SIEMENS

Industrial Controls

SIRIUS Innovations

System Overview

System Manual

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Answers for industry.

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Industrial Controls

SIRIUS Innovations - System Overview

System Manual

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SIRIUS Innovations System Overview

1

1.1 Introduction

1.1.1 Modular system for SIRIUS

System is everything: The SIRIUS modular system for the control cabinet

Siemens is one of the most important manufacturers of switching devices, whose product range extends from devices that switch just a few milliamps to motor starter protectors for power distribution. The process of configuring control cabinets must be quick, easy, flexible, and must enable you to create space-saving solutions.

This is exactly what Siemens offers with its unique SIRIUS modular system. This system offers all the functions and devices you will need for switching, starting, protecting, and monitoring motors and systems. In other words, it provides a modular range of standard components, which are perfectly matched to one another, can be combined really easily, and use the same accessories. That's how easy controls and distribution can be.

Continuous further development and constant innovations ensure that, with SIRIUS, you are ideally equipped to meet the challenges of today and tomorrow, and can benefit from cost-effective solutions. All the components that make up the SIRIUS modular system are characterized by a space-saving design and a high degree of flexibility. Configuration, installation, wiring, and maintenance work are all extremely quick and easy to perform.

In further developing these products, a great deal of emphasis has consistently been placed on meeting or even exceeding requirements in terms of essential performance features, electrical and mechanical durability, dimensions, and ease of mounting and maintenance.

Environmentally-friendly and recyclable materials have been developed and used in the system to reflect the ecological awareness that has grown at a quite incredible rate over the last decade in particular. In the field of low-voltage switching devices, this has resulted in the creation of modern industrial switching devices which fulfill all requirements with regard to environmental compatibility.

Building on decades of experience, a totally new generation of devices for performing switching, starting, protecting, and monitoring functions was created for the large and ever growing number of motorized operating mechanisms: SIRIUS Innovations.

These new SIRIUS devices meet all requirements that have arisen in the field and can be used as individual devices, as modules for complete load feeders, or installed in low-voltage distribution boards or low-voltage switchgear. So no matter whether you want to configure load feeders with motor starter protectors or overload relays, contactors, or soft starters, SIRIUS has just the product you will need for any application.

1.1.2 SIRIUS Innovations

SIRIUS stands for innovation

Siemens is constantly developing its product portfolio to enable it to meet the demands of industry, not only today, but in the future too. As part of this process, Siemens gathers customer feedback on an ongoing basis and considers it in conjunction with the global trends of tomorrow.

This manual underlines Siemens' claim to be a trendsetting company which offers you the very best products for switching, starting, protecting, and monitoring your motors and systems.

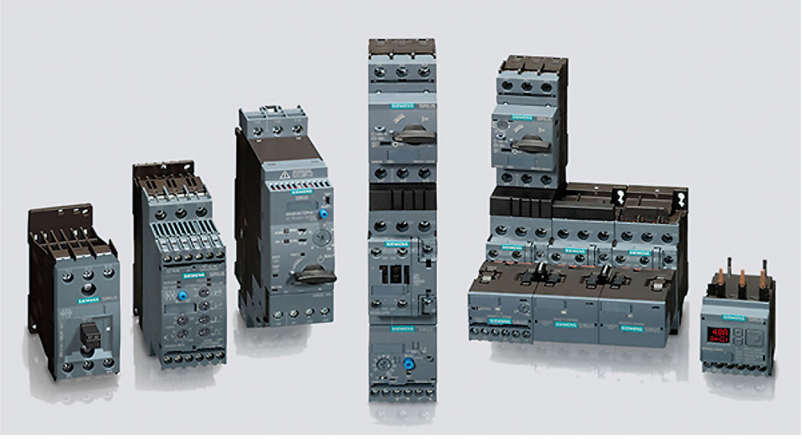

Figure 1-1 Innovations in the SIRIUS modular system

When coming up with these innovations for the SIRIUS modular system, particular importance was placed on reducing the amount of wiring needed, saving space, reducing the number of versions available, and providing operational reliability.

Simple and straightforward connection

The options for connecting to the higher-level control have now also been further improved: The SIRIUS modular system now not only features the AS-Interface, but also the IO-Link, which has been standardized as well. This ensures that switching devices can benefit from optimum interaction with our SIMATIC automation system and also with third-party controls.

The connection to the automation level is implemented via function modules, which are plugged onto contactors. However, these function modules are also available in a version for traditional parallel wiring, as well as in versions featuring AS-i or IO-Link interfaces. This simple version just contains the logic for performing the star-delta (wye-delta) functions of a feeder, for example. There is no longer any need to carry out laborious control circuit wiring work. The star-delta (wye-delta) times are set directly on the function module; all necessary interlocks are already integrated therein. The smaller width is not only due to the higher performance capability of the new devices, but also to the fact that the timing relay, for example, which used to be connected separately, has been done away with completely.

Monitoring in just a few short steps

More and more often, drives are being required to monitor complex processes or expensive machines to ensure they are functioning correctly. Previous solutions to such tasks involved quite a lot of wiring. That's why the current monitoring relay has been fully integrated in the main circuit in the new SIRIUS modular system. Designed like an overload relay, apparent or active current measuring can thus be added in just a few short steps; but phase sequence, phase failure, and other process-relevant data can also be evaluated too.

Reduced wiring

The infeed and power distribution options for a group of feeders has also been optimized in order to reduce the wiring in the main circuit. The SIRIUS 3RV29 infeed system now benefits, for example, from having a spring-loaded connection system available throughout, which means that whole groups of feeders can be assembled quickly and without the need for tools.

Minimized planning and configuration outlay

In order to reduce the effort involved in planning and configuration to a minimum, Siemens offers a range of Internet tools in addition to the standard documents in paper format. These tools can help you to select the most suitable product for your needs, to find the associated technical data quickly, and to put together the relevant technical documentation easily.

Problem-free usage

With its versatile product range, the SIRIUS modular system offers technology which is suitable for use in all industries and all regions of the world. The products have been tested in accordance with common standards and have obtained the approvals required to ensure that they can be used anywhere in the world without any problems.

Flexible mounting options

The devices have been designed for installation on standard mounting rails ("DIN rails"), as well as for screw fixing. A whole range of link modules is available for easily connecting switching devices, both electrically and mechanically. These link modules are used to combine the individual components of the SIRIUS modular system together to create load feeders. If you make use of the spring-loaded connection system, this can even be done without the need for tools by simply plugging the different components together.

The spring-loaded connection system has now been extended to cover the entire product range of sizes S00 and S0 for the main circuit and the control circuit. From size S2, spring-loaded connection is only available in the control circuit. The ring cable lug connection system is also available for use with particular applications and on request for certain regions.

1.1.3 Siemens Industry Online Support

Information and Service

In Siemens Industry Online Support, you can obtain up-to-date information from our global support database quickly and simply. To accompany our products and systems, we offer a wealth of information and services that provide support in every phase of the lifecycle of your machine or plant – from planning and implementation, through commissioning, up to maintenance and modernization:

- Product support
- Application examples
- Services
- Forum
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Link: Siemens Industry Online Support (https://support.industry.siemens.com/cs/de/en)

Product support

You will find here all the information and comprehensive know-how covering all aspects of your product:

- **FAQs**

  Our answers to frequently asked questions.
- **Manuals/operating instructions**

  Read online or download, available as PDF or individually configurable.
- **Certificates**

  Clearly sorted according to approving authority, type and country.
- **Characteristic curves**

  For support in planning and configuring your system.
- **Product announcements**

  The latest information and news concerning our products.
- **Downloads**

  You can find here updates, service packs, HSPs and much more for your product.
- **Application examples**

  Function blocks, background and system descriptions, performance statements, demonstration systems, and application examples, clearly explained and represented.
- **Technical data**

  Technical product data for support in planning and implementing your project.

Link: Product support (https://support.industry.siemens.com/cs/ww/en/ps)

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1.2 Safety instructions

Five safety rules for work in or on electrical installations

A set of rules, which are summarized in DIN VDE 0105 as the "five safety rules", are defined for work in or on electrical installations as a preventative measure against electrical accidents:

1. Isolate
2. Secure against switching on again
3. Verify that the equipment is not live
4. Ground and short-circuit
5. Erect barriers around or cover adjacent live parts

These five safety rules must be applied in the above order prior to starting work on an electrical system. After completing the work, proceed in the reverse order.

It is assumed that every electrician is familiar with these rules.

Explanations

1. The isolating distances between live and de-energized parts of the system must vary according to the operating voltage that is applied.
   In electrical installations, "isolate" refers to the disconnection of all poles of live parts. Disconnection of all poles can be achieved by, for example:
   - Switching off the miniature circuit breaker
   - Switching off the motor starter protector
   - Unscrewing fuses
   - Removing LV HRC fuses
2. The feeder must be secured against inadvertent restarting to ensure that it remains isolated for the duration of the work. This can be achieved, for instance, by securing the motor starter protector and miniature circuit breaker with lockable blocking elements in the disconnected state, either using a lock or by unscrewing the fuses.

1. The deenergized state of the equipment should be verified using suitable test equipment, e.g. a two-pole voltmeter. Single-pole test pins are not suitable for this purpose. The absence of power must be established for all poles, phase to phase, and phase to N/PE.
2. Grounding and short-circuiting are only mandatory if the system has a nominal voltage greater than 1 kV. In this case, the system should always be grounded first and then connected to the live parts to be short-circuited.
3. These parts should be covered, or barriers erected around them, to avoid accidental contact during the work with adjacent parts that are still live.

1.3 Standards and approvals

1.3.1 Standards

The standards from Catalog IC 10 "SIRIUS Industrial Controls" in the appendix always apply. Below are some of the most important standards which apply to the innovations to the SIRIUS modular system.

Standards

Table 1- 1 IEC/DIN EN/DIN VDE standards

IEC	DIN EN	DIN VDE	Title
60947-1	60947-1	—	Low-voltage switchgear and controlgear: General rules
60947-2	60947-2	—	• Circuit breakers
60947-3	60947-3	—	• Switches, disconnectors, switch-disconnectors and fuse-combination units
60947-4-1	60947-4-1	—	• Contactors and motor-starters: Electromechanical contactors and motor-starters
60947-4-2	60947-4-2	—	• Contactors and motor-starters: AC semiconductor motor controllers and starters
60947-4-3	60947-4-3	—	• AC semiconductor controllers and contactors for non-motorized loads
60947-5-1	60947-5-1	—	Control circuit devices and switching elements: Electromechanical control circuit devices
60947-6-2	60947-6-2	—	Multiple function equipment: Control and protective switching devices (or equipment) (CPS)
60335-1	60335-1	—	Safety of household and similar electrical appliances - Part 1: General requirements
—	50274	—	Low-voltage switchgear and controlgear assemblies - Protection against electric shock - Protection against unintentional direct contact with hazardous live parts
61439-1	61439-1	—	Low-voltage switchgear and controlgear assemblies: General rules
—	50274	—	Low-voltage switchgear and controlgear assemblies - Protection against electric shock - Protection against unintentional direct contact with hazardous live parts

IEC	DIN EN	DIN VDE	Title
61140	61140	—	Protection against electric shock - Common aspects for installation and equipment
61000-4-1	61000-4-1	—	Electromagnetic compatibility (EMC); Part 4: Testing and measurement techniques; Section 1: Overview of IEC 61000-4 series
61000-6-3	61000-6-3	—	Electromagnetic compatibility (EMC); Generic standards - Emission standard for residential, commercial and light-industrial environments
61000-6-4	61000-6-4	—	Electromagnetic compatibility (EMC); Generic standards - Emission standard for industrial environments

Table 1- 2 UL/CSA/JIS standards

UL	CSA C22.2	ASME	JIS	Title
UL 508	—	—	—	Industrial Control Equipment
UL 489	—	—	—	Molded Case Circuit-Breakers, Molded Case Switches, and Circuit Breaker Enclosures
—	No. 14	—	—	Industrial Control Equipment
—	No. 5	—	—	Molded Case Circuit-Breakers, Molded Case Switches, and Circuit Breaker Enclosures
—	—	A17.5/B44.1	—	Elevator and Escalator Electrical Equipment
—	—	—	C 8201-4-1	Low-Voltage Switchgear and Controlgear; Contactors and Motor-Starter

1.3.2 Approvals, test certificates, characteristics

Approvals, test certificates, characteristics

You can find an overview of the certifications available for low-voltage controls and distribution products and other technical documentation, updated daily, on the Internet (http://www.siemens.com/sirius/support).

You can find further information in the appendix of Catalog IC 10 "SIRIUS Industrial Controls".

1.4 Overview

1.4.1 SIRIUS modular system

SIRIUS modular system

The SIRIUS product range comprises devices for use in switching, starting, protecting, and monitoring, as well as combinations thereof, which are known as "load feeders". Load feeders can be created from the following devices:

- 3RT/3RH contactors
- 3RF solid-state switching devices
- 3RW soft starters
- 3RV motor starter protectors
- Thermal (3RU) or solid-state (3RB) overload relays
- 3RR monitoring relays

Since all devices are matched to one both electrically and mechanically, they can be combined really easily to create load feeders. Alternatively, pre-assembled 3RA2 load feeders or 3RA6 compact starters are also available.

The devices named above are supplemented for the main circuit by devices for the control circuit: 3RA28 function modules for mounting on 3RT2 contactors and 3RA27 function modules for connection to the higher-level control.

			Size				
	Function	**Components**	**S00**	**S0**	**S2**	**...**	**S12**
Main circuit	**Switching and starting**	Contactors					
		Solid-state switching devices					
		Soft starters				...	
	Protecting	Motor starter protectors					
		Overload relays				...	
	Monitoring	Current monitoring relays					
	Feeders	Feeders					

			Size				
	Function	**Components**	**S00**	**S0**	**S2**	**...**	**S12**
		Compact starters					
Control circuit		Function modules for mounting on contactors					
		Function modules for connection to the automation level	AS-i IO-Link				

1.4.2 SIRIUS Innovations manuals

This system manual focuses on the product descriptions of the SIRIUS Innovations in sizes S00, S0 and S2 for motors in the performance range up to 37 kW (400 V). Products which have separate, device-specific manuals, are only briefly mentioned in this system manual. Comprehensive technical details for such devices can be found in the relevant device-specific manuals. You can download the manuals from the Internet (http://www.siemens.com/sirius/manuals).

Information about ...	Is available in ...
• SIRIUS Innovations - System Overview	• "SIRIUS Innovations - System Overview" (http://support.automation.siemens.com/WW/view/en/60311318) manual (Article number: 3ZX1012-0RA01-5AC1)
• 3RT2, 3RH2, and 3RA23/24 contactors and contactor assemblies	• "SIRIUS Innovations - SIRIUS 3RT2 Contactors / Contactor Assemblies" (http://support.automation.siemens.com/WW/view/en/60306557) manual (Article number: 3ZX1012-0RT20-5AB1)
• 3RF34 solid-state switching devices	• "SIRIUS Innovations - SIRIUS 3RF34 Solid-State Switching Devices" (http://support.automation.siemens.com/WW/view/en/60298187) manual (Article number: 3ZX1012-0RF34-5AC1)
• 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" (http://support.automation.siemens.com/WW/view/en/60279172) manual (Article number: 3ZX1012-0RV20-5AC1)
• 3RU2, 3RB30/31 overload relays	• "SIRIUS Innovations - SIRIUS 3RU2 / 3RB3 Overload Relays" (http://support.automation.siemens.com/WW/view/en/60298164) manual (Article number: 3ZX1012-0RU20-5AC1)
• 3RB24 solid-state overload relay	• "3RB24 Solid-State Overload Relay for IO-Link" (http://support.automation.siemens.com/WW/view/en/46165627) manual (Article number: 3ZX1012-0RB24-0AC0)

Information about ...	Is available in ...
• 3UG4 monitoring relays/3RR2 current monitoring relays	• "3UG4 / 3RR2 Monitoring Relays" (http://support.automation.siemens.com/WW/view/en/70210263) manual (Article number: 3ZX1012-0UG40-0AC0)
• 3RS1/3RS2 temperature monitoring relays	• "3RS1 / 3RS2 Temperature Monitoring Relays" (http://support.automation.siemens.com/WW/view/en/54999309) manual (Article number: 3ZX1012-0RS10-1AC1)
• 3UG48 monitoring relays / 3RR24 current monitoring relays for IO-Link	• "3UG48 / 3RR24 Monitoring Relays for IO-Link" (http://support.automation.siemens.com/WW/view/en/54375430) manual (Article number: 3ZX1012-0UG48-0AC1)
• 3RS14 / 3RS15 temperature monitoring relays for IO-Link	• "3RS14 / 3RS15 Temperature Monitoring Relays for IO-Link" (http://support.automation.siemens.com/WW/view/en/54375463) manual (Article number: 3ZX1012-0RS14-0AC0)
• 3RA21/22 load feeders	• "SIRIUS Innovations - SIRIUS 3RA21 / 3RA22 Load Feeders" (http://support.automation.siemens.com/WW/view/en/60284351) manual (Article number: 3ZX1012-0RA21-5AC1)
• 3RA6 compact starters	• "SIRIUS 3RA6 Compact Starter" (http://support.automation.siemens.com/WW/view/en/27865747) manual (Article number: 3RA6992-0A)
• 3RA28 function modules for mounting on contactors	• Manual "SIRIUS Innovations - SIRIUS 3RA28 Function Modules for mounting on 3RT2 Contactors" (http://support.automation.siemens.com/WW/view/en/60279150) (Article 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 (http://support.automation.siemens.com/WW/view/en/37856470) (Article No.:3ZX1012-0LB00-0AA1)

Reference

You can download the manuals from the Internet (http://www.siemens.com/sirius/manuals).

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

Notes on further information (product information, product documentation, product selection, etc.) available on the Internet can be found in the chapter "More information (Page 227)".

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.

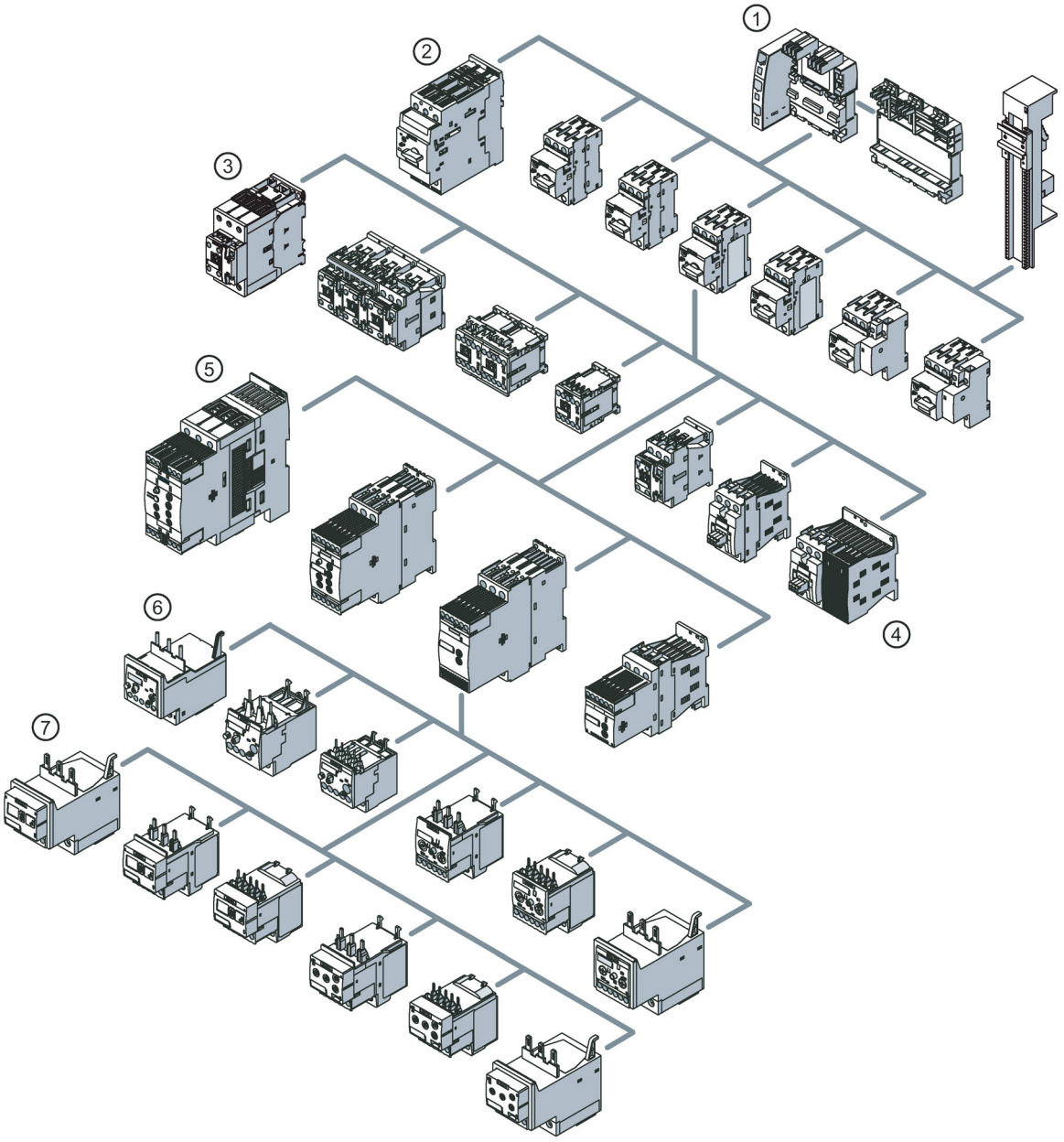
1.5 System properties

1.5.1 System properties

The entire device range of the innovations in the SIRIUS modular system is divided into three sizes (S00 to 7.5 kW, S0 to 18.5 kW and S2 to 37 kW at 400 V). The device portfolio has a uniform range of accessories.

1.5.2 Modular system design

The individual SIRIUS Innovations components are modules from the complete SIRIUS modular system (up to size S12, 250 kW at 400 V), which are matched to one another in terms of their size and their technical data. This enables individual requirements to be met quickly and cost-effectively. And it goes without saying that this applies to the uniform range of accessories as well.



1 3RV29 infeed systems
2 3RV2 motor starter protectors
3 3RT2 contactors and contactor assemblies
4 3RF34 solid-state switching devices
5 3RW30/3RW40 soft starters
6 3RU2, 3RB3 overload relays
7 3RR2 current monitoring relays

Figure 1-2 Overview graphic (assembly in the control cabinet)

1.5.3 Switching technology

The SIRIUS modular system has the right technology for every application:

Table 1- 3 Motor starting options

Application		Technology
Electromechanical starting	• Direct-on-line start	• 3RT contactors, 3RA contactor assemblies, or 3RA6 compact starters
	• Reversing start	• 3RA reversing contactor assemblies • 3RA6 compact starters
	• Star-delta (wye-delta) start	• 3RA contactor assemblies for star-delta (wye-delta) start
Electronic starting	• Direct-on-line start	• 3RF solid-state switching devices
	• Reversing start	• 3RF solid-state switching devices
	• Soft start	• 3RW soft starters

Example: 3RT contactors, 3RA contactor assemblies, or 3RA6 compact starters

3RT contactors, 3RA contactor assemblies, or 3RA6 compact starters are used for all standard applications up to 250 kW.

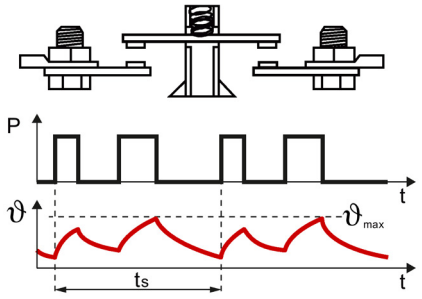


Figure 1-3 Direct switching through current feed of the contactor coil

Example: 3RF solid-state switching devices

3RF solid-state switching devices are used for frequent switching or reversing, of motors in parcel distribution systems, for example.

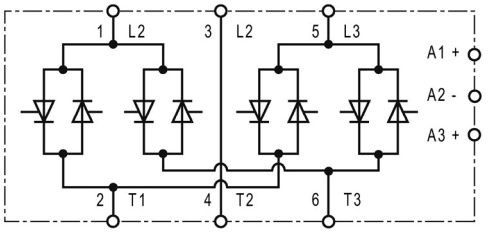


Figure 1-4 Two-phase switching through antiparallel thyristor pairs

Example: 3RW soft starters

3RW soft starters are used for soft starting and ramp-down, for pumps and fans, for example.

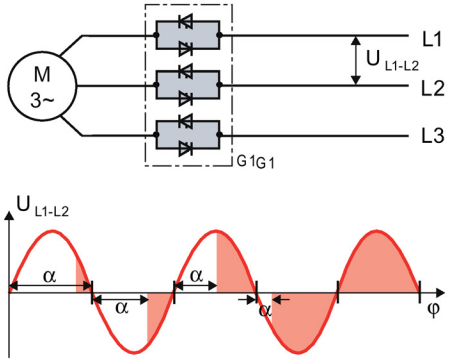
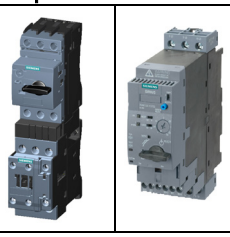


Figure 1-5 Phase angle control of the thyristor pairs

Technology selection depends on various factors. The table below provides an overview of the most important aspects:

Table 1- 4 Technology selection

	Technology		
	Electromechanical	**Electronic**	
	3RT contactors, 3RA load feeders, or 3RA6 compact starters	**3RF solid-state switching devices**	**3RW soft starters**
			
Number of starts per hour	Average	High	Low
Switching service life	Average	Long	Average
Switching capacity	High	Low	High
Occurrence of current peaks	High	High	Low
Occurrence of torque peaks	High	High	Low
Reversing operation	Yes	Yes	No
Acoustic noise generation	Average	None	Low
Galvanic isolation	Yes	No	No
Shock and vibration resistance	Average	High	Average
Power loss	Low	High	Low

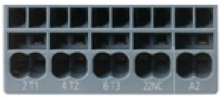
1.5.4 Uniform connection system

The devices are matched to one another in terms of their rated sizes and technical data.

- The same width guarantees quick mounting.
- Devices with the same rated current have the same terminals.
- Device combinations are matched to one another and offer screw-type, spring-loaded, and ring cable lug connection systems.

The SIRIUS modular system has the right connection system for every environment. The table below will help you to choose the right connection system:

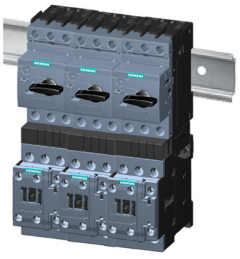
Table 1- 5 Connection systems

	Screw-type	**Spring-loaded**	**Ring cable lug**
			
Assembly/disassembly time	Standard	Short	Long
Testing after transportation	Required	Not required	Required
Maintenance costs	Standard	Low	Standard
Contact reliability	Standard	High	Standard
Vibration/shock resistance	Standard	High	Standard
Ferrule required on conductor	Partially required	Not required	Required
Removal of the conductor	Standard	Easy	Laborious
Use of link modules	Standard	Easy: plug-in	Not possible
Available products	S00 to S12 (consistent)	S00 and S0 (consistent)	S00 and S0 (partially restricted)
Application frequency	80 %	15 %	5 %
Costs	Standard	Standard	Standard

1.5.5 Flexible assembly methods

The SIRIUS modular system offers maximum flexibility in terms of configuration. The system components can be assembled as feeders or mounted separately.

Table 1- 6 Assembly (mounted separately or assembled as feeders)

Separately mounted	Mounted as complete feeders
	
The system components are assembled separately (e.g. on separate DIN rails).	The system components are assembled as a unit (e.g. with a link module).

The SIRIUS modular system offers the right solution for every type of assembly:

Table 1- 7 Assembly types

Assembly type	Benefit
Feeders assembled from individual SIRIUS devices	More than 45000 tested combinations offer solutions for almost every application.
SIRIUS 3RA2 load feeders	More than 500 pre-assembled combinations facilitate rapid and fault-free control cabinet assembly.
SIRIUS 3RA6 compact starters	Compact devices with high integrated functionality for improved efficiency and reliability in the control cabinet.

1.5.6 Performance capability

All innovations in the SIRIUS modular system can be mounted side by side and operated at an ambient operating temperature of -25 °C to +60 °C. The SIRIUS modular system is optimally suited for applications in demanding environments (in terms of dust exposure, vibration and shock load; ATEX, etc.). All standard approvals have been obtained, making the system suitable for use all over the world. In 400 V systems, size S00 covers a performance range of up to 7.5 kW and size S0 up to 18.5 kW, with a width of just 45 mm. In 400 V systems, size S2 covers a performance range of up to 37 kW, with a width of 55 mm. A short-circuit breaking capacity of up to 150 kA is available.

1.5.7 Assembly and mounting

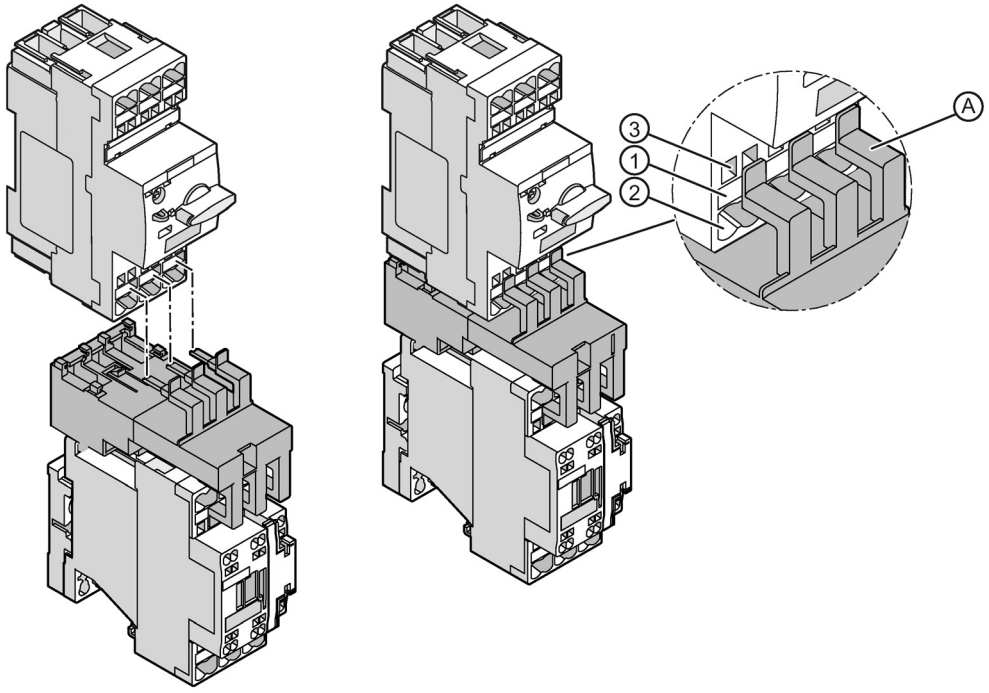
Accessories such as auxiliary switches and surge suppressors can be mounted quickly and disassembled in just a few short steps. Standard tools are required to disassemble components only very rarely. For all devices of the SIRIUS Innovations with spring-loaded connections, Siemens offers a standardized operating tool (screwdriver 3RA2908-1A).

1.5.8 Load feeders

Link modules based on screw-type and spring-loaded connection systems are available for assembling device combinations and fuseless load feeders. The link modules establish the mechanical and electrical connections for the devices. Motor starter protectors can be combined with the following devices via link modules:

- Contactors
- Soft starter
- Solid-state switching devices

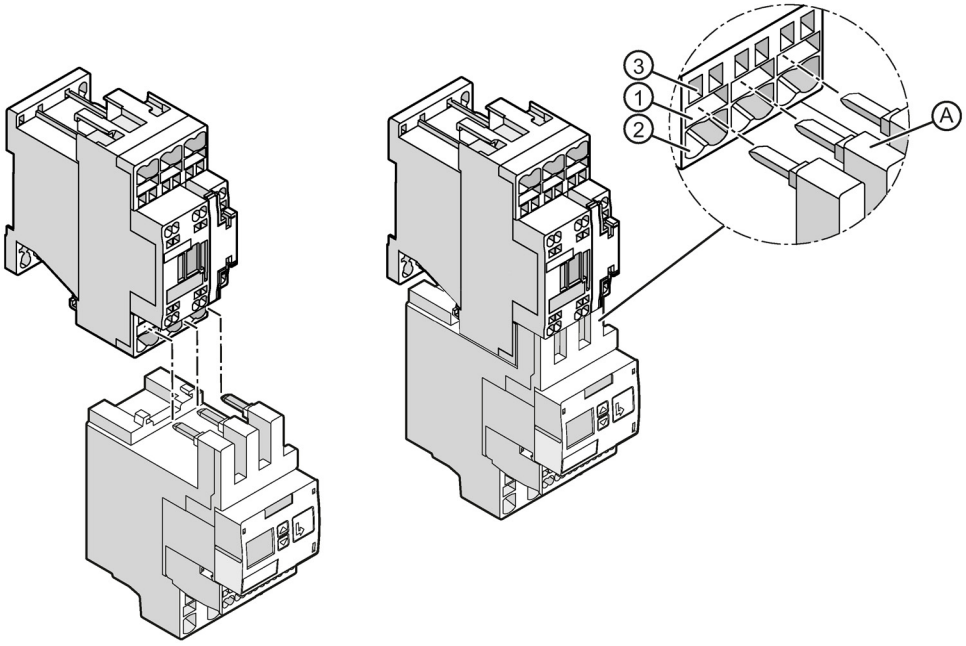
The SIRIUS Innovations products now also offer a "plug-in connection system" for assembling load feeders from devices with spring-loaded terminals. Contactors, solid-state switching devices, and soft starters can be connected to the motor starter protector by simply plugging them in via a link module:



A Link module
① Slot for link modules
② Slot for conductor connection
③ Screwdriver opening for assembly/disassembly without a link module

Figure 1-6 Link module

The link module is first attached to the device to be connected, then the resulting unit is plugged on to the motor starter protector. This ensures that the requisite electrical and mechanical connections are established in the main circuit. Overload relays and current monitoring relays can easily be mounted on contactors in a similar way, without the need for another link module:



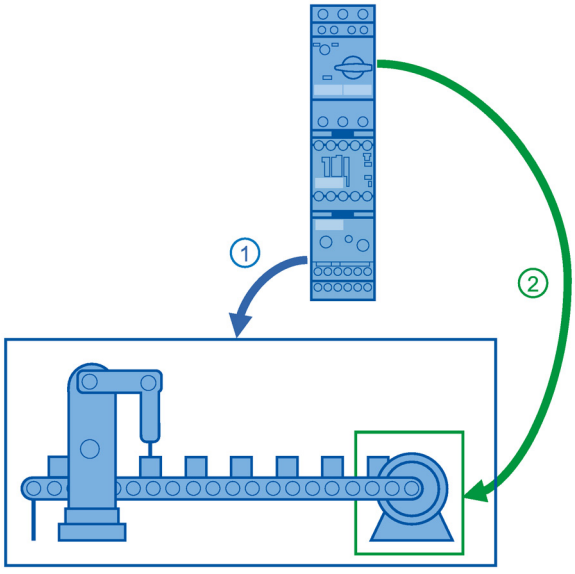
A Current monitoring relay
① Slot for link modules
② Slot for conductor connection
③ Screwdriver opening for assembly/disassembly without a link module

Figure 1-7 Plug-in connection system on the current monitoring relay

1.5.9 Application monitoring

The current monitoring relays, which enable intelligent protective functions to be easily implemented within the application, are a central component of the innovations made to the SIRIUS modular system.

Increasing numbers of customers require application monitoring in addition to motor protection. Overload protection (based on I^2t measuring/calculation) provides information on the motorized load, but it does not necessarily allow for conclusions to be drawn regarding the correct execution of processes within the machine. 2- or 3-phase current monitoring with SIRIUS 3RR2 current monitoring relays facilitates the direct monitoring and protection of the application.



① Application monitoring
② Motor protection

Figure 1-8 Application monitoring

1.5.10 Communication

SIRIUS switching devices can be connected to higher-level control systems using conventional wiring, but also by means of intelligent wiring and a fieldbus:

- IO-Link
- AS-Interface

SIRIUS switching devices are linked into the Siemens Totally Integrated Automation concept via function modules. Totally Integrated Automation offers the user uniformity in terms of configuration, programming, data storage, and communication.

SIRIUS switching devices are connected to the automation level via AS-Interface or IO-Link, without any additional wiring. These interfaces ensure that information about the switch position and the readiness of the feeder for operation is transferred, and that contactor control is implemented. In addition to these three items of information relating to feeders, IO-Link also transfers diagnostics data.

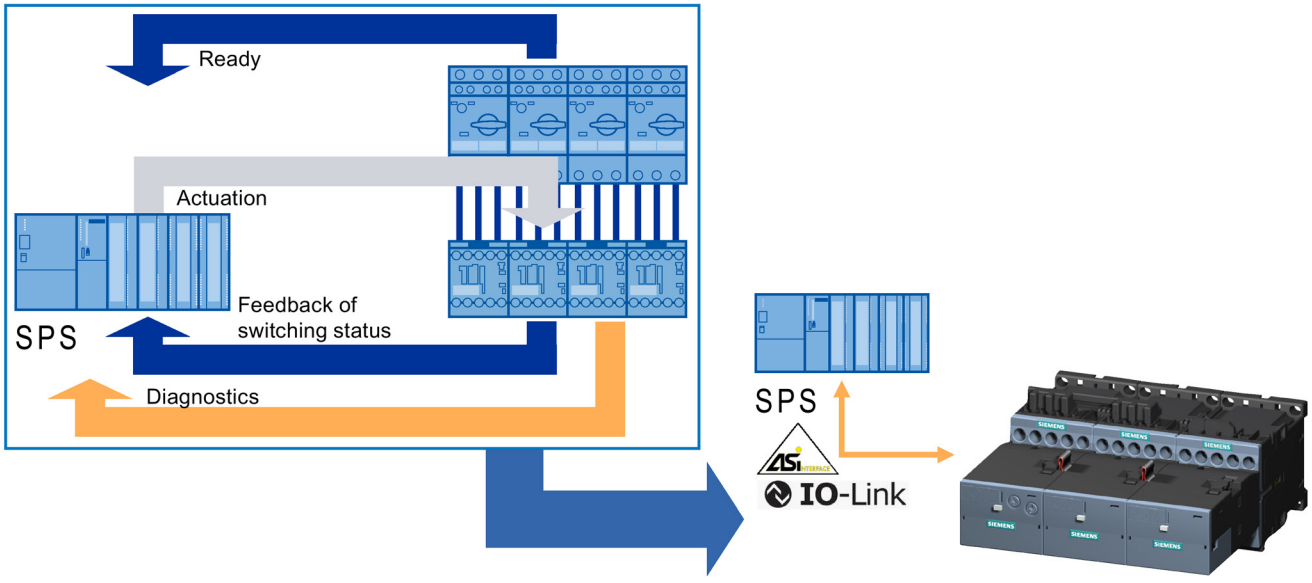


Figure 1-9 Communication via AS-Interface or IO-Link

1.5.11 Safety applications

SIRIUS switching devices are often used in parts of the system which have a bearing on safety. The Safety Integrated concept enables uniform solutions to be created, from safety relays through to fail-safe communication via AS-Interface or PROFIBUS DP.

Example

SIRIUS contactor in a safety application:

- Motor starter protectors in combination with undervoltage release and contactor:
  PL d (ISO 13849-1) or SIL 2 (IEC 62061)
- Contactor assemblies for star-delta (wye-delta) start:
  PL e (ISO 13849-1) or SIL 3 (IEC 62061)

1.5.12 Environmental protection

Siemens attaches great importance to the subject of eco-design. Our company-internal standard SN 36350 on environmentally compatible product design has been permanently integrated in our product development processes since 1993. Our production meets the highest quality and environmental standards.

The CO_2 balance is another important topic as regards the manufacturing processes used for our products. All Siemens products are eco-labeled in accordance with DIN EN ISO 14021 as a matter of course. This process of eco-labeling makes our environmentally-compatible product design more transparent and ensures that a continual improvement in the CO_2 balance can be observed.

1.5.13 Energy efficiency

1.5.13.1 Energy efficiency

The **SIRIUS modular system** offers products that significantly reduce energy consumption in the control cabinet thanks to their minimum intrinsic power losses. The modular system includes devices that not only switch reliably, but also measure energy and thus supply solutions for energy-optimized drive concepts.

Energy efficiency increases resulting from the use of SIRIUS Innovations can be divided into three topic areas:

- Acquisition of measured energy values
- Reduction in intrinsic power losses
- Optimal drive solution

These three pillars form the basis of optimized energy management with the support of SIRIUS Innovations.

1.5.13.2 Acquisition of measured energy values

Acquisition of measured energy values (identification of energy flows)

One of the essential starting points for increasing energy efficiency is the acquisition of energy flows through detailed analysis of the machinery and systems used. You can do without installing additional measuring instruments if you use switching devices with integral current acquisition and communication interface at the planning phase, e.g. motor starters of the SIMATIC ET 200S distributed I/O device. These switching devices can transfer the up-to-date current value to the higher-level controller via PROFIBUS or PROFINET. With overload relays for IO-Link, monitoring relays for IO-Link, the SIMOCODE motor protection and control device, or the SIRIUS 3RW44 soft starter, further additional measured values such as voltage and power values can be acquired and transferred. Like the ET 200S motor starter and the High Feature motor starter, the M200D motor starter in degree of protection IP65 offers current values in the standard format of the PROFIenergy profile. This simplifies integration into energy management systems. The measured values of the actuators – thus simultaneously serving as sensors – can be dragged and dropped to the visualization system of the energy data.

Thanks to evaluation and analysis of the measured current values, energy management systems are able to make an assessment of the current situation and thus shut down individual load groups or consumers.

1.5.13.3 Reduction in intrinsic power losses

Reduction in intrinsic power losses (calculation of potential savings)

Each device installed in a control cabinet produces a power loss. For example, devices with integral power electronics (e.g. soft starters) are already burdened with higher power losses than non-solid-state power contactors. Significantly higher power losses are sustained when using frequency converters.

The power loss can be perceived in the form of heat that usually has to be minimized with high energy consumption using, for example, fans or air conditioners requiring regular maintenance. By using SIRIUS soft starters, the power semiconductors are bypassed after the power-up phase with the help of bypass contacts. This reduces the resulting heat losses to a minimum.

When using **SIRIUS contactors**, the potential savings in the main circuit are extremely low since the electromechanical contacts generate very low intrinsic heat losses. The savings potential is to be found in the control circuit where the pickup currents and holding currents of conventional AC coils or DC coils are reduced by up to 92 % thanks to modern control electronics.
The control electronics of these contactors with electronic operating mechanism (AC / DC drive) offer the following benefits:

- Smaller power supply units in the control circuit thanks to significantly reduced pickup currents and holding currents
- Control optionally with DC voltage or AC voltage
- Reduced stockkeeping thanks to wide voltage ranges
- Control by 0.5 A outputs of the controller
- Avoidance of overvoltage damage in the control electronics thanks to integral suppressor circuit

In the sphere of influence of IEC standards, **fuseless** design of **load feeders** has become established. The preferred method of protecting plants, cables and motors is to use circuit breakers or motor starter protectors with conventional electromechanical design. The protective function against overload is performed with the help of bimetal strips with low heat losses. These losses are reduced by up to 20% on the SIRIUS Innovations (size S0) thanks to the use of modern materials, so that it has been possible to increase the maximum settable current from 25 A to 40 A.
The current setting ranges of the **SIRIUS motor starter protectors** overlap (size S00: 11 ... 16 A and size S0: 14 ... 20 A). If the user requires, for example, a motor starter protector for a 7.5 kW IE2 motor (I_N = 14.7 A), the size S0 motor starter protector is the obvious choice since the intrinsic power losses can be reduced by up to 40% thanks to the low setting of the overload protection.

As well as the widespread use of fuseless load feeders, the following reasons speak in favor of the design with **SIRIUS overload relays (thermal or electronic)**:

- Differentiation of the signals for overload and short-circuit
- Extremely high short-circuit breaking capacity in high rated operating voltage ranges in combination with fuses

Further benefits result from the use of solid-state overload relays instead of the widely used thermal overload relays:

- Wide setting range of the rated operational current of up to 1:10
- Adjustable tripping classes (also suitable for heavy starting)
- Remote reset after overload tripping

Thanks to the use of the solid-state overload relays and the fact that there is no need for the motor starter protector, power losses are reduced by up to 98%. This reduction in intrinsic heat buildup can significantly simplify air-conditioning in the control cabinet, particularly with compact constructions.

The **SIRIUS compact starter** represents a new class of energy-efficient switching devices. The combination of motor starter protector, contactor and solid-state overload relay in one enclosure, and the specified benefits of each individual device result in savings in intrinsic power losses of up to 80% compared to conventional load feeders.

Consistent use of energy-efficient switching devices allow significant reductions in the intrinsic losses of the devices and the associated measures for heat dissipation in the control cabinet. This essential benefit affects not only power costs but also the availability of the plant.

1.5.13.4 Optimal drive solution

Optimal drive solution (specific measures for realizing potential energy savings)

Three-phase induction motors have a substantial responsibility for the power of a machine. These motors can be operated in the most diverse ways. While the optimal area of application of the frequency converters is in closed-loop speed control, soft starters specialize in the regulation of current and torque during start-up and run-down. In combination with the contactor-based motor starters and load feeders, soft starters have a cost-optimized design for long operating periods at rated speed of the motors.

In such applications, the obvious choice is the combination with motors of Energy Efficiency Class 2 (IE2) or high-efficiency motors of Energy Efficiency Class 3 (IE3). These motors have especially low power losses in operation and thus improve the energy balance.

The power losses of the devices increase as the functionality increases. Choosing an optimal drive solution requires economic dimensioning of the motor power to avoid generating high losses with overdimensioned motors and later having to adapt an overdimensioned application to low requirements using a frequency converter. Simple closed-loop control methods, such as two-step controllers, usually represent an ecologically better and economically more favorable alternative.

Further savings potential, e.g. with pumps, fans or compressors, the obvious choice is a combination of a cascaded frequency converter and switching devices. In this case, the switching devices cover the basic load requirements of the plant, and the frequency converter covers the variable proportion of the application. This means the following benefits of both drive systems can be optimally exploited:

- Very user-friendly closed-loop control
- Low intrinsic energy losses with simultaneously high efficiency

1.5.13.5 Energy efficiency examples

The devices which make up the SIRIUS modular system are designed for minimum power loss, and passively and actively support the realization of efficient systems and applications.

The SIRIUS Innovations devices have an average 10% lower intrinsic power loss so that as well as saving on energy costs, the heat generated in the control cabinet can also be reduced. This enables a higher packing density in the control cabinet and reduces the cooling capacity.

The following examples show the reduction in intrinsic power loss compared to the predecessor devices.

Product example soft starters

- Reduction of peak loads by up to 60%.
  - The soft starter protects the connected products and systems both on the connection and drive sides.
- Minimum intrinsic power loss thanks to integrated bypasses.
  - The complete soft starter portfolio bridges the thyristors during operation by means of bypasses and thus enables the intrinsic power loss to be reduced to contactor level.
  - 1 W power loss requires 3 W cooling expenditure. Typical frequency converters generate a power loss which is 30 times higher than that created by a comparable soft starter (bypass operation) and thus require 90 times the cooling expenditure.
- The most space-saving starter ever.
  - Volume reduction compared to typical contactor assemblies for star-delta (wye-delta) start: 66 %.
  - Volume reduction compared to typical frequency converters: up to 98%.

Product example contactors

- Minimized holding and closing power.
  - The aspects of low power loss and further optimization of the holding and closing power ratings played an important role in the development of SIRIUS contactors.
  - SIRIUS contactors with electronically controlled coils support further reduction of the holding power by up to 90%.
  - All SIRIUS contactors can be used on the Chinese market, as they meet the Chinese energy efficiency standard GB 21518-2008 for AC contactors in accordance with "Grade 2". The contactors thus far exceed the minimum requirement ("Grade 3") and are optimally equipped for the future.

Product example compact starters

- Only one switching point for minimized losses on the current path.
  - Thanks to the combined functions of a solid-state overload relay, a motor starter protector, and a contactor in a single device, transfer resistances (switching points, cable transitions, etc.) are reduced to a minimum.

Product example overload relays

- Electronics instead of bimetal for minimized intrinsic power loss.
  - In addition to a wide setting range of up to 1:10, the application of electronic sensors and actuators facilitates intrinsic power loss reductions of more than 98%.
- Optimized thermal release (bimetal).
  - For devices with thermal overload relay, the power loss compared to predecessor products is reduced by 5 to 10% thanks to the optimized bimetal release.

1.6 Customer benefits

Customer benefits

SIRIUS offers benefits in the following areas:

- Assembly and handling
- Planning and configuration
- Connection to the automation level
- System monitoring

Table 1- 8 Customer benefits

Area	Technical highlights	Customer benefits
	Proven and optimized modularity and functional diversity in the SIRIUS modular system	Maximum flexibility for application-oriented solutions
	Performance increase with unchanged size, functions which are already integrated, and "all-in-one" solution with compact starters	Space savings in the control cabinet
	Reduced variance, e.g. thanks to size-independent accessories and wide voltage and wide setting ranges	Reduced storage costs as well as planning and ordering expenditure
Assembly and handling	• Integrated spring-loaded connection system • Assembly of starters with plug-in connection system • Corresponding infeed systems and integrated functionalities	Reduced wiring expenditure and fault avoidance in terms of assembly and handling
System monitoring	• Monitoring relays and function modules for extremely simple application monitoring • End-of-lifetime detection for 3RA6 compact starter • Comprehensive diagnostics messages	Operational reliability and system availability
Connection to the automation level	Easy connection to AS-i or IO-Link	Optimum integration in the automation environment (TIA)
Planning and configuration	• Comprehensive planning and configuration tools • Numerous approvals • Numerous combination tests for SIRIUS	• Simplified system planning and documentation • Global applicability

SIRIUS offers the perfect solution throughout the entire product lifecycle:

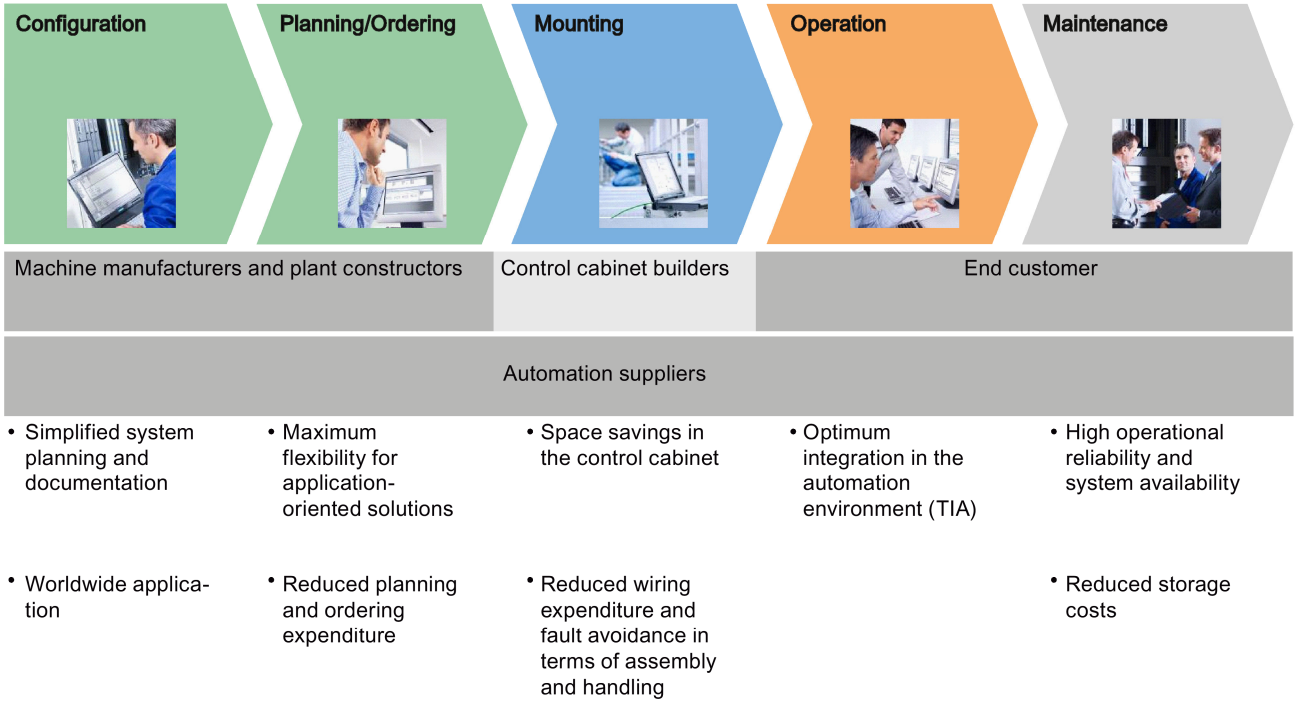


Figure 1-10 Customer benefits by product lifecycle

1.7 Components and combinations

1.7.1 Switching and starting

1.7.1.1 SIRIUS 3RT2 contactors

3RT2 contactors

Figure 1-11 S0 contactor

SIRIUS 3RT2 contactors and contactor assemblies offer maximum flexibility in terms of dimensioning, handling, and function:

Table 1- 9 3RT2 contactors and contactor assemblies

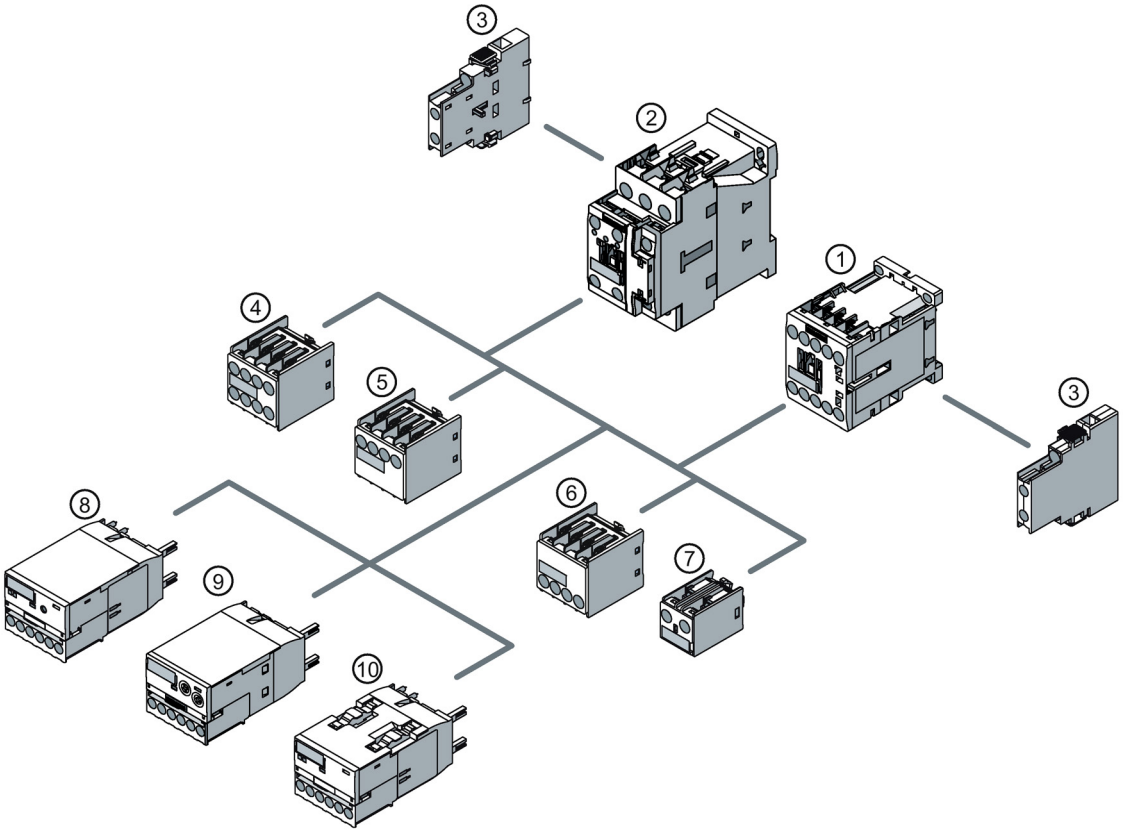
Area	Customer benefits
Functions	• Power contactors (motors, resistive loads) and contactor relays • Conventional (S00, S0 and S2) and electronic drive (S0 and S2 only; reduced power consumption) • Function modules for mounting on contactors and for connection to the automation level (AS-i/IO-Link) • Reversing contactor: space-saving mechanical interlock for S00 and S0
Dimensioning and design	• Performance increase: S00 (7.5 kW, 16 A), S0 (18.5 kW, 38 A), S2 (37 kW, 80 A) • Width: 45 mm (S00 and S0), 55 mm (S2) • Integrated auxiliary contacts • Identical auxiliary switch blocks for all sizes • Screw-type connection system, spring-loaded connection system (with S2 only in the control circuit), ring cable lug connection system (S00 and S0 only), solder pin connection system (S00 only)

Area	Customer benefits
Mounting advantages	• Contactor assemblies (for star-delta (wye-delta) start, reversing contactor assembly, 2 contactors in series) • Contactor assembly for star-delta (wye-delta) start: – up to 55 kW – Control circuit wiring integrated in function modules, incl. electrical and mechanical interlock – Mechanical interlock (optionally available with S2) • Easy assembly of contactor assemblies and feeders by means of link modules for screw-type and spring-loaded terminals • Integrated cable duct for feeder-oriented assembly (with S0 and S2)
Application areas/customer benefits	• Easy connection of feeders to the automation level via AS-Interface or IO-Link • Power increase up to 18.5 kW in 45 mm width, and 37 kW in 55 mm width • Safety applications: Motor starter protectors in combination with – Undervoltage release and contactor usable in PL d/SIL 2 – Star-delta (wye-delta) starter usable in PL e/SIL 3 • Comprehensive approvals for global applicability

Reference

More information ...	Is available in ...
about SIRIUS 3RT2 contactors	the chapter "SIRIUS 3RT2, 3RH2, 3RA23/3RA24 contactors/contactor assemblies (Page 111)".

Fitting of auxiliary switches on 3RT2 contactors (size S00 and S0)



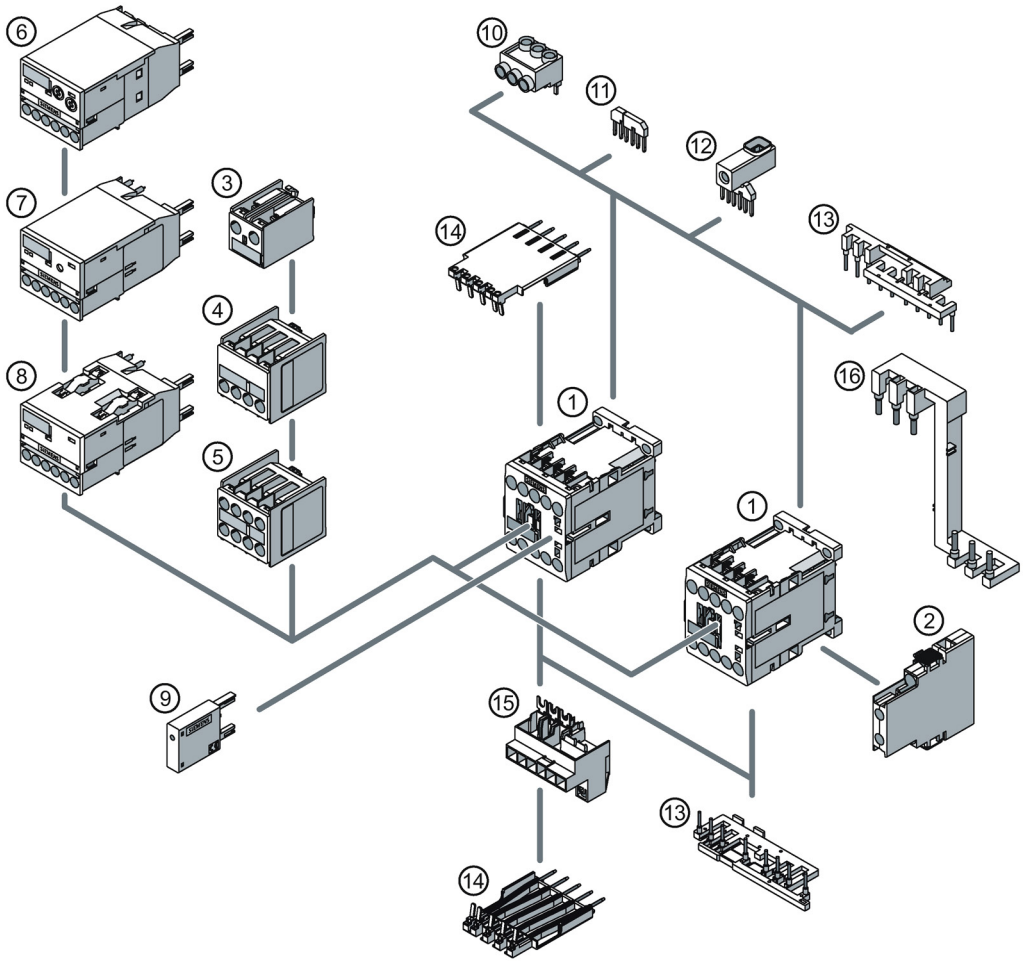
1 Contactor size S00
2 Contactor size S0
3 Laterally mountable auxiliary switch block (right or left), 2-pole
4 Auxiliary switch block for snapping onto the front, 4-pole
5 Auxiliary switch block for snapping onto the front, 2-pole (cable entry from above)
6 Auxiliary switch block for snapping onto the front, 2-pole (cable entry from below)
7 Auxiliary switch block for snapping onto the front, 1-pole (cable entry from above or below)
8 Function module for AS-Interface, direct-on-line start
9 3RA28 function modules
10 Function module for IO-Link, direct-on-line start

Figure 1-12 Fitting of auxiliary switches on 3RT2 contactors (size S00 and S0)

Note

Combining 2-pole auxiliary switches for mounting on the front with a lateral auxiliary switch is not permitted.

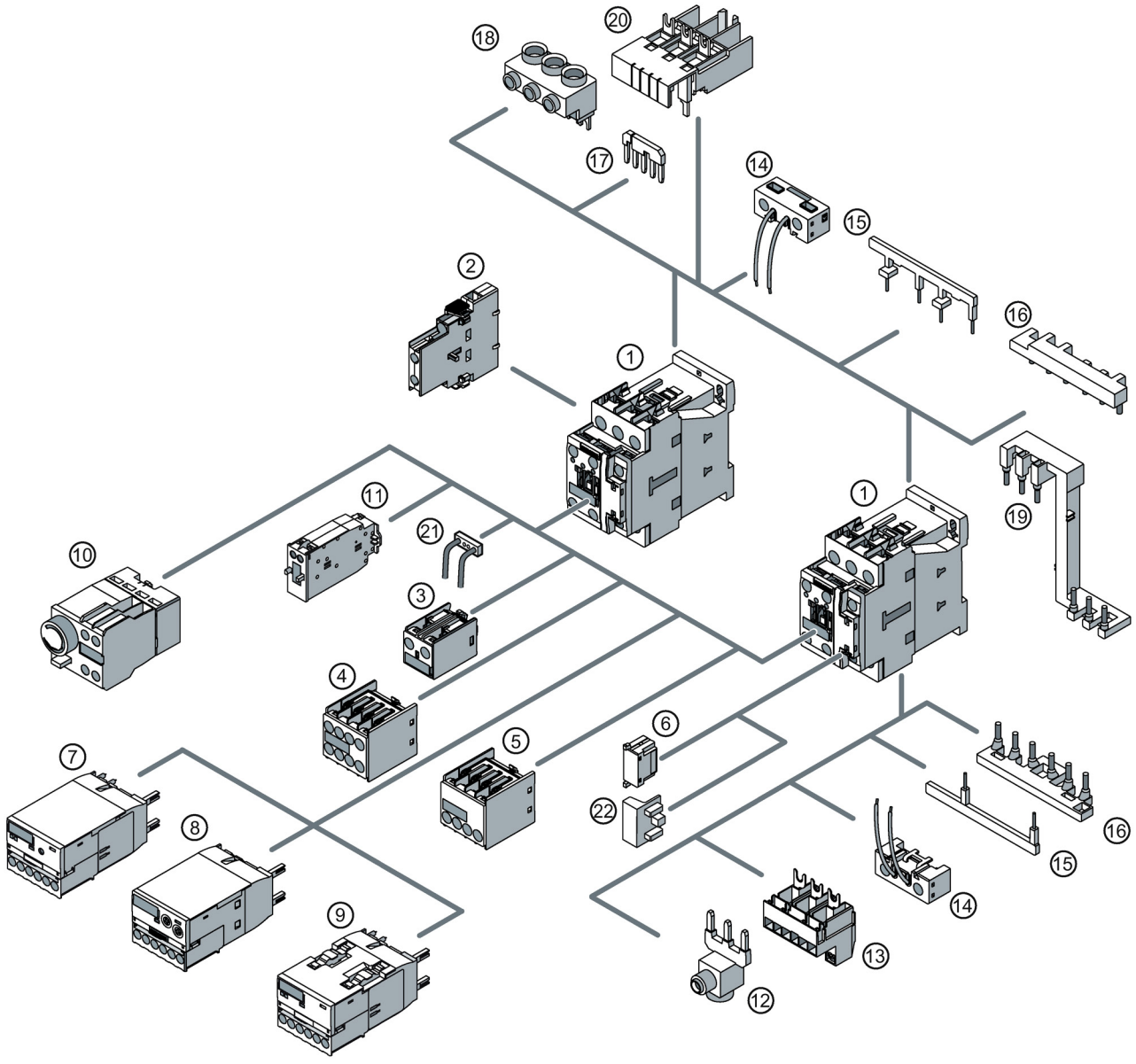
Size-specific accessories for 3RT2 contactors (size S00)



1 Contactor size S00
2 Laterally mountable auxiliary switch block (right or left), 2-pole
3 Auxiliary switch block for snapping onto the front, 1-pole (cable entry from above or below)
4 Auxiliary switch block for snapping onto the front, 2-pole (cable entry from above or below)
5 Auxiliary switch block for snapping onto the front, 4-pole
6 3RA28 function modules
7 Function module for AS-Interface, direct-on-line start
8 Function module for IO-Link, direct-on-line start
9 Surge suppressor
10 3-phase infeed terminal
11 Star jumper, 3-pole, without connection terminal
12 Parallel switching connector, 3-pole or 4-pole, with connection terminal
13 Wiring modules on the top and bottom, for connecting the main and control current paths
14 Solder pin adapter
15 Terminal module (adapter) for contactors with screw connections
16 Safety main circuit connectors for 2 contactors

Figure 1-13 Size-specific accessories for 3RT2 contactors (size S00)

Size-specific accessories for contactors (size S0)



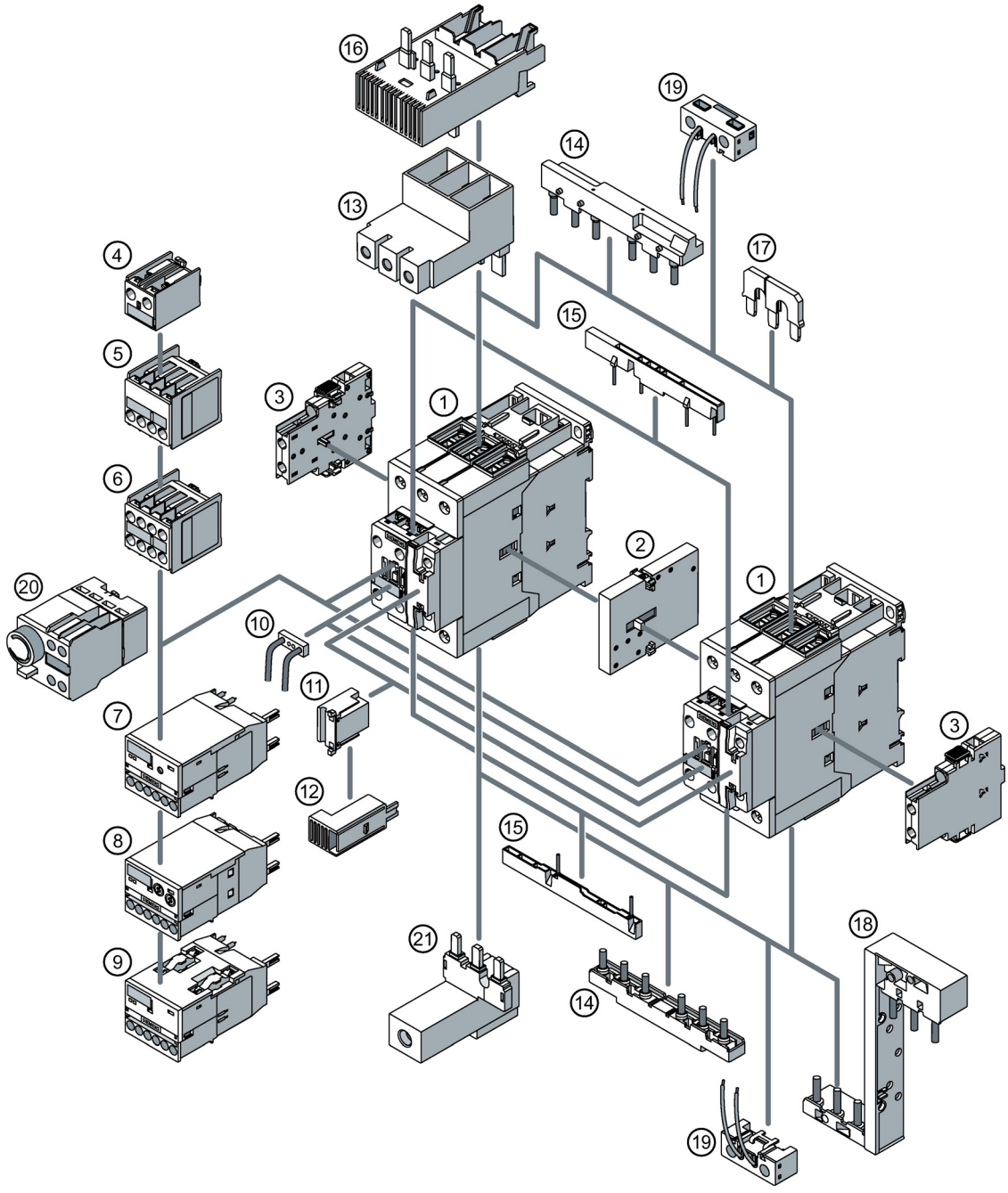
1 Contactor size S0
2 Laterally mountable auxiliary switch block (right or left), 2-pole
3 Auxiliary switch block for snapping onto the front, 1-pole (cable entry from above or below)
4 Auxiliary switch block for snapping onto the front, 4-pole
5 Auxiliary switch block for snapping onto the front, 2-pole (cable entry from above or below)
6 Surge suppressor
7 Function module for AS-Interface, direct-on-line start
8 3RA28 function modules
9 Function module for IO-Link, direct-on-line start
10 Pneumatic delay block
11 Mechanical latch

12 Parallel switching connector
13 Terminal module (adapter) for contactors with screw connections
14 Coil terminal module, top and bottom
15 Wiring modules, top and bottom, for connecting the control current paths
16 Wiring modules, top and bottom, for connecting the main current paths
17 Star jumper, 3-pole, without connection terminal
18 3-phase infeed terminal
19 Link module for two contactors in series (safety main circuit connectors for two contactors)
20 Link module for motor starter protector
21 LED display indicator module
22 Control kit for manual operation of contactor contacts

Figure 1-14 Size-specific accessories for 3RT2 contactors (size S0)

1.7.1.2 Size-specific accessories for SIRIUS 3RT2 contactors (S2)

Contactor accessories (size S2)



1 Contactor size S2
2 Mechanical interlock
3 Laterally mountable auxiliary switch block (right or left), 2-pole
4 Auxiliary switch block for snapping onto the front, 1-pole (cable entry from above or below)

5 Auxiliary switch block for snapping onto the front, 2-pole (cable entry from above or below)
6 Auxiliary switch block for snapping onto the front, 4-pole
7 Function module for AS-Interface, direct-on-line start
8 3RA28 function modules
9 Function module for IO-Link, direct-on-line start
10 LED display indicator module
11 Surge suppressor
12 Control kit for manual operation of contactor contacts
13 3-phase infeed terminal (type E)
14 Wiring modules, top and bottom, for connecting the main current paths
15 Wiring modules, top and bottom, for connecting the control current paths
16 Link module for motor starter protector
17 Star jumper, 3-pole, without connection terminal
18 Link module for two contactors in series (safety main circuit connectors for two contactors)
19 Coil terminal module, top and bottom
20 Pneumatically delayed auxiliary switch (available from mid 2015)
21 Parallel switching connector

Figure 1-15 Accessories for 3RT2 contactors (size S2)

1.7.1.3 SIRIUS 3RF34 solid-state switching devices

3RF34 solid-state switching devices

Figure 1-16 Solid-state switching device

SIRIUS 3RF34 solid-state switching devices feature a heat sink integrated in the insulated enclosure, so no grounding is required.

Table 1- 10 3RF34 solid-state switching devices

Area	Customer benefits
Functions	• Instantaneous switching solid-state contactors for motor switching • Direct-on-line and reversing contactor (integrated electric interlock).
Dimensioning and design	• S0 (0.5 to 16 A) • Width 45 mm (2.2 kW/5.4 A) or 90 mm (7.5 kW/16 A) • 24 V DC and 110 to 230 V AC • Rated voltage up to 600 V • Insulated enclosure • Optimized sizing and few power versions up to 7.5 kW • Screw-type and spring-loaded terminals
Mounting advantages	• Combination with protection devices and monitoring devices • Side-by-side assembly possible • Easy connection to the motor starter protector by means of link module • Connection option for solid-state overload relay or current monitoring relay • Removable terminals for auxiliary circuit wiring
Application areas/customer benefits	• Wear- and noise-free operation for frequent motor switching • Long service life (over 100 million operating cycles) • Comprehensive approvals for global applicability

Reference

More information ...	Is available in ...
about SIRIUS 3RF34 solid-state switching devices	the chapter "SIRIUS 3RF34 solid-state switching devices (Page 127)".

1.7.1.4 SIRIUS 3RW30/40 soft starters

3RW30/40 soft starters

Figure 1-17 S0 soft starter

The SIRIUS 3RW30 soft starters for standard applications in 200 to 480 V systems (3RW40: 200 to 600 V) provide basic functionalities at cost-optimized prices:

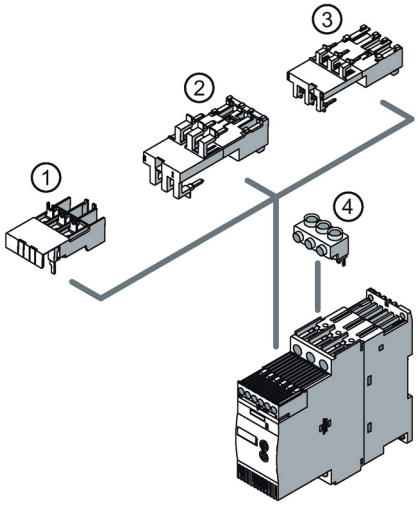
Table 1- 11 3RW30/40 soft starters

Area	Customer benefits
Functions	• Soft starting for simple startup conditions • Integrated bypass contact system • Integrated protection functions for motor starter and soft starter (3RW40) • Two-phase "polarity balancing" control method (consistently up to 250 kW) • Thermistor motor protection (optional with 3RW40) • Settable current limiting (3RW40)
Dimensioning and design	• Performance increase of 2 performance classes in smaller sizes: – S00 up to 17.6 A – S0 up to 38 A – S2 up to 72 A • Sizes S00 / S0: 45 mm width (18.5 kW / 38 A) • Size S2: 55 mm width (37 kW / 72 A) • Screw-type and spring-loaded terminals
Mounting advantages	• Easy commissioning and maintenance • Matched with the SIRIUS modular system • Easy retrofitting with wiring already installed • Parameterizable output (3RW40)
Application areas/customer benefits	• Considerable power savings through integrated bypass contact system • Adjustable tripping classes (3RW40) • Integrated diagnostics functions (3RW40) • Comprehensive approvals for global applicability, also ATEX (3RW40)

Reference

More information ...	Is available in...
about SIRIUS 3RW30/40 soft starters	the chapter "SIRIUS 3RW30/3RW40 soft starters (Page 137)".

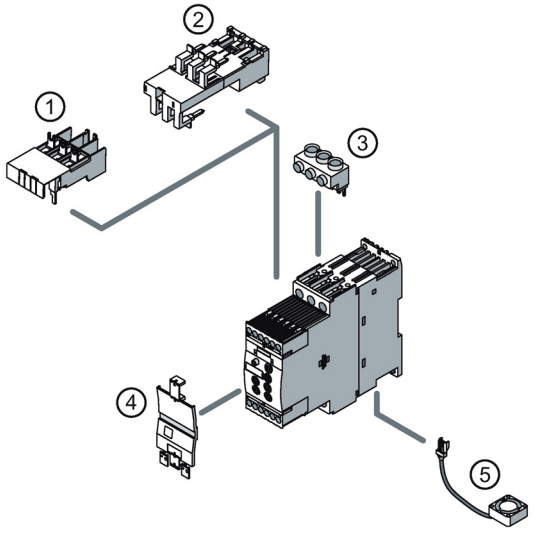
Accessories for 3RW30 soft starters



1 Link module to motor starter protector with screw-type terminals
2 Link module to motor starter protector with spring-loaded terminals (size S0)
3 Link module to motor starter protector with spring-loaded terminals (size S00)
4 Infeed terminal (sizes S00 and S0)

Figure 1-18 Accessories for 3RW30 soft starters

Accessories for 3RW40 soft starters



1 Link module to motor starter protector with screw-type terminals
2 Link module to motor starter protector with spring-loaded terminals
3 Infeed terminal
4 Sealing cover
5 Fan for increased switching frequency

Figure 1-19 Accessories for 3RW40 soft starters

1.7.2 Protecting

1.7.2.1 SIRIUS 3RV2 motor starter protectors

3RV2 motor starter protectors

Figure 1-20 Motor starter protector S0

SIRIUS 3RV2 motor starter protectors can be combined with other SIRIUS devices easily and flexibly, while also saving on space and wiring:

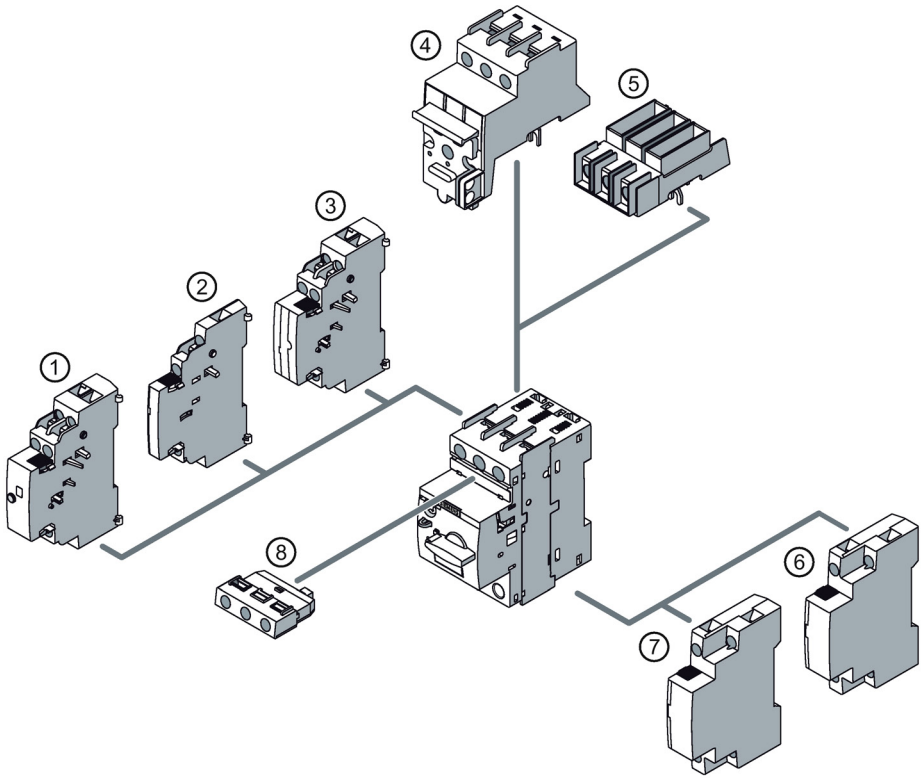
Table 1- 12 3RV2 motor starter protectors

Area	Customer benefits
Functions	• Short-circuit protection, overload protection, switching (manual), isolation • Fuseless • Motor protection, starter protection, system protection, and transformer protection
Dimensioning and design	• S00 and S0 (up to 40 A in a width of only 45 mm) • S2 (up to 80 A in a width of only 55 mm) • Choice of connection systems: - Screw-type terminals - Spring-loaded terminals (S00 / S0) - Ring cable lugs (S00 / S0)
Mounting advantages	• Can be combined easily and quickly with any SIRIUS switching device • Reduced main circuit wiring through combination with: – SIRIUS infeed system – 3-phase busbar system – Infeed system for 3RA6 compact starters – 8US busbar system
Application areas/customer benefits	• Minimized space requirements • Reduced power consumption • Global applicability thanks to comprehensive approvals

Reference

More information ...	Is available in ...
about SIRIUS 3RV2 motor starter protectors	the chapter "SIRIUS 3RV2 motor starter protectors (Page 151)".

Accessories for 3RV2 motor starter protectors

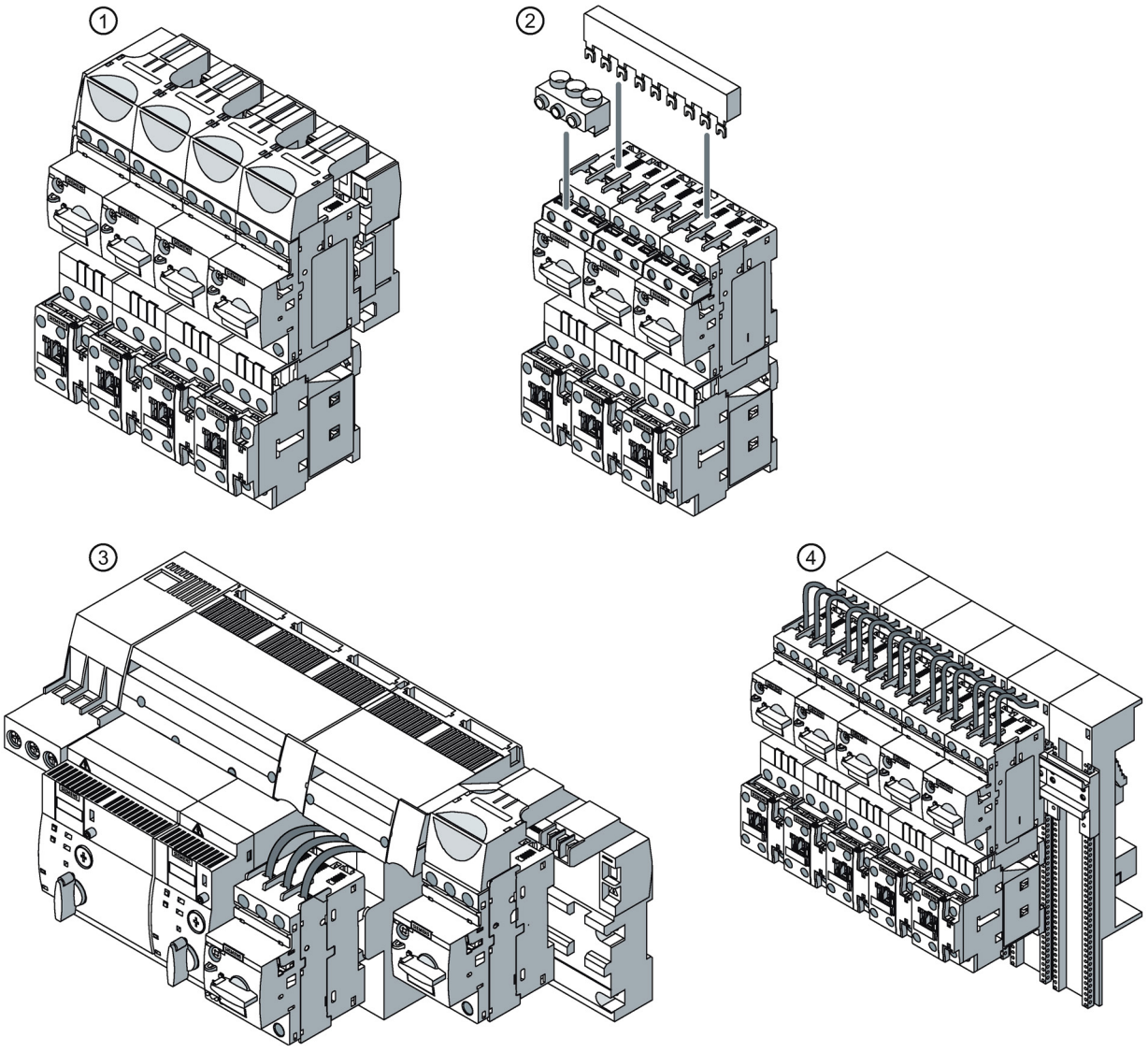


1 Signaling switch
2 Lateral auxiliary switch with 2 contacts
3 Lateral auxiliary switch with 4 contacts
4 Disconnector module
5 Terminal block type E
6 Undervoltage release
7 Shunt release
8 Transverse auxiliary switch

Figure 1-21 Accessories for 3RV2 motor starter protectors

Infeed systems

The SIRIUS modular system has the right infeed for every requirement.

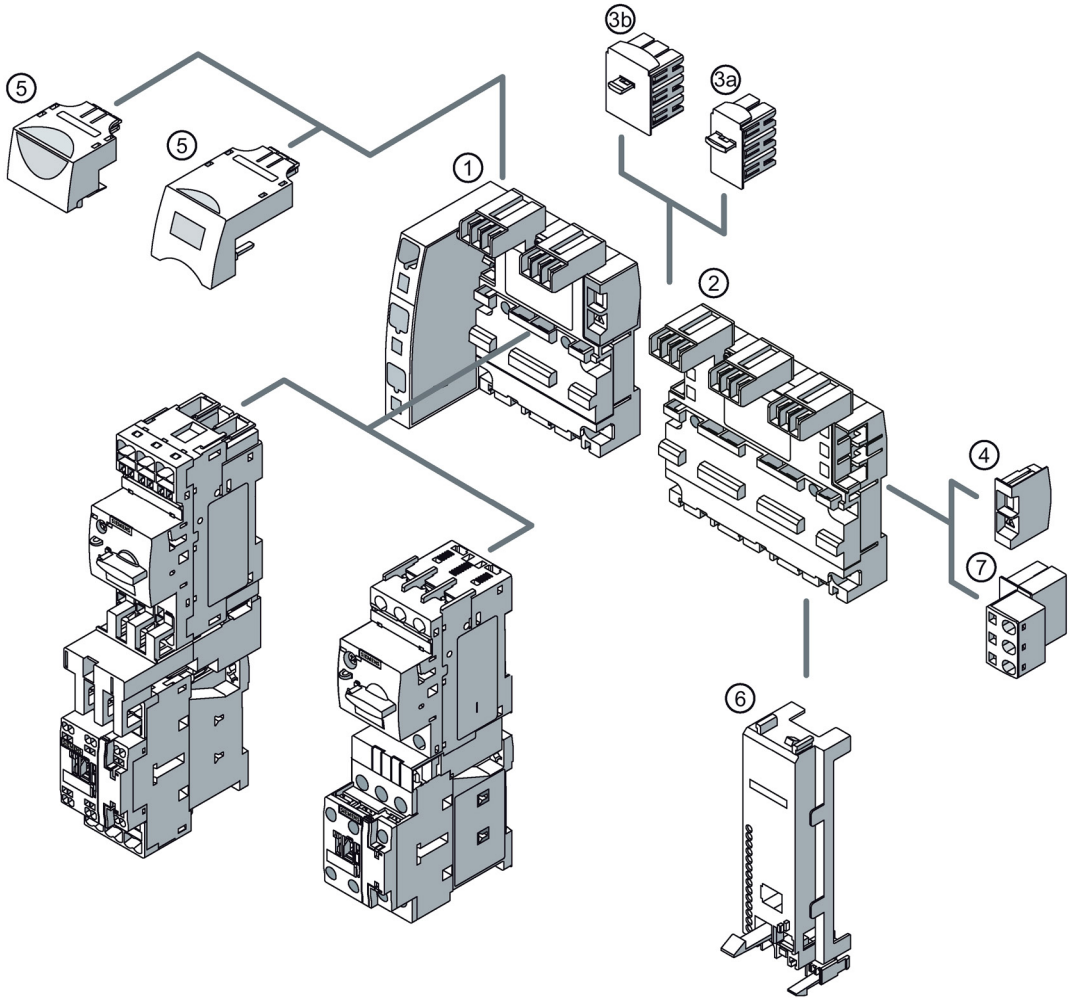


1 SIRIUS infeed system (3RV2917)
2 3-phase busbar system (3RV1915)
3 Combination of 3RA68 infeed system for compact starter and 3RV2917 infeed system for motor starter protector
4 Busbar system (8US)

Figure 1-22 Infeed systems

1.7.2.2 SIRIUS 3RV2917 infeed system

3RV2917 infeed system



1 3-phase busbar with infeed
2 3-phase busbar for system expansion
3 Expansion plug
4 End cap
5 Connector
6 Contactor base
7 Outgoing terminal

Figure 1-23 3RV2917 infeed system

1.7.2.3 SIRIUS 3RU2/3RB3 overload relays

3RU2/3RB3 overload relays

Figure 1-24 S0 overload relay

The thermal and solid-state overload relays are available in the modular system with graded functionality, which reflects their flexible applicability.

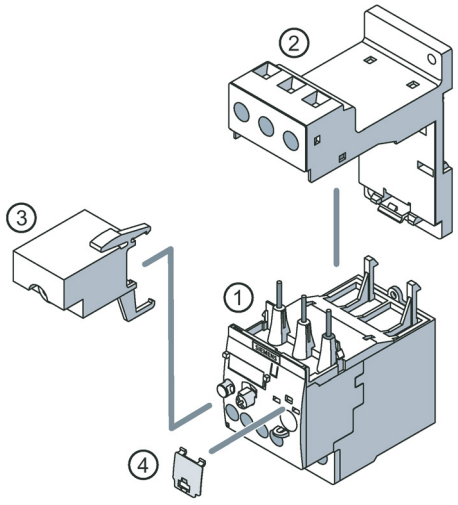
Table 1- 13 3RU2/3RB3 overload relays

Area	Customer benefits
Functions	• Current-dependent motor protection • Modular system: Graded functionality for individual requirements • Integrated temperature compensation • Integrated remote reset with 3RB31
Dimensioning and design	• Performance increase: – S00 (7.5 kW / up to 16 A) – S0 (18.5 kW / up to 40 A) – S2 (37 kW / up to 80 A) • Width: – 45 mm (40 A) – 55 mm (80 A) • Large wide setting range of 1:4 with 3RB3 • High long-term stability through special bimetals with 3RU2 • Matched and uniform accessories for thermal and solid-state overload relays • Screw-type, spring-loaded, ring cable lug connection system (only with 3RU2)
Mounting advantages	• Optional direct mounting on contactor or stand-alone assembly • Removable terminals for control circuit wiring (3RB3) • Same stand-alone assembly support for 3RU2 and 3RB3, with screw-type and spring-loaded connection systems
Application areas/customer benefits	• 98% lower power consumption than conventional solutions (3RB3) • Lower power loss compared to predecessor (5 to 10% with 3RU2) • Optimum adjustability to the motor current: overlapping ranges up to 60°C, above that up to 70°C without overlapping • Comprehensive approvals for global applicability (e.g. ATEX)

Reference

More information ...	Is available in ...
about the SIRIUS 3RU2/3RB3 overload relays and the 3RB24 solid-state overload relays for IO-Link	the chapter "SIRIUS 3RU2/3RB3, 3RB24 overload relays (Page 157)".

Accessories for 3RU2 and 3RB30/31 overload relays



1 Overload relay size S0
2 Stand-alone assembly support
3 Electrical remote RESET (3RU2 only)
4 Sealing cover

Figure 1-25 Accessories for 3RU2 and 3RB30/31 overload relays

1.7.3 Monitoring

1.7.3.1 SIRIUS 3RR2 current monitoring relays

3RR2 current monitoring relays

Figure 1-26 S0 current monitoring relays

The SIRIUS 3RR2 current monitoring relays are ideally suited to a range of applications, thanks to the flexible way in which they can be adjusted:

Table 1- 14 3RR2 current monitoring relays

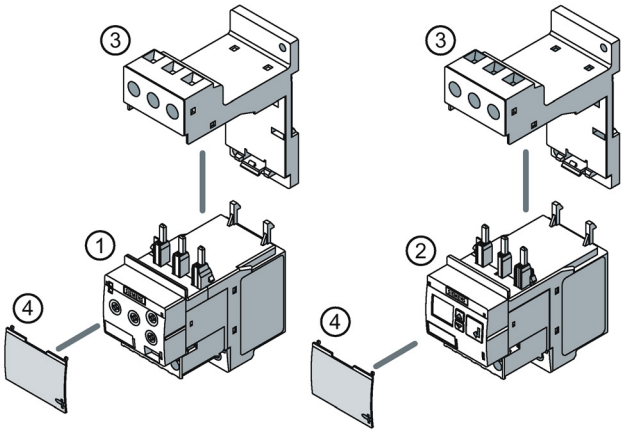
Area	Customer benefits
Functions	• Analog or digital setting • Versions available for IO-Link • Overcurrent and undercurrent monitoring • Phase sequence, phase failure, and fault current monitoring • Apparent or active current monitoring • Freely parameterizable threshold values and delay times • Manual and automatic reset
Dimensioning and design	• S00, S0, S2 (1.6 up to 80 A with only two versions) • 24 V AC/DC, 24 to 240 V AC/DC • 160 to 690 V wide voltage range in the main circuit • Width: – 45 mm (up to 40 A) – 55 mm (up to 80 A) • 1 CO contact and 1 semiconductor output • Clear status signals on the display • Screw-type and spring-loaded terminals

Area	Customer benefits
Mounting advantages	• Removable terminals for auxiliary circuit wiring • Direct mounting on contactor • Same stand-alone mounting support as with overload relays
Application areas/customer benefits	• One device for overload and underload monitoring • Integrated assembly: – Reduced wiring – No separate transformers required – 3-phase current monitoring with further monitoring options • Current monitoring relay for feeder-integrated load monitoring • Detection of fast and substantial, as well as slight and "subtle" changes

Reference

More information ...	Is available in ...
about the SIRIUS 3RR2 current monitoring relays, 3UG4 monitoring relays, 3UG48 / 3RR24 monitoring relays for IO-Link, 3RS1 / 3RS2 temperature monitoring relays, and 3RS14 / 3RS15 temperature monitoring relays for IO-Link	the chapter "SIRIUS 3UG4 / 3RR2, 3RS1 / 3RS2, 3UG48 / 3RR24, 3RS14 / 3RS15 monitoring relays (Page 179)".

Accessories for 3RR2 current monitoring relays



1 3RR21 current monitoring relays
2 3RR22 / 3RR24 current monitoring relays
3 Stand-alone assembly support
4 Sealing cover

Figure 1-27 3RR2 current monitoring relays

1.7.4 Feeders

1.7.4.1 SIRIUS 3RA21/22 load feeders

Load feeders

Figure 1-28 S0 load feeder

The tested load feeders offer switching and protection functions. Thanks to their multiple combination options, they can be easily configured for almost any requirement.

Table 1- 15 Load feeders

Area	Customer benefits
Functions	• Switching and protection functions in one mechanical unit • High short-circuit breaking capacity • Tested combinations (fuseless and fused) • Coordination types 1 and 2 (tested up to 150 kA) • Tested for CLASS 10, 20, 30 • With motor starter protectors or MSPs for starter combinations • With contactor, solid-state contactor, and soft starter • Connection to the automation level via IO-Link and AS-i
Dimensioning and design	• Tested for all common line voltages • S00, S0, S2 (0.06 up to 37 kW) • Pre-assembled SIRIUS 3RA2 feeders with 230 V AC and 24 V DC
Mounting advantages	• Easy mounting of individual components into tested combinations • Direct connection of switching devices • Perfectly matched accessories • Screw-type, spring-loaded, ring cable lug connection systems
Application areas/customer benefits	• Completely pre-assembled load feeders • Comprehensive type tests for load feeders for self-assembly by the customer (approx. 45000 combinations) • Comprehensive approvals for global applicability • Comprehensive dimensioning, planning, and construction support

Accessories for load feeders

The main accessories for 3RV2 motor starter protectors, and those for 3RT2 contactors (such as side-mounted and transverse auxiliary switches, current limiters, undervoltage limiters, rotary operating mechanisms, busbar adapters, etc.) can be used for 3RA21/22 load feeders and feeders for self-assembly.

3RA21/22 pre-assembled load feeders

The 3RA21/22 fuseless load feeders can be ordered as a complete device for direct-on-line starting or reversing operation. Sizes S00 and S0 are both available with either screw-type or spring-loaded connection systems. Size S2 is available with screw-type connection.

Reference

More information ...	Is available in ...
about SIRIUS 3RA21/22 load feeders	the chapter "SIRIUS 3RA21/22 load feeders (Page 193)".

1.7.4.2 SIRIUS 3RA6 compact starters

3RA6 compact starter

Figure 1-29 Compact starter

The SIRIUS 3RA6 compact starter is a compact, highly integrated device which features state-of-the-art controls, including practical diagnostics functions. The compact starter ensures improved efficiency and reliability in the control cabinet.

Table 1- 16 3RA6 compact starters

Area	Customer benefits
Functions	• Direct-on-line starter and reversing starter • Short-circuit protection, electronic overload protection, functional switching, and line protection • Mechanical and electrical interlock with reversing starter • IO-Link and AS-i connection • Manual and automatic reset (remote reset via control)
Dimensioning and design	• S0 (0.1 up to 32 A/15 kW) • Width of 45 mm (direct-on-line starter) or 90 mm (reversing starter) • 5 setting ranges from 0.1 A to 32 A • Weld-free contacts (end-of-service-life indication) • Screw-type and spring-loaded connection systems with removable terminals in the main and auxiliary circuits
Mounting advantages	• SIRIUS 3RA68 infeed system for simpler, space-saving installation • Connection of cables up to 70 mm² • Coding and locking options in the 3RA6 compact starter • Screw-type and spring-loaded terminals • Removable terminals for easy and quick replacement if service is required (permanent wiring) • Optional control kit for testing the main current path
Application areas/customer benefits	• Integrated diagnostics functions • Large wide voltage ranges and wide setting ranges • Three different power infeed options • Comprehensive approvals for global applicability • Fast and standardized configuration thanks to full integration in STEP 7

Versions

The 3RA6 compact starter is available in the following versions:

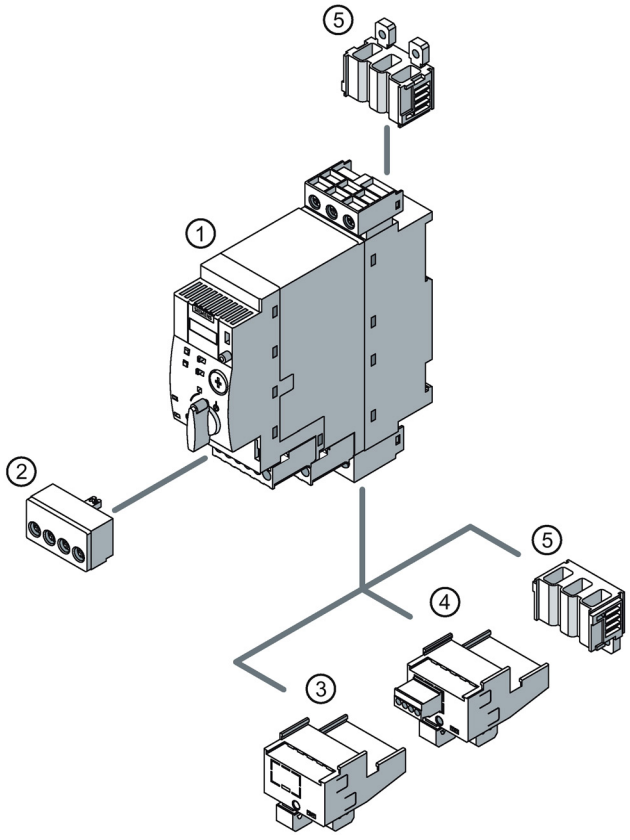
Table 1- 17 3RA6 compact starter versions

Version	Image
Compact starter direct-on-line version	
Compact starter reversing version	
Compact starter direct-on-line, IO-Link version	
Compact starter reversing, IO-Link version	

Reference

More information ...	Is available in ...
About the 3RA6 compact starter	the chapter "SIRIUS 3RA6 compact starters (Page 201)".

Accessories for 3RA6 compact starters

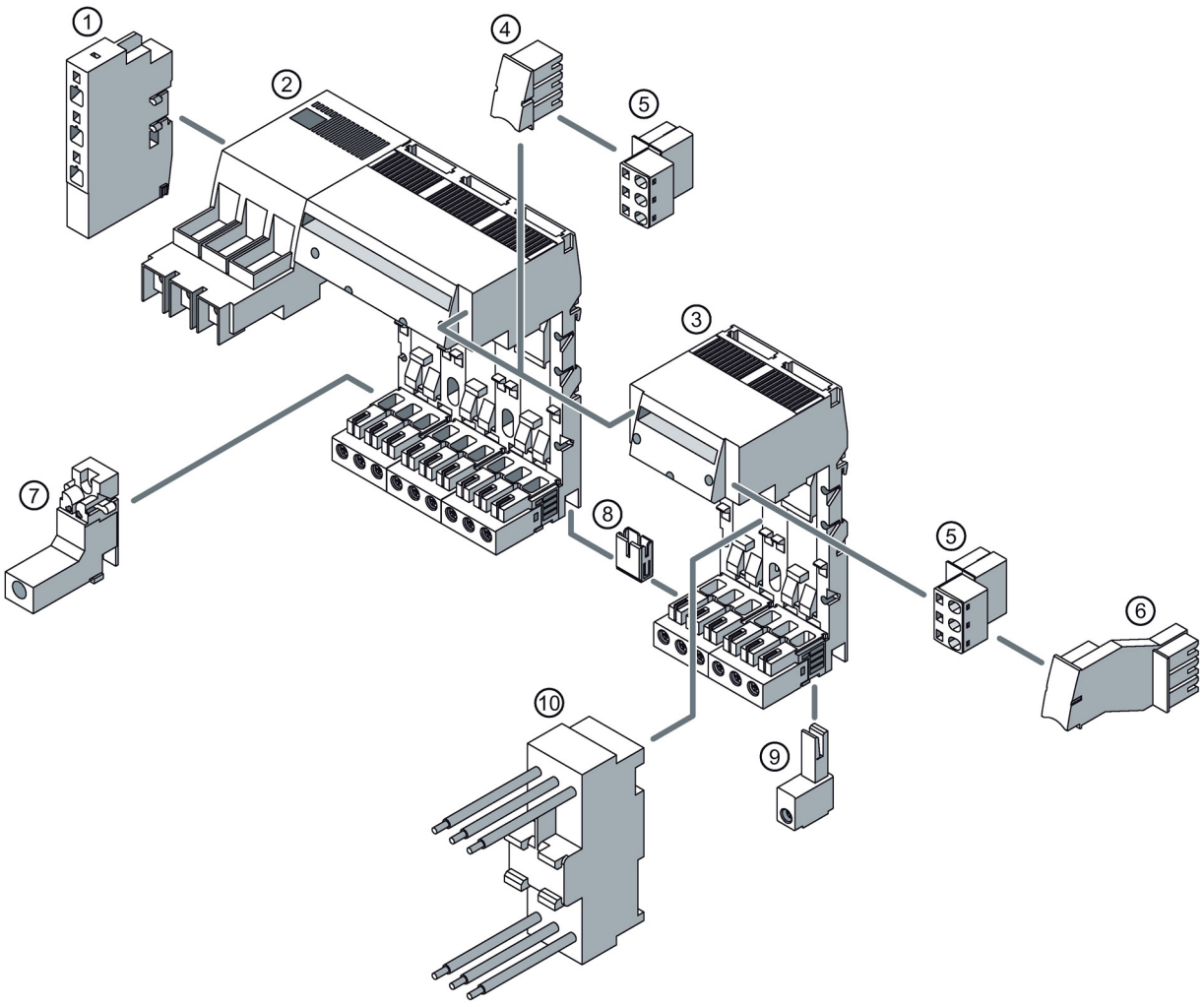


1 3RA6 compact starter
2 External auxiliary switch block
3 AS-i add-on module
4 AS-i add-on module with:
- Two local inputs for safe disconnection
- Two additional digital inputs
- One additional digital input and one digital output
- Two additional digital outputs
- For on-site control

5 Adapter for screw mounting

Figure 1-30 Accessories for 3RA6 compact starters

Infeed system for 3RA6 compact starter



1 Infeed on left or right using spring-loaded connection system
2 Infeed on left using screw-type connection system
3 Expansion module
4 Expansion plug
5 Terminal block
6 Expansion plug for 3RV19
7 PE infeed
8 PE expansion plug
9 PE tap
10 45 mm adapter for infeed system for 3RA6

Figure 1-31 Infeed system for 3RA6 compact starter

1.7.5 Function modules

Figure 1-32 Function modules

Function modules are used to perform various control jobs on automatic production lines and for processing machines. They are suited to all time-delayed switching operations in control, starting, protection, and regulation circuits, and ensure a high degree of repeat accuracy for delay times, once they have been set.

Function modules are divided into those with a communication connection (AS-Interface or IO-Link) and those without a communication connection.

Communication-capable 3RA27 function modules are available for the following contactors and contactor assemblies:

- For direct-on-line start
- For reversing start
- For star-delta (wye-delta) start

1.7.5.1 SIRIUS 3RA28 function modules for mounting on SIRIUS 3RT2 contactors

3RA28 function modules for mounting on 3RT2 contactors

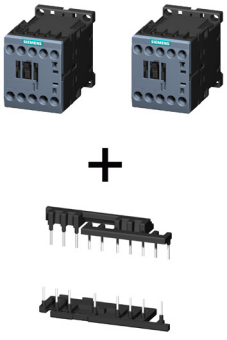
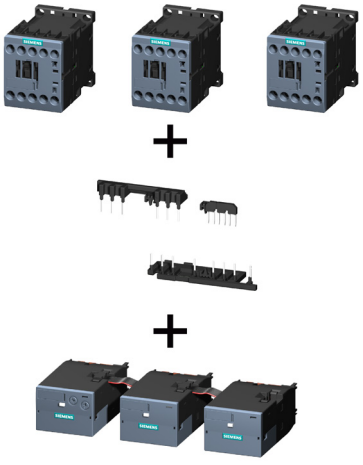
SIRIUS 3RA28 function modules for mounting on SIRIUS 3RT2 contactors enable the control circuit wiring to be reduced significantly. With star-delta (wye-delta) starters, for example, they replace the control circuit wiring in its entirety.

Table 1- 18 3RA28 function modules for mounting on 3RT2 contactors

Area	Customer benefits
Functions	• Direct-on-line, reversing, and star-delta (wye-delta) start • Time-delayed switching of contactors (0.05 to 100 s) • ON-delay and OFF-delay versions • Star-delta (wye-delta) function module without extra control circuit wiring • Switch position indication for the contactor via a mechanical plunger
Dimensioning and design	• Only one version for S00, S0 and S2 • Suitable for control voltages of 24 to 240 V AC/DC • Contactor coil controlled via semiconductor output • Star-delta (wye-delta) switchover 0.5 to 60 s • Star-delta (wye-delta) changeover delay ≥ 50 ms
Mounting advantages	• Easy plug-on assembly of a starter, without tools • Removable terminals • Screw-type and spring-loaded terminals
Application areas/customer benefits	• Assembly of star-delta (wye-delta) starters, including timing function and electrical interlock, without additional wiring • Universal applicability thanks to wide voltage and time ranges

Assembly

With 3RA28 function modules, a starter can be easily assembled by combining individual modules together or by using pre-assembled combinations.

Type of starter	Individual modules	Pre-assembled combinations
Direct-on-line start		
Reversing start		
Star-delta (wye-delta) start		

Reference

More information ...	Is available in ...
About 3RA28 function modules for direct-on-line start and star-delta (wye-delta) start	the chapter "SIRIUS 3RA28 function modules for mounting on 3RT2 contactors (Page 212)".
About function modules for reversing starting	the chapter "SIRIUS 3RT2, 3RH2, 3RA23/3RA24 contactors/contactor assemblies (Page 111)".

1.7.5.2 SIRIUS 3RA27 function modules for connection to the automation level

3RA27 function modules for connection to the automation level

3RA27 function modules are integrated into the higher-level control system via an IO-Link master or AS-Interface. They facilitate the simple exchange of data with the control.

Communication-capable function modules are mounted on contactors or contactor assemblies with a communication connection from the SIRIUS device family.

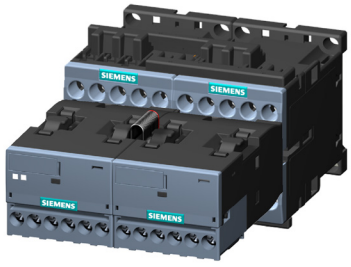
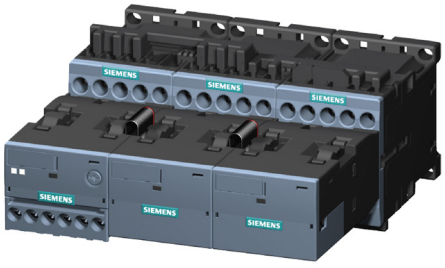
Table 1- 19 3RA27 function modules for connection to the automation level

Area	Customer benefits
Functions	• Connection of direct-on-line, reversing, and star-delta (wye-delta) starters to the automation level • Function modules with IO-Link or AS-i interface • 2- or 3-wire communication to the control • Integrated logic functions for starter types • Replacement of laborious control circuit wiring • Additional diagnostics via IO-Link.
Dimensioning and design	• One module for sizes S00, S0 and S2 • Standard motor starter profile for all starter types • Starter-oriented configuration in the TIA environment • IO-Link: – Up to 4 feeders in one group per channel on the master – Addressing not required • AS-i – One address per feeder – Max. 62 addresses
Mounting advantages	• Just a few cable connections to the control • Considerably minimized wiring complexity within a starter • Also available as pre-assembled contactor assemblies (e.g. star-delta (wye-delta) starters) • No control circuit wiring to the motor starter protector (voltage check) • Available with screw-type and spring-loaded connection systems
Application areas/customer benefits	• Easy and fast connection of a load feeder to the control • Reduced number of I/O channels on the control • Easy and fast configuration • Improved transparency through integrated diagnostics

Assembly

With the 3RA27 function modules, feeder functions are realized with contactors and a connection is established with the control. This connection is realized via IO-Link or AS-i (3RA2712) or via parallel wiring (3RA28).

Table 1- 20 Assembly of 3RA27 function modules

Type of starter	Assembly
Direct-on-line start	
Reversing start	
Star-delta (wye-delta) start	

Reference

More information ...	Is available in ...
about 3RA27 function modules for IO-Link	the chapter "3RA2711 function modules for IO-Link (Page 209)".
about 3RA27 function modules for AS-Interface	the chapter "3RA2712 function modules for AS-Interface (Page 211)".

1.7.6 Device combinations

The flexible designs enable the individual devices to be combined in myriad different ways. More than 45000 combinations have been tested, which offer solutions for almost every application. Over 500 pre-assembled combinations are available, facilitating rapid and fault-free control cabinet assembly.

Device combinations

The combination matrix below shows which devices can be combined for the main circuit:

		Switching and starting			Protecting			Monitoring
		3RT2	3RF34	3RW30/40	3RV2	3RU2	3RB30/31	3RR2
Contactors	3RT2		—	—	x s	x s o	x s	x s
Solid-state switching devices	3RF34	—		—	x	—	x	x
Soft starters	3RW30/40	—	—		x s	—	—	—
Motor starter protectors	3RV2	x s	x	x s		—	—	—
Overload relays	3RU2	x s o	—	—	—			—
	3RB30/31	x s	x	—	—			—
Current monitoring relays	3RR2	x s	x	—	—	—	—	

x Screw-type connection system
s Spring-loaded connection system (size S00 / S0 only)
o Ring cable lug connection system (size S00 / S0 only)
Mechanical connection with link module
Direct mechanical connection

Figure 1-33 Device combinations

Link modules

Link modules can be used to easily assemble feeders from individual devices. The table below shows the different combination options for devices with screw-type and spring-loaded connection systems:

Combination device	3RV2 motor starter protectors	3RT2 contactors; 3RW30, 3RW40 soft starters; 3RF34 solid-state contactors	Link modules	
			3RV2 motor starter protectors with screw-type terminals	3RV2 motor starter protectors with spring-loaded terminals
	Size	Size		
Link modules for connection of switching devices to 3RV2 motor starter protectors [1]				
3RT2 contactors with AC or DC coil	S00	S00	3RA1921-1DA00	3RA2911-2AA00
3RT2 contactors with AC coil	S0	S0	3RA2921-1AA00	3RA2921-2AA00
3RT2 contactors with DC coil	S0	S0	3RA2921-1BA00	3RA2921-2AA00
3RT2 contactors with AC coil or AC / DC coil	S2	S2	3RA2931-1AA00	—
3RW30 soft starters	S00	S00	3RA2921-1BA00	3RA2911-2GA00
3RW30/3RW40 soft starters	S0	S0	3RA2921-1BA00	3RA2921-2GA00
3RW30/3RW40 soft starters	S2	S2	3RA2931-1AA00	—
3RF34 solid-state switching devices	S00	S00	3RA2921-1BA00	—
Hybrid link modules for connection of contactors with a spring-loaded connection system to 3RV2 motor starter protectors with a screw-type connection system [1]				
3RT2 contactors with AC or DC coil	S00	S00	3RA2911-2FA00	—
3RT2 contactors with AC or DC coil	S0	S0	3RA2921-2FA00	—

[1] The link modules and hybrid link modules cannot be used for 3RV2.21-4PA1. and 3RV2.21-4FA1. motor starter protectors or 3RV27 and 3RV28 circuit breakers.

1.8 Mounting and disassembly

Mounting and disassembly

Within each device size, the mounting options are identical.

Table 1- 21 Mounting options

Size	Mounting	Disassembly
S00, S0, S2	Screw mounting	Disassembly with a screwdriver
	Snap-on mounting on 35 mm DIN rail (according to DIN EN 60715)	• Disassembly without tools (size S00 / S0) • Disassembly with a screwdriver (size S2)

1.8.1 Screw mounting

Screw mounting

SIRIUS switching devices can be screwed onto a level surface.

Push-in lugs are required in order to fasten the 3RV2 motor starter protectors with screws.

1.8.2 Snap-on mounting

Snap-on mounting

SIRIUS Innovations in sizes S00, S0 and S2 are snapped onto 35 mm DIN rails according to EN 60 715, without tools.

The tables below describe how to snap a component onto a DIN rail, using a contactor (size S00) as an example. The procedure is the same for all SIRIUS switching devices.

Table 1- 22 Mounting on a DIN rail

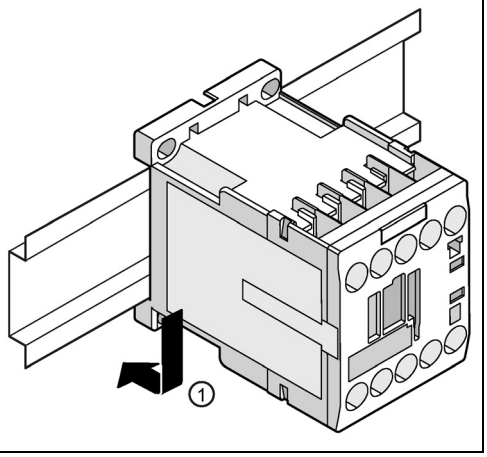
Step	Operating instruction	Image
1	Position the device on the top edge of the DIN rail. Press down until it snaps onto the bottom edge of the DIN rail.	

Table 1- 23 Disassembling from a DIN rail

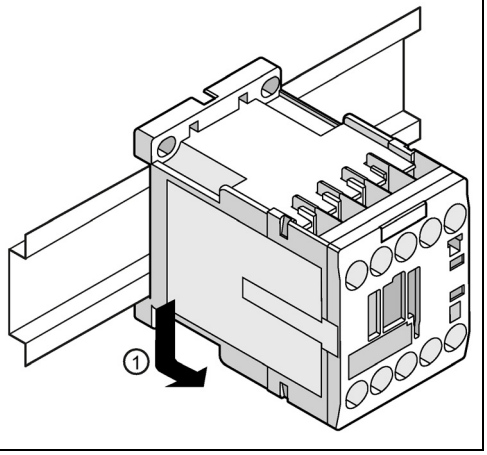
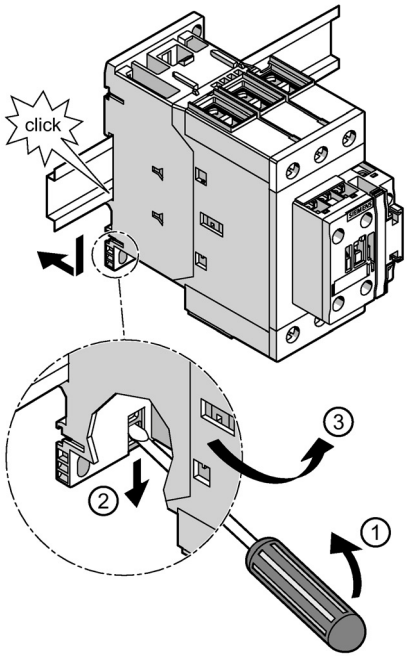
Step	Operating instruction	Image
1	To disassemble the device, press it down, pushing against the mounting springs. Swivel the device to remove it.	

Table 1- 24 Snapping onto / off DIN rail (size S2)

Step	Operating instruction	Image
1 / 2 / 3	Position the device on the top edge of the DIN rail and press down until it snaps onto the bottom edge of the DIN rail. To disassemble, press the locking device down with a screwdriver. (①/②) Then push the device down against the mounting springs, and swivel the device to remove it.③	

Refer to the product manuals or operating instructions for specific details of how to snap the different devices onto DIN rails.

1.9 Connection

1.9.1 Connection systems

1.9.1.1 Screw connection

Screw connection

Within each device size, the terminals are identical. The current which the various devices of a particular size are able to switch is also the same. This means that the same tool, torque, and conductor cross-section is used when working on all SIRIUS Innovations products of the same size. The stripped lengths are identical too; this is important for pre-assembled cables.

Size S00, S0 and S2 devices feature screw-type terminals with captive screws and terminal washers. The screw-type terminals also allow for the connection of 2 conductors with different cross-sections.

DANGER

Hazardous voltage.

Will cause death or serious injury.

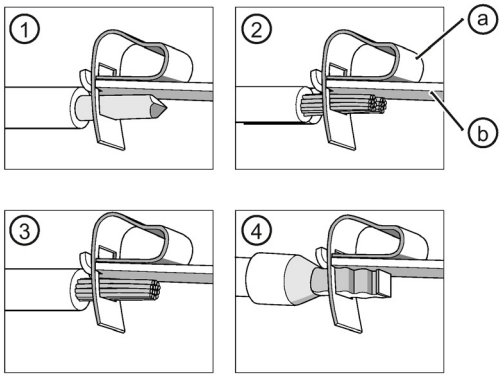
Turn off and lock out all power supplying this device before working on this device.

Use the following tool to establish the connection: The screws are designed for a size PZ 2 Pozidriv screwdriver at rated currents of up to 80 A.

1.9.1.2 Spring-loaded connection

Spring-loaded connection

Spring-loaded connection systems are found consistently on all SIRIUS Innovations products. They make wiring quick and maintenance-free, while also meeting high demands in terms of vibration and shock resistance.



① Solid
② Finely stranded
③ Stranded
④ Finely stranded with end sleeve
a Spring-loaded terminal
b Busbar

Figure 1-34 Spring-loaded terminal

The spring-loaded terminal on the switching devices clamps copper conductors from 0.25 mm^2 (removable terminal) to 10 mm^2 (main circuit terminal, size S0). For more details, see the information about conductor cross-sections in the chapter titled "Conductor cross-sections for spring-loaded connection systems (Page 93)". The conductors can be clamped directly or you can pre-treat them to add a form of splice protection. This could involve attaching end sleeves or pin cable lugs to the ends of the conductors; the tidiest solution is to use conductors whose ends have been sealed by means of ultrasound.

The devices are equipped with a two-wire connection, i.e. two independent connections per current path. Just one conductor is connected to each clamping point. The spring-loaded terminal presses the conductor against the busbar, which curves around inside the terminal. The high contact pressure per unit area achieved in this way is gas-tight. The spring-loaded terminal presses flat against the conductor, but does not damage it. The spring force of the spring-loaded terminal has been dimensioned such that the clamping force adjusts to the conductor diameter automatically. This ensures that any conductor deformation caused by settling, creepage, or yielding is compensated for. The clamping point cannot become loose of its own accord. This connection is vibration- and shock-proof. Vibrations or shocks will not damage the conductor, nor will they cause contact separation. These terminals are particularly well suited for use with machines and systems which are subject to stresses such as these, e.g. vibrators, rail vehicles, and elevators.

The contact pressure between the conductor and the busbar is set to an optimum level, so this clamp connection is appropriate for high-voltage applications, as well as for transferring voltages and currents in the mV or mA range within instrumentation and electronic components.

Catalog IC 10 "SIRIUS Industrial Controls" offers a standard screwdriver, which can be used as the operating tool for opening the spring-loaded connections.

The table below describes the procedure for creating a spring-loaded connection:

⚠ DANGER

Hazardous voltage.

Will cause death or serious injury.

Turn off and lock out all power supplying this device before working on this device.

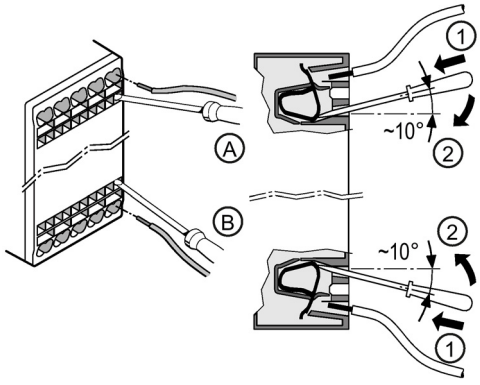
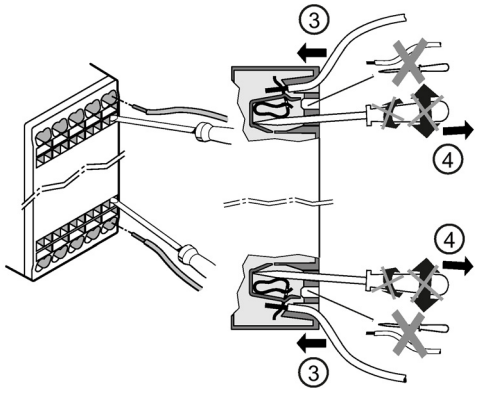
NOTICE

Damage to the spring-loaded terminal!

If you insert the screwdriver into the central opening on the spring-loaded terminal, this could damage the terminal.

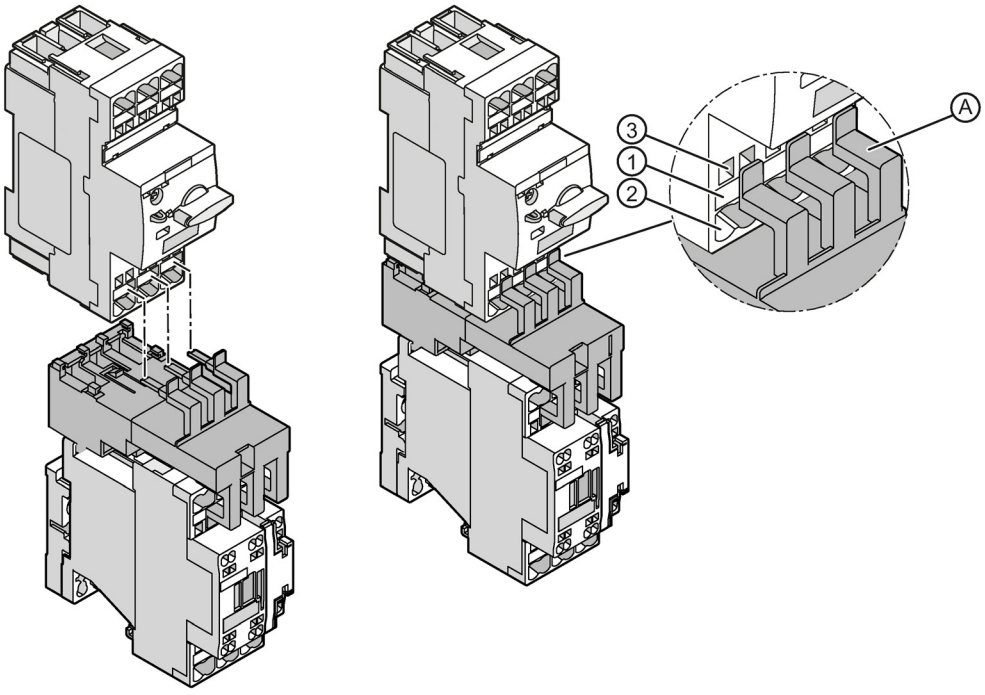
Do not insert the screwdriver into the central opening on the spring-loaded terminal.

Table 1- 25 Connecting the spring-loaded terminal

Step	Operating instruction	Image
1	Insert the screwdriver into the bottommost (A) or topmost (B) operating slot on the right-hand side.	
2	Press the screwdriver down (A) or up (B), then push it into the operating slot as far as it will go. The screwdriver blade keeps the spring-loaded terminal open automatically.	
3	Insert the conductor into the oval connection slot.	
4	Remove the screwdriver. The terminal closes and the conductor is now securely clamped.	

Link modules

Link modules enable load feeders to be assembled without tools, simply by plugging the relevant devices in.



A Link module
① Slot for link modules
② Slot for conductor connection
③ Screwdriver opening for mounting/disassembly without a link module

Figure 1-35 Link module

NOTICE
Damage to the spring-loaded terminal of the link module If a conductor is plugged into the socket for conductor connection when a link module is used, it can be damaged. If a link module is used, do not plug a conductor into the slot for conductor connection.

Insulating stop

With conductor cross-sections which are ≤ 1 mm², you should use an insulating stop to prevent the conductor insulation from being clamped. The insulating stop can be used with the following devices:

Table 1- 26 Overview table - Use of insulating stop for conductor cross-sections ≤ 1 mm² (size S00 / S0)

	Size S00		Size S0	
	Main circuit	Control circuit	Main circuit	Control circuit
3RT2/3RH2 contactors (basic devices)	2	2	—	1
Accessories for 3RT2 contactors (e.g. auxiliary switches)	—	1	—	1
3RF34 solid-state switching devices	—	—	2	—
3RW30 / 40 soft starters	2	0	—	0
3RV2 motor starter protectors (basic devices)	2	1	—	1
Accessories for 3RV2 motor starter protectors (e.g. auxiliary switches)	—	1	—	1
3RU2 thermal overload relays	—	1	—	1
3RB3 solid-state overload relays	—	0	—	0
3RA6 compact starters	—	—	—	0
3RA27/3RA28 function modules	—	0	—	0
3RR2 current monitoring relays	—	0	—	0

0: No insulating stop required

1: Insulating stop 3RT1916-4AJ02

2: Insulating stop 3RT2916-4AJ02

—: Not relevant (e.g. conductor cross-section ≤ 1 mm²) or not available

Table 1- 27 Overview table - Use of insulating stop for conductor cross-sections ≤ 1 mm² (size 2)

	Size S2	
	Main circuit	**Control circuit**
3RT2/3RH2 contactors (basic devices)	—	1
Accessories for 3RT2 contactors (e.g. auxiliary switches)	—	1
3RF34 solid-state switching devices	—	—
3RW30 / 40 soft starters	—	0
3RV2 motor starter protectors (basic devices)	—	1
Accessories for 3RV2 motor starter protectors (e.g. auxiliary switches)	—	1
3RU2 thermal overload relays	—	1
3RB3 solid-state overload relays	—	0
3RA6 compact starters	—	0
3RA27/3RA28 function modules	—	0
3RR2 current monitoring relays	—	0

0: No insulating stop required

1: Insulating stop 3RT1916-4AJ02

—: Not relevant (e.g. conductor cross-section ≤ 1 mm²) or not available

The graphic below shows how the insulating stop is used:

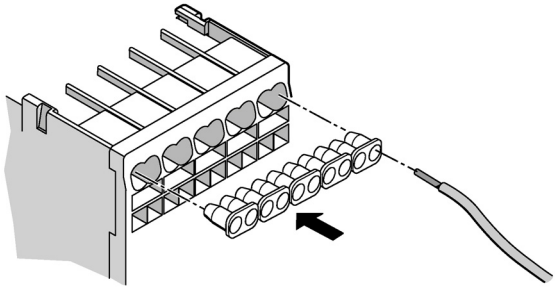


Figure 1-36 Insulating stop on spring-loaded connection system

1.9.1.3 Ring cable lug connection

Ring cable lug connection (sizes S00 and S0)

The ring cable lug connection is equipped with an M3 or M4 combination screw. A special cover ensures finger-safety. See the information on ring cable lugs in the chapter titled "Conductor cross-sections for ring cable lug connection system (Page 95)".

DANGER

Hazardous voltage.

Will cause death or serious injury.

Turn off and lock out all power supplying this device before working on this device.

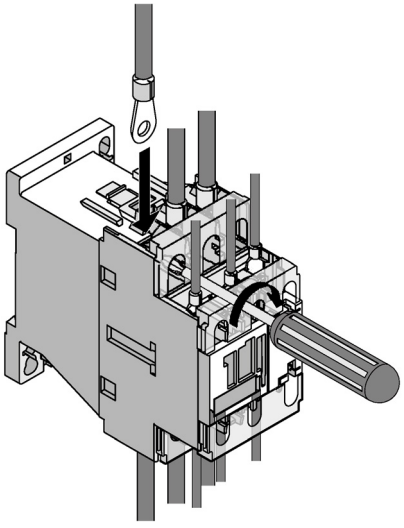


Figure 1-37 Ring cable lug connection system

1.9.2 Conductor cross-sections

Conductor cross-sections

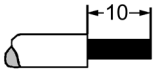
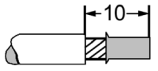
Due to SIRIUS being a modular system, the conductor cross-sections of all the devices of one size are identical.

1.9.2.1 Conductor cross-sections for screw-type connection systems

Conductor cross-sections for screw-type connection systems

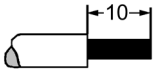
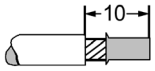
The tables below define the permissible conductor cross-sections for main terminals and auxiliary conductor connections in sizes S00, S0 and S2 for screw-type connection systems.

Table 1- 28 Main conductors of size S00 with M3 combination screws

		Motor starter protectors	Contactors	Overload relays [1], current monitoring relays [1]
Tool		Pozidriv size PZ 2, Ø 5 … 6 mm		
Tightening torque		0.8 to 1.2 Nm		
Solid and stranded			2 x (0.5 ... 1.5) mm²	2 x (0.5 ... 1.5) mm²
		2 x (0.75 ... 2.5) mm²	2 x (0.75 ... 2.5) mm²	2 x (0.75 ... 2.5) mm²
		Max. 2 x 4 mm²	Max. 2 x 4 mm²	Max. 2 x 4 mm²
Finely stranded with end sleeve		2 x (0.5 ... 1.5) mm²	2 x (0.5 ... 1.5) mm²	2 x (0.5 ... 1.5) mm²
		2 x (0.75 ... 2.5) mm²	2 x (0.75 ... 2.5) mm²	2 x (0.75 ... 2.5) mm²
AWG			2 x (20 to 16)	2 x (20 to 16)
		2 x (18 to 14)	2 x (18 to 14)	2 x (18 to 14)
		2 x 12	2 x 12	2 x 12

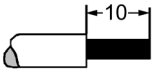
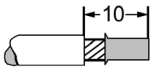
[1] Only 1 conductor can be clamped on the stand-alone assembly support.

Table 1- 29 Main conductors of size S0 with M4 combination screws

		Motor starter protectors	Contactors	Overload relays [1], current monitoring relays [1]
Tool		Pozidriv size PZ 2, Ø 5 … 6 mm		
Tightening torque		2.0 to 2.5 Nm		
Solid and stranded		2 x (1.0 to 2.5) mm²	2 x (1.0 to 2.5) mm²	2 x (1.0 to 2.5) mm²
		2 x (2.5 to 10) mm²	2 x (2.5 to 10) mm²	2 x (2.5 to 10) mm²
Finely stranded with end sleeve		2 x (1 to 2.5) mm²	2 x (1 to 2.5) mm²	2 x (1 to 2.5) mm²
		2 x (2.5 to 6) mm²	2 x (2.5 to 6) mm²	2 x (2.5 to 6) mm²
		Max. 1 x 10 mm²	Max. 1 x 10 mm²	Max. 1 x 10 mm²
AWG		2 x (16 to 12)	2 x (16 to 12)	2 x (16 to 12)
		2 x (14 to 8)	2 x (14 to 8)	2 x (14 to 8)

[1] Only 1 conductor can be clamped on the stand-alone assembly support.

Table 1- 30 Main conductors of size S2 with box terminal

		Motor starter protectors		Contactors	Overload relays [1], current monitoring relays [1]
		3RV2.31-4S/T/B/D/E/P/U/V.1	3RV2.31-4W/X/J/K/R.1. 3RV2431-4VA1. 3RV2.32-...		
Tool		Pozidriv size PZ 2, Ø 5 … 6 mm			
Tightening torque		3.0 ... 4.5 Nm			
Solid and stranded		2 x (1.0 ... 25) mm²	2 x (1.0 ... 35) mm²	2 x (1.0 ... 35) mm²	2 x (1.0 ... 35) mm²
		1 x (1.0 ... 35) mm²	1 x (1.0 ... 50) mm²	2 x (1.0 ... 50) mm²	1 x (1.0 ... 50) mm²
Finely strand-ed with end sleeve		2 x (1.0 ... 16) mm²	2 x (1.0 ... 25) mm²	2 x (1.0 ... 25) mm²	2 x (1.0 ... 25) mm²
		1 x (1.0 ... 25) mm²	1 x (1.0 ... 35) mm²	1 x (1.0 ... 35) mm²	1 x (1.0 ... 35) mm²
AWG		2 x (18 to 3)	2 x (18 to 2)	2 x (18 to 2)	2 x (18 to 2)
		1 x (18 to 2)	1 x (18 to 1)	1 x (18 to 1)	1 x (18 to 1)

[1] Only 1 conductor can be clamped on the stand-alone assembly support.

Table 1- 31 Auxiliary conductors of sizes S00 / S0 / S2 with M3 combination screws

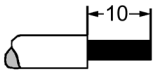
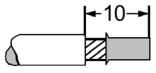
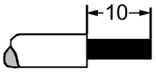
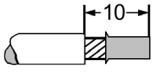
		Accessories for motor starter protectors, accessories for contactors, overload relays	**Contactors, size S00**	**Contactors, sizes S0 and S2**
Tool		Pozidriv size PZ 2, Ø 5 … 6 mm		
Tightening torque		0.8 to 1.2 Nm		
Solid and stranded		2 x (0.5 ... 1.5) mm²	2 x (0.5 ... 1.5) mm²	2 x (0.5 ... 1.5) mm²
		2 x (0.75 ... 2.5) mm²	2 x (0.75 ... 2.5) mm²	2 x (0.75 ... 2.5) mm²
			Max. 2 x 4 mm²	
Finely stranded with end sleeve		2 x (0.5 ... 1.5) mm²	2 x (0.5 ... 1.5) mm²	2 x (0.5 ... 1.5) mm²
		2 x (0.75 ... 2.5) mm²	2 x (0.75 ... 2.5) mm²	2 x (0.75 ... 2.5) mm²
AWG		2 x (20 to 16)	2 x (20 to 16)	2 x (20 to 16)
		2 x (18 to 14)	2 x (18 to 14)	2 x (18 to 14)
			2 x 12	

Table 1- 32 Removable terminal

		Removable terminal
Tool		Pozidriv size PZ 2, Ø 6 mm
Tightening torque		0.8 to 1.2 Nm
Solid and stranded		1 x (0.5 to 4) mm²
		2 x (0.5 to 2.5) mm²
Finely stranded with end sleeve		1 x (0.5 to 2.5) mm²
		2 x (0.5 ... 1.5) mm²
AWG		2 x (20 to 14)

1.9.2.2 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 (sizes S00 and S0) and auxiliary conductor connections (sizes S00, S0 and S2) for spring-loaded connection systems.

Table 1- 33 Main conductors of size S00

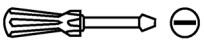
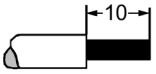
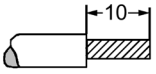
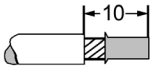
		Motor starter protectors, contactors	Overload relays, current monitoring relays
Tool		Ø 3.0 x 0.5 (3RA2808-1A)	
Solid and stranded		2 x (0.5 to 4.0) mm²	0.5 to 4.0 mm²
Finely stranded without end sleeve		2 x (0.5 to 2.5) mm²	0.5 to 2.5 mm²
Finely stranded with end sleeve (DIN 46 228 Part 1)		2 x (0.5 to 2.5) mm²	0.5 to 2.5 mm²
AWG		2 x (20 to 12)	2 x (20 to 12)

Table 1- 34 Main conductors of size S0

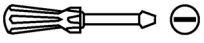
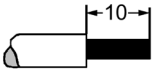
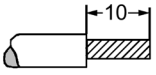
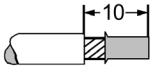
		Motor starter protectors, contactors	Overload relays, current monitoring relays
Tool		Ø 3.0 x 0.5 (3RA2808-1A)	
Solid and stranded		2 x (1.0 to 10) mm²	1.0 to 10 mm²
Finely stranded without end sleeve		2 x (1.0 to 6.0) mm²	1.0 to 6.0 mm²
Finely stranded with end sleeve (DIN 46 228 Part 1)		2 x (1.0 to 6.0) mm²	1.0 to 6.0 mm²
AWG		2 x (18 to 8)	2 x (18 to 8)

Table 1- 35 Auxiliary conductors of size S00/S0/S2

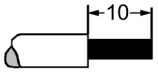
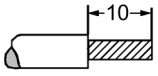
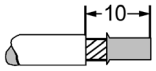
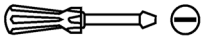
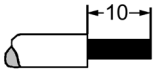
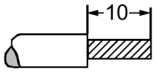
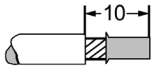
		Contactors, size S00, basic devices	**Contactors, sizes S0 and S2, integrated auxiliary switches, overload relays, accessories for contactors, accessories for motor starter protectors**
Tool		Ø 3.0 x 0.5 (3RA2808-1A)	
Solid and stranded		2 x (0.5 to 4) mm²	2 x (0.5 to 2.5) mm²
Finely stranded without end sleeve		2 x (0.5 to 2.5) mm²	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	2 x (0.5 ... 1.5) mm²
AWG		2 x (20 to 12)	2 x (20 to 14)

Table 1- 36 Removable terminal

		Removable terminal
Tool		Ø 3.0 x 0.5 (3RA2808-1A)
Solid and stranded		2 x (0.25 to 1.5) mm²
Finely stranded without end sleeve		2 x (0.25 to 1.5) mm²
Finely stranded with end sleeve		2 x (0.25 to 1.5) mm²
AWG		2 x (24 to 16)

1.9.2.3 Conductor cross-sections for ring cable lug connection system

Conductor cross-sections for ring cable lug connection system (sizes S00 and S0)

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 1- 37 Main conductors and auxiliary conductors of size S00 with M3 combination screws

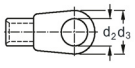
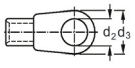
		SIRIUS devices
Tool		Pozidriv size 2, Ø 5 to 6 mm
Tightening torque		0.8 to 1.2 Nm
Ring cable lug [1]		d_2 = min. 3.2 mm d_3 = max. 7.5 mm

Table 1- 38 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.

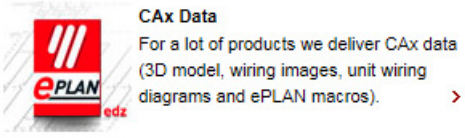
Only use approved ring cable lugs to meet the required clearances and creepage distances.

1.9.3 Image database

Internal circuit diagrams

You can find the internal circuit diagrams for SIRIUS Innovations products online in the image database (https://www.automation.siemens.com/bilddb).

To do so, click "CAx Data".



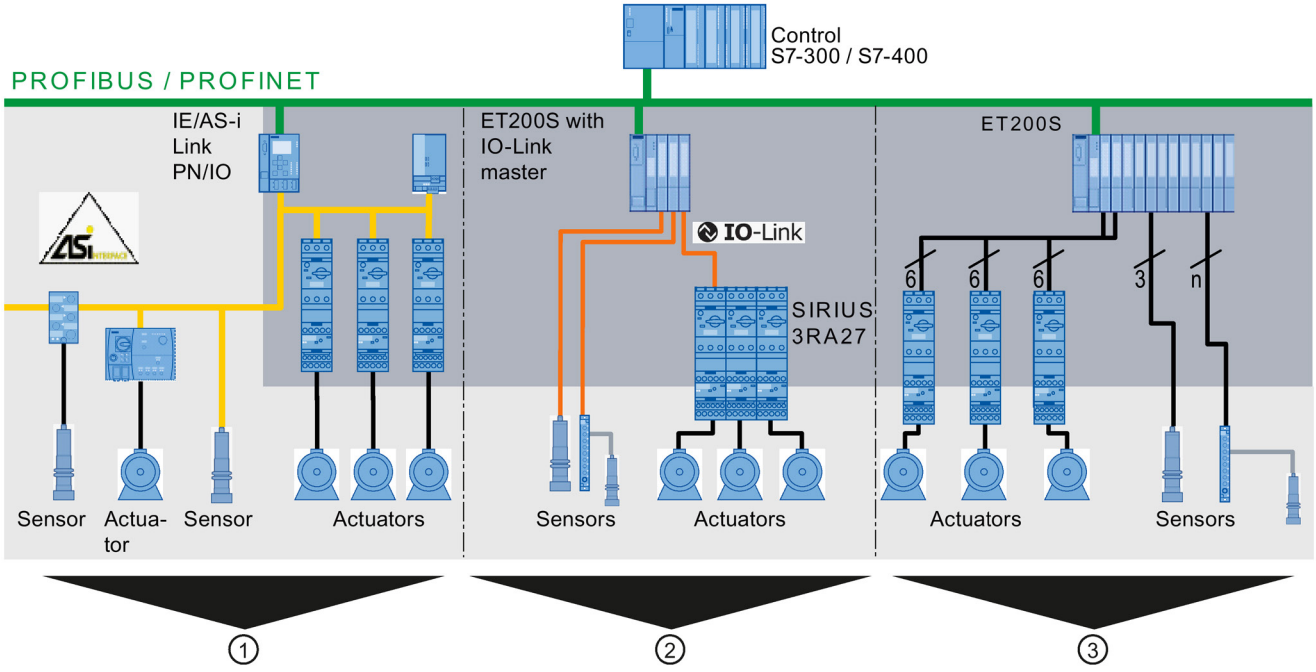
Enter the article number of the device in the "Article number" field, and select "Unit wiring diagram" in the "Motif type" selection menu on the right-hand side. Click "Search motifs".

1.10 Connection to the higher-level control

1.10.1 Connection to the higher-level control

Connection to the higher-level control

The communication-capable SIRIUS Innovations from Siemens provide the user with a uniform automation solution. Automation functions can be implemented consistently, from field devices through to the control cabinet and beyond to human machine interfaces and visualization stations. The concept is based on AS-Interface and PROFIBUS DP, two standardized and open fieldbus systems which can be connected to almost all the control systems provided by well-known manufacturers.



1 Acquisition or connection of distributed I/Os and distributed load feeders.

2 A point-to-point connection is established via IO-Link if a number of signals are grouped together.

3 Classic wiring via digital I/Os is used if the number of signals is manageable.

Figure 1-38 Options for connection to the automation level

In addition to the established fieldbus systems, SIRIUS Innovations also safeguard communication right up to the "final mile" on the actuator side. In a similar way to with PROFIBUS DP and AS-Interface, a user organization made up of a range of renowned manufacturers ensures that control data, status data, and diagnostics data can now be transferred in accordance with a uniform communication standard via IO-Link intelligent wiring, as well as via classic parallel wiring.

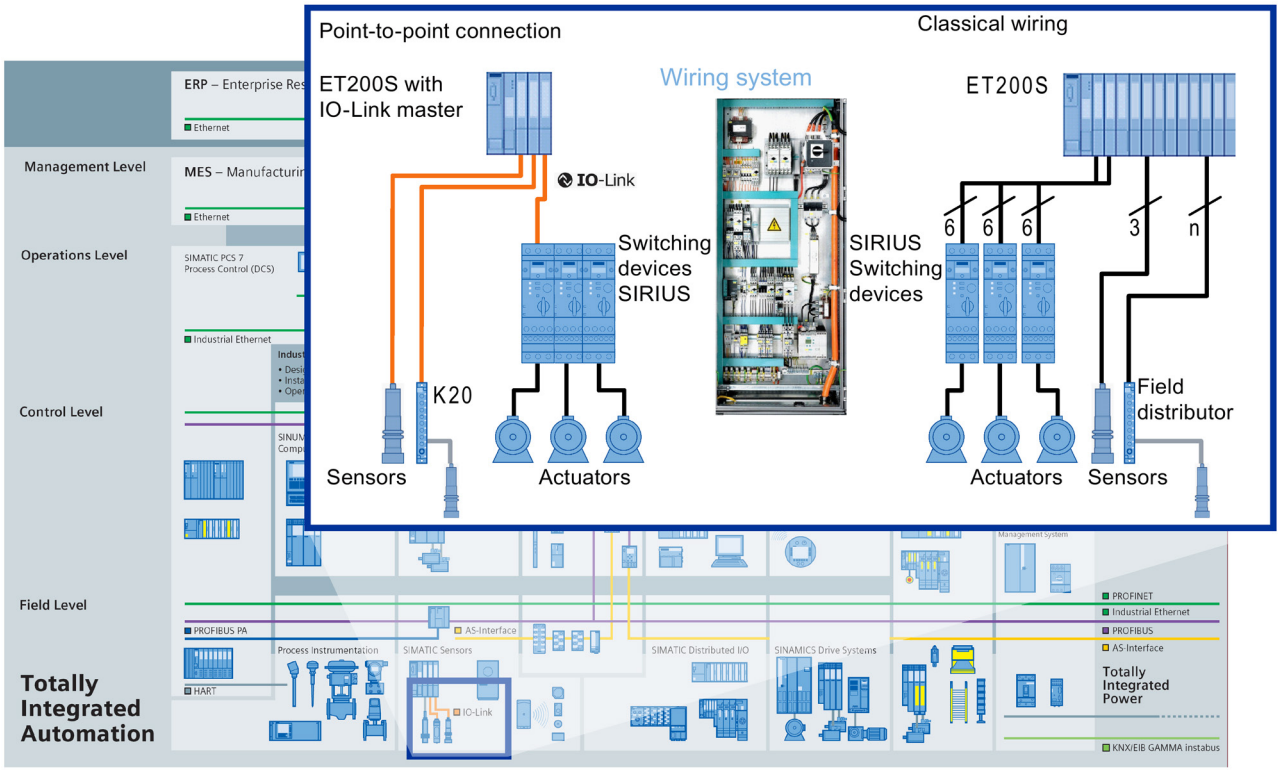


Figure 1-39 Connection to the higher-level control

SIRIUS switching devices can be connected to higher-level control systems using conventional wiring, but also by means of intelligent wiring and a fieldbus:

- IO-Link
- AS-Interface

SIRIUS switching devices are linked into the Siemens Totally Integrated Automation concept via function modules. Totally Integrated Automation offers the user uniformity in terms of configuration, programming, data storage, and communication.

SIRIUS switching devices are connected to the automation level via AS-Interface or IO-Link, without any additional wiring. These interfaces ensure that information about the switch position and the readiness of the feeder for operation is transferred, and that contactor control is implemented. In addition to these three items of information relating to feeders, IO-Link also transfers diagnostics data.

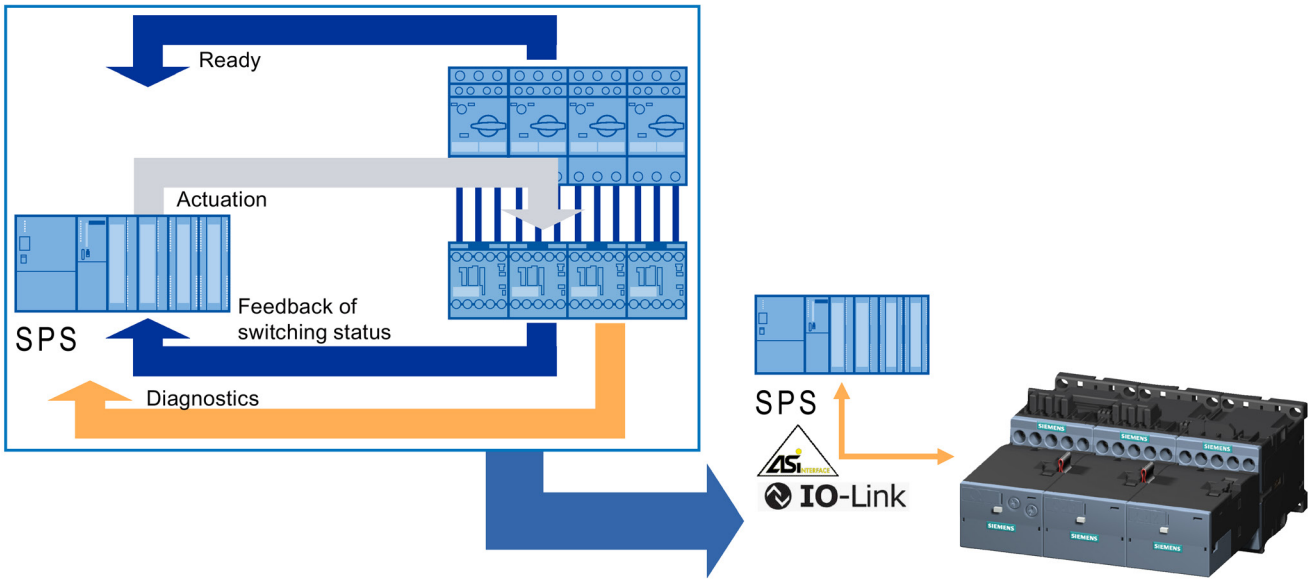


Figure 1-40 Communication via AS-Interface or IO-Link

SIRIUS 3RA27 function modules or SIRIUS 3RA6 compact starters can communicate with a higher-level control either via the AS-i fieldbus or via the IO-Link wiring system. Cyclic data transmission (DIs and DOs) is identical for both IO-Link and AS-i.

Table 1- 39 Motor starter profile

Standard motor starter profile		**Group diagnostics (only with IO-Link)**
• 4 DI, 2 DO (per feeder) • 2 LEDs for "Device" and "Group fault"		• Device fault • No main voltage (motor starter protector tripped) • Auxiliary voltage 24 V DC (U_{aux}) missing • Signaling limit position right/left • Manual/local mode
DI 0.0	Ready	
DI 0.1	Motor ON	
DI 0.2	Group fault	
DI 0.3	Group warning	
DO 0.0	Motor ON or Motor CW	
DO 0.1	Motor CCW	

1.10.2 IO-Link

IO-Link is a new communication standard for sensors and actuators - defined by the PROFIBUS User Organization (PNO). The IO-Link technology is based on a point-to-point connection of the sensors and actuators to the control. Therefore, this technology is not a bus system, but an enhanced version of a classic point-to-point connection. In addition to the cyclic operating data, comprehensive parameters and diagnostics data are transferred for the connected sensors and actuators. The same 3-wire connecting cable as currently used for standard sensors is used.

IO-Link is:

- An open and standardized system for transmitting device-specific data.
- An intelligent wiring system positioned between conventional wiring and fieldbus systems.
- A system which offers advantages in the control cabinet and is integrated in the TIA concept.

IO-Link is thus an intelligent wiring system which is fully integrated in TIA.

1.10.2.1 Overview

Components of an IO-Link system

Only 2 components are required to use IO-Link:

- IO-Link master
- IO-Link device (e.g. IO-Link sensor/switching device, IO-Link I/O module)

Compatibility of IO-Link

IO-Link guarantees compatibility between standard modules and those with IO-Link capability as follows:

- IO-Link sensors/actuators can generally be operated on IO-Link modules (master) and on standard I/O modules.
- Both IO-Link sensors/actuators and current standard sensors/actuators can be used on IO-Link modules (master).
- If conventional components are used in the IO-Link system, naturally only the standard functions are available in this case.

Expansion by means of IO-Link I/O modules

The compatibility of IO-Link means that you can connect standard (conventional) sensors/actuators to it too. This can be implemented especially cost-effectively with IO-Link I/O modules that permit the connection of several sensors/actuators to the controller via one cable.

Analog signals

One further advantage of the IO-Link technology is that analog signals are digitized directly in the IO-Link sensor and are then transmitted digitally via IO-Link communication. This prevents any interference and eliminates the need for cable shielding.

Integration in STEP 7

Integration of the device configuration into the STEP 7 environment ensures:

- Simple and fast engineering.
- Consistent data storage.
- Fast location and clearance of faults.

This raises productivity across all phases of the system lifecycle − configuration, commissioning, and operation. With the Siemens IO-Link solution, even sensors/actuators and switching devices below the fieldbus level are optimally integrated with their complete performance capability in the Totally Integrated Automation (TIA) environment.

1.10.2.2 Benefits

Benefits

The IO-link system offers important benefits when connecting complex (intelligent) sensors/actuators:

- Dynamic modification of the sensor and actuator parameters directly via the PLC.
- Possibility of device replacement during operation without a programming device/PC, by means of re-parameterization via the consistent storage of parameters.
- Fast commissioning due to central data storage.
- Integrated diagnostics information as far as the sensor and actuator levels.
- Uniform and significantly reduced wiring of different sensors/actuators/switching devices.
- Fewer parameterization tools.
- Integrated communication: transmission of process data and service data between sensors/actuators and the control.
- Uniform and transparent configuration and programming by means of a parameterization tool (Port Configurator Tool, PCT) integrated into SIMATIC STEP 7.
- Transparent representation of all parameter and diagnostics data.
- Reduced costs during configuration and commissioning.
- Alarms and indicators for preventive maintenance.

1.10.2.3 Applications

Applications

IO-Link can be used in the following applications:

- Simple connection of complex sensors/actuators with a large number of parameters to the control.
- Optimum replacement of IO-Link modules for sensor/actuator boxes when connecting binary sensors.

In both cases, all diagnostics data is transmitted to the higher-level control via IO-Link. Parameter settings can be changed during operation. A sensor/actuator can be replaced without a programming device/PC thanks to the central data storage feature.

The IO-Link range comprises:

- IO-Link master
- IO-Link module K20
- IO-Link starting controls
- IO-Link switching controls
- IO-Link sensors

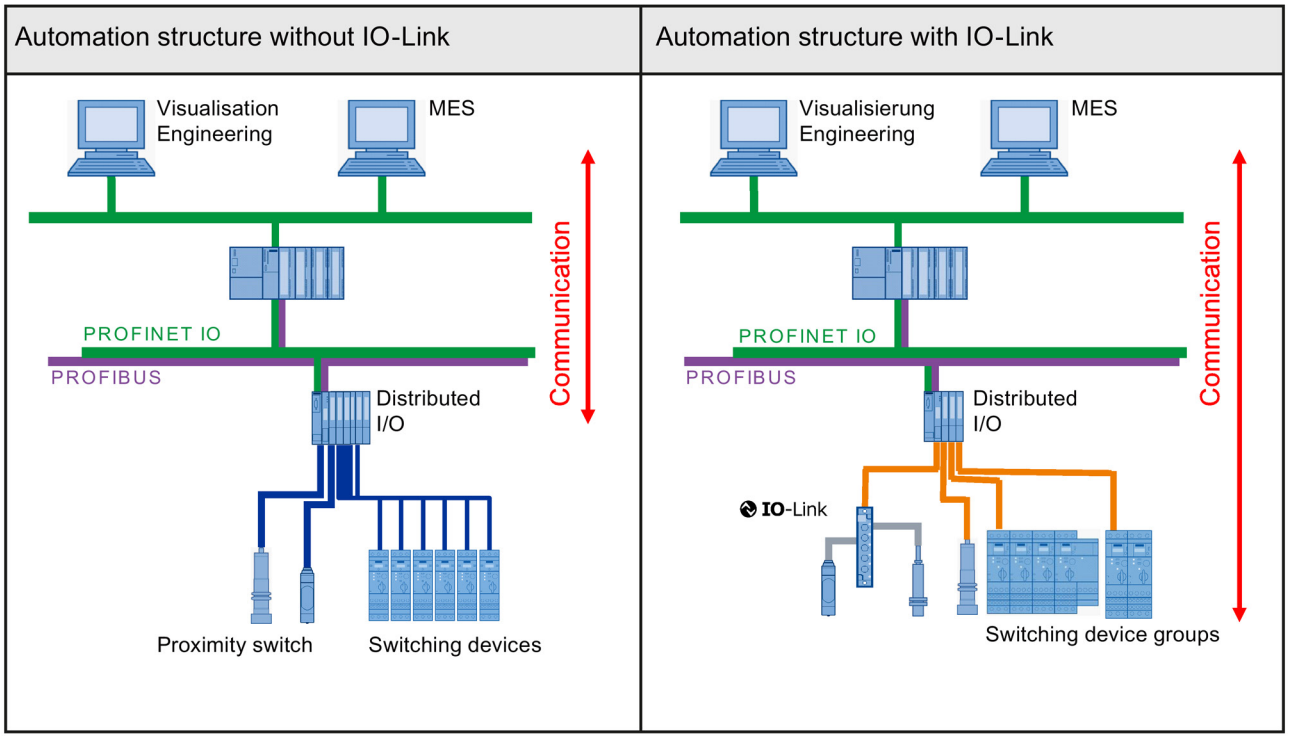


Figure 1-41 Comparison of automation structures with and without IO-Link

SIRIUS 4SI electronic module

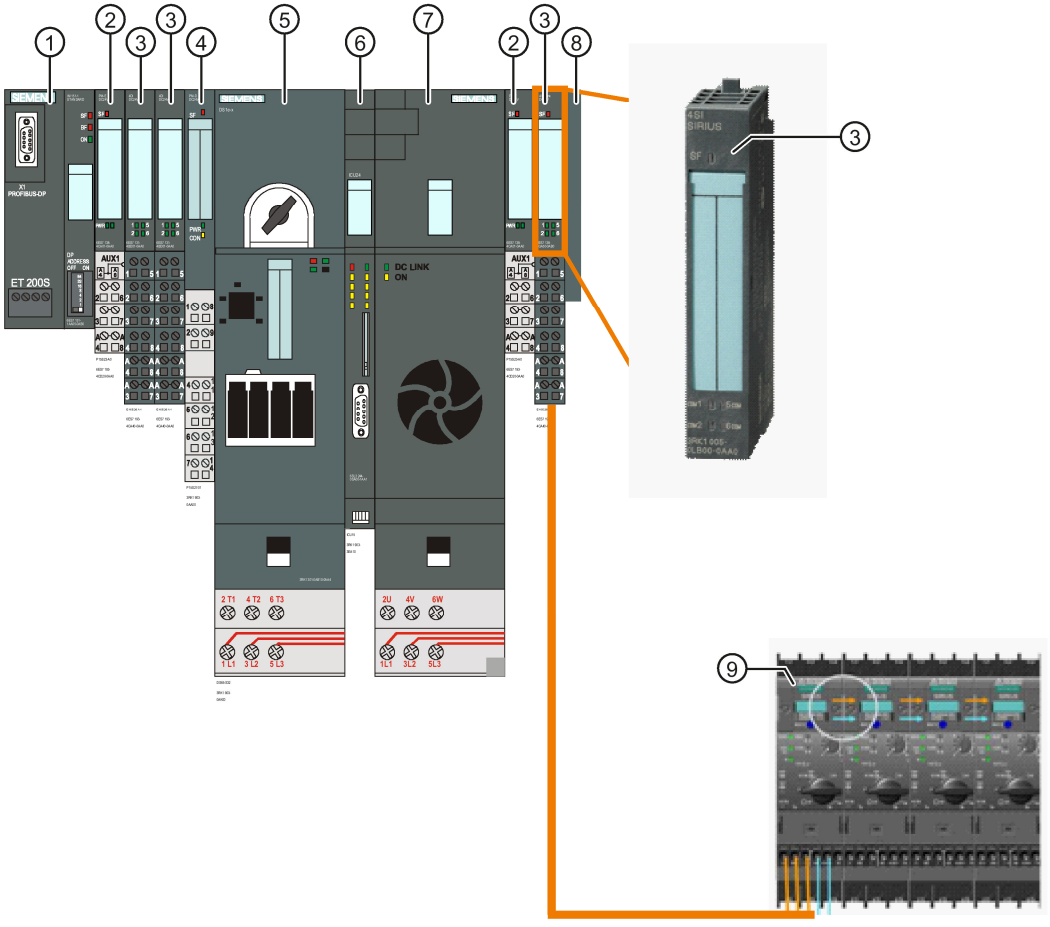
Ideally suited to connecting SIRIUS Innovations products to IO-Link is the IO-Link master for SIRIUS controls: the SIRIUS 4SI electronic module for SIMATIC ET 200S.

The SIRIUS 4SI electronic module facilitates the efficient and space-saving integration of IO-Link-capable SIRIUS switching devices into the TIA world. It connects up to 16 SIRIUS load feeders to the higher-level control environment.

Table 1- 40 SIRIUS 4SI electronic module

Area	Customer benefits
Functions	• Integration of IO-Link-capable SIRIUS controls in the distributed I/O ET 200S. • Diagnostics data. • Status display and group fault signaling.
Dimensioning and design	• Width 15 mm. • 4 IO-Link ports. • Connection of up to 16 load feeders.
Mounting advantages	• Considerably reduced wiring and space requirements in the control cabinet. • Terminal modules with screw-type, spring-loaded, and insulation displacement connection system.
Application areas/customer benefits	• Considerably lower price (50%) than the IO-Link master if only SIRIUS devices are used. • Reduced wiring (5 cable connections for 4 feeders). • Fast module selection via the ET 200 configurator.

The figure below uses an example to show where the SIRIUS 4SI electronic module is positioned within the SIRIUS controls.



1 Interface module IM...
2 Power module electronic PM-E
3 Electronic module, e.g. SIRIUS 4SI, DI, DO, AI, AO, CP, FM
4 Power module drives PM-D
5 Motor starter
6 Frequency converter ICU
7 Frequency converter IPM
8 Termination module
9 SIRIUS modular system with IO-Link (e.g. SIRIUS 3RA6 compact starters)

Figure 1-42 Options for connection to the automation level

1.10.3 AS-Interface

1.10.3.1 Overview

The AS-Interface is an open, international standard in accordance with EN 50295 and IEC 62026-2 for process communication and field communication. Leading manufacturers of actuators and sensors worldwide support AS-Interface.

AS-Interface is a single master system. For direct integration into automation systems from Siemens, e.g. S7-300 or S7-1200, communications processors (CPs or CMs) are the obvious choice. In addition, AS-i networks can also be connected via PROFINET or PROFIBUS with the help of routers (links).

In both cases, the lower-level AS-i networks with connected actuators and sensors can be parameterized and diagnosed direct from the controller.

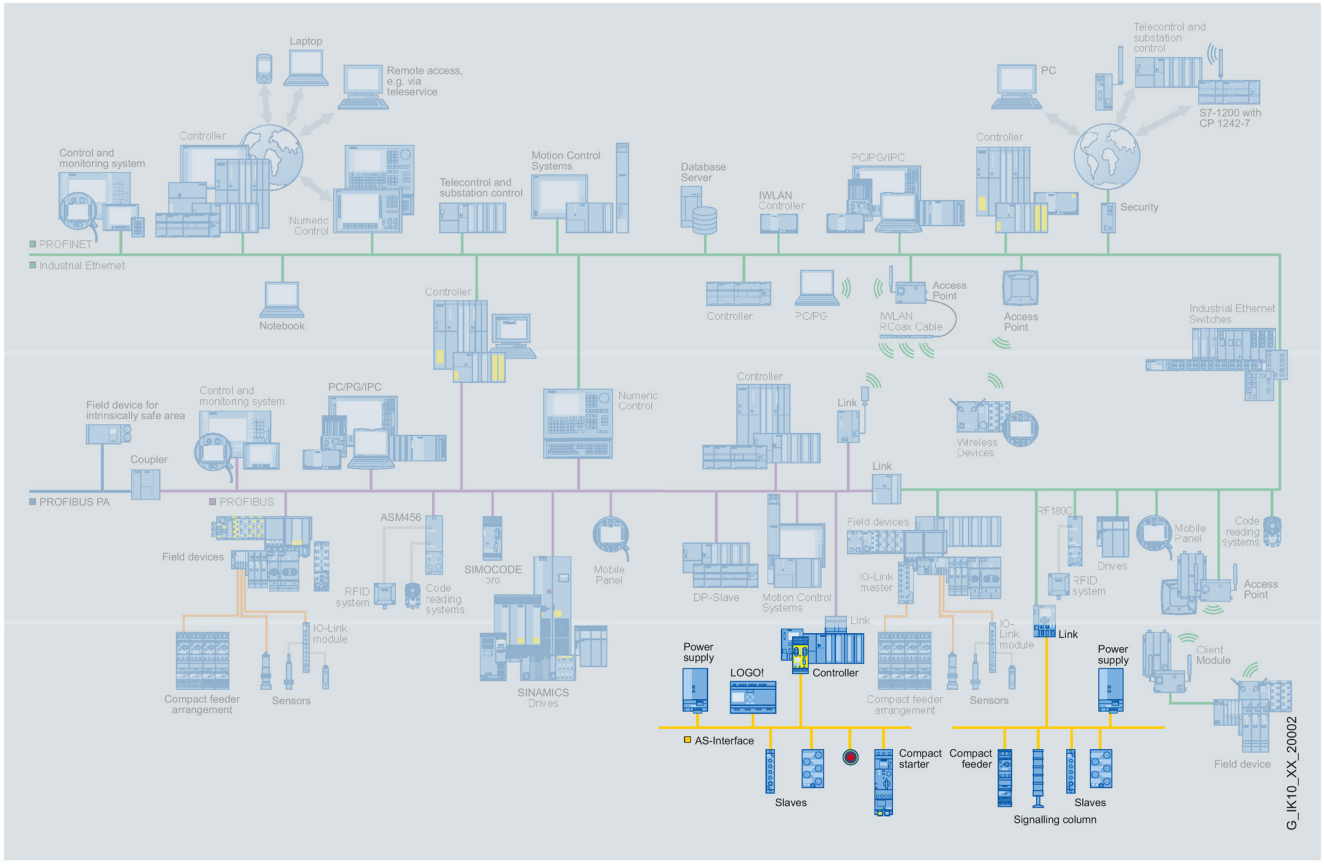


Figure 1-43 AS-Interface

1.10.3.2 Benefits

An important characteristic of the AS-Interface technology is the use of a shared two-wire cable for data transmission including distribution of auxiliary power to the sensors and actuators in high degree of protection IP65/67. One AS-Interface power supply unit is used per AS-i network to distribute the auxiliary power.

The AS-i network is installed with the help of a profiled (reverse-polarity-protected) AS-Interface cable on which the AS-i slaves can be mounted as desired. The AS-i network is electrically contacted by the piercing contacts of the AS-i slaves (insulation displacement method). Any bus topology can therefore be chosen.

Complex control cable wiring in the control cabinet and terminal blocks can be replaced with AS-Interface. Thanks to a specially developed cable and the insulation displacement method, the AS-Interface cable can be connected anywhere. This concept is extremely flexible and enables you to make huge savings.

1.10.3.3 Operating modes

In general, the following operating modes are distinguished between for the master interfaces:

- I/O data exchange:
  In this operating mode, the inputs and outputs of the binary AS-Interface slaves are read and written to.
- Analog value transmission:
  AS-Interface masters in accordance with AS-Interface Specification V2.1 or V3.0 support integral analog value processing. This means that data can be exchanged using analog AS-Interface slaves (in accordance with analog profile 7.3 or 7.4) just as easily as with digital slaves.
- Command interface:
  As well as I/O data exchange with binary and analog AS-Interface slaves, the AS-Interface masters provide a range of other functions using the command interface. Thus, for example, slave addresses can be allocated, parameter values can be transferred, or diagnostics information can be read out from user programs.

1.10.3.4 Process communication and field communication

The AS-Interface is used where individual actuators and sensors are distributed at different locations on a machine (e.g. in a bottling plant or production line, etc.). AS-Interface replaces complex cable harnesses and connects binary and analog actuators and sensors such as proximity switches, valves, or indicator lights with a control, such as SIMATIC, or a PC.

In practice this means that the installation process is really simple, because both data and power are transported via the same cable. No expert knowledge is required for installation and commissioning. Furthermore, thanks to the simple cable laying procedure and the clear cable structure, as well as the special design of the cable, you not only significantly reduce the risk of errors, but also service and maintenance costs.

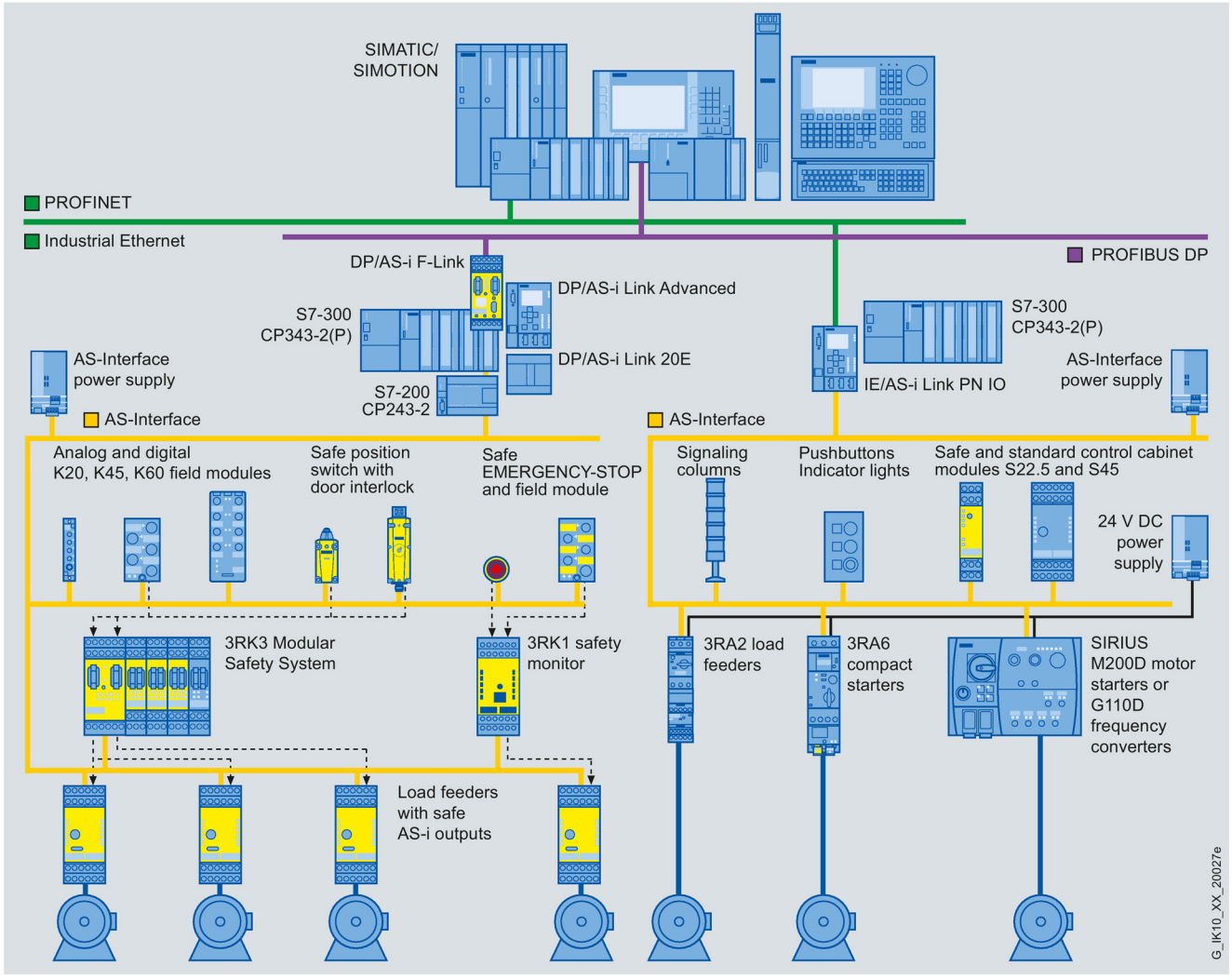


Figure 1-44 Example of a system configuration

1.10.3.5 System components

Numerous system components are offered to perform communication. The main components of a system installation are:

- Master interfaces for central control units such as SIMATIC S7, ET 200 M distributed I/O, or routers from PROFIBUS/PROFINET to AS-Interface
- AS-Interface shaped cable
- Network components, e.g. repeater and extension plug
- Power supply unit for powering the slaves
- Modules for connecting standard sensors/actuators
- Sensors and actuators with integrated AS-i slave (e.g. motor starters, soft starters, load feeders, pushbuttons,indicator lights, or position switches)
- Secure modules for transferring safety-related data over AS-Interface
- Addressing device for setting slave addresses during commissioning

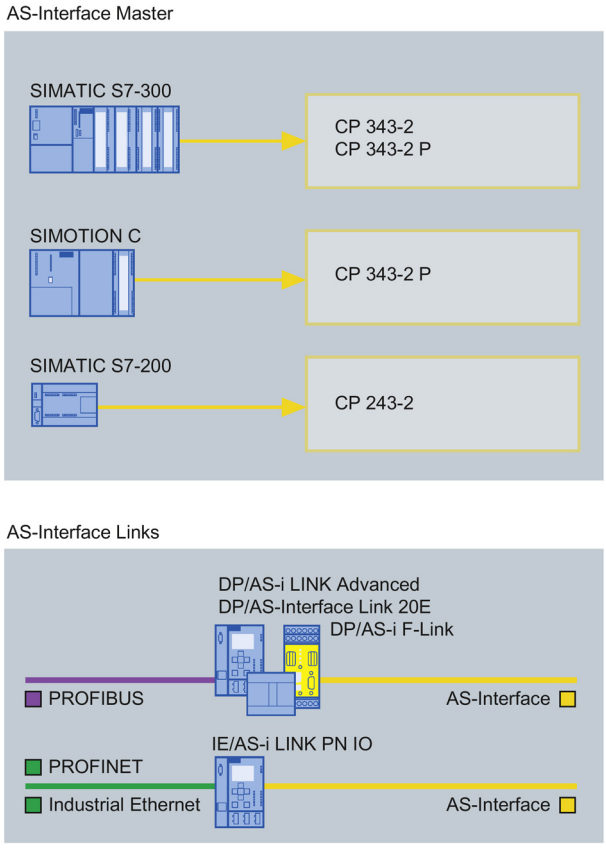


Figure 1-45 AS-Interface master and AS-Interface links

1.10.3.6 Technical data

Feature	Specification
Standard	EN 50295/IEC 61158
Topology	Line topology, star topology, or tree topology (same as electrical installation)
Transmission medium	Unshielded twisted pair (2 x 1.5 mm^2) for data and auxiliary power
Connection system	Contacting of the AS-Interface cable using insulation displacement
Maximum cable length	100 m without repeater 200 m with extension plug 300 m with 2 repeaters connected in series 600 m with extension plugs and 2 repeaters connected in parallel With parallel connection, more repeaters allow for longer cable lengths
Maximum cycle time	5 ms for maximum configuration with standard addresses 10 ms for maximum configuration with A/B addresses Profile-specific for Spec 3.0 slaves
Number of stations per AS-Interface segment	31 slaves in accordance with AS-Interface Spec. V2.0 62 slaves (A/B method) in accordance with AS-Interface Spec. V2.1 and V3.0, integrated analog value transmission
Number of binary sensors/actuators	Max. 124 DI/124 DO acc. to Spec. V2.0 Max. 248 DI/186 DO acc. to Spec. V2.1 Max. 496 DI/496 DO acc. to Spec. V3.0
Access method	Cyclic polling master/slave procedure, cyclic data acceptance by host (PLC, PC)
Error control	Identification and resending of faulty messages

1.10.3.7 More information

More information

Always observe the conditions and constraints for use and the additional information available for the modules referred to above.

AS-Interface System Manual

More information about the AS-Interface is available in the AS-Interface System Manual.

The system manual can be downloaded from the Internet free of charge:

- German version (http://support.automation.siemens.com/WW/view/de/26250840)
- English version (http://support.automation.siemens.com/WW/view/en/26250840)

The AS-Interface System Manual can also be supplied in paper format in both languages.

Internet

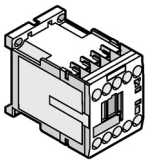
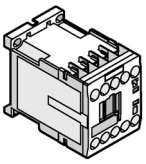
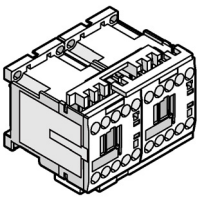
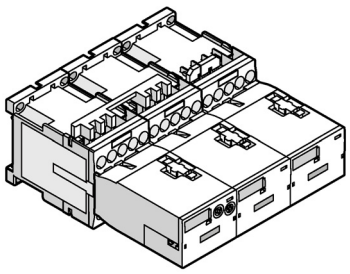
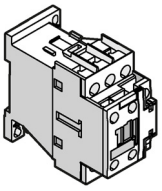
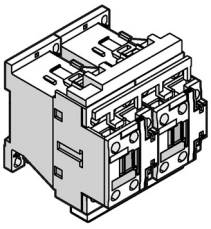
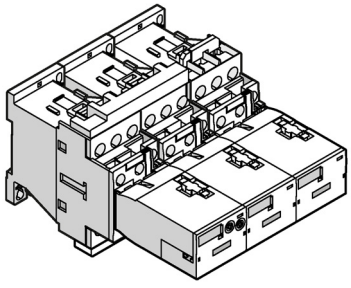
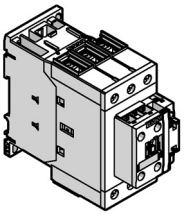
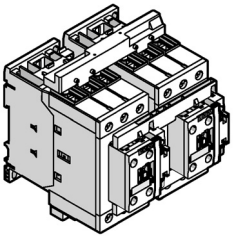
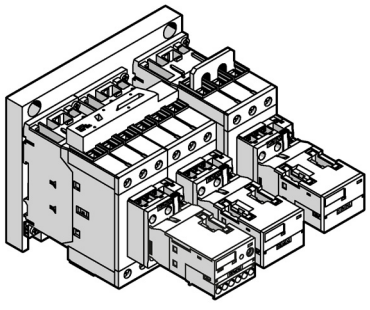
More information can be found on the Internet (http://support.automation.siemens.com/WW/view/en/10805888/130000).

SIRIUS 3RT2, 3RH2, 3RA23/3RA24 contactors/contactor assemblies

2

2.1 Overview of the contactor range

The SIRIUS range offers various switching devices for the safe and functional switching of electrical loads. The table below provides an overview of the contactor versions and contactor assemblies available in size S00 to S2 (table contains versions featuring screw terminals).

Size	3RH2 contactor relays	3RT2 power contactors	3RA23 reversing contactor assembly	3RA24 contactor assembly for star-delta (wye-delta) start
S00				
S0	---			
S2	---			

2.2 Device versions

Various different switching devices are available for switching electrical loads. The contactor is the ideal device for performing switching operations which are frequently repeated. it is the most commonly used switching device in industry, mechanical engineering, and the manufacture of switching stations.

The SIRIUS contactor range with a width of 45 mm (size S00 / S0) and 55 mm for size S2 comprises:

- 3RT20 power contactors for switching motors up to 37 kW / 400 V (AC-3), 90 A (AC-1)
- 4-pole 3RT23 contactors (4 NO) for switching resistive loads up to 110 kW (AC-1) and 4-pole 3RT25 contactors (2 NO + 2 NC) up to 22 kW
- 3RH2 contactor relays for switching in the control circuit with contact versions of 4 NO contacts, 3 NO contacts + 1 NC contact, and 2 NO contacts + 2 NC contacts
- 3RA23 (reversing) and 3RA24 (star-delta (wye-delta)) contactor assemblies
- 3RT26 capacitor contactors for switching capacitive loads (AC-6b)

2.2.1 3RH2 contactor relays

3RH2 contactor relays are available in the versions detailed below. The contactors can be supplied with AC and DC operating mechanisms of between 24 V and 230 V (preferred voltages). Different voltage versions are available on request.

Versions

Table 2- 1 Versions of the 3RH2 contactor relays

Feature	Specifications	Contactors for special applications	
Version	Contactor relay	Contactors with extended operating range for railway applications	Coupling relay
Number of poles	4 / 8	4	4
Size	S00		
Width	45 mm		

Connection systems

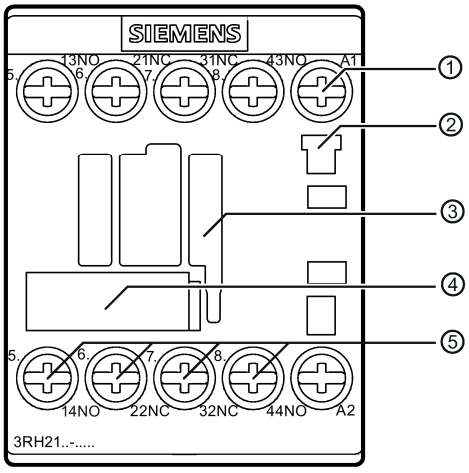
The contactor relays can be supplied with the connection systems detailed below.

Table 2- 2 Connection systems available for 3RH2 contactor relays

Connection system	Contactor relay	Contactors with extended operating range for railway applications	Coupling relay
Screw connection	✓	✓	✓
Spring-loaded connection	✓	✓	✓
Ring cable lug connection	✓	---	---
Solder pin connection (only possible in conjunction with the "solder pin adapter" optional accessory)	✓	✓	✓

The illustrations below show example equipment features of the 3RH2 contactor relays for switching in the auxiliary circuit.

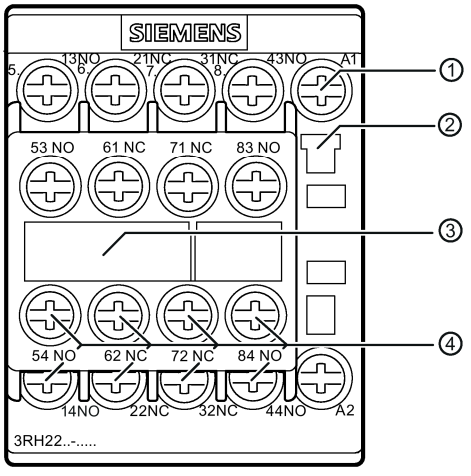
3RH21 contactor relay, 4-pole



① Coil terminal on the front
② Location hole for surge suppression
③ Location hole for 1-, 2-, and 4-pole auxiliary switch blocks
④ Label
⑤ Auxiliary contacts

Figure 2-1 3RH21..-..... contactor relay, 4-pole, size S00, overview

3RH22 contactor relay, 8-pole



① Coil terminal on the front
② Location hole for surge suppression
③ Label
④ Auxiliary contacts

Figure 2-2 3RH22..-..... contactor relay with auxiliary switch block on the front which cannot be removed, 8-pole, size S00, overview

2.2.2 3RT2 power contactors

The table below shows the different versions of the 3RT2 power contactors. The contactors are equipped with AC and DC operating mechanism options. An electronic AC/DC operating mechanism can also be ordered for size S0. An AC operating mechanism and an electronic AC / DC operating mechanism can be ordered for size S2. Special contactor variants with voltage tap of the main circuit are available for contactor integration via AS-Interface or IO-Link using 3RA27 function modules. These power contactors are supplied with 24 V DC coils.

Versions

Table 2- 3 Versions of the 3RT2 power contactors

Feature		Specifications				
Version		Power contactor for switching electrical loads	Power contactor with extended operating range for railway applications	Coupling relay for switching electrical loads	3RT23 power contactor with 4 NO contacts	3RT25 power contactor with 2 NO contacts and 2 NC contacts
Number of poles		3	3	3	4	2 NO contacts + 2 NC contacts
Number of integrated auxiliary contacts	S00	1 NO contact or 1 NC contact	1 NO contact or 1 NC contact	1 NO contact or 1 NC contact	---	---
	S0	1 NO contact and 1 NC contact	1 NO contact and 1 NC contact	1 NO contact and 1 NC contact	1 NO contact and 1 NC contact	1 NO contact and 1 NC contact
	S2	1 NO contact and 1 NC contact	1 NO contact and 1 NC contact	---	1 NO contact and 1 NC contact	1 NO contact and 1 NC contact
Size		S00/S0				
Width		45 mm				
Size		S2				
Width		55 mm				

Connection systems

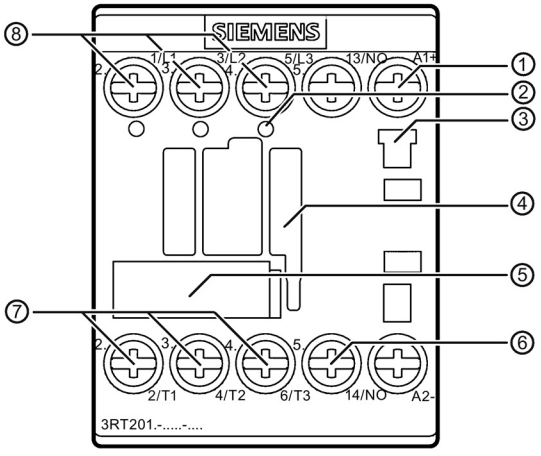
The power contactors can be supplied with the connection systems detailed below:

- Screw connection
- Spring-loaded connection (S2 only auxiliary and control line)
- Ring cable lug connection (S0 and S00)
- Solder pin connection (size S00 only)

  Solder pin connection is only possible in conjunction with the optional solder pin adapter accessory)

The illustrations below show example equipment features of the 3RT2 power contactors for switching motorized loads.

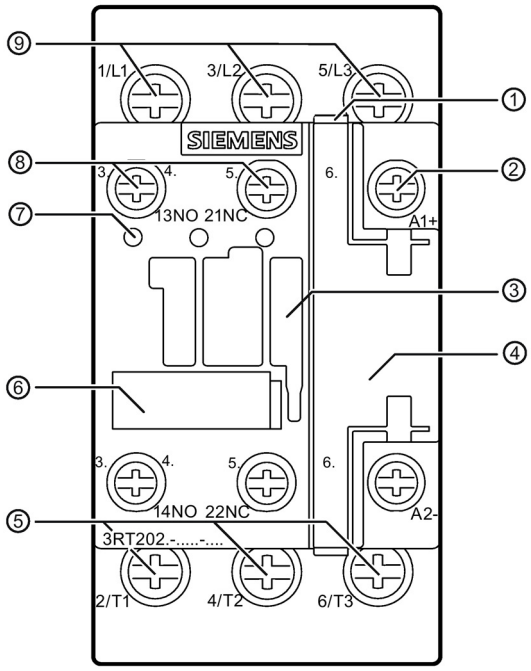
3RT2 power contactors (size S00)



① Coil terminal on the front
② Openings for voltage tap of the main circuit (only special version with voltage tap)
③ Location hole for surge suppression
④ Location hole for 1-, 2-, and 4-pole auxiliary switch blocks
⑤ Label
⑥ 1 auxiliary contact integrated (1 NO contact)
⑦ Contactor's main circuit terminal to the load / motor connection (T1, T2, T3)
⑧ Contactor's main circuit terminal to the power network (L1, L2, L3)

Figure 2-3 3RT201.-.....-.... power contactor, size S00, overview

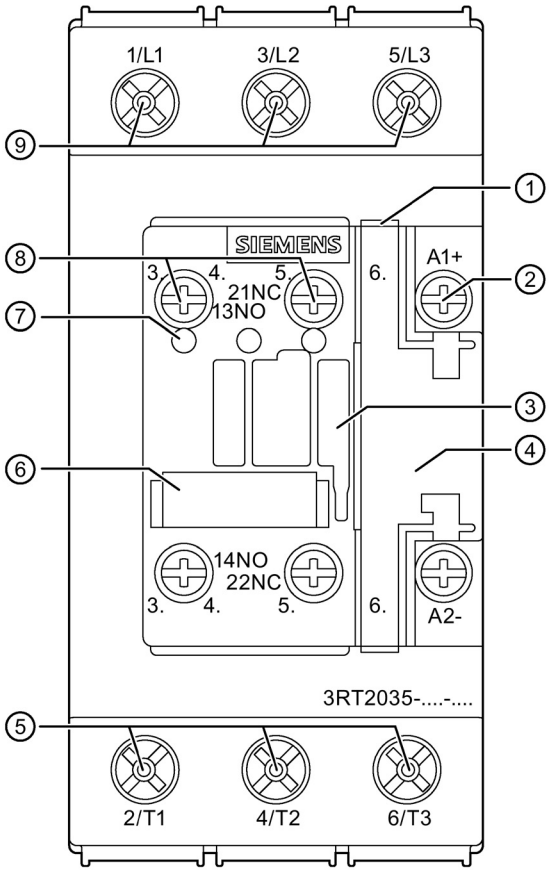
3RT2 power contactors (size S0)



① Cable duct
② Coil terminal on the front
③ Location hole for 1-, 2-, and 4-pole auxiliary switch blocks
④ Location hole for surge suppression (underneath flap)
⑤ Contactor's main circuit terminal to the load / motor connection (T1, T2, T3)
⑥ Label
⑦ Openings for voltage tap of the main circuit (only special version with voltage tap)
⑧ 2 auxiliary contacts integrated (1 NO contact and 1 NC contact)
⑨ Contactor's main circuit terminal to the power network (L1, L2, L3)

Figure 2-4 3RT202.-.....-.... power contactor, size S0, overview

3RT2 power contactors (size S2)



① Cable duct
② Coil terminal on the front
③ Location hole for 1-, 2-, and 4-pole auxiliary switch blocks
④ Location hole for surge suppression (underneath flap)
⑤ Contactor's main circuit terminal to the load / motor connection (T1, T2, T3)
⑥ Label
⑦ Openings for voltage tap of the main circuit (only special version with voltage tap)
⑧ 2 auxiliary contacts integrated (1 NO contact and 1 NC contact)
⑨ Contactor's main circuit terminal to the power network (L1, L2, L3)

Figure 2-5 3RT203.-.....-.... power contactor, size S2, overview

2.2.3 3RA23 reversing contactor assemblies

The reversing contactor assemblies of sizes S00 to S2 are available in two versions:

- Fully wired and tested with electrical and mechanical interlock.
- As a kit for customer assembly.

The fully wired and tested reversing contactor assembly consists of 2 contactors of the same power rating, each with an NC contact in the basic device, link modules and wiring modules. The contactors are mechanically and electrically interlocked (NC contact interlock). The contactor assemblies for reversing are climate-proof. They are safe to touch according to DIN EN 61140.

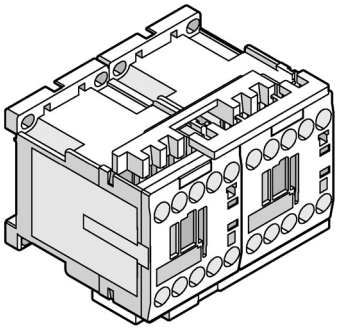
Connection systems

The fully wired 3RA23 reversing contactor assembly is available either with a screw-type connection system or a spring-loaded connection system (S0 and S00).

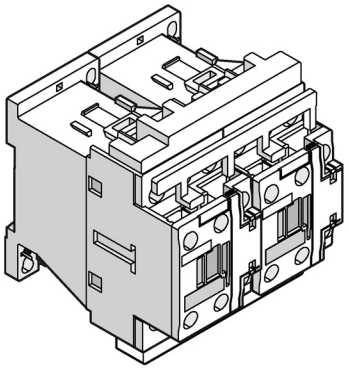
Size S2 is only available with screw-type connection. In size S2, the spring-loaded connection system is only available in the control circuit.

The illustrations below show the fully assembled reversing contactor assemblies, in the version with the screw-type connection system.

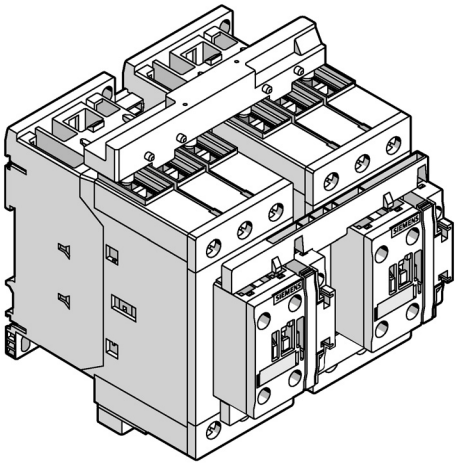
3RA23 reversing contactor assembly, screw connection, size S00



3RA23 reversing contactor assembly, screw connection, size S0



3RA23 reversing contactor assembly, screw connection, size S2



Reversing contactor assemblies with communication interface

The reversing contactor assemblies with communication interface are required for mounting the function modules for connection to the automation level via the bus system.

2.2.4 3RA24 contactor assemblies for star-delta (wye-delta) start

The 3RA24 contactor assembly for star-delta (wye-delta) start consists of three 3-pole contactors (line contactor, star contactor, and delta contactor), main circuit wiring modules, and plug-on function modules for the control circuit wiring.

The 3RA24 contactor assembly for star-delta (wye-delta) start of sizes S00 to S2 is available in two versions:

- Fully wired and tested with electrical and mechanical interlock.
- As a kit for customer assembly.

The fully wired 3RA24 contactor assemblies for star-delta (wye-delta) start can be ordered with the following plug-on function modules:

- Without a communication connection.
- With communication connection (IO-Link or AS-Interface)

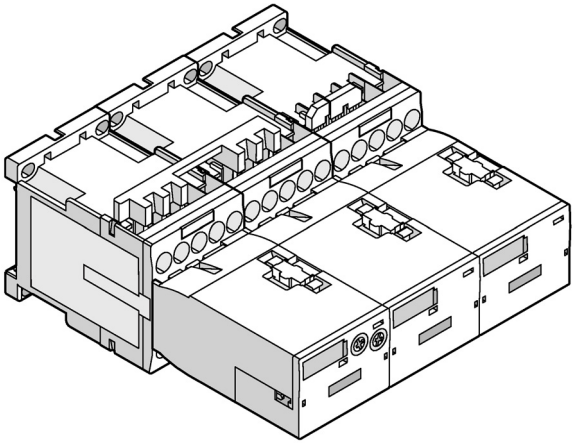
Connection systems

The fully wired 3RA24 contactor assembly for star-delta (wye-delta) start is available either with a screw-type connection system or a spring-loaded connection system (S0 and S00).

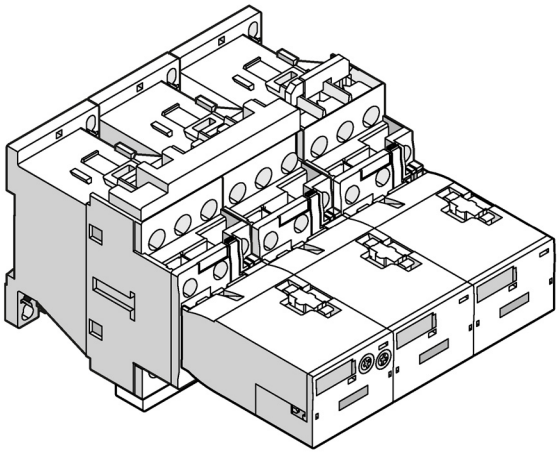
Size S2 is only available with screw-type connection.

The illustrations below show the fully assembled contactor assembly for star-delta (wye-delta) start without a communication connection, in the version with the screw-type connection system.

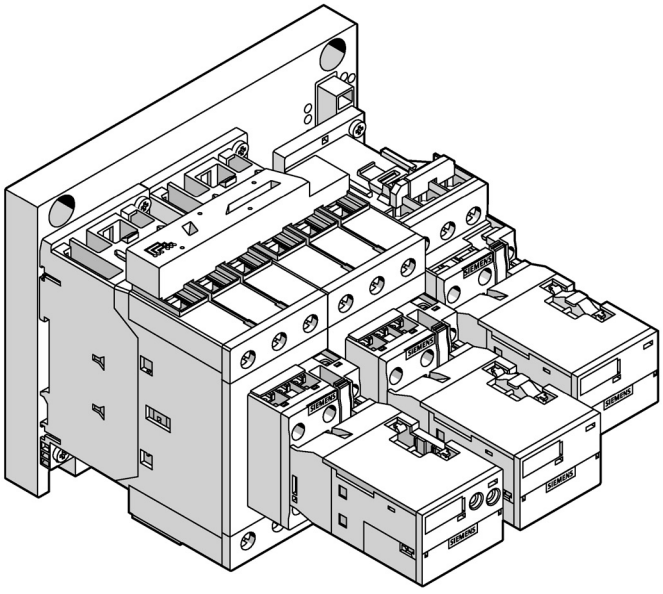
3RA24 contactor assembly for star-delta (wye-delta) start, screw connection, size S00



3RA24 contactor assembly for star-delta (wye-delta) start, screw connection, size S0

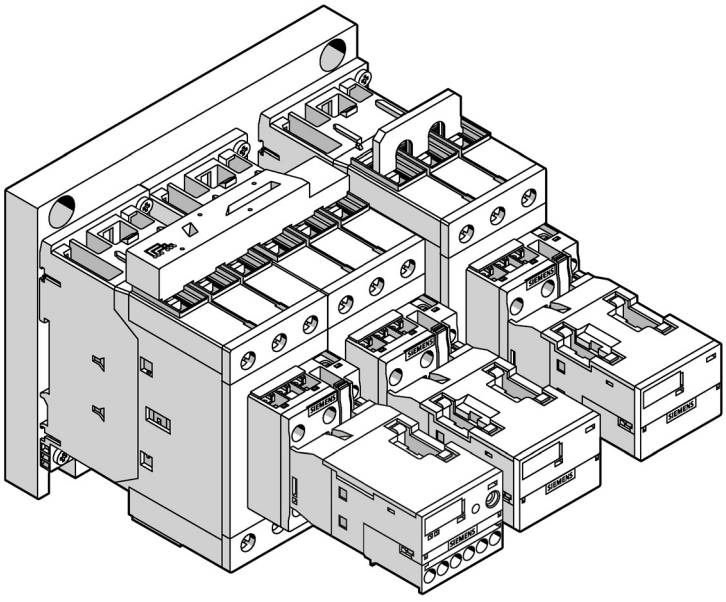


3RA24 contactor assembly for star-delta (wye-delta) start, screw connection, size S2 / S2 / S0



3RA2434-8X.32-1...
3RA2435-8X.32-1...
3RA2436-8X.32-1...

3RA24 contactor assembly for star-delta (wye-delta) start, screw connection, size S2 / S2 / S2



3RA2437-8X.32-1...

2.2.5 Drive options

Operating mechanism options

The following operating mechanism types are available for 3RH2 contactor relays and 3RT2 power contactors:

- AC operating mechanism (sizes S0 to S2)
- DC operating mechanism (sizes S00 and S0)
- AC/DC operating mechanism (sizes S0 and S2)

2.3 Applications

Utilization categories

According to DIN EN 60947-4-1, the application area of and the load applied to power contactors can be identified by looking at the specified utilization category in conjunction with the specified rated operational current or the motor power and the rated voltage. The table below lists the most important utilization categories for contactors.

Utilization categories	
AC	**Main circuit contacts: Utilization category for AC voltages**
AC-1	Non-inductive or slightly inductive loads, resistance furnaces
AC-2	Slip-ring motors: starting, switching off
AC-3	Squirrel-cage motors: starting, switching-off motors during running
AC-4	Squirrel-cage motors: starting, plugging, inching
AC-5a	Switching of discharge lamp controls
AC-5b	Switching of incandescent lamps
AC-6a	Switching of transformers
AC-6b	Switching of capacitive loads
DC	**Main circuit contacts: Utilization category for DC voltages**
DC-1	Non-inductive or slightly inductive loads, resistance furnaces
DC-3	Shunt-wound motors: Starting, plugging, reversing, inching, dynamic braking
DC-5	Series-wound motors: Starting, plugging, reversing, inching, dynamic braking
AC	**Auxiliary circuit contacts: Utilization category for AC voltages**
AC-12	Control of resistive loads and solid-state loads with isolation by opto couplers
AC-14	Control of small electromagnetic loads (max. 72 VA)
AC-15	Control of electromagnetic loads (over 72 VA)
DC	**Auxiliary circuit contacts: Utilization category for DC voltages**
DC-12	Control of resistive loads and solid-state loads with isolation by opto couplers
DC-13	Control of electromagnets

2.4 Performance features

The SIRIUS range of contactors offers the following technical advantages:

Technical highlights	Customer benefits
Uniform connection systems: • Screw connection • Spring-loaded connection • Ring cable lug connection • Solder pin 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 and spring-loaded connection system
Power contactors • Size (S0, S00) up to 38 A (18.5 kW) in 45 mm width • Size (S2) up to 80 A (37 kW) in 55 mm width	Space and cost savings
Factory-fitted integrated auxiliary switches	Reduced installation complexity
High contact reliability of the auxiliary switches	Enhanced operational reliability (reduction of fault signals)
Joint range of accessories for size S00 and S2	Easy to configure, reduced stockkeeping
Plug-on function modules for connection without tools	Fault avoidance and reduced wiring (without tools)
Connection to AS-Interface or IO-Link	Reduced wiring and integration in TIA

Reference

More information ...	Is available in ...
about the 3RT2, 3RH2, and 3RA23/3RA24 contactors and contactor assemblies	the chapter "SIRIUS Innovations manuals (Page 22)" in the "SIRIUS Innovations - SIRIUS 3RT2 Contactors/Contactor Assemblies" manual.

SIRIUS 3RF34 solid-state switching devices 3

3.1 Device versions

Solid-state switching devices are primarily used in single-phase applications, which have to meet the following requirements:

- Very high switching frequencies (> 1000 switching operations per hour)
- Resistive loads

The SIRIUS modular system features single- and three-phase solid-state contactors and solid-state relays for the frequent switching of resistive loads. Three-phase solid-state contactors and solid-state reversing contactors are available for switching motorized loads. Standardized function modules for various applications complete the range of SIRIUS solid-state switching devices.

The solid-state contactor and solid-state reversing contactor versions listed in this manual are intended specifically for operation on three-phase motors up to 7.5 kW.

Overview

These 2-phase controlled instantaneous switching solid-state switching devices are operated in two mounting widths in an insulating enclosure:

- In 45 mm width
  - Up to 5.2 A as solid-state contactor (motor contactor) or
  - Up to 5.4 A as solid-state reversing contactor and
- In 90 mm width
  - Up to 16 A as solid-state contactor or
  - Up to 7.4 A as solid-state reversing contactor

This means that it is possible to operate motors up to 7.5 kW.

The solid-state contactors and solid-state reversing contactors for screw-type connection can be connected directly to a motor starter protector with a 3RA2921-1BA00 link module. Direct mounting of a 3RB30/3RB31 solid-state overload relay and, in some cases, a 3RR2 current monitoring relay, is also possible. This provides a time-saving way of implementing rapid-switching motor feeders with and without fuses.

Versions

The following table provides an overview of the versions of the 3RF34 instantaneous switching solid-state contactors for switching motors.

Table 3- 1 Versions of solid-state switching devices

Characteristic	Versions	
Version	Solid-state contactor	Solid-state reversing contactor
Description	Complete devices in insulated enclosures for frequent switching on and switching off of AC drives.	Compact design of the reversing circuit for frequent switching on and switching off of AC drives with continuous reversal of the direction of rotation
Order numbers	3RF34..-.BB..	3RF34..-.BD..
Size	S0	
Width (motor power[1]/max. rated operational current)	• 45 mm (motors up to 2.2 kW, 5.2 A) • 90 mm (motors up to 7.5 kW, 16 A)	• 45 mm (motors up to 2.2 kW, 5.4 A) • 90 mm (motors up to 3.0 kW, 7.4 A)
Number of poles	3	3
Connection system	Screw-type and spring-loaded terminals	Screw-type
Rated operating voltage	Up to 600 V	Up to 480 V
Rated control supply voltage	24 V DC and 110 to 230 V AC	
Switching delay ON-delay OFF-delay	 1 ms (24 V DC), 5 ms (110 to 230 V AC) 1 ms (24 V DC), 30 ms (110 to 230 V AC) plus up to one half-wave	 5 ms (24 V DC), 20 ms (110 to 230 V AC) 5 ms (24 V DC), 10 ms (110 to 230 V AC) plus up to one half-wave
Interlock time	60 to 100 ms (24 V DC), 50 to 100 ms (110 to 230 V AC)	
Enclosure	Insulated (no grounding required)	
Control connections	Screw-type connection system and spring-loaded connection system, removable terminal for auxiliary circuit wiring (2 contacts)	Screw-type connection system, removable terminal for auxiliary circuit wiring (3 contacts)

[1] Rating data relates to 400 V line voltage

3.2 Applications

Solid-state switching devices for switching motors

The **solid-state contactors** for the wear-free and noiseless switching of motors are designed for the frequent switching on and switching off of AC drives up to 7.5 kW as well as for reversing up to 3.0 kW. The devices are fully insulated and can be mounted directly on motor starter protectors and overload relays or SIRIUS current monitoring relays, which makes them really easy to integrate into motor feeders.

These 3-phase solid-state contactors are equipped with a 2-phase control which is particularly suitable for typical motor circuits without a connection to the neutral conductor.

The integration of four current paths to form a single reversing circuit, accommodated in one enclosure, makes the **solid-state reversing contactor** a particularly compact solution. Unlike conventional systems which require two contactors, width can be reduced by up to 50% with the 3-phase solid-state reversing contactors. Devices with a width of 45 mm cover motors up to 2.2 kW and those with a width of 90 mm cover motors up to 3 kW.

Integration in the SIRIUS modular system facilitates connection to a SIRIUS motor starter protector via a link module or to a 3RB30/3RB31 solid-state overload relay or a 3RR2 current monitoring relay without additional steps. As a result, fuseless or fused motor feeders can be implemented quickly and easily.

Main features:

- Insulated enclosure with integrated heat sink
- Degree of protection IP20
- Integrated mounting foot for snapping on a DIN rail or mounting on a support plate
- Variety of connection systems
- Plug-in control connection
- LED to indicate control voltage

3.3 Application environment

General operating conditions

The following table lists the general operating conditions under which the product may be operated.

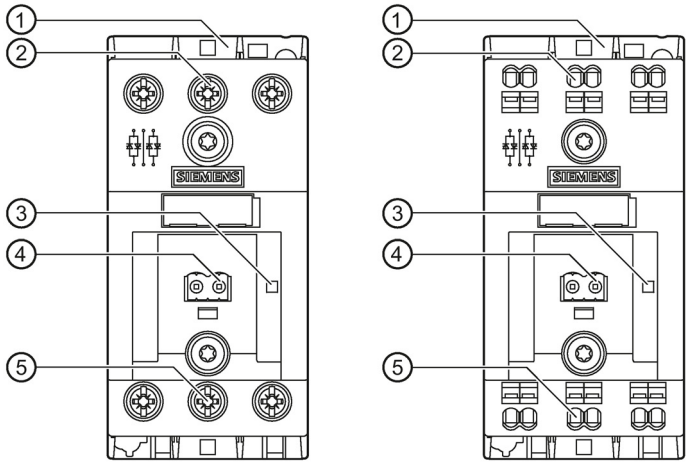
Table 3- 2 General operating conditions

Operating conditions	Value
Degree of protection	IP20
Ambient temperature during operation	- 25 to 60 °C
Installation altitude	0 to 1000 m; at > 1,000 m seek advice from Technical Assistance (http://www.siemens.com/sirius/technical-assistance)
Shock resistance	15 g/11 ms; acc. to DIN IEC 68-2-27
Vibration resistance	2 g; acc. to DIN IEC 68-2-6
EMC conditions	Acc. to DIN IEC 60947-4-2, DIN IEC 61000-4-2, DIN IEC 61000-4-4, DIN IEC 61000-4-5, and DIN IEC 61000-4-6,
Insulation strength 50/60 Hz	4,000 V_{rms}

3.4 Solid-state switching devices

Operator controls and equipment

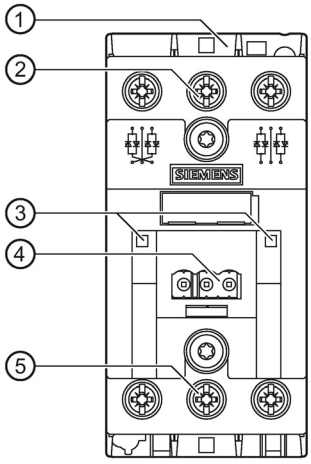
Solid-state contactor



	Operator control/Equipment	Function
1	Solid-state contactor	Frequent switching on and switching off of AC drives
2	Screw-type connection system/Spring-loaded connection system	Main circuit terminals infeed/line side
3	LED	The yellow LED lights up when the control voltage is applied.
4	Plug-in control connection (2 terminals)	Removable terminals for the control circuit
5	Screw-type connection system/Spring-loaded connection system	Main circuit terminals outgoing feeder motor/load side

Figure 3-1 Solid-state contactor overview - Screw-type connection system and spring-loaded connection system

Solid-state reversing contactor

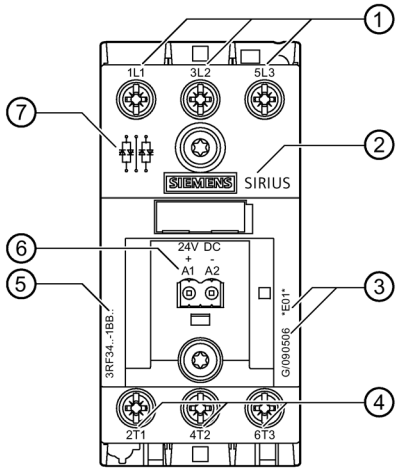


	Operator control/Equipment	Function
1	Solid-state contactor	Frequent switching on and switching off of AC drives
2	Screw-type connection system	Main circuit terminals infeed/line side
3	LEDs	The left-hand LED lights up yellow when counterclockwise rotation is activated (control voltage applied at terminal A1 and A2). The right-hand LED lights up yellow when clockwise rotation is activated (control voltage applied at terminal A3 and A2).
4	Plug-in control connection (3 terminals)	Removable terminals for the control circuit
5	Screw-type connection system	Main circuit terminals outgoing feeder motor/load side

Figure 3-2 Solid-state reversing contactor overview - Screw-type connection system

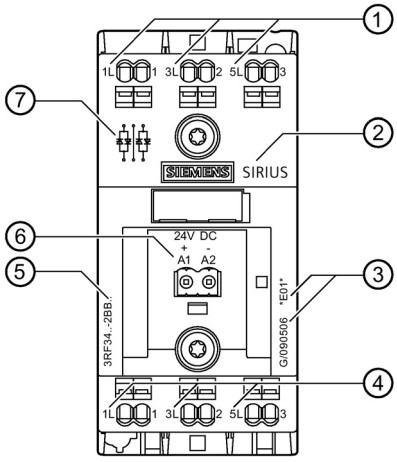
3.5 Device labels

Device labels



1 Labeling to identify the main circuit terminals infeed/line side
2 SIRIUS (device group)
3 Production date/Product version
4 Labeling to identify the main circuit terminals outgoing feeder motor/load side
5 Order designation
6 Labeling to identify the control circuit terminals and indication of the control voltage (See also the diagrams below, "Labeling on solid-state contactors, zoom view".)
7 Circuit diagram

Figure 3-3 Labeling to identify solid-state contactors with screw-type connection system



1 Labeling to identify the main circuit terminals infeed/line side
2 SIRIUS (device group)
3 Production date/Product version
4 Labeling to identify the main circuit terminals outgoing feeder motor/load side
5 Order designation
6 Labeling to identify the control circuit terminals and indication of the control voltage (See also the diagrams below, "Labeling on solid-state contactors, zoom view".)
7 Circuit diagram

Figure 3-4 Labeling to identify solid-state contactors with spring-loaded terminals

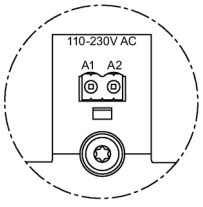


Figure 3-5 Labeling on solid-state contactors with AC control voltage, zoom view

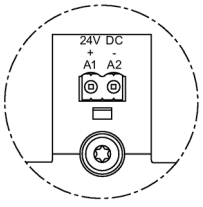
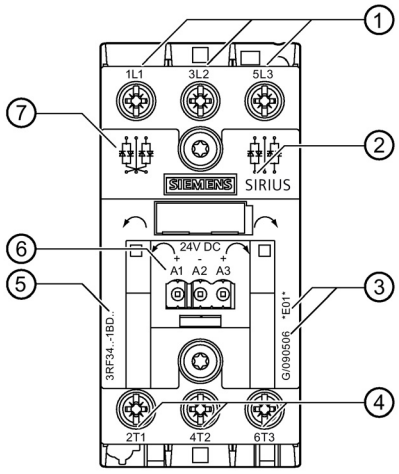


Figure 3-6 Labeling on solid-state contactors with DC control voltage, zoom view



1 Labeling to identify the main circuit terminals infeed/line side
2 SIRIUS (device group)
3 Production date/Product version
4 Labeling to identify the main circuit terminals outgoing feeder motor/load side
5 Order designation
6 Labeling to identify the control circuit terminals and indication of the control voltage
(See also the diagrams below, "Labeling on solid-state reversing contactors, zoom view".)
7 Circuit diagram

Figure 3-7 Labeling to identify solid-state reversing contactors with screw connection

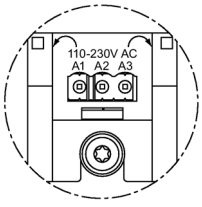


Figure 3-8 Labeling on solid-state reversing contactors with AC control voltage, zoom view

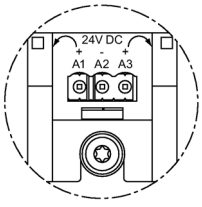


Figure 3-9 Labeling on solid-state reversing contactors with DC control voltage, zoom view

3.6 Advantages of solid-state switching devices

Technical advantages/Customer benefits

Table 3- 3 Advantages of solid-state switching devices

Technical highlights	Customer benefits
Top customer benefits	
Removable terminals for auxiliary circuit wiring	Avoidance of wiring errors if devices need to be replaced
Integrated electrical interlocking	Cost savings and fault avoidance
All motor contactors available in spring-loaded connection system	Improved operational reliability and quicker wiring
Wear-free switching	Long contact service life avoids cyclic replacement in applications with high switching frequency. The system is in operation for longer.
Other customer benefits	
Screw connection with practical cross-sections	Flexible cable selection based on application at hand
Link modules from motor starter protector to switching device	Fast, fault-free assembly for screw-type connection system
Noise-free switching	Can be used in residential environments thank to reduced switching noise
Integrated combination tests for fuseless and fused assembly	Planning reliability
Comprehensive approvals	Global applicability
Uniform tools and torques for all devices	Quick and easy installation
Only a small number of different power versions up to 7.5 kW	Easy configuration
Versions supporting wide voltage range 110 to 230 V AC	Saves storage costs thanks to a reduction of the number of variants at the customer end
Extensive CAx data provision	Easy and fault-free configuration
Data sheets in 10 languages per order number	Daily updated technical data available in 10 languages

Reference

More information ...	Is available in ...
about the 3RF34 solid-state switching devices	the chapter "SIRIUS Innovations manuals (Page 22)" in the "SIRIUS Innovations - SIRIUS 3RF34 Solid-State Switching Devices" manual.

SIRIUS 3RW30/3RW40 soft starters 4

4.1 Fields of application

Soft starters are used to start three-phase induction motors with reduced torque and reduced starting current.

SIRIUS soft starter family

The SIEMENS SIRIUS soft starter family comprises three different versions with different functionalities and prices.

3RW30 and 3RW40

Simple or standard applications are covered by the SIRIUS 3RW30 and 3RW40 soft starters and are described in a separate manual.

3RW44

The SIRIUS 3RW44 soft starter is used if higher functionality is specified, e.g. communication over PROFIBUS or the availability of measuring and monitoring values, as well as for ultra-heavy-duty starting. The SIRIUS 3RW44 soft starter is described in a separate system manual.

4.2 Reference

Reference

More information ...	Is available in ...
about the 3RW soft starters	the chapter "SIRIUS Innovations manuals (Page 22)" in the "SIRIUS 3RW30/3RW40 Soft Starters" manual and the "SIRIUS 3RW44 Soft Starters" manual.

4.3 Basic physical principles of a three-phase induction motor

4.3.1 Use

SIRIUS soft starters are used to reduce the current and torque of a three-phase induction motor during the startup process.

4.3.2 Three-phase induction motor

Fields of application

Three-phase induction motors are used in a wide range of applications in commerce, industry, and trade owing to their simple, robust design and their minimal maintenance.

Problem

If a three-phase induction motor is started directly, its typical current and torque characteristics can cause disturbances in the supply system and the load machine.

Starting current

Three-phase induction motors have a high direct starting current $I_{starting}$. Depending on the motor type, this current can be between three and fifteen times as high as the rated operational current. Seven or eight times the motor's rated current can be assumed as a typical value.

Disadvantage

This results in the following disadvantage:

- Higher load on the electrical supply system. The supply system must therefore be dimensioned for this higher power during the motor startup.

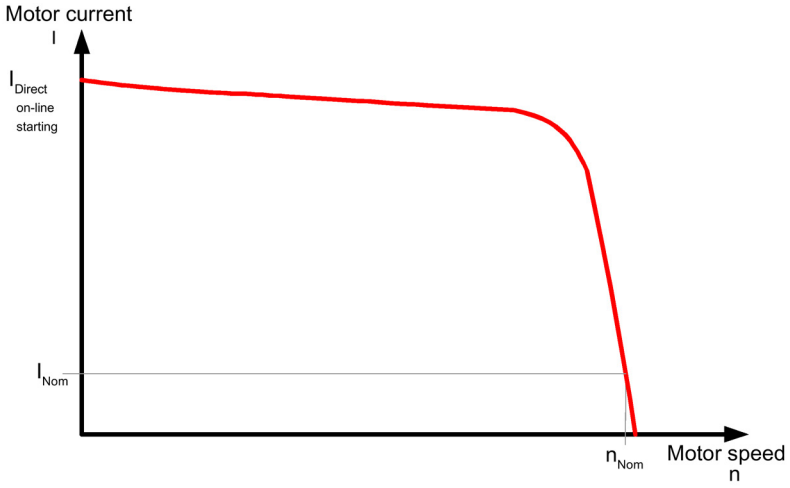


Figure 4-1 Typical starting current characteristic of a three-phase induction motor

Starting torque

The starting torque and the breakdown torque can usually be assumed to be between two and four times the rated torque. From the point of view of the load machine, this means that the starting and acceleration forces exert a higher mechanical load on the machine and the product being conveyed compared to nominal operation.

Disadvantages

This results in the following disadvantages

- A higher load is placed on the machine's mechanical components
- The costs for replacing worn parts and maintaining the application are higher

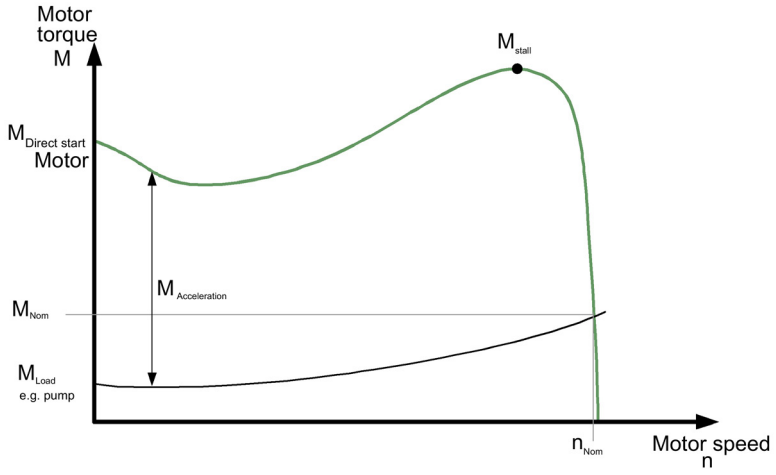


Figure 4-2 Typical starting torque characteristic of a three-phase induction motor

Remedy

The SIRIUS 3RW30 and 3RW40 electronic soft starters allow the current and torque characteristics during starting to be optimally adapted to the requirements of each application.

4.4 Functional principle of the SIRIUS 3RW30 and 3RW40 soft starters

The SIRIUS 3RW30 and 3RW40 soft starters have two antiparallel thyristors in two out of the three phases. These are one thyristor for the positive and one for the negative half-wave in each case (see Bypass mode (Page 144)). The current in the third, uncontrolled phase is the sum of the currents in the controlled phases.

The rms value of the motor voltage is increased (from a settable starting voltage) to the rated motor voltage within a definable ramp-up time by means of the phase angle control.

The motor current changes in proportion to the voltage applied to the motor. As a result, the starting current is reduced by the factor of this voltage.

There is a quadratic relationship between the torque and the voltage applied to the motor. As a result, the starting torque is reduced quadratically in relation to this voltage.

Example

SIEMENS 1LG4253AA motor (55 kW)

Rated data at 400 V

P_e:	55 kW
I_e:	100 A
$I_{direct\ starting}$:	Approx. 700 A
M_e:	355 Nm ; e.g.: $M_e = 9.55 \times 55\ kW \times \frac{1000}{1480\ min^{-1}}$
n_e:	1480 rpm
$M_{direct\ starting}$:	Approx. 700 Nm
Set starting voltage:	50 % (½ of mains voltage)

=> $I_{starting}$ ½ of direct starting current (approx. 350 A)

=> $M_{starting}$ ¼ of direct starting torque (approx. 175 Nm)

The diagrams below show the starting current and torque characteristics for a three-phase induction motor in combination with a soft starter:

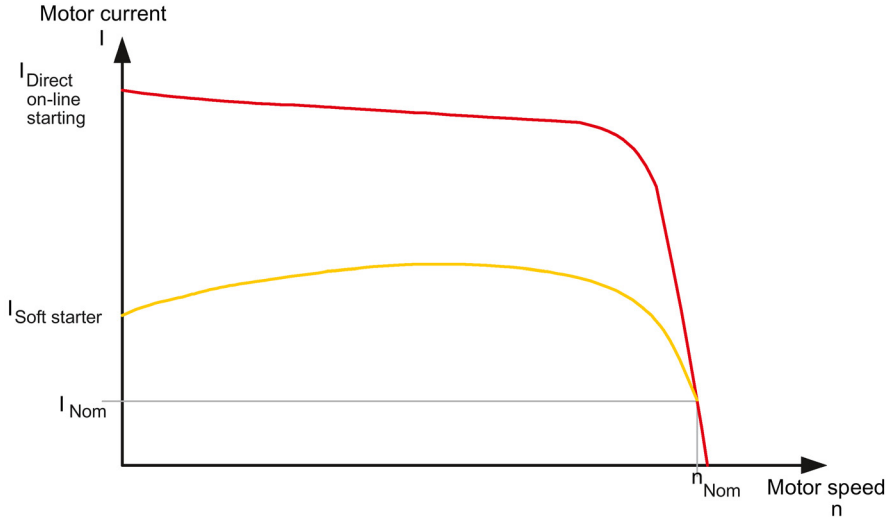


Figure 4-3 Reduced current characteristic of a three-phase induction motor during starting with a SIRIUS 3RW30 or 3RW40 soft starter

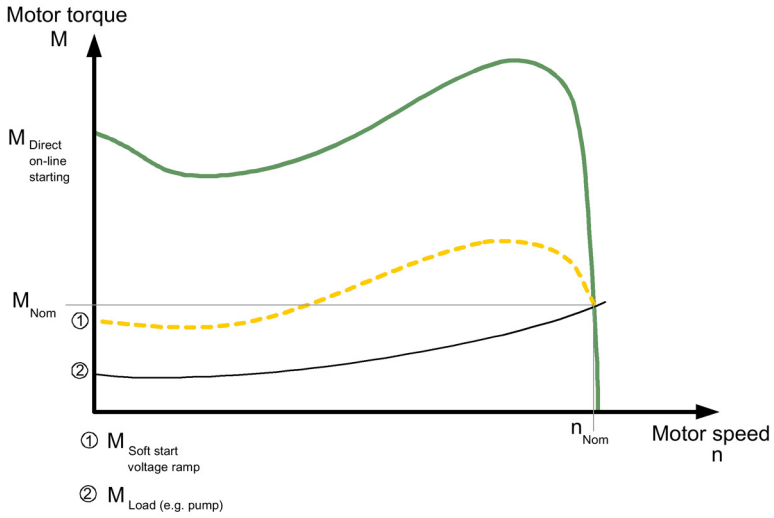


Figure 4-4 Reduced torque characteristic of a three-phase induction motor during starting with a SIRIUS 3RW30 or 3RW40 soft starter

Soft start /soft ramp-down

This means that, since the motor voltage is controlled by the electronic soft starter during the startup process, the consumed starting current and the starting torque generated in the motor are also controlled.

The same principle is applied during the stop process. This ensures that the torque generated in the motor is gradually reduced, so that the application can stop smoothly (the soft ramp-down function is only supported by the 3RW40).

The frequency remains constant during this process and corresponds to the mains frequency, in contrast to frequency controlled starting and stopping of a frequency converter.

4.4.1 Bypass mode

Bypass mode

Once the motor has been started up correctly, the thyristors are subject to fully advanced control, meaning that the whole mains voltage is applied to the motor terminals. As the motor voltage does not have to be controlled during operation, the thyristors are bridged by integral bypass contacts that are rated for AC1 current. This minimizes the waste heat generated during uninterrupted duty (which is caused by the thyristor's power loss), and minimizes heating up of the switching device's environment.

The bypass contacts are protected by an integrated, electronic arc quenching system during operation. If they are opened in the event of a fault, e.g. if the control voltage is temporarily interrupted, mechanical vibrations occur, or the coil operating mechanism or the main contact spring has reached the end of its service life and is defective, the equipment is not damaged.

The diagram below shows the method of operation of the SIRIUS 3RW30 and 3RW40 soft starters:

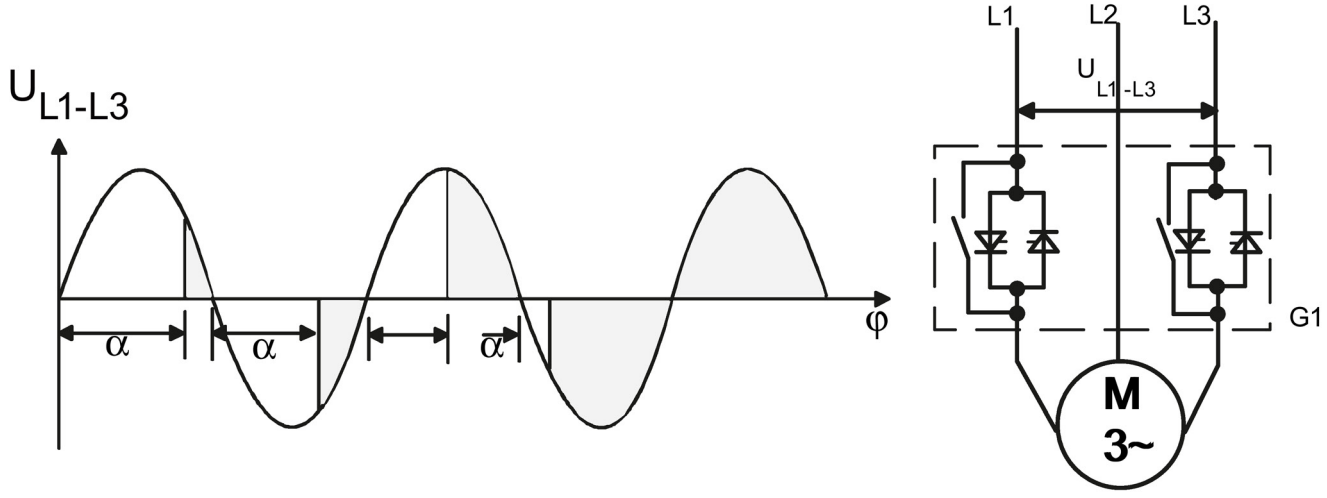


Figure 4-5 Phase angle control and schematic diagram of a two-phase controlled soft starter with integral bypass contacts

4.4.2 Method of operation of a two-phase controlled soft starter

A special method of operation is used for the SIRIUS 3RW30 and 3RW40 two-phase controlled soft starters based on SIEMENS' patented "polarity balancing" control principle.

Two-phase control

The SIRIUS 3RW30 and 3RW40 soft starters are two-phase controlled soft starters, in other words they are designed with two antiparallel thyristors in each of phases L1 and L3. Phase 2 is an uncontrolled phase, which is merely guided through the starter by a copper connection.

In a two-phase controlled soft starter, the current that results from the superimposition of the two controlled phases flows in the uncontrolled phase. The main advantages of two-phase control include the more compact size compared to a three-phase version and the lower hardware costs.

The occurrence of DC components, caused by the phase angle and the overlapping phase currents, is a negative physical effect of two-phase control during the startup process that can mean a louder noise is produced by the motor. The "polarity balancing" control principle was developed and patented by SIEMENS to prevent these DC components during starting.

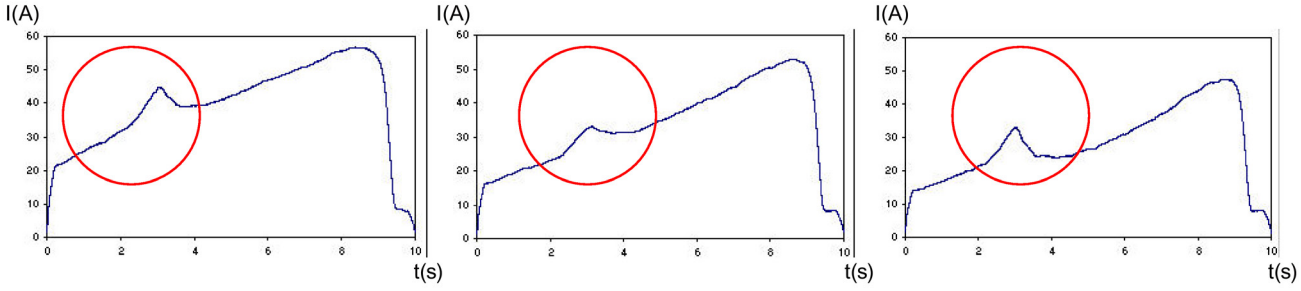


Figure 4-6 Current characteristic and occurrence of DC components in the three phases without "polarity balancing"

Polarity balancing

"Polarity balancing" effectively eliminates these DC components during the ramp-up phase. It allows the motor to be started up with a constant speed, torque, and current rise.

The acoustic quality of the startup process comes very close to that of a three-phase controlled startup. This is made possible by the continuous dynamic alignment and balancing of current half-waves with different polarities during the motor startup.

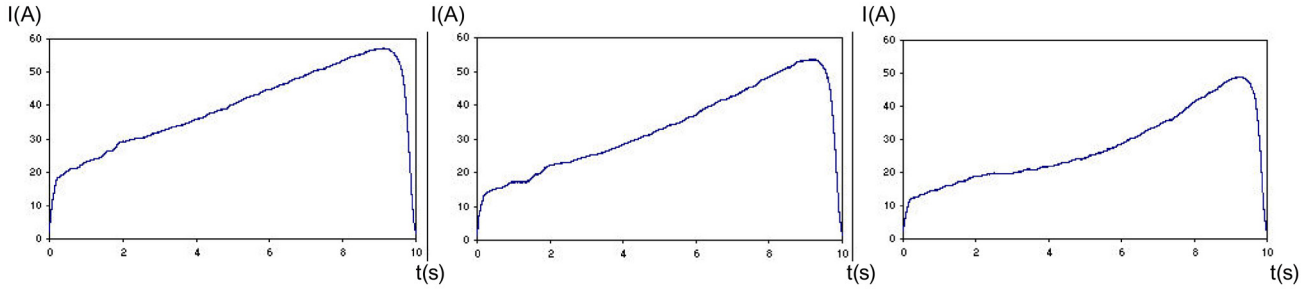


Figure 4-7 Current characteristic in the three phases without DC components thanks to "polarity balancing"

4.4.3 Starting current asymmetry

With two-phase control the starting current is asymmetrical for physical reasons, because the current in the uncontrolled phase is the sum of the currents in the two controlled phases.

This asymmetry can be as much as 30 to 40% during starting (ratio of minimum current to maximum current in all three phases).

Even though this cannot be influenced, it is not critical in most applications. It could cause an insufficiently rated fuse to trip in the uncontrolled phase, for instance. Recommended fuse ratings can be found in the "SIRIUS 3RW30/3RW40 Soft Starters" manual.

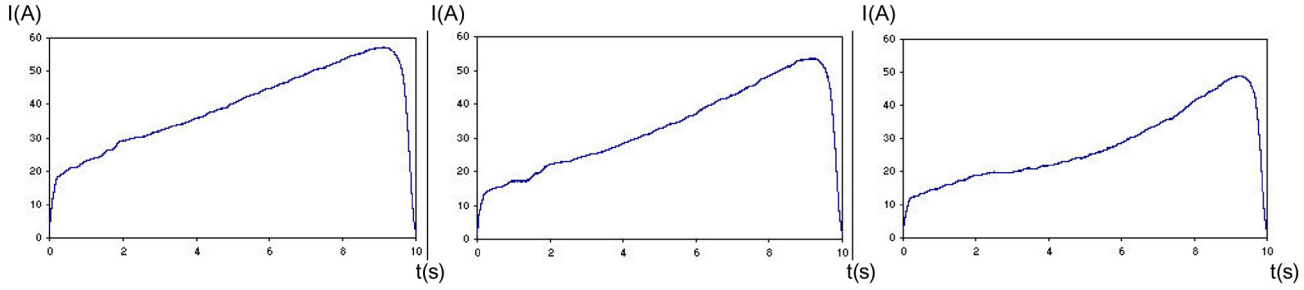


Figure 4-8 Starting current asymmetry

Note

If wye-delta starters are exchanged for soft starters in an existing system, you should check the fuse ratings in the feeder in order to avoid false tripping. This is particularly important in connection with heavy-duty starting or if the fuse that is installed has already been operated close to the thermal tripping limit with the wye-delta assembly.

All elements of the main circuit (such as fuses, motor starter protectors, and switching devices) must be dimensioned for direct starting and according to the on-site short-circuit conditions, and ordered separately.

You can find recommended fuse and motor starter protector ratings for the feeder with soft starter in the "SIRIUS 3RW30/3RW40 Soft Starters" manual.

Reference

More information ...	Is available in ...
about the recommended fuse ratings	the chapter "SIRIUS Innovations manuals (Page 22)" in the "SIRIUS 3RW30/3RW40 Soft Starters" manual.
about the recommended fuse and motor starter protector ratings for the feeder with soft starter	the chapter "SIRIUS Innovations manuals (Page 22)" in the "SIRIUS 3RW30/3RW40 Soft Starters" manual.

4.4.4 Applications and use

Applications and selection criteria

The SIRIUS 3RW30 and 3RW40 soft starters represent a good alternative to direct or wye-delta starters.

The most important advantages are:

- Soft start
- Soft stop (3RW40 only)
- Uninterrupted switching without current peaks that place a heavy load on the system
- Simple installation and commissioning
- Compact, space-saving design

Applications

The typical applications include:

- Conveyor belts
- Roller conveyors
- Compressors
- Fans
- Pumps
- Hydraulic pumps
- Agitators
- Circular saws / band saws

Advantages

Conveyor belts and transport systems:

- Smooth starting
- Smooth stopping

Rotary pumps and piston pumps:

- No pressure surges
- Increased service life of the pipe system

Agitators and mixers:

- Reduced starting current

Fans:

- Protection for the gearbox and V belt

4.5 Comparison of device functions

4.5.1 Soft starter functions




		SIRIUS 3RW30 Standard applications	SIRIUS 3RW40 Standard applications	SIRIUS 3RW44 High Feature applications
Rated current at 40 °C / 50 °C	A	3 . . . 1 0 6 / 3 . . . 9 8	12.5...432 / 11 ... 385	29 ... 1214 / 26 ... 1076
Rated operational voltage	V	200...480	200...600	200...690
Motor rating at 400 V / 460 V •Standard connection •Inside-delta circuit	 kW /hp kW /hp	 1.5...55 / 1.5 ... 75 –	 5.5...250 / 7.5 ... 300 –	 15...710 / 15 ... 950 22...1200 / 30 ... 1700
Ambient temperature	°C	-25...+60	-25...+60	0 . . . + 6 0
Soft start/soft stop		✔[1]	✔	✔
Voltage ramp		✔	✔	✔
Starting/stopping voltage	%	40...100	40...100	20...100
Ramp-up and ramp-down time	s	0 . . . 2 0	0 . . . 2 0	1 . . . 3 6 0
Torque control		–	–	✔
Starting/stopping torque	%	–	–	20...100
Torque limiting	%	–	–	20...200
Ramp time	s	–	–	1 . . . 3 6 0
Integrated jumper contact system		✔	✔	✔
Intrinsic device protection		–	✔	✔
Motor overload protection		–	✔[7]	✔
Thermistor motor protection		–	✔[2]	✔
Integrated remote RESET		–	✔[3]	✔
Settable current limiting		–	✔	✔
Inside-delta circuit		–	–	✔
Breakaway torque		–	–	✔
Creep speed in both directions of rotation		–	–	✔
Pump stop		–	–	✔[4]
DC braking		–	–	✔[4] [5]
Combined braking		–	–	✔[4] [5]
Motor heating		–	–	✔
Communication		–	–	With PROFIBUS DP (option)
External display and operator control module		–	–	(option)
Status measured value display		–	–	✔
Error log		–	–	✔
Events list		–	–	✔
Min/max pointer function		–	–	✔
Trace function		–	–	✔[6]
Programmable control inputs and outputs		–	–	✔
Number of parameter sets		1	1	3
Parameterizing software (SoftStarterES)		–	–	✔
Power semiconductors (thyristors)		2 controlled phases	2 controlled phases	3 controlled phases
Screw terminals		✔	✔	✔
Spring-loaded terminals		✔	✔	✔
UL/CSA		✔	✔	✔
CE mark		✔	✔	✔
Soft starting under heavy-duty starting		–	–	✔[4]
Support for configuration		Win-Soft Starter, electronic selection slider, Technical Assistance ++49 9118955900		

✔ Function available; – function not available.

1) For 3RW30 only soft start.

2) Optional up to size S3 (device variants).

3) For 3RW402. to 3RW404.; for 3RW405. and 3RW407. optional.

4) If necessary, overdimension soft starter and motor.

5) Not possible in inside-delta circuit.

6) Trace function with SoftStarterES software.

7) Acc. to ATEX

Reference

More information ...	Is available in ...
about the 3RW soft starters	the chapter "SIRIUS Innovations manuals (Page 22)" in the "SIRIUS 3RW30/3RW40 Soft Starters" manual and the "SIRIUS 3RW44 Soft Starters" manual.

SIRIUS 3RV2 motor starter protectors

5

5.1 Introduction

Applications

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

Functions

The motor starter protectors protect loads against overloads and short circuits. They also feature a lockable rotary operating mechanism 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 three sizes, S00, S0 and S2.

Note

3RF solid-state contactors are available in two sizes, S00 and S0.

Connection systems

The motor starter protectors are available with the following connection system options (in the main circuit):

- Screw-type connection system (up to 80 A)
- Spring-loaded connection system (3RV2 only, in sizes S00 and S0 up to 32 A)
- Ring cable lug connection system (3RV2 only, in sizes S00 and S0 up to 32 A)

Accessories

The accessories have been tailored to the motor starter protectors and they are available with a screw-type connection system, spring-loaded connection system or ring cable lug connection system. Accessories can be fitted easily and without the need for tools.

5.2 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 three sizes, S00, S0 and S2.

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 5- 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
S2	55 mm[3)]	80 A	37 kW

1) 3RV211, 3RV212: 65 mm

2) 3RV20 and 3RV23 only

3) 3RV213: 75 mm

Number of poles

3RV2 motor starter protectors have 3 poles.

5.3 Applications

General

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

- Three-phase motors up to 37 kW at 400 V AC
- Loads with rated currents of up to 80 A

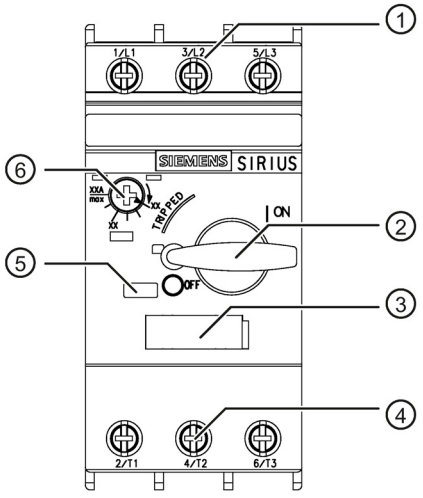
Special applications

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 (size S2 on request)
- Hazardous areas (ATEX)
- Use as Branch Circuit Protection Device (BCPD) according to UL (3RV27/28)

5.4 Motor starter protectors

3RV2 motor starter protectors (size S00 and S0)



1 Terminals:

Up to two conductors with different cross-sections can be connected for the main and auxiliary circuits.
In the case of size S00 and S0 devices, the main circuit can be connected by screw-type, spring-type and ring cable lug connection terminals. In the case of size S00 and S0 devices, 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; display of a possible trip; with integrated locking device.
Switching on and off must be quick and without interruption.

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:

Enables testing of the release mechanism.

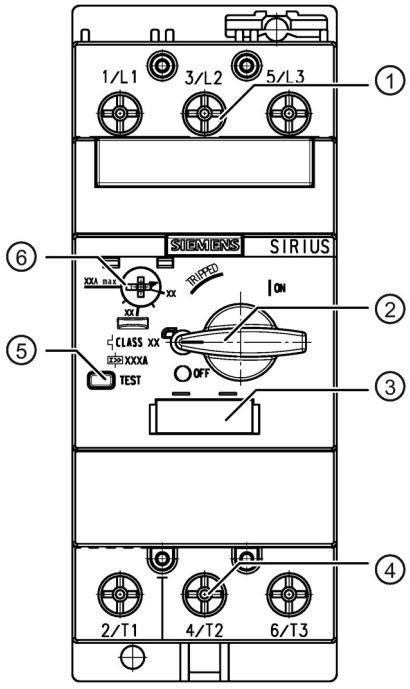
6 Motor current setting:

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

Figure 5-1 Features of 3RV2.1/3RV2.2 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).

3RV2.3 motor starter protectors (size S2)



1 Terminals:

Up to two conductors with different cross-sections can be connected for the main and auxiliary circuits.
In the case of size S2 devices, the main circuit can be connected by screw-type connection terminals. In the case of size S2 devices, 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; display of a possible trip; with integrated locking device.
Switching on and off must be quick and without interruption.

3 Label

4 Connection for mounting contactors and soft starters in various connection systems:

- Direct mounting using link modules
- Separately using connecting cables

5 TEST function:

Enables 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 5-2 Features of 3RV2.3 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).

5.5 Performance features

SIRIUS motor starter protectors boast the following technical advantages:

Technical highlights	Customer benefits
Up to 20 % less power consumption than previous solutions	• Reduced temperature rise in the control cabinet • Cost savings during operation
Uniform connection systems: • Screw-type connection (sizes S00, S0 and S2) • Spring-type connection (sizes S00, S0 and S2[1]) • Ring cable lug-type connection (sizes S00, S0 and S2[3])	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 design and motor starter protectors up to 80 A (37 kW) in 55 mm width design	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 (optional)	Reduced installation complexity
Joint range of accessories for sizes S00, S0 and S2	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 (with derating)
Bimetals with extreme long-term stability	Operational reliability over many years
Compatible for use in all infeed systems (3-phase busbars, 3RA6[2], 3RV29 infeed[2], 8US)	Maximum flexibility in terms of power infeed

1) In the case of size S2 devices, only connection of the auxiliary circuit is possible using spring-type terminals.

2) Only in the case of sizes S00 and S0.

3) In the case of size S2 devices, only connection of the auxiliary circuit is possible using ring cable lug connection systems.

Reference

More information ...	Is available in ...
about the 3RV2 motor starter protectors	the chapter "SIRIUS Innovations manuals (Page 22)" in the "SIRIUS Innovations - SIRIUS 3RV2 Motor Starter Protectors" manual.

SIRIUS 3RU2/3RB3, 3RB24 overload relays 6

6.1 SIRIUS 3RU2 thermal overload relays / SIRIUS 3RB3 solid-state overload relays

6.1.1 Introduction

3RU21 thermal overload relays

3RU21 thermal overload relays up to 80 A have been designed to provide current-dependent protection for loads with normal starting against impermissibly high temperature rises due to overload, phase asymmetry or phase failure.

An overload or phase failure results in an increase of the motor current beyond the set rated motor current. Via heating elements, this current rise increasingly heats up the bimetal strips located inside the device. The deflection of these bimetal strips eventually activates the auxiliary contacts via a release mechanism. The contacts then disconnect the load via a contactor. (The contactor function is not an integral component of the overload relay).

3RB30/3RB31 solid-state overload relays

3RB30 / 3RB31 solid-state overload relays up to 80 A with internal power supply have been designed to provide current-dependent protection for loads with normal starting and heavy starting against impermissibly high temperature rises due to overload, phase asymmetry or phase failure.

An overload, phase asymmetry or a phase failure results in an increase of the motor current beyond the set rated motor current.

This current rise is detected by the current transformers integrated in the devices and evaluated by corresponding solid-state circuits which then supply a pulse to the auxiliary contacts. The contacts then disconnect the load via a contactor. (The contactor function is not an integral component of the overload relay).

In addition to current-dependent protection for loads against impermissibly high temperature rise caused by overload, phase asymmetry, and phase failure, 3RB31 solid-state overload relays feature internal ground-fault detection (not possible in conjunction with contactor assemblies for star-delta (wye-delta) start). This provides protection of loads against high-impedance faults to ground caused by damaged insulation, moisture, condensation, etc.

System integration

The overload relays have been matched to the contactors in the 3RT2 series both electrically and mechanically and can be integrated in the feeder by means of direct mounting.
3RU2 thermal overload relays and 3RB30 and 3RB31 solid-state overload relays are available in three sizes, S00, S0 and S2.

Connection systems

The overload relays are available with the following connection system options:

- Screw-type connection system
- Spring-loaded connection system (size S2 auxiliary circuit only)
- Ring cable lug connection technology (3RU21 only, in size S00 and S0)

3RB3 solid-state overload relays are available in size S2 also in through-hole technology with straight-through transformer.

Accessories

The accessories have been tailored to the overload relays; they can be mounted easily and without the need for tools.

6.1.2 Versions

Sizes, setting ranges, and device versions

The table below provides an overview of the various sizes in which 3RU21 thermal overload relays and 3RB30/3RB31 solid-state overload relays are available. The maximum rated currents, the minimum and maximum setting ranges, and the available tripping classes are listed for each individual size.

Table 6- 1 3RU21 thermal overload relays

Size	Width	Current range	Rated operating power for three-phase motors at 400 V AC	Rated operating voltage U_e	Rated frequency	Trip class
S00	45 mm	0.11 to 16 A	0.04 to 7.5 kW	690 V AC	50/60 Hz	CLASS 10
S0	45 mm	1.8 to 40 A	0.75 to 18.5 kW			
S2	55 mm	11 to 80 A	5.5 to 37 kW			CLASS 10 or CLASS 10A

Table 6- 2 3RB30 solid-state overload relays

Size	Width	Current range	Rated operating power for three-phase motors at 400 V AC	Rated operating voltage U_e	Rated frequency	Trip class
S00	45 mm	0.1 to 16 A	0.04 to 7.5 kW	690 V AC	50/60 Hz	CLASS 10E or 20E (fixed)
S0	45 mm	0.1 to 40 A	0.04 to 18.5 kW			
S2	55 mm	12.5 to 80 A	5.5 to 37 kW			

Table 6- 3 3RB31 solid-state overload relays

Size	Width	Current range	Rated operating power for three-phase motors at 400 V AC	Rated operating voltage U_e	Rated frequency	Trip class
S00	45 mm	0.1 to 16 A	0.04 to 7.5 kW	690 V AC	50/60 Hz	CLASS 5E, 10E, 20E, 30E (adjustable)
S0	45 mm	0.1 to 40 A	0.04 to 18.5 kW			
S2	55 mm	12.5 to 80 A	5.5 to 37 kW			

3RB30 / 3RB31 solid-state overload relays have approximately the same dimensions as 3RU21 thermal overload relays. As a result, the thermal overload relays can be replaced easily with the electronic variant 3RB30/3RB31. This is necessary, for example, when lower demands are placed on overload protection (wide setting ranges (1:4), for example, or even reduced power loss and, as a result, minimized energy consumption).

6.1.3 Applications

Table 6- 4 Overview of applications

Applications	3RU21	3RB30/3RB31
System protection	✓[1)]	✓[1)]
Motor protection	✓	✓
Alternating current, 3-phase	✓	✓
Alternating current, 1-phase	✓	-
DC current	✓	-

[1)] In the main circuit, the devices provide overload protection for the assigned electrical loads (e.g. motors), feeder cable, and other switching and protection devices in the respective load feeder. The 3 phases have to be under symmetrical load.

3RU21 thermal overload relays

3RU21 thermal overload relays have been designed to protect three-phase loads, DC loads, and single-phase AC loads.

Note

Protection of DC loads/single-phase AC loads

If a 3RU21 thermal overload relay is to be used to protect DC loads or single-phase AC loads, all the bimetal strips have to be heated. Therefore, all of the relay's main current paths have to be connected in series.

3RB30 / 3RB31 solid-state overload relays

3RB30/3RB31 solid-state overload relays are designed to protect three-phase loads in sinusoidal 50/60 Hz voltage supplies.

Note

DC loads/Single-phase AC loads

The relay is not suitable for protecting DC loads or single-phase AC loads. On single-pole loads, the 3RU21 thermal overload relay or the 3RB22, 3RB23 and 3RB24 solid-state overload relays for higher applications (no protection for DC loads) must be used for IO-Link.

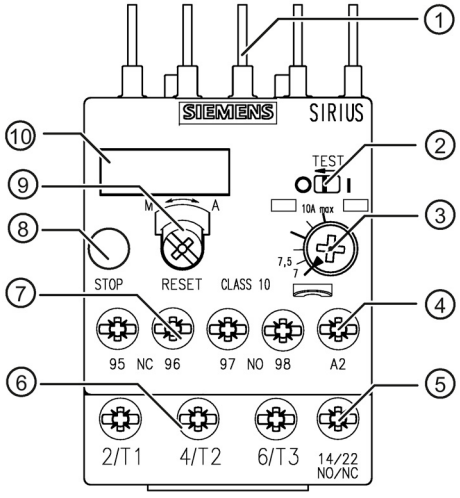
The advantages of load feeders with overload relays

Installing load feeders with overload relays (fuses + contactor + overload relay or MSP for starter combinations/circuit breaker (acc. to UL) + contactor + overload relay) has the following advantages over configurations without overload relays (motor starter protector + contactor):

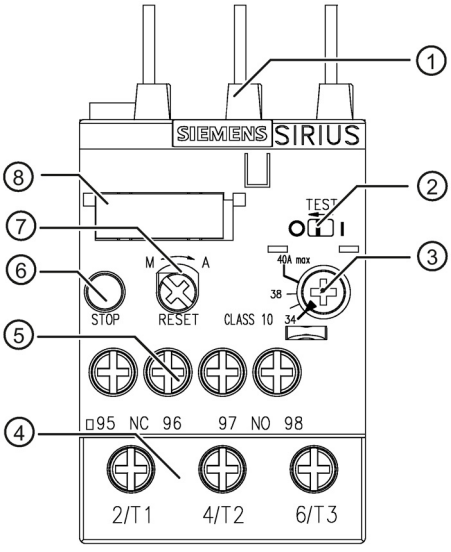
- Overload release and short-circuit release are signaled separately. In the event of a short circuit the fuses or the MSP for starter combinations/circuit breaker (acc. to UL) limit the short-circuit current and in the event of an overload the overload relay disconnects the contactor (and thus the load).
- The overload relays are especially suitable for use in fused switchgear assemblies. The devices are also used in applications in line networks with operating voltages pf more than 400 V. Compared with fuseless design, the fuses still have an extremely high short-circuit breaking capacity in excess of 100 kA, even in these voltage ranges.
- Automatic RESET is easy to implement with the overload relays. Following an overload trip, the load feeder need not be switched on again on-site.
- Attachable electrical or mechanical RESET modules compatible for use with all sizes enable 3RU21 thermal overload relays to be RESET remotely. Mechanical RESET modules which are compatible for use with all sizes can also be attached to 3RB30/3RB31 solid-state overload relays. An electrical remote RESET is an integral component of the 3RB31.
- Applications with lengthy start times can be implemented thanks to the different trip classes of the 3RB30 / 3RB31 solid-state overload relays.
- 3RB30/3RB31 solid-state overload relays reduce variation and simplify configuring and inventory management thanks to their wide 1:4 setting range.
- MSP for starter combinations/circuit breaker (acc. to UL) + contactor + overload relay combinations have the advantage that the load feeder can be isolated easily and all three poles can be disconnected in the event of a short circuit.

6.1.4 3RU21 thermal overload relays

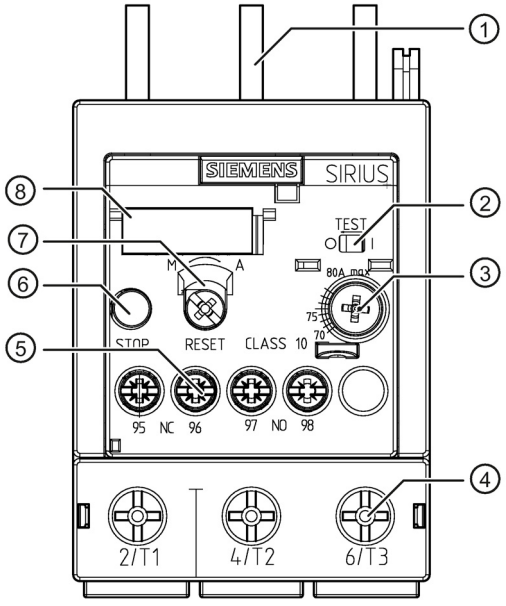
3RU2116 thermal overload relay, size S00, 45 mm width

Front view	Description	
 3RU2116 overload relay equipment	**Position digits**	
	①	Connection for contactor mounting: In terms of their electrical and mechanical features and their design, these pins are perfectly compatible with the 3RT2 contactors for the direct mounting of overload relays. Stand-alone assembly is also an option (in conjunction with a stand-alone assembly module).
	②	Switch position indicator and TEST function for wiring: Indicates a trip and facilitates testing of the wiring.
	③	Motor current setting: The large rotary button provides an easy means of setting the device to the rated motor current.
	④	Feed-through: Contactor coil terminal
	⑤	Feed-through: Contactor auxiliary switch
	⑥	Main circuit terminals: A screw-type, spring-loaded or ring cable lug connection system can be used to connect the main circuit terminal.
	⑦	Control circuit terminals: A screw-type, spring-loaded or ring cable lug connection system can be used to connect the control circuit terminal.
	⑧	STOP button: Pressing the button opens the NC contact, thereby disconnecting the downstream contactor. The NC contact closes again when the button is released.
	⑨	Selector switch for manual/automatic RESET and RESET button: This switch is used to choose between manual and automatic RESET. A device set to manual RESET can be reset locally by pressing the RESET button. The device can be reset remotely using the RESET modules (accessories) which are compatible for use with all sizes.
	⑩	Label
	Terminal labels	
	2/T1	Main circuit terminals
	4/T2	
	6/T3	
	95	NC contact (NC 95-96)
	96	
	97	NO contact (NO 97-98)
	98	
	14/22	Feed-through contactor auxiliary switch
	A2	Feed-through contactor coil terminal

3RU2126 thermal overload relay, size S0, 45 mm width

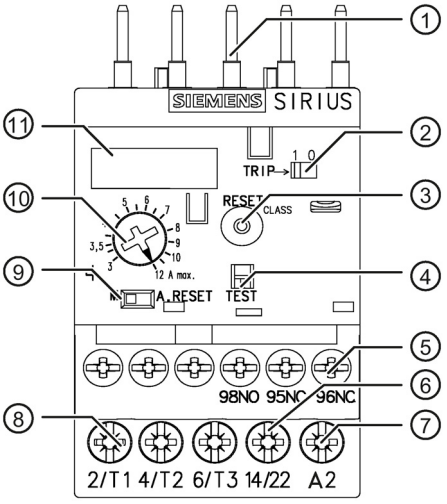
Front view	Description	
 3RU2126 overload relay equipment	**Position digits**	
	①	Connection for contactor mounting: In terms of their electrical and mechanical features and their design, these pins are perfectly compatible with the 3RT2 contactors for the direct mounting of overload relays. Stand-alone assembly is also an option (in conjunction with a stand-alone assembly module).
	②	Switch position indicator and TEST function for wiring: Indicates a trip and facilitates testing of the wiring.
	③	Motor current setting: The large rotary button provides an easy means of setting the device to the rated motor current.
	④	Main circuit terminals: A screw-type, spring-loaded or ring cable lug connection system can be used to connect the main circuit terminal.
	⑤	Control circuit terminals: A screw-type, spring-loaded or ring cable lug connection system can be used to connect the control circuit terminal.
	⑥	STOP button: Pressing the button opens the NC contact, thereby disconnecting the downstream contactor. The NC contact closes again when the button is released.
	⑦	Selector switch for manual/automatic RESET and RESET button: This switch is used to choose between manual and automatic RESET. A device set to manual RESET can be reset locally by pressing the RESET button. The device can be reset remotely using the RESET modules (accessories) which are compatible for use with all sizes.
	⑧	Label
	Terminal labels	
	2/T1	Main circuit terminals
	4/T2	
	6/T3	
	95	NC contact (NC 95-96)
	96	
	97	NO contact (NO 97-98)
	98	

3RU2136 thermal overload relay, size S2, 55 mm width

Front view	Description	
 3RU2136 overload relay equipment	**Position digits**	
	①	Connection for contactor mounting: In terms of their electrical and mechanical features and their design, these pins are perfectly compatible with the 3RT2 contactors for the direct mounting of overload relays. Stand-alone assembly is also an option (in conjunction with a stand-alone assembly module).
	②	Switch position indicator and TEST function for wiring: Indicates a trip and facilitates testing of the wiring.
	③	Motor current setting: The large rotary button provides an easy means of setting the device to the rated motor current.
	④	Main circuit terminals: A screw-type connection system can be used to connect the main circuit terminal.
	⑤	Control circuit terminals: A screw-type or spring-loaded connection system can be used to connect the control circuit terminal.
	⑥	STOP button: Pressing the button opens the NC contact, thereby disconnecting the downstream contactor. The NC contact closes again when the button is released.
	⑦	Selector switch for manual/automatic RESET and RESET button: This switch is used to choose between manual and automatic RESET. A device set to manual RESET can be reset locally by pressing the RESET button. The device can be reset remotely using the RESET modules (accessories) which are compatible for use with all sizes.
	⑧	Label
	Terminal labels	
	2/T1	Main circuit terminals
	4/T2	
	6/T3	
	95	NC contact (NC 95-96)
	96	
	97	NO contact (NO 97-98)
	98	

6.1.5 3RB30 solid-state overload relays

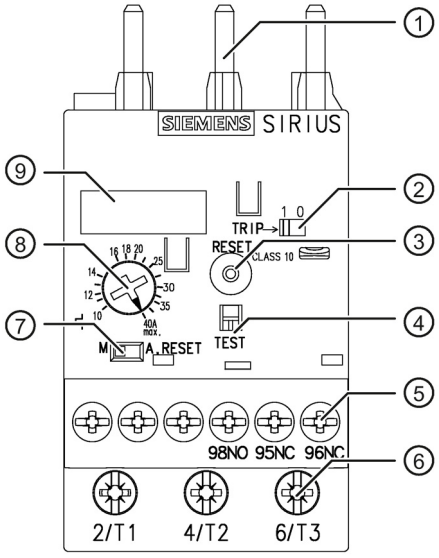
3RB3016 solid-state overload relay, size S00, 45 mm width



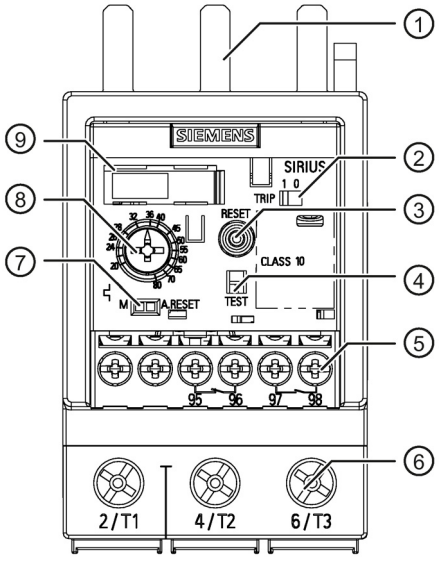
3RB3016 overload relay equipment

Description		
Position digits		
①	Connection for contactor mounting: In terms of their electrical and mechanical features and their design, these pins are perfectly compatible with the 3RT2 contactors for the direct mounting of overload relays. Stand-alone assembly is also an option (in some cases in conjunction with a stand-alone assembly module).	
②	Switch position indicator and TEST function for wiring: Indicates a trip and facilitates testing of the wiring.	
③	RESET button A device set to manual RESET can be reset locally by pressing the RESET button.	
④	Electronics test (device test): Enables a test of all major device components and functions.	
⑤	Control circuit terminals (removable): A screw-type or spring-loaded system can be used to connect the control circuit terminal.	
⑥	Feed-through: Contactor auxiliary switch	
⑦	Feed-through: Contactor coil terminal	
⑧	Main circuit terminals: A screw-type or spring-loaded system can be used to connect the main circuit terminal.	
⑨	Selector switch for manual/automatic RESET and RESET button: The slide switch is used to choose between manual and automatic RESET.	
⑩	Motor current setting: The large rotary button provides an easy means of setting the device to the rated motor current.	
⑪	Label	
Terminal labels		
2/T1	Main circuit terminals	
4/T2		
6/T3		
95	NC contact (NC 95-96)	
96		
97	NO contact (NO 97-98)	
98		
14/22	Feed-through contactor auxiliary switch	
A2	Feed-through contactor coil terminal	

3RB3026 thermal overload relay, size S0, 45 mm width

Front view	Description	
 3RB3026 overload relay equipment	**Position digits**	
	①	Connection for contactor mounting: In terms of their electrical and mechanical features and their design, these pins are perfectly compatible with the 3RT2 contactors for the direct mounting of overload relays. Stand-alone assembly is also an option (in some cases in conjunction with a stand-alone assembly module).
	②	Switch position indicator and TEST function for wiring: Indicates a trip and facilitates testing of the wiring.
	③	RESET button A device set to manual RESET can be reset locally by pressing the RESET button.
	④	Electronics test (device test): Enables a test of all major device components and functions.
	⑤	Control circuit terminals (removable): A screw-type or spring-loaded system can be used to connect the control circuit terminal.
	⑥	Main circuit terminals: A screw-type or spring-loaded system can be used to connect the main circuit terminal.
	⑦	Selector switch for manual/automatic RESET and RESET button: The slide switch is used to choose between manual and automatic RESET.
	⑧	Motor current setting: The large rotary button provides an easy means of setting the device to the rated motor current.
	⑨	Label
	Terminal labels	
	2/T1	Main circuit terminals
	4/T2	
	6/T3	
	95	NC contact (NC 95-96)
	96	
	97	NO contact (NO 97-98)
	98	

3RB3036 solid-state overload relays, size S2, 55 mm width

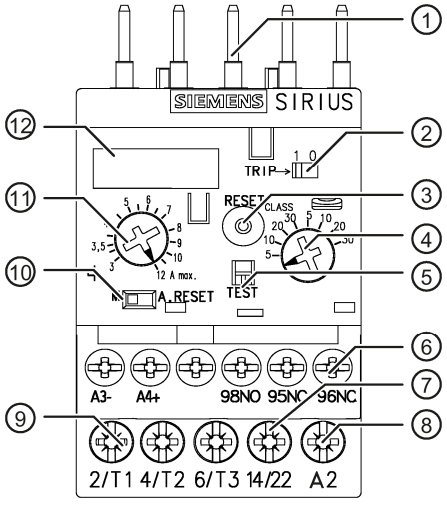


3RB3036 overload relay equipment

Front view	Description	
	Position digits	
	①	Connection for contactor mounting: In terms of their electrical and mechanical features and their design, these pins are perfectly compatible with the 3RT2 contactors for the direct mounting of overload relays. Stand-alone assembly is also an option (in some cases in conjunction with a stand-alone assembly module).
	②	Switch position indicator and TEST function for wiring: Indicates a trip and facilitates testing of the wiring.
	③	RESET button A device set to manual RESET can be reset locally by pressing the RESET button. On the 3RB31 an electronic remote RESET is integrated.
	④	Electronics test (device test): Enables a test of all major device components and functions.
	⑤	Control circuit terminal (removable): A screw-type or spring-loaded system can be used to connect the control circuit terminal.
	⑥	Main circuit terminal: The main circuit can be connected using either the screw-type connection system or through-hole technology with straight-through transformer.
	⑦	Selector switch for manual/automatic RESET and RESET button: The slide switch is used to choose between manual and automatic RESET.
	⑧	Motor current setting: The large rotary button provides an easy means of setting the device to the rated motor current.
	⑨	Label / DataMatrix code (behind the label)
	Terminal labels	
	2/T1	Main circuit terminals
	4/T2	
	6/T3	
	95	NC contact (NC 95-96)
	96	
	97	NO contact (NO 97-98)
	98	

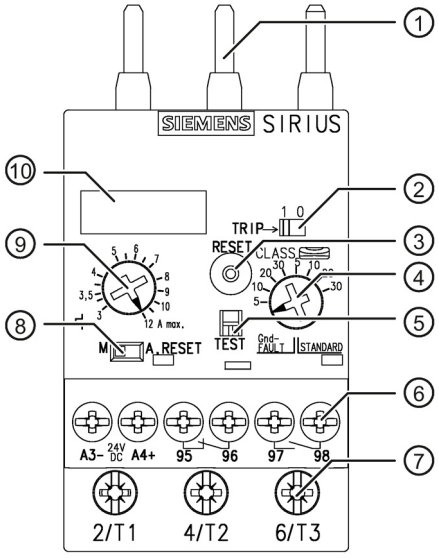
6.1.6 3RB31 solid-state overload relays

3RB3113 solid-state overload relays, size S00, 45 mm width

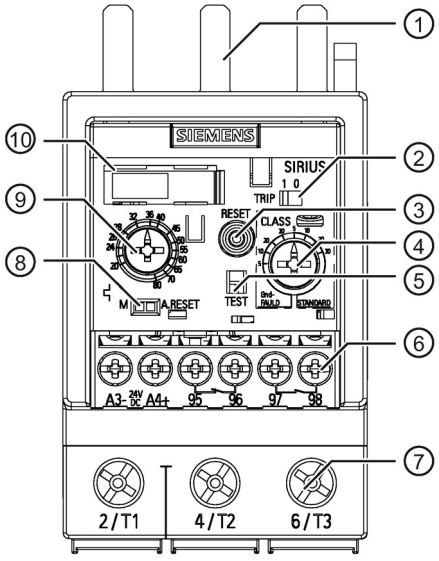
Front view	Description	
 3RB3113 solid-state overload relay equipment	**Position digits**	
	①	Connection for contactor mounting: In terms of their electrical and mechanical features and their design, these pins are perfectly compatible with the 3RT2 contactors for the direct mounting of overload relays. Stand-alone assembly is also an option (in some cases in conjunction with a stand-alone assembly module).
	②	Switch position indicator and TEST function for wiring: Indicates a trip and facilitates testing of the wiring.
	③	RESET button A device set to manual RESET can be reset locally by pressing the RESET button. In addition, an electronic remote RESET is integrated into the 3RB31.
	④	Tripping class setting/internal ground-fault detection: This rotary switch is used to set the required tripping class dependent upon the starting conditions and activate internal ground-fault detection.
	⑤	Electronics test (device test): Enables a test of all major device components and functions.
	⑥	Control circuit terminal (removable): A screw-type or spring-loaded system can be used to connect the control circuit terminal.
	⑦	Feed-through: Contactor auxiliary switch
	⑧	Feed-through: Contactor coil terminal
	⑨	Main circuit terminal: A screw-type or spring-loaded system can be used to connect the main circuit terminal.
	⑩	Selector switch for manual/automatic RESET and RESET button: The slide switch is used to choose between manual and automatic RESET.
	⑪	Motor current setting: The large rotary button provides an easy means of setting the device to the rated motor current.
	⑫	Label

Front view	Description	
	Terminal labels	
	2/T1	Main circuit terminals
	4/T2	
	6/T3	
	95	NC contact (NC 95-96)
	96	
	97	NO contact (NO 97-98)
	98	
	14/22	Feed-through contactor auxiliary switch
	A2	Feed-through contactor coil terminal

3RB3123 solid-state overload relays, size S0, 45 mm width

Front view	Description	
 3RB3123 overload relay equipment	**Position digits**	
	①	Connection for contactor mounting: In terms of their electrical and mechanical features and their design, these pins are perfectly compatible with the 3RT2 contactors for the direct mounting of overload relays. Stand-alone assembly is also an option (in some cases in conjunction with a stand-alone assembly module).
	②	Switch position indicator and TEST function for wiring: Indicates a trip and facilitates testing of the wiring.
	③	RESET button A device set to manual RESET can be reset locally by pressing the RESET button. In addition, an electronic remote RESET is integrated into the 3RB31.
	④	Tripping class setting/internal ground-fault detection: This rotary switch is used to set the required tripping class dependent upon the starting conditions and activate internal ground-fault detection.
	⑤	Electronics test (device test): Enables a test of all major device components and functions.
	⑥	Control circuit terminal (removable): A screw-type or spring-loaded system can be used to connect the control circuit terminal.
	⑦	Main circuit terminal: A screw-type or spring-loaded system can be used to connect the main circuit terminal.
	⑧	Selector switch for manual/automatic RESET and RESET button: The slide switch is used to choose between manual and automatic RESET.
	⑨	Motor current setting: The large rotary button provides an easy means of setting the device to the rated motor current.
	⑩	Label
	Terminal labels	
	2/T1	Main circuit terminals
	4/T2	
	6/T3	
	95	NC contact (NC 95-96)
	96	
	97	NO contact (NO 97-98)
	98	

3RB3133 solid-state overload relays, size S2, 55 mm width



3RB3133 overload relay equipment

Description		
Position digits		
①	Connection for contactor mounting: In terms of their electrical and mechanical features and their design, these pins are perfectly compatible with the 3RT2 contactors for the direct mounting of overload relays. Stand-alone assembly is also an option (in some cases in conjunction with a stand-alone assembly module).	
②	Switch position indicator and TEST function for wiring: Indicates a trip and facilitates testing of the wiring.	
③	RESET button A device set to manual RESET can be reset locally by pressing the RESET button. In addition, an electronic remote RESET is integrated into the 3RB31.	
④	Tripping class setting/internal ground-fault detection (3RB313 only): This rotary switch is used to set the required tripping class dependent upon the starting conditions and activate internal ground-fault detection.	
⑤	Electronics test (device test): Enables a test of all major device components and functions.	
⑥	Control circuit terminal (removable): A screw-type or spring-loaded system can be used to connect the control circuit terminal.	
⑦	Main circuit terminal: The main circuit can be connected using either the screw-type connection system or through-hole technology with straight-through transformer.	
⑧	Selector switch for manual/automatic RESET and RESET button: The slide switch is used to choose between manual and automatic RESET.	
⑨	Motor current setting: The large rotary button provides an easy means of setting the device to the rated motor current.	
⑩	Label / DataMatrix code (behind the label)	
Terminal labels		
2/T1	Main circuit terminals	
4/T2		
6/T3		
95	NC contact (NC 95-96)	
96		
97	NO contact (NO 97-98)	
98		

Reference

More information ...	Is available in ...
about the 3RU2, 3RB30/3RB31 overload relays	the chapter "SIRIUS Innovations manuals (Page 22)" in the "SIRIUS Innovations - SIRIUS 3RU2/3RB3 Overload Relays" manual.

6.2 3RB24 solid-state overload relay for IO-Link

6.2.1 Properties

Solid-state overload relay for IO-Link

The solid-state overload relay, comprising the 3RB24 evaluation module and a 3RB29 current measuring module, protects electrical equipment (e.g. three-phase motors) with two different protection mechanisms: overload protection and thermistor protection. Ground fault detection can also be enabled via IO-Link.

In conjunction with the 3RT contactors, the solid-state overload relay for IO-Link can be used as a direct-on-line starter, reversing starter or, with the help of an additional circuit, as a star-delta (wye-delta) starter. It is possible to read out diagnostics data, such as the current, via IO-Link and to further process this data in the higher-level controller.

6.2.2 System structure

Device concept

The 3RB24 solid-state overload relay has a modular device concept. Each device consists of a motor-current-independent evaluation module, and a motor-current-dependent current measuring module. Both modules are connected electrically to each other by connecting cable via the interface.

Optionally, the 3RA6935-0A operator panel can be connected to the front of the evaluation module.

Requirements

You require the following tools for system setup:

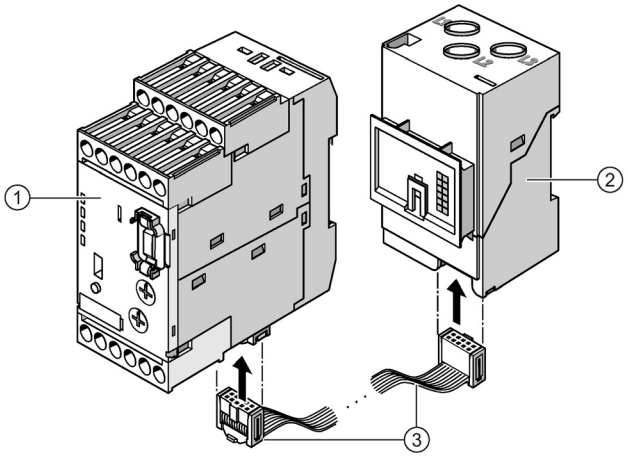
- 1 x evaluation module 3RB2483-4A .1
- 1 x current measuring module 3RB29.6-2...
- 1 x connecting cable 3RB2987-2.

Note

The connecting cable 3RB2987-2B for linking the evaluation module and the current measuring module is only to be used when the evaluation module is mounted direct on the current measuring module.

System structure

The following graphic illustrates the design principle of a system.



① Evaluation module 3RB2483-4A .1
② Current measuring module 3RB29.6-2...
③ Connecting cable 3RB2987-2.

Figure 6-1 System structure

6.2.3 Functions

Overview of the basic functions

The 3RB24 solid-state overload relay for IO-Link offers the following basic functions:

Protective function:

- Current-dependent protection of loads against overload
- Current-dependent protection of loads against phase asymmetry
- Current-dependent protection of loads against phase failure
- Cold conductor (PTC) sensor circuit (thermistor protection)
- Protection of loads against incomplete ground faults

Motor starter function:

- Control of the relay contacts for operating the connected contactors via IO-Link

Diagnostics and monitoring:

- Output of an analog signal DC 4 mA to DC 20 mA as an image of the flowing motor current
- Diagnostics via IO-Link for further processing in the higher-level controller, e.g. device status with regard to protective functions, parameterization and transfer of the measured current value

Note

Fuses or circuit breakers must be used for short-circuit protection.

Overload protection/phase asymmetry/phase failure

The 3RB24 solid-state overload relays for IO-Link are modular in design and are supplied with power via the IO-Link master. The associated 3RB29 current measuring modules can be ordered in different sizes and cover a current range of 0.3 to 630 A. This means the right current measuring module can be selected for every application. A current setting up to 820 A is possible in conjunction with a series transformer. The solid-state overload relays have been designed to provide current-dependent protection for loads with normal starting and heavy starting against impermissibly high temperature rises due to overload, phase asymmetry or phase failure. The devices can be used as direct-on-line starters, reversing starters or, with the help of an additional circuit, as star-delta (wye-delta) starters.

Overload, phase asymmetry or phase failure results in an increase of the motor current beyond the set rated operational current of the motor. This increase in current is detected using a current measuring module, and electronically analyzed by a connected 3RB24 evaluation module. The evaluation electronics send a signal to the auxiliary contacts. The auxiliary contacts then disconnect the contactor and the load. The break time depends on the ratio of the tripping current to the rated operational current I_e and is stored in the form of a tripping characteristic with long-term stability.

The status "Tripped" is signaled by an "OVERLOAD" LED showing a permanently red light and a "DEVICE / IO-Link" LED showing a permanently red light. The "OVERLOAD" LED flickers to indicate an imminent relay trip following violation of a limit current resulting from overload, phase asymmetry or phase failure. This overload warning is reported as a general warning via the IO-Link to the higher-level controller.

If, after a tripping operation, the voltage supply of the overload relay is interrupted within the recovery time of 3 minutes, the time starts again when the supply is restored, and a period of 3 minutes must elapse before the device is ready for service again.

Thermistor protection

The 3RB24 solid-state overload relays for IO-Link offer the option of direct temperature monitoring of the motor windings. Full motor protection is implemented by connection of a cold conductor (PTC) sensor circuit monitored for short-circuit and wire break.

With this temperature-dependent protection, the loads can be protected against overtemperature resulting indirectly from restricted coolant flow, for example, and undetectable by current measurement. In the case of overtemperature, the devices shut down the contactor and thus the loads via the auxiliary contact.

The status "Tripped" is signaled by a "THERMISTOR" LED showing a permanently red light and a "DEVICE / IO-Link" LED showing a permanently red light.

Note

To guarantee sure functioning of the short-circuit detection in the thermistor circuit, the line resistance must not exceed 10 Ω in the case of a short-circuited thermistor.

Ground fault protection

To also protect the loads against high-resistance short circuits due to damage to the insulation, humidity or condensation the solid-state overload relays for IO-Link offer the possibility of internal ground fault detection.

Note

Internal ground fault detection is not possible in conjunction with contactor assemblies for star-delta (wye-delta) start.

In the event of a ground fault, the relays trip instantaneously.

The "Tripped" status is signaled by means of a "GND FAULT" LED showing a permanently red light and a "DEVICE / IO-Link" LED showing a permanently red light, and it can also be signaled via IO-Link.

Ground fault detection can be enabled or parameterized in the solid-state overload relay when using with motors with 3-conductor connection (without N connection). Ground fault detection is disabled in the delivery state.

Self-monitoring

The 3RB24 solid-state overload relay for IO-Link has a self-monitoring feature. The overload relay constantly monitors its own basic functions and trips if an internal fault is detected.

Electrical interlock

The electrical interlock prevents simultaneous selection of direction of rotation 1 and direction of rotation 2. If direction of rotation 1 and direction of rotation 2 are selected simultaneously, the overload relay outputs a process image error.

The switchover time is the time provided for changing the direction of rotation. The switchover time is 0.5 s and cannot be parameterized. The electrical interlock is also active during the switchover time, in other words, selection of a direction of rotation only becomes effective 0.5 s after revoking a selection signal for the other direction of rotation.

Residual current detection

The 3RB24 solid-state overload relay for IO-Link has internal residual current detection and checks for a current-free state with regard to an active or non-active control command. If not, the device switches off and signals a fault.

A current flow is detected if the current is greater than 12% of the rated operational current. Detection takes place 1.5 s after switching the overload relay on or off.

The table below represents the different states.

Table 6- 5 Residual current detection

Switch-on command …	Current flow …	Response/state	Message
pending	detected	Device ready for service	No fault message
pending	not detected	Residual current tripping	Fault message and shutdown of the auxiliary contacts
not pending	detected	Switching element defective	Fault message (no further response possible)
not pending	not detected	Device ready for service	No fault message

Reference

More information ...	Is available in ...
about 3RB24 solid-state overload relay for IO-Link	the chapter "SIRIUS Innovations manuals (Page 22)" in the "3RB24 Solid-State Overload Relay for IO-Link" manual.

SIRIUS 3UG4 / 3RR2, 3RS1 / 3RS2, 3UG48 / 3RR24, 3RS14 / 3RS15 monitoring relays

7

7.1 3UG4 / 3RR2 monitoring relays

Product description

The tried and tested SIRIUS monitoring relays for electrical and mechanical quantities enable constant monitoring of all important characteristic quantities that provide information about the reliability performance of the plant. Sudden disturbances and gradual changes, which may reveal a maintenance requirement, for example, are both indicated. By means of relay outputs, the monitoring relays enable direct shutdown of the affected sections of the plant as well as issuing an alarm (e.g. by switching on a warning lamp). To respond flexibly to short-term disturbances such as voltage dips or load variation, the monitoring relays have settable delay times. This avoids unnecessary alarming and shutdowns while enhancing plant availability.

The individual 3UG4 monitoring relays offer the following functions in various combinations:

- Undershoot and/or overshoot of liquid levels
- Phase sequence
- Phase failure, neutral failure
- Phase asymmetry
- Undershoot and/or overshoot of voltage thresholds
- Undershoot and/or overshoot of current thresholds
- Undershoot and/or overshoot of power factor thresholds
- Monitoring of the active current or apparent current
- Monitoring of the fault current
- Monitoring the insulation resistance
- Undershoot and/or overshoot of speed thresholds

The 3RT2 contactors for mounting on 3RR2 current monitoring relays offer:

- Phase sequence
- Phase failure
- Undershoot and/or overshoot of current thresholds
- Monitoring of the active current or apparent current
- Monitoring of the fault current

7.1.1 Overview of the functions

7.1.1.1 3RR2 current monitoring relays

Table 7- 1 Functions of the 3RR21 / 3RR22 current monitoring relays for analog and digital setting

Function	Current monitoring relay	
	3RR21	3RR22
Current monitoring		
Monitoring for undercurrent	2p	3p
Monitoring for overcurrent	2p	3p
Apparent current monitoring	✓	✓
Active current monitoring	—	✓
Range monitoring	2p	3p
Monitoring for phase failure, wire break	2p	3p
Monitoring for phase sequence	—	✓
Internal ground-fault detection (fault current monitoring)	—	✓
Blocking current monitoring	—	✓
Supply voltage		
Self-powered, without auxiliary voltage	—	—
Externally powered, with auxiliary voltage	✓	✓

✓: Function available

2p: Monitoring is 2-phase

3p: Monitoring is 3-phase

— : Function not available

7.1.1.2 3UG45 / 3UG46 monitoring relays

Table 7- 2 Functions of the 3UG45/3UG46 monitoring relays for analog and digital setting

Function	Monitoring relays																	
	3UG45					3UG46												
	01	11	12	13	8	14	15	16	17	18	31	32	33	21	22	41	25	51
Line monitoring and voltage monitoring																		
Monitoring for phase sequence	—	✓	✓	✓	—	✓	✓	✓	✓	✓	—	—	—	—	—	—	—	—
Monitoring for phase failure	—	○1)	✓	✓	—	✓	✓	✓	✓	✓	—	—	—	—	—	—	—	—
Monitoring for asymmetry	—	—	10 %	20 %	—	✓	○2)	○2)	✓	✓	—	—	—	—	—	—	—	—
Monitoring for undervoltage	—	—	—	3p	—	3p	3p	3p	3p	3p	1p	1p	1p	—	—	—	—	—
Monitoring for overvoltage	—	—	—	—	—	—	3p	3p	3p	3p	1p	1p	1p	—	—	—	—	—
Monitoring for neutral failure	—	—	—	—	—	—	—	✓	—	✓	—	—	—	—	—	—	—	—
Automatic direction of rotation correction in the case of incorrect phase sequence	—	—	—	—	—	—	—	—	✓	✓	—	—	—	—	—	—	—	—
Power factor monitoring and current monitoring																		
Monitoring for undercurrent	—	—	—	—	—	—	—	—	—	—	—	—	—	1p	1p	1p	—	—
Monitoring for overcurrent	—	—	—	—	—	—	—	—	—	—	—	—	—	1p	1p	1p	—	—
Active current monitoring	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✓	—	—
Apparent current monitoring	—	—	—	—	—	—	—	—	—	—	—	—	—	✓	✓	—	—	—
Power factor monitoring	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✓	—	—
Fault current monitoring/insulation monitoring																		
Monitoring for fault current/ground fault	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✓	—
Insulation monitoring	—	—	—	—	✓	—	—	—	—	—	—	—	—	—	—	—	—	—
Filling level monitoring																		
Monitoring for filling level overshoot/resistance overshoot	✓	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Monitoring for filling level undershoot/resistance undershoot	✓	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Speed monitoring																		
Monitoring for speed overshoot	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✓
Monitoring for speed undershoot	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✓

Function	Monitoring relays																	
	3UG45					3UG46												
	01	11	12	13	8	14	15	16	17	18	31	32	33	21	22	41	25	51
Rated control supply voltage																		
Self-powered, without auxiliary voltage	—	✓	✓	✓	—	✓	✓	✓	✓	✓	—	—	✓	—	—	✓	—	—
Externally powered, with auxiliary voltage	✓	—	—	—	✓	—	—	—	—	—	✓	✓	—	✓	✓	—	✓	✓

✓: Function available

1p: Monitoring is 1-phase

3p: Monitoring is 3-phase

— : Function not available

○: Function available with limitations

1) Detection causes problems with regenerative power recovery.

2) By monitoring the voltage thresholds.

Reference

More information ...	Is available in ...
about the 3UG4/3RR2 monitoring relays	the chapter "SIRIUS Innovations manuals (Page 22)" of the "3UG4/3RR2 Monitoring Relays" manual.

7.2 3RS1/3RS2 temperature monitoring relays

7.2.1 Product description

Product description

The temperature monitoring relays are used for measuring temperatures in solid, liquid, and gaseous media. The temperature is sensed by the sensors in the medium and evaluated by the device. It is monitored for overshoot, undershoot or, on digital device versions, remaining within a working range (range function).

The family comprises the following devices:

- Devices for analog setting, with one or two limit values
- Digital devices for 1 sensor (e.g. alternative to temperature controllers for low-end applications)
- Digital devices for up to 3 sensors (optimized for monitoring large motors)

7.2.2 Overview of the functions (3RS10/ 11/ 20/ 21)

Function

Table 7- 3 Functions of the 3RS1 / 3RS2 temperature monitoring relays

Function	Temperature monitoring relays															
	3RS10							3RS20[2]		3RS11						3RS21[2]
	00	10	20	30	40	41	42	40	41	00	01	20	21	40	42	40
Settings	a	a	a	a	d	d	d	d	d	a	a	a	a	d	d	d
Connectable sensor type																
Resistance sensors	✓	✓	✓	✓	✓	✓	✓	✓	✓	--	--	--	--	--	--	--
Thermocouple	--	--	--	--	--	--	--	--	--	✓	✓	✓	✓	✓	✓	✓
Number of sensors that can be monitored	1	1	1	1	1	3	1	1	3	1	1	1	1	1	1	1
Temperature monitoring																
Temperature monitoring for overshoot	✓	--	✓	--	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Temperature monitoring for undershoot	--	✓	--	✓	✓	✓	✓	✓	✓	--	--	--	--	✓	✓	✓
Number of limit values that can be set[1]	1	1	2	2	2	2	2	2	2	1	1	2	2	2	2	2

[1] The device versions with two limit values can be switched between the open-circuit principle NO and the closed-circuit principle NC.

[2] Temperature scale of the sensors in degrees Fahrenheit [°F].

✓: Function available

--: Function not available

a : Analog setting

d: Digital setting

Reference

More information ...	Is available in ...
about the 3RS1/3RS2 temperature monitoring relays	the chapter "SIRIUS Innovations manuals (Page 22)" in the "3RS1/3RS2 Temperature Monitoring Relays" manual.

7.3 3UG48 / 3RR24 monitoring relays for IO-Link

7.3.1 Product description

Product description

The tried and tested SIRIUS monitoring relays for electrical and mechanical quantities enable constant monitoring of all important characteristic quantities that provide information about the reliability performance of the plant. Sudden disturbances and gradual changes, which may reveal a maintenance requirement, for example, are both indicated. Through relay outputs, the monitoring relays enable direct shutdown of the affected sections of the plant as well as alarming (e.g. by switching a warning lamp). To respond flexibly to short-term disturbances such as voltage dips or load variation, the monitoring relays have settable delay times. This avoids unnecessary alarming and shutdowns while enhancing plant availability.

The individual monitoring relays provide the following functions in different combinations:

- Phase sequence
- Phase failure, neutral failure
- Phase asymmetry
- Voltage below and / or above thresholds
- Current below and / or above thresholds
- Power factor below and / or above thresholds
- Monitoring of the active current or apparent current
- Speed below and / or above thresholds

The SIRIUS 3UG48/3RR24 monitoring relays for IO-Link offer many other performance features in addition to monitoring functions:

- Measured values (including resolution and unit) to the higher-level control.
  Some device versions allow you to set which value is to be transferred cyclically.
- Transmission of alarm flags to the higher-level control.
- Comprehensive diagnostics capability by querying the precise cause of the error in the diagnostic data record.
- Remote parameterization additionally possible (supplementing local parameterization or instead of local parameterization).
- Fast parameterization of identical devices by duplicating the parameter assignment in the higher-level control.
- Parameter transfer by means of Upload to the higher-level control via- IO-Link call or by parameter server[1)] when using an IO-Link master in
  IO-Link Communication Specification V1.1 or higher).
- Local parameter assignment can be disabled via IO-Link.
- To prevent automatic startup after a power failure and to avoid losing diagnostic data, errors can be configured so that they are saved to non-volatile memory.
- Linking to a higher-level control makes it possible to assign parameters to the monitoring relays via a display unit. The measured values can be displayed directly in a control room or at the machine/control cabinet.

Up until now, using redundant sensors and/or analog signal converters to transfer measured values to a higher-level control incurred significant additional expense and wiring effort. Combining the autonomous monitoring relays with IO-Link communication reduces this wiring outlay and cuts costs.
As the availability of up-to-date measured values means that the higher-level control can take care of the control tasks within the plant, the continued availability of the output relays on the monitoring relays increases the plant's operational reliability (e.g. by shutting down the plant if thresholds that cannot be achieved under normal operating conditions are overshot).

The monitoring relays continue to function autonomously in spite of the IO-Link connection. Parameters can be assigned locally at the device, independently of a higher-level control. As long as the 24 VDC supply voltage is available, the monitoring relays will function if the controller fails or is not yet available. If the 3UG48/3RR24 monitoring relay is used for IO-Link without a connection to a higher-level control, because of the integrated SIO-Mode, the devices feature an additional semiconductor output that switches when settable warning thresholds are exceeded.

[1)] The parameter server provides an assurance of consistent central data management in the event of changes to parameters (made locally or via the control). The "Parameter server" function supports the automatic backup of parameter data (automatic re-assignment of parameter data if a device is replaced).

7.3.2 Overview of the functions

7.3.2.1 3RR24 current monitoring relays for IO-Link

Table 7- 4 Functions of the digitally adjustable 3RR24 current monitoring relays for IO-Link

	Current monitoring relay
	3RR24
Current monitoring	
Monitoring for undercurrent	3p
Monitoring for overcurrent	3p
Range monitoring	3p
Apparent current monitoring	✓
Active current monitoring	✓
Monitoring for phase failure, wire break	3p
Monitoring for phase sequence	✓
Monitoring for current asymmetry	✓
Internal ground-fault detection (fault current monitoring)	✓
Blocking current monitoring	✓
Supply voltage	
External power supply (via the IO-Link master or an external 24 V DC voltage source)	✓
Additional functions	
Runtime meter	✓
Switching cycle counter	✓
Voltage measurement	1p
Cos phi calculation	✓
Runtime meter	✓
Switching cycle counter	✓
Voltage measurement	1p
Cos phi calculation	✓
Apparent power calculation	3p
Active power calculation	3p

✓: Function available

1p: Measuring is single-phase

3p: Monitoring/calculation is 3-phase

7.3.2.2 3UG48 monitoring relays for IO-Link

Table 7- 5 Functions of the 3UG48 monitoring relays for IO-Link

	3UG48 monitoring relays					
	15	**16**	**32**	**22**	**41**	**51**
Line monitoring and voltage monitoring						
Monitoring for phase sequence	✓	✓	—	—	—	—
Monitoring for phase failure	✓	✓	—	—	—	—
Monitoring for asymmetry	✓	✓	—	—	—	—
Monitoring for undervoltage	3p	3p	1p	—	—	—
Monitoring for overvoltage	3p	3p	1p	—	—	—
Monitoring for N-conductor failure	—	✓	—	—	—	—
Cos phi monitoring and current monitoring						
Monitoring for undercurrent	—	—	—	1p	1p	—
Monitoring for overcurrent	—	—	—	1p	1p	—
Active current monitoring	—	—	—	—	1p	—
Apparent current monitoring	—	—	—	1p	—	—
Monitoring for cos phi	—	—	—	—	1p	—
Speed monitoring						
Monitoring for speed overshoot	—	—	—	—	—	✓
Monitoring for speed undershoot	—	—	—	—	—	✓
Power supply						
External power supply (via the IO-Link master or an external 24 V DC voltage source)	✓	✓	✓	✓	✓	✓

✓: Function available

1p: Monitoring is single-phase

3p: Monitoring is 3-phase

— : Function not available

Reference

More information ...	Is available in ...
about the 3UG48 monitoring relays for IO-Link	the chapter "SIRIUS Innovations manuals (Page 22)" of the "3UG48 Monitoring Relays" manual.

7.4 3RS14/3RS15 temperature monitoring relays for IO-Link

7.4.1 Product description

Product description

The new SIRIUS 3RS14/3RS15 temperature monitoring relays for IO-Link are used to measure temperatures in solid, liquid, and gaseous media. The temperature is sensed by the sensors in the medium and evaluated by the device. Up to 2 limit values for overshoot, undershoot, or staying within a working range (range function) are monitored. In addition to providing warning and shutdown functions in the event of temperature deviations, the devices can be used as temperature controllers (single-step control, two-step control, or three-step control).

The devices differ in terms of the type and number of temperature sensors that can be connected to them:

- 3RS14: Connection for 1 or up to 3 resistance sensors
- 3RS15: Connection for 1 thermocouple

The 3RS14/3RS15 temperature monitoring relays for IO-Link offer many other performance features in addition to monitoring functions:

- Transmission of measured values (including resolution and unit) to the higher-level control.
  Local display and transmission of the temperature unit (°C or °F) can be parameterized.
  The temperature measured value transferred from temperature monitoring relays with more than one resistance sensor can be adjusted. Some device versions allow you to set which value is transferred cyclically.
- Transfer of alarm flags to the higher-level control.
- Comprehensive diagnostics capability by querying the precise cause of the error in the diagnostic data record.
- Remote parameterization is also possible (instead of local parameter assignment).
- Fast parameterization of identical devices by duplicating the parameter assignment in the higher-level control.
- Parameter transfer by means of Upload to the higher-level control via- IO-Link call or by parameter server[1)] when using an IO-Link master in
  IO-Link Communication Specification V1.1 or higher).
- Local parameter assignment can be disabled via IO-Link.
- To prevent automatic startup after a power failure and in order not to lose diagnostic data, errors can be configured so that they are saved to non-volatile memory.
- Linking to a higher-level control makes it possible to assign parameters to the monitoring relays via a display unit. The measured values can be displayed directly in a control room or at the machine/control cabinet.

[1)] The parameter server provides an assurance of consistent central data management in the event of changes to parameters (made locally or via the control). The "Parameter server" function supports the automatic backup of parameter data (automatic re-assignment of parameter data if a device is replaced).

Up until now, using redundant sensors and/or analog signal converters to transfer measured values to a higher-level control incurred significant additional expense and wiring effort. Combining the autonomous monitoring relays with IO-Link communication reduces this wiring outlay and cuts costs.
As the availability of up-to-date measured values means that the higher-level control can take care of the control tasks within the plant, the continued availability of the output relays on the monitoring relays increases the plant's operational reliability (e.g. by shutting down the plant if limit values that cannot be achieved under normal operating conditions are overshot).

The monitoring relays continue to function autonomously in spite of the IO-Link connection. Parameters can be assigned locally at the device, independently of a higher-level control. As long as the 24 VDC power supply is available, the monitoring relays will function should the controller fail or not yet be available.

7.4.2 Overview of the functions

Function

Table 7- 6 Functions of the temperature monitoring relays for IO-Link

Function	Temperature monitoring relays		
	3RS14		3RS15
	40	41	40
Connectable sensor type			
Resistance sensors	✓	✓	--
Thermocouple	--	--	✓
Number of sensors that can be monitored	1	3	1
Temperature monitoring			
Temperature monitoring for overshoot	✓	✓	✓
Temperature monitoring for undershoot	✓	✓	✓
Number of limit values that can be set[1)]	2	2	2

1) It is possible to switch between the open-circuit principle NO and the closed-circuit principle NC.

✓: Function available

--: Function not available

Reference

More information ...	Is available in ...
3RS14/3RS15 temperature monitoring relays for IO-Link	the chapter "SIRIUS Innovations manuals (Page 22)" of the "3RS14/3RS15 Temperature Monitoring Relays for IO-Link" manual.

SIRIUS 3RA21/22 load feeders

8

8.1 Overview

Fuseless load feeders

Fuseless load feeders are device combinations comprising a 3RV motor starter protector for overload and short-circuit protection and a 3RT contactor for normal switching. The SIRIUS portfolio features two different configuration options for fuseless load feeders.

- 3RA2 tested pre-assembled complete devices
- Tested combinations of individual devices

8.2 Device versions

The modular standard components in the SIRIUS modular system are ideally matched and support the simple configuration of fuseless load feeders. The load feeders are also available as 3RA2 complete devices.

Both options are characterized by the following features.

- Type of coordination 1 or 2
- Rated control supply voltage
- Mounting on busbar or DIN rail
- Screw or spring-loaded connection

A detailed overview of the fuseless load feeders product range appears below.

Types of coordination

Fuseless load feeders up to 38 A (discrete configuration of individual devices with connecting cables) and 32 A (pre-assembled complete devices or configuration with link module) can be assembled in sizes S00 and S0.

An assembly up to 80 A (discrete configuration of individual devices with connecting cables) and 65 A (as pre-assembled complete devices, or configuration with link module) is possible in size S2.

The table below lists the maximum power of the three-phase motor for pre-assembled 3RA2 complete devices based on the type of coordination at a voltage of 400 V AC.

Table 8- 1 Motor starter protector sizes

Size	Type of coordination	Power of three-phase motor
S00	1	0.06 to 7.5 kW
	2	0.06 to 1.5 kW
S0	1	7.5 to 15 kW
	2	1.5 to 15 kW
S2	1	15 kW to 30 / 37 kW
	2	15 kW to 30 / 37 kW

Auxiliary contacts

The following auxiliary contacts are integrated into fuseless load feeders dependent upon size.

Table 8- 2 Integrated auxiliary contacts

Size	Direct feeder	Reversing feeder
S00	1 NO contact is integrated in the contactor.	1 NC contact is integrated in the contactor.
S0	1 NO contact and 1 NC contact are integrated in the contactor. The user can decide how the NC contact is assigned.	1 NO contact and 1 NC contact are integrated in the contactor. The NC contact is assigned to the interlock.
S2		

Assembly/Installation

The devices are prepared for DIN rail mounting, for mounting on a 60 mm busbar or for mounting directly on a wall.

Table 8- 3 Mounting options

Starter combination		Direct-on-line starter			Reversing starter		
Size		S00	S0	S2	S00	S0	S2
Mounting on a standard rail							
	Snap-on mounting without adapter	✓1)	✓1)	✓2)	✓1)		
	With DIN rail adapter	✓3)	✓3)	✓2)	✓3)	✓3)	✓2)
Mounting on 8US busbar							
	With 8US busbar adapter	✓	✓	✓	✓	✓	✓
Wall mounting							
	Direct	✓	✓	✓	✓	✓	✓
	With DIN rail adapter	✓	✓	✓	✓	✓	✓

1) Mounting on 1 DIN rail

2) Mounting on 2 DIN rails

3) Mounting on 1 or 2 DIN rails

8.2.1 Pre-assembled complete devices

Pre-assembled complete devices

3RA2 fuseless load feeders are pre-assembled complete devices; they are delivered ready-wired and with all mechanical connections established. The devices are available in sizes S00, S0 and S2 for direct-on-line start. Pre-assembled complete devices in size S00 and S0 are available for reversing start. The fuseless load feeders can be ordered with or without pre-assembled busbar adapters for mounting on a DIN rail or busbar.

Connection systems

3RA2 fuseless load feeders are available with the following connection system options.

Table 8- 4 Connection systems available for 3RA2 fuseless load feeders

Connection system	3RA2 pre-assembled complete devices	
	S00 / S0	S2
Screw terminals	✓[1) 2)]	✓
Spring-loaded terminals	✓	---
Ring cable lug connection	---	---

1) The link module for the S00 load feeder can also be used to mount an S00 contactor on an S0 motor starter protector.

2) The link module for the S0 load feeder can also be used to mount an S0 contactor on an S00 motor starter protector.

Rated powers

3RA2 pre-assembled feeders are dimensioned for the following powers:

Powers	S00	S0	S2
Direct-on-line starter	≤ 7.5 kW (16 A)	15 kW (32 A)	30 / 37 kW (65 A)
Reversing starter	≤ 7.5 kW (16 A)	15 kW (32 A)	---

Control supply voltages of 3RA2 load feeders

3RA2 pre-assembled feeders are available for the following rated control supply voltages:

Rated control supply voltages		
S00	S0	S2
230 V AC / 50/60 Hz	230 V AC / 50 Hz	230 V AC / 50 Hz
24 V DC	24 V DC	20 ... 33 V AC/DC

8.2.2 Self-assembled load feeders

Assembly of load feeders from individual devices

Self-assembly load feeders comprising individual devices are available as an alternative to the 3RA2 complete device. The following components can be combined via the intermediary of a link module.

Combination	S00	S0	S2
Motor starter protector and contactor	7.5 kW (16 A)	15 kW (32 A)	30 / 37 kW (65 A)
Motor starter protector and soft starter	7.5 kW (16 A)	15 kW (32 A)	30 / 37 kW (65 A) [1]
Motor starter protector and solid-state contactor	---	7.5 kW (16 A)	---

[1] A DIN rail adapter shall be used for this combination

The modularity of the SIRIUS system means that the standard devices are perfectly matched from both a mechanical and an electrical point of view. As a straightforward means of assembling starter combinations, wiring kits are available for contactor assemblies for reversing and star-delta (wye-delta) start for size S2 with screw terminals, and for size S00 / S0 with various connection systems. Assembly kits are available for mounting self-assembled load feeders on DIN rails or busbars.

Assembly of three-part combinations with link module between the motor starter protector and the contactor

You are basically advised to refrain from setting up combinations of a motor starter protector, a contactor and an overload relay or a monitoring relay as a completely assembled three-part combination. If this should nevertheless be necessary, the following restrictions apply:

Motor starter protector + contactor + electronic overload relay / 3RR monitoring relay (size S00 / S0)

Thermal restrictions	Mechanical restrictions
No restrictions	DIN rail adapter required

Motor starter protector + contactor + electronic overload relay / 3RR monitoring relay (size S2)

Thermal restrictions	Mechanical restrictions
• At an ambient temperature of T_a = 40 °C (no restrictions) • At an ambient temperature of T_a = 60 °C (clearance between the load feeders: ≥ 10 mm)	No restrictions

Motor starter protector + contactor + thermal overload relay (size S00 / S0)

Thermal restrictions:	Mechanical restrictions
Reduce permissible ambient temperature by 20 K	DIN rail adapter required
No side-by-side mounting (≥ 10 mm clearance for vertical installation, > 20 mm for horizontal installation)	
Current derating to 87 % of I_n	

Motor starter protector + contactor + thermal overload relay (size S2)

Note

A three-part combination comprising a motor starter protector, a contactor and a thermal overload relay is not permissible for size S2.

Connection systems

Self-assembled fuseless load feeders are available with the following connection system options.

Table 8- 5 Connection systems available for self-assembled fuseless load feeders

Connection system	Self-assembled fuseless load feeders	
	S00 / S0	S2
Screw terminals	✓	✓
Spring-loaded terminals	✓	2)
Ring cable lug connection	✓ 1)	--

1) These versions can be snapped onto a DIN rail. Mounting on a busbar adapter is not possible.

2) In the case of size S2 devices, spring-loaded terminals are only possible in the auxiliary circuit.

Rated powers

The pre-assembled feeders are dimensioned for the following powers:

Assembly		S00	S0	S2
Direct-on-line starter	with link module	7.5 kW (16 A)	15 kW (32 A)	30 / 37 kW (65 A)
	Separately wired	7.5 kW (16 A)	17.5 kW (38 A)	37 kW (80 A)
Reversing starter	with link module	7.5 kW (16 A)	15 kW (32 A)	30 / 37 kW (65 A)
	Separately wired	7.5 kW (16 A)	17.5 kW (38 A)	37 kW (80 A)

Control supply voltages of load feeders

The contactors can be ordered with different rated control supply voltages as appropriate for the application area of the fuseless load feeders.

8.3 Applications

Fuseless load feeders can be used anywhere in industry where fuse, contactor, and overload relay combinations were previously used. The increased functionality of the motor starter protector (unlike a fuse combination, it can be used as an EMERGENCY OFF and as a disconnector) means that a fuseless load feeder is capable of solving numerous applications easily.

8.4 Application environment

3RA2 load feeders are climate-proof. They are designed 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 or damp rooms, suitable enclosures must be provided.

Reference

More information ...	Is available in ...
about 3RA21/3RA22 load feeders	the chapter "SIRIUS Innovations manuals (Page 22)" in the "SIRIUS Innovations - SIRIUS 3RA21/3RA22 Load Feeders" manual.

SIRIUS 3RA6 compact starters

9

9.1 System overview

Features

The SIRIUS compact starter is a universal, weld-free motor feeder in accordance with IEC/EN 60947-6-2. It combines the functions of a circuit breaker, a solid-state overload relay and a contactor within a single enclosure and can be used in any application involving the direct starting of standard three-phase motors with a rating of up to 32 A (approx. 15 kW/400 V).

The compact starter is available as either a direct or a reversing starter.

As an option, an AS-i mounting module can be mounted on the 3RA61/3RA62 compact starter with a 24 V control supply voltage. The AS-i mounting module enables the compact starter to communicate via an AS-Interface.

The 3RA64/3RA65 compact starter with IO-Link can communicate via IO-Link.

Table 9- 1 Compact starter communication options

Compact starter	Communication
3RA61/3RA62 compact starter without optional AS-i mounting module	Communication via auxiliary contacts and signaling contacts
3RA61/3RA62 compact starter (24 V) with optional AS-i mounting module	Communication via AS-Interface
3RA64/3RA65 compact starter with IO-Link	Communication via IO-Link

Accessories

You can find more information in the chapter SIRIUS Innovations manuals (Page 22) in the "SIRIUS 3RA6 Compact Starter" manual.

In addition to the 3RA61/3RA62 compact starter and the 3RA64/3RA65 compact starter with IO-Link, this document also describes the following accessories:

Table 9- 2 Accessories for the compact starter

Accessories	Description
Auxiliary switch block for compact starter	Optional auxiliary switch block in the following versions: 2 NO contacts, 2 NC contacts or 1 NO contact + 1 NC contact.
AS-i mounting module	The AS-i mounting module enables the 3RA61/3RA62 compact starter with 24 V control supply voltage to communicate via an AS-Interface.
Control kit	Tool for closing the main contacts manually by means of the handle.
Adapter for screw fastening the compact starter	The adapters for screw fastening enable you to install the compact starter on a level surface (screw fastening).
Terminals for "Combination Controller Type E"	The terminals conform to the clearances and creepage distances stipulated by UL 508 (Type E).
Infeed system for 3RA6	The infeed system for 3RA6 is a modular infeed system with an optional PE system. The permanent wiring means that compact starters can be mounted quickly and easily.
3-phase busbar	The 3-phase busbar enables several compact starters to be fed using a single infeed terminal.
8US busbar adapter	The 8US busbar adapter enables the compact starter to be mechanically fastened and electrically connected to a busbar system.
Door-coupling rotary operating mechanism	Door-coupling rotary operating mechanisms enable compact starters to be operated with the control cabinet doors closed.

9.2 Automation environment

Main circuit

The following supply options are available for the compact starter's main circuit:

- Parallel wiring
- Infeed system for 3RA6
- 3RV19 3-phase busbar
- 8US busbar adapter

You can find more information in the chapter SIRIUS Innovations manuals (Page 22) in the "SIRIUS 3RA6 Compact Starter" manual.

Control circuit and supply circuit

The control circuit can be structured as follows:

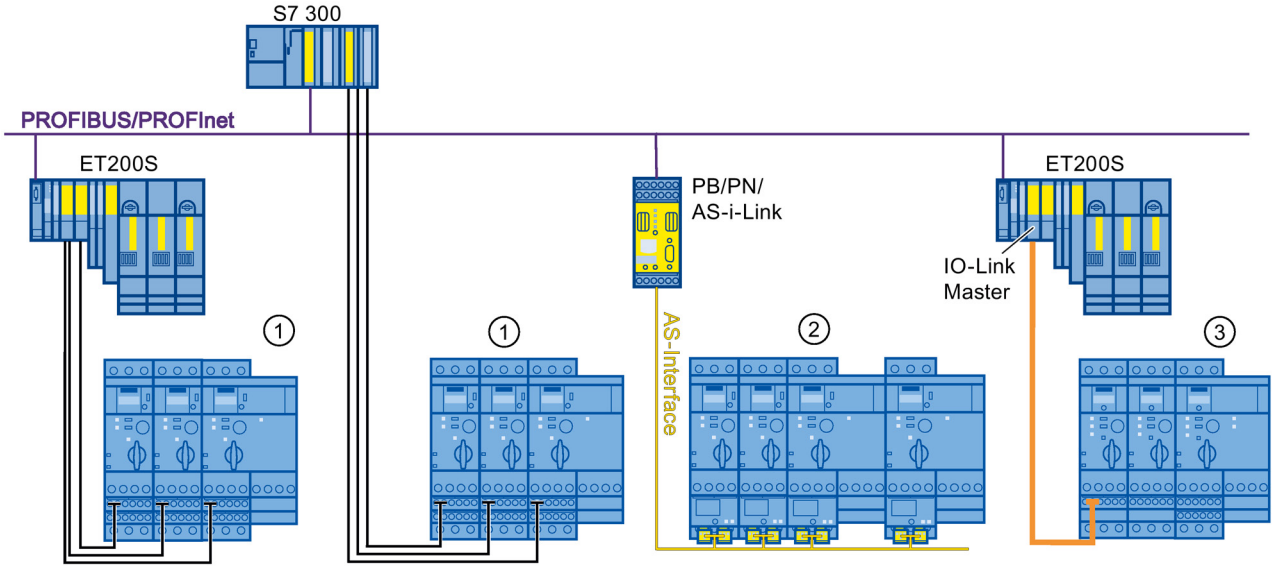
Table 9- 3 Control circuit (configuration)

Compact starter	Control system
3RA61/3RA62 compact starter without optional AS-i mounting module	Parallel wiring to control system (e.g. PLC)
3RA61/3RA62 compact starter (24 V) with optional AS-i mounting module	AS-Interface
3RA64/3RA65 compact starter with IO-Link	IO-Link

Note

There are capacitors in the control circuit of the 3RA6 compact starter. As a result, high charging currents can arise briefly upon activation of the control supply voltage.

Examples of how the compact starter can be integrated into the automation environment



① 3RA61/3RA62 compact starter without AS-i mounting module
② 3RA61/3RA62 compact starter with AS-i mounting module
③ 3RA64/3RA65 compact starter with IO-Link

Figure 9-1 Integration into the automation environment

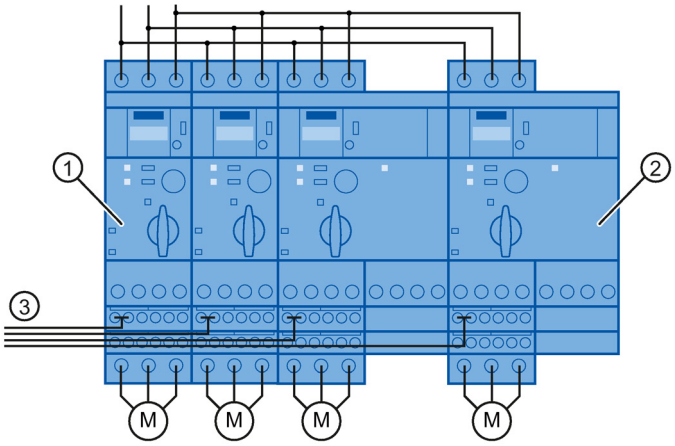
9.3 3RA61/3RA62 compact starter without optional AS-i mounting module

Configuration of parallel wiring

The 3RA61/3RA62 compact starter is connected to the control system via parallel wiring. Control takes place via the following terminals:

- Direct starter: A1+, A2-
- Reversing starter: A1+, A2/B2-, B1+

View of parallel wiring



① 3RA61 compact starter (direct starter)
② 3RA62 compact starter (reversing starter)
③ Connection to control system (e.g. PLC)

Figure 9-2 System configuration with 3RA61/3RA62 compact starter without AS-i mounting module

9.4 3RA61/3RA62 compact starter with optional AS-i mounting module

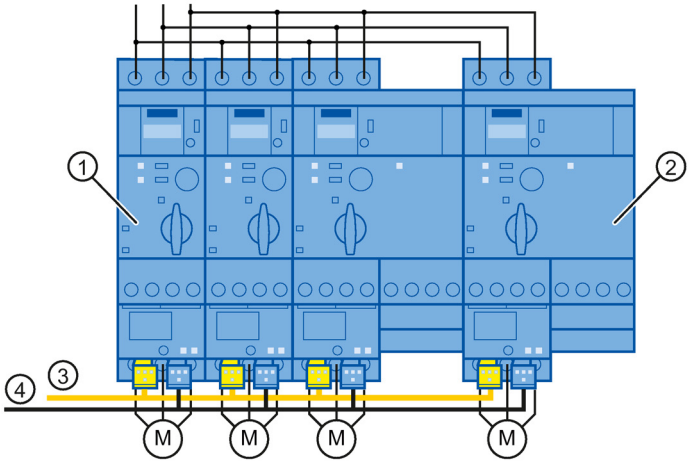
The 3RA61/3RA62 compact starter with 24 V control supply voltage can be controlled via an AS-Interface. The actuator sensor interface (AS-Interface) is a modular networking system for sensors and actuators at the lowest field level.

Configuration with AS-Interface

If the AS-Interface is being used for control purposes, the AS-i mounting module needs to be installed on the 3RA61/3RA62 compact starter (24 V) instead of the two auxiliary circuit terminals. The AS-i and auxiliary voltage cables are connected to the AS-i mounting module.

An AS-i power supply is used to feed the AS-i voltage into the AS-i cable, which also serves as a communication cable between the AS-i master and slave. The auxiliary voltage is supplied by a 24 VDC PELV power supply in accordance with VDE 0106 safety class III.

View with AS-Interface



① 3RA61 compact starter (direct starter) with AS-i mounting module
② 3RA62 compact starter (reversing starter) with AS-i mounting module
③ AS-i
④ External voltage supply (AUX PWR)

Figure 9-3 System configuration 3RA61/3RA62 compact starter with AS-i mounting module

Reference

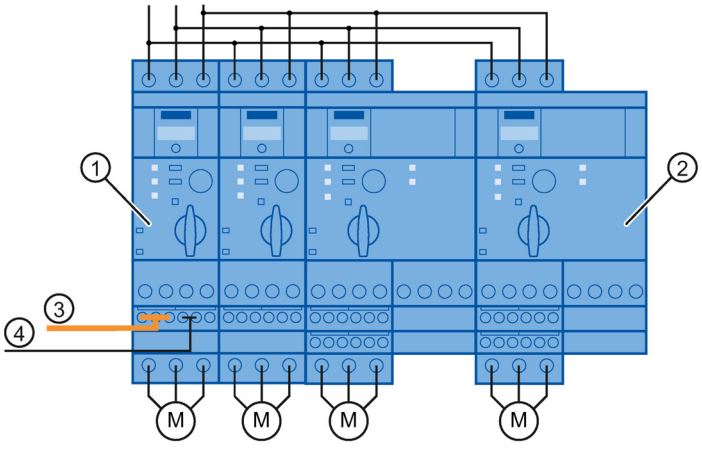
More information ...	Is available in ...
about AS Interface	"System AS Interface" manual (order number: 3RK2703-3AB02-1AA1).
about connecting the AS-i mounting module	"System AS Interface" manual (order number: 3RK2703-3AB02-1AA1).

9.5 3RA64/3RA65 compact starter with IO-Link

Configuration with IO-Link

The 3RA64/3RA65 compact starter with IO-Link is controlled via IO-Link. The auxiliary voltage V_{Aux} (24 V DC) is connected via a separate terminal.
Direct starters and reversing starters can be combined as desired to form a group of four compact starters. For this purpose, three other compact starters are installed to the right of the first compact starter and linked using a 14-core connecting cable. These three compact starters do not require their own connection to IO-Link via the removable terminal since they are supplied with data and auxiliary voltage V_{Aux} via the 14-core connection cable (8 mm, 200 mm).

View with IO-link



① 3RA64 compact starter with IO-Link (direct starter)
② 3RA65 compact starter with IO-Link (reversing starter)
③ IO-Link
④ Auxiliary voltage V_{Aux}

Figure 9-4 System configuration with 3RA64/3RA65 compact starter with IO-Link

Reference

More information ...	Is available in ...
about the 3RA6 compact starters	the chapter "SIRIUS Innovations manuals (Page 22)" in the "SIRIUS 3RA6 Compact Starter" manual.

SIRIUS 3RA27/3RA28 function modules 10

10.1 3RA27 function modules for connection to the higher-level control

10.1.1 3RA2711 function modules for IO-Link

Function modules for IO-Link

Function modules for IO-Link are integrated in the higher-level control system via an IO-Link master. They are mounted on contactors with a communication link or contactor assemblies with a communication link from the SIRIUS device family.
The function modules for IO-Link comply with the IO-Link communication specification V1.1.

The function modules for IO-Link are available for the following contactors and contactor assemblies:

- For direct starting
- For reversing starting
- For star-delta starting

The function modules are divided into basic modules and coupling modules. Coupling modules are connected with the basic module or another coupling module via module connectors.

The process image of the function module outputs controls the starter. The process image of the inputs represents the status of the starter.

Operator panel

The starters are controlled with the operator panel in manual mode. The states of the device are also queried for up to 4 starters.

The operator panel is connected to the last available interface of a starter group via the 10-core connecting cable.

The voltage supply of the operator panel is provided with the 2 m long connecting cable.

Note

If communication between the IO-Link master and IO-Link device is interrupted, the IO-Link devices switch off connected loads for safety reasons.

Manual operation is still possible with the operator panel.

Reference

More information ...	Is available in ...
about the 3RA2711 function modules for IO-Link	the chapter "SIRIUS Innovations manuals (Page 22)" of the "Function Modules for IO-Link" manual.

10.1.2 3RA2712 function modules for AS-Interface

Function modules for AS-Interface

Function modules for AS-Interface are mounted on contactors or contactor combinations of the SIRIUS device family, and they connect these with the AS-Interface.

The function modules for AS-Interface are available for the following contactors and contactor combinations:

- For direct starting
- For reverse starting
- For star-delta starting

The function modules are divided into basic modules and coupling modules. Coupling modules are connected with the basic module or another coupling module via module connectors.

Basic modules are connected with the AS-Interface using a removable terminal. For this purpose, the AS-Interface cable and the auxiliary voltage are connected to the basic module's removable terminal.

The process image of the function modules controls the starter. The process image of the inputs represents the status of the starter.

AS-i addressing unit

The AS-i addressing unit can be used to control the contactors and display the process image independently of the AS-i bus.

Reference

More information ...	Is available in ...
about the 3RA2712 function modules for AS-Interface	the chapter "SIRIUS Innovations manuals (Page 22)" of the "Function Modules for AS-Interface" manual.

10.2 SIRIUS 3RA28 function modules for mounting on 3RT2 contactors

Applications

Function modules are used to perform various control jobs on automatic production lines and for processing machines. They are suited to all time-delayed switching operations in control, starting, protection, and regulation circuits, and ensure a high degree of repeat accuracy for delay times, once they have been set.

The function modules are subdivided into function modules with communication interfacing and function modules without communication interfacing.

Function modules	
3RA28 function modules	Solid-state timing relays with semiconductor output
	Solid-state time-delay auxiliary switches
	Function module for star-delta (wye-delta) start
3RA27 function modules with communication connection	Function modules for AS-Interface
	Function modules for IO-Link

This chapter describes 3RA28 function modules without a communication connection. You will find information about function modules with a communication connection in the corresponding manuals (see Reference).

Function

Function modules are used to delay switching functions.

System integration

The 3RA28 function modules have been matched to the contactors in the 3RT2 and 3RH2 series[1)] both electrically and mechanically, and can be integrated in the feeders by directly mounting them on contactors. The function modules can be used for size S00, S0 and S2 contactors.

The 3RA27 function modules can only be used for communication-capable contactors.

[1)] The 3RA28 function modules must not be mounted on 3RH2 coupling relays.

Connection system

Users can choose either function modules with screw-type connection system or function modules with spring-loaded connection system.

10.2.1 Device versions

Device versions

- Function modules for direct-on-line start
  - Solid-state timing relays with semiconductor output
  - Solid-state time-delay auxiliary switches
- Function modules for star-delta (wye-delta) start

Characteristics

The table below provides an overview of the versions of 3RA28 function modules for mounting on 3RT2 and 3RH2 contactors[1)].

[1)] The 3RA28 function modules must not be mounted on 3RH2 coupling relays.

Characteristic	Versions			
	Function modules for direct-on-line start			Function module for star-delta (wye-delta) start
	Solid-state timing relay with semiconductor output		Solid-state time-delay auxiliary switches	
Function	ON-delay and OFF-delay with control signal		ON-delay and OFF-delay with/without control signal	Star-delta (wye-delta) function
Article numbers	3RA2811-.CW10/ 3RA2812-.DW10	3RA2831-.D.10 / 3RA2832-.D.10	3RA2813-..W10/ 3RA2814-..W10/ 3RA2815-..W10	3RA2816-0EW20 comprising: 1 basic module (3RA2912-0) 2 coupling modules (3RA2911-0)
Size	For size S00 and S0 contactors.	For size S2 contactors.	One module for contactor sizes S00, S0 and S2.	
Width	45 mm			135 mm (3 x 45 mm)
Connection system	Screw-type, spring-loaded			Without terminals (can be used for contactor screw-type and spring-loaded connection systems)

3RA28 version overview

Article number	Function	Output
Screw connection		
3RA2811-1CW10	ON-delay, two-wire	Thyristor
3RA2812-1DW10	OFF-delay with control signal	PowerMos
3RA2831-1DG10	ON-delay, two-wire	PowerMos
3RA2831-1DH10	ON-delay, two-wire	PowerMos
3RA2832-1DG10	OFF-delay with control signal	PowerMos
3RA2832-1DH10	OFF-delay with control signal	PowerMos
3RA2813-1AW10	ON-delay	1 CO contact
3RA2813-1FW10	ON-delay	1 NO contact 1 NC contact
3RA2814-1AW10	OFF-delay with control signal	1 CO contact
3RA2814-1FW10	OFF-delay with control signal	1 NO contact 1 NC contact
3RA2815-1AW10	OFF-delay without control signal	1 CO contact
3RA2815-1FW10	OFF-delay without control signal	1 NO contact 1 NC contact
Spring-loaded connection		
3RA2811-2CW10	ON-delay, two-wire	Thyristor
3RA2812-2DW10	OFF-delay with control signal	PowerMos
3RA2831-2DG10	ON-delay, two-wire	PowerMos
3RA2831-2DH10	ON-delay, two-wire	PowerMos
3RA2831-2DG10	OFF-delay with control signal	PowerMos
3RA2932-2DH10	OFF-delay with control signal	
3RA2813-2AW10	ON-delay	1 CO contact
3RA2813-2FW10	ON-delay	1 NO contact 1 NC contact
3RA2814-2AW10	OFF-delay with control signal	1 CO contact
3RA2814-2FW10	OFF-delay with control signal	1 NO contact 1 NC contact
3RA2815-2AW10	OFF-delay without control signal	1 CO contact
3RA2815-2FW10	OFF-delay without control signal	1 NO contact 1 NC contact
Plug-in, without terminals		
3RA2816-0EW20	Star-delta (wye-delta) function module	2 NO contacts (internal)
3RA2910-0	Sealable cover cap	—

The 8th digit of the article number designates the terminal type:

0: No terminals

1: Screw-type terminals

2: Spring-loaded terminals

10.2.2 Performance features

Features

The function modules have the following features:

Function module		Features
Function modules for direct-on-line start	Solid-state timing relays with semiconductor output	• ON-delay (1 NO contact) • OFF-delay with control signal (1 NO contact) • Versions with screw-type and spring-loaded connection systems
	Solid-state time-delay auxiliary switches	• ON-delay (1 NO contact + 1 NC contact or 1 CO contact) • OFF-delay with/without control signal (1 NO contact + 1 NC contact or 1 CO contact) • Versions with screw-type and spring-loaded connection systems
Function modules for star-delta (wye-delta) start	Star-delta (wye-delta) start	• Control exclusively via contactor A1/A2 – no further control circuit wiring required • No control circuit wiring (plug-in system and connecting cables) • Interchange proof construction • Timing function for switching over from star to delta in basic module • Electrical interlock without additional wiring • Changeover delay time set to a non-adjustable value of ≥ 50 ms

10.2.3 Applications

10.2.3.1 Function modules for direct-on-line start

Applications

The function modules for direct-on-line start are used for the time-delayed switching of contactors. The following different function modules are available:

- Solid-state timing relay with semiconductor output
- Solid-state time-delay auxiliary switch with 1 CO contact or 1 NC contact/1 NO contact

Features of direct-on-line starters

The function module for direct-on-line start has the following features:

- All modules with wide control voltage range
- Integrated varistor (surge suppressor)
- Applicable for size S00, S0 and S2 contactors.
  The following table is an overview of which function modules you can use for which size of contactors.

	S00	S0	S2
3RA2811, 3RA2812	X	X	-
3RA2831, 3RA2832	-	-	X
3RA2813, 3RA2814, 3RA2815	X	X	X

- Wide voltage range (24 to 240 V AC/DC)
- Extended operating ranges (24 to 90 V, 90 to 240 V), for 3RA2831 and 3RA2832 only
- 3 selectable time ranges (1 s, 10 s, 100 s)
- Operating time adjustment from 5 to 100% per time range
- Switch position indicator for the contactor below (plunger)

10.2.3.2 Function modules for star-delta (wye-delta) start

Applications

The function module for star-delta (wye-delta) start is used to switch from star (wye) to delta operation.

Features

The function module for star-delta (wye-delta) start has the following features:

- All modules with wide control voltage range
- Integrated varistor (surge suppressor)
- One module kit for contactor screw-type and spring-loaded connection systems
- One module kit for S00, S0 and S2 size contactors (options only with main circuit connecting comb)
- Wide voltage range (24 to 240 V AC/DC) and
- 3 selectable time ranges (10 s, 30 s, 60 s)
- Operating time adjustment from 5 to 100% per time range (corresponds to 0.5 s to 60 s)
- Changeover delay set to a non-adjustable value of ≥ 50 ms
- Switch position indication for the contactor below in the form of a mechanical switch position indicator (plunger)
- Control exclusively via A1/A2 on the line contactor below
- No further wiring required

The wide voltage and the wide time range ensure advanced use of the function modules.

3RA2816-0EW20 function module for contactor assemblies for star-delta (wye-delta) start

The function module for plugging into contactor assemblies for star-delta (wye-delta) start for sizes S00, S0 and S2 comprises the following devices:

- 1 basic module with time setting
- 2 coupling modules with corresponding connecting cable to coupling or function module

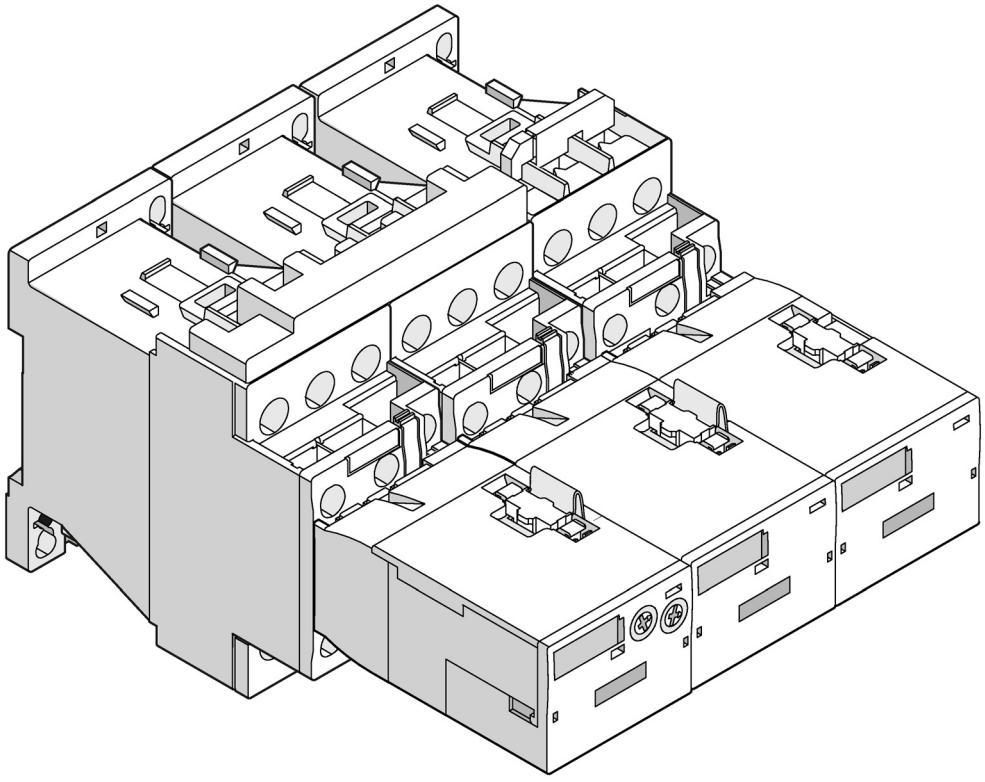


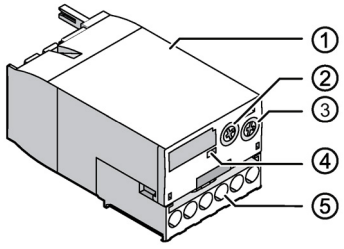
Figure 10-1 Star-delta (wye-delta) starter, completely assembled

The function module replaces the entire control circuit wiring and combines the functions of the following devices and tasks:

- Timing relay star-delta (wye-delta) function
- Auxiliary switches
- Auxiliary conductor wiring
- Electrical interlock
- Switch position indicator for the contactor below (plunger)

10.2.4 3RA28 function modules

Function module for direct-on-line start (solid-state timing relays with semiconductor output/solid-state time-delay auxiliary switches)

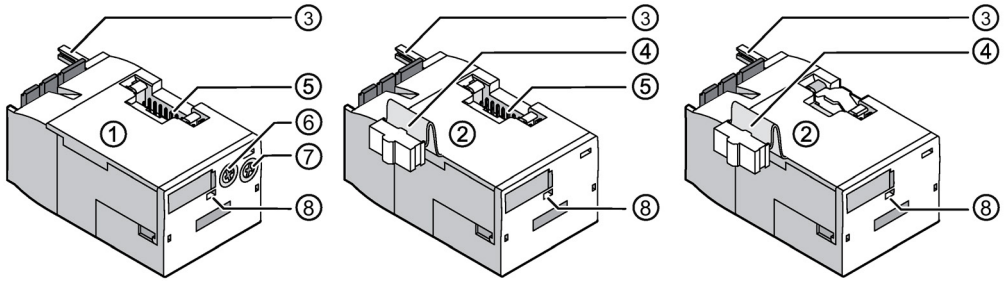


1	Timing relay attachment	
2	Time range selector switch:	Sets the time base (1 s, 10 s, 100 s)
3	Operating time adjustment switch:	Sets the relative time (5 to 100%)
4	Mechanical plunger:	Indicates the switching state of the contactor
5	Screw-type/spring-loaded connections:	The terminals are available as both screw-type and spring-loaded connections.

Figure 10-2 Solid-state timing relay with semiconductor output/solid-state time-delay auxiliary switches

Function module for star-delta (wye-delta) start

The function module for star-delta (wye-delta) start comprises a basic module with integrated control logic and two coupling modules of the same type.



1	Basic module with integrated control logic	
2	Coupling module	
3	Coil control:	Basic module: Voltage measurement at the line contactor Coupling module: Controls the contactor below
4	Ribbon cable:	Electrical connection of modules
5	Slot for connecting cable:	Routes the supply voltage and electrical interlock
6	Time range selector switch:	Sets the time base (10 s, 30 s, 60 s)
7	Operating time adjustment switch:	Sets the relative time (5 to 100%)
8	Mechanical plunger:	Indicates the switching state of the contactor

Figure 10-3 Basic module and coupling modules for the contactor assembly for star-delta (wye-delta) start

Reference

More information ...	Is available in ...
about the 3RA28 function modules for mounting on 3RT2 contactors	the chapter "SIRIUS Innovations manuals (Page 22)" in the manual "SIRIUS Innovations - SIRIUS 3RA28 Function Modules for Mounting on 3RT2 Contactors".

SIRIUS 4SI electronic module for SIMATIC ET 200S 11

Properties

The 4SI SIRIUS electronic module is a 4-channel serial interface module. Its main features are as follows:

- Connection of up to 4 SIRIUS devices with IO-Link interface
- The 4SI SIRIUS is a single-width (15 mm) electronic module that can be used with the following terminal modules:
  - TM-E15S26-A1, TM-E15C26-A1 and TM-E15N26-A1
- Replacing the 4SI SIRIUS electronic module without programming device (via user program)
- Supports I&M data
- Supports firmware update
- Extended temperature range from 0 to 55°C with vertical installation.

Configuring

Configuration of the 4SI SIRIUS electronic module takes place in two steps with STEP 7 V5.4 SP5 or higher:

- In HW Config, you configure the 4SI SIRIUS electronic module using the HSP or the GSD file. You can download the GSD files from the Internet (http://www.siemens.de/comdec).

With *STEP 7* V5.4 SP5 or higher		
ET 200S PROFIBUS interface modules	IM151-1 STANDARD	6ES7151-1AA05-0AB0
	IM151-1 HIGH FEATURE *	6ES7151-1BA02-0AB0
ET 200S PROFINET interface modules	IM151-3 PN	6ES7151-3AA23-0AB0, V6.1 or higher
	IM151-3 PN HF **	6ES7151-3BA23-0AB0, V6.1 or higher
	IM151-3 PN FO **	6ES7151-3BB23-0AB0, V6.1 or higher
	IM151-3 PN HS **	6ES7151-3BA60-0AB0, V2.1 or higher
Only using HSP:		
ET 200S PROFIBUS-CPU	IM151-7 CPU	6ES7151-7AA20-0AB0, V2.6 or higher
	IM151-7 F-CPU	6ES7151-7FA20-0AB0, V2.6 or higher
ET 200S PROFINET-CPU	IM151-8 PN/DP CPU	6ES7151-8AB00-0AB0, V2.7 or higher
	IM151-8 F-CPU	6ES7151-8FB00-0AB0, V2.7 or higher

* Not possible in conjunction with fail-safe modules or isochronous mode when configuring using GSD.

** Configuring using GSD not possible in conjunction with fail-safe modules (with HF and FO) and isochronous mode (with HS)

Note

Using an IO-Link master behind a CPU IM151-7 or CPU IM151-8 in IO-Link (actuator) operating mode

If the 4SI SIRIUS is located behind an ET200S-CPU, the last valid output value may be output in the following cases:

- Switching on the load voltage on the power module PM-E
- Inserting the 4SI SIRIUS
- CPU startup

Workaround: Write a valid output value in the I/O address area of the 4SI SIRIUS in the respective execution level (e.g. OB 100, ...).

- You configure the connected SIRIUS devices with the Port Configurator tool (*S7-PCT V2.x)* .

Note

To parameterize the SIRIUS devices, these must be physically available and an online connection to the SIRIUS devices must be made via the S7-PCT.

Reference

More information ...	Is available in ...
about the SIRIUS 4SI electronic module for SIMATIC ET 200S	the chapter "SIRIUS Innovations manuals (Page 22)" in the "SIRIUS 4SI Electronic Module" manual.

Types of coordination

A

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". In the case of both types of coordination, the short-circuit is reliably mastered. the only differences are in the extent of the damage sustained by the device following a short circuit.

Type of coordination 1

The load feeder may be non-operational after a short circuit has been cleared. Damage to the contactor and the overload release is also permissible.

Type of coordination 2

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

Literature

B

B.1 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 (http://www.siemens.com/sirius/support).
- **Product information**
  Catalogs and other informative documents can be obtained from the Information Center and Download Center (http://www.siemens.com/sirius/infomaterial).
- **Online ordering system**
  You will find the online ordering system with all the latest data on the ordering and information platform (http://www.siemens.com/sirius/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 (http://www.siemens.com/sirius/technical-assistance). You can also submit your question directly to a technical consultant using our support request service.

Correction sheet

C

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.

Fax response

	From (please complete):
To	Name
SIEMENS AG	
DF CP PRM IM 2	Company/Department
92220 Amberg / Germany	Address

Fax: +49 (0)9621-80-3337

Manual title:

Errors, comments, and suggestions for improvements

Glossary

3-phase busbar

The 3-phase busbar enables several motor starter protectors or compact starters to be fed using a single infeed terminal.

8US busbar adapter

The 8US busbar adapter enables motor starter protectors, load feeders, or compact starters to be mechanically fastened and electrically connected to a busbar system.

a release

Short designation for "inverse-time delayed overload release".

Adapter for screw mounting

The adapters for screw mounting enable you to mount the compact starter on a level surface.

Approvals

Approval of switching devices and switchgear in accordance with national standards, some of which must be met on a mandatory basis, which exist in addition to "IEC", "CENELEC", and "CEE" guidelines, for example. So, the North American market (the USA and Canada) requires UL or CSA approvals, for instance. There is also an obligation to label the equipment accordingly, i.e. the approval mark must be inscribed on the device itself.

AS-Interface

The AS-Interface is an open, international standard in accordance with EN 50295 and IEC 62026-2 for process communication and field communication. Leading manufacturers of actuators and sensors worldwide support AS-Interface. The electrical and mechanical specifications of the AS-Interface Association are disclosed to interested companies.

Assembly method

SIRIUS offers maximum flexibility in terms of configuration. The system components can be assembled as feeders or mounted separately.

Auxiliary switch block for compact starter

Optional auxiliary switch block in the following versions: 2 NO contacts, 2 NC contacts or 1 NO contact plus 1 NC contact.

AWG (American Wire Gauge)

A standard measure for conductors used in the USA, which is assigned to a specific cross-sectional area of a conductor or wire. Each AWG number represents a jump of 26% in the cross-sectional area. The thicker the wire, the smaller the AWG number.

Basic module

Function modules consist of at least one basic module, which can be expanded by adding coupling modules as required. The basic module contains the control logic and, for star-delta (wye-delta) modules, the time setting for starting in star operation and a 10-pin connector into which the plug connectors on the coupling modules are inserted.

Bypass operation

Once the motor has been started up correctly, the thyristors in the SIRIUS soft starters are subject to fully advanced control, meaning that the whole line voltage is applied to the motor terminals. As the motor voltage does not have to be controlled during operation, the thyristors are bridged by integral bypass contacts that are rated for AC1 current. This minimizes the waste heat generated during continuous operation (which is caused by the thyristors' power loss), and prevents the switching device's environment from heating up.

CLASS (time)

See "Tripping class".

Closing power

The power input of the magnet coils of a contactor, which is required to set the magnet system in motion. In AC operation, this power input is usually higher than the holding power. When running SIRIUS contactors in DC operation, the closing power is equal to the holding power.

Connection system

SIRIUS has the right connection system for every environment: screw terminals, spring-loaded terminals, or ring cable lug connection.

Contactor

Switching device with just one neutral position, usually without a mechanical lock, which is not activated manually and which, under normal circuit conditions, including an operating overload, can switch on, conduct and switch off currents. Contactors are primarily used where high switching frequencies are involved. A distinction is made between: contactors for switching motors (motor switches) and contactor relays for control purposes.

Contactor assembly for star-delta (wye-delta) start

Contactor assembly which switches the motor to the star circuit during startup (1/3 of the starting current compared to delta startup) and back to the delta circuit after a certain period of time. Contactor assemblies for star-delta (wye-delta) start are used in situations where a high starting current has to be avoided in order to reduce the effects on the mechanical components or the line.

Control kit

Tool for closing the main contacts manually by means of the handle.

Coupling module

Function modules consist of at least one basic module, which can be expanded by adding coupling modules as required. The coupling module includes one NO contact and one 10-pole connecting cable with a plug connector for insertion into the coupling module and basic module; it is used for the mutual interlocking of star and delta operation. The communication-capable version transfers signals to the other contactors and implements the electrical interlock (reversing/star-delta (wye-delta) start) - in this case, there is no integrated connecting cable.

Current limiting for soft starters

The SIRIUS 3RW40 soft starter measures the phase current (motor current) continuously with the help of integrated current transformers. The motor current that flows during the startup process can be actively limited by means of the soft starter. The current limiting function takes priority over the voltage ramp function. As soon as a parameterizable current limit is reached, in other words, the voltage ramp is interrupted and the motor is started with the current limiting value until it has started up successfully.

The current limiting function is always active with SIRIUS 3RW40 soft starters. If the current limiting potentiometer is set to the right endstop (maximum), the starting current is limited to five times the set rated motor current.

The current limiting value is set to the current required during startup as a factor of the rated motor current. Since the starting current is asymmetrical, the set current corresponds to the arithmetic mean value for the three phases.

Current monitoring relays

Current monitoring relays are used to monitor motors or other loads for underload and overload. The level of current permits extensive conclusions to be drawn about the powered process or plant, e.g. a torn belt, pump no-load operation, tool wear, hoist overload or blockage. With multi-phase monitoring, the phase sequence, phase failure, or fault current can be monitored too. If the current measured values are outside the defined range, an alert will be issued or a disconnection initiated either immediately or with a time delay.

Current setting range (of an overcurrent release)

The range between the lowest and highest current value to which the release can be set.

Door-coupling rotary operating mechanism

Door-coupling rotary operating mechanisms enable motor starter protectors/circuit breakers and compact starters to be operated with the control cabinet doors closed.

Electrical interlock

Electrical dependency between switching devices, implemented by means of circuitry. Auxiliary contacts or auxiliary switches are usually used to realize an electrical interlock.

Explosion protection

Prerequisite for using electrical equipment in hazardous areas conforming to DIN EN 50014 (VDE 0170/0171). In terms of explosion protection, you must ensure that equipment which may generate explosive arcs (plasma) during operation is enclosed in a flameproof casing. This means that, although the potentially explosive mixture could penetrate the enclosure, if an explosion were to occur inside it then no explosive flame could escape.

Function module

Different function modules are used for:

- Direct-on-line start
- Reversing start
- Star-delta (wye-delta) start

Function modules are also available in communication-capable versions with AS-i or IO-Link, in order to establish a connection to a higher-level control system.

Function module for direct-on-line start

This function module is used for the time-delayed switching of contactors.

Function module for reversing start

The function module for reversing start is used to control a reversing starter. The version without a fieldbus interface consists of bridge modules, while the version for AS-Interface or IO-Link comprises basic and coupling modules. In all three cases, the electrical interlocks for protection in both directions are already in place.

Function module for star-delta (wye-delta) start

The function module for star-delta (wye-delta) start is used for toggling between star (wye) and delta operation. It consists of one basic module and two coupling modules. The electrical interlocks are already in place in the modules.

Generalized phase control for soft starters

With SIRIUS soft starters, the rms value of the motor voltage is increased (from a settable starting voltage) to the rated motor voltage within a definable start time by means of the phase control of two anti-parallel thyristor pairs.

The motor current changes in proportion to the voltage applied to the motor. As a result, the starting current is reduced by the factor of this voltage.

There is a quadratic relationship between the torque and the voltage applied to the motor. As a result, the starting torque is reduced quadratically in relation to this voltage.

Heavy-duty starting

Heavy starting exists if a motor requires more than 10 to 15 seconds from being switched on to reaching its rated speed on account of its special load conditions. When heavy starting exists, the load torque of the machine to be driven is greater during startup than in rated operation. It takes a long time for the rated speed to be reached because large centrifugal masses need to be accelerated (e.g. on rolling mills, centrifuges). Special overload relays (heavy-duty starting relays, solid-state overload relays) or thermistor motor protection devices must be used to protect heavy-starting motors.

Heavy-duty starting for soft starters

Assuming that certain conditions and constraints apply, the SIRIUS soft starter size must be at least one performance class higher than the motor rating for heavy-duty starting (CLASS 20 startup). The tables in the relevant product manual provide sample set values and device dimensions.

Holding power

The power input of the magnet coils of a contactor, which depends on the continuously consumed current, and which is required to hold the magnet system in the ON state.

Infeed system for 3RA6

The infeed system for 3RA6 enables several compact starters to be fed using an infeed system designed to modular principles with retained wiring.

Instantaneous short-circuit release

Release for a motor starter protector/circuit breaker, which provides short-circuit protection for the downstream load or the cable. The instantaneous short-circuit release must disable all poles of the motor starter protector/circuit breaker (acc. to UL) instantaneously or with a short-time delay in the event of a short circuit.

Intrinsic device protection for soft starters

The SIRIUS 3RW40 soft starter features integrated intrinsic device protection, which protects the thyristors from thermal overload. This is achieved by measuring the current via transformers in the three phases on the one hand, and also by measuring the temperature via thermal sensors on the thyristor heat sink. If the internal, permanently set trip value is exceeded, the soft starter will switch off automatically.

Inverse-time delayed overload release (a release)

A thermal overload release which works with a time delay that decreases as the current rises.

IO-Link

IO-Link is a new communication standard for sensors and actuators - defined by the PROFIBUS User Organization (PNO). The IO-Link technology is based on a point-to-point connection of the sensors and actuators to the control. Therefore, this technology is not a bus system, but an enhanced version of a classic point-to-point connection. In addition to the cyclic operating data, comprehensive parameters and diagnostics data are transferred for the connected sensors and actuators. The connection system consists of a three-pole standard cable or three single wires.

Leakage current

If semiconductors are used to control the current flow, no galvanic isolation can take place within the device. This means that, even when the supply is disconnected, if a connected load is present then a small residual current, known as the leakage current, will still flow.

Low-voltage switchgear and controlgear combination

A switchgear and controlgear combination is a grouping of one or more low-voltage switching devices with associated equipment for controlling, measuring, and indicating, together with the associated protective devices and control devices. The manufacturer is responsible for all assembly work, including all internal electrical and mechanical connections and structural parts.

Main switch

Every industrial machine which falls under the scope of DIN EN 60204 Part 1 (VDE 0113, Part 1) must be equipped with a main switch which disconnects all electrical equipment from the network while cleaning, maintenance, and repair work is being carried out, as well as during long periods of downtime. Usually a switch which can be operated by hand is stipulated in order to prevent electrical or mechanical hazards. The main switch can also function as an EMERGENCY-STOP device.

It must meet the following requirements:

1. Externally accessible handle
2. Only one "Off" position and one "On" position with allocated stops
3. Two positions labeled "0" and "I"
4. Lockable "Off" position
5. Cover for the power supply terminals to protect against accidental contact
6. The switching capacity must correspond to AC-23 for motor switches and AC-22 for load-break switches (utilization category).
7. Switch position displayed automatically

Mirror contacts of power contactors

A mirror contact is an NC contact, which cannot be closed at the same time as an NO main contact (according to EN 60947-5-1, Annex F).

Modular system

The SIRIUS modular system offers all the functions and devices needed for switching, starting, protecting, and monitoring motors and systems. In other words, it provides a modular range of standard components, which are perfectly matched to one another, can be combined really easily, and use the same accessories.

Motor protection

Protection for three-phase motors against overload and short circuit, i.e. protection for the winding insulation against impermissible heating.

Motor starter protectors

Generally a latch-operated switch, which can switch on, conduct, and switch off currents in the circuit under normal operating conditions; it can also switch on the current up to the point of a short circuit under specified operating conditions that are not normal, conduct current for a defined period, and interrupt it too.

n release

Short designation for "instantaneous electromagnetic overcurrent release".

OFF-delay

The time interval effected by a timing relay or timer (on contactors, for example) between a switch-off command being issued and the contacts of the timing relay or timer reaching their initial position.

ON time in %

The duty ratio ON time in % is the ratio between the load duration and the cycle duration for loads that are frequently switched on and off.

Operating range

Range within which the operating voltage of a switching device (e.g. a contactor) may deviate from the rated operating voltage without impairing the operational reliability of the switching device (e.g. contactor drop-out).

Overload relays

Inverse-time delayed relay which responds to an overload in accordance with a time-current characteristic, thus protecting the switching device and load from overloads.

Overload release

Overcurrent release that provides protection against overload.

Phase loss sensitivity

A product feature which enables the protective device to respond even when a three-phase induction motor is running in single-phase operation, before the motor sustains thermal damage (DIN VDE 0660 Part 102).

Polarity balancing for soft starters

In two-phase controlled SIRIUS 3RW30 and 3RW40 soft starters, the current that results from the superimposition of the two controlled phases flows in the uncontrolled phase. The main advantages of two-phase control include the more compact size compared to a three-phase version and the lower hardware costs.

The occurrence of DC components, caused by the phase control and the overlapping of phase currents, is a negative physical effect of two-phase control during the startup process that can mean a louder noise is produced by the motor. The "Polarity Balancing" control principle was developed and patented by SIEMENS to prevent these DC components during starting.

""Polarity Balancing" effectively eliminates these DC components during the startup phase. It allows the motor to be started up with a constant speed, torque, and current rise. The acoustic quality of the startup process comes very close to that of a three-phase controlled startup. This is made possible by the continuous dynamic alignment and balancing of current half-waves with different polarities during motor startup.

Positively driven contacts for contactor relays

Positively driven contact elements are a combination of "n" NO contacts and "m" NC contacts, which are designed such that they cannot be closed simultaneously (EN 60947-5-1, Annex L).

Preferred wiring for star-delta (wye-delta) starters

According to the preferred wiring, the motor terminals of a motor running in the clockwise direction are connected correctly if phase L1 is connected to motor terminals U1 and V2, L2 to V1 and W2, and L3 to W1 and U2. This order should be observed during installation in order to keep the switchover current peaks in a motor running in the clockwise direction as low as possible during switchover from star to delta operation.

Protective technology

A basic distinction can be made between two current-based protective technologies: thermal and electronic protection. Motor starter protectors and thermal overload relays provide protection by means of bimetal releases, while solid-state overload relays, 3RW40 soft starters, and 3RA6 compact starters offer protection via electronic means. Electronic protective devices not only offer a significantly lower level of power loss, they also provide a wide setting range of 1:4 and, as a result, much less variance than thermal releases. The SIRIUS modular system offers the right solution for every type of switching technology.

Ramp time

With SIRIUS soft starters, the length of the set ramp time determines the time taken to increase the motor voltage from the parameterized starting voltage to the line voltage. This influences the motor's acceleration torque, which drives the load during the startup process. A longer ramp time results in a lower acceleration torque as the motor is started up. The startup is slower and smoother as a result. The ramp time should be long enough for the motor to reach its nominal speed. If the time selected is too short, in other words if the ramp time ends before the motor has started up successfully, a very high starting current that can even equal the direct starting current at the same speed occurs at this instant.

Ramp-down time

The "Ramp-down time" potentiometer on the SIRIUS 3RW40 soft starter allows you to specify how long power should still be supplied to the motor after the ON command has been removed. The torque generated in the motor is reduced by means of a voltage ramp function within this ramp-down time and the application stops smoothly.

Ramp-up detection for soft starters

The SIRIUS 3RW40 soft starter is equipped with an integrated ramp-up detection function. If it detects a motor startup, the motor voltage is immediately increased to 100% of the line voltage. The internal bypass contacts close and the thyristors are bridged.

Rated conditional short-circuit current I_q

The guaranteed short-circuit breaking capacity of switchgear assemblies and load feeders, also called "rated conditional short-circuit current".

Rated data for the control circuit

The most important rated data for the control circuit in terms of selecting a switching device (e.g. a contactor) are the rated control supply voltage U_s (voltage of the coil terminal) with the associated frequency (e.g. 50 Hz), as well as the power input of the coil (closing power and holding power) in the case of contactors, for example.

Rated data for the main circuit

The most important rated data for the main circuit in terms of selecting a switching device (e.g. a contactor) are the rated operational current I_e (current specified by the conditions of use) or the rated power (motor power), as well as the corresponding rated voltage U_e.

Rated impulse withstand voltage (U_{imp})

Peak value of a surge voltage with a defined waveform and polarity, which can be applied to the device under specified test conditions without the device failing and to which the clearances refer. The rated impulse withstand voltage of a device must be equal to or greater than the transient overvoltages which occur in the network on which the device is being used.

Rated insulation voltage U_i

Voltage value which specifies the insulation strength of the switching device or accessory and to which the insulation tests and the creepages and clearances refer. The maximum rated operational voltage must not be greater than the rated insulation voltage under any circumstances.

Rated service short-circuit breaking capacity I_{cs}

Compared to the rated ultimate short-circuit breaking capacity I_{cu}, the test conditions here are stricter and the short-circuit current is usually lower. Determined using test sequence II, operating sequence O-t-CO-t-CO (O = open, t = time, CO = close-open). The function of the motor starter protector/circuit breaker must remain unrestricted following this test.

Rated short-circuit breaking capacity I_{cn}

According to IEC 60947-2 and DIN EN 60947-2, the rated short-circuit breaking capacity of a motor starter protector/circuit breaker is the value of the short-circuit current, which it can switch off at the rated operational voltage, rated frequency, and specified power factor (or specified time constant). The value of the prospective current (for alternating current, the rms value of the AC component) specified by the manufacturer applies. For AC motor starter protectors/circuit breakers, the rated short-circuit breaking capacity must be independent of the magnitude of the DC (direct-current) component. The rated short-circuit breaking capacity also ensures that the motor starter protector/circuit breaker can switch off every current up to the rated short-circuit breaking capacity in the event of a line-frequency recovery voltage with 110% of the rated operational voltage.

This applies

- For alternating current, at every value of the power factor, but not lower than the value defined in the relevant test specification
- For direct current, if no other specifications have been made to the contrary by the manufacturer, with every time constant, but not greater than the value defined in the relevant test specification.

The short-circuit breaking capacity does not apply in the event of a line-frequency recovery voltage above 110% of the rated operational voltage.

Rated ultimate short-circuit breaking capacity I_{cu}

Maximum short-circuit current I_k (limit value of the rated short-circuit breaking capacity), which can switch the motor starter protector/circuit breaker off under specific conditions. Determined using test sequence III, operating sequence O-t-CO (O = open, t = time, CO = close-open). The function of the motor starter protector/circuit breaker may be restricted following this test.

Recovery time

When a protection function in a switching device has been tripped (e.g. motor starter protector, soft starter, overload relay, or current monitoring relay), the motor cannot be restarted until a recovery time has elapsed. The length of the recovery time will vary, depending on the cause of the error. For more information, refer to the corresponding product documentation.

Response delay

The response delay is the time from when you start to enter a command until the first contact connection is made, at the contactor, for example.

RoHS

EC Directive 2002/95/EC concerning the restriction of the use of certain hazardous substances in electrical and electronic equipment regulates the use of hazardous substances in devices and components. The English abbreviation RoHS is used to refer to this directive: (Restriction of the use of certain hazardous substances), as well as all related measures for implementing it into national legislation.

Service life

Period of time for which the switching device will work properly under normal operating conditions. This is specified as the number of operating cycles, the electrical durability (e.g. contact erosion), and the mechanical durability (e.g. operating cycles without load).

Short-circuit strength

This is the resistivity of a switching device in the closed state, along with its components (e.g. releases), or a complete switchgear, to the electrodynamic (dynamic strength) and thermal (thermal strength) stresses which arise in the event of a short circuit. The characteristic for the dynamic stress is the rated peak withstand current, which is the maximum instantaneous value of the short-circuit current. The characteristic for the thermal stress of the short-circuit current is the root-mean-square value of the short-circuit current throughout its duration.

SIL (Safety Integrity Level)

Discrete level (one of three possibilities) for defining safety integrity specifications of safety-related control functions. Safety integrity level 3 is the highest possible level, level 1 the lowest.

Soft ramp-down

The same principle as that used for soft starting is applied during the ramp-down process. This ensures that the torque generated in the motor is reduced gradually, so that the application can ramp down smoothly.

In "soft ramp-down" mode, the natural stop process of the load is decelerated. The function is used when the load must be prevented from stopping abruptly. This is typically the case in applications with a low mass inertia or a high counter-torque.

Soft start

Since the motor voltage is controlled (phase control) by an electronic soft starter during the startup process, the consumed starting current and the starting torque generated in the motor are also controlled.

Soft starter

This is a motor starter which reduces the starting torque (starting torque, break loose torque) and the starting current of the motor in order to decrease the vibrations experienced by the driven machine and to prevent current peaks in the network. The starting torque is reduced because the supply voltage is initially set to a value lower than the rated voltage of the motor (the starting torque is proportional to the square of the voltage applied). The terminal voltage can be increased as soon as the motor starts to run. Classic ways of reducing the terminal voltage are star-delta (wye-delta) start, startup via resistors in the stator, and startup with an auto-transformer, for example. The use of solid-state motor controllers with switched thyristor circuits is becoming more and more prevalent as a way of controlling the terminal voltage on squirrel-cage motors. See also "Soft starting" and "Soft ramp-down".

Space above the arc chute

When a switching device is being operated, particularly when highly inductive load currents or short-circuit currents are being switched off, the ionized gases generated by the arc are pressed out of the openings in the arc chute. In order to ensure that the concentration of these ionized gases does not reach a hazardous level, a specific clearance must be provided above or in front of the device. This space above the arc chute is defined by the manufacturer (usually on the dimension drawings) and depends on whether exposed live conductors (e.g. busbars), conductive structural components, and insulating partitions can be found on the switching device. Arc chute attachments can be mounted to larger motor starter protectors in order to reduce the required clearance and therefore the space required in the control cabinet. No space is required above the arc chute for vacuum circuit breakers and vacuum contactors, since the arc will not escape from the vacuum chute and no ionized gases will be released.

Star-delta (wye-delta) starter

See "Contactor assembly for star-delta (wye-delta) start".

Starting current

Three-phase induction motors have a high direct starting current $I_{starting.}$ Depending on the motor type, this current can be between three and fifteen times as high as the rated operational current. Seven or eight times the rated motor current can be assumed as a typical value.

Starting torque

The starting torque and the breakdown torque can usually be assumed to be between two and four times the rated torque. From the point of view of the load machine, this means that the starting and acceleration forces exert a higher mechanical load on the machine and the product being conveyed compared to nominal operation.

Starting voltage

The starting voltage determines the starting torque of the motor for SIRIUS soft starters. A lower starting voltage results in a lower starting torque and a lower starting current. The starting voltage selected must be sufficiently high to ensure that motor starts up smoothly as soon as the start command is received by the soft starter.

Switching frequency

Number of operating cycles per time unit (e.g. 15 operations per hour).

The maximum permissible switching frequency must not be exceeded because the SIRIUS soft starters could be damaged due to thermal overloading. The switching frequency of SIRIUS soft starters size S0 to S3 can be increased by installing an optional additional fan.

Switching technology

A basic distinction can be made between two types of switching technology: On the electromechanical side, there are contactors, contactor assemblies, and compact starters which can be used to implement solutions for direct-on-line start, reversing start, and star-delta (wye-delta) start. Frequent switching or reversing, soft starting, and soft ramp-down, on the other hand, are initiated using electronic switching devices: solid-state switching devices and soft starters. The SIRIUS modular system offers the right solution for every type of switching technology.

Temperature compensation

With inverse-time delayed (thermal) overload releases and relays, not only the current, but also the ambient temperature has an effect on the tripping time. An additional bimetal strip, which is not heated up by the current, can be used to compensate for the influence of the ambient temperature. If solid-state overload relays are used, electronic compensation is possible.

Terminals for "Self Protected Combination Motor Controller Type E"

The terminals conform to the clearances and creepage distances stipulated by UL 508 (Type E).

Thermistor motor protection

Motor protection provided by temperature sensors (PTC sensors) integrated in the windings. These sensors monitor the winding temperature directly.

Time-delayed auxiliary switch

Module which can be integrated into various combinations of auxiliary switches and can usually be retrofitted to a switching device too.

Timing relay

Switching device with electronic time delay, which opens or closes contacts after a specified period of time has elapsed.

Tripping characteristic curve

The tripping characteristic (curve) is the graphical representation of the relationship between the tripping time and the controlling variable. The time-current diagram can be used to find out, for example, how long it will take for the release or the tripping relay to respond at a particular current.

Tripping class (CLASS)

The tripping class of a current-dependent overload relay (including thermal and solid-state overload relays and releases) specifies the maximum tripping time from cold at a particular load. The tripping class number (e.g. CLASS 10, 20, 30) represents the maximum permissible tripping time in seconds when the relay is subjected to a symmetrical 3-pole load from cold with 7.2 times the current setting (IEC 947-4-1; DIN VDE 0660 Part 107). Tripping classes 20 and 30 are used for protecting the motor under heavy-duty starting conditions, for example.

Tripping current (of an overload release)

The current value at which a release trips within a certain time.

Two-phase control

With solid-state switching devices like soft starters or solid-state contactors, two out of three active phases are controlled by means of semiconductors. For example, SIRIUS 3RW30 and 3RW40 soft starters feature two anti-parallel thyristors in each of phases L1 and L3. Phase L2 is an uncontrolled phase, which is routed through the starter via a copper link and connected directly to the corresponding output terminal.

Types of coordination

The standard DIN EN 60947-4-1 (VDE 0660 Part 102) or IEC 0947-4-1 distinguishes between two types of coordination, which are referred to as coordination type "1" and coordination type "2". Any short circuits that occur are cleared safely in both types of coordination. the only differences are in the extent of the damage sustained by the device following a short circuit.

Utilization category

According to DIN EN 60947-4-1, the application area of and the load applied to power contactors can be identified by looking at the specified utilization category in conjunction with the specified rated operational current or the motor power and the rated voltage. An example is utilization category AC-3 for starting and switching off squirrel-cage motors.

Voltage ramp

The SIRIUS 3RW30 and 3RW40 soft starters achieve soft starting by means of a voltage ramp. The motor terminal voltage is increased from a parameterizable starting voltage up to the line voltage within a definable start time.

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