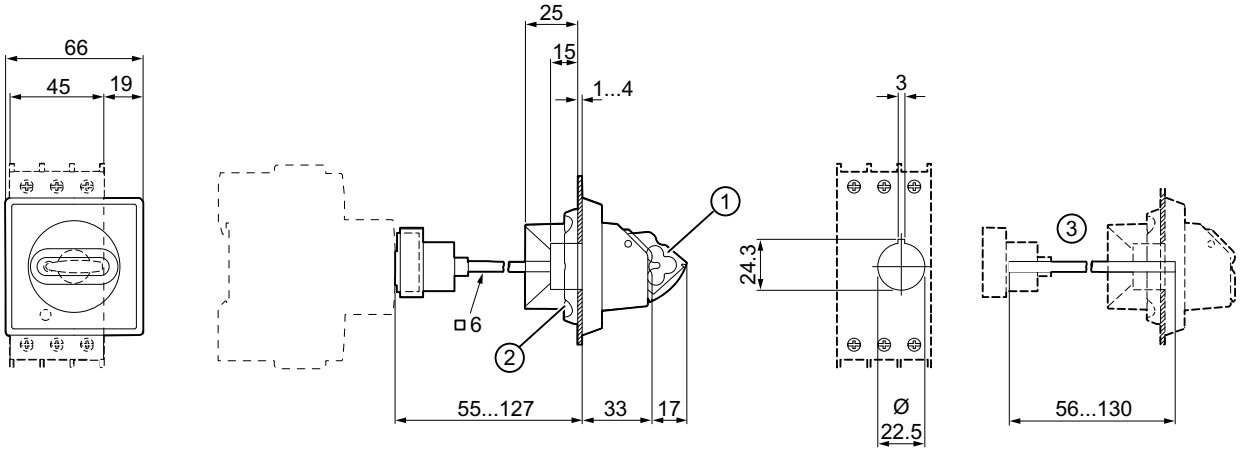
Type	a
3RV2.1 / 3RV2.2	23

Figure C-14 3RV2935-5B

C.4 Dimension drawings for 3RV2926-0 door-coupling rotary operating mechanisms

3RV2926-0B, 3RV2926-0C

Short shaft[3)], for motor starter protectors sizes S00 and S0

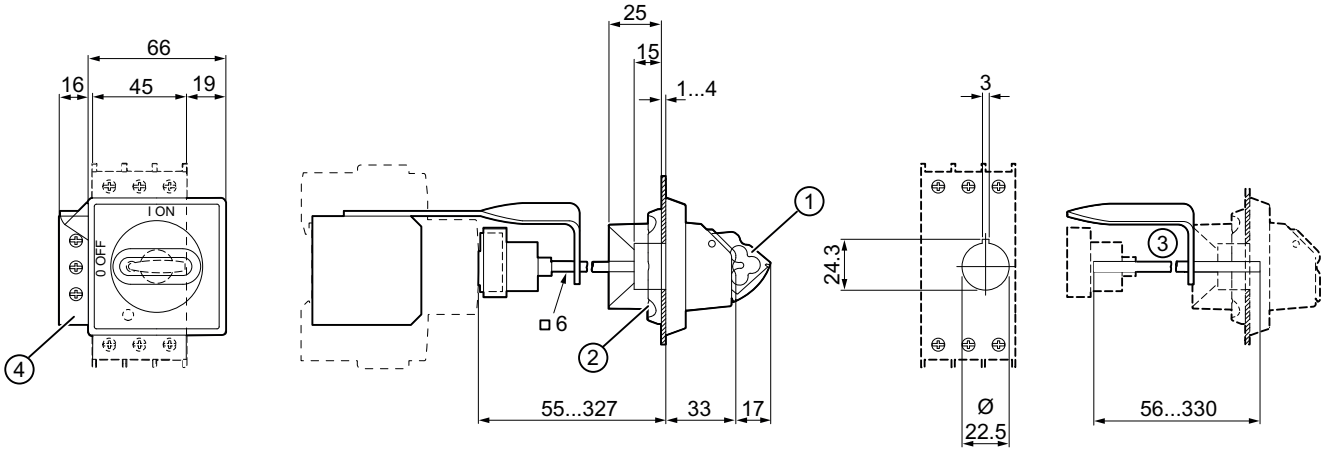


① Can be locked in neutral position with maximum shackle diameter 8 mm.
② Mounting with screw caps.
③, 3) Delivered with shaft length of 130 mm; adaptable by shortening the shaft.

Figure C-15 3RV2926-0B, 3RV2926-0C

3RV2926-0K, 3RV2926-0L

Long shaft (with bracket)[3)], for motor starter protectors sizes S00 and S0



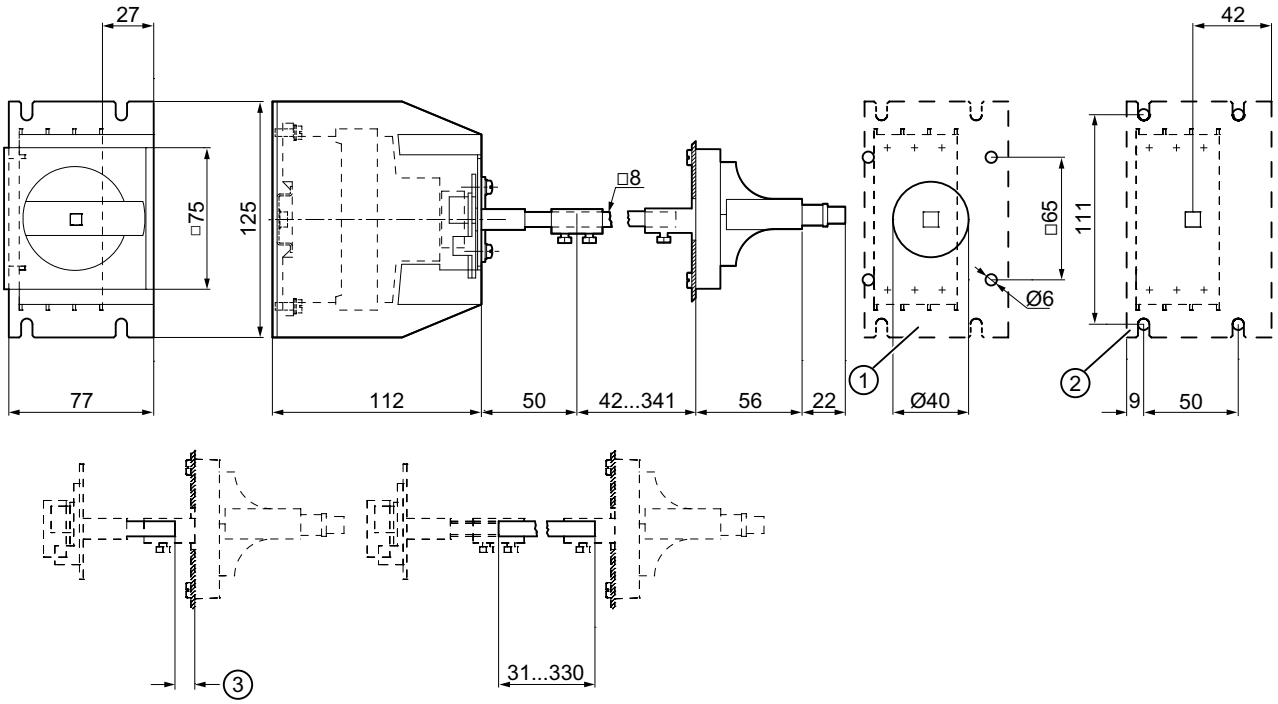
① Can be locked in neutral position with maximum shackle diameter 8 mm.
② Mounting with screw caps.
③, 3) Delivered with shaft length of 330 mm; adaptable by shortening the shaft.
④ Grounding terminal 35 mm^2 and metal bracket for 330 mm shaft.

Figure C-16 3RV2926-0K, 3RV2926-0L

C.5 Dimension drawings for 3RV29.6-2. door-coupling rotary operating mechanisms for arduous conditions

3RV2926-2.

For motor starter protectors sizes S00 and S0



① Drilling pattern door
② Drilling pattern floor
③ min. 11 mm without shaft

Figure C-17 3RV2926-2.

C.6 Dimension drawings for terminals for "Self-Protected Combination Motor Controller Type E" according to UL 508

3RV2928-1H

For motor starter protectors sizes S00 and S0

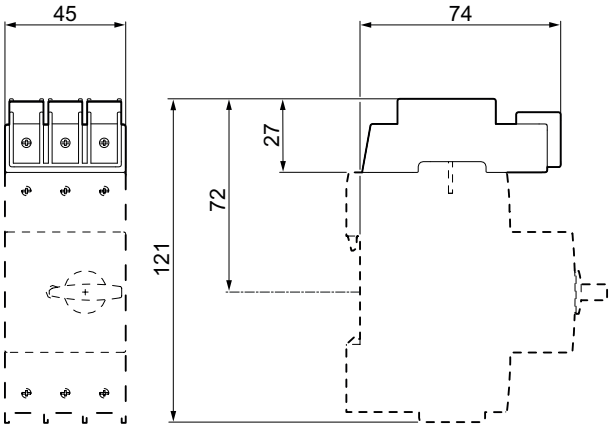
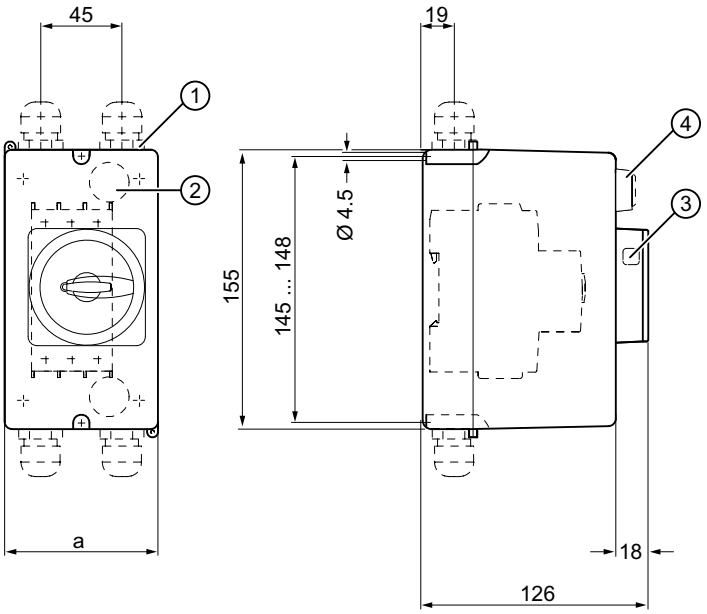


Figure C-18 3RV2928-1H

C.7 Dimension drawings for 3RV19.3-1.A00 molded-plastic surface-mounting enclosure

3RV1923-1.A00

For motor starter protectors sizes S00 and S0



Type	a
3RV1923-1CA00	85
3RV1923-1DA00	105

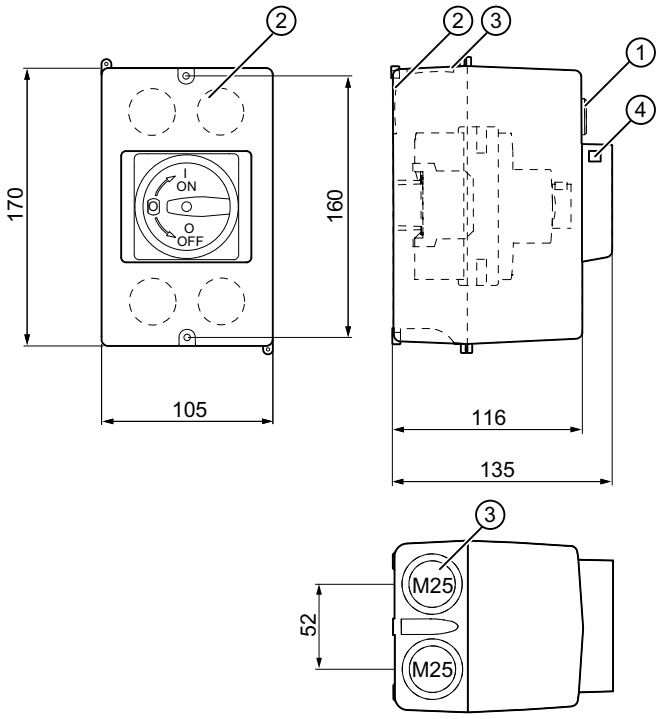
① Knockouts for M25 cable glands.
② Knockouts for M20 cable entry on the rear.
The cable entries on the rear cannot be used with devices with spring-loaded connections 3RV2..11-...2. and 3RV2.21-...2..
③ Opening for padlock with maximum shackle diameter 6 to 8 mm.
④ 3RV1903-5 indicator light

Figure C-19 3RV1923-1.A00

C.8 Dimension drawings for 3RV1923-1.A01 cast-aluminum surface-mounting enclosure

3RV1923-1DA01, 3RV1923-1GA01

For motor starter protectors sizes S00 and S0



① 3RV1903-5 indicator light

② Knockouts for M20 cable entry on the rear.
The cable entries on the rear cannot be used with devices with spring-loaded connections 3RV2..11-...2. and 3RV2.21-...2..

③ Knockouts for M25 cable glands.

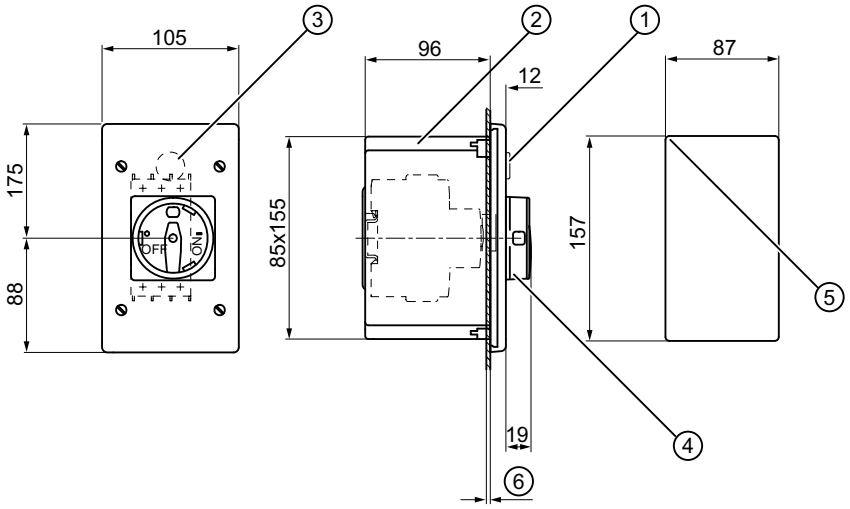
④ Opening for padlock with shackle diameter 6 to 8 mm

Figure C-20 3RV1923-1DA01, 3RV1923-1GA01

C.9 Dimension drawings for 3RV1923-2.A00 molded-plastic flush-mounting enclosure

3RV1923-2DA00, 3RV1923-2GA00

For motor starter protectors sizes S00 and S0, not for devices with spring-loaded connections



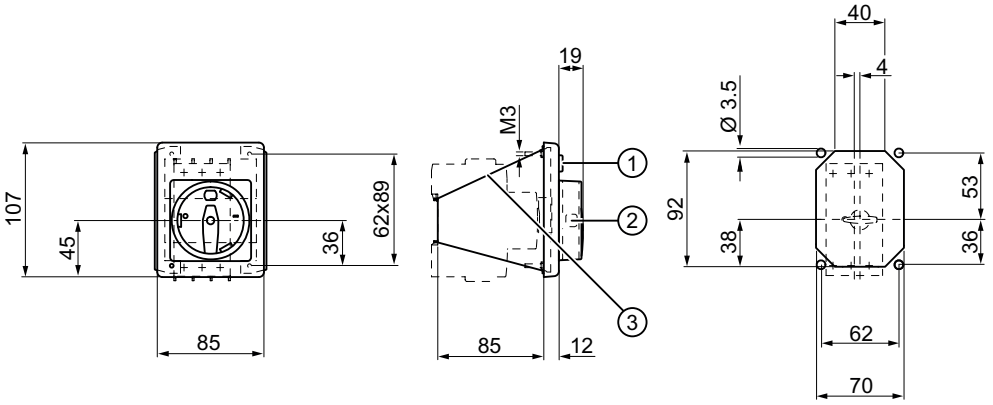
① 3RV1903-5 indicator light
② Knockouts for M25 cable glands.
③ Knockouts for M20 cable entry on the rear.
④ Opening for padlock with shackle diameter 6 to 8 mm.
⑤ R3 max.
⑥ max. 6

Figure C-21 3RV1923-2DA00, 3RV1923-2GA00

C.10 Dimension drawings for 3RV1923-4 molded-plastic front plates

3RV1923-4B, 3RV1923-4E

For motor starter protectors sizes S00 and S0;
3RV1923-4G bracket only for motor starter protectors sizes S00 and S0



① 3RV1903-5 indicator light
② Opening for padlock with shackle diameter 6 to 8 mm.
③ 3RV1923-4G bracket

Figure C-22 3RV1923-4B, 3RV1923-4E

Correction sheet

D

Correction sheet

Have you noticed any errors while reading this manual? If so, please use this form to tell us about them. We welcome comments and suggestions for improvement.

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92220 Amberg / Germany	Address

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Table D- 1 Errors, comments, and suggestions for improvements

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