SIEMENS

SIMATIC

ET 200S
Motor starters
Fail-Safe Motor Starters
Safety-Integrated Systems

Manual

Edition 06/2015

GWA-4NEB950007202-15

3ZX1012-0RK13-0AC0

Safety guidelines

This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. The information regarding your personal safety is indicated by a warning triangle, while information regarding only property damage does not have a warning triangle. According to the warning level, the warnings are shown in decreasing order as follows:

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

Warning
Indicates that death or severe personal injury **can** result if proper precautions are not taken.

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

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

Attention
Indicates that an undesired result or state can occur if the corresponding notice is not observed.

If multiple warning levels occur, the warning for the highest level is always used. If a warning triangle indicating an injury hazard is shown in a warning message, a warning indicating property damage can also be included in the same warning message.

Qualified personnel

The product/system belonging to this documentation must only be used for the relevant task by **qualified personnel** observing the relevant documentation for the corresponding task, in particular the safety and warning information included. Thanks to their training and experience, qualified personnel are able to recognize hazards when using these products/systems and avoid possible dangers.

Correct usage of SIEMENS products

Note the following:

Warning
Siemens products must only be used for the applications described in the catalog or the technical documentation. If third party products and components are used, these must be recommended or approved by Siemens. The correct and safe operation of the products requires correct transportation, correct storage, setup, assembly, installation, commissioning, operation and maintenance. The permissible ambient conditions must be observed. Information in the relevant documentation must be observed.

Trademarks

All names marked with the trademark symbol ® are registered trademarks of Siemens AG. Some other designations used in these documents are also brands; the owner's rights may be violated if they are used by third parties for their own purposes.

Disclaimer of liability

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

Technical Assistance:	Telephone:	+49 (0) 911-895-5900 (8.00 am - 5.00 pm CET)	SIEMENS AG
	Fax:	+49 (0) 911-895-5907	Technical Assistance
	Email:	technical-assistance@siemens.com	Breslauer Str. 5
	Website:	www.siemens.com/sirius/technical-assistance	D-90766 Fürth

Siemens AG
Industry Sector
Postfach 4848
90026 Nürnberg
GERMANY

Siemens Aktiengesellschaft

Important information

Purpose of the manual

This manual is an addition to the following manuals:

- *ET 200S Distributed I/O Device*
- *IM 151/CPU Interface Module*
- *ET 200S Process-Related Functions*
- *ET 200S Positioning*
- *ET 200S Serial Interface Module*
- *Distributed I/O System ET 200S Fail-Safe Modules*
- *Safety Engineering in SIMATIC S7, System Description*
- *S7 Distributed Safety Configuration and Programming*

This manual describes all the functions of the ET 200S motor starters. The manual does not deal with general ET 200S functions. You can find descriptions of these in the *SIMATIC ET 200S Distributed I/O Device* manual.

Target group

This manual describes the hardware of the ET 200S motor starters and fail-safe motor starters and the safety-integrated system.
It is aimed at configuration engineers, commissioning engineers and maintenance personnel.

Manuals

The following list provides a table of contents of the manuals (also see Section B.6):

Distributed I/O System ET 200S	**Automation Systems S7-300, Operations list**	**IM 151-7 CPU Interface Module**
in Internet only	in Internet only	in Internet only
• Installing and wiring the ET 200S • Commissioning and diagnostics of the ET 200S • ET 200S distributed I/O system, fail-safe technology • PM-D F PROFIsafe module • Technical data from IM 151-1, digital and analog electronic modules • Order numbers for ET 200S	• IM 151-7 CPU	• Addressing of IM 151-7 CPU • ET 200S with IM 151-7 CPU in a PROFIBUS network • Commissioning and diagnostics of the IM 151-7 CPU • Technical data for the IM 151-7 CPU
Positioning ET 200S	**Process-Related Functions ET 200S**	**Serial interface module ET 200S**
in Internet only	in Internet only	in Internet only
• 1STEP 5V/204 kHZ • 1POS INC/Digital • 1POS SSI/Digital • 1POS INC/Analog • 1POS SSI/Analog	• 1COUNT 24V/100kHz • 1COUNT 5V/500kHz • 1SSI • 2PULSE	• 1SI 3964/ASCII • 1SI MODBUS/USS

Note
The fail-safe modules are described in the "*ET 200S Distributed I/O Device for Fail-Safe Modules*" manual. This and additional manuals for fail-safe systems can be downloaded on the Internet.

Scope of validity

This manual is valid for ET 200S motor starters. It contains a description of the components that were valid at the time the manual was published. We reserve the right to enclose a product information document containing up-to-date information about new components and new versions of components.

Approvals

The product series in the ET 200S distributed I/O device - motor starters, fail-safe motor starters, and safety-integrated system corresponds to the following regulations:

- EC Directive 2006/95/EC on low voltage
- EC Directive 2004/108/EC on electromagnetic compatibility
- Underwriters Laboratories, Inc.: UL 508 registered (Industrial Control Equipment)
- Canadian Standards Association: CSA C22.2 Number 142, tested (Process Control Equipment)

Standards, certificates and approvals

The ET 200S distributed I/O system is based on IEC 61158/EN 50170, Volume 2, PROFIBUS. The ET 200S distributed I/O device fulfills the requirements and criteria of IEC 61131, Part 2 and the requirements for obtaining the CE marking. ET 200S has CSA and UL approval.
You will find detailed information on the relevant standards, certificates, and approvals in the SIMATIC manual *ET 200S Distributed I/O System*.

Disclaimer of liability

The products described in this manual were developed to discharge safety-oriented functions as part of a higher-order system or machine. A complete safety system generally comprises sensors, analyzers, signaling devices and concepts for safe shutdowns. The manufacturer of the system or machine is responsible for ensuring correct overall functioning. Siemens AG, its subsidiaries and its affiliated companies (hereinafter designated "Siemens") are not in a position to guarantee all features of an overall system or machine not designed by Siemens.

Siemens also refuses to accept liability for recommendations, express or implicit, in the subsequent description. No warranty, guarantee or liability claims above and beyond the General Terms and Conditions of Supply and Sale of Siemens can be derived from the subsequent description.

Installation notes

Measures to be observed for improving immunity to
conducted radio-frequency emissions:
* Spatial separation of sensitive electrical circuit from sources of interference
* Use of transposed conductors
* Maintaining a sufficient distance between interference from emitting conductors and conductors in sensitive electrical circuits
* Aligning cables and lines as close to 90° as possible at crossovers
* Using the thickest possible conductor routing at groundplane
* Use of electrostatic / electromagnetic shields

Position in the information landscape

As well as this manual, you will need the manual for the DP master you are using.

Note

A guide to the contents of the SIMATIC ET 200S manuals can be found in Section 1.5 of this manual.

We recommend that you first look in this section to find out which contents of which manual are important for solving your problem.

Aids to accessing information

You can find specific information in the manual quickly by using the following aids:

- There is a table of contents at the front of the manual.
- Each section contains subheadings that provide you with an overview of the contents of the relevant sections.
- Following the appendices you will find a glossary, in which important technical terms used in the manual are defined.
- At the end of the manual you will find a detailed index, which makes it easy for you to find the information you are looking for.

Constantly updated information

Should you have any queries regarding motor starters, please get in touch with the point of contact in your region responsible for low-voltage switchgear/controlgear with communication capability. You can obtain a list of the points of contact, along with the latest release of the manual, at the following Internet address:

www.siemens.de/sirius-motorstarter

Table of contents

13 Fail-safe modules

Product overview

1

1.1 Overview

1.1.1 General components

The following table shows the general components required for a configuration with motor starters.

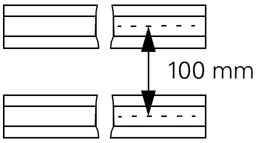
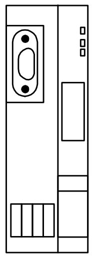
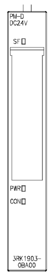
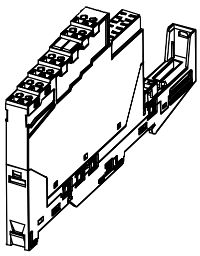
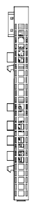
Component	Function	Drawing
DIN rails	... are the mechanical supports onto which the terminal modules of the ET 200S are snapped.	
Interface module IM 151	... connects the ET 200S with the control via a field bus system and prepares the data for the electronic modules and motor starters connected. (See the *ET 200S Distributed I/O System* manual.)	
PM-D power module	The module monitors the voltage of the electronic components and contactors for a group of motor starters (potential group) (see Section 7).	
Terminal modules TM-P15 S27-01	... carry the wiring and take the PM-D power module (with terminating cover) (see Section 6.2).	
Spacing module DM-V15	... in the case of specific mounting positions, high ambient temperatures and for operation in the upper current range, it may be necessary to insert a spacing module. Configuration is not necessary. (see Section 3.4.3).	

Table 1-1: General components

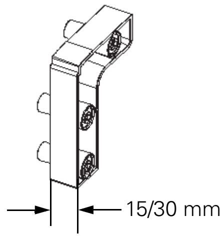
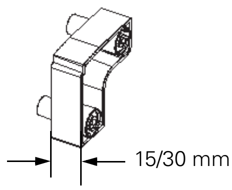
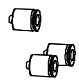
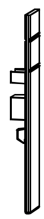
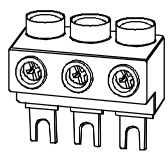
Component	Function	Drawing
Jumper module L1/L2/L3	... loops L1, L2 and L3 through ... for closing gaps in the power bus, for example when expansion modules and spacing modules are used Available types: • With L1/L2/L3 throughfeed, 15 mm, 30 mm	
PE/N jumper module	... adds a PEN conductor (N) and protective ground (PE) to the power bus. ... for closing gaps in the PE/N bus, for example when expansion modules and spacing modules are used Available types: • with PE/N throughfeed, 15 mm, 30 mm	
Caps	... protect the contacts of the power bus from touching (IP20) and included with the terminal modules with power bus infeed and with the terminal blocks with PE/N infeed (see Section 3.8).	
Terminating module	... terminates the internal data bus of the ET 200S electrically and is included with the IM module. (see Section 3.8 and *ET 200S Distributed I/O System* manual).	
Terminating cover	... prevents the contacts of the motor starters from being touched and is included with the terminal modules TM-P15 S27-01, TM-PF30 S47 B1/C1/F1, and TM-PFX30 S47-G1. (see Section 3.8).	
3-phase feed-in terminal for S0	... for expanding the conductor cross section for power infeed - if necessary - as follows: • solid or stranded: 2.5 to 25 mm^2 • finely stranded with end sleeve: 2.5 to 25 mm^2 • solid or stranded: 12 to 4 AWG (see Section B.2)	

Table 1-1: General components (Contd.)

1.1.2 Components up to 5.5 kW and 45/90 mm installation width for standard motor starters

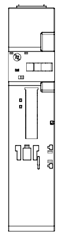
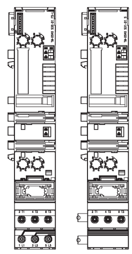
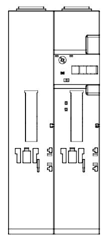
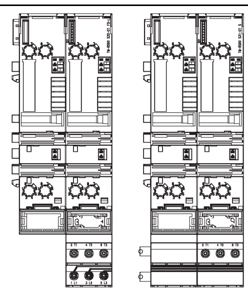
Component	Function	Drawing
Direct starter; standard DS-x1	direct starter; standard SIRIUS ... switches a motor on or off. ... protects three-phase motors up to 5.5 kW in the event of overloading and short-circuiting. ... also controls a brake control module (xB1 to xB6). Only the brake function of the xB3, xB4 and xB6 is supported, the inputs have no effect. ... also controls a brake control module (xB3 or xB4) (see Section 8.2).	
Terminal module TM-DS45	... carries the wiring and takes a DS1-x direct starter; standard. ... distributes L1, L2 and L3 via the integrated power bus. Available types: • with power bus infeed for a load group (drawing on left), including 3 caps • with power bus throughfeed (drawing on right) (see Section 6.3.1).	
Reversing starters; standard RS1-x	reversing starter; standard SIRIUS ... switches a motor rotating clockwise or counterclockwise on or off. ... protects three-phase motors up to 5.5 kW in the event of overloading and short-circuiting. ... also controls a brake control module (xB1 to xB6). Only the brake function of the xB3, xB4 and xB6 is supported, the inputs have no effect. ... also controls a brake control module (xB3 or xB4) (see Section 9.2).	
Terminal module TM-RS90	... carries the wiring and takes an RS1-x reversing starter; standard. ... distributes L1, L2 and L3 via the integrated power bus. Available types: • with power bus infeed for a load group (drawing on left), including 3 caps • with power bus throughfeed (drawing on right) (see Section 6.3.5).	

Table 1-2: Components for motor starters, standard up to 5.5 kW and 45/90 mm installation width

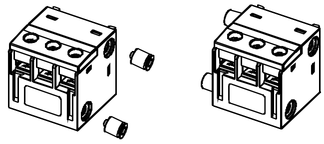
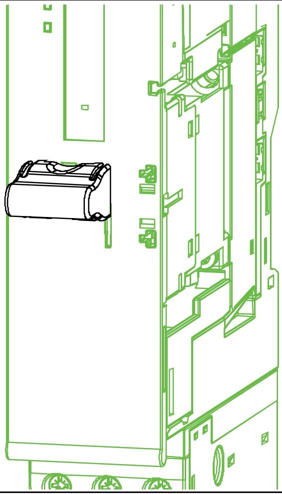
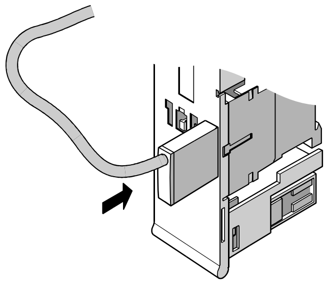
Component	Function	Drawing
PE/N terminal block	... adds a PEN conductor (N) and protective ground (PE) to the power bus. Available types: • with PE/N infeed and connection to right, including 2 caps, 45 mm • with PE/N connection and throughfeed, 45 mm (see Section 6.3.1 and 6.3.5).	
Control kit	... for manual operation of the contactor (only for DS1-x, RS1-x) (see Section 4.2).	
Control unit for ET 200S	... for direct drive of the contactor coils and for checking the wiring and operation of the powers section for commissioning and service purposes. (only for DS1-x, RS1-x) (see Section 4.3).	

Table 1-2: Components for motor starters, standard up to 5.5 kW and 45/90 mm installation width (Contd.)

1.1.3 Components up to 7.5 kW and 65/130 mm installation width for High Feature motor starters

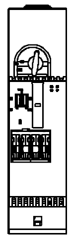
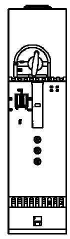
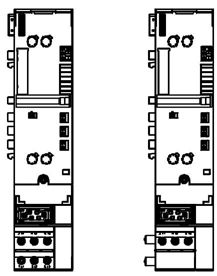
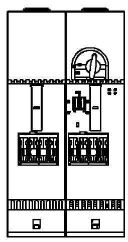
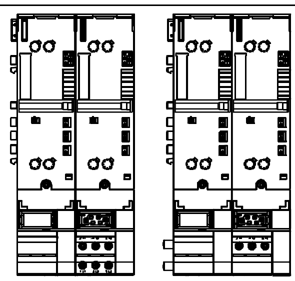
Component	Function	Drawing
Direct starter DS1e-x; high feature	direct starter; high feature with electronic overload protection ... switches a motor on or off. ... protects three-phase motors up to 7.5 kW in the event of overloading and short circuiting. ... also controls a brake control module (xB1 to xB6). ... with integrated fail-safe kit (see Section 8.3).	
Direct soft starters DSS1e-x; high feature	direct soft starter; high feature with electronic overload protection ... switches a motor on or off. ... protects three-phase motors up to 7.5 kW in the event of overloading and short circuiting. ... also controls a brake control module (xB1, xB3) (see Section 8.4).	
Terminal module TM-DS65	carries the wiring and takes a DS1e-x direct starter; high feature or DSS1e-x direct soft starter; high feature. ... distributes L1, L2 and L3 via the integrated power bus. Available types: • with power bus infeed for a load group (drawing on left), including 3 caps • with power bus throughfeed (drawing on right) (see Section 6.3.2).	
RS1e-x reversingstarter; high feature	reversing starter; high feature with electronic overload protection ... switches a motor rotating clockwise or counterclockwise on or off. ... protects three-phase motors up to 7.5 kW in the event of overloading and short circuiting. ... also controls a brake control module (xB1 to xB6). ... with integrated fail-safe kit (see Section 9.3).	
Terminal module TM-RS130	... carries the wiring and takes an RS1e-x reversing starter; high feature. ... distributes L1, L2 and L3 via the integrated power bus. Available types: • with power bus infeed for a load group (drawing on left), including 3 caps • with power bus throughfeed (drawing on right) (see Section 6.3.6).	

Table 1-3: Components up to 7.5 kW and 65/130 mm installation width for motor starters; high feature

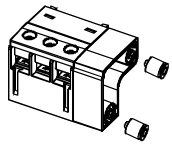
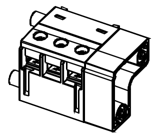
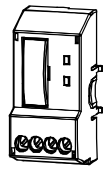
Component	Function	Drawing
Terminal block and jumper module PE/N	... adds a PEN conductor (N) and protective ground (PE) to the power bus. Available types: • with PE/N infeed and connection to right, including 2 caps, 65 mm • with PE/N connection and throughfeed, 65 mm (see Section 6.3.2, 6.3.3, 6.3.6, and 6.3.7).	 
Control module 2DI COM	Digital module with • 2 inputs for parameterizable motor starters; high feature. Actions, e.g., for local operating mode, end position operation, emergency start, etc. (for DS1e-x, RS1e-x, DSS1e-x, F-DS1e-x, F-RS1e-x) • Connection possibility on the PC via the 'LOGO! PC cable (order no.: 6ED1057-1AA00-0BA0) (see Section 4.4).	
Control module 2DI LC COM	Like 2DI COM control module, but also with input for switching to the manual local operating mode. (see Section 4.5).	

Table 1-3: Components up to 7.5 kW and 65/130 mm installation width for motor starters; high feature (Contd.)

1.1.4 Fail-safe components

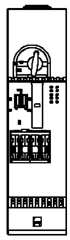
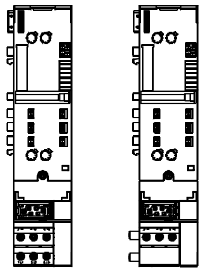
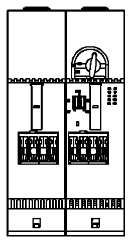
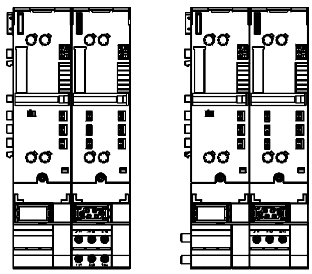
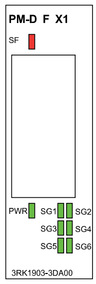
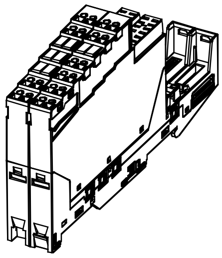
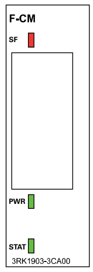
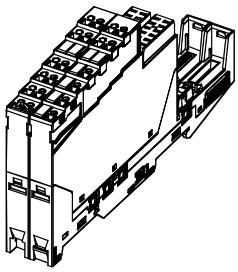
Component	Function	Drawing
Fail-safe direct starters F-DS1e-x	fail-safe direct starter with electronic overload protection ... switches a motor on or off. ... switches off safely if there is no SG signal. ... protects three-phase motors up to 7.5 kW in the event of overloading and short circuiting. ... also controls a brake control module (xB1 to xB6). (see Section 8.3).	
Terminal module TM-FDS65	... carries the wiring and takes a fail-safe F-DS1e-x direct starter. ... distributes L1, L2 and L3 via the integrated power bus. ... contains the coding for the safety group (SG1 to SG6) Available types: • with power bus infeed for a load group (drawing on left), including 3 caps • with power bus throughfeed (drawing on right) (see Section 6.3.3).	
Fail-safe reversing starters F-RS1e-x	fail-safe reversing starter; high feature with electronic overload protection ... switches a motor rotating clockwise or counterclockwise on or off. ... switches off safely if there is no SG signal. ... protects three-phase motors up to 7.5 kW in the event of overloading and short circuiting. ... also controls a brake control module (xB1 to xB6). (see Section 9.3).	
Terminal module TM-FRS130	... carries the wiring and takes a fail-safe F-RS1e-x reversing starter. ... distributes L1, L2 and L3 via the integrated power bus. ... contains the coding for the safety group (SG1 to SG6) Available types: • with power bus infeed for a load group (drawing on left), including 3 caps • with power bus throughfeed (drawing on right) (see Section 6.3.7).	

Table 1-4: Fail-safe components

Component	Function	Drawing
PM-D F X1 power/expan-sion module	... supplies external safety devices ... loops the 6 SG buses and U_1 and M through (see Section 13.3).	
TM-PFX30 terminal mod-ule	... carries the wiring and takes a PM-D F X1 power/expansion module Available types: • Incoming supply from the left for expan-sion • Without an incoming supply from the left as power module (see Section 13.2).	
F-CM contact repli-cator	... used in conjunction with a fail-safe power module PM-D F PROFIsafe [1)] or PM-D F X1 ... makes 4 floating relay contacts available for safe shutdown of external components. Switches off the relay contacts safely if there is no SG signal. ... for safe shutdown of external compo-nents, such as valves. (see Section 13.4).	
TM-FCM30 terminal mod-ule	... carries the wiring and takes a contact rep-licator module (see Section 13.2).	

1) PM-D F PROFIsafe power module; see the "*ET 200S Distributed I/O Device for Fail-Safe Modules*" manual.

Table 1-4: Fail-safe components (Contd.)

1.1.5 Components for safety-integrated systems

The following table shows the components required to set up an emergency stop circuit.
Technical data, see Section 11.3 or Table 11-13.

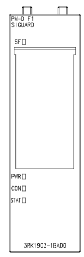
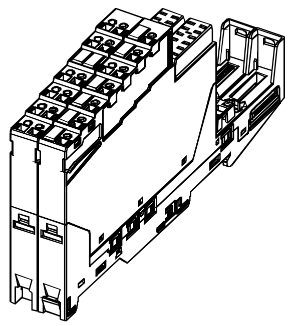
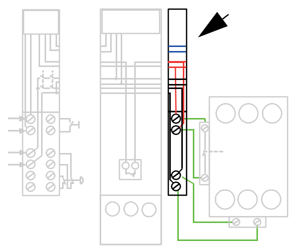
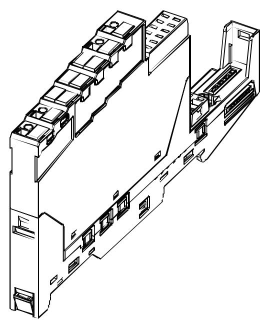
Component	Function	Drawing
Power module PM-D F1 through 4 PM-D F5	The module monitors the voltage of the electronic components and contactors for a group of motor feeders (potential group). ... Ensures that all motor starters in a group are switched off in the interests of safety. ... In combination with PM-D F 1 to 4, makes available four additional enabling circuits for safe shutdown. (see Section 11.3).	
TM-PF30 S47 terminal modules	... carry the wiring and take the PM-D F1 to 5 power module. ... incorporate the terminals for the sensor circuits (PM-D F1, 2). ... incorporate the terminals for the auxiliary voltages (PM-D F1 to 4). ... incorporate the terminals for the enabling circuits (PM-D F5). ... ... types ...B1 and ...C1 with terminating cover (see Section 11.2).	
Connection module PM-X	... for terminating the release circuit ... for connecting an external infeed contactor/release circuit ... for integrating ET 200S motor starter groups in external safety circuits (see Section 11.4).	
TM-X15 S27-01 terminal module	... carries the wiring and takes the PM-X connection module. The same model is used for the start and end of a motor starter group (see Section 11.2.7).	

Table 1-5: Components for safety-integrated systems

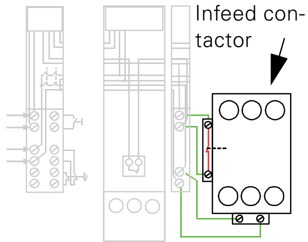
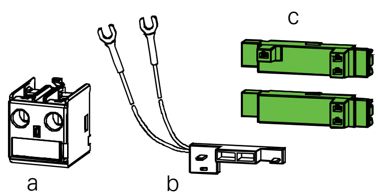
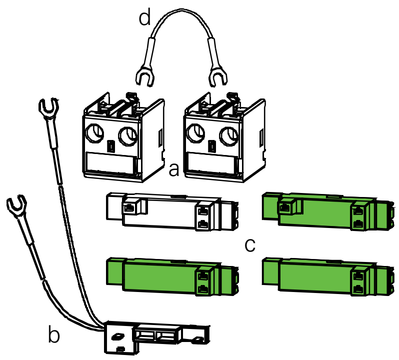
Component	Function	Drawing
Infeed contactor, e.g. SIRIUS	... is a second circuit-breaking element in the main circuit. (see Section 11.6).	
Fail-safe kit 1 for DS1-x direct starter; standard	... is necessary to achieve a moderate to high level of diagnostic coverage ... consists of • an auxiliary switch block (a) • a contact holder with a connecting lead for the direct starter (b) • two contact supports for the terminal module (c) ... is already integrated into the DS1e-x and TM-DS65 high feature starters (see Section 11.5).	
Fail-safe kit 2 for RS1-x reversing starter; standard	... is necessary to achieve a moderate to high level of diagnostic coverage ... consists of • two auxiliary switch blocks (a) • a contact holder with a connecting lead for the reversing starter (b) • four contact holders for the terminal module (c) • a connecting lead (d) ... is already integrated into the RS1e-x and TM-RS130 high feature starters (see Section 11.5).	

Table 1-5: Components for safety-integrated systems (Contd.)

1.1.6 Components of the expansion modules

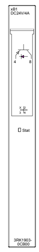
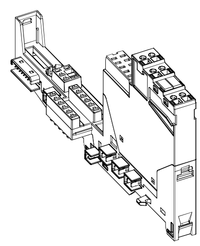
Component	Function	Drawing
Brake control module	... for all motor starters except DS and RS	
xB1	... with externally powered mechanical brakes (24 V DC/4 A)	
xB3	... and 2 inputs (see Section 12.3.5).	
xB2	... with internally powered mechanical brakes (500 V DC/0.7 A)	
xB4	... and 2 inputs (see Section 12.3.6).	
xB5	... with internally powered mechanical brakes (400 V AC/0.5 A) (see Section 12.3.7).	
xB6	... and 2 inputs (see Section 12.3.7).	
Terminal module TM-xB15 S24-01	... carries the wiring and takes a brake control module xB1, xB2 or xB5.	
Terminal module TM-xB215 S24-01	... carries the wiring and takes a brake control module xB3, xB4 or xB6. (see Section 12.3.2).	

Table 1-6: Components of the expansion modules

1.2 ET 200S configuration options

Motor starters with the following features can be combined as follows:

- Motor starters of installation width 45/90 mm (motor starters; standard) and 65/130 mm (motor starters; high feature) can be used in any combination.
- Supply through the backplane bus is compatible.
- Power infeed between the motor starters with installation widths of 45/90 mm and 65/130 mm is separate on account of the different installation lengths.

Safety note
Only applies in fail-safe mode (fail-safe technology)
It is **not** permissible to combine fail-safe modules with standard modules in a single fail-safe potential group,
(Exception: expansion racks, e.g. xB1 to xB6 according to performance level, see Section 8.3, 9.3).

ET 200S with motor starters

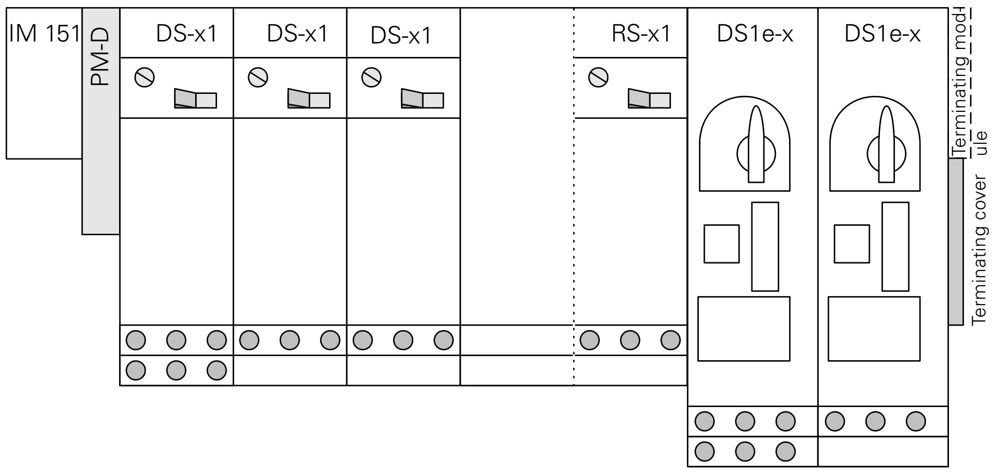


Figure 1-1: ET 200S with motor starters

ET 200S with motor starters and electronic modules

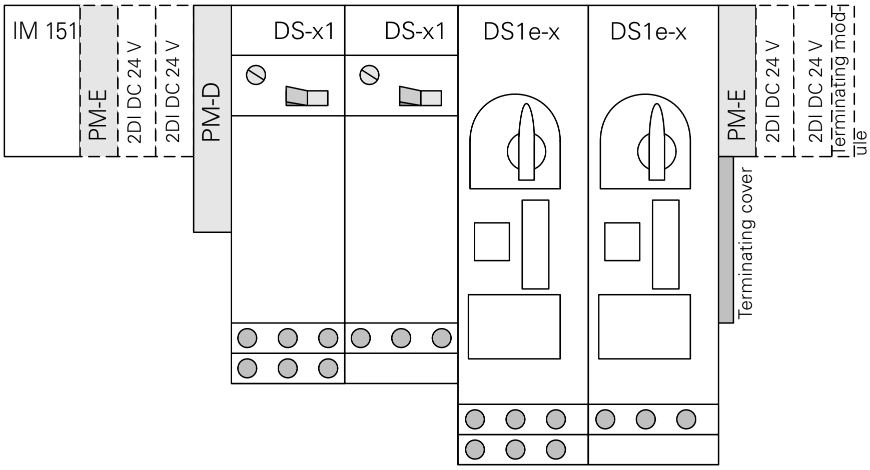


Figure 1-2: ET 200S with motor starters and electronic modules

ET 200S with motor starters and safety-integrated systems up to PL e

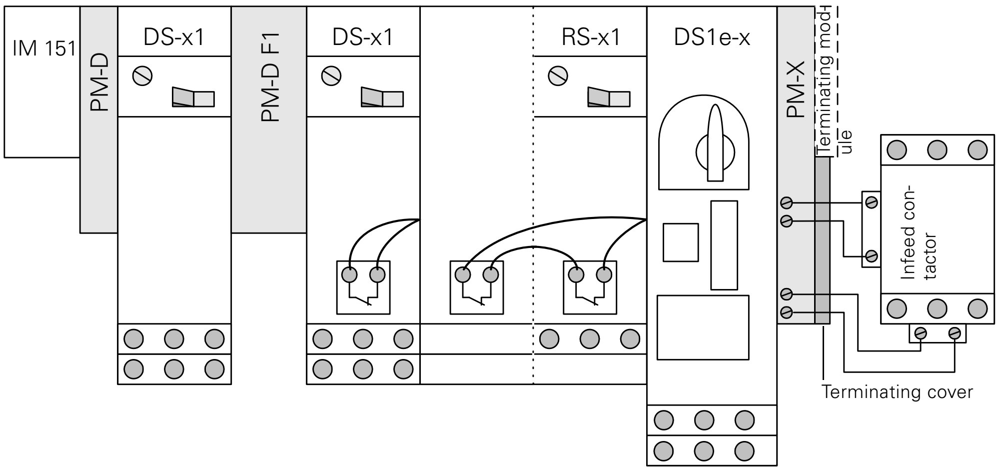


Figure 1-3: ET 200S with motor starters and safety-integrated systems up to PL e

Parts list

The following parts list contains all the components required for an ET 200S sample configuration with motor starters and safety-integrated systems (see Figure 1-3).

Abbreviation	Order number	Description
IM 151	6ES7151-1AA00-0AB0	IM 151 interface module
PM-D	3RK1903-0BA00	Power module for motor starter
TM-P15 S27-01	3RK1903-0AA00	Terminal module for power module
TM-DS45S32	3RK1903-0AB00	Terminal module for direct starter; standard with power bus infeed
DS-x1	3RK1301-0KB00-0AA2	Direct starter; standard, electromechanical, 0.9 to 1.25 A
TM-PF30 S47-B1	3RK1903-1AA10	Terminal module with infeed for power module
PM-D F1	3RK1903-1BA00	Power module for emergency stop
TM-DS45S32	3RK1903-0AB00	Terminal module for direct starter; standard with power bus infeed
DS-x1	3RK1301-1EB00-0AA2	Direct starter; standard, electromechanical, 2.8 to 4.0 A
Fail-safe kit 1	3RK1903-1CA00	Fail-safe kit 1, for direct starter; standard
TM-RS90S31	3RK1903-0AC10	Terminal module for reversing starter; standard with power bus throughfeed
RS-x1	3RK1301-1BB00-1AA2	Reversing starter; standard, electromechanical, 1.4 to 2.0 A
Fail-safe kit 2	3RK1903-1CA01	Fail-safe kit 2, for reversing starter; standard
TM-DS65 S32 -01 FS L	3RK1903-0AK00	Terminal module for direct starter; high feature with power bus infeed
DS1e-x	3RK1301-0CB10-0AB4	Direct starter; high feature with electronic overload protection, 2.4 to 16 A
TM-X15 S27-01	3RK1903-1AB00	Terminal module for connection module
PM-X	3RK1903-1CB00	Connection module
		Terminating cover (component of the terminal modules with power bus infeed for power modules of motor starters)
		Terminating module (component of the IM 151)
	3RT1035-1BB40	Infeed contactor as 2nd deactivation possibility, e.g. SIRIUS, size 2

ET 200S with fail-safe motor starters up to PL e / SIL3

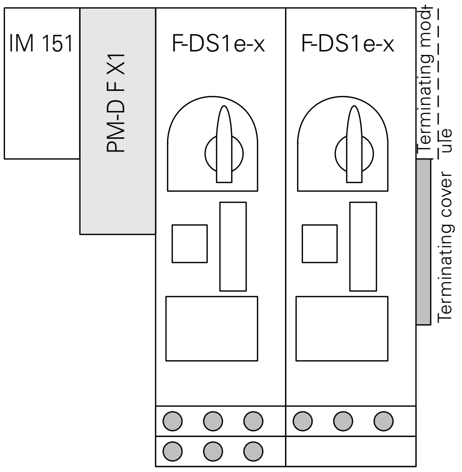


Figure 1-4: ET 200S with fail-safe motor starters up to PL e / SIL3

ET 200S with fail-safe motor starters and fail-safe electronic modules up to PL e / SIL3

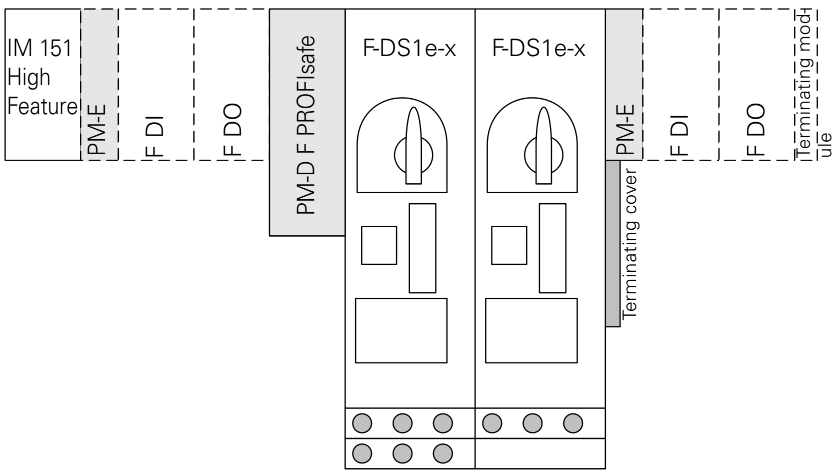


Figure 1-5: ET 200S with fail-safe motor starters and fail-safe electronic modules up to PL e / SIL3

Potential groups and load groups

A potential group (24V) consists of a PM-D power module and all the modules to the right of the power module up to the next PM-D power module.

A load group (400V) consists of a motor starter with power infeed and all the motor starters to the right of it up to the next motor starter with a power infeed.

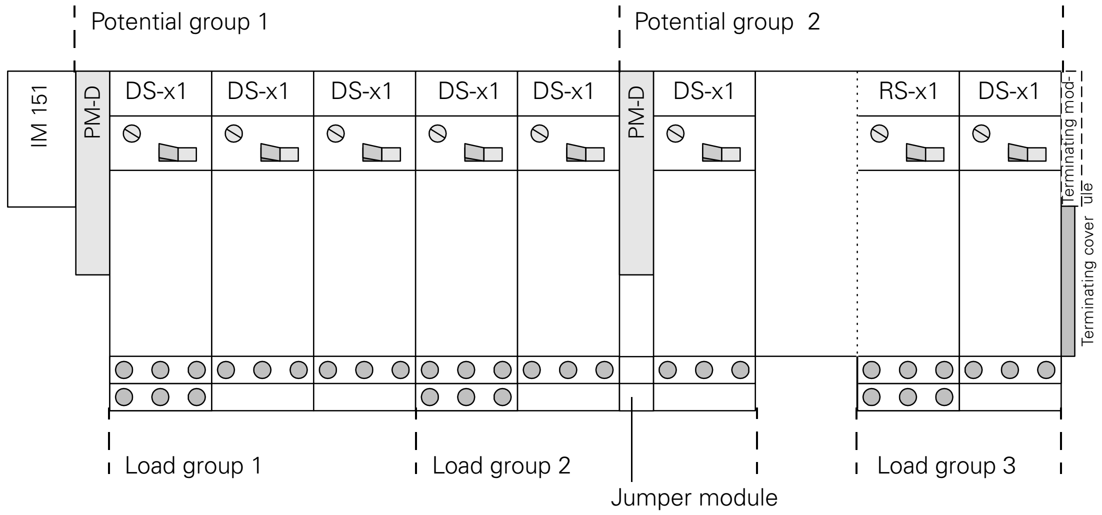


Figure 1-6: Potential groups and load groups

1.3 Maximum number of modules that can be connected/maximum configuration

Please note the following rules when configuring your ET 200S station:

- The maximum number of of modules is 64.
  This includes:
  - interface module
  - power modules
  - electronic modules
  - modules for reserve
  - motor starter
- The maximum length of the parameters is 244 bytes (depending on the DP master used).

The following table contains the parameter length of the different modules in bytes:

Module	Parameters (bytes)	PAA/PAE (bytes)	Module	Parameters (bytes)	PAA/PAE (bytes)
PM-D	3	0/0	DS-x1	3	1/1 1)
PM-D F1	3	0/0	RS-x1	3	1/1 1)
PM-D F2	3	0/0	DS1e-x	12	2/2
PM-D F3	3	0/0	RS1e-x	12	2/2
PM-D F4	3	0/0	DSS1e-x	12	2/2
PM-D F5	3	0/0	F-DS1e-x	12	2/2
PM-X	1	0/0	F-RS1e-x	12	2/2
PM-D F X1	3	0/0	DS1e-x ab -.A**B**4	22 3)	2/2
F-CM	3	0/0	RS1e-x ab -.A**B**4	22 3)	2/2
PM-D F PROFIsafe	20	5/5	DSS1e-x ab -.A**B**4	22 3)	2/2
xB3	3	1/1 1)			
xB4	3	1/1 1)			
xB1	- 2)	0/0			
xB2	- 2)	0/0			
xB5	- 2)	0/0			
xB6	3	1/1 1)			
DM V15	- 2)	0/0			

1) 2 bits each in PAA/PAE are used; addresses can be packed
2) Not included with the configuration tool
3) This shows that max. **10** starters could be operated on a head-end in the DPV0 operating mode from the point of view of data volume framework: 22 bytes + (10 * 22 bytes) = 242 bytes.

Table 1-7: Parameter length of the modules

- The following table shows you the maximum current-carrying capacity of the modules you have to take into consideration:

<table>
<tr><th>Power modules</th><th>Maximum current-carrying capacity</th><th>Modules that can be connected</th></tr>
<tr><td>PM-D</td><td>10 A</td><td rowspan="8">The number of modules that can be connected depends on the total current of all the modules in this potential group. This must not exceed the relevant maximum current-carrying capacity.</td></tr>
<tr><td>PM-D F1</td><td rowspan="5">4 A
(see Section 11.3.3)</td></tr>
<tr><td>PM-D F2</td></tr>
<tr><td>PM-D F3</td></tr>
<tr><td>PM-D F4</td></tr>
<tr><td>PM-D F5</td></tr>
<tr><td>PM-D F X1</td><td>6 A</td></tr>
<tr><td>PM-D F PROFIsafe</td><td>Making current: 10 A
Continuous current:5 A</td></tr>
</table>

Table 1-8: Maximum current-carrying capacity

1.4 PROFIenergy

What is PROFIenergy

PROFIenergy is a manufacturer-independent profile on PROFINET. The profile supports the shutdown in idle times (energy-saving function), measurement of the energy flow (measurement function) and the status function that is used to export the current status conditions and other information on PROFIenergy. PROFIenergy uses field-tested PROFINET mechanisms ensuring rapid and simple implementation

Origination

Both standards and regulations are increasingly focussing on environmental protection and energy management as well as the desire to save energy costs in a production plant and thus secure a sustainable competitive advantage. As a result, the aim of industry is to save energy and to actively reduce CO2 emissions. The careful use of valuable resources means that the manacturer-non-specific PROFIenergy profile defined on PROFINET PROFIenergy makes an active contribution to environmental protection.

PROFIenergy (version 1.0) in the ET 200S motor starter (from order suffix: -.AB4)

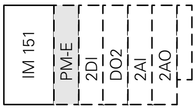
PROFIenergy allows consumption data from the equipment to be read in a standardized format. This data is recorded during operation and displayed on control device, for example, or transferred to higher level energy management software packages. This ensures that these measurements, as currently present in motor starters, are available to the user for onward processing in a standardized, manufacturer-nonspecific defined format and structure. These functions von PROFIenergy therefore form the basis for an active load and energy management system in ongoing operations.
The system and device manufacturers provide the user with function blocks for PROFIenergy and implement the relevant commands and status functions in the field devices. The plant and machinery engineer and the plant operator coordinate the switch-on and switch-off sequences as before, as well as the enabling signals for the process. The control stores which components are switched off with which pause type. The system operator does not need to get involved with the technology in detail.

1.5 Guide to the ET 200S manuals

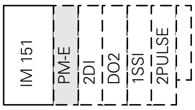
The components of the ET 200S are described in various manuals in the ET 200S manual package. The examples below show the possible ET 200S configurations and the manuals required for them.

You use the following components ...

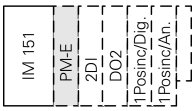
ET 200S consists of the following components: | **You need the information from the following manuals:** | **Order numbers of the required documentation packages and manuals**



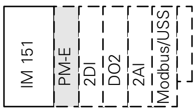
ET 200S Distributed I/O Device — 6ES7151-1AA10-8xA0 [1])



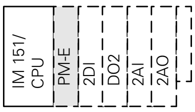
ET 200S Distributed I/O Device — 6ES7151-1AA10-8xA0 [1])
+
ET 200S Process-Related Functions — Available on the Internet



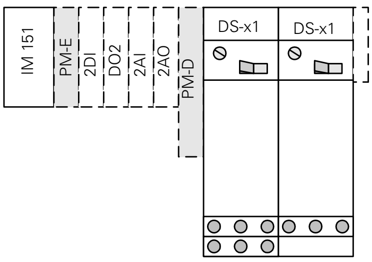
ET 200S Distributed I/O Device — 6ES7151-1AA10-8xA0 [1])
+
ET 200S Positioning — Available on the Internet



ET 200S Distributed I/O Device — 6ES7151-1AA10-8xA0 [1])
+
ET 200S Serial Interface Module — Available on the Internet



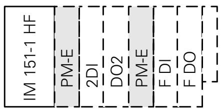
ET 200S Distributed I/O Device — 6ES7151-1AA10-8xA0 [1])
+
IM 151/CPU Interface Module — Available on the Internet



ET 200S Distributed I/O Device
+ — 6ES7151-1AA10-8xA0 [1])
ET 200S Motor Starters
Fail-Safe Motor Starters
Safety-Integrated Systems

[1]) x = The documentation packages or manuals can be ordered in the following languages:
A = German
B = English
French, Spanish, and Italian are also available on the Internet.

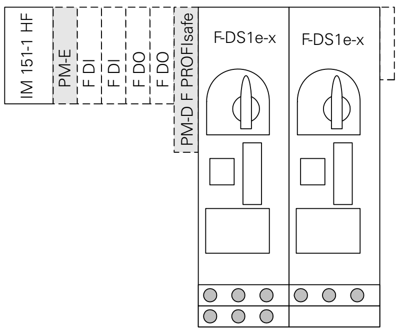
You use the following fail-safe components ...



ET 200S Distributed I/O Device — 6ES7151-1AA10-8xA0 [1)]

\+

ET 200S Distributed I/O Device
Fail-safe modules — Available on the Internet



ET 200S Distributed I/O Device
Fail-safe modules — Available on the Internet

\+

ET 200S Distributed I/O Device — 6ES7151-1AA10-8xA0 [1)]

\+

ET 200S Motor Starters
Fail-Safe Motor Starters
Safety-Integrated Systems

[1)] x = The documentation packages or manuals can be ordered in the following languages:
A = German
B = English
French, Spanish, and Italian are also available on the Internet.

Where do you find information?

The following table is designed to help you quickly find the information you need. It tells you which manual you need to refer to and which section deals with the topic you are interested in.

Subject	Manual section/appendix								
	ET 200S Motor Starters Fail-Safe Motor Starters	**ET 200S Distributed I/O Device**	**IM 151/CPU Interface Module**	**ET 200S Process-Related Functions**	**ET 200S Positioning**	**ET 200S Serial Interface Module**	**Distributed I/O System ET 200S Fail-Safe Modules**	**Safety-Integrated Systems in S7 System Description**	**S7 Distributed Safety Configuration and Programming**
Components of ET 200S	1	1	1				2	2	2
Brief instructions	2	2	2						
Configuration options	1	3	4				3	3	
Communication								4	
Configuration	4							7	3
Addressing			2				5		
Mounting	3	4					5		
Electrical layout and wiring of the ET 200S		5					6		
Programming								8	5
Commissioning and diagnostics	4	6					7		
Functions	10		5						
Function diagrams									
General technical specifications	5	7					8		
Technical specifications	6, 11-13		6	2-5	2	2, 3			
Terminal modules	7, 11, 13	9							
Power modules	7, 10, 12	10							
Direct and soft starters	8								
Reversing starters	9								
ET 200S safety-integrated system	10								
Interface modules		8							
Electronic modules		11-15							
Positioning modules					3-6				
Expansion modules	12								
Fail-safe modules	13						9		
Monitoring, cycle, and response times			7				12	9	
Order numbers	B	A					11		
Dimensioned drawings	C	B					10		
Applications	D								
Glossary	Gl	Gl	Gl				13	10	9

Brief commissioning instructions 2

2.1 Introduction and purpose of the example

Introduction

By means of the following example, you will learn how to commission the ET 200S with motor starters step by step.
The DS1-x direct starter; standard is controlled by an ON button and an OFF button connected to a 4DI DC24V ST module.
The STEP 7 software is used for configuration. The configuration and parameterization is carried out in hardware configuration using STEP 7.

Purpose of the example

This example shall

1. show you how to commission a simple DS1-x direct starter; standard with ET 200S in a few steps.
2. let you modify this example for your application.
3. help you easily realize other applications.

Essential steps

The essential steps with ET 200S are always as follows:

- Mounting of ET 200S components and the external wiring of control elements (buttons) and actuators (e.g. motors)
- Configuration with STEP 7
- Integration into the user program
- Activation of the ET 200S
- Evaluation of the diagnostics

Information on PROFINET commissioning can be found in the SIMATIC PROFINET system description manual. You can download the manual on the internet from the following address:
http://support.automation.siemens.com/WW/view/en/19292127

2.2 ET 200S components

Required components

The following table contains the components you need for this example:

Number	Order number	Description
1	According to design	Short circuit and overload protection for AC 400 V infeed
1	According to design	Power supply unit for DC 24 V
1	According to design	Button with normally open contact function for ON
1	According to design	Button with normally closed contact function for OFF
1	According to design	PLC with master for PROFIBUS-DP according to your selection
1	6ES7151-1AA01-0AB0	Interface modules IM151-1 STANDARD (with terminating module)
1	6ES7193-4CE00-0AA0	Terminal module for PM-E DC24V TM-P15S22-01
1	6ES7138-4CA00-0AA0	Power module for electronic modules PM-E DC24V
1	6ES7193-4CB20-0AA0	Terminal module for 4DI DC24V ST TM-E15S24-01
1	6ES7131-4BD00-0AA0	Digital electronic module with 4 inputs 4DI DC24V ST
1	3RK1903-0AA00	Terminal module for PM-D TM-P15 S27-01 (with terminating cover)
1	3RK1903-0BA00	Power module for motor starter PM-D
1	3RK1903-0AB00	Terminal module for DS1-x with infeed TM-DS45-S32 (with 3 caps)
1	3RK1903-2AA00	Terminal block with infeed PE/N (with 2 caps)
1	3RK1301-**xx**B00-0AA2 1)	Direct starter; standard DS1-x

1) **xx** = The current range should be selected according to your connected load.

Table 2-1: Components for the example

2.3 Requirements

The requirements for the example are as follows:

- You have set up an S7 station, consisting of a power supply module and a DP master (e.g. CPU 315-2 DP). For this example, a CPU 315-2 DP was used as the DP master. Every other DP master (standard: IEC 61784-1:2002 Ed1 CP 3/1) can naturally be used as well.
- STEP 7 (V5.2 or later) is fully installed on your PG. You know how to use STEP 7.
- The PG is connected to the DP master.

Note
Information regarding the operation of STEP 7 can be found in the online help.

2.4 Installation

Warning
Dangerous electrical voltage! This can lead to electrical shock and burns.
Before starting work, de-energize the plant and device.

The following diagram shows you in which order you should mount the ET 200S components to the mounting rails.

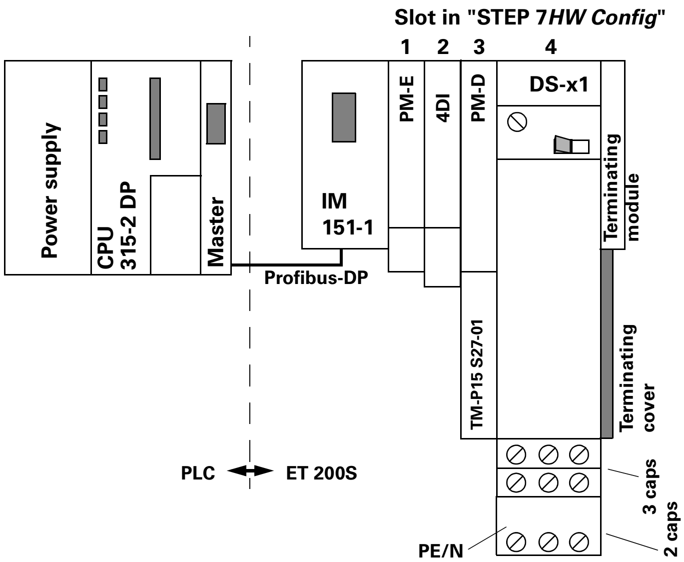


Figure 2-1: Components and setup for the example

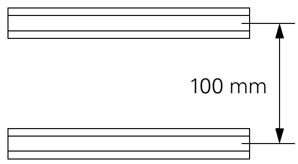
Installation sequence

A precise mounting description can be found for the following:

- Installing terminal modules in Section 3.5
- Inserting power modules in Section 3.6
- Installing and removing motor starters in Section 3.7

For mounting, proceed as follows:

1. Mount both profile rails (35 x 7.5 mm or 15 mm) with a length of at least 210 mm to a solid base with a center-to-center-to-center clearance of 100 mm.



2. Start mounting the individual modules from the left of the profile rail (suspend – pivot – push to the left).
   Observe the following sequence:
   - Interface module IM151-1 STANDARD
   - Terminal module TM-P15 S22-01
   - Terminal module TM-E15 S24-01
   - Terminal module TM-P15 S27-01
   - Plug together the PE/N terminal block and terminal module TM-DS45-S32
   - Mount terminal module TM-DS45-S32 to the mounting rail
3. On the right hand side of the TM-DS45-S32, position the following parts:
   - The termination module (included with IM151-1)
   - The end cover (included with TM-P15 S27-01)
   - The 3 caps for L1 through L3 (included with TM-DS45-S32)
   - The 2 caps for PE and N (included with PE/N terminal block)
   (see Figure 2-1)
4. Set PROFIBUS address 3 on the interface module IM151-1 STANDARD.

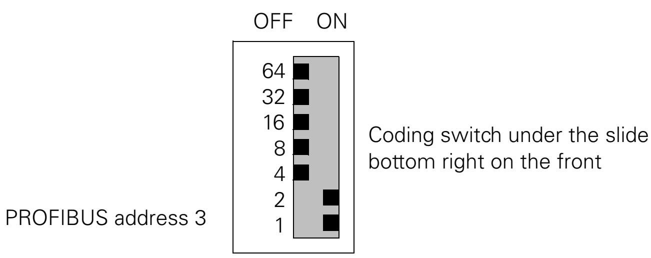


Figure 2-2: Set PROFIBUS address 3

2.4.1 Circuitry for the example setup

The following diagram shows the circuitry of the main circuit and the control circuit for the example.

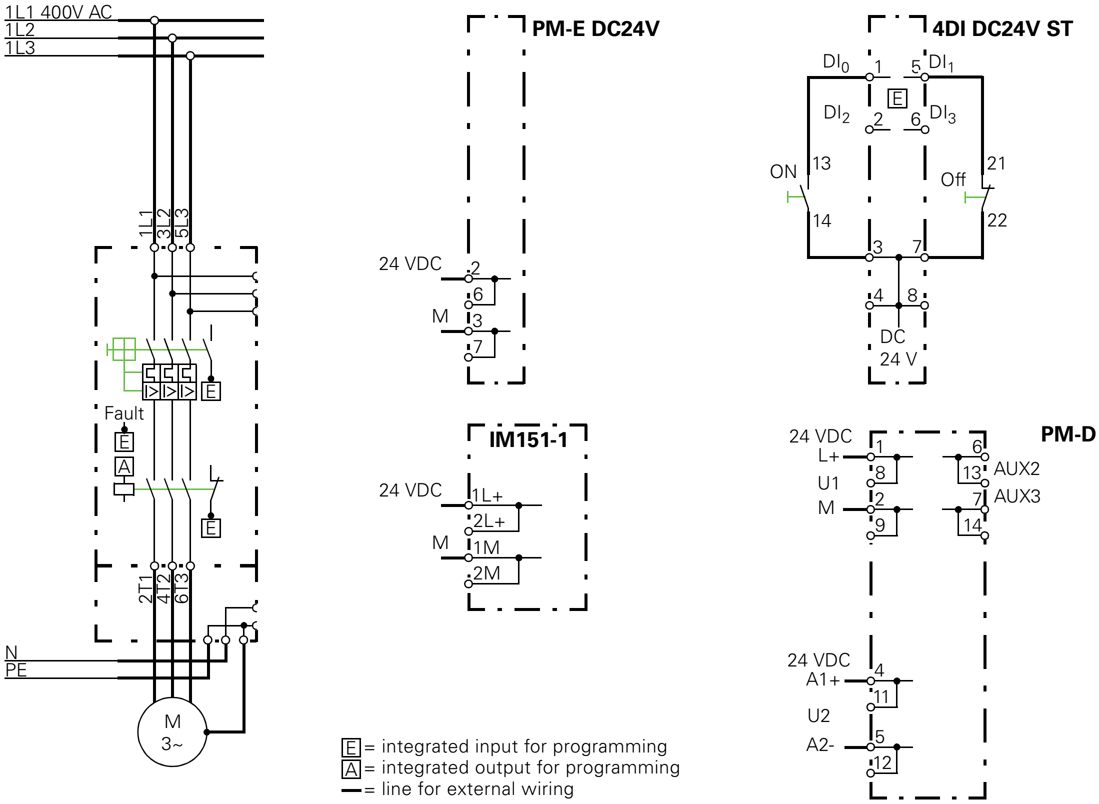


Figure 2-3: Circuitry for the example

2.5 Wiring and fitting

Perform the following steps:

1.

Caution
Provide sufficient short circuit and overload protection for the entire setup.

---

2. Wire the ET 200S as shown in Figure 2-3. The bolded external lines must still be wired. These are:
   - 400 VAC at L1 - L3 on the terminal module of the motor starter
   - PE and N on terminal block PE/N
   - Consumer (motor) at T1 - T3 and PE
   - 24 VDC at IM151-1
   - 24 VDC at terminal module for PM-E
   - 24 VDC at terminal module for PM-D
   - Both buttons for ON (normally open contact) and OFF (normally closed contact)
3. Using the PROFIBUS bus connecting plug, connect the DP master with the ET 200S. The PROFIBUS DP interface is located on the IM151-1 STANDARD.
4. Plug the power and electronic modules and the motor starters into the terminal modules.
5. Switch on the voltage supply for the DP master.
6. Observe the status LEDs on the DP master.
   CPU 315-2 DP:
   - 5 VDC green
   - SF DP off
   - BF flashes red

Note on power supply of motor starters; high feature with order number suffix -.AB4
High feature motor starters with order number suffix -.AB4 that are not integrated via
GSD/GSDML into the ET200S substation use extended start-up data records:
To ensure that the high feature motor starters are automatically assigned the extended start-up data records on the re-start of the ET200S substation, the electronics power supply (U_1 of the PM-D module) of the high feature motor starter must be supplied from the same voltage source as the interface module (header module).

2.6 Configuring

1. Start the SIMATIC Manager and create a new project with a DP master (e.g. CPU315-2 DP) (see Figure 2-4).
2. Generate the PROFIBUS subnet.
3. Add the ET 200S to PROFIBUS from the hardware catalogue.
4. Set PROFIBUS address 3 for ET 200S.
5. Drag the individual ET 200S modules from the hardware catalog into the configuration table (see Figure 2-4).

Module/ DP code	Order number	Input address	Output address	Comment
1	6ES7138-4CA00-0AA0			Power module PM-E DC24V
2	6ES7131-4BD00-0AA0	0.0 - 0.3		Input module 4DI DC24V ST
3	3RK1903-0BA00			Power module PM-D [1])
4	3RK1301-**xx**B00-0AA2 [2])	1.0 - 1.3	0.0 - 0.3	Motor starter DS1-x

[1]) Can be found in the module selection under "*Motor starters.*"
[2]) **xx** = The current range should be selected according to your connected load.

Table 2-2: Configuration table in STEP 7 "*hardware configuration*"

Note
Brake modules xB1, xB2 and xB5 are not configured in the hardware configuration of STEP 7.

You should then see the following screen.

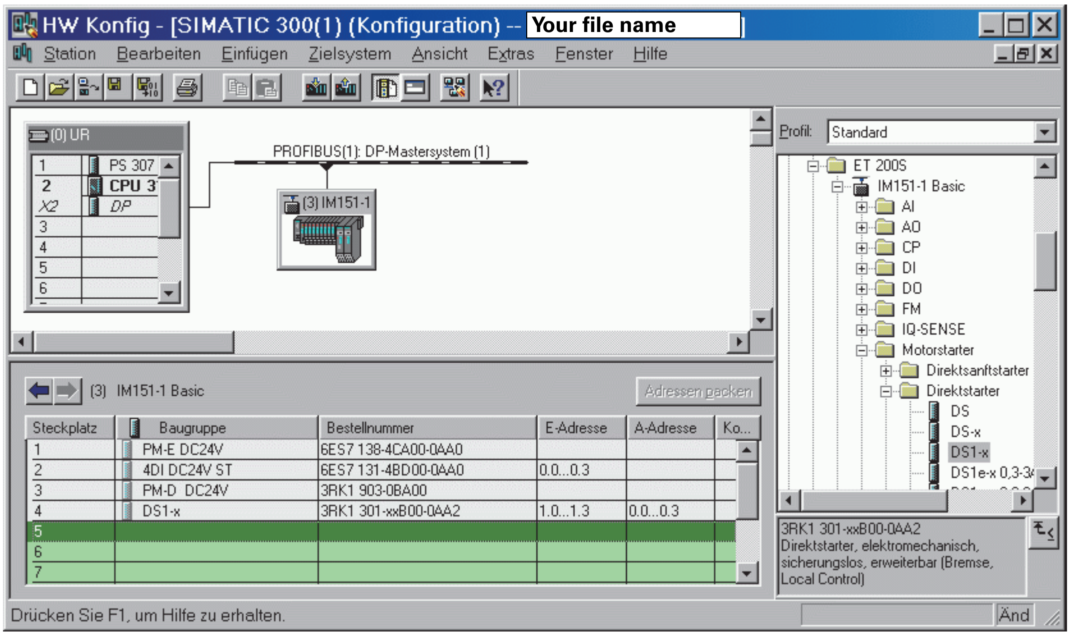


Figure 2-4: Modules in STEP 7 "*hardware configuration*"

Parameter setting

6. To obtain diagnoses of the modules, set the following parameters for the individual modules:

   -In the Properties of DP Slave for ET 200S dialog box
     Start at setpoint <> actual setup: Enable
     Module change during operation: Enable
   - In the Properties of DP Slave for PM-E DC24V dialogue box:
     Module/DP code 1 (in the configuration table)
     Diagnosis: Missing load voltage
   - In the Properties of DP Slave for PM-D dialogue box:
     Module/DP code 3 (in the configuration table)
     Diagnosis: Enable collective diagnosis
   - In the Properties of DP Slave for DS1-x dialogue box:
     Module/DP Code 4 (in the configuration table)
     Diagnosis: Enable collective diagnosis
7. Save the configuration.

2.6.1 Design of 24 VDC power pack for F-DS1e-x, FRS1e-x failsafe motor starter

When configuring the 24 VDC power pack for the voltage U1, ensure that the power pack has a current of 1.5A * number of starters when the test function of several motor starters is activated.
See technical specifications page 8-23

2.7 Integration into the user program

1. Create the user program using the KOP/AWL/FUP editor in OB1.

```
AWL
U  E 0.0         And input 0.0 (ON button)
S  A 0.0         Set output 0.0
UN E 0.1         And not input 0.1 (OFF button)
R  A 0.0         Reset output 0.0
```

2. Save the project in the SIMATIC Manager.
3. Load the configuration in the DP master.

2.8 Activation

1. Switch on the following voltage supplies on ET 200S.
   - IM151-1 STANDARD
   - PM-E DC24V
   - PM-D with U1 and U2
   - Do **not** yet switch on supply voltage 400 VAC!
2. Observe the status LEDs on the DP master and ET 200S
   - CPU 315-2 DP:
     5 VDC: Lights up
     SF DP: off
     BF: Off
3. Observe the status LEDs on IM151-1 STANDARD.
   - SF off
   - BF off
   - ON green
4. Observe the status LEDs on PM-E DC24V
   - SF off
   - PWR green
5. Observe the status LEDs on 4DI DC24V ST
   - DI_0 off
   - DI_1 green
   - DI_2 off
   - DI_3 green
6. Observe the status LEDs on PM-D
   - SF off
   - PWR green
   - CON green
7. Observe the status LEDs on motor starter DS1-x
   - SF off
   - C-STAT off

Check the wiring

Check the correct wiring of the ON and OFF buttons.

8. Press the ON button
   Watch the LEDs
   - 4DI DC24V ST, DI0 green
   - Motor starter DS1-x, C-STAT yellow
9. Press the OFF button
   Watch the LEDs
   - 4DI DC24V ST, DI1 off
   - Motor starter DS1-x, C-STAT off
10. Switch on the supply voltage AC 400 V for the motor starter.

Danger
Make sure that no dangerous live parts can be touched.

11. Repeat steps 8 and 9 whilst observing the behavior of the connected consumer.

Warning
Make sure that the actuators connected to the motor starters do not present a danger (e.g. uncontrolled rotary movements of the motor).

2.9 Diagnostic options

There are several options for accessing the diagnostics of the ET 200S modules:

- via the DP diagnostics modules for SIMATIC S7 "FB125" or "FC125".
  You can download both modules and a description in PDF format from the following web address:
  http://support.automation.siemens.com/WW/view/en/26996747
- via STEP 7 "*Hardware configuration*" S7 (or STEP 7+ in "*Devices and power systems*").
  See following Section 2.9.1
- using the convenient parameterization and diagnostics software "*Motor Starter ES*".
  Using this software, which is integrated into S7, it is very easy and convenient to parameterize, operate and observe (diagnosis) the ET 200S High Feature motor starter.
  Information about functionality and license types can be found online at the following address:
  DE: **http://www.siemens.de/sirius/software**
  EN: **http://www.siemens.com/sirius/software**

2.9.1 Diagnosis via "Hardware configuration (*HW Config)*" from STEP 7

1. Open the "STEP 7 "*Hardware configuration*"" window in the SIMATIC Manager on your computer or programming device.
2. Open the "Online" station.
3. Simulate the various errors and observe the messages in the "*DP Slave diagnosis*" status window such as:
   - Pull out and plug in the motor starter in the ON state and the OFF state
   -Switch off the U1 and/or U2 voltages at the PM-D
   - Trip the circuit breaker

In the following image, for example, a motor starter has been removed from Slot 7.

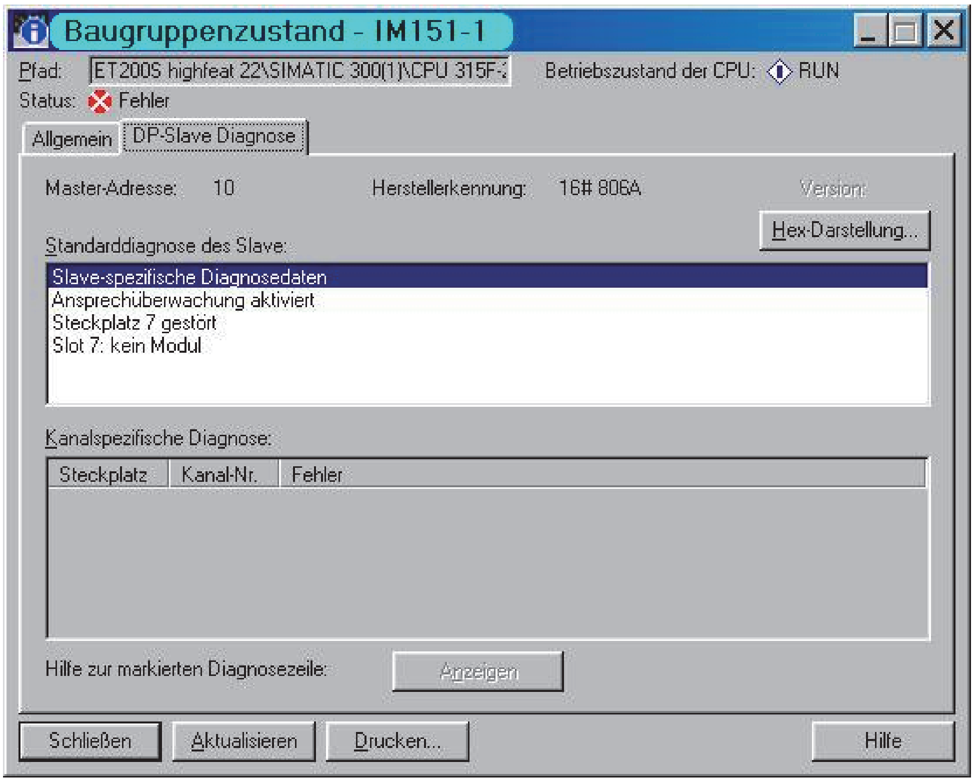


Figure 2-5: View of the "*DP Slave Diagnosis*" status window

4. After every performed action, press the F5 on the computer/programming device to update the status window. The IM151-1 module is marked by a red dot with a white cross in case of an error message.
5. Double-click the missing station to display the module state of IM151-1 ("*General*" tab). For precise error diagnosis, select "*DP Slave Diagnosis.*" The individual diagnoses of the malfunctioning slave are shown in text form.

2.10 Help

If you have problems or questions, please contact:

Technical Assistance:	Telephone:	+49 (911) 895-5900 (8:00 am - 5:00 pm CET)	SIEMENS AG
	Fax:	+49 (911) 895-5907	Technical Assistance
	Email:	technical-assistance@siemens.com	Breslauer Str. 5
	Website:	www.siemens.com/sirius/technical-assistance	D-90766 Fürth

Installation

3

3.1 Slot rules

Compliance with the following slot rules is essential in order to ensure correct and reliable operation of an ET 200S system.

Rule	Module		
The slot immediately to the right of an IM 151 module is always occupied by a...	• PM-E • PM-D • PM-D F1 to 4 [1]		• PM-E F PROFIsafe • PM-D F X1 • PM-D F PROFIsafe
The slot immediately to the left of a PM-X module is always occupied by a...	• Motor starter	DS1-x DS1e-x RS...	• PM-D • PM-D F1 to 5 • xB1 to xB6
The slot immediately to the left of an xB1 to xB6 module is always occupied by a ...	• DS-x1 • DS1e-x • DSS1e-x [3]) • F-DS1e-x [4])		• RS-x1 • RS1e-x • F-RS1e-x [4])
Between a PM-D F1 to F5 and a PM-X module there must **never be a**...	• DSS1e-x • F-DS1e-x • F-RS1e-x		
The slot immediately to the left of a PM-D F5 module is always occupied by a...	• Motor starter	DS... RS...	• PM-D F1 to 5 • xB1 to xB6
The slot immediately to the right of a PM-D F X1 module is always occupied by a...	• F-CM • F-DS1e-x • F-RS1e-x		• PM-D F X1
The slot immediately to the left of an F-CM module is always occupied by a...	• PM-D F X1 • PM-D F PROFIsafe • F-DS1e-x • F-RS1e-x		• xB1 to xB6 • F-CM

1) Precondition for PM-D F3, 4 is that another row of the same EMERGENCY STOP group must include a PM-D F1, 2 basic unit
2) The inputs of xB3, xB4 have no function
3) See Section 12.3
4) Depending on the performance level for xB3, xB4 and xB6, see Section 8.3, 9.3

Table 3-1: Slot rules

3.2 Installation rules

Easy installation

The ET 200S distributed I/O device is designed for easy installation.
To install an ET 200S with power modules, first snap on the terminal modules and then insert the power modules and motor starters into them.

Installation rules for the configuration of an ET 200S with motor starters

To install an ET 200S, comply with the following installation rules (also see the figures in Section 1.2, ET 200S configuration options):

- The components are arranged in a single line in groups.
- Each line begins on the left with an IM 151 interface module.
- A power module comes after the interface module or at the beginning of each potential group.
- Groups with motor starters require special power modules with connections for contactor supply voltage.
- The ET 200S distributed I/O device ends with the termination module, motor starters additionally with an end cover and with cover caps for the power bus.

Station width, number of modules and usable motor starters of an ET 200S rail

The station width, the number of connectable modules, and usable motor starters of an ET 200S rail depend on the IM 151 interface module used.

Information regarding the IM 151 interface module can be found in the "ET 200S Distributed I/O Device" manual.

Removing the cover cap in the case of a backplane bus connector

Remove the cover cap at the rear of the motor starter before you plug the motor starter onto the terminal module!

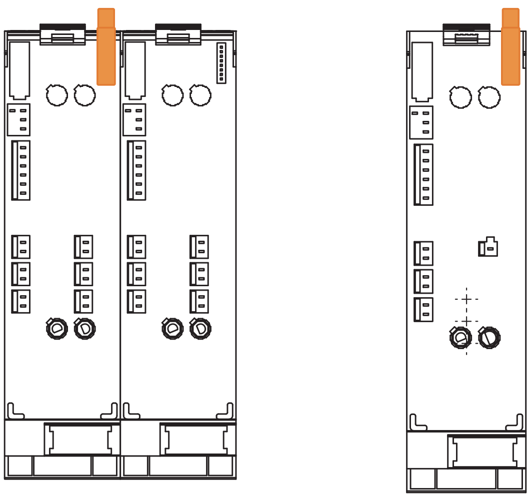


Bild 3-1: Cover cap in the case of a backplane bus connector

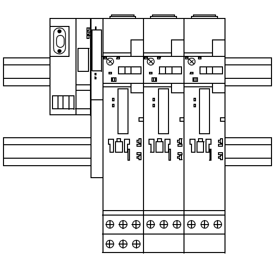
Installation position and station width

Both perpendicular and parallel installation positions on a perpendicular mounting surface of a mounting rail are permissible.

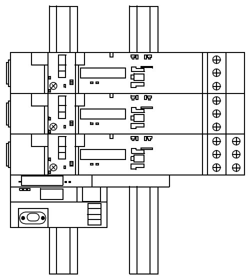
Here, the following rules apply for motor starters:

<table>
<tr><th>Motor starters</th><th>Horizontal profile rails</th><th>Vertical profile rails</th></tr>
<tr><td>standard
DS1-x,
RS1-x</td><td rowspan="3">max. 2 m</td><td>max. 1 m</td></tr>
<tr><td>high feature
DS1e-x, RS1e-x</td><td rowspan="2">max. 2 m</td></tr>
<tr><td>fail-safe
F-DS1e-x, F-RS1e-x</td></tr>
</table>

Table 3-2: Installation position and station width



Perpendicular installation on horizontal rails



Parallel installation on vertical rails

Figure 3-2: Installation on rails

Rail

The ET 200S distributed I/O device is installed on profile rails complying with EN 50022 (35 x 7.5 mm or 35 x 15 mm). To install an ET 200S with motor starters you need two profile rails installed with center-to-center clearance of 100 mm.

Important
We recommend screwing the rails to the fixing surface at intervals of 200 mm.

Please note:

During configuration, please observe the following points:

- A suitable IM 151 interface module depending on the used motor starters for the intended station width.
- Sufficient parameter capacity.
- Sufficient heat dissipation in the switch cabinet.
- Any required derating for the motor starter (see Section 3.4).

3.3 Installation measurements and clearances

Measure-ments	Module	mm
Installation width	Terminal module for • PM-D power module • DM-V15 spacing module • PM-X connection module (safety-integrated system) • PM-D power module F1 to F5 (safety-integrated system) • PM-D F PROFIsafe power module • PM-D F X1 power module • DS1-x direct starter; standard • DS1e-x direct starter; high feature • DSS1e-x direct soft starter; high feature • Fail-safe F-DS1e-x direct starter • RS1-x reversing starter; standard • RS1e-x reversing starter; high feature • Fail-safe F-RS1e-x reversing starter	 15 15 15 30 30 30 45 65 65 65 90 130 130
Installation height	Terminal module for direct and reversing starters; standard with installation width of 45 or 90 mm • With 3-pin power bus (L1, L2, L3) • With 5-pin power bus (incl. PE/N) Terminal module for direct and reversing starters; high feature or fail-safe, with installation width of 65 or 130 mm • With 3-pin power bus (L1, L2, L3) • With 5-pin power bus (incl. PE/N)	 264 306 290 332
Installation depth	ET 200S on rail with 7.5 mm depth: • ET 200S • ET 200S for motor starters; standard with 45 or 90 mm installation width • ET 200S for motor starters; standard with 45 or 90 mm installation width and safety-integrated system • ET 200S for motor starters; high feature or fail-safe with 65 or 130 mm installation width • ET 200S for motor starters; high feature or fail-safe with 65 or 130 mm installation width and 2DI COM/-2DI LC COM control module • ET 200S for motor starters; high feature or fail-safe with 65 or 130 mm installation width and 2DI COM/-2DI LC COM control module with LOGO! PC cable	 75 127 152 157 180 220
Minimum spacing for installation and wiring	• Above and below the terminal module • To the left of the IM 151 interface module • To the right of the ET 200S terminating module • Under the installed shield bus	35 20 20 15

Table 3-3: Installation measurements and clearances

3.4 Derating

3.4.1 What is derating?

Derating refers to the use of devices in difficult operating conditions by selectively limiting their performance. In the case of motor starters, this generally involves operating at high ambient temperatures.

3.4.2 Derating factors

The following applies exclusively to the following motor starters, which are installed side by side in a row.

- Standard motor starter:
  - DS1-x
- High Feature motor starters:
  - DS1e-x 2.4 - 16
  - RS1e-x 2.4 - 16A
  - DSS1e-x 2.4 - 16A
- Fail-safe motor starters:
  - F-DS1e-x
  - F-RS1e-x

In the case of the ET 200S motor starters, the following factors must be taken into account in difficult environmental conditions:

- Ambient temperature T_u:
  The ambient temperature T_u is the temperature surrounding the housing of the motor starter.
  The lower the max. ambient temperature T_u, the higher the current load within the motor starter can be.
- Absolute current load:
  The lower the current through a motor starter, the lower the heat loss in the device. If the device does not generate much heat, the ambient temperature T_u can be higher.

Motors with a high efficiency and high motor starting currents

High starting currents may have to be taken into consideration when using motor starters on high-efficiency motors. Motor starters are designed for motors with a maximum 8-fold starting current in accordance with IEC 60947-4-2. If motors are operated that have a higher starting current, refer to the following table for the maximum adjustable motor current:

Motor starter version I_e [A] at 40°C max. motor starting current	≤ 8-fold I_e	9-fold I_e	10-fold I_e
3RK1301-0AB*	3 A	2,9 A	2,6 A
3RK1301-0BB*	8 A	6,8 A	6 A
3RK1301-0CB*	16 A	13 A	12 A

ET 200S High Feature motor starters

Motor starter version I_e [A] at 40°C max. motor starting current	≤ 8-fach I_e	9-fach I_e	10-fach I_e
3RK1301-0BB00*	0,2 A	0,18 A	0,16 A
3RK1301-0CB00*	0,25 A	0,22 A	0,2 A
3RK1301-0DB00*	0,32 A	0,29 A	0,26 A
3RK1301-0EB00*	0,4 A	0,35 A	0,3 A
3RK1301-0FB00*	0,5 A	0,41 A	0,32 A
3RK1301-0GB00*	0,63 A	0,49 A	0,4 A
3RK1301-0HB00*	0,8 A	0,65 A	0,5 A
3RK1301-0JB00*	1 A	0,85 A	0,7 A
3RK1301-0KB00*	1,25 A	1 A	0,8 A
3RK1301-1AB00*	1,6 A	1,3 A	1 A
3RK1301-1BB00*	2 A	1,65 A	1,3 A
3RK1301-1CB00*	2,5 A	2,1 A	1,7 A
3RK1301-1DB00*	3,2 A	2,65 A	2,1 A
3RK1301-1EB00*	4 A	3,25 A	2,5 A
3RK1301-1FB00*	5 A	4,1 A	3,2 A

ET 200S standard motor starters

Motor starter version I_e [A] at 40°C max. motor starting current	≤ 8-fach I_e	9-fach I_e	10-fach I_e
3RK1301-1GB00*	6,3 A	5,15 A	4 A
3RK1301-1HB00*	8 A	6,6 A	5,3 A
3RK1301-1JB00*	10 A	8,5 A	7 A
3RK1301-1KB00*	12 A	10 A	8 A

ET 200S standard motor starters

Site altitude

If site altitude is above 1000 m, the following are necessary:

- A reduction in the rated current for thermal reasons
- A reduction in rated voltage on account of the diminished dielectric strength

The diagram below plots the reduction in rated device current and rated operating voltage as a function of site altitude:

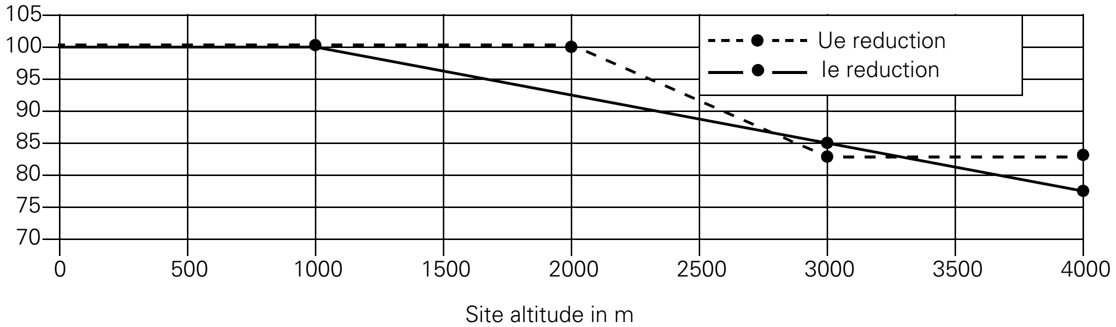


Figure 3-3: Reductions as a function of site altitude

3.4.3 DM-V15 spacing module

If operating conditions are difficult and render derating necessary, a DM-V15 spacing module is inserted between the corresponding motor starters.

The DM-V15 spacing module is suitable for all motor starter series. It is entirely passive and requires no configuration. The bus and all the other connections are looped through for the following modules.

The elements of the spacing module are illustrated below.

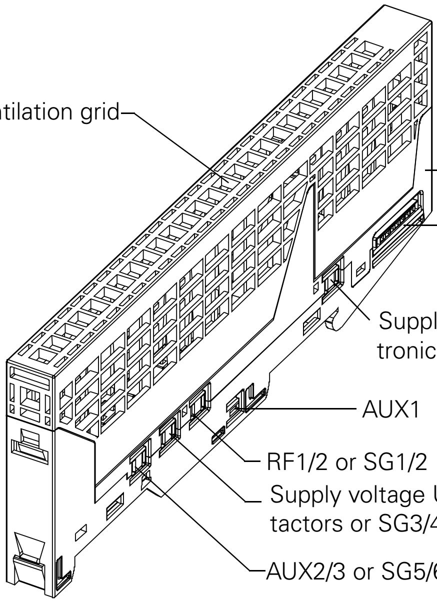


Figure 3-4: DM-V15 spacing module

Note
No specific measurements are required for the following motor starters:

- RS1-x reversing starter; standard
- DS1e-x direct starter; high feature, order number suffix -.AA2, -.AA4
- DS1e-x direct starter; high feature, 0.3 - 3A, 2.4 - 8A, order number suffix -.AB4
- DSS1e-x direct soft starter; high feature, order number suffix -.AA2, -.AA4
- DSS1e-x direct soft starter; high feature, 0.3 - 3A, 2.4 - 8A
  order number suffix -.A**B**4
- RS1e-x reversing starter; high feature, order number suffix -.AA2, -.AA4

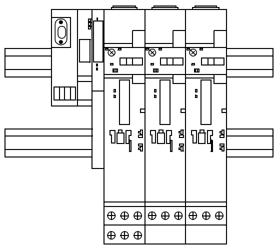
RS1e-x reversing starter; high feature, 0.3 - 3A, 2.4 - 8A
order number suffix -.A**B**4

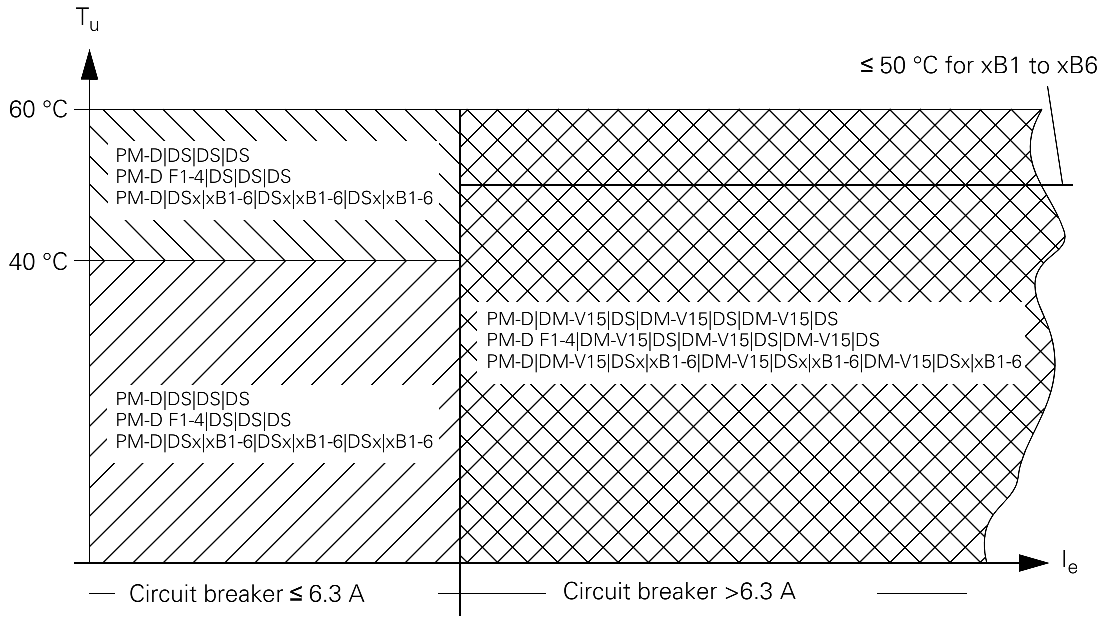
3.4.4 Criteria for configurations with/without DM-V15 spacing module

The graphics below show under which criteria and designs distance modules are recommended.

Criteria for DS1-x

Vertical installation on horizontal rails





= without DM-V15, motor current 90 % of I_e or with DM-V15, motor current 100% of I_e

= without DM-V15

= with DM-V15

I_e = max. current setting of circuit breaker

Figure 3-5: Criteria for vertical installation on horizontal mounting rails with DS1-x

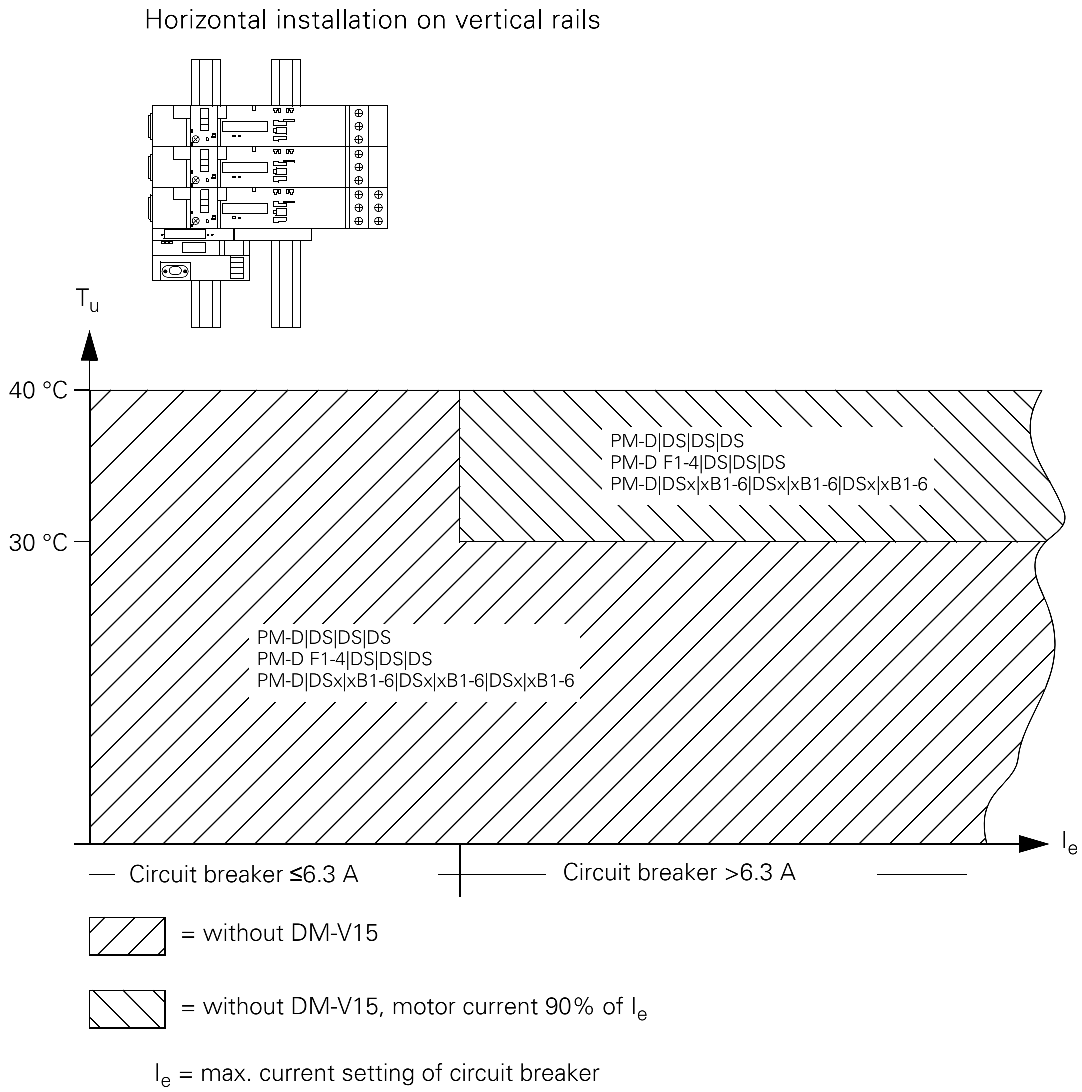
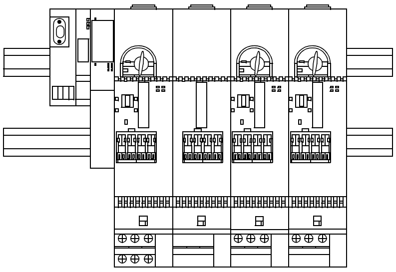
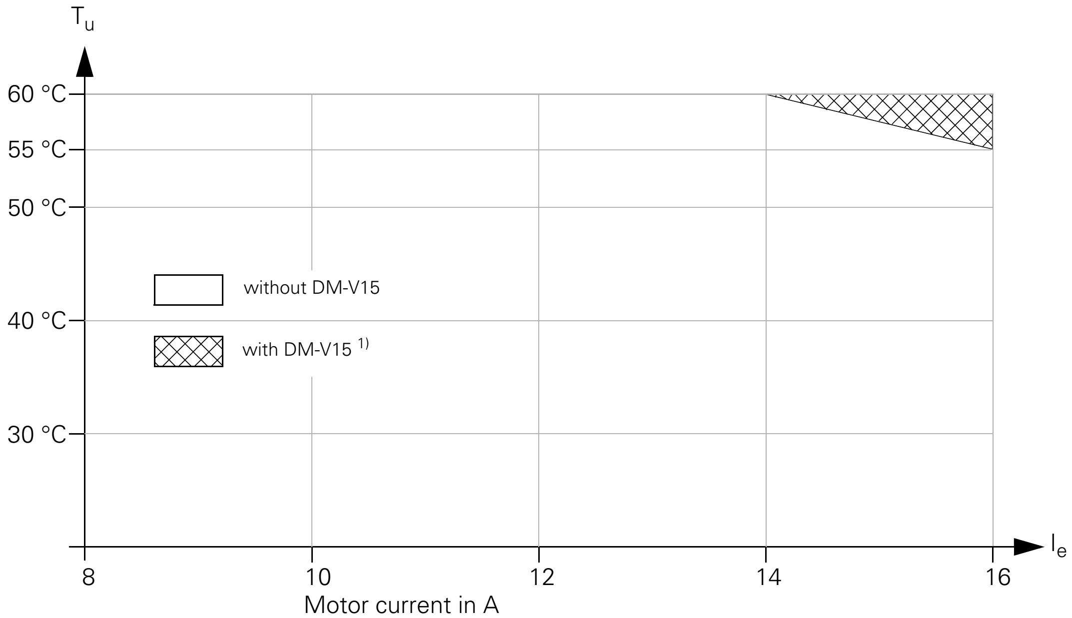


Figure 3-6: Criteria for horizontal installation on vertical mounting rails with DS1-x

Criteria for DS1e-x, RS1e-x, DSS1e-x with order number suffix -.AB4

Vertical installation on horizontal rails





T_u = ambient temperature

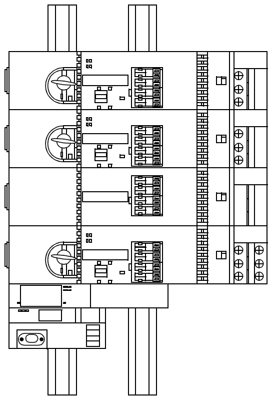
I_e = max. current setting of circuit breaker

1) With DM-V15:

- for DS1e-x and DSS1e-x (with or without brake control module) a DM-V15 is required on both sides.
  For an RS1e-x (with or without brake control module) a DM-V15 should be provided on the right.
  The left half of an RS1e-x is equivalent to a DM-V15 for derating.

Figure 3-7: Criteria for vertical installation on horizontal rails with DS1e-x, RS1e-x and DSS1e-x 2.4 - 16A with order number suffix -.A**B**4

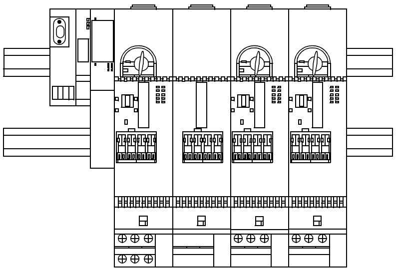
Horizontal installation on vertical rails

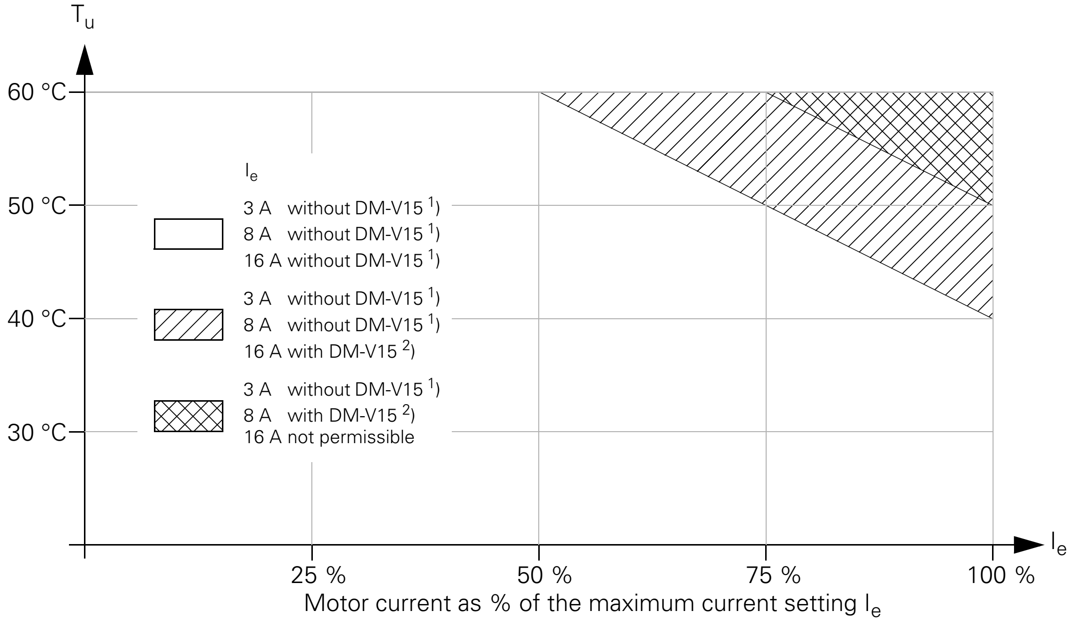


Horizontal installation is permissible for an ambient temperature up to T_u = 40°C.
Derating and therefore a DM-V15 is not required for high feature motor starters installed horizontally up to a temperature of T_u = 40 °C.

Criteria for F-DS1e-x, F-RS1e-x

Vertical installation on horizontal rails





T_u = ambient temperature

I_e = max. current setting of circuit breaker

1) without DM-V15:
A DM-V15 is not necessary between the motor starters

2) With DM-V15:
- A DM-V15 must be placed on the left and right in the case of a F-DS1e-x (with or without brake control module).
- A DM-V15 must be placed on the right in the case of a F-RS1e-x (with or without brake control module). The left half of an F-RS1e-x counts as a DM-V15 for the purpose of derating.

Figure 3-8: Criteria for vertical installation on horizontal rails with F-DS1e-x, F-RS1e-x

Caution

Above an ambient temperature of $T_u \geq 50$ °C, a DM-V15 must be inserted between a PM-D F PROFIsafe and an F-DS1e-x.

Example:

The following sample configuration shows you when a DM-V15 spacing module is recommended.

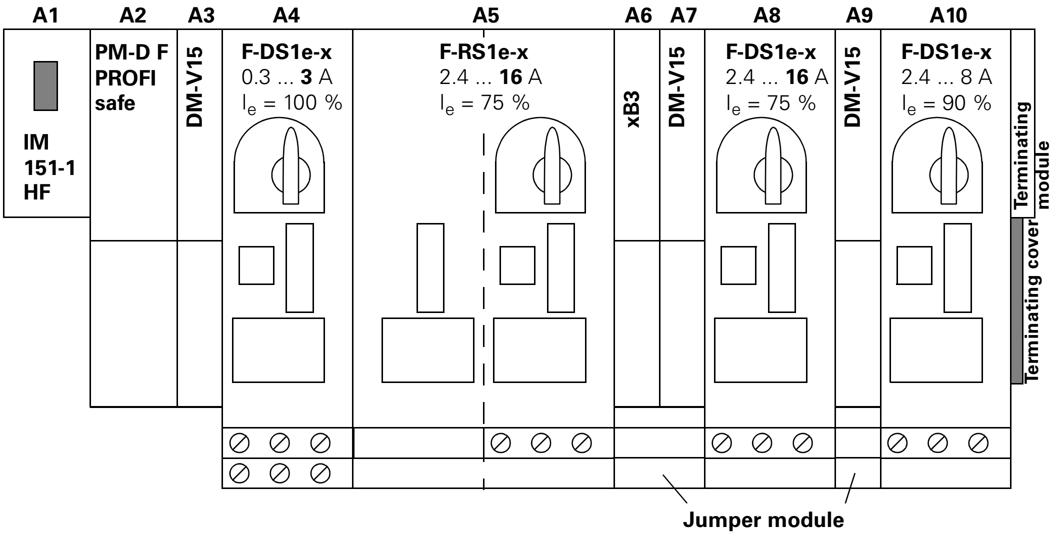


Figure 3-9: Configuration example for derating

The following criteria were taken into consideration in this example:

- The ambient temperature T_u is 55°C.
- A3 is necessary because T_u > 50 °C and A4 is an F-DS1e-x on the right of a PM-D F PROFIsafe.
- A4 is loaded with 3 A (100%) and therefore a DM-V15 is not necessary.
- A5 is loaded with 12 A (75%) and therefore a DM-V15 (A7) is required next to the brake control module.
- A8 is loaded with 12 A (75%) and therefore a DM-V15 is required on the right (A9) and left (A7).
- A10 is loaded with 7.2 A (90%) and therefore a DM-V15 is required on the left (A9). The DM-V15 to the right of A10 is not necessary because the ET 200S station is finished at this point.

The following diagram shows you how to determine when a DM-V15 is necessary.

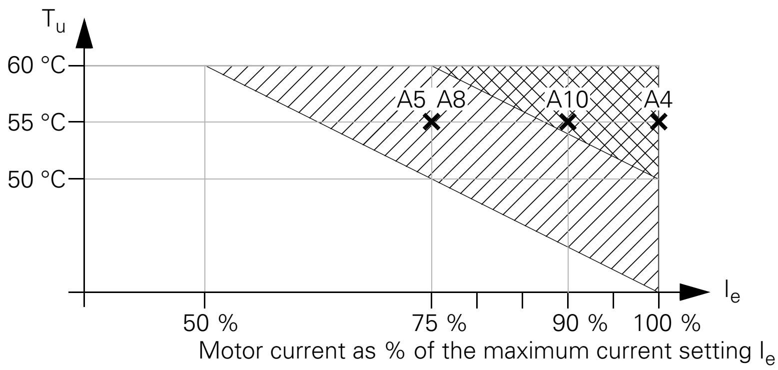
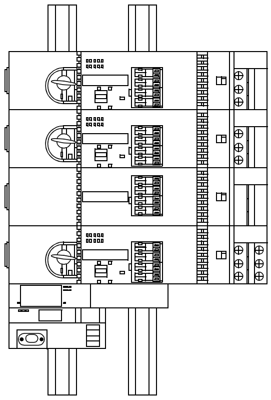


Figure 3-10: Determining the derating for a configuration example

Horizontal installation on vertical rails



Horizontal installation is permissible for an ambient temperature up to T_u = 40°C.

Derating and therefore a DM-V15 is not required for fail-safe motor starters installed horizontally up to a temperature of T_u = 40°C.

Other configurations

The configurations shown above can also be combined, in which case the derating factors specified above change. In these circumstances, please contact your Siemens contact person or Technical Assistance.

Technical Assistance:

Telephone:	+49 (0) 911-895-5900 (8.00 am - 5.00 pm CET)	SIEMENS AG
Fax:	+49 (0) 911-895-5907	Technical Assistance
Email:	technical-assistance@siemens.com	Breslauer Str. 5
Website:	www.siemens.com/industrial-controls/technical-assistance	D-90766 Fürth

3.5 Installing terminal modules

Features

- Terminal modules replace the control wiring in the switch cabinet and are mechanical carriers for the function modules (e.g. the power modules and the motor starters).
- With the terminal modules, you can completely prewire the switch cabinet without the power modules and motor starters being fitted.

Requirements

- Two rails are installed (center-to-center spacing 100 mm).
- Space is left for the IM 151 interface module.

Mechanical coding of the modules

When the module is first inserted, the terminal module is mechanically coded to ensure that, in the event of a fault, it can only be replaced by a module with identical functions.
If a brand-new module is plugged into a terminal module that is already coded, the part of the code element for the terminal module must be removed from the module beforehand.

Note the configured structure when installing and identify the terminal modules using the labels (see Section 3.2).

Installing terminal modules for motor starters

The example below illustrates the installation of terminal modules with an installation width of 45 mm for direct starter; standard.

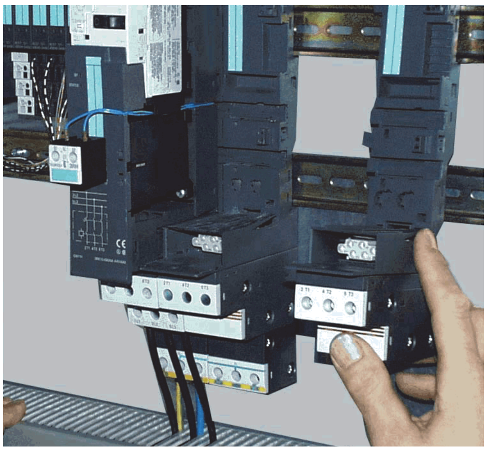
Drawing	Procedure
	**1** Hang the terminal module on the upper rail.

Table 3-4: Installing terminal modules - example: direct starter; standard

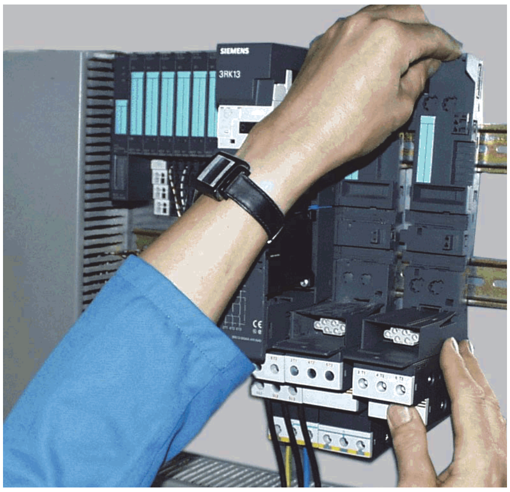
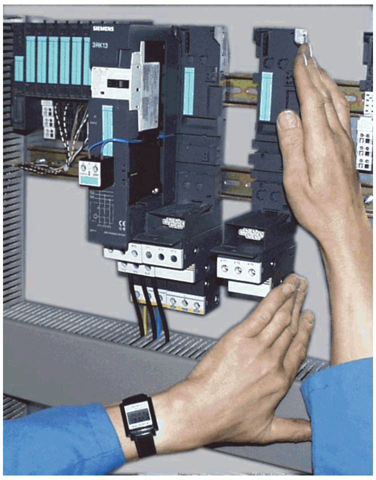
Drawing	Procedure
	**2** Tilt the terminal module backwards into the lower rail until you hear it engage.
	**3** Push the terminal to the left with both hands towards the module you have already installed, keeping it straight, until you can hear it engage with the adjacent module.

Table 3-4: Installing terminal modules - example: direct starter; standard (Contd.)

Removing terminal modules for motor starters

Warning
Switch off all the connected supply voltage!

You can only remove a terminal module if there are no modules connected on the right. If necessary, you must remove all the modules on the right or move them to the side.

The example below illustrates the removal of terminal modules with an installation width of 45 mm for direct starter; standard.

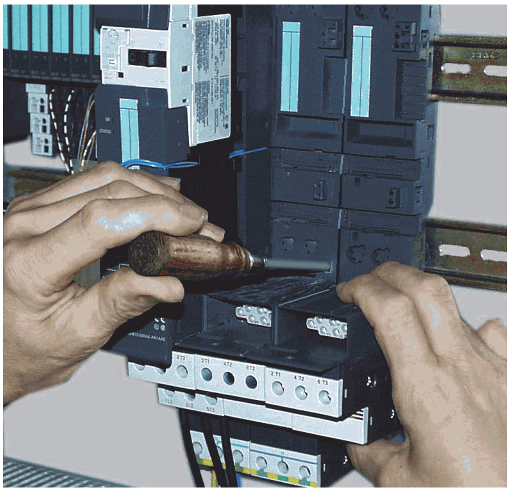
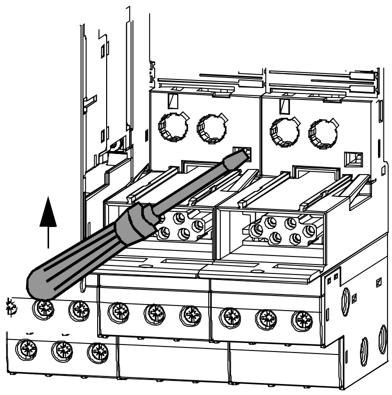
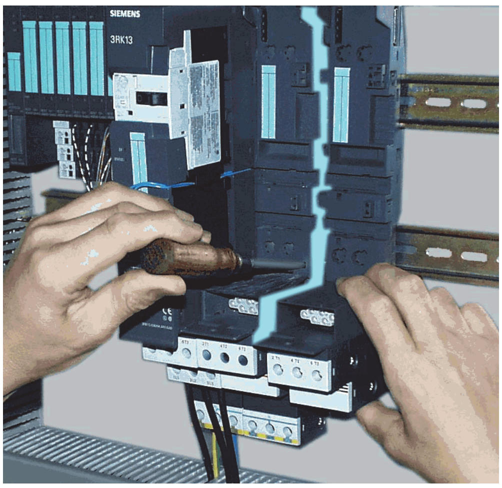
Drawing	Procedure
	**1** Use a screwdriver (5 mm) to push down the locking mechanism of the next module to the **left**. 
	**2** With the locking mechanism of the neighboring module open, pull the module to be removed to the right parallel to the rails.

Table 3-5: Removing terminal modules - example: direct starter; standard

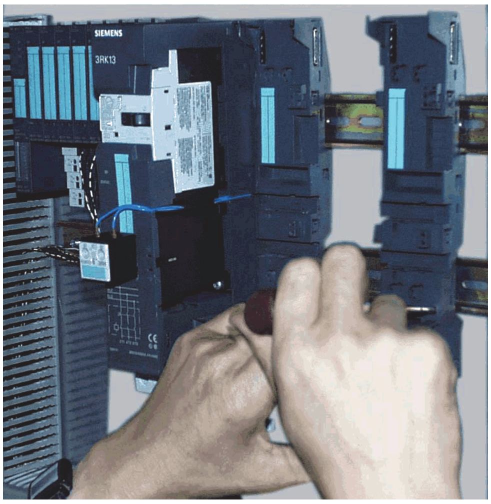
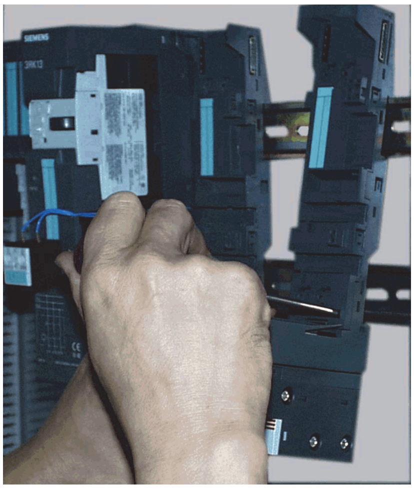
Drawing	Procedure
	**3** Unlock the module by inserting the screwdriver in the opening of the locking mechanism and pushing the locking mechanism downward. This unlocks both the upper and lower rail.
	**4** With the locking mechanism depressed, tilt the module so that it comes off the lower rail. You can then remove the module from the upper rail.

Table 3-5: Removing terminal modules - example: direct starter; standard (Contd.)

3.6 Inserting power modules

Requirements

Before inserting power modules, the following requirements must be met:

- Both rails must be installed.
- The terminal module for the power module must be installed.

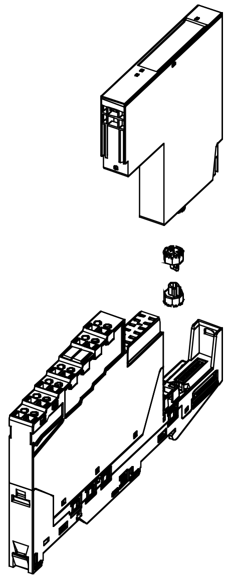
Mechanical coding

When the modules are inserted, the corresponding terminal module is mechanically coded (two coding elements) to ensure that, in the event of a fault, it can only be replaced by a module with identical functions.

You must therefore bear the configured layout in mind when you insert the modules.

The illustration on the right shows the coding of a PM-D power module by way of example.

Incorrectly inserted code elements can be removed from the terminal module using a 3 mm screwdriver.



Note
If a brand-new module is plugged into a terminal module that is already coded, the part of the code element for the terminal module must be removed from the module beforehand.

Figure 3-11: Mechanical coding of terminal modules

Inserting power modules

Insert the power module onto the installed and prewired terminal module as shown in the drawing. Power modules can only be connected to the correct terminal modules regardless of the code element.

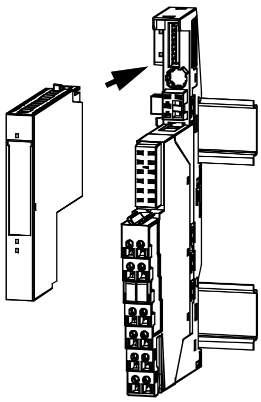


Figure 3-12: Inserting power modules

3.7 Installing and removing motor starters

Requirements

- Both rails must be installed.
- All the terminal modules for the power modules and motor starters must be installed.

Note

Before installation, check the socket and plug on the rear wall bus interface. It is not permissible to use any damaged sockets. The plugs must be straight and central in sequence.

Note

The rear wall bus must only be engaged after the power bus has been connected. Never engage both connections at the same time.

Mechanical coding

When the motor starters are installed, the terminal modules are mechanically coded to ensure that, in the event of a fault, they can only be replaced by modules with identical functions.
If a brand-new module is plugged into a terminal module that is already coded, the part of the code element for the terminal module must be removed from the module beforehand.

You must therefore bear the configured layout in mind when you insert the modules.

3.7.1 Standard motor starter with installation width of 45 or 90 mm

Installing standard motor starters

- The motor starters are inserted in the installed terminal modules, whereby two "latched positions" must be observed. Depending on the position, electrical connections are established or disconnected at removal. The locking spring prevents you removing the motor starters under load.
- The following table describes how the motor starters should be installed, using the example of a direct starter; standard.

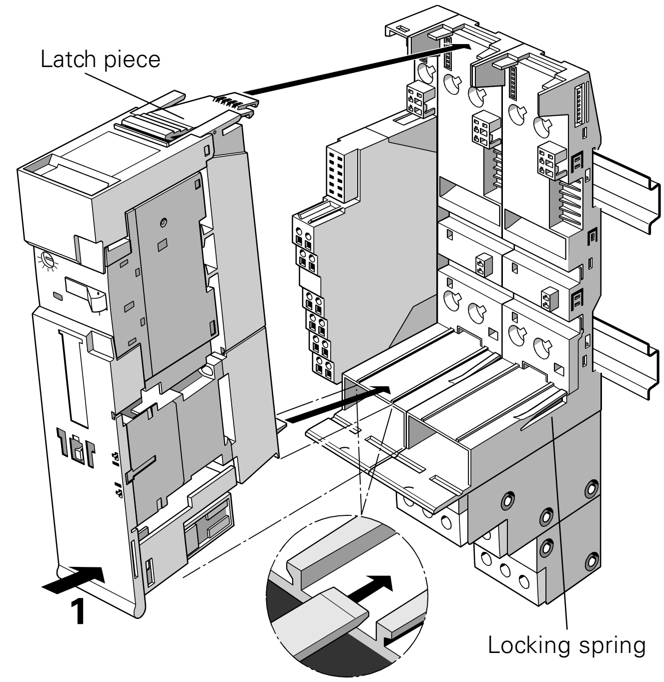
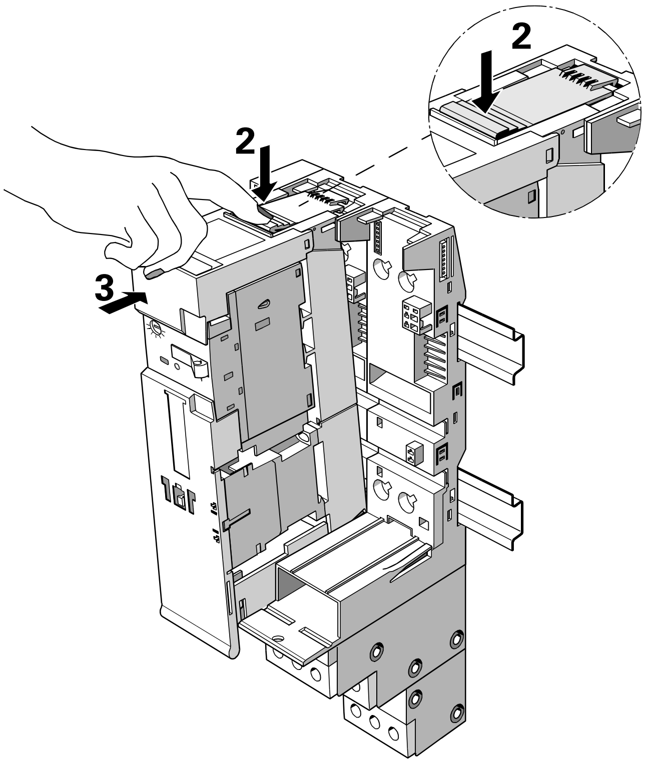
Drawing	Procedure/Description
 	**1** Slide the motor starter; standard at a slight incline (see figure) from the front into the terminal module. Avoid a lateral slope. Push firmly on the lower part until contact is established with the power bus. • The motor starter; standard remains slightly inclined, and the latch piece is not engaged. • The locking spring is not yet engaged. The motor starter; standard is mechanically insecure in this position and connected only to the power bus.

Table 3-6: Motor starter; standard with installation width of 45 or 90 mm: installation

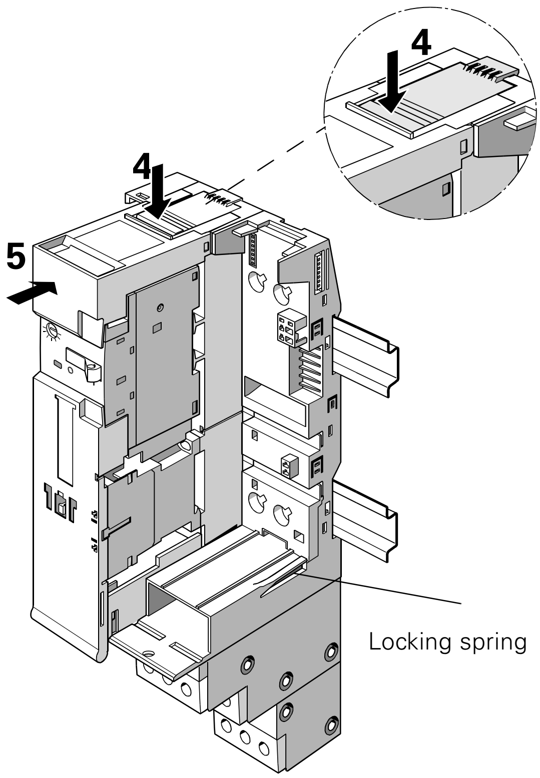
<table>
<tr><th>Drawing</th><th>Procedure/Description</th></tr>
<tr><td>
</td><td>

2
3 Press the latch piece and move the motor starter further towards the rail until the latch piece engages.

The motor starter; standard is now located in the **parked position**.

Parked position

- The connection to the backplane bus is not yet established.
- There is no supply to the electronic components.
- The connection to the power bus is established. The contactors cannot respond, however, because there is no connection to the backplane bus and the electronic components and switching commands thus remain ineffective.

</td></tr>
<tr><td>
</td><td>

4
5 Press the latch piece again and move the motor starter further towards the DIN rail until the latch piece engages again.

The motor starter; standard is now located in the **operating position**.

Operating position

- The connection to the backplane bus is established. The electronic components and contactors are supplied with power.
- The locking spring is engaged.

The locking spring prevents the motor starter from being removed when live.

</td></tr>
</table>

Table 3-6: Motor starter; standard with installation width of 45 or 90 mm: installation (Contd.)

Removing the standard motor starter

A motor starter can be removed from the terminal module during operation. The feeder must be dead, e.g. circuit breaker switched off. Before you can remove the module, the latch piece must be taken beyond both latched positions, thus interrupting the electrical connections. The locking spring prevents you removing the load feeders under load.

Important
If you remove more than one module from the ET 200S, the substation switches to STOP mode.

Danger
In version 1 of the IM 151, **no** modules can be removed during operation. Module replacement is only permitted when the supply of the IM 151 is switched off.

The following table describes how the motor starters should be removed, using the example of a reversing starter; standard.

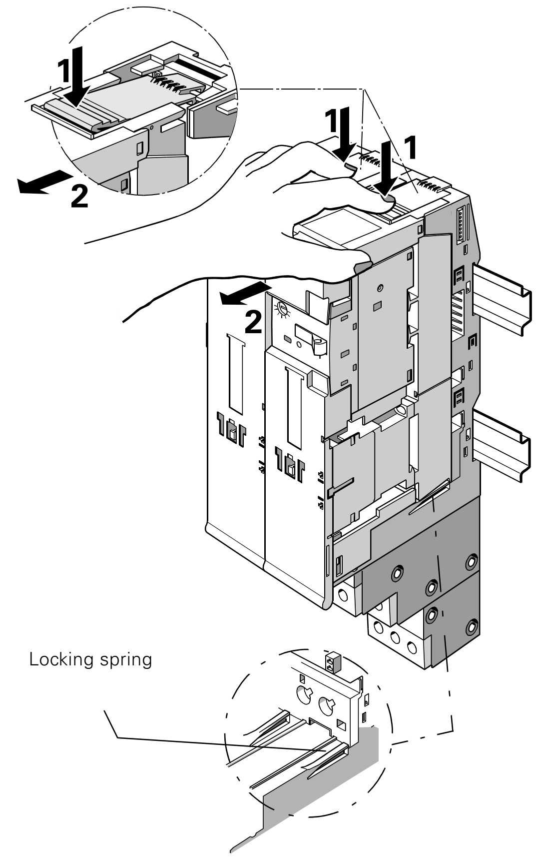
Drawing		Procedure/Description
	 1 2	Ensure that the motor starter is switched off. • Press both latches down. • Move the latch piece beyond the first latched position. The connection to the bus and the supply voltages is interrupted. The motor starter is now in its parked position, i.e. the connection to the backplane bus has been interrupted and the module is (still) in a mechanically secure position (see also Table 3-5). • Once you move the latch piece beyond the second latched position, the motor starter is released, the locking spring is disengaged and the motor starter is no longer mechanically secure.

Table 3-7: Motor starter; standard with installation width of 45 or 90 mm: removal

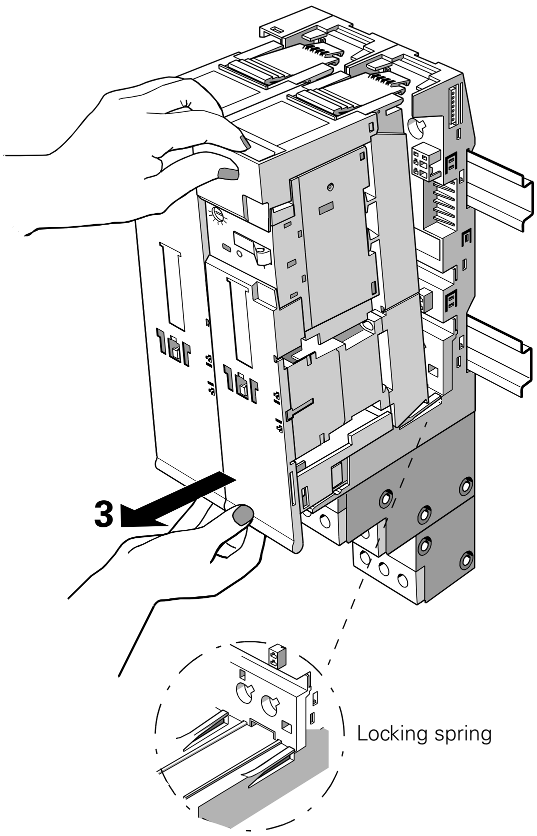
Drawing	Procedure/Description
	**3** Take hold of the load feeder in both hands using the upper and lower grip recesses, and pull the motor starter out. Pull the module from the bottom in a continuous movement (approx. 30 N tensile force) at an angle out of the plug-in connection.

Table 3-7: Motor starter; standard with installation width of 45 or 90 mm: removal (Contd.)

Note
It is advisable to inform maintenance and service personnel in detail about correct handling of the motor starters before the system is handed over to ensure that the advantages of ET 200S will be available immediately in the event of replacement.

Electrical connections during installation and removal

The figures below show the various installation and removal positions of a standard motor starter and the resultant electrical connections.

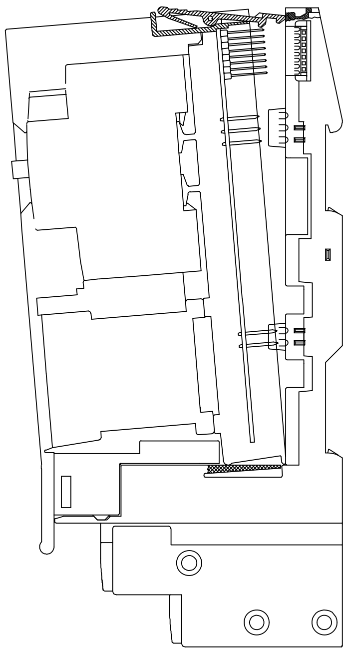
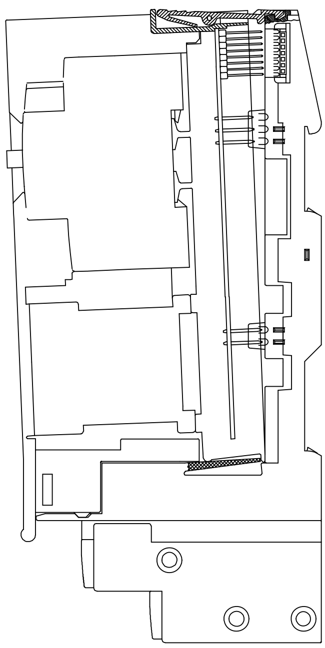
Drawing	Description
	**Insertion or release position** The motor starter; standard is electrically connected only to the power bus in this position. The locking spring is in the release position, and the load feeder is mechanically insecure in this position.
	**Parked position** The motor starter; standard is electrically connected only to the power bus in this position. The connection to the backplane bus is not established. The supply to the contactors is established but remains ineffective because there is no connection to the ET 200S backplane bus. In this position, the feeder is mechanically secured against falling out.

Table 3-8: El. connections with installation/removal of motor starter; standard (45 or 90 mm)

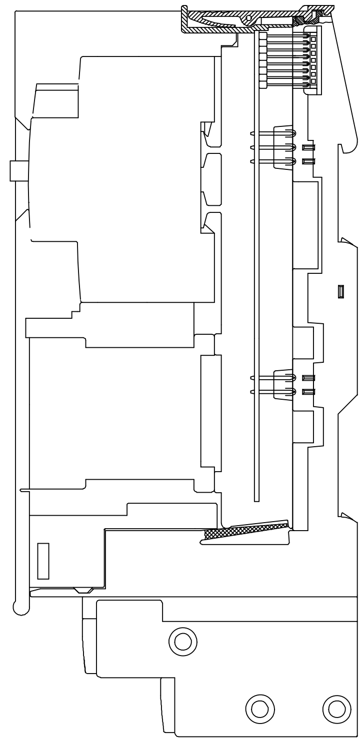
Drawing	Description
	**Operating position** The connections to the backplane bus and the supply to the electronic components and to the contactors have been established. The locking spring is engaged, which means the motor starter cannot be removed.

Table 3-8: El. connections with installation/removal of motor starter; standard (45 or 90 mm) (Contd.)

3.7.2 High feature/failsafe motor starter with installation width of 65 or 130 mm

Requirements

- Both rails must be installed.
- All the terminal modules for the power modules and motor starters must be installed.
- The safety group (SG) must be specified in the terminal modules of the fail-safe motor starters before the fail-safe motor starters are installed.

Specifying the safety group

Only relevant for the fail-safe motor starters.

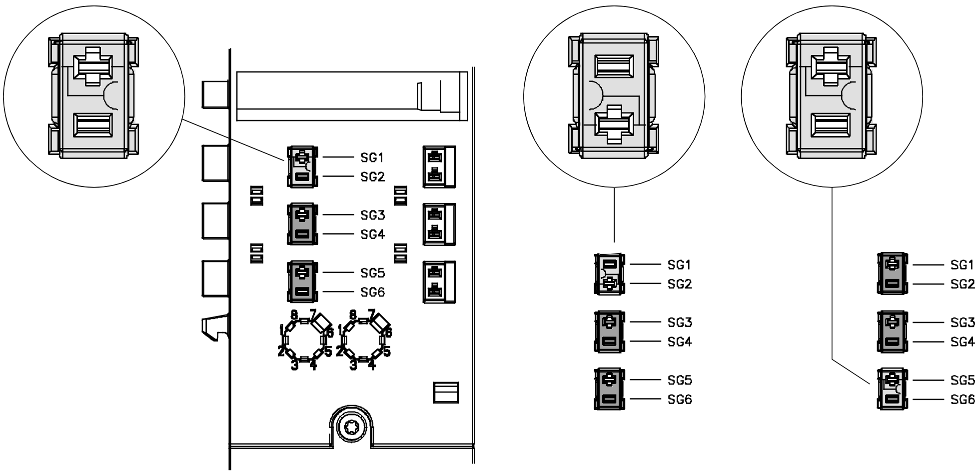
One of the six safety groups can be coded for each terminal module.
The terminal modules can be arranged in any order.
The terminal modules are supplied coded for the SG1 safety group.

Use the light gray coding connector to set the safety group. The indentation indicates the connection to which the contact of the coding connector applies.

The two dark gray coding connectors do not have any contacts.

To change the coding to another safety group, proceed as follows

- Coding for safety group SG2.
  Pull the light gray coding plug (see the illustration below) from the terminal module, turn it by 180°, and reinsert it.
- Coding for safety groups SG3 through SG6.
  First pull out the dark gray coding plug for safety group SG3/4 or SG5/6. After that, insert the light grey coding plug into the corresponding position. Insert the dark gray coding plug in the free position.



State on delivery | Example for SG2 | Example for SG5

Figure 3-13: Specifying the safety group

Safety note
Only one safety group can be selected for each terminal module.

Mechanical coding

When the motor starters are installed, the terminal modules are mechanically coded to ensure that, in the event of a fault, they can only be replaced by power modules with identical functions.

You must therefore bear the configured layout in mind when you insert the modules.

Installing the motor starter; high feature/failsafe

- The motor starters are inserted in the installed terminal modules, whereby two "latched positions" must be observed. Depending on the position, electrical connections are established or disconnected at removal. The locking hook prevents you removing the motor starters under load.
- The following table describes how the motor starters should be installed, using the example of a direct starter; high feature.

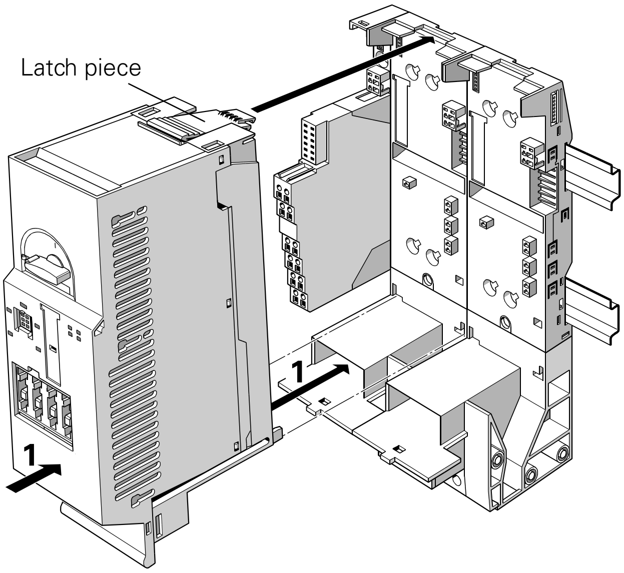
Drawing	Procedure/Description
	**1** Slide the motor starter; high feature at a slight incline (see figure) fron the front into the terminal module. Avoid a lateral slope. Push firmly on the lower part until contact is established with the power bus. • The motor starter; high feature remains slightly inclined, and the latch piece is not engaged. • The locking hook is not yet engaged. The motor starter; high feature is mechanically insecure in this position and connected only to the power bus.

Table 3-9: Installing high feature/failsafe motor starter with installation width of 65 or 130 mm

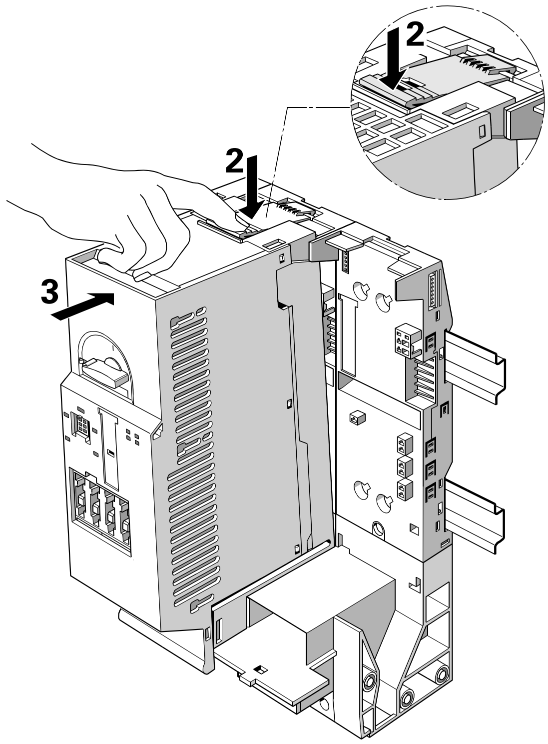
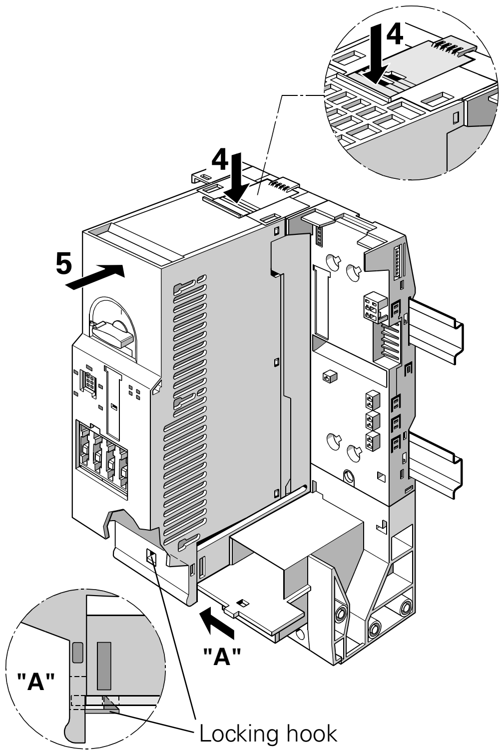
Drawing	Procedure/Description
	**2** **3** Press the latch piece and move the motor starter further towards the rail until the latch piece engages. The motor starter; high feature is now located in the **parked position**. **Parked position** • The connection to the backplane bus is not yet established. • There is no supply to the electronic components. • The connection to the power bus is established. The contactors cannot respond, however, because there is no connection to the backplane bus and the electronic components and switching commands thus remain ineffective.
	**4** **5** Press the latch piece again and move the motor starter further towards the DIN rail until the latch piece engages again. The motor starter; high feature is now located in the **operating position**. **Operating position** • The connection to the backplane bus is established. The electronic components and contactors are supplied with power. • The locking hook is engaged. The locking hook prevents the motor starter from being removed when live.

Table 3-9: Installing high feature/failsafe motor starter with installation width of 65 or 130 mm (Contd.)

Removing the motor starter; high feature/failsafe

A motor starter can be removed from the terminal module during operation. The feeder must be dead, e.g. circuit breaker switched off. Before you can remove the module, the latch piece must be taken beyond both latched positions, thus interrupting the electrical connections. The locking hook prevents you removing the load feeders under load.

Important
If you remove more than one module from the ET 200S, the substation switches to STOP mode.

Danger
In version 1 of the IM 151, **no** modules can be removed during operation. Module replacement is only permitted when the supply of the IM 151 is switched off.

The following table describes how the motor starters should be removed, using the example of a reversing starter; high feature.

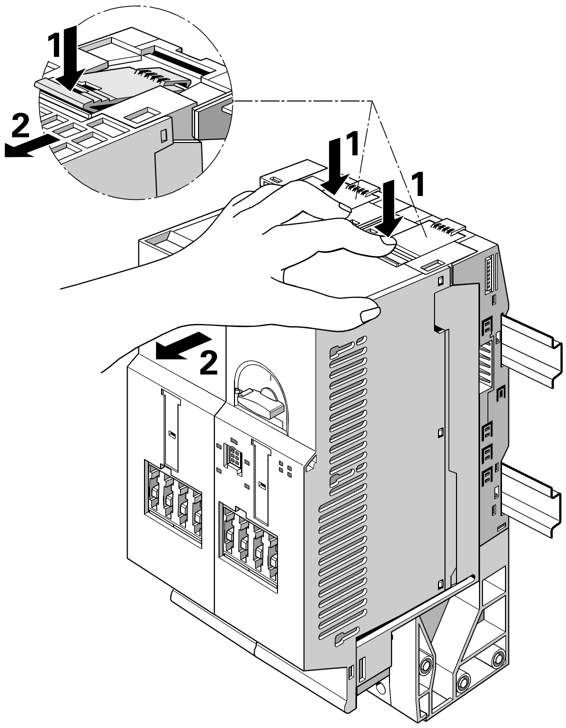
Drawing	Procedure/Description
	Ensure that the motor starter is switched off. **1** • Press both latches down. **2** • Move the latch piece beyond the first latched position. The connection to the bus and the supply voltages is interrupted. The motor starter is now in its parked position, i.e. the connection to the backplane bus has been interrupted and the module is (still) in a mechanically secure position (see also Table 3-5). • Once you move the latch piece beyond the second latched position, the motor starter is released, the locking hook is disengaged and the motor starter is no longer mechanically secure.

Table 3-10: Removing high feature/failsafe motor starter with installation width of 65 or 130 mm

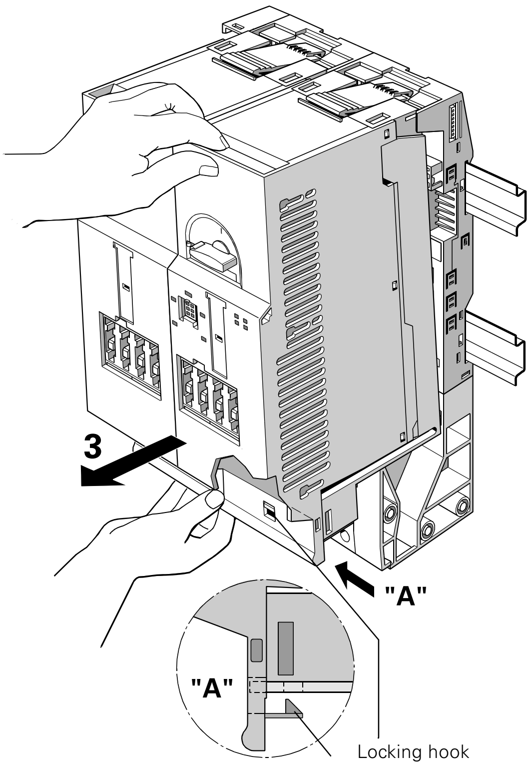
Drawing	Procedure/Description
	**3** Take hold of the load feeder in both hands using the upper and lower grip recesses, and pull the motor starter out. Pull the module from the bottom in a continuous movement (approx. 30 N tensile force) at an angle out of the plug-in connection.

Table 3-10: Removing high feature/failsafe motor starter with installation width of 65 or 130 mm (Contd.)

Note
It is advisable to inform maintenance and service personnel in detail about correct handling of the motor starters before the system is handed over to ensure that the advantages of ET 200S will be available immediately in the event of replacement.

Caution
Check the F-DS1e-x or F-RS1e-x after the exchange (see Section 8.3, 9.3).

Electrical connections during installation and removal

The figures below show the various installation and removal positions of a high feature/failsafe motor starter and the resultant electrical connections.

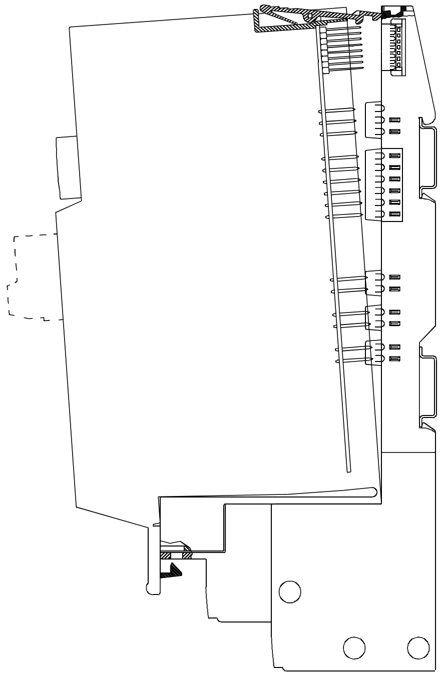
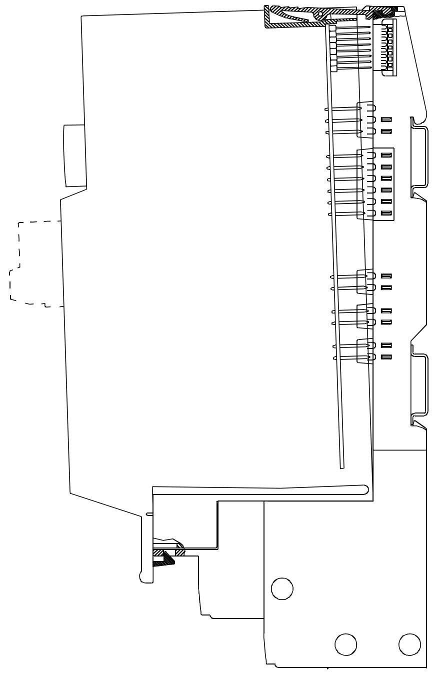
Drawing	Description
	**Insertion or release position** The motor starter; high feature is electrically connected only to the power bus in this position. The locking hook is in the release position, and the load feeder is mechanically insecure in this position.
	**Parked position** The motor starter; high feature is electrically connected only to the power bus in this position. The connection to the backplane bus is not established. The supply to the contactors is established but remains ineffective because there is no connection to the ET 200S backplane bus. In this position, the feeder is mechanically secured against falling out.

Table 3-11: El. connections with installation/removal of high feature/failsafe motor starter (65 or 130 mm)

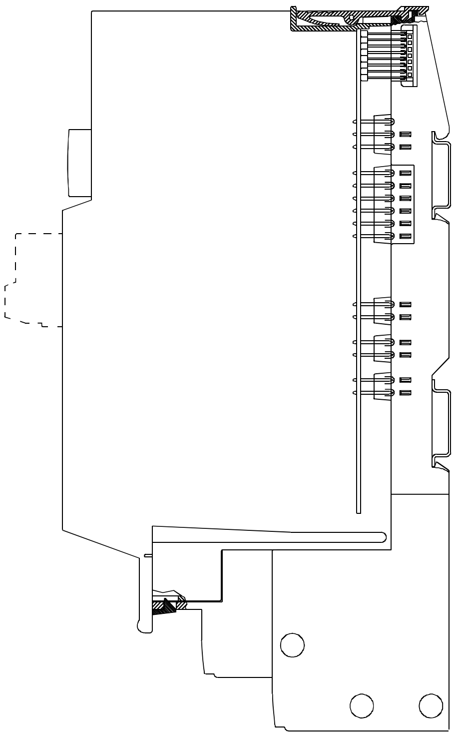
Drawing	Description
	**Operating position** The connections to the backplane bus and the supply to the electronic components and to the contactors have been established. The locking hook is engaged, which means the motor starter cannot be removed.

Table 3-11: El. connections with installation/removal of high feature/failsafe motor starter (65 or 130 mm) (Contd.)

3.8 Inserting the terminating module, terminating cover and caps

Terminating module

The last module to be installed in the ET 200S distributed I/O device is the terminating module. The ET 200S is ready for operation only when the terminating module is inserted. The terminating module module is included with the delivery of the IM 151interface module. More information can be found in the *SIMATIC ET 200S Distributed I/O Device* manual.

Terminating cover

In a configuration with motor starters, a terminating cover has to be fitted to the last terminal module of a potential group if it is followed by a PM-E or a terminating module in order to ensure that open contacts are protected against dirt and that the ET 200S is "finger-proof".
The terminating cover is supplied with the TM-P15 S27-01, TM-PF30 S47-B1/C1/F1 and TM-PFX30 S47-G1 terminal modules for the power modules.

Caps

Warning
In the case of the last terminal module for motor starters in a load group, the open contacts must be sealed with caps on the power bus (L1, L2, L3, N, PE) prior to commissioning, so that they are safe from touching (push the caps on firmly). This prevents the contacts being touched and removes the danger of an electric shock (400 V AC).

When you add to the ET 200S station, you must remove the caps. Use a 1 mm screwdriver to do this. Then replace the caps on the power bus of the new last motor starter.

The caps are included in the delivery package of the terminal module for motor starters with power bus infeed and of the terminal block with PE/N infeed.

If any caps are lost, replacements can be ordered using the following order number: 3RK1903-0AF20.

Concluding the line of an ET 200S configuration

You can conclude the installation of the ET 200S distributed I/O device with motor starters by inserting the following components:

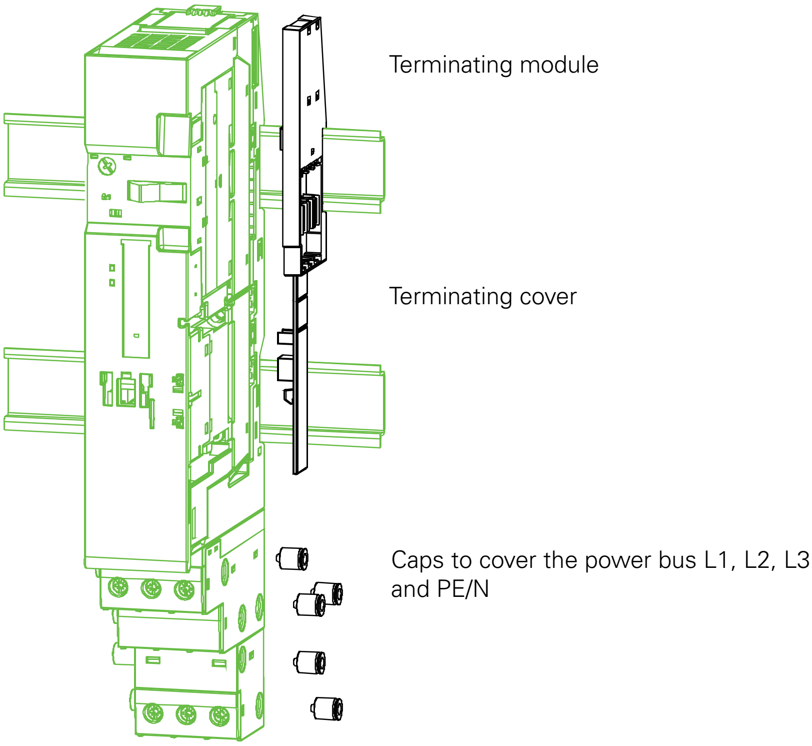


Figure 3-14: Inserting the terminating module, terminating cover and caps

Installing the terminating module

1. Hang the terminating module on the upper rail.
2. Tilt the terminating module backwards onto the rail until you hear it engage.
3. Move the terminating module to the left until you hear it engage with the last terminal module.

Removing the terminating module

1. Use a screwdriver (5 mm) to push the locking mechanism on the last terminal module to the stop, and move the terminating module to the right.
2. Tilt the terminating module so that it comes off the rail.

3.9 Labeling motor starters

The labels for the ET200S motor starter, terminal and power modules can be produced simply and efficiently from STEP 7 using the S7 Smartlabel program (2XV9450-1SL03-0YX0).

Further information can be found online at the following web address:
https://www.industry.siemens.com/services/global/en/IT4Industry/products/simatic_add_ons/s7_smartlabel/Pages/Default.aspx

Commissioning and diagnostics 4

4.1 Commissioning

Attention
It is essential that you comply with the voltage tolerance for the U_2 contactor supply up to 60 °C: 20.4 V to 28.8 V (does not apply to F-DS1e-x, F-RS1e-x).

Current setting

- For standard motor starters with an installation width of 45/90 mm (see Figure 4-1):
  Use a screwdriver to adjust the current setting for overload tripping on the scale of the circuit breaker before commissioning the motor starter. Note the two possible setting marks:
  - Line marking:
    Setting mark for the circuit breaker with reverse combination starters or spacing modules
  - Triangular marking:
    Setting mark for the circuit breaker in side-by-side installation.

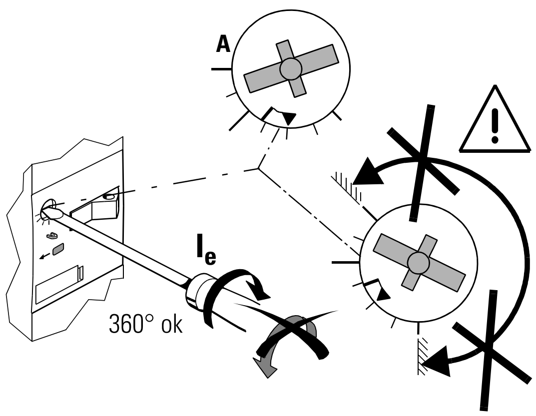


Figure 4-1: Current setting

Warning
The adjusting knob can be rotated 360° clockwise. You can only turn it back within the setting range.

- For high feature/failsafe motor starters with installation width of 65/130 mm: Parameterize the current setting via the Motor Starter ES or from STEP 7 or STEP 7+ in "*Devices and power systems*"

External short-circuit protection

Safety note
External short-circuit protection
If the short-circuit current at the installation position of the motor starter can exceed the rated short-circuit breaking capacity (50 kA) of the circuit breaker or starter protection switch, you must provide additional external short-circuit protection (fuse or circuit breaker).

Overload tripping test

Only for motor starters; standard with 45/90 mm installation width
You can test overload tripping. To do this, proceed as follows:

1. Switch the toggle switch from 0 to 1.
2. Put a screwdriver in the test opening and push it to the left. Overload tripping works when the toggle switch moves from 1 to 0.

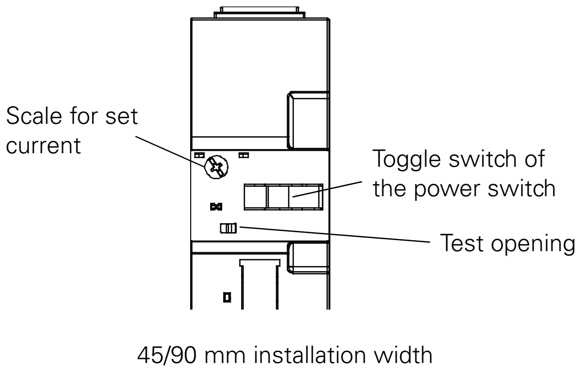


Figure 4-2: Overload tripping test

After overload or short-circuit tripping

- For standard motor starters with installation width of 45/90 mm:
  After an overload or short-circuit release during operation, the circuit breaker must be reset.
  1. Switch the toggle switch from 0 to 1.
  2. Check that the contactor is working.
- For high feature/failsafe motor starters with installation width of 65/130 mm:
  - After **short-circuit tripping** (knob switch of the power switch is between 0 and 1), you must turn the knob switch all the way to 0 (reset function) and then back to 1.
  - After **overload tripping** (power switch not tripped), there are two ways of resetting overload tripping:

    a) Using the toggle switch on the motor starter on site:
    Turn the toggle switch from 1 to 0 and then back from 0 to 1 **within 2 seconds**.

    b) Via remote reset:
    Using a rising signal at the DO 0.3 output.

Disconnecting a load from the power supply

By switching the toggle switch on the circuit breaker or motor circuit protector from 1 to 0, you can electrically isolate a connected load from the power supply.

Wiring of the contactors with diodes not permitted

The contactors of the motor starters must not be wired with diodes because Zener diodes are already integrated as induction protection and additional diodes would thus prolong the switch-off times.

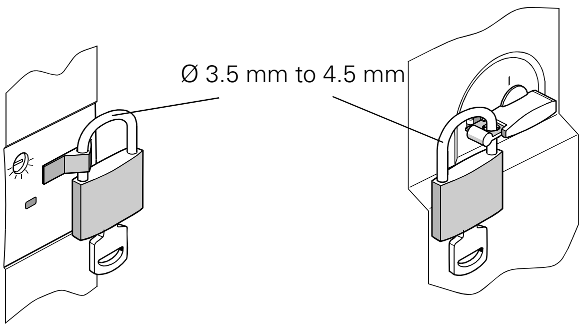
Reversing starters

Before a change of direction, use the user program to ensure that the drive is switched to "STOP" mode and remains in stop until the motor has stopped turning.

Preventing unauthorized persons from switching on

You can prevent the motor starter from being switched on without authorization by attaching a padlock (with a bow diameter of 3.5 to 4.5 mm) at position 0

- of the toggle switch of the circuit breaker in motor starter; standard
- in the projecting tip of the power switch knob in motor starter; high feature/ failsafe

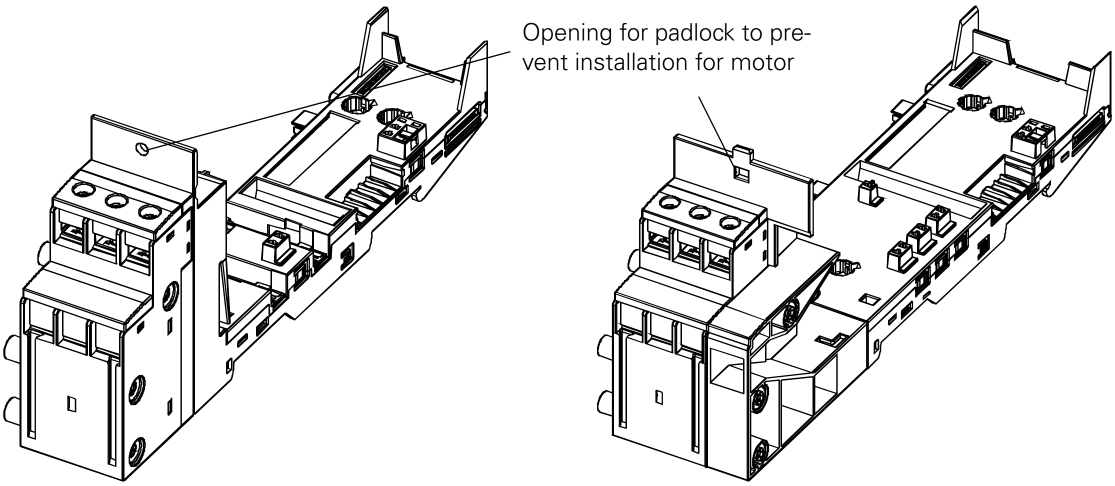


Motor starter; standard

Motor starter;
high feature falsafe

Figure 4-3: Preventing unauthorized persons from switching on

This protection loses its effect if a locked motor starter is replaced by an unlocked motor starter. To ensure isolation, we therefore recommend that you remove the motor starter and affix a padlock to the terminal module.



Terminal module 45 mm installation width

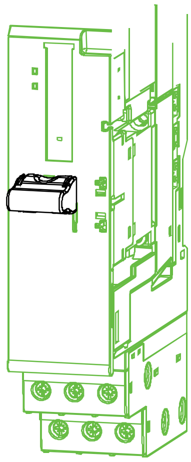
Terminal module 65 mm installation width

Figure 4-4: Lock in the terminal module preventing unauthorized persons from switching on

4.2 Control kit

The control kit is only intended for motor starters; standard with installation widths 45 and 90 mm.

The control kit is for the manual operation of the contactors for initial operation and for troubleshooting.



Note
Before connecting the control kit to the contactor or removing it again, always deenergize the motor starter in order to avoid unnecessary wear on the contacts of the contactor.

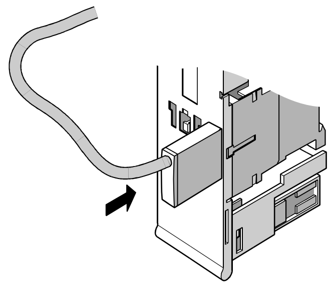
The load can be switched on and off only by means of the power circuit breaker.

Warning
Do **not** use the control kit in conjunction with safety-oriented applications (with power module PM-D F1 to 5), or with motor starters together with brake control modules xB1 to xB6!

4.3 Control unit

The control unit is only intended for motor starters; standard with installation widths 45 and 90 mm.

The control unit is for direct drive of the contactor coils of ET 200S devices (manual control) for commissioning, servicing, and troubleshooting purposes.



Mounting

Set the control unit cable end up on the open coil auxiliary connections of the ET 200S contactor and press it in until seated.

Warning
Do **not** use the control unit in conjunction with safety-oriented applications (with power module PM-D F1 to 5), or with motor starters together with brake control modules xB1 to xB6!

Wiring

Use **non-overlapping** switching elements for the "manual/automatic" selector switch.

The cable of the control unit is 1 m in length.

Wire the control unit in accordance with the circuit diagram below.

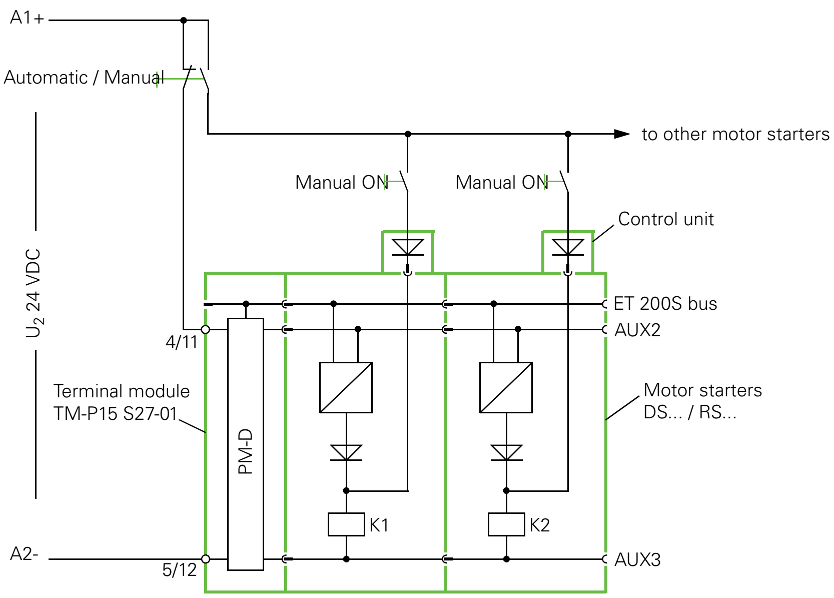


Figure 4-5: Wiring diagram for control unit

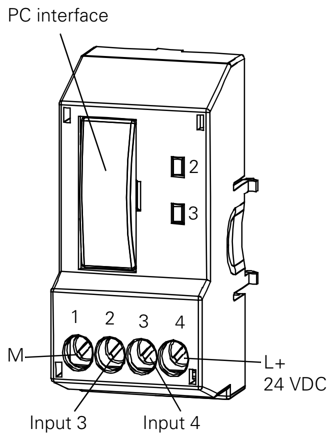
4.4 2DI COM control module

The 2DI COM control module is intended for high feature/failsafe motor starters of installation widths 65 and 130 mm:

Note
The 2DI COM control module can only be used for motor starters; high feature from order number suffixes -.AA**3** or -.AB**4** and failsafe motor starters.

Description

The 2DI COM control module has two inputs for the integration of internal control cabinet signals; these inputs can be parameterized by means of the motor starter on which the module is mounted. Each input has a green LED which indicates the status.



The signal states of the inputs are as follows:

LED IN3, 4	Status
Off	Low signal
Green	High signal

Table 4-1: Signal states, control module 2DI

NO or NC switching elements or 2-wire or 3-wire sensors (PNP) can be connected to the inputs.

The 2DI COM control module also has a computer interface for the integration of the "*Motor Starter ES*" parameterization and diagnostics software (from Version 2.0). A short description of the software can be found in Section 4.10.

Warning
The inputs are not floating and do not have a diagnostic message for faults such as: wire break, overload and short-circuit. In the event of the fault stated, it is not possible to simultaneously recognize and execute the respective input function to be dealt with.
It may therefore not be used in safety-related system sections.

Safety note
The 2DI COM control module can only be used in conjunction with F-DS1e-x and F-RS1e-x depending on the performance level (see Section 8.3 and 9.3).

Parameter assignment

The inputs can be parameterized independently of each other for different actions. Parameterization is described in:

- 8.3.4 for direct starter; high feature/failsafe
- 8.4.5 for direct soft starter; high feature
- 9.3.4 for reversing starter; high feature/failsafe

Installation - removal

To install the 2DI COM control module, slide down the clear cover on the front of the high feature/failsafe motor starter. After that, clip the 2DI COM control module onto the motor starter.

Remove the 2DI COM control module by pressing the recessed grips on each side toward each other and pulling off the high feature/failsafe motor starter. After removal, push the transparent cover up to protect the connections.

Open the dust cap on the 2DI COM control module on the corresponding motor starter to insert the cable for the connection to the PC. Insert the other end of the cable
in your PC in the port for the serial interface.

Supply voltage

The 2DI COM control module is supplied by the U_1 voltage. This applies both to connected sensors and contact elements.

Wiring

Wire the inputs in accordance with the circuit diagram below.

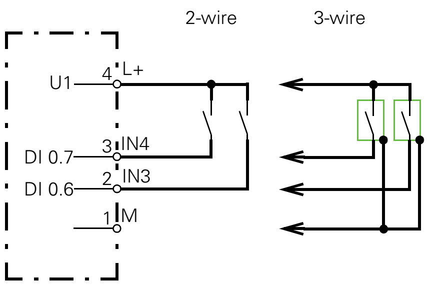


Figure 4-6: 2DI COM control module wiring diagram

The "LOGO! PC Cable" (order no.: 6ED1057-1AA00-0BA0) is used as a connecting line between the 2DI COM control module and the computer.

Technical specifications of the 2DI COM control module

Dimensions and weight		
Dimensions W x H x D (mm) (installed)		23.8 x 45 x 23.3
Weight (g)		approx. 15
Module-specific data		
Ambient temperature	operation storage	0 to 60 °C -40 to 80 °C
Degree of protection		IP20, IEC 60529
Inputs IN3 and IN4 (terminals 2 and 3) **Input IN LC (terminal 1)** (only with 2DI LC COM control module)		
Input characteristic curve to IEC 1131		Type 1
Low input current	I_{in}	<1.5 mA
High input current	I_{in}	>5 mA
Max. input current		max. 8 to 10 mA
Input delay	t_{in}	approx. 10 ms
Supply from U_1 (terminals 1 and 4) short circuit-proof and overload-proof		
Operating voltage range (relative to mass U_1)		20.4 to 28.8 VDC
Current limitation on short-circuit against mass of U_1		approx. 100 mA
Assignment of the inputs		
Control module 2DI COM IN3 IN4		Motor starter; high feature/failsafe Input 3 (DI 0.6) Input 4 (DI 0.7)
Conductor cross-sections		
Single-core (mm^2)		1 x (0.14 to 2.5) to IEC 60947
Single-wire or finely stranded (mm^2)		2 x (0.14 to 1)
Finely stranded with wire end ferrule (mm^2)		1 x (0.14 to 1.5) to IEC 60947
AWG cables, single- or multi-core		1 x (18 to 22)
Wiring		
Tool required		Standard screwdriver, size 1
Tightening torque (Nm)		0.4 to 0.7

Table 4-2: Technical specifications of the 2DI COM control module

Protective measures
In case of a single high-energy pulse (surge) at the digital inputs according to IEC 61000-4-5, lightning protection elements (e.g. those manufactured by Dehn: DCO RK D 5 24 order number: 919986) are recommended (see the DP master manual and the description of the SIMATIC NET PROFIBUS networks).

Table 4-2: Technical specifications of the 2DI COM control module (Contd.)

4.5 2DI LC COM control module

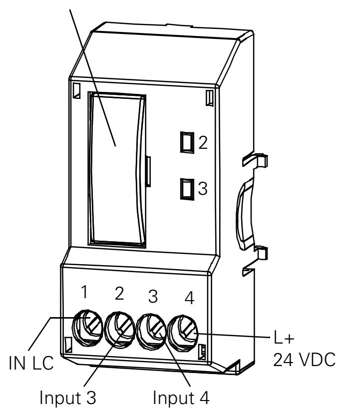
The control module 2DI LC COM possesses the same characteristics as the control module 2DI COM described in Section 4.4.

In this section only the additional input point IN LC is described.

Description

The 2DI LC COM control module is suitable for motor starters with installation widths of 65 and 130 mm:

- High feature with order number suffix -.AA**3** (from product version E02) or from order number suffix -.AB**4**
- Fail-safe motor starters (revision level E05 or higher).



If the input point IN LC is connected to L+ 24 VDC, the motor starter is switched to "Manual Operation Local" mode.

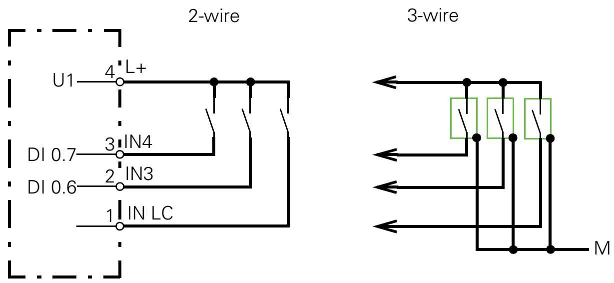
Regardless of the parameterized input function,
IN3 (input point 3) for clockwise and IN4 (input point 4) for counterclockwise operation of the motor starter are then required. In the manual operation local mode the brake is automatically disengaged by a pending ON signal (IN3/IN4).

If IN LC is open, then this module behaves like the control module 2DI COM. The parameterized input measures are performed.

Warning
Switching the input point IN LC while simultaneously parameterizing the input functions of the input points 3 and 4 can lead to unforeseeable motor starter states (e. g. unwanted switching on and off, if the motor starter is in the end position and then switched to the manual operation local mode).

Wiring

Wire the inputs in accordance with the circuit diagram below.



The 3-wire ground should be connected to the ground of the potential group (e.g. PM-D).

Figure 4-7: 2DI LC COM control module wiring diagram

4.6 Configuration

Configuring means configuring and parameterizing the ET 200S.

More information can be found in Section I 7.1 of the 'SIMATIC ET 200S Distributed I/O Device' manual.

The STEP 7 versions from which the individual modules are included are listed in the table below.

Product label	**MLFB**	**Brief description**	**STEP 7 version**
PM-D DC24V	3RK1903-0BA00	Power module; PM-D; 2 x 24 V DC	5.0 SP3
PM-D F1	3RK1903-1BA00	Power module; emergency stop; monitored start; 2-channel	5.0 SP3
PM-D F2	3RK1903-1BB00	Power module; protective door; automatic start; 2-channel	5.0 SP3
PM-D F4	3RK1903-1BC00	Power module; expansion board of F1/2 for another potential group	5.0 SP3
PM-D F3	3RK1903-1BD00	Power module; expansion board of F1/2 for another potential group; time-delayed	5.0 SP3
PM-X	3RK1903-1CB00	Connection module for infeed contactor; external safety circuit	5.0 SP3
RS-x1	3RK1301-xxB00-1AA2	Reversing starter; electromechanical; unfused; can be expanded (brake, local control)	5.1
xB3 DC24V/4A	3RK1903-0CE00	Brake control module 24 V DC/4A, DI 2 x 24 V DC local control	5.1
xB4 DC500V/0.7A	3RK1903-0CF00	Brake control module 500 V DC/0.7 A, DI 2 x 24 V DC local control	5.1
xB1	non-configurable, so not included in STEP 7 HW Config / STEP 7+ in "*Devices and power systems*"!		
xB2			
xB5			
DM-V15			
DS-x1	3RK1301-xxB00-0AA2	Direct starter; electromechanical; unfused; can be expanded (brake, local control)	5.1 SP1
PM-D F5	3RK1903-1BE00	Power module; expansion board for F1 through 4; contact multiplier	5.1 SP1

Table 4-3: Configuration of the motor starters

Product label	MLFB	Brief description	STEP 7 version
F-DS1e-x 0.3 to 3 A high feature 1)	3RK1301-0AB13-0AA2	Safe direct starter; switch mechanically; electronic UE protection; unfused; up to 1.1 kW/400V; 0.3 A to 3 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.1 SP4
F-DS1e-x 2.4 to 8 A high feature 1)	3RK1301-0BB13-0AA2	Safe direct starter; switch mechanically; electronic UE protection; unfused; up to 3 kW/400V; 2.4 A to 8 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.1 SP4
F-DS1e-x 2.4 to 16 A high feature 1)	3RK1301-0CB13-0AA2	Safe direct starter; switch mechanically; electronic UE protection; unfused; up to 7.5 kW/400V; 2.4 A to 16 A Option: Brake control module xB1 to xB6 control module 2DI (LC) COM	5.1 SP4
F-RS1e-x 0.3 to 3 A High feature 1)	3RK1301-0AB13-1AA2	Safe reversing starter; switch mechanically; electronic UE protection; unfused; up to 1.1 kW/400V; 0.3 A to 3 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.1 SP4
F-RS1e-x 2.4 to 8 A High feature 1)	3RK1301-0BB13-1AA2	Safe reversing starter; switch mechanically; electronic UE protection; unfused; up to 3 kW/400V; 2.4 A to 8 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.1 SP4
F-RS1e-x 2.4 to 16 A High feature 1)	3RK1301-0CB13-1AA2	Safe reversing starter; switch mechanically; electronic UE protection; unfused; up to 7.5 kW/400V; 2.4 A to 16 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.1 SP4
F-CM	3RK1903-3CA00	Fail-safe contact replicator	5.1 SP4
PM-D F X1	3RK1903-3DA00	Fail-safe power/expansion module	5.1 SP4

1) Switching to the manual operation local mode is possible with the 2DI LC COM control module, beginning with revision level 02.

Table 4-3: Configuration of the motor starters (Contd.)

Product label	MLFB	Brief description	STEP 7 version
DS1e-x 0.3 to 3 A High feature [1)]	3RK1301-0AB10-0AA3	Direct starter; high feature: switch mechanically; electronic UE protection; unfused; up to 1.1 kW/400V; 0.3 A to 3 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.2
DS1e-x 2.4 to 8 A High feature [1)]	3RK1301-0BB10-0AA3	Direct starter; high feature: switch mechanically; electronic UE protection; unfused; up to 3 kW/400V; 2.4 A to 8 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.2
DS1e-x 2.4 to 16 A High feature [1)]	3RK1301-0CB10-0AA3	Direct starter; high feature: switch mechanically; electronic UE protection; unfused; up to 7.5 kW/400V; 2.4 A to 16 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.2
DSS1e-x 0.3 to 3 A High feature [1)]	3RK1301-0AB20-0AA3	Direct soft starter; high feature: switch electronically; electronic UE protection; unfused; up to 1.1 kW/400V; 0.3 A to 3 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.2
DSS1e-x 2.4 to 8 A High feature [1)]	3RK1301-0BB20-0AA3	Direct soft starter; high feature: switch electronically; electronic UE protection; unfused; up to 3 kW/400V; 2.4 A to 8 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.2
DSS1e-x 2.4 to 16 A High feature [1)]	3RK1301-0CB20-0AA3	Direct soft starter; high feature: switch electronically; electronic UE protection; unfused; up to 7.5 kW/400V; 2.4 A to 16 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.2

1) Communication possibility via the 2DI COM control module with the "Motor Starter ES" software through the front device interface. From revision level 02, switchover into "Manual Operation Local" mode possible using the 2DI LC COM control module.

Table 4-3: Configuration of the motor starters (Contd.)

Product label	MLFB	Brief description	STEP 7 version
RS1e-x 0.3 to 3 A High feature [1)]	3RK1301-0AB10-1AA3	Reversing starter; high feature: switch mechanically; electronic UE protection; unfused; up to 1.1 kW/400V; 0.3 A to 3 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.2
RS1e-x 2.4 to 8 A High feature [1)]	3RK1301-0BB10-1AA3	Reversing starter; high feature: switch mechanically; electronic UE protection; unfused; up to 3 kW/400V; 2.4 A to 8 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.2
RS1e-x 2.4 to 16 A High feature [1)]	3RK1301-0CB10-1AA3	Reversing starter; high feature: switch mechanically; electronic UE protection; unfused; up to 7.5 kW/400V; 2.4 A to 16 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.2

1) Communication possibility via the 2DI COM control module with the "Motor Starter ES" software through the front device interface. From revision level 02, switchover into "Manual Operation Local" mode possible using the 2DI LC COM control module.

Table 4-3: Configuration of the motor starters (Contd.)

Product label	MLFB	Brief description	STEP 7 version
DS1e-x 0.3 to 3 A High feature [1)]	3RK1301-0AB10-0AA4	Direct starter; high feature: switch mechanically; electronic UE protection; unfused; up to 1.1 kW/400V; 0.3 A to 3 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.4
DS1e-x 2.4 to 8 A High feature [1)]	3RK1301-0BB10-0AA4	Direct starter; high feature: switch mechanically; electronic UE protection; unfused; up to 3 kW/400V; 2.4 A to 8 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.4
DS1e-x 2.4 to 16 A High feature [1)]	3RK1301-0CB10-0AA4	Direct starter; high feature: switch mechanically; electronic UE protection; unfused; up to 7.5 kW/400V; 2.4 A to 16 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.4
DSS1e-x 0.3 to 3 A High feature [1)]	3RK1301-0AB20-0AA4	Direct soft starter; high feature: switch electronically; electronic UE protection; unfused; up to 1.1 kW/400V; 0.3 A to 3 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.4
DSS1e-x 2.4 to 8 A High feature [1)]	3RK1301-0BB20-0AA4	Direct soft starter; high feature: switch electronically; electronic UE protection; unfused; up to 3 kW/400V; 2.4 A to 8 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.4
DSS1e-x 2.4 to 16 A High feature [1)]	3RK1301-0CB20-0AA4	Direct soft starter; high feature: switch electronically; electronic UE protection; unfused; up to 7.5 kW/400V; 2.4 A to 16 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.4

Table 4-3: Configuration of the motor starters (Contd.)

Product label	MLFB	Brief description	STEP 7 version
RS1e-x 0.3 to 3 A High feature [1)]	3RK1301-0AB10-1AA4	Reversing starter; high feature: switch mechanically; electronic UE protection; unfused; up to 1.1 kW/400V; 0.3 A to 3 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.4
RS1e-x 2.4 to 8 A High feature [1)]	3RK1301-0BB10-1AA4	Reversing starter; high feature: switch mechanically; electronic UE protection; unfused; up to 3 kW/400V; 2.4 A to 8 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.4
RS1e-x 2.4 to 16 A High feature [1)]	3RK1301-0CB10-1AA4	Reversing starter; high feature: switch mechanically; electronic UE protection; unfused; up to 7.5 kW/400V; 2.4 A to 16 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.4
F-DS1e-x 0.3 to 3 A high feature [1)]	3RK1301-0AB13-0AA4	Safe direct starter; switch mechanically; electronic UE protection; unfused; up to 1.1 kW/400V; 0.3 A to 3 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.4 SP4
F-DS1e-x 2.4 to 8 A high feature [1)]	3RK1301-0BB13-0AA4	Safe direct starter; switch mechanically; electronic UE protection; unfused; up to 3 kW/400V; 2.4 A to 8 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.4 SP4
F-DS1e-x 2.4 to 16 A high feature [1)]	3RK1301-0CB13-0AA4	Safe direct starter; switch mechanically; electronic UE protection; unfused; up to 7.5 kW/400V; 2.4 A to 16 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.4 SP4
F-RS1e-x 0.3 to 3 A High feature [1)]	3RK1301-0AB13-1AA4	Safe reversing starter; switch mechanically; electronic UE protection; unfused; up to 1.1 kW/400V; 0.3 A to 3 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.4 SP4

Table 4-3: Configuration of the motor starters (Contd.)

Product label	MLFB	Brief description	STEP 7 version
F-RS1e-x 2.4 to 8 A High feature 1)	3RK1301-0BB13-1AA4	Safe reversing starter; switch mechanically; electronic UE protection; unfused; up to 3 kW/400V; 2.4 A to 8 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.4 SP4
F-RS1e-x 2.4 to 16 A High feature 1)	3RK1301-0CB13-1AA4	Safe reversing starter; switch mechanically; electronic UE protection; unfused; up to 7.5 kW/400V; 2.4 A to 16 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.4 SP4

1) Communication possibility via the 2DI COM control module with the "Motor Starter ES" software through the front device interface. From revision level 02, switchover into "Manual Operation Local" mode possible using the 2DI LC COM control module.

Table 4-3: Configuration of the motor starters (Contd.)

Product label	MLFB	Brief description	STEP 7 version
DS1e-x 0.3 to 3 A High feature [1)]	3RK1301-0AB10-0AB4	Direct starter; high feature: switch mechanically; electronic UE protection; unfused; up to 1.1 kW/400V; 0.3 A to 3 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.5 SP1
DS1e-x 2.4 to 8 A High feature [1)]	3RK1301-0BB10-0AB4	Direct starter; high feature: switch mechanically; electronic UE protection; unfused; up to 3 kW/400V; 2.4 A to 8 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.5 SP1
DS1e-x 2.4 to 16 A High feature [1)]	3RK1301-0CB10-0AB4	Direct starter; high feature: switch mechanically; electronic UE protection; unfused; up to 7.5 kW/400V; 2.4 A to 16 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.5 SP1
DSS1e-x 0.3 to 3 A High feature [1)]	3RK1301-0AB20-0AB4	Direct soft starter; high feature: switch electronically; electronic UE protection; unfused; up to 1.1 kW/400V; 0.3 A to 3 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.5 SP1
DSS1e-x 2.4 to 8 A High feature [1)]	3RK1301-0BB20-0AB4	Direct soft starter; high feature: switch electronically; electronic UE protection; unfused; up to 3 kW/400V; 2.4 A to 8 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.5 SP1
DSS1e-x 2.4 to 16 A High feature [1)]	3RK1301-0CB20-0AB4	Direct soft starter; high feature: switch electronically; electronic UE protection; unfused; up to 7.5 kW/400V; 2.4 A to 16 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.5 SP1

Table 4-3: Configuration of the motor starters (Contd.)

Product label	MLFB	Brief description	STEP 7 version
RS1e-x 0.3 to 3 A High feature 1)	3RK1301-0AB10-1AB4	Reversing starter; high feature: switch mechanically; electronic UE protection; unfused; up to 1.1 kW/400V; 0.3 A to 3 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.5 SP1
RS1e-x 2.4 to 8 A High feature 1)	3RK1301-0BB10-1AB4	Reversing starter; high feature: switch mechanically; electronic UE protection; unfused; up to 3 kW/400V; 2.4 A to 8 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.5 SP1
RS1e-x 2.4 to 16 A High feature 1)	3RK1301-0CB10-1AB4	Reversing starter; high feature: switch mechanically; electronic UE protection; unfused; up to 7.5 kW/400V; 2.4 A to 16 A Option: Brake control module xB1 to xB6 2DI (LC) COM control module	5.5 SP1
xB6 AC400V/0.5A	3RK1903-0CK00	Brake control module AC 400 V/0.5 A, DI 2 x DC 24 V Local Control	5.5 SP1

1) Communication possibility via the 2DI COM control module with the "Motor Starter ES" software through the front device interface. From revision level 02, switchover into "Manual Operation Local" mode possible using the 2DI LC COM control module.

Table 4-3: Configuration of the motor starters (Contd.)

4.7 Diagnostics

4.7.1 Diagnosis and monitoring through the user program

Diagnostics and monitoring for ET 200S motor starters take place via the user program and/or the diagnostics channel of the field bus system.

For comprehensive diagnostic analysis and demo programs using *STEP 5* and *STEP 7*, see *SIMATIC ET 200S* Distributed I/O Device manual.

The S7 modules FB125 and FC125 are available for diagnostic analysis in the user program. The S7 blocks and the accompanying descriptions are available as free downloads from:

http://support.automation.siemens.com/WW/view/de/26996747
DE: http://support.automation.siemens.com/WW/view/de/5362473
http://support.automation.siemens.com/WW/view/en/5362473

In the following tables you will find the respective error types and their meanings as a supplement to the channel-based diagnostics.

Power module fault types

Power modules	Fault type	Meaning	Remedy
PM-D PM-D F2 1) PM-D F3 1) PM-D F4 1) PM-D F5 1) F-CM 1)	01001: Fault	Module fault has occurred	Replace the module
PM-D F1 1)			Check whether EMERGENCY STOP was unlatched with ON circuit jumpered
PM-D PM-D F1 1) PM-D F2 1) PM-D F3 1) PM-D F4 1) PM-D F5 1) F-CM 1) PM-D F X1	10001: No supply voltage	U_1 or U_2 not measurable or too low	Correct the process wiring. Check the voltage supply
PM-D F1 1) PM-D F2 1) PM-D F3 1) PM-D F4 1) PM-D F5 1)	11000: Actuator shutdown	Safety relay OFF	Press ON button to acknowledge
PM-D F1 1) PM-D F2 1)	11001: Safety-oriented tripping	Emergency stop actuated or crossover has occurred between the cables of the emergency stop	Rectify the cause of the shutdown, e.g. disengage the emergency stop or rectify crossover.

1) Fault type is mapped correctly only as of revision level 5 of IM 151.

Table 4-4: Power module fault types

Expansion module fault types

Expansion modules	Fault type	Meaning	Remedy
Brake control • xB3 • xB4	00100: Fault	• Brake overload	Rectify overload

Table 4-5: Expansion module fault types

Motor starter fault types

The following table applies to standard motor starters up to 5.5 kW.

Motor starters	Fault type	Meaning	Remedy
Direct starter • DS-x1 Reversing starters • RS-x1	01001: Fault	• Contactor jammed or welded • Internal failure/ device fault	Replace the module. Check the contactor
	11000: Actuator shutdown	• The circuit breaker has been tripped. • All designated faults/ asymmetry/motor blockage (additional fault entry for more detailed fault description may exist)	Rectify the cause of the shutdown and reset. Check the components

Table 4-6: Fault types for motor starters up to 5.5 kW

The following table applies for high feature/failsafe motor starters up to 7.5 kW.

Motor starters	Fault type	Meaning/cause	Remedy
Direct starter • DS1e-x, • DSS1e-x • F-DS1e-x Reversing starters • RS1e-x • F-RS1e-x	00001: Short-circuit (F1) [1]	• Power switch has tripped / is switched off	Correct short-circuit and switch power switch back on.
	00100: Overload (F4)	• Thermal motor model overload	• Allow the motor to cool down • Check the motor's current consumption • Check the set current limits
	00111: Upper limit violated (F7)	• I_e upper current limit violated	
	01000: Lower limit violated (F8)	• I_e lower current limit violated	
	01001: Fault (F9)	• Internal failure/device fault • Switching element defective (contactor is fused or jammed)	Switch supply voltage U_1 off and on; replace the motor starter if the fault persists.
	10000: Parameter error (F16)	• Invalid parameter value	Check parameter values.
	11000: Actuator shutdown (F24)	• Asymmetry • Motor blocked • Residual current detected • Or in conjunction with another type of fault in this table • Cold run shutdown • Power switch has tripped / is switched off	Check phases L1 to L3. Clear stalled rotor. Check main phases L1 to L3 for interruption.
	11001: Safety-oriented shutdown (F25) [2]	• EMERGENCY STOP	Remove the cause of the emergency stop
	11001: (F17)	• Switching element power supply missing	Check A1+/A2- (PM-D)

1) Altered response of the circuit breaker for motor starters with order number suffix -.AA**3** with revision level E02 and for fail-safe motor starters with revision level E05.
If the circuit breaker is switched to the status
O/TRIPPED when the starter is tripped (DI 0.0 and DI 0.1 = 0) , no "short circuit" diagnosis is generated.
During acceleration, a circuit breaker in the O/TRIPPED position likewise generates no "short circuit" diagnosis.
If the circuit breaker is activated with the motor running (DI 0.0 and DI 0.1 = 1)(due to short circuit or operation in the O/TRIPPED position), a "short circuit" diagnosis is generated as previously.

2) Only applicable to F-DS1e-x, F-RS1e-x

Table 4-7: Fault types for motor starters up to 7.5 kW

Motor starters	Fault type	Meaning/cause	Remedy
Direct starter • DS1e-x, • DSS1e-x • F-DS1e-x Reversing starters • RS1e-x • F-RS1e-x	11010: External fault (F26)	• Input tripping • Input tripping limit position • Process mapping error (RS1e-x only: simultaneous actuation of motor clockwise and motor counterclockwise).	• Eliminate the external fault (withdraw from limit position, for example) • Start in opposite direction of rotation • Actuate in only one direction of rotation.
	00101 Overload switching element (F5)	• Thermal motor type is loaded to >178 %. Shutdown occurs to protect device with parameter "thermal motor type" = alert. • For DSS1e-x startup current overshoot $I>5xI_e$[1)]	Check system configuration Increase starting time Reduce starting voltage.

1) with DSS1e-x from order number suffix: -.A**B**4 startup current overshoot I > 5 x Iemax applies

Table 4-7: Fault types for motor starters up to 7.5 kW (Contd.)

Note
The group error bit is cleared when the cause of the shutdown is remedied and acknowledged using "Trip Reset" (DO 0.3 or by turning the knob from 1-0-1 on the circuit breaker).

Exception – device fault:
This can only be acknowledged by means of an OFF - ON supply voltage (module replacement recommended).

Note
(only for F-DS1e-x, F-RS1e-x).
An emergency stop always generates a fault of type F24 and F25. An emergency stop does not have to be acknowledged on the motor starter with a "Trip Reset."

4.7.2 Diagnosis by LEDs

The LEDs on the power modules and on the direct and reversing starters display the status of the relevant modules.

Note
If a power module (PM-D, PM-D F1 to 5, PM-D F X1, F-CM) returns a diagnostic message of the type "Error" or "Sensor or load voltage missing", the diagnostic messages of the modules downstream from the power module as far as the next power module are suppressed.

4.8 LED indicators

4.8.1 Diagnosis of the PM-D power module

SF	■	Group error	Red
PWR	■	Power U_1	Green
CON	■	Contactor U_2	Green

LEDs			Status/Cause/Remedy
SF [1)]	**PWR**	**CON**	
Off	Green	Green	Normal operation
Red	Green	Green	Group error
Red	Off	Green	No supply voltage U_1 for electronic components
Red	Green	Off	No supply voltage U_2 for contactors
Red	Off	Off	No supply voltages U_1 and U_2

1) Status of the LEDs in this form only when group diagnostics activated

Table 4-8: LED status and error displays on the PM-D power module

4.8.2 Diagnosis of the PM-D F1 power module

SF		Group error	Red
PWR		Power (electronic power supply U_1)	Green
CON		Contactor (contactor supply U_2)	Green
STAT		Status indicator for safety relay	Red/green

LEDs				**Safety relay**	**EMER-GENCY STOP switch**	**ON but-ton**	**Status/Cause/Remedy**
SF [1]	**PWR**	**CON**	**STAT**				
Off	Green	Green	Green	On	Not actu-ated	Once actuated	Normal operation
Red	Green	Green	Green	On	[2]	[2]	Bus fault
Red	Green	Green	Off	Off	Not actu-ated	Not actu-ated	Safety relay switched off. Press the ON button to start.
Red	Green	Green	Red	Off	actuated	[2]	Switch-on not possible: Unlock EMERGENCY STOP. If the status LED goes red again there is a cross-cir-cuit in the EMERGENCY STOP system (rectify the external fault) or the power module is defective. (Replace the device).
Red	Green	Green	Red	Off	Transi-tion from actuated to not actuated	actuated	Emergency stop disen-gaged when ON circuit closed
Red	Green	Green	Red	Off	Not actu-ated	[2]	Power module defective: replace the device.
Red	Off	Green	Red	Off	[2]	[2]	No supply voltage U_1 for electronics.
Red	Green	Off	[2]	[2]	[2]	[2]	No supply voltage U_2 for motor starter.
Red	Off	Off	Red	Off	[2]	[2]	No supply voltages U_1 and U_2

1) Status of the LEDs in this form only when group diagnostics activated
2) Not relevant

Table 4-9: LED status and error displays on the PM-D F1 power module

4.8.3 Diagnosis of the PM-D F2 power module

SF	■	Group error	Red
PWR	■	Power (electronic power supply U_1)	Green
CON	■	Contactor (contactor supply U_2)	Green
STAT	■	Status indicator for safety relay	Red/green

LEDs				**Safety relay**	**Protective door switch**	**ON button**	**Status/Cause/Remedy**
SF [1]	**PWR**	**CON**	**STAT**				
Off	Green	Green	Green	On	Closed	Once actuated (jumpered)	Normal operation
Red	Green	Green	Green	On	[2]	[2]	Bus fault
Red	Green	Green	Off	Off	Closed	Not actuated	Safety relay switched off. Press the ON button to start.
Red	Green	Green	Red	Off	Open	[2]	Switch-on not possible: close protective doors. If the status LED goes red again there is a cross-circuit in the sensor system (rectify the external fault) or the power module is defective. (Replace the device).
Red	Green	Green	Red	Off	Closed	[2]	Power module defective: replace the device.
Red	Off	Green	Red	Off	[2]	[2]	No supply voltage U_1 for electronics.
Red	Green	Off	[2]	[2]	[2]	[2]	No supply voltage U_2 for motor starter.
Red	Off	Off	Red	Off	[2]	[2]	No supply voltages U_1 and U_2

[1] Status of the LEDs in this form only when group diagnostics activated
[2] Not relevant

Table 4-10: LED status and error displays on the PM-D F2 power module

4.8.4 Diagnosis of the PM-D F3 power module

SF		Group error	Red
PWR		Power (electronic power supply U_1)	Green
CON		Contactor (contactor supply U_2)	Green
STAT		Status indicator for safety relay	Red/green

LEDs				**Safety relay**	**Status/Cause/Remedy**
SF [1)]	**PWR**	**CON**	**STAT**		
Off	Green	Green	Green	On	Normal operation
Red	Green	Green	Green	On	Bus fault
Red	Green	Green	Off	On/off	Timeout or safety relay switched off.
Red	Green	Green	Red	Off	Power module defective: replace the device.
Red	Off	Green	Red	Off	No supply voltage U_1 for electronics.
Red	Green	Off	[2)]	[2)]	No supply voltage U_2 for motor starter.
Red	Off	Off	Red	Off	No supply voltages U_1 and U_2

1) Status of the LEDs in this form only when group diagnostics activated
2) Not relevant

Table 4-11: LED status and error displays on the PM-D F3 power module

4.8.5 Diagnosis of the PM-D F4 power module

SF		Group error	Red
PWR		Power (electronic power supply U_1)	Green
CON		Contactor (contactor supply U_2)	Green
STAT		Status indicator for safety relay	Red/green

LEDs				**Safety relay**	**Status/Cause/Remedy**
SF [1]	**PWR**	**CON**	**STAT**		
Off	Green	Green	Green	On	Normal operation
Red	Green	Green	Green	On	Bus fault
Red	Green	Green	Off	Off	Safety relay switched off.
Red	Green	Green	Red	Off	Power module defective: replace the device.
Red	Off	Green	Red	Off	No supply voltage U_1 for electronics.
Red	Green	Off	[2]	[2]	No supply voltage U_2 for motor starter.
Red	Off	Off	Red	Off	No supply voltages U_1 and U_2

1) Status of the LEDs in this form only when group diagnostics activated
2) Not relevant

Table 4-12: LED status and error displays on the PM-D F4 power module

4.8.6 Diagnosis of the PM-D F5 power module

SF	Group error	Red
PWR	Power (electronic power supply U_1)	Green
STAT	Status indicator for safety relay	Red/green

LEDs			Safety relay	Status/Cause/Remedy
SF [1]	PWR	STAT		
Off	Green	Green	On	Normal operation
Red	Green	Green	On	Bus fault
Red	Green	Off	Off	Safety relay switched off.
Red	Green	Red	Off	Power module defective: replace the device.
Red	Off	Red	Off	No supply voltage U_1 for electronics.

1) Status of the LEDs in this form only when group diagnostics activated

Table 4-13: LED status and error displays on the PM-D F5 power module

4.8.7 Diagnosis of the PM-X connection module

LED SF	Status
Off	Normal operation
Red	Group error

Table 4-14: Diagnosis of the PM-X connection module

4.8.8 Diagnosis of the PM-D F X1 fail-safe power/expansion module

SF		Group error	Red
PWR		Power (electronic power supply U_1)	Green
SGx		Status display for SG1 to SG6	Green

LEDs			Status/Cause/Remedy
SF [1]	**PWR**	**SGx**	
Off	Green		Normal operation
Red	Green		Bus fault
Red	Off		No supply voltage U_1 for electronics.
		Green	Emergency stop not activated Normal operation
		Off	Emergency stop on SGx bus Bus not wired (unused) Wire break at SGx input

[1] Status of the LEDs in this form only when group diagnostics activated

Table 4-15: Status and error displays with LEDs on the fail-safe PM-D F X1 power/expansion module

4.8.9 Diagnosis of the F-CM fail-safe contact replicator

SF	■	Group error	Red
PWR	■	Power (electronic power supply U_1)	Green
STAT	■	Status indicator for safety relay	Red/green

LEDs			Safety relay	Status/Cause/Remedy
SF [1]	PWR	STAT		
Off	Green	Green	On	Normal operation
Red	Green	Green	On	Bus fault
Red	Green	Off	Off	Safety relay switched off.
Red	Green	Red	Off	F-CM faulty: replace the device.
Red	Off	Red	Off	No supply voltage U_1 for electronics.

1) Status of the LEDs in this form only when group diagnostics activated

Table 4-16: Status and error displays with LEDs on the fail-safe F-CM contact replicator

4.8.10 Diagnosis of the DS1-x and RS1-x motor starters; standard

SF		Group error	Red
C-STAT		Contactor status	Red/green/ yellow

LEDs		Status/Cause/Remedy
SF [1]	**C-STAT**	
		Operating status
Off	Yellow	Motor on (clockwise or counterclockwise in the case of the RS1-x)
Off	Off	Motor off
		Device fault
Red	Green	Contactor jammed or coil defective (cannot be switched on) In the case of a DS1-x and RS1-x, the limit switch might be actuated in conjunction with xB3 or xB4
Red	Red	Contactor welded
Red	Off	Contactor defective
		System fault
Red	Off	Power switch tripped, contactor off
Red	Yellow	Power switch tripped, contactor on
		Group error via bus
Red	Off/yellow	Header module sets group error

1) Status of the LEDs in this form only when group diagnostics activated

Table 4-17: Status and error displays via LEDs on the motor starters; standard (5.5 kW)

4.8.11 Diagnosis of DS1e-x, RS1e-x and DSS1e-x motor starters; high feature F-DS1e-x and FRS1e-x fail-safe motor starters

Red	Group error	SF	DEVICE	Device status	Red/ green/ yellow
Red/ green/ yellow	Contactor status	C-STAT			
Green	Safety group	SGx	(nur bei F-DS1e-x, F-RS1e-x)		

LEDs			Status/Cause/Remedy
SF [1]	**C-STAT**	**Device**	
			Operating status **Control by bus**
Off	Yellow	Green	Motor on (clockwise or counterclockwise in the case of the RS1e-x and F-RS1e-x)
Off	Off	Flashing green [2]	No startup parameters received [4]
Off	Off	Green	Motor off
Off	Flickering green [2]	Green	Shutdown via input action quick stop [4]
Off	Off	Flickering green [5]	Energy-saving mode active
			Manual operation local Control via 2DI COM/ -2DI LC COM control modules
Off	Flickering yellow [2]	Green	Motor on (clockwise or counterclockwise in the case of the RS1e-x and F-RS1e-x)
Off	Flickering green [2]	Green	Motor off
Off	Flashing green [3]	Green	Lost connection in manual operating mode [4]
			Soft starting/coasting down (only with DSS1e-x)
Off	Flashing yellow [3]	Green	Motor is in soft start

1) Status of the LEDs in this form only when group diagnostics activated
2) Flicker frequency: 8 to 10 Hz
3) Flash frequency: 0.5 Hz
4) Display/function only from order number suffix: -.A**B**4
5) Flash sequence: 0.25 s on / 1.75 s from unique flashing rhythm for power-saving mode

Table 4-18: LED status and error displays for DS1e-x, RS1e-x, DSS1e-x, F-DS1e-x and F-RS1e-x

LEDs			Status/Cause/Remedy
SF [1]	**C-STAT**	**Device**	**Group error**
			Category: Device fault
Red	Red	Red	Current flow without switch-on command (e.g. contactor welded, connection through thy-ristor) Safety shutdown due to faults in the fail-safe area
Red	Off	Red	Defective electronics, self test error (e.g. contac-tor actuation defective, communication fault) Fault in the fail-safe area (defective electronic component)
			Category: System fault
Red	Green	Yellow	No current flow despite switch-on command (residual current detected) (e.g. contactor jammed, coil defective, no 400 V incoming supply, no load connected)
Red	Off	Yellow	Power switch tripped Overload, thermal motor model Overload, switching element Motor blocked Asymmetry Current limit violated Shutdown on account of input action (e.g.: end position shutdown through xB3, 4 or 2DI COM/2DI LC COM control module) Process mapping error Faulty parameterization Safety shutdown (SGx/U_2 missing) Switching element power supply missing Cold run shutdown [4]
Off	Off	Off	Electronics supply voltage missing
Red	Off	Off	Electronics power supply too low
			General warning
			Category: System fault
Off	-.AA**3**: Off -.AA**4** and -.A**B**4: Green	Flashing yellow [2]	• No current flow despite switch-on command (residual current detected) (e.g. contactor jammed, coil defective, no 400 V incoming supply, no load connected)
	Yellow	Flashing yellow [2]	• Thermal motor model overload • Asymmetry • Current range violation Group warning regarding input action (e. g. via 2DI COM/ -2DI LC COM control modules) • Switching element power supply missing • Power switch tripped/switched off • Maintenance timer limit value exceeded [4]

1) Status of the LEDs in this form only when group diagnostics activated
2) Flash frequency: 0.5 Hz
3) Flicker frequency: 8 to 10 Hz
4) Display/function only from order number suffix: -.A**B**4

Table 4-18: LED status and error displays for DS1e-x, RS1e-x, DSS1e-x, F-DS1e-x and F-RS1e-x

Only for F-DS1e-x and F-RS1e-x

LEDs	Status/Cause/Remedy
SGx	
Off	not parameterized and EMERGENCY STOP on mechanically selected rail
Flashing green 1)	no EMERGENCY STOP and not configured or EMERGENCY STOP and configured
Green	No EMERGENCY STOP and configured

1) Flash frequency: 0.5 Hz

Table 4-19: LED status and error displays for F-DS1e-x and F-RS1e-x

From order number suffix -.AA**4**, the following applies for the self test after POWER ON:

LEDs			
SF	**C-STAT**	**Device**	**SGx**
Red	Yellow	Yellow	Running light

Note
If two different SGx LEDs are flashing, the configuration does not correspond to the mechanically selected SG bus. Please check the mechanical selection or configuration.

Running light over all SGx LEDs:
Error in decoder for SG bus.
Remedy: replace the motor starter

4.8.12 Diagnosis of brake control modules xB3, xB4, xB6

SF		Group error	Red
2		Input limit switch, clockwise rotation	Green
6		Input limit switch, counterclockwise rotation	Green
STAT		Circuit state of brake	Yellow

LEDs				**Status/Cause/Remedy**
SF [1]	**2**	**6**	**STAT**	
Off	Green	Green	Off	Limit switch [4] not activated Brake is active, motor braked
Off	Green	Green	Yellow	Limit switch [4] not activated Brake released
Off	Off	Green	Off	Limit switch [4] for clockwise rotation activated, brake active motor braked
Off	Green	Off	Off	Limit switch [4] for counterclockwise rotation activated, brake active motor braked
Red	x [2]	x [2]	Yellow	Brake overload Motor braked [5]
Red	x [2]	x [2]	[3]	Bus fault

1) Status of the LEDs in this form only when group diagnostics activated
2) Circuit state is irrelevant
3) Depending on the parameterization in the motor starter
(for response in case of CPU/master STOP, see Section 8.2.2, 8.3.4, 8.4.5, 9.2.2, and 9.3.4)
4) With normally closed contact function
5) does not apply with xB6

Table 4-20: Status and error displays via LEDs for xB3, xB4, xB6

Note
The brake control modules xB1, xB2 and xB5 are not active modules and cannot therefore provide diagnostics, i.e. they cannot be configured in the control either.

4.9 Process mappings

4.9.1 Process mapping of DS1-x and RS1-x motor starters; standard

Input signals

DI 0.0	**Readiness for operation**	**DI 0.1**	**Return message from contactor**
0	Contactor jammed or fused (device fault)	0	Off
1	Ready for operation, no problems	1	On (clockwise/counterclockwise rotation in the case of RS-x 1)
DI 0.2	**Circuit breaker**	**DI 0.3**	Not set
0	Switched on (ON)		
1	Tripped (OFF)		

Output signals for DS1-x and RS1-x

DO 0.0	**Signal to contactor**	**DO 0.1**	**Signal to contactor** (RS1-x only)
0	Motor off Clockwise rotation off (in case of RS1-x)	0	Counterclockwise rotation off (only RS1-x)
1	Motor on Clockwise rotation on (in case of RS1-x)	1	Counterclockwise rotation on (only RS1-x)
DO 0.2	**Drive for expansion module** (e.g. brake control)	**DO 0.3**	Not set
0	No drive (e.g. brake control - brake active - motor braked)		
1	Drive (e.g. brake control - brake released - motor unbraked)		

4.9.2 Process mapping of DS1e-x, RS1e-x and DSS1e-x motor starters; high feature F-DS1e-x and FRS1e-x fail-safe motor starters

Input signals

DI 0.0	**Ready (automatic)**	**DI 1.0**	**Motor current I_{act}** [5]
0	Starter cannot be operated by host/PLC		Bit 0
1	Starter can be operated by host		
DI 0.1	**Motor on** [1]	**DI 1.1**	**Motor current I_{act}** [5]
0	Off		Bit 1
1	On (clockwise/counterclock-wise rotation)		
DI 0.2	**Group error**	**DI 1.2**	**Motor current I_{act}** [5]
	(If one or more faults described in Table 4-7 occur, "Group error" is reported irrespective of whether the "Group diagnosis" parameter (see Section 8.3.4, 8.4.5, and 9.3.4) is set to "Disable" or "Enable").		Bit 2
0	No faults		
1	Fault		
DI 0.3	**General warning**	**DI 1.3**	**Motor current I_{act}** [5]
0	No warning		Bit 3
1	Warning		
DI 0.4	**Input 1** [2]	**DI 1.4**	**Motor current I_{act}** [5]
0	[4]		Bit 4
1			
DI 0.5	**Input 2** [2]	**DI 1.5**	**Motor current I_{act}** [5]
0	[4]		Bit 5
1			
DI 0.6	**Input 3** [3]	**DI 1.6**	**Manual operation local**
0	[4]	0	No manual operation local
1		1	Manual operation local
DI 0.7	**Input 4** [3]	**DI 1.7**	**Ramp operation (for soft starter)**
0	[4]	0	Not active
1		1	Active

1) Signal is 1 if the motor current is >18.75% of the set rated current
2) From the expansion module, e.g. brake control xB3,4 (optional)
3) From 2DI COM/-2DI LC COM control module (optional)
4) See following Section "Input behavior"
5) See Section 10.3
For parameter description see Section 10

Input behavior

Inputs 1 to 4 of the fail-safe F-DS1e-x and F-RS1e-x motor starters behave in accordance with the motor starter profile of the PNO (PROFIBUS User Organization).

Inputs 1 to 4 on the DS1e-x, DSS1e-x and RS1e-x motor starter; high feature with order number suffixes -.AA**2** up to revision level E0**3** respond differently than do order number suffixes -.AA**2** from revision level E0**4** and order number suffix -.AA**3** and order number suffix -.A**B**4 when parameterizing NC function in process mapping of the inputs (PII).

There is no variation in behavior for the parameterization of the inputs for the normally open contact function.

The table below presents an overview of the differences:

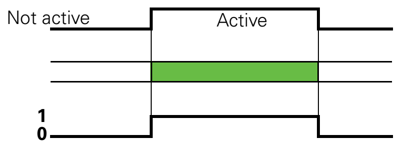
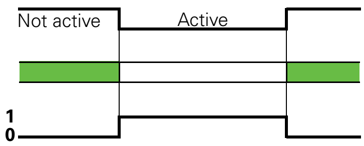
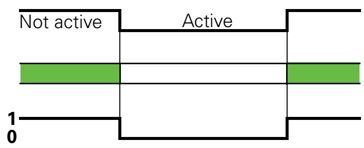
Input parameterized for		**With order number suffix -.AA2** and revision level **up to E03**	**With order number suffix -.AA2** and revision level **from E04** **or order number suffix -.AA3 or order number suffix -.AA4 or order number suffix -.AB4**
NO	 **LED** **PII**		
NC	 **LED** **PII**		

Table 4-21: Input behavior

Caution

When replacing a motor starter with revision level **up to E03** with order number suffix -.AA**2** with a motor starter with revision level **from E04** and order number suffix -.AA**2**; -.AA**3** or -.A**B**4 , care should be taken in the PLC user program because of the different behavior of an input when parameterizing NC function.

Output signals

DO 0.0	**Motor cw**	**DO 1.0**	Not used
0	Motor off		
1	Motor on		
DO 0.1	**Motor ccw** (for RS1e-x, F-RS1e-x)	**DO 1.1**	Not used
0	Motor off		
1	Motor on		
DO 0.2	**Drive for expansion module** (e.g. brake control)	**DO 1.2**	Not used
0	No drive (e.g. brake control - brake active - motor braked)		
1	Drive (e.g. brake control - brake released - motor unbraked)		
DO 0.3	**Trip Reset** (edge 0 > 1)	**DO 1.3**	Not used
0	Trip Reset inactive		
1	Trip Reset active		
DO 0.4	Emergency start	**DO 1.4**	Not used
0	Not active		
1	Active		
DO 0.5	**Self-test** (edge 0 > 1) (F-DS1e-x, F-RS1e-x only)	**DO 1.5**	Not used
0	Not active		
1	Active		
DO 0.6	Not used	**DO 1.6**	Not used
DO 0.7	Not used	**DO 1.7**	**Quick stop lock** (from order number suffixes: -.A**B**4)
		0	not activated
		1	activated

4.9.3 Process mapping of xB3, xB4, xB6 brake control modules

Input signals

DI 0.0	**Input 1**	**DI 0.1**	**Input 2**
0	No current flow	0	No current flow
1	Current flow present	1	Current flow present

Output signals

DO 0.0	Reserved	**DO 0.1**	Reserved
0	-	0	-
1	-	1	-

4.10 Motor Starter ES

Features

The "*Motor Starter ES*" diagnostics and commissioning tool (version 2.0 and above) offers:

- Structured and tool-supported configuration of low-voltage switching devices
- Quick diagnosis

Local commissioning and monitoring on site such as:

- Parameter assignment during operation of the programmable controller and control system
- Observation
- Diagnostics and testing
- Factory setting
- Read individual phase currents as direct values
- Residual current detection
- A parameterization block can be set
- Integrated online help
- Read statistics and measured values

Application

The "*Motor Starter ES*" diagnostic and commissioning tool is suitable for the following motor starters:

- High feature with order number suffixes -.AA**3**
- High feature with order number suffixes .AA4
- High feature with order number suffixes -.A**B**4
  (from software motor starter ES 2007 + SP4)
- Fail-safe motor starters:

The connection between the PC or programming device and the motor starter is set up using a LOGO! PC cable and 2DI COM/2DI LC COM control module (see Section 4.4/4.5 for a description) that is installed on the corresponding motor starter.

You can find additional information on the software in the online help.

Order numbers

You will require the following order numbers:

- LOGO! PC cable: 6ED1057-1AA00-0BA0
- The diagnostic and commissioning tool "*Motor Starter ES*":
  - Basic package, Floating License 3ZS1310-**4**CC10-0YA5
  - Standard package, Floating License 3ZS1310-**5**CC10-0YA5
  - Premium package, Floating License 3ZS1310-**6**CC10-0YA5
- 2DI COM control module: 3RK1903-0CH10 or
  2DI LC COM control module: 3RK1903-0CH20

Note
When using the high feature starter -.AB4 with Motor Starter ES and a STEP 7, special diagnosis is not possible for an online diagnosis. The diagnosis can be carried out using Motor Starter ES.

4.11 High Feature motor starter with order number suffix -.AB4

4.11.1 Device replacement of HF starters -.AA3 and -.AA4 with -.AB4 starters

The new motor starters (-.AB4) are backwards-compatible, i.e. when replacement is required (old -.AA3 or -.AA4 starters), they are replaced with new starters with no S7 re-configuration or modification of the user program), the new starters runs in DPV0 operation with 12 bytes of parameter data and can be operated like the replaced unit in terms of data technology. For active use of the newly integrated DPV1 functionality, the new starter must be re-configured on the control. In the startup, the following differences in the telegram length parameter data are generated:
Motor starter; high feature with order number suffixes -.AA3 12 bytes
Motor starter; high feature with order number suffixes -.AA4 12 bytes
Motor starter; high feature with order number suffixes -.AB4 22 Byte (required due to DPV1 support)

Note
If a -.AA3 starter is replaced by a -.AB4 starter, a change in the device response is generated with power switch OFF (see Section 10.7.3, table 10-18).

4.11.2 Device response during parameterization

With a DPV0 start-up, the parameter values of all parameters not accessible via DPV0. This has the advantage that a full parameterization previously carried out using the DS131 (via DPV1 start-up mode, C2 channel or Motor Starter ES) is effective apart from the DPV0 part (= differential parameterization).
If backup of all DS131 parameters against overwriting in the new startup operating state is desired, this can be achieved by setting a parameter lock (command). A basic factory setting can be carried out directly on the device with motor starters; high feature with order number suffixes -.AB4 (see Section 10.18).

4.11.3 Power supply for High Feature motor starter with order number suffix -.AB4

Note
Motor starters; high feature with order number suffix -.AB4 that are not integrated via GSD/GSDML into the ET200S station use extended start-up data records
To ensure that the motor starters; high feature are automatically assigned the extended start-up data records on the re-start of the ET200S station, the electronics power supply (U_1 of the PM-D module) of the motor starter; high feature are supplied from the same voltage source as the interface module (header module).

4.11.4 Configuration of High Feature motor starter with order number suffix -.AB4

4.11.4.1 Configuration and parameterization with STEP

When configuring the motor starter via STEP 7, the complete parameterization is set in hardware config and automatically sent to the motor starters.
The following interface modules support the complete parameterization of the motor starters:

• 6ES7 151-1AA04-0AB0
• 6ES7 151-1AA05-0AB0
• 6ES7 151-1AB05-0AB0
• 6ES7 151-1BA02-0AB0
• 6ES7 151-7AA20-0AB0
• 6ES7 151-7FA20-0AB0
• 6ES7 151-3AA23-0AB0 V6.1
• 6ES7 151-3AA23-0AB0 V7.0
• 6ES7 151-3BA23-0AB0 V6.1
• 6ES7 151-3BA23-0AB0 V7.0
• 6ES7 151-3BB23-0AB0 V6.1
• 6ES7 151-3BB23-0AB0 V7.0
• 6ES7 151-8AB00-0AB0
• 6ES7 151-8FB00-0AB0
• 6ES7 151-8AB01-0AB0
• 6ES7 151-8FB01-0AB0

Table 4-22: Interface modules with support of the complete parameterization scope

On interface modules that do not support the complete parameterization scope of the motor starters, a motor starter; high feature with order number suffix -.AB4 must be configured as motor starter; high feature with order number suffix -.AA4.

For example: a 3RK1301-0AB10-0A**B**4 must be configured as 3RK1301-0AB10-0A**A**4

Note
In the following cases, the full scope of the parameters is reduced as a function of the system by the calculation tool to the standard parameters:
- Activated DPV0 alarm mode (for PROFIBUS IMs)
- Activated option handling (for PROFIBUS IMs)
- For configuring via GSD/GSDML

4.11.4.2 Configuration and parameterization with GSD/GSDML

When configuring the motor starter with GSD/GSDML, only the default parameters are available.
Setting the parameter "Wait for startup data records" means that it is possible to send the complete parameterization scope to the starter as startup data records from the user program. This applies in particular to field bus masters from other manufacturers.

For complete startup parameterization, multiple parameter data records are required.
If associated data records are to be sent for the startup, the list data set DS128 must be sent to the starter first.
List data set DS128 must contain the data record numbers for all data records to be sent to the starter.

Layout of the DS128:

Byte	Meaning	Value
0	Coordination	32
1 ... 6	Reserved	0 ... 6
7	Number of startup data records	0
8 ... 13	DS131: Device parameters (see Section A.16) DS134: Maintenance (see Section A.17) DS165: Comment (see Section A.18) DS232: Equipment identifier (see Section A.19.2) DS233: Installation (see Section A.19.3) DS234: Description (see Section A.19.4)	131 134 165 232 233 234
14 ... 27	Reserved	0

The startup data records must be written to the device in the sequence as listed in the data record 128 (bytes 8 ... 13). The number of startup data records can vary between one and six data records. The time between sending the individual startup data records must not exceed 5 seconds.
If no list data record (DS128) is used, the device accepts each data record individually. This also occurs with an empty DS128 (number of data records = 0).

After receiving the specified data records, the motor starter is ready for operation and can be operated via the control.

General technical specifications 5

5.1 Shipping and storage conditions

Shipping and storage conditions

The motor starters fulfill the requirements of IEC 61131, part 2 in respect of shipping and storage conditions. The following information applies to modules that are shipped and stored in their original packaging.

Type of condition	Permissible range
Free fall	0.35 m
Temperature	from -40 °C to +70 °C
Temperature variation	20 K/h
Air pressure	from 1080 to 660 hPa (corresponds to an altitude of -1000 to 3500 m)
Relative humidity	from 5 to 95 %, without condensation

Insulation resistance

Circuits with rated voltage U_e against other circuits or earth	Test voltage in accordance with IEC 61131, part 2
0 V < U_e ≤ 50 V	500 VDC
300 V < U_e ≤ 600 V	2.6 kVDC to ground

5.2 Mechanical and climatic environmental conditions

Installation position

The preferred installation position is horizontal on a vertical wall. to do this, please also observe the information in Section 3.4 'Derating'.

Mechanical environmental conditions

Oscillations tested in accordance with IEC 60068, part 2-6 (sine)	
• Oscillation type:	Frequency sweeps with a rate of change of 1 octave a minute
- 10 Hz ≤ f ≤ 58 Hz	Constant amplitude: 0.15 mm
- 58 Hz ≤ f ≤ 150 Hz	Constant acceleration: 2 g
• Oscillation time:	10 frequency sweeps per axis in each of the 3 axes arranged vertically in relation to each other
Shock tested in accordance with IEC 60068, part 2-27 (right angle)	
• Type of shock:	Half sine
• Intensity of shock:	5 g peak value, 11 ms duration
• Direction of shock:	3 shocks in the +/– directions in each of the 3 axes arranged vertically in relation to each other

Climatic environmental conditions

Betriebstemperatur Temperature variation Permissible rated current	0°C to 60°C, from +40°C with derating (See Section 3.4 'Derating')	
Relative humidity	from 5 to 95 %	
Air pressure	from 1080 to 795 hPa	Corresponds to an altitude of -1000 to 2000 m
Contaminant concentration	SO_2 : < 0.5 ppm rel. humidity < 60 %, no condensation	Test: 10 ppm; 4 days
	H_2S: < 0.1 ppm rel. humidity < 60 %, no condensation	1 ppm; 4 days

5.3 Electromagnetic compatibility

Definition of "EMC"

Electromagnetic compatibility is the capability of an electrical device to work satisfactorily in an electromagnetic environment without influencing the environment.
ET 200S motor starters and their modules also fulfil the requirements of the EMC Directive of the European Single Market. The prerequisite for this is that the ET 200S distributed I/O device meets the requirements and guidelines regarding the electrical structure.

Pulse-shaped disturbance variables

The following table shows the electromagnetic compatibility of the fail-safe modules in comparison with pulse-shaped disturbance variables.

Pulse-shaped disturbance variable	Tested with	Corresponds to degree of severity
Electrostatic discharge according to IEC 61000-4-4	8 kV 4 kV	3 (air discharge) 3 (contact discharge)
Burst pulse (fast, transient disturbance variables) according to IEC 61000-4-4.	2 kV (supply line) 1 kV	3 3
High-energy individual pulse (surge) according to IEC 61000-4-5. For degrees of severity 2 and 3, an external safety circuit is required (see paragraph below).		
• Asymmetrical coupling	2 kV (supply line) 2 kV (signal line/data line)	
• Asymmetrical coupling	1 kV (supply line) 1 kV (signal line/data line)	3

Sinusoidal disturbance variables

The following table shows the electromagnetic compatibility of the ET 200S motor starters and their respective modules in comparison with sinusoidal disturbance variables.

- HF irradiation according to IEC 61000-4-3
  Electromagnetic HF field, amplitude-modulated

80 to 1000 MHz, 1.4 to 3 GHz
10 V/m
80% AM (1 kHz)

HF decoupling according to IEC 61000-4-6
0.15 MHz to 80 MHz
10 V_{eff} unmodulated
80% AM (1 kHz)

Emission of radio interference

Emitted interference of electromagnetic fields according to EN 55011/CISPR 11: limit value class A, Group 1 (measured at a distance of 10 m).

Frequency	Emitted interference
from 30 to 230 MHz	< 40 dB (μV/m) Q
from 30 to 230 MHz	< 47 dB (μV/m) Q

Protecting the ET 200S motor starters from overvoltage

If your plant requires protection from overvoltage, an external safety circuit (surge filter) should be placed upstream of the electronics/contactor supply of the terminal modules to guarantee the surge resistance of the ET 200S motor starters.

Note
Lightning protection measures always require an individual assessment of the plant as a whole.
An almost complete protection from overvoltage can only be achieved, however, when the entire surrounding building has been designed for protection against overvoltage. In particular, this includes applying structural measures to the building right from the planning stage.
For comprehensive protection from overvoltage, get in touch with your Siemens contact person or a company that specializes in lightning protection.

Fail-safe modules/motor starters

Fail-safe modules/motor starters were additionally tested according to the IEC 61326-3-1 and IEC 62061 standards.

Explosion protection

The ET 200S Standard starters (3RK1301-xxB00-xAA2) have ATEX approval in accordance with EU Directive 94/9/EC.
They are suitable for protecting motors of the "Increased Safety e" type of protection.
The EC type test certificate for Category (2) G/D is available. It has the number DMT 02 ATEX F OO1.

Terminal modules 6

6.1 Assignment of the terminal modules

The following tables show which power modules, motor starters, expansion modules, and fail-safe modules you can use with the various terminal modules.

You can find information on the terminal modules in the following sections:

- Safety-integrated systems in Section 11
- Section 12 for expansion modules such as the brake control module
- Fail-safe modules in Section 13

Power modules	**Terminal modules**						
	TM-P15 S27-01	TM-PF30 S47					TM-X15 S27-01
		... -B0	... -B1	... -C0	... -C1	... -D0	
3RK1903	-0AA00	-1AA10	-1AA00	-1AC10	-1AC00	-1AD10	-1AB00
PM-D	X						
PM-D F1		X	X				
PM-D F2		X	X				
PM-D F3				X	X		
PM-D F4				X	X		
PM-D F5						X	
PM-X							X

Table 6-1: Assignment of the terminal modules for power modules

Motor starters	Terminal modules			
	TM-DS45 -S32	TM-RS90 -S32	TM-DS65 -S32	TM-RS130 -S32
	TM-DS45 -S31	TM-RS90 -S31	TM-DS65 -S31	TM-RS130 -S31
3RK1903	-0AB00 -0AB10	-0AC00 -0AC10	-0AK00 -0AK10	-0AL00 -0AL10
DS1-x direct starter; standard	X			
DS1e-x direct starter; high feature			X	
DSS1e-x direct soft starter; high feature			X	
RS1-x reversing starter; standard		X		
RS1e-x reversing starter; high feature				X

Table 6-2: Assignment of the terminal modules for motor starters

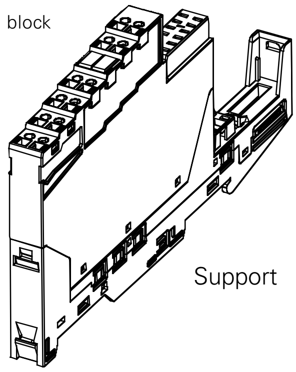
Fail-safe modules	Terminal modules			
	TM-FDS65 -S32	TM-FRS130 -S32	TM-PFX30 S47-G1	TM-FCM30 S47
	TM-FDS65 -S31	TM-FRS130 -S31	TM-PFX30 S47-G0	
3RK1903	-3AC00 -3AC10	-3AD00 -3AD10	-3AE00 -3AE10	-3AB10
Fail-safe F-DS1e-x direct starter	X			
Fail-safe F-RS1e-x reversing starter		X		
PM-D F X1 power/expansion module			X	
F-CM contact replicator				X
PM-D F PROFIsafe power module See the "*ET 200S Distributed I/O Devcie for Fail-Safe Modules.*"				

Table 6-3: Assignment of the terminal modules for fail-safe modules

6.2 TM-P15 S27-01 terminal module for PM-D power module

Features

- The terminal module consists of a support and a terminal block.
- TM-P15 S27-01 terminal module for PM-D power module
- Connection by screw-type terminal
- Prewiring of the terminal module
- AUX1 cable fed through without terminals



Color coding labels

1. You can apply the color coding labels in the opening provided next to the terminal directly from the strip.
2. Push the color coding labels onto the terminal module with your finger.

Looping the potentials through

Terminals 1/8, 2/9, 4/11, 5/12, 6/13 and 7/14 are bridged in the terminal module and can be used to loop the potentials through.

Terminal assignment

The following table illustrates the terminal assignment of the TM-P15 S27-01 terminal module:

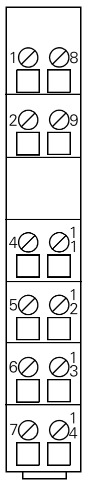
View	Terminal	Meaning	
	**1/8** **2/9**	L+ M	**U_1:** Voltage supply for electronic components U_{RATED} = 24 V DC
	4/11 **5/12**	A1+ A2-	**U_2:** Voltage supply for contactor U_{RATED} = 24 V DC
	6/13	AUX2	For safety-integrated systems, see Section 11.6.6
	7/14	AUX3	For safety-integrated systems, see Section 11.6.6
	-	AUX1	Fed through without terminals

Table 6-4: Terminal assignment of the TM-P15 S27-01 terminal module for the PM-D power module

Note on power supply of motor starters; high feature with order number suffix -.AB4
Motor starters; high feature with order number suffix -.AB4 that are not integrated via GSD/GSDML into the ET200S station use extended start-up data records
To ensure that the motor starters; high feature are automatically assigned the extended start-up data records on the re-start of the ET200S station, the electronics power supply (U_1 of the PM-D module) of the motor starter; high feature are supplied from the same voltage source as the interface module (header module).

Technical specifications - TM-P15 S27-01

Dimensions and weight	
Installation dimensions W x H x D (mm)	15 x 196.5 x 102
Depth with power module (mm)	117.5
Weight (g)	approx. 175
Insulation voltages and rated currents	
Insulation voltage	500 V
Rated operating voltage	24 VDC
Rated operating current	10 A
Conductor cross-sections	
Single-core (mm^2)	1 x (0.14 to 2.5) to IEC 60947 1 x 2.5
Finely stranded with wire end ferrule (mm^2)	1 x (0.14 to 1.5) to IEC 60947
AWG cables, single- or multi-core	1 x (18 to 22)
Wiring	
Tool required	Standard screwdriver, size 1
Tightening torque (Nm)	0.4 to 0.7

Table 6-5: Technical specifications - TM-P15 S27-01

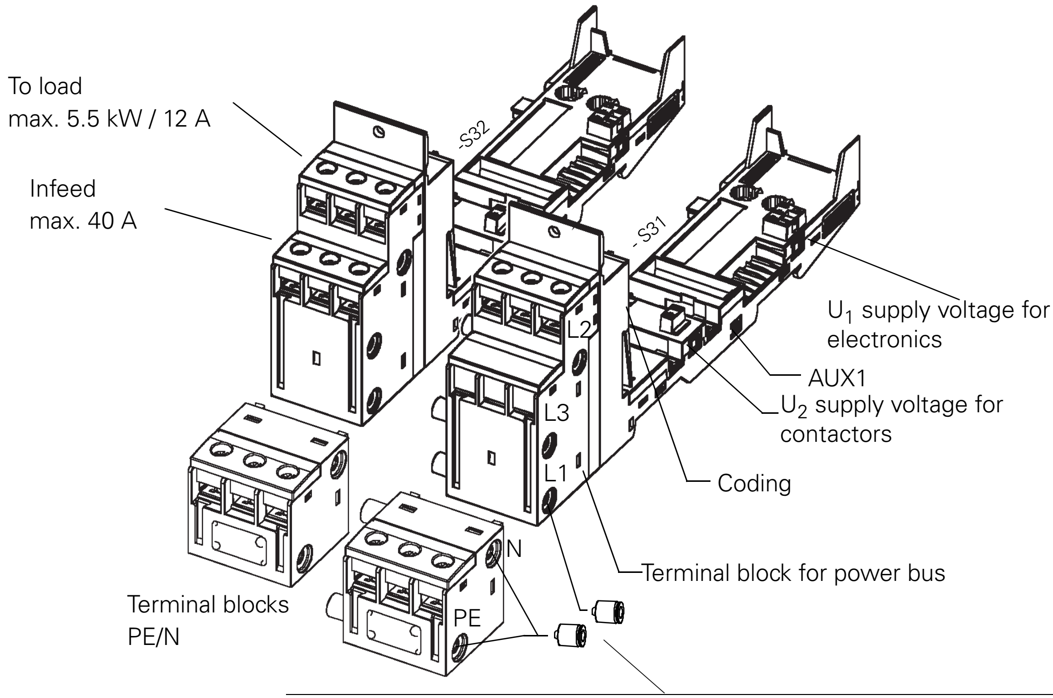
6.3 Terminal modules for motor starters

6.3.1 TM-DS45 terminal modules for the DS1-x direct starter; standard

Features

- TM-DS45... terminal modules for the DS1-x direct starter; standard
  - with TM-DS45 S32 power bus infeed
  - with TM-DS45 S31 power bus throughfeed
- Connection by screw-type terminals
- Prewiring possible
- AUX1 cable fed through without terminals
- Expansion possible with PE/N terminal block

TM-DS45 terminal modules



Warning
In the case of the last terminal module for motor starters in a load group, the open contacts must be sealed with caps on the power bus (L1, L2, L3, N, PE) prior to commissioning, so that they are safe from touching (push the caps on firmly). This prevents the contacts being touched and removes the danger of an electric shock (400 V AC).

Figure 6-1: TM-DS45 terminal modules for the DS1-x direct starter; standard

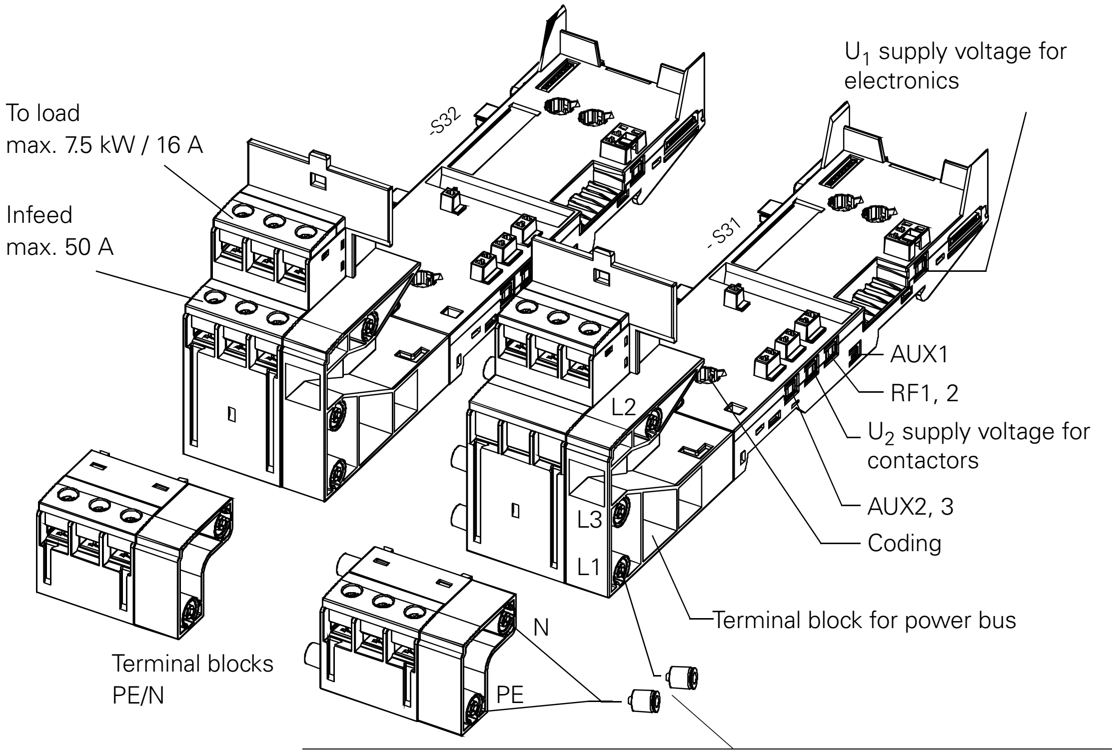
Important
Install the PE/N terminal blocks before connecting the terminal modules for motor starters.

6.3.2 TM-DS65 terminal modules for DS1e-x direct starter; high feature and DSS1e-x direct soft starter; high feature

Features

- TM-DS65... terminal modules for DS1e-x direct starter; high feature and DSS1e-x direct soft starter; high feature
  - with TM-DS65 S32 power bus infeed
  - with TM-DS65 S31 power bus throughfeed
- Connection by screw-type terminals
- Prewiring possible
- AUX1 cable fed through without terminals
- Expansion possible with PE/N terminal block
- Fail-safe-kit functionality is integrated

TM-DS65 terminal modules



Warning
In the case of the last terminal module for motor starters in a load group, the open contacts must be sealed with caps on the power bus (L1, L2, L3, N, PE) prior to commissioning, so that they are safe from touching (push the caps on firmly). This prevents the contacts being touched and removes the danger of an electric shock (400 V AC).

Figure 6-2: TM-DS65 terminal modules for DS1e-x direct starter and DSS1e-x soft starter; high feature

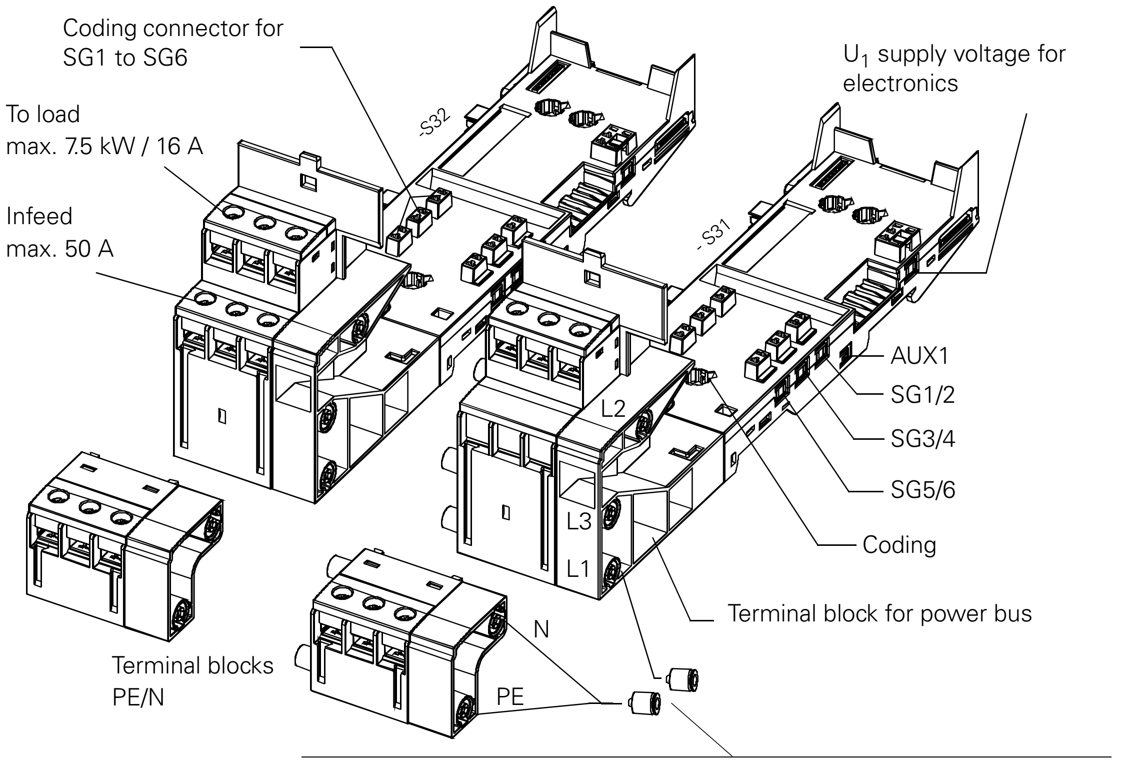
Important
Install the PE/N terminal blocks before connecting the terminal modules for motor starters.

6.3.3 TM-FDS65 terminal modules for fail-safe F-DS1e-x direct starters

Features

- TM-FDS65 terminal modules for fail-safe F-DS1e-x direct starters
  - with TM-FDS65 S32 power bus infeed
  - with TM-FDS65 S31 power bus throughfeed
- Connection by screw-type terminals
- Prewiring possible
- AUX1 cable fed through without terminals
- Coding connector for SG1 to SG6
- Expansion possible with PE/N terminal block
- The fail-safe modules are identified by yellow labeling strips.

TM-FDS65 terminal modules



Warning
In the case of the last terminal module for motor starters in a load group, the open contacts must be sealed with caps on the power bus (L1, L2, L3, N, PE) prior to commissioning, so that they are safe from touching (push the caps on firmly). This prevents the contacts being touched and removes the danger of an electric shock (400 V AC).

Figure 6-3: TM-FDS65 terminal modules for fail-safe F-DS1e-x direct starters

Important
Install the PE/N terminal blocks before connecting the terminal modules for motor starters.

6.3.4 Technical specifications, TM-DS45 and TM-DS65/TM-FDS65

Dimensions and weight	**TM-DS45**	**TM-DS65/TM-FDS65**
Installation dimensions W x H x D (mm)	45 x 264 x 100	65 x 290 x 100
Height with PE/N terminal block (mm)	306	332
Depth with motor starter (mm)	127	150
Depth with motor starter and fail-safe kit (safety-integrated system) (mm)	152	-
Depth with motor starter and 2DI COM control module (mm)	-	173
Weight (g)	approx. 305	approx. 400
Shock protection		
Type of protection according to IEC 60529	IP20, (IP00 im Anschlussraum von L1 - L3, T1 - T3, N und PE)	
Rated voltages, currents and frequencies for the power bus		
Rated insulation voltage U_i	690 V	
Rated operating voltage U_e	500 V AC	
Rated impulse strength U_{imp}	6 kV	
Rated operating current I_e	40 A	50 A
Rated frequency	50/60 Hz	
Conductor cross-sections		
Single-core (mm^2)	1 x 10 2 x (1 to 2.5) or 2 x (2.5 to 6)	
Finely stranded with wire end ferrule (mm^2)	2 x (1 to 2.5) or 2 x (2.5 to 6) in acc. with IEC 60947	
AWG cables, single- or multi-core	2 x (14 to 10)	
With 3-phase feed-in terminal, if necessary Single-core or multi-core (mm^2) Finely stranded with wire end ferrule (mm^2) AWG cables, single- or multi-core	 1 x 2.5 to 25 1 x 2.5 to 25 1 x 12 to 4	
Wiring		
Tool required	Standard screwdriver, size 2 and Pozidriv 2	
Tightening torque (Nm)	2.0 to 2.5	

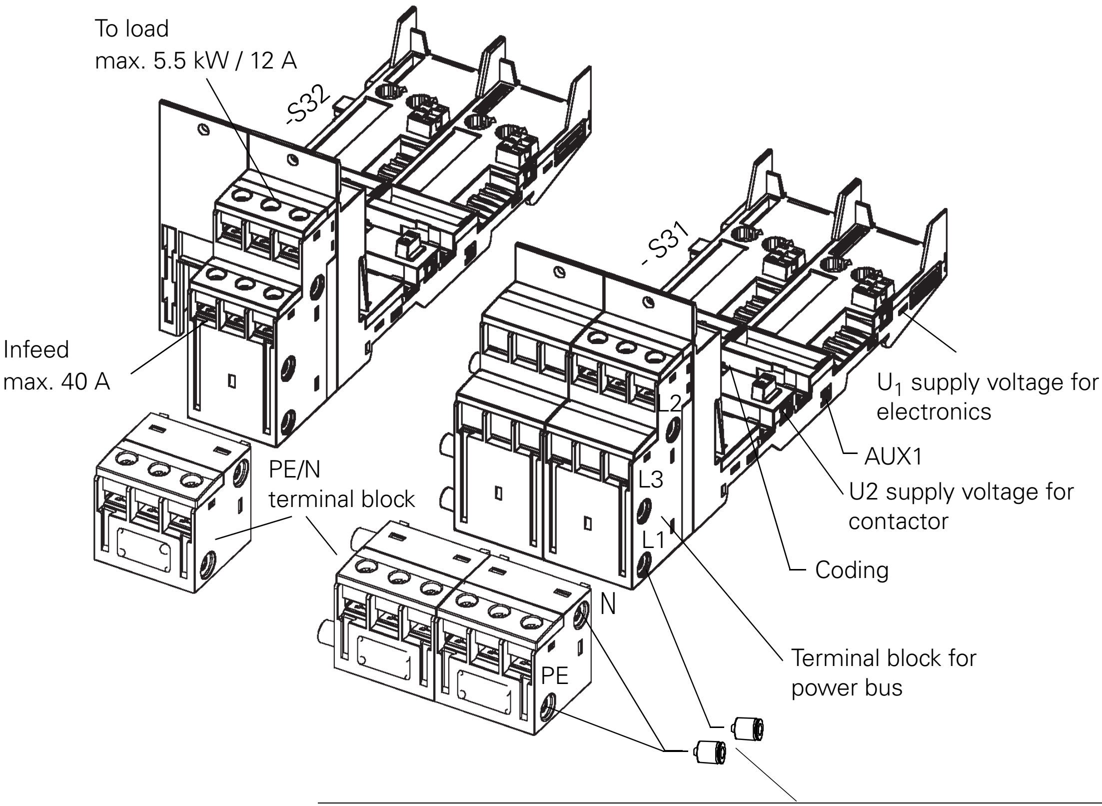
Table 6-6: Technical specifications - TM-DS45 and TM-DS65/TM-FDS65

6.3.5 TM-RS90 terminal modules for RS1-x reversing starter; standard

Features

- TM-RS90... terminal modules for RS1-x reversing starter; standard
  - with TM-RS90 S32 power bus infeed
  - with TM-RS90 S31 power bus throughfeed
- Connection by screw-type terminal
- Prewiring possible
- AUX1 cable fed through without terminals
- Expansion possible with two PE/N terminal blocks

TM-RS90 terminal modules



Warning
In the case of the last terminal module for motor starters in a load group, the open contacts must be sealed with caps on the power bus (L1, L2, L3, N, PE) prior to commissioning, so that they are safe from touching (push the caps on firmly). This prevents the contacts being touched and removes the danger of an electric shock (400 V AC).

Figure 6-4: TM-RS90 terminal modules for RS1-x reversing starter; standard

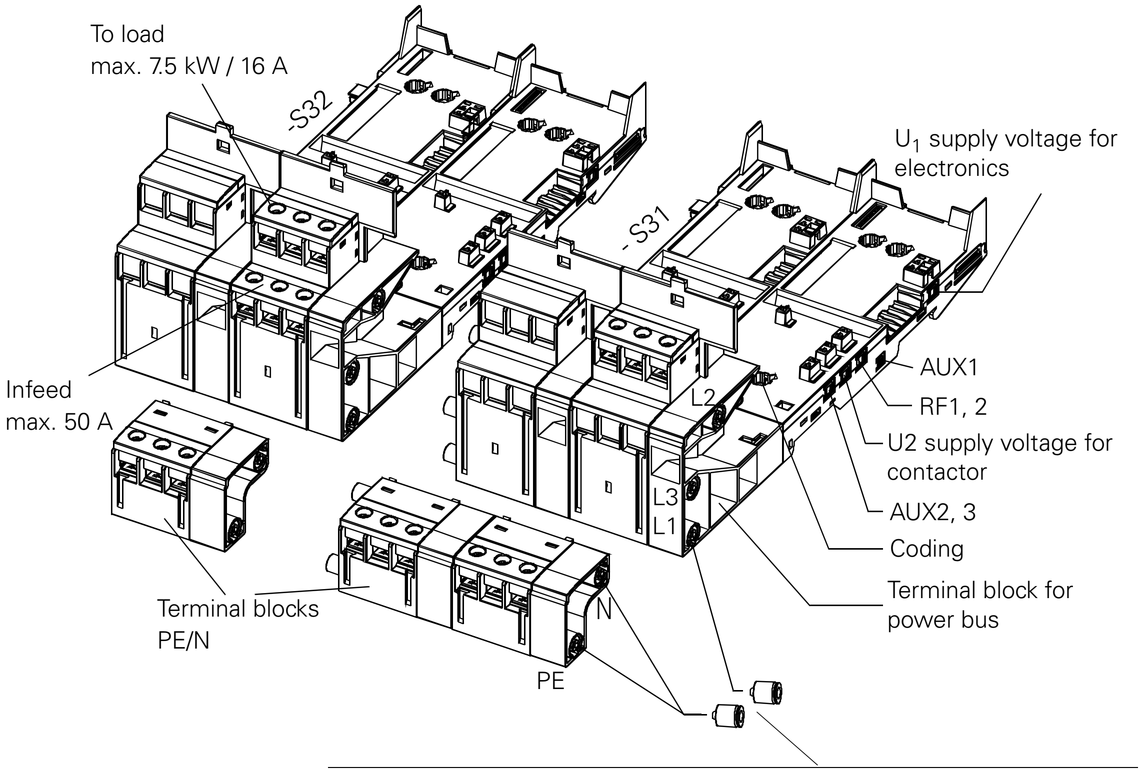
Important
Install the PE/N terminal blocks before connecting the terminal modules for motor starters.

6.3.6 TM-RS130 terminal modules for RS1e-x reversing starter; high feature

Features

- TM-RS130... terminal modules for RS1e-x reversing starter; high feature
  - with TM-RS130 S32 power bus infeed
  - with TM-RS130 S31 power bus throughfeed
- Connection by screw-type terminal
- Prewiring possible
- AUX1 cable fed through without terminals
- Expansion possible with two PE/N terminal blocks
- Fail-safe-kit functionality is integrated

TM-RS130 terminal modules



Warning
In the case of the last terminal module for motor starters in a load group, the open contacts must be sealed with caps on the power bus (L1, L2, L3, N, PE) prior to commissioning, so that they are safe from touching (push the caps on firmly). This prevents the contacts being touched and removes the danger of an electric shock (400 V AC).

Figure 6-5: TM-RS130 terminal modules for RS1e-x reversing starter; high feature

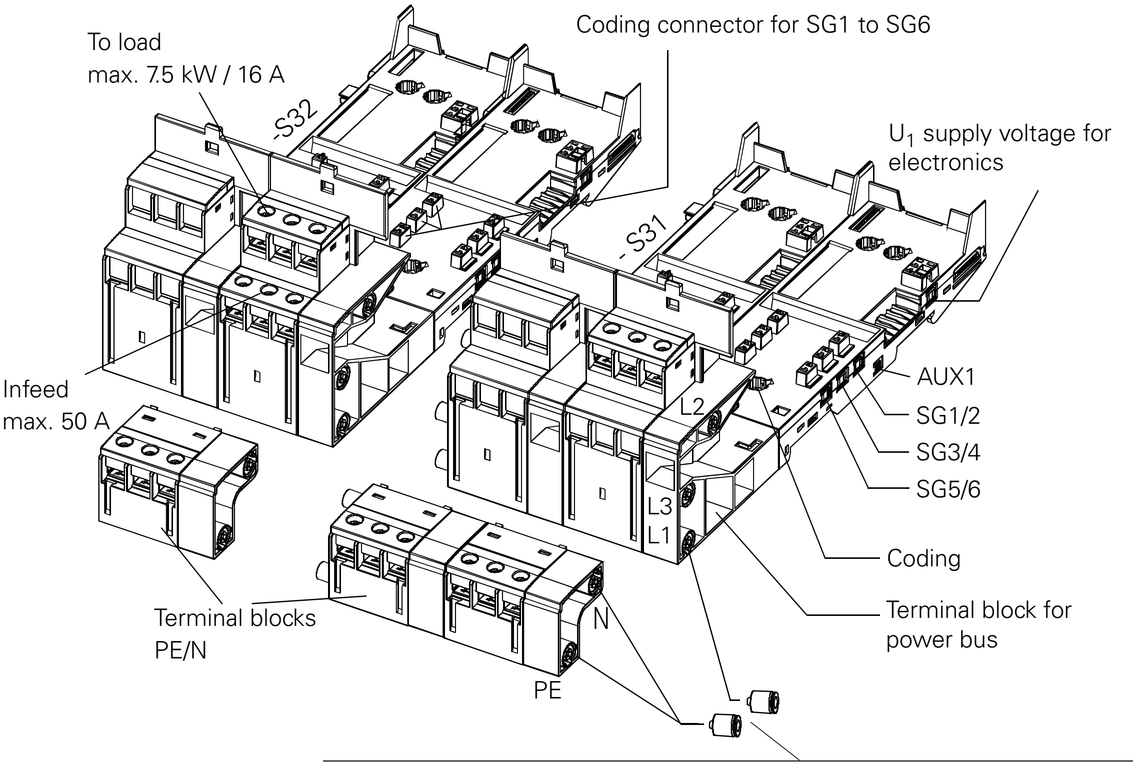
Important
Install the PE/N terminal blocks before connecting the terminal modules for motor starters.

6.3.7 TM-FRS130 terminal modules for fail-safe F-RS1e-x reversing starters

Features

- TM-FRS130 terminal modules for fail-safe F-RS1e-x reversing starters
  - with TM-FRS130 S32 power bus infeed
  - with TM-FRS130 S31 power bus throughfeed
- Connection by screw-type terminal
- Prewiring possible
- AUX1 cable fed through without terminals
- Coding connector for SG1 to SG6
- Expansion possible with two PE/N terminal blocks
- The fail-safe modules are identified by yellow labeling strips.

TM-FRS130 terminal modules



Warning
In the case of the last terminal module for motor starters in a load group, the open contacts must be sealed with caps on the power bus (L1, L2, L3, N, PE) prior to commissioning, so that they are safe from touching (push the caps on firmly). This prevents the contacts being touched and removes the danger of an electric shock (400 V AC).

Figure 6-6: TM-FRS130 terminal modules for fail-safe F-RS1e-x reversing starters

Important
Install the PE/N terminal blocks before connecting the terminal modules for motor starters.

6.3.8 Technical specifications - TM-RS90 and TM-RS130/TM-FRS130

Dimensions and weight	TM-RS90	TM-RS130/TM-FRS130
Installation dimensions W x H x D (mm)	90 x 264 x 100	130 x 290 x 100
Height with PE/N (mm)	306	332
Depth with motor starter (mm)	127	150
Depth with motor starter and fail-safe kit (safety-integrated system) (mm)	152	-
Depth with motor starter and 2DI COM control module (mm)	-	173
Weight (g)	approx. 600	approx. 800
Shock protection		
Type of protection according to IEC 60529	IP20, (IP00 im Anschlussraum von L1 - L3, T1 - T3, N und PE)	
Rated voltages, currents and frequencies for the power bus		
Rated insulation voltage U_i	690 V	
Rated operating voltage U_e	500 V AC	
Rated impulse strength U_{imp}	6 kV	
Rated operating current I_e	40 A	50 A
Rated frequency	50/60 Hz	
Conductor cross-sections		
Single-core (mm^2)	1 x 10 2 x (1 to 2.5) or 2 x (2.5 to 6)	
Finely stranded with wire end ferrule (mm^2)	2 x (1 to 2.5) or 2 x (2.5 to 6) in acc. with IEC 60947	
AWG cables, single- or multi-core	2 x (14 to 10)	
With 3-phase feed-in terminal, if necessary Single-core or multi-core (mm^2) Finely stranded with wire end ferrule (mm^2) AWG cables, single- or multi-core	 1 x 2.5 to 25 1 x 2.5 to 25 1 x 12 to 4	
Wiring		
Tool required	Standard screwdriver, size 2 and Pozidriv 2	
Tightening torque (Nm)	2.0 to 2.5	

Table 6-7: Technical specifications - TM-RS90 and TM-RS130/TM-FRS130

6.4 Power bus

Features

- The power bus consists of components that have fixed links to the terminal modules for the motor starters.
- The power bus distributes the power in a load group.
- The maximum current-carrying capacity at 60 °C is:
  – In terminal modules with an installation width of 45/90 mm, 40 A for motor starter; standard
  – For terminal modules with 65/130 mm installation width 50 A for motor starter; high feature/fail-safe
- The wiring is done automatically when the terminal module is installed.
- Terminal blocks with an installation width of 45 or 90 mm and 65 or 130 mm
  – with power bus infeed (for one load group) and motor connection
  – with power bus throughfeed and motor connection
- Power bus: 3 pins (L1, L2, L3),
  expandable to 5 pins with PE/N terminal block.

View

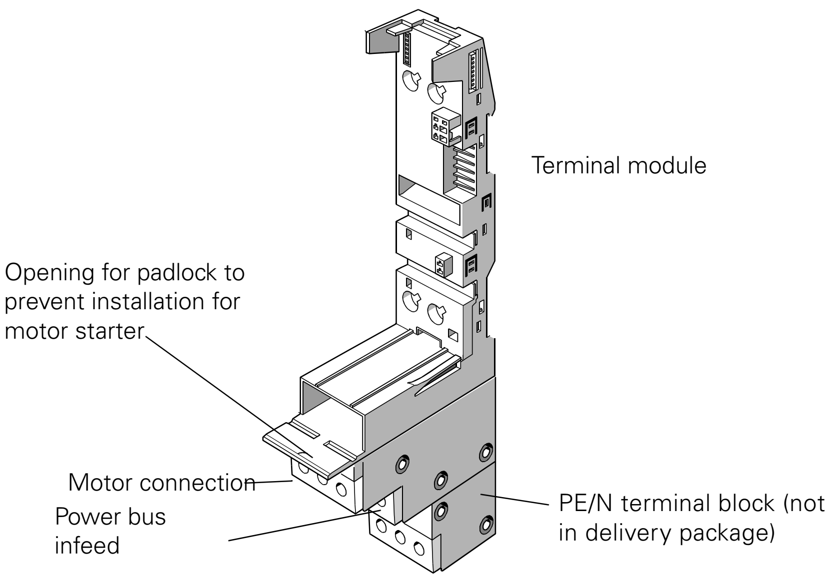


Figure 6-7: TM-DS45 terminal module - example for DS1-x direct starter; standard

Warning
In the case of the last terminal module for motor starters in a load group, the open contacts must be sealed with caps on the power bus (L1, L2, L3, N, PE) prior to commissioning, so that they are safe from touching (push the caps on firmly). This prevents the contacts being touched and removes the danger of an electric shock (400 V AC).

PE/N terminal block accessories

The power bus can be supplemented by a PE/N terminal block. Terminal blocks with installation widths of 45 and 65 mm are available as follows:

- with infeed at the beginning of a new load group (i.e. contacts on the right only). This terminal block is supplied with caps for N and PE
- with throughfeed (i.e. with contacts on the right and left)

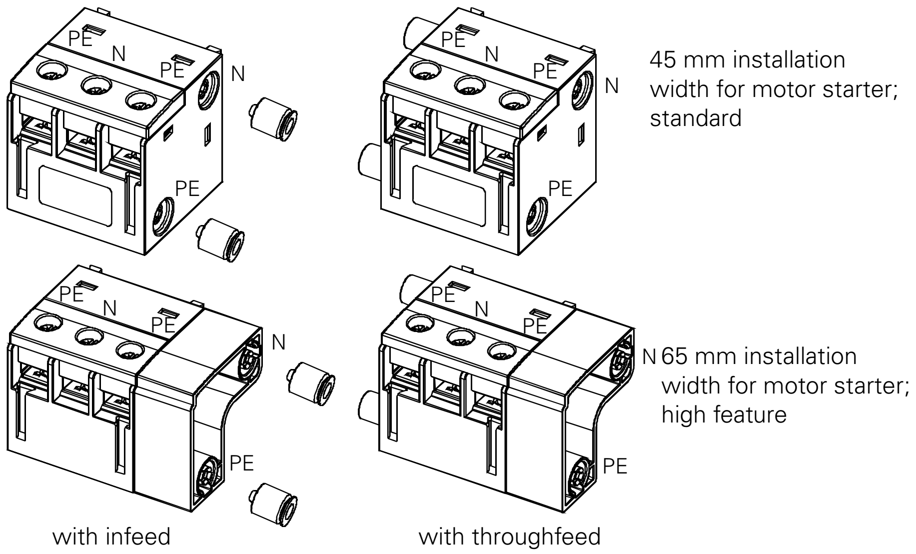


Figure 6-8: PE/N terminal block

Warning

In the case of the last terminal module for motor starters in a load group, the open contacts must be sealed with caps on the power bus (L1, L2, L3, N, PE) prior to commissioning, so that they are safe from touching (push the caps on firmly). This prevents the contacts being touched and removes the danger of an electric shock (400 V AC).

Important

Install the PE/N terminal blocks before connecting the terminal modules for motor starters.

Load group

All the motor starters supplied via **a** single power bus infeed are referred to as a load group. A load group does not have to be identical to a potential group. Within a group of motor starters supplied by the same power module, an additional power bus infeed may be required to ensure that the rated operating current (aggregate current) of the terminal modules is not exceeded.

The aggregate current of the power bus may amount to the following:

- for terminal modules with an installation width of 45 or 90 mm: 40 A (for motor starter; standard)
- for terminal modules with an installation width of 65 or 130 mm: 50 A (for motor starter; high feature/fail-safe)

Current flow via the power bus

The following image shows the current flow via the power bus:

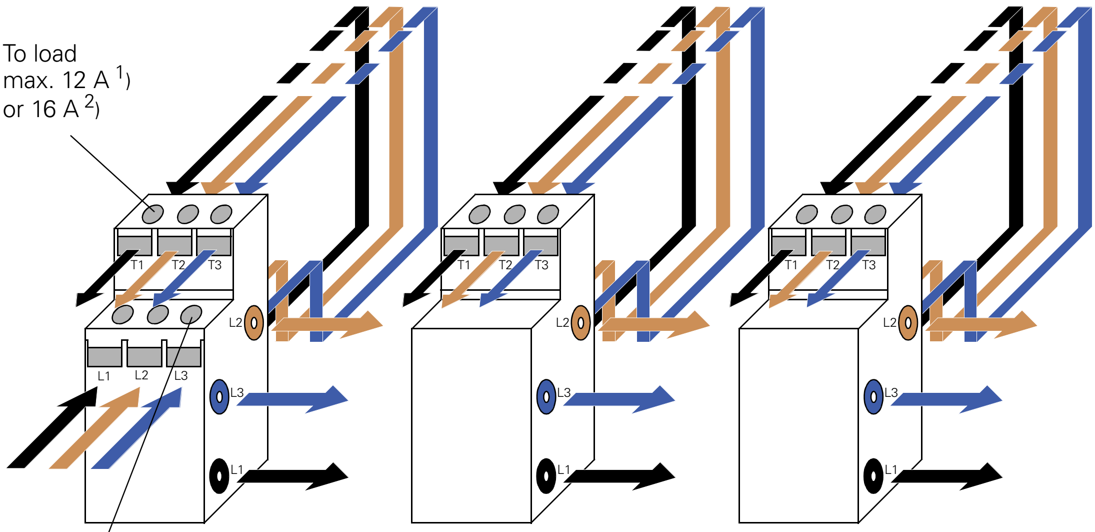


Figure 6-9: Current flow in the power bus

PM-D power module

7

7.1 PM-D power module for motor starters

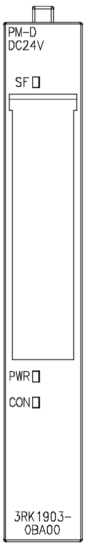
Features

- A new potential group begins with the power module - together with the associated terminal module. The motor starters of a potential group are connected to the right of the power module.
- The power module conducts the voltages for supplying the electronic components to the voltage buses of the terminal modules. It does this for all the motor starters in a potential group.
- The PM-D monitors the U_1 (PWR) voltage supply for the electronics and the U_2 (CON) power supply for contactors. Power failures are displayed using LEDs and indicated via bus if the group diagnostics are enabled.

Caution

Power modules can be neither inserted nor removed during operation.

View



LEDs:
SF group error

PWR (power) (U_1)
CON (contactor) (U_2)

Figure 7-1: PM-D power module

7.1.1 Parameters

The following table indicates the parameter that can be set for the PM-D power module.

Parameters	Action, value range	Factory setting	Applicability
Group diagnosis	• Disable • Enable	Disable	Module

Table 7-1: Parameters for the PM-D power module

Group diagnosis:
This parameter enables diagnosis messaging
(error types are listed in Section 4.8).

Note
The "Disable group diagnosis" parameter also suppresses the display of faults on the SF-LED.

7.1.2 Technical specifications - PM-D

Dimensions and weight	
Installation dimensions W x H x D (mm) (incl. terminal module)	15 x 196.5 x 117.5
Weight (g)	approx. 65
Voltages, currents, potentials	
Rated control supply voltage U_s	20.4 to 28.8 V DC; 0 up to 60 °C
Rated operating current I_e	10 A
Recommended upstream short-circuit protection: • Fuse • Circuit breaker	 gL/gG 10 A 10 A, trip characteristic B
Insulation between U_1 and U_2 tested with	500 V
Supply of: • Motor starters • Motor starters for safety-integrated systems • Electronic modules • Ex[i] modules • Frequency converters	 yes no no no yes
Power draw from the backplane bus	≤10 mA
Status, interrupts, diagnostics	
Interrupts	None
Diagnostic functions: • Group error/device fault • Monitoring of the supply voltage for electronic components U_1 (PWR) • Monitoring of supply voltage for contactors U_2 (CON) • Diagnostic information readable	yes red SF LED green PWR LED green CON LED yes

Table 7-2: Technical specifications - PM-D

7.1.3 Power supply for High Feature motor starter with order number suffix -.AB4

Note
Motor starters; high feature with order number suffix -.AB4 that are not integrated via GSD/GSDML into the ET200S station use extended start-up data records
To ensure that the motor starters; high feature are automatically assigned the extended start-up data records on the re-start of the ET200S station, the electronics power supply (U_1 of the PM-D module) of the motor starter; high feature are supplied from the same voltage source as the interface module (header module).

If the electronics supply of the motor starters fails and reactivates during ongoing operation of the header group, the motor starters[1)] do not receive any extended startup data records.
In this case, the motor starter issues the following error after three minutes: Parameterization error (F16).
If a common power supply with the header group is not possible, a re-parameterization is provided by the user program is carried out.

[1)] from an order number suffix: -.A**B**4

Direct and soft starters

8

8.1 Overview

Three versions of the ET 200S motor starters are available:

- Standard series (code: DS1-x)
- High feature series, characterized by properties that boost system availability and improve diagnosis
  (code for direct starters: DS1e-x, for direct soft starters: DSS1e-x).
  A distinction is made between the following:
  - If there is no communication interface at the front, the order number ends in: -.AA**2**
  - If there is a communication interface at the front, the order number ends in: -.AA**3** via the 2DI COM control module for the "Motor Starter ES" software (from Version 2.0)
  - If there is a communication interface at the front, the order number ends in: -.AA**3** from revision level **E02** and -.AA**4** via the 2DI COM/-2DI **LC** COM control module for the 'Motor Starter ES' software (from version 2.0)
  - If there is a communication interface at the front, the order number ends in: -.AB**4** via the 2DI COM control module for the motor starter ES 2007 + SP4 software
- Fail-safe series that ensures safe shutdown of the motor starter after an emergency stop command by means of the mechanically selected SG bus (code: F-DS1e-x).
  A distinction is made between the following:
  - With front communication interface via the 2DI COM control module for the "Motor Starter ES" software (from Version 2.0).
  - With front communication interface from revision level **E05** via the 2DI COM/-2DI **LC** COM control module for the "Motor Starter ES" software (from Version 2.0)

All motor starters have full protection against short-circuit and overload.

Due to the integrated electronic overload protection, a cover of the power range up to 16 A with only two device versions is possible with motor starter; high feature/ fail-safe. They also have more extensive diagnostics and additional parameters for system control and monitoring.

The motor starter series with installation widths of 45/90 mm and 65/130 mm; high feature can be used in conjunction with the ET 200S safety-integrated system components for safety applications to PL e / SIL3.

The fail-safe motor starter series (F-DS1e-x and F-RS1e-x) in conjunction with fail-safe power modules (PM-D PROFIsafe and PM-D F X1) is suitable for use in safety applications up to SIL3 according to IEC 62061 / PL e according to DIN EN ISO 13849-1.

Warning
If the circuit breaker or starter protection switch is switched on again after being tripped as a result of an overload or a short circuit, and there is a pending On signal for the contactor, the motor starts up.

Caution
Due to the operation of star-connected three-phase motors, high EMC interference may occur. Interference above the IEC limit values can lead to an impairment of functions or failure of the electronics. In case of high EMC interference, we recommend the use of motors with EMC protection circuits. (Exception: electronic starters may not be operated with a EMC protection circuit). The best filtering effect is achieved with three-phase RC interference inversion modules. Varistor interference inversion modules should not be used since they only insufficiently filter out fast transients.

The table below presents an overview of the properties of the direct and soft starters.

Feature	DS-x1	DS1e-x F-DS1e-x	DSS1e-x
Installation width [mm]	45	65	
for power rating up to [kW]	5.5	7.5	
Integrated switching devices for SIRIUS components of the size	S00	S0	
Short-circuit protection with 3RV circuit breaker with instantaneous overcurrent release	X		
Short-circuit protection with 3RV circuit breaker with instantaneous overcurrent release		X	
Overload protection with thermal overload release integrated into circuit breaker	X		
Programmable electronic overload protection		X	
Switching function	mechanical		electronic
Rated operating current	0.14 - 12 A	0.3 - 16 A	
Rated operating voltage U_e • IEC 60947-1, EN 60947-1 • UL, CSA	 400 V AC 600 V AC		 480 V 600 V AC
Parameterizable	no	yes	
Tripping class CLASS	10	5[5)],10,15[5)], 20	10A, 10
Asymmetry recognition	yes		
Residual current detection	no	yes	
Parameterizable current limits	no	yes	
Anti-blocking function with rapid shutdown	no	yes	
Type of coordination (2 at 400 V)	2 (up to 1.6 A)	2	1
Use up to SIL (IEC 62 061)	SIL3[1)]	SIL3 [1)] SIL2 [3)]	SIL1
Up to performance level (DIN EN ISO 13849-1)	PLe[1)]	PLe [2)] PLd [3)]	PLc
Feedback contact for safety-integrated system	with fail-safe kit 1	integral	
Compatible expansion modules (brake control modules)	xB1 to xB6		xB1, xB3, xB5[6)], xB6[6)]

Table 8-1: Overview of direct starters and soft starters

Feature	DS-x1	DS1e-x / F-DS1e-x	DSS1e-x
Free inputs through 2DI COM control module	no	yes [3)]	
2DI LC COM control module usable?	no	yes [4)]	
"*Motor Starter ES*" usable?	no	yes [3)]	
Derating necessary at top end of performance range?	yes	yes [2)]	no
Diagnosis, fault types see Section	4.7		

1) Only with failsafe kit and additional infeed contactor
2) With additional infeed contactor
3) From order number suffix -.AA**3** and for F-DS1e-x; see Section 8.3.2
4) As of order number suffix -.AA**3** and revision level **E02**, as well as for F-DS1e-x from revision level **E05**
5) From order number suffix -.A**B**4
6) Only in combination with a separately protected power supply of the brake

Table 8-1: Overview of direct starters and soft starters (Contd.)

8.2 DS1-x direct starter; standard

8.2.1 Features

ET 200S **DS1-x ...** direct starter; standard (see Figure 8-2)

- Are motor starters for a single direction of rotation that can be can be used in the ET 200S distributed I/O device.
- Are suitable for switching and protecting three-phase loads up to 5.5 kW at 400 and 500 V AC
- Are available with setting ranges of 0.14 - 0.2 A to 9 - 12 A
- Are equipped with electromechanical SIRIUS switchgear
- The contactor coils are controlled directly via integrated outputs.
- The switching states of circuit breaker and contactor are indicated via integrated inputs.
- Available diagnostic information of the direct starter:
  - overload or short-circuit tripping/disconnection of the motor starter
  - fault at the motor starter
- The circuit state and status are displayed via LEDs.
- Integrated disconnection functions via circuit breaker
- Upgradable with fail-safe kit 1 for safety system applications
- Have an expansion interface (DO 0.2) for driving an additional module (e.g. brake control module xB1 to xB6)
- The inputs of the xB3, xB4 or xB6 brake control module (e.g. limit-position switches) act directly on the contactor and brake drive circuit (for signal response, see Section 12.3.3).

Important
A protection circuit for the contactor coils is already integrated in the motor starter. Additional protection circuits connected to the contactor are not permissible.

Note
Input 1 (clockwise limit switch) has a direct effect on the contactor for the DS1-x and on the activation of the brake control module.
Input 2 (counter-clockwise limit switch) only affects activation of the brake control module.

View

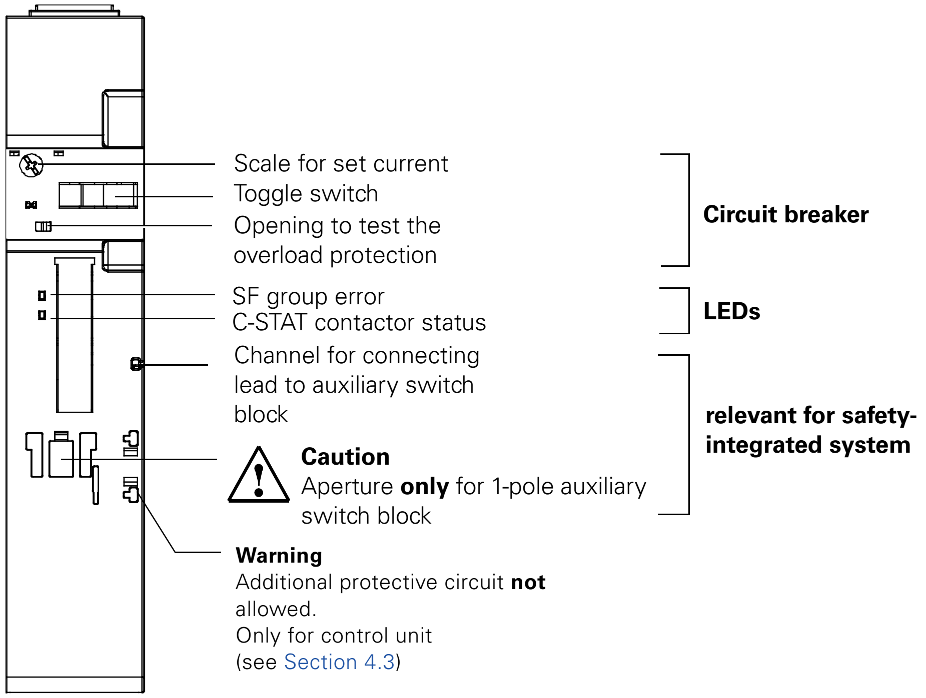


Figure 8-1: DS1-x direct starter; standard

Circuit diagram

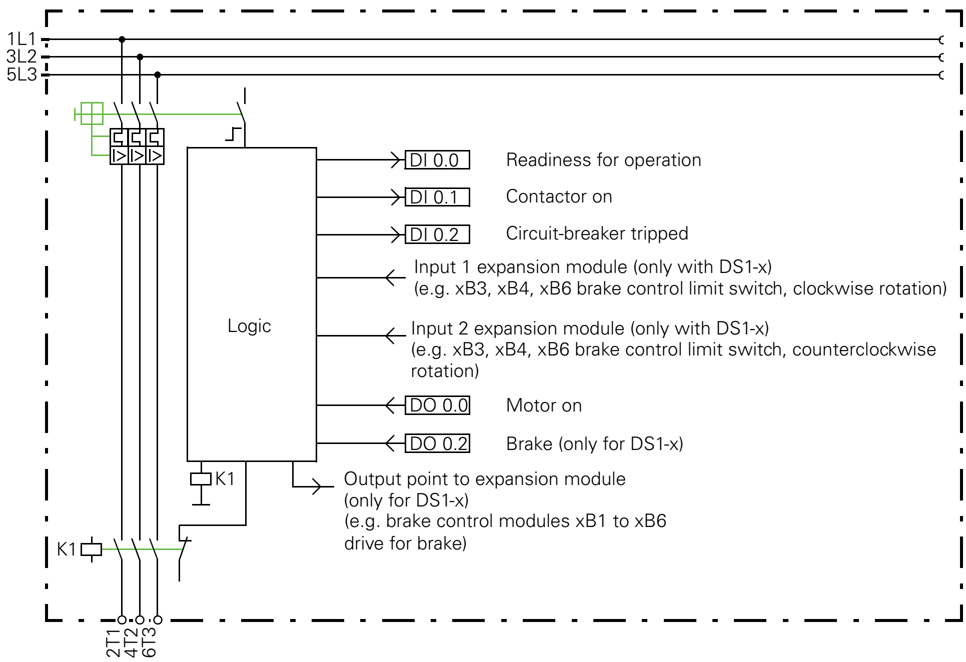


Figure 8-2: Circuit diagram - DS1-x direct starter; standard

8.2.2 Parameters

The following table indicates the parameters that can be set for the direct starter.

Parameters	Action, value range	Factory setting	Applicability
Group diagnosis	• Disable • Enable	Disable	Module
Response to CPU/ master STOP	• Disconnect • Keep circuit state	Disconnect	Module

Table 8-2: Parameters for DS1-x direct starter; standard

Group diagnosis:
This parameter enables diagnosis messaging
(error types are listed in).

Note
The "Disable group diagnosis" parameter also suppresses the display of faults on the SF-LED.

8.2.3 Technical specifications

Dimensions and weight	
Installation dimensions W x H x D (mm)	
• Reversing starter incl. terminal module	45 x 264 x 120
• Height with PE/N block	306
• Depth with fail-safe kit (safety-integrated system)	144.5
Weight	
• Reversing starter incl. terminal module	1.0 kg
• Direct starter incl. PE/N terminal block	1.1 kg
Module-specific data	
Assignment type	Type 1 to I_e ≤ 12 A, IEC 60947-4-1, DIN VDE 0660, Part 102 Type 2 to I_e ≤ 1.6 A
Pollution severity	
• At 400 V	3, IEC 60664 (IEC 61131)
• At 500 V	2, IEC 60664 (IEC 61131)
Safety class	I, DIN EN 61140 (VDE 140-1)
Degree of protection	IP20, IEC 60529
Power loss P_v [1)] at I_e ≤ 1.25 A	approx. 9 W
1.6 to 6.3 A	approx. 10 W
8 to 12 A	approx. 11 W
Ambient temperature range	0°C to 60°C
• Derating, see Section 3.4	
• Order number suffix -.AB**4** UL/CSA (vertical installation on horizontal rails)	
without DM-V15	60°C/14A 55°C/16A
with DM-V15	60°C/15.2A
(horizontal installation on vertical rails)	
without DM-V15	40°C/14A
Control circuit	
Rated operating voltage for electronic components: U_1 Reverse polarity protection	24 VDC (20.4 to 28.8 VDC) yes
Rated operating voltage for contactor: U_2 Reverse polarity protection	24 VDC (20.4 to 28.8 VDC) yes
power input	
• From electronic component supply: U_1	approx. 20 mA
• From contactor supply: U_2	approx. 100 mA
• From the backplane bus	≤10 mA
Main circuit	
Rated operating voltage U_e	
• IEC 60947-1, EN 60947-1	400 V AC
• Protective separation between main and auxiliary circuits	400 V
UL, CSA	600 V AC
Rated insulation voltage U_i	500 V AC
Rated impulse strength U_{imp}	6 kV
Rated frequency	50/60 Hz

[1)] For motor starter and terminal module as a function of rated operating current I_e (upper setting range).

Table 8-3: Technical specifications - DS1-x direct starter; standard

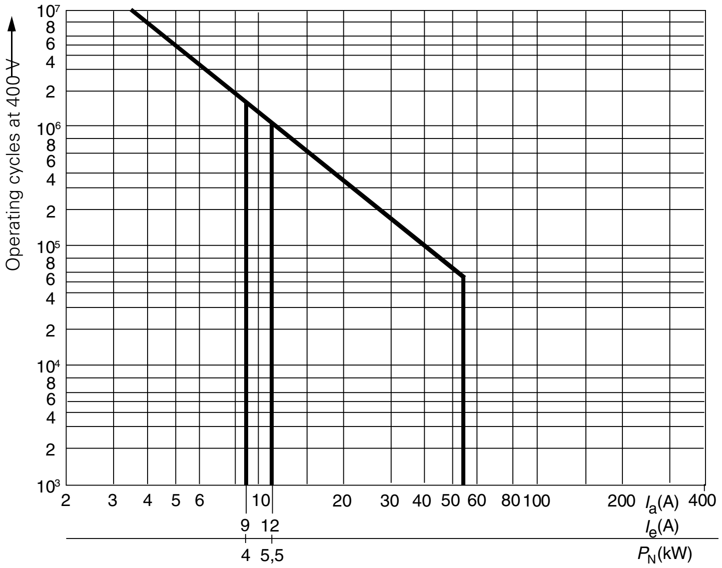
Technical specifications - circuit breaker, contactor

Circuit breaker	
Tripping class	Class 10
Max. rated operating current	12 A
Adjustment ranges • Thermal overload release • Instantaneous overcurrent release	 0.14 - 0.2 A to 9 - 12 A fixed setting at 12 x I_e
Minimum tripping current in the event of phase failure (= 100 % current asymmetry)	0.85 x I_e
Rated short-circuit breaking capacity to I_e = 12 A	50 kA at 400 V
Mechanical life Electrical life	≥ 100 000 switching cycles 100 000
contactor	
Rated operational current I_e at 60°C • AC-1 • AC-2, AC-3 - At 400 V - At 500 V • AC-4 at 400 V	 12 A 12 A 9 A 4.1 A
Max. permissible output of the three-phase induction motors at 500 V AC	5.5 kW
Positively driven operation - auxiliary contacts, contactor	yes
Mechanical life • contactor • Contactor with safety functionality	 30 million switching cycles 10 million switching cycles
Electrical life B10	see Figure 8-3. 1,000,000 [1)]
Surge suppression	Zener diodes integrated
Operating times in the case of DC operation (total break time = contact parting time + arcing time) • At 0.85 to 1.1 x U_s - Closing time - Contact parting time • Arcing time	 25 to 100 ms 20 to 50 ms 10 to 15 ms
• At 1.0 x U_s - Closing time - Contact parting time	 typ. 25 ms typ. 20 ms

1) This information refers only to the mechanical switching element under its reference conditions.

Table 8-4: Technical specifications DS... - circuit breaker, contactor, auxiliary switch block

Electrical life



I_a = Breaking current

I_e = Rated operating current

P_N = Rated power of three-phase motors at 400 V

Figure 8-3: Electrical service life, contactor

8.3 DS1e-x direct starter; high feature F-DS1e-x fail-safe direct starter

8.3.1 Features

ET 200S **DS1e-x** direct starter; high feature
ET 200S **F-DS1e-x** fail-safe direct starter

- Are motor starters for a single direction of rotation that can be can be used in the ET 200S distributed I/O device.
- Are suitable for switching and protecting three-phase loads up to 7.5 kW at 400 and 500 V AC
- Are available in 3 setting ranges with 0.3 - 3 A, 2.4 - 8 A, 2.4 - 16 A
- fitted with electro-mechanical SIRIUS switchgear (power switch, contactor)
- Have parameterizable electronic overload protection
- Upper and lower current limits can be defined and monitored for system and process supervision
- The motor starter can be parameterized for warning or shutdown as the response to an overload event or if a current limit is violated
- The integral protective mechanism recognizes a blocked motor and triggers a rapid shutdown
- Integrated residual current detection
- Integrated asymmetry detection
- The as-is current is measured and the information transmitted to analyzers
- The contactor coils are controlled directly via integrated outputs.
- The switching status of the power switch is registered by means of an auxiliary switch
- Detection of the circuit state of the contactor on the basis of current flow evaluation
  Detection of the circuit state in the case of the F-DS1e-x using an auxiliary switch block as well
- Available diagnostic information of the direct starter (see Table 4-7)
- Circuit state and motor-starter status are indicated by LEDs
- Integrated disconnection functions via circuit breaker
- For DS1e-x:
  auxiliary switch for ET 200S safety engineering (failsafe kit) already integrated
  For F-DS1e-x:
  Fail-safe partial shutdown integrated
- The motor starters can be expanded using front-mounted standard SIRIUS accessories (e.g. auxiliary switch block, time relay) for contactor size S0
- Have an expansion interface (DO 0.2) at the side for driving an expansion module (e.g. brake control module xB1 to xB6)
- "Response to circuit breaker off" parameterizable (from order number suffix -.AA**4**)
- The 2 parameterizable inputs (DI 0.4 and DI 0.5, e.g. limit-position switches) of the expansion interface (expansion module, e.g. brake control module xB3, xB4, xB6) act directly on contactor and brake drive
- 2 additional parameterizable inputs (DI 0.6 and DI 0.7) are available through the 2DI COM/-2DI LC COM control module that can be plugged into the front
- Basic factory settings via the rotary switch of the power switch possible (see Section 10.18)

- Communication interface at the front for DS1e-x and DSS1e-x with order number suffix -.AA**3** and for F-DS1e-x via the 2DI COM control module for the "Motor Starter ES" software (from Version 2.0)
- With the 2DI LC COM control module for the "Manual Operation Local" mode for DS1e-x and DSS1e-x with order number suffix: -.AA**3** from revision level **E02** and for
  F-DS1e-x from revision level **E05**.
- For DS1e-x, from order number suffix -.A**B**4:
  -Quick stop
  -Cold run
  -Integrated log book functions with 3 device log books
  -Has expanded parameter options
  - PROFIenergy
  - Comprehensive diagnostics via data records
  - I&M data

More information can be found in Section 10

View of DS1e-x direct starter; high feature

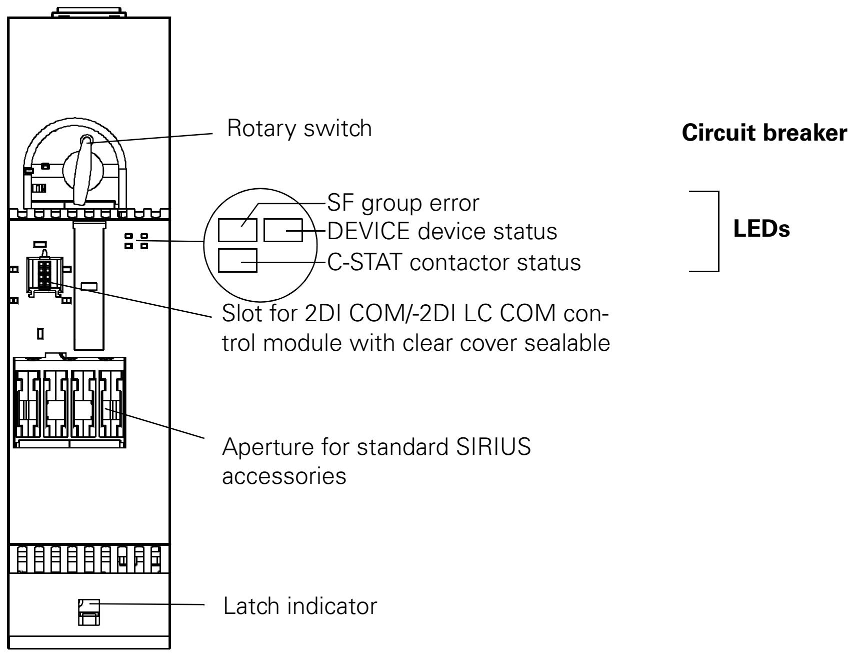


Figure 8-4: DS1e-x direct starter; high feature

Circuit diagram of DS1e-x direct starter; high feature

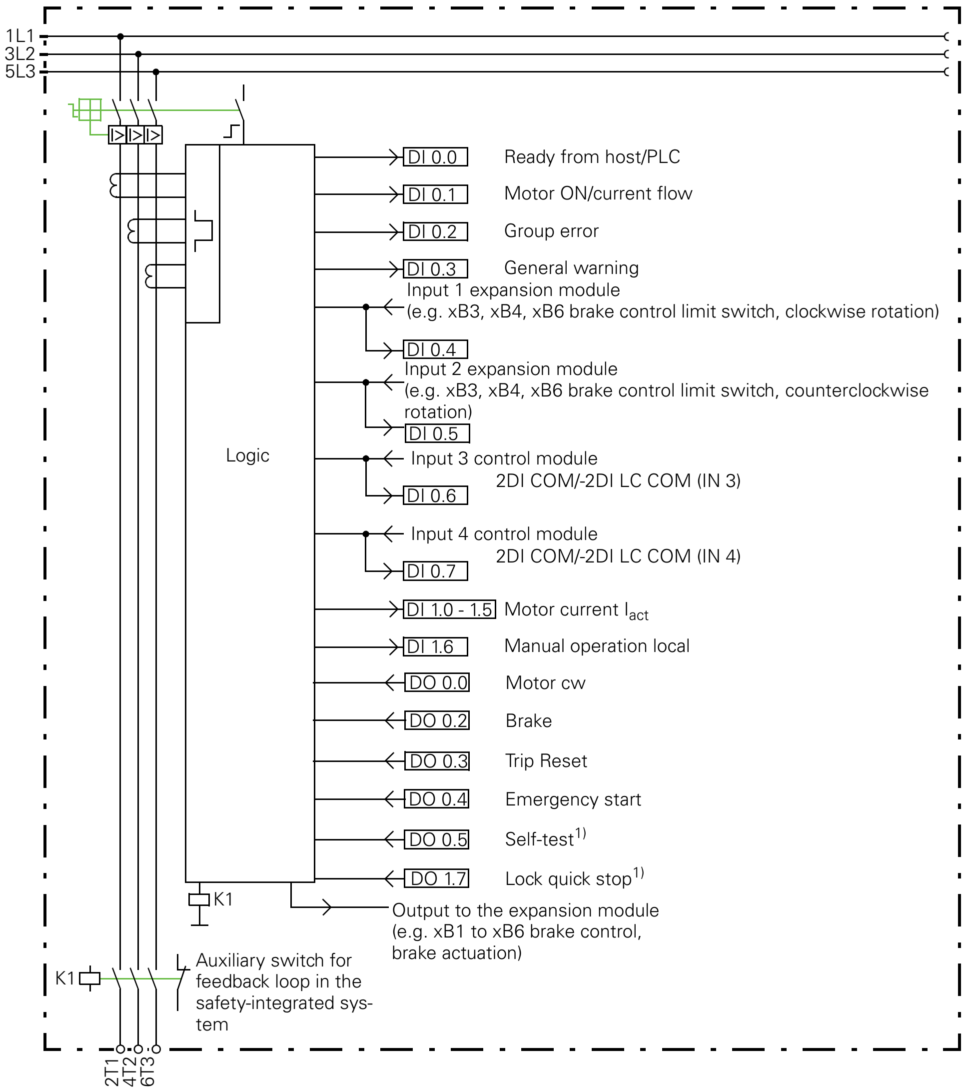


Figure 8-5: Circuit diagram of DS1e-x direct starter; high feature

More detailed descriptions:

- Input signals, in section 4.9.2
- Output signals in section 4.9.2
- Motor current I_{Act} in section 10.3
- Inputs/actions in section 10.11
- Emergency start in section 10.13
- Trip reset in section 10.14

[1] Order number suffix -.A**B**4

8.3.2 Additional features of the F-DS1e-x

Additional features that **only** apply to the **F-DS1e-x** fail-safe direct starters are:

- 6 safety groups (SG1 to SG6) can be set using coding connectors in the terminal module
- The safety groups are supplied via a fail-safe power module with overvoltage protection (PM-D F PROFIsafe, PM-D F X1)
- 2 processors that monitor each other, for controlling the safety function: Safe shutdown in the event of emergency stop via the mechanically selected SG bus
- The motor starter is safely shut down if the two processors produce varying results
- A shunt release for the power switch is integrated to ensure a safe shutdown in the event of one of the contactors being welded. This feature can also be used in non-fail-safe mode to ensure a shutdown in the event of a welded contactor (see note)
- It is possible to test the shunt release/power switch via the bus (DO 0.5)
- Storage of the U_1 operating voltage using a capacitor to ensure a safe shutdown in the event of U_1 failure
- Monitoring of the functioning of the capacitor for the U_1
- Redundant configuration of the fail-safe components in the motor starter
- The fail-safe modules are identified by yellow labeling strips.

Note
A fail-safe motor starter can also be used in non-fail-safe mode with a PM-D power module. To do this, the coding for the safety group in the terminal module of the fail-safe motor starter must be set to SG3 and the U_1 and U_2 supply voltages must have the same potential.

Safety note
When using expansion modules (brake modules xB1 to xB6, 2DI COM/-2DI LC COM control module), make sure that these modules are **not** fail-safe modules with fail-safe technology.

Expansion module PL according to DIN EN ISO 13849-1 SIL according to IEC 62061	Operating mode of the F-Starter Non-fail-safe mode	PLc/ SIL1/	PLd/ SIL2	PLe /SIL3
xB1	X	X	X	X
xB2	X	X	X	X
xB3	X	X [1)	X [1)	
xB4	X	X [1)	X [1)	
xB5	X	X	X	X
xB6	X	X [1)	X [1)	
2DI COM control module 2DI LC COM control module	X	X [1)	X [1)	X [1)

1) No feedback to the fail-safe technology may occur through the inputs, i.e. cross-circuits to the sensor cables should be eliminated (cross-circuit proof cable installation)

Safety note
Only applies in fail-safe mode (fail-safe technology)
The F-DS1e-x can only be operated in the potential group of a PM-D F PROFIsafe or PM-D F X1 that safely limits the voltage to within the SIMATIC range.

Safety note
Cyclic test of the F-DS1e-x
- Shunt release/circuit breaker
  Starter protector must be in position "1"
  Request self-test (DO 0.5) (signal-triggered)
  Starter protector must move to "Trip" position
  If the starter protector changes to the "Trip" position the test has been successful
  Turn starter protector to position "0"
  Turn starter protector to position "1"

The test can also be carried out when the motor side switch is switched on. After this test, the motor starter is automatically switched back on if a switching command (D0.0 / D0.1) is pending.

Safety note
Only one SG bus can be selected in the terminal module for each motor starter.

Safety note
You must only use the F-DS1e-x motor starter to control motors that do not constitute a danger to persons or to the environment if they suddenly shut down.

Important
After U_1 has been applied, the F-DS1e-x requires approximately 30 s until the internal self-test is completed. DI 0.0 ready is then set in the process mapping via the host/PLC. Once the internal self-test is completed, the selected SG bus is monitored.

View of the F-DS1e-x fail-safe direct starter

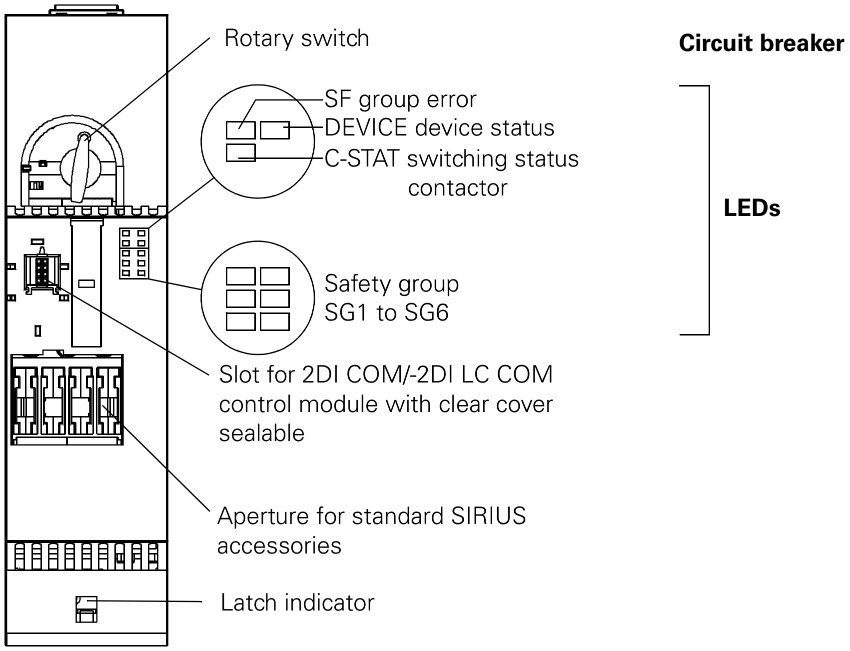


Figure 8-6: Fail-safe F-DS1e-x direct starter

Circuit diagram of the F-DS1e-x fail-safe direct starter

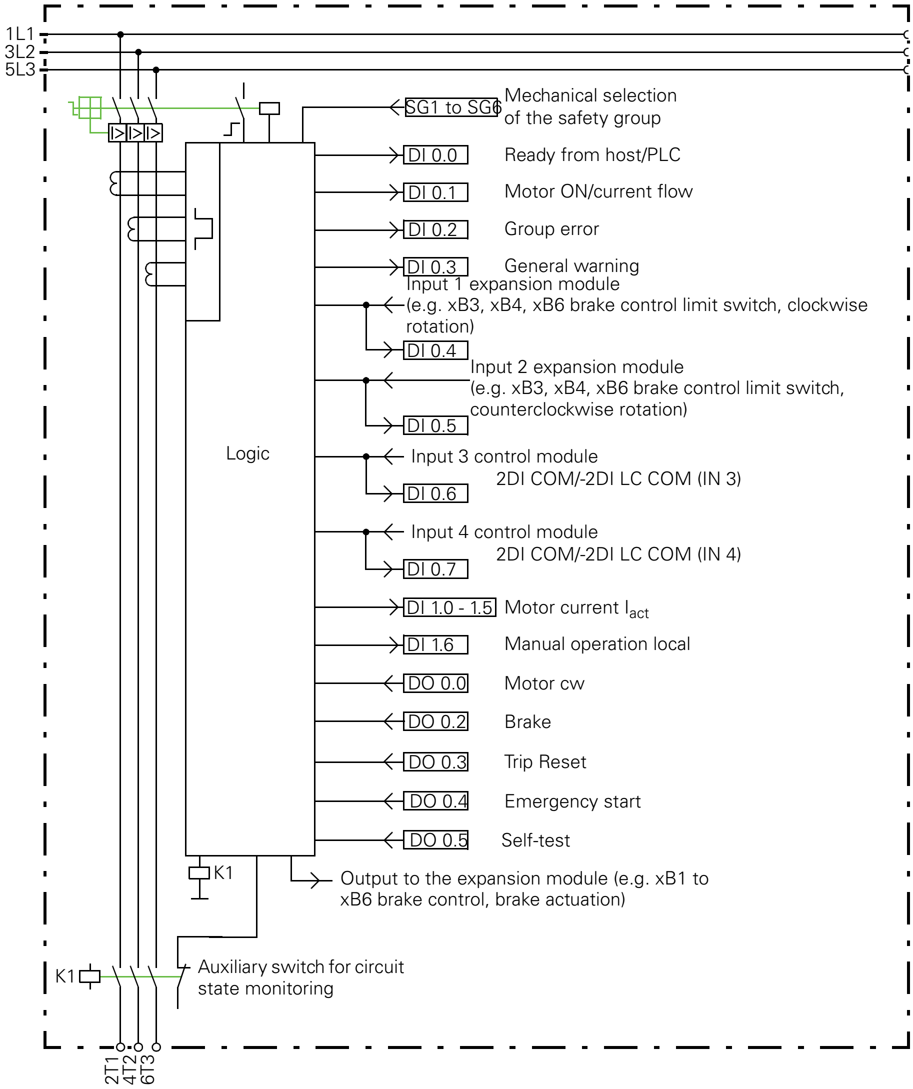


Figure 8-7: Circuit diagram of the fail-safe F-DS1e-x direct starter

More detailed descriptions:

- Input signals, in section 4.9.2
- Output signals in section 4.9.2
- Motor current I_{Act} in section 10.3
- Inputs/actions in section 10.11
- Emergency start in section 10.13
- Trip reset in section 10.14

[1] Order number suffix -.A**B**4

8.3.3 Module replacement

If a module has to be replaced, an acceptance test is not necessary. With the F-DS1e-x, however, it is necessary to repeat the safety function test (see cyclic test).

Warning
If there is a pending ON signal for the contactor, the motor starts up automatically.
This applies to an F-DS1e-x motor starter after the self-test if there is no emergency stop present on the selected SG bus.

8.3.4 Parameters

A description of the parameters can be found in Section 10.

The table below lists the actions and value ranges that can be set with the various parameters for the DS1e-x and F-DS1e-x direct starters.

Parameters	Action, value range	Factory setting
Rated operating current • Range 1 • Range 2 • Range 3	(Increment 10 mA) • 0.3 to 3 A (0.05 to 1.1 kW) • 2.4 to 8 A (1.1 to 3 kW) • 2.4 to 16 A (1.1 to 7.5 kW)	 • 3 A • 8 A • 16 A
Load type [1, 2]	• 3 - phase motor • 1 - phase motor (only with electromechanical starters)	3 - phase motor
Non-resetting on voltage failure [1, 2]	• no • yes	yes
Prewarning limit value [1] (Motor heating)	• 0 ... 95 % I_e • 0 = deactivated (increment: 5 %)	0 = deactivated
Response to overload - thermal motor model	• Shutdown without restart • Shutdown with restart • Warning	Shutdown without restart
Tripping class	• CLASS 5 (10a)[1] • CLASS 10 • CLASS 15[1] • CLASS 20	CLASS 10
Recovery time [1, 2]	• 1 ... 30 min (increment: 0.5 min)	1.5 min
Idle time Reset the thermal overload model through functional switching	• 0 ... 255 s • 0 = deactivated (increment: 1 s)	0 (deactivated)
Prewarning limit value [1] (time-based triggering)	• 0 to 500 s • 0 = deactivated (increment: 1 s)	0 (deactivated)
Response to current limit violation	• Warning • Shutdown[4]	Warning
Lower current limit	• 18.75 to 100 % [3] (increment: 3.125 %)	18.75 %
Upper current limit	• 50 ... 150 % Ie [3] • 50 ... 400 % Ie [1] (increment: 3.125 %)	112.5 %

1) from order number suffix: -.**AB**4 present, and can be changed
2) Up to order number suffix: -.AA4: value present, but cannot be changed (fixed on factory setting)
3) Of rated operational current
4) Possible with DS1e-x direct starter with order number suffix -.AA3, and with F-DS1e-x

Table 8-5: Parameters for DS1e-x direct starter; high feature and F-DS1e-x fail-safe direct starter

Parameters	Action, value range	Factory setting
Blocking current [1,2]	• 150 ... 1000 % I_e (DS1e-x, RS1e-x) • 150 ... 800 % I_e (DSS1e-x) (increment: 50 %)	800 %
Blocking time [1, 2]	• 1 … 5 s (increment: 0.5 s)	1 s
Response with power supply switching element missing [1, 2]	• Group error • Group error only with ON command [4, 1] • Group warning[1]	Group error
Response to residual current detection	• Warning • Disconnect	Disconnect
Response with power switch OFF	• Group error • Group error with ON command [5, 1] • Group warning [1]	Group error
Asymmetry limit value [1, 2]	• 30 … 60 % I_e • 0 = deactivated (increment 10 %)	30 %
Response to asymmetry	• Warning • Disconnect	Disconnect
vInput signal extension [1]	• 0 … 200 ms (increment: 10 ms)	0 ms
Input signal delay [1]	• 10 … 80 ms (increment: 10 ms)	10 ms
Input 1, 2 - signal level (x-increment, expansion module) Input 3, 4 - signal level 2DI COM control module 2DI LC COM control module) (see Section 10)	• NC • NO	NO
Input 1 to 4 - action NO only NO only NO only NO only NO only	• No action • Shutdown without restart • Shutdown with restart • Shutdown at limit position, clockwise rotation • Shutdown at limit position, counterclockwise rotation • Group warning [6] • "Manual Operation Local" mode[6] • Quick stop[1] • Cold run[1] • Emergency start [6] • Motor-cw [6] • Motor ccw [6] • Trip reset [1]	No action
Inputs 1 to 4 signal [1]	• non-retentive • Retentive	non-retentive
Response to CPU/master STOP	• Use dummy value • Keep last value	Use dummy value = disconnect

1) from order number suffix: -.A**B**4 present, and can be changed
2) Up to order number suffix: -.AA4: value present, but cannot be changed (fixed on factory setting)
4) Possible with DS1e-x direct starter with order number suffix -.AA3, and with F-DS1e-x
5) Possible from order number suffix -.AA**4**
6) Also possible with inputs 1 and 2 for DS1e-x, RS1e-x and DSS1e-x with order number suffix -.AA3, and with F-DS1e-x and F-RS1e-x

Table 8-5: Parameters for DS1e-x direct starter; high feature and F-DS1e-x fail-safe direct starter (Contd.)

Parameters	Action, value range	Factory setting
Replacement values [1]	• Motor cw • Motor ccw (only with reversing starters) • Brake actuation • Trip Reset • Emergency start • Self-test • Quick stop lock	No action
Wait for startup parameter - data record [1]	• no • yes	no
Enable delay of the brake when starting [1]	• - 2.5 … 2.5 s • (increment: 0.01 s)	0 s
Holding time of the brake when stopping [1]	• 0 … 25 s • (increment: 0.01 s)	0 s
Group diagnosis	• Disable • Enable	Disable
Safe shutdown group [7]	• Not assigned • SG1 to SG6	Not assigned

1) from order number suffix: -.A**B**4 present, and can be changed
7) Only with F-DS1e-x and F-RS1e-x

Table 8-5: Parameters for DS1e-x direct starter; high feature and F-DS1e-x fail-safe direct starter (Contd.)

Group diagnosis:
This parameter enables diagnosis messaging (error types are listed in Section 4.7).

Note
The "Disable group diagnosis" parameter also suppresses the display of faults on the SF-LED.

8.3.5 Technical specifications

Direct starter		DS1e-x	F-DS1e-x
Dimensions and weight			
Installation dimensions W x H x D (mm) • Reversing starter incl. terminal module • Height with PE/N block • Depth with brake control module 2DI		 65 x 290 x 150 332 173	
Weight • Reversing starter incl. terminal module • Direct starter incl. PE/N terminal block		 1.6 kg 1.7 kg	
Ambient temperature range		0°C to 60°C	
Module-specific data			
Assignment type Type (up to $I_e \leq 16$ A at 400 V)		2	
Pollution severity • At 400 V • At 500 V		 3, IEC 60664 (IEC 61131) 2, IEC 60664 (IEC 61131)	
Safety class		I, DIN EN 61140 (VDE 140-1)	
Degree of protection		IP20, IEC 60529	
Power loss P_v [1]	at I_e 0.3 up to 3 A 2.4 to 8 A 2.4 to 16 A	approx. 9 W approx. 10 W approx. 18 W	
Ambient temperature range • For derating see Section 3.4 • Order number suffix -.AB**4** UL/CSA (vertical installation on horizontal rails) without DM-V15 with DM-V15 (horizontal installation on vertical rails) without DM-V15 		0°C to 60°C 60°C/14A 55°C/16A 60°C/15.2A 40°C/16A	
Maximum attainable safety classes:			
• SIL[2] according to IEC 62061 • PL[2] according to DIN EN ISO 13849)		3[4] e[4]	2 d

Table 8-6: Technical specifications - DS1e-x direct starter; high feature and F-DS1e-x fail-safe direct starter

Direct starter	DS1e-x	**F-DS1e-x**
Safety parameters:		
• SFF (IEC 62061)	–	99.64 %/ 99.70 %
• DC (DIN EN ISO 13849)	–	>99
• HFT (DIN EN / IEC 61508	–	0
• n_{OP} (DIN EN ISO 13849)	–	1
• d_{OP} (DIN EN ISO 13849)	–	365
• h_{OP} (DIN EN ISO 13849)	–	24
• Low demand - PFD_{AVG} (10a)		
Test interval 3 mos.	–	3.5×10^{-5}
Test interval 6 mos.	–	8.0×10^{-5}
• High demand/continuous mode - PFH		
Test intervall 3 mos. 1/h	–	8.1×10^{-10}
Test intervall 6 mos. 1/h	–	1.8×10^{-9}
• Proof test interval T_1 years	–	20
• B10	1,000,000[3)	
Control circuit		
Rated operating voltage for electronic components: U_1	24 VDC (20.4 to 28.8 VDC)	(21.6 to 26.4 VDC)
Reverse polarity protection	yes	
Rated operating voltage for contactor: U_2	24 V DC (20.4 to 28.8 V DC) [5)	
Reverse polarity protection	yes	
power input		
• From electronic component supply: U_1	approx. 40 mA	approx. 100 mA
• From contactor supply U_2		
Pick-up: (for 800 ms)	**250 mA**	
Hold-in:	max. **150 mA**	
• From SG1 to SG6		
Pick-up: (for 200 ms)	approx. 250 mA	
Hold-in:	max. 55 mA	
• Test function of the shunt release/ power switch (50 ms) from U_1		approx. 1.5 A[6)
• From the backplane bus	approx. 20 mA	
Main circuit		
Rated operating voltage U_e		
• IEC 60947-1, EN 60947-1	400 V AC	
• Protective separation between main and auxiliary circuits	400 V	
UL, CSA	600 V AC	
Rated insulation voltage U_i	500 V AC	
Rated impulse strength U_{imp}	6 kV	
Rated frequency	50/60 Hz	

1) For motor starter and terminal module as a function of rated operating current I_e (upper setting range).
2) Max. achievable values
3) This information refers only to the mechanical switching element under its reference conditions.
4) Only in conjunction with a PM-D F module and an external additional infeed contactor with feedback loop monitoring.
5) For motor starters with order number suffix -.AA**3** from revision level **E02**, the frame potential for the contactor supply U_2 is connected to the frame potential of the electronics supply U_1. Connect the frame potential of U_1 and U_2 to the power module in order to prevent high compensating current.
6) In the event of simultaneous activation of the test function of several starters, the currents are cumulative.

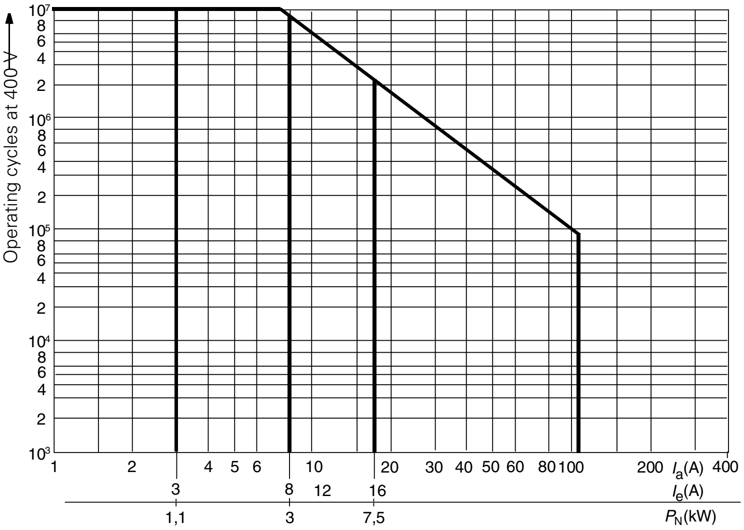
Table 8-6: Technical specifications - DS1e-x direct starter; high feature and F-DS1e-x fail-safe direct starter

Technical specifications - circuit breaker, contactor

Direct starter	DS1e-x	F-DS1e-x
Circuit breaker		
Rated operating current	3/8/16 A	
Instantaneous overcurrent release	Fixed setting at 13 x $I_{e\ max}$	
Rated short-circuit breaking capacity to I_e = 16 A (motor starter)	50 kA at 400 V	
Mechanical life Electrical life	≥ 100,000 operating cycles 100,000 operating cycles	
Contactor		
Rated operational current I_e at 60°C • AC-1 • AC-2, AC-3 - At 400 V - At 500 V • AC-4 at 400 V	 16 A 16 A 11 A 9 A	
Max. permissible output of the three-phase induction motors at 500 V AC	7.5 kW	
Positively driven operation - auxiliary contacts, contactor	yes	
Mechanical life contactor	 10 million switching cycles	
Electrical life Switching frequency	see Figure 8-8. 80/hr	
Surge suppression	Zener diodes integrated	
Operating times in the case of DC operation (total break time = contact parting time + arcing time) • At 0.85 to 1.1 x U_s - Closing time (ms) - Contact parting time (ms) • Arcing time (ms)	 25 to 100 20 to 50 10 to 15	 50 to 170 40 to 100 10 to 15
• At 1.0 x U_s - Closing time (ms) - Contact parting time (ms)	 typ. 25 typ. 20	 typ. 50 typ. 40

Table 8-7: Technical specifications of the DS1e-x and F-DS1e-x - power switch, contactor

Electrical life



I_a = Breaking current

I_e = Rated operating current

P_N = Rated power of three-phase motors at 400 V

Figure 8-8: Electrical service life, contactor

8.4 DSS1e-x direct soft starter; high feature

The electrical features of the DSS1e-x direct soft starter; high feature are identical to those of the SIRIUS soft starter 3RW30. The same power electronics are used.

8.4.1 Physical principles

Starting current

Three-phase asynchronous motors have a higher making current $I_{(startup)}$. This inrush current can be between three and fifteen times as high as the rated operating current, depending on the type of motor. A figure between seven and eight times the rated motor current can be postulated as typical.

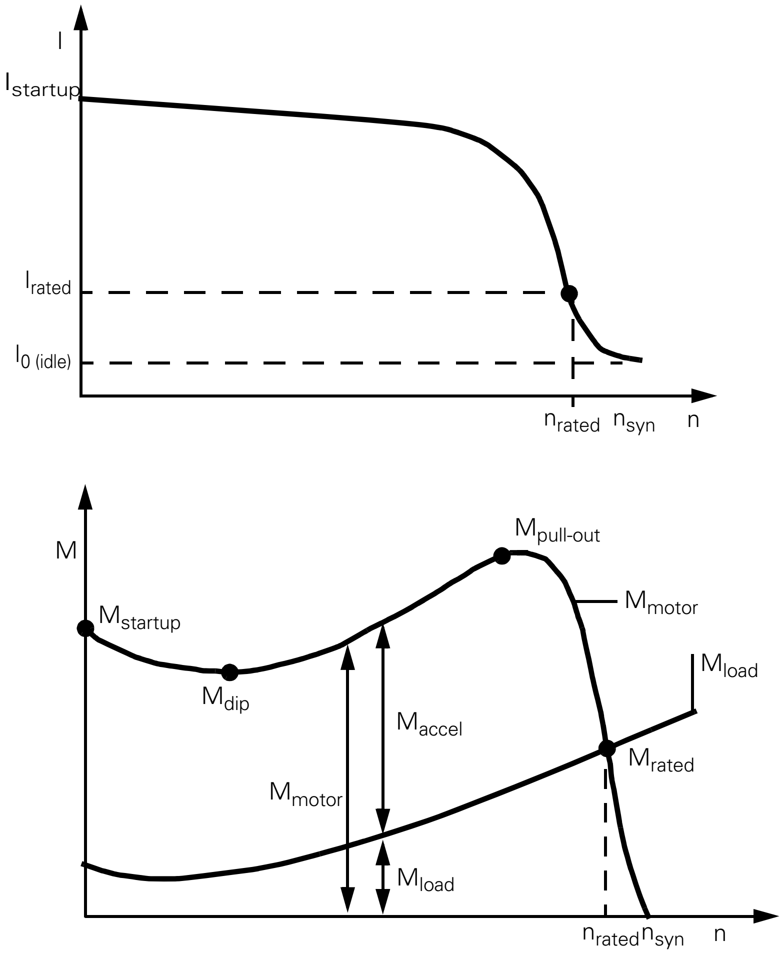


Figure 8-9: Typical current and torque curve of a three-phase asynchronous motor

Reducing the starting current

There are various ways of reducing the starting current:

- by star delta starter
- by frequency converter
- by soft starter

Star delta starter

After a certain delay, the motor windings are switched over from a star to a delta configuration. Motor current for star starting is only about 1/3 of that required for delta starting (motor torque is also reduced to approximately 1/3 of the delta torque).

Disadvantages:

- 6 motor cables are necessary
- Occurrence of switching surges (in the current and torque transients)
- Startup cannot be matched to the system environment
- Installation is relatively complicated and time-consuming
- Contactor switching calls for an extra time relay or PLC programming
- More space needed in the control cabinet

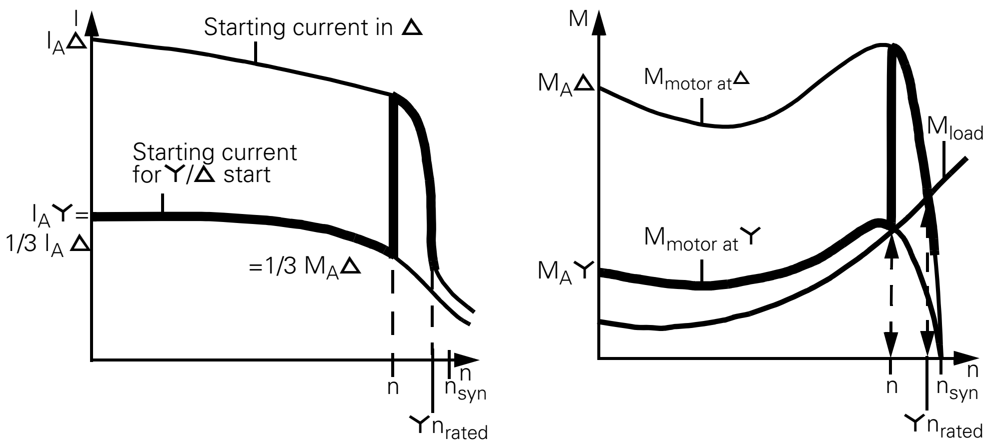


Figure 8-10: Current and torque curves for star-delta starting

Soft starter

With a soft starter, motor voltage is increased from a selectable starting voltage to the rated voltage by phase firing within a defined starting time. Motor current is proportional to the motor voltage, so the starting current is reduced by the factor of the defined starting voltage.

The illustration below shows how the DSS1e-x soft starter works:

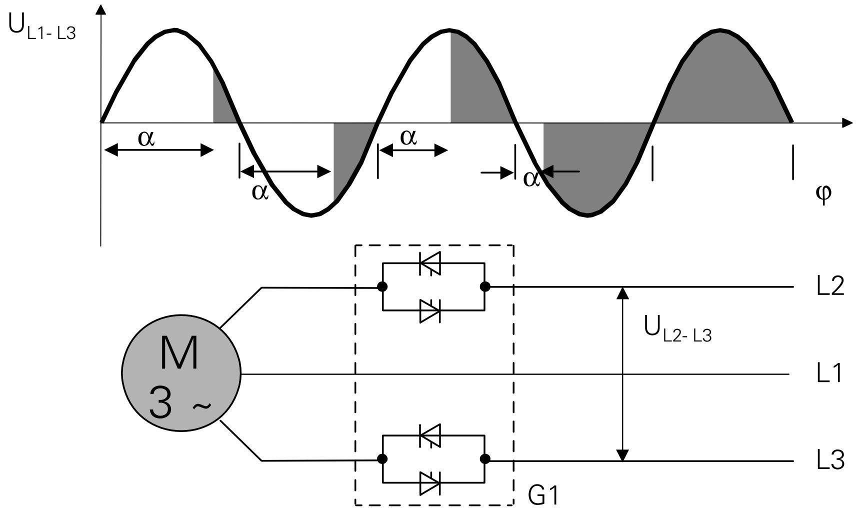


Figure 8-11: Phase firing of the supply voltage by semiconductor elements in the DSS1e-x soft starter

Example:

Starting voltage 50 % of U_e => starting current equals 50 % of the motor starting current for direct-on-line starting.

A soft starter also reduces motor torque. This is the reason why a soft-started motor does not jerk into action.
The relationship is as follows: motor torque is proportional to the square of motor voltage.

Example:
Starting voltage 50 % of U_e => starting torque 25 % of the starting torque for direct-on-line starting.

Advantages:
- Less space needed in the control cabinet
- No protective circuitry (e.g. filter elements) needed for compliance with radio interference suppression requirements
- Lower installation costs
- Straightforward system startup
- Only 3 motor feeder cables, half as many as are needed for a star delta starter
- Local adjustments make the unit easy to configure in accordance with system requirements.

Disadvantages:
- Long-term speed settings not possible.
- Lower torque at reduced voltage

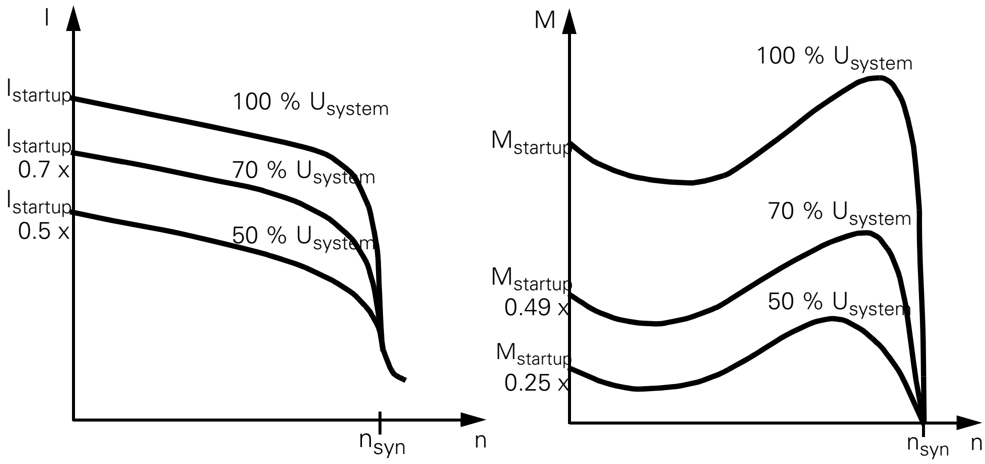


Figure 8-12: Current and torque curves for a soft starter

8.4.2 Application and use

Areas of application and criteria for selection

The ET 200S DSS1e-x soft starters are an alternative to star-delta starters and frequency converters (for comparison and advantages, see Section 8.4.1).
The most important advantages are soft starting and soft rundown, interruption-free switching without current spikes that could interfere with the supply system, and the compact size.
Many drives that needed frequency converters in the past, can be changed to soft-start operation with the DSS1e-x, if the applications do not call for variations in speed.

Applications

Typical applications include, for example:

Conveyor belts, conveyor systems:
- smooth starting
- smooth slowing,

Rotary pumps, piston-type pumps
- avoidance of pressure surges
- service life of the piping system is extended

Agitators, mixers:
- reduced starting current

Fans:
- less strain on gearing and drive belts

Drive for a motor with electromechanical brake

An electromechanical brake with infeed from the main voltage (L1/L2/L3) should not be connected directly to the output of the soft starter. An internally powered electromechanical brake should be supplied via a separate contactor.

Important
Do not use a soft starter to supply an internally powered brake (xB2, xB4).
Brakes xB5 and xB6 must only be operated with externally supplied voltage (see Section 12.3).

8.4.3 Features

ET 200S **DSS1e-x** direct soft starter; high feature

- Are motor starters for a single direction of rotation that can be can be used in the ET 200S distributed I/O device.
- Are suitable for switching and protecting three-phase loads up to 7.5 kW at 400 V AC
- Are available in 3 setting ranges with 0.3 - 3 A, 2.4 - 8 A, 2.4 - 16 A
- Are equipped with electromechanical SIRIUS switchgear (circuit breaker) to monitor short circuits and for line protection
- The 2-phase power electronics from the SIRIUS 3RW30 soft starter are integrated
- When the motor starts the power thyristors of the soft starter are jumpered by integrated relays in the current ranges 2.4 - 8 A and 2.4 - 16 A
- Have parameterizable electronic overload protection
- Upper and lower current limits can be defined and monitored for system and process supervision
- The motor starter can be parameterized for warning or shutdown as the response to an overload event or if a current limit is violated
- The integral protective mechanism recognizes a blocked motor and triggers a rapid shutdown
- Integrated residual current detection
- Integrated asymmetry detection
- The as-is current is measured and the information transmitted to analyzers
- The soft starter is controlled directly via integrated outputs
- The switching status of the power switch is registered by means of an auxiliary switch
- The switching status of the soft starter is registered by means of current flow analysis
- Local adjustments by potentiometers for
  - starting time
  - starting voltage
  - Coasting down time
- Available diagnostic information of the soft starter (see Table 4-7)
- Circuit state and motor-starter status are indicated by LEDs
- Integrated disconnection functions via circuit breaker
- Have an expansion interface (DO 0.2) at the side for driving an expansion module (e.g. brake control module xB1, 3)
- The 2 parameterizable inputs (DI 0.4 and DI 0.5, e.g. limit-position switches) of the expansion interface (expansion module, e.g. brake control module xB3) act directly on soft-starter and brake drive
- 2 additional parameterizable inputs (DI 0.6 and DI 0.7) are available through the 2DI COM/-2DI LC COM control module that can be plugged into the front
- With the 2DI LC COM control module for the "Manual Operation Local" mode for DSS1e-x with order number suffix: -.AA**3** from revision level **E02**.
- "Response to circuit breaker off" parameterizable
  (from order number suffix -.AA**4**)
- For DSS1e-x, from order number suffix -.A**B**4:
  -Quick stop
  -Cold run
  -Integrated log book functions with 3 device log books
  -Has expanded parameter options
  - PROFIenergy
  - Comprehensive diagnostics via data records
  - I&M data

More information can be found in Section 10

View

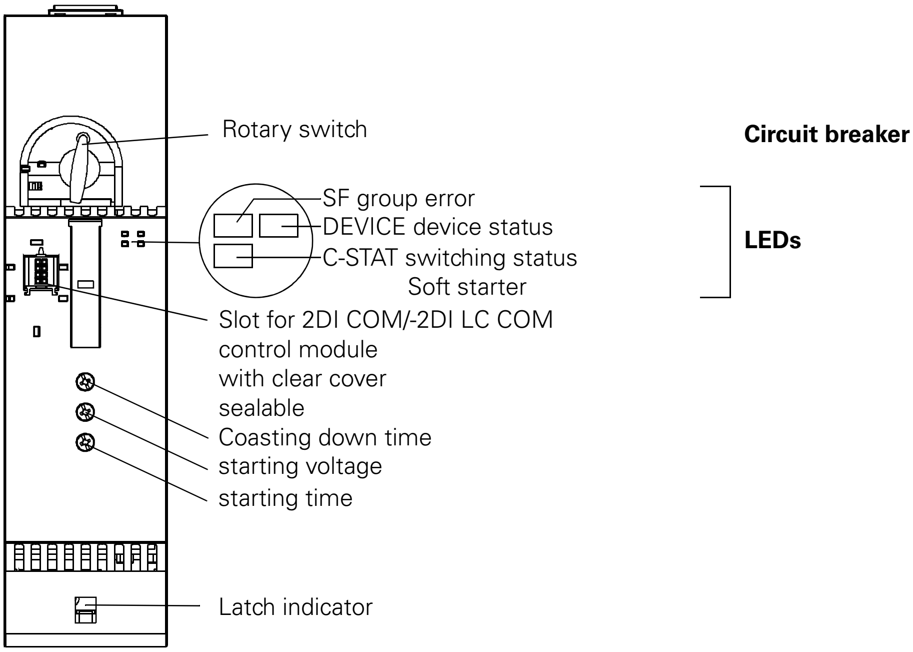


Figure 8-13: DSS1e-x direct soft starter; high feature

Circuit diagram

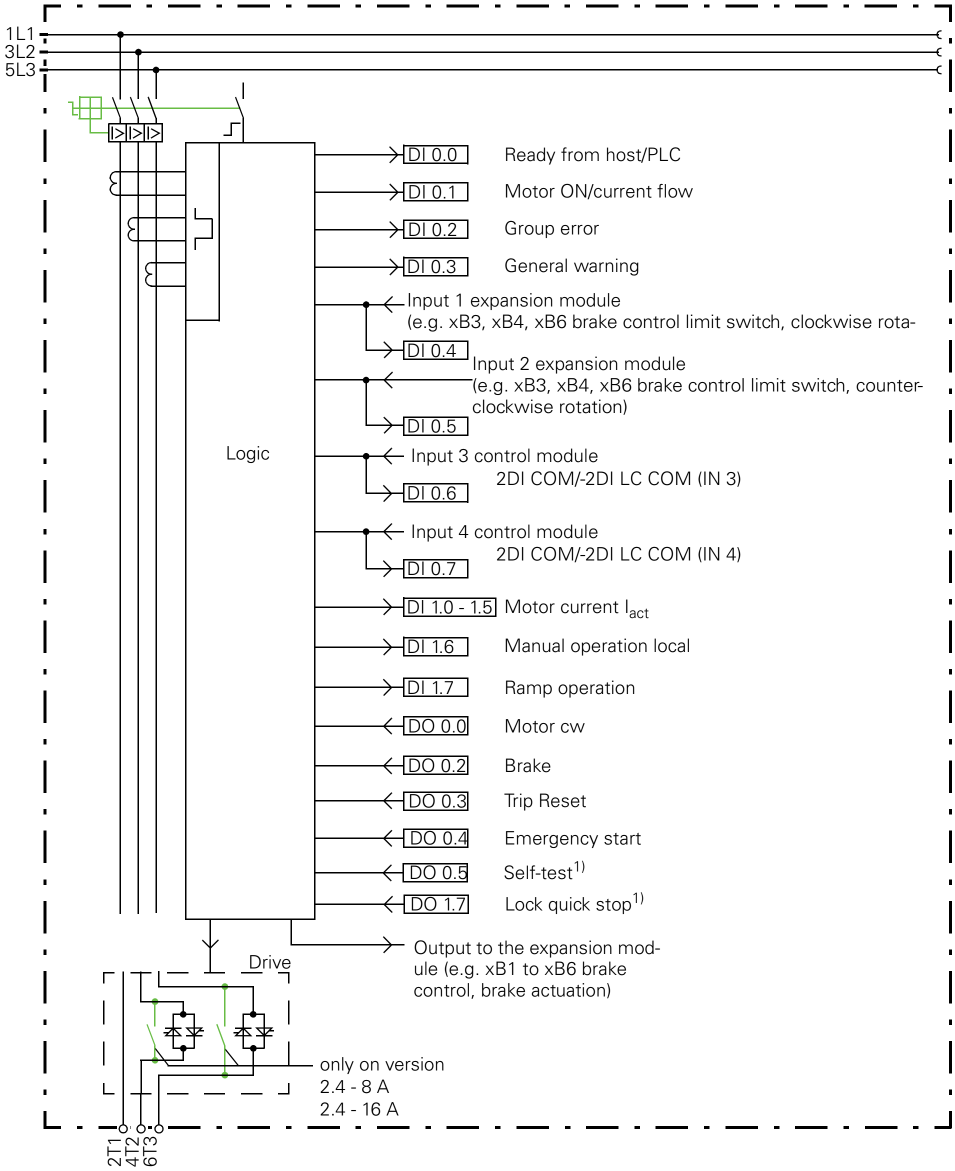


Figure 8-14: Circuit diagram of DSS1e-x direct soft starter; high feature

More detailed descriptions:

- Input signals, in section 4.9.2
- Output signals in section 4.9.2
- Motor current I_{Act} in section 10.3
- Inputs/actions in section 10.11
- Emergency start in section 10.13
- Trip reset in section 10.14

Caution
Phase L1 is not looped through the semiconductors in the DSS1e-x. Always switch off the power switch before commencing work on the output.

[1)] Order number suffix -.A**B**4

Settings

The devices can be set as follows (see Figure 8-13):

By means of 3 potentiometers for setting:

- Starting time in the range from 0 to 20 s
- Starting voltage in the range from approx. 30 to 100 % of rated voltage for motor
- Coasting-down time in the range from 0 to 20 s

Soft starting function

Torque-reduced start for three-phase asynchronous motors:
Triggering is two-phase, which means that the current is kept low throughout the run-up phase. Current peaks such as those that occur in a star-delta start at the changeover from star to delta are prevented by continuous voltage management.
Transient current peaks (inrush peaks) are automatically avoided in each switch-on procedure by a special control function of the power semiconductors.

Soft coasting-down function

The integrated soft rundown function prevents the drive coming to an abrupt halt when the motor is switched off.

Warning
The soft run down time set locally on the soft starter is also effective in controlling the brake or shutdown function via one of the parameterizable inputs (for example, the 2DI COM control module or the xB1 to xB6 brake control module) for an additional 1-2 seconds. This leads to a delay in an immediate standstill of the motor following a shutdown function without motor brake.
For a shutdown function with motor brake, the soft run down and the delay time thereof act against the braked motor.

Time ramp

The illustration below shows the time ramp of the DSS1e-x for parameterized ramp operation (DI 1.7 = 1):

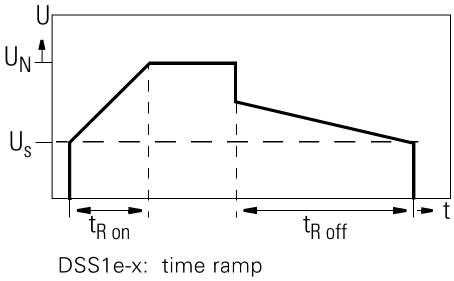


Figure 8-15: Time ramp/timing diagram, DSS1e-x

Changing settings

The potentiometer settings are scanned before each switching operation ("ON" or "OFF").

If, for example, the setting of the potentiometer for starting time is changed while the motor is running up, the change does not come into effect until the next start.

Starting voltage

The starting voltage should be set to a value at which the motor starts rapidly.

Ramp time (start time)

The ramp time should be set such that the motor can run up within the defined time.

If the star time for star-delta starting is known, the ramp time can be set to this value.

Coasting down time (stop time)

The "Coasting-down time" potentiometer is used to set the duration of the voltage ramp for coasting down. This parameter can be used to make motor run-down longer than it would be if the motor were merely to coast to a stop.

The motor coasts to a stop on its own if this potentiometer is set to a value of 0.

Cyclic duration factor CD

The cyclic duration factor CD in % is the ratio between load duration and free-wheeling duration for loads that are switched frequently on and off.

This factor can be calculated with the aid of the formula below:

$$ED = \frac{t_s + t_b}{t_s + t_b + t_p}$$

In this formula:

- CD cyclic duration factor [%]
- t_s starting time [s]
- t_b operating time [s]
- t_p idle time [s]

The illustration below shows the procedure.

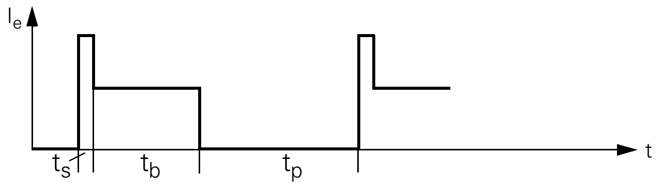


Figure 8-16: Cyclic duration factor CD

Switching frequency

It is essential to comply with the maximum permissible switching frequency in order to avoid exposing the devices to thermal overload. The "response to overload - thermal motor model" parameter has to be deactivated (shutdown without restart). It is also necessary to deactivate the idle time for cooling in the thermal motor model by selecting the default = 0 = deactivated (see Section 10.6, "Idle time parameters").

The table below presents an overview of switching frequencies per hour in accordance with the influencing factors.

3RK1301-0AB20-0AA2 (0.3 to 3 A)				
CLASS 10A				
Device orientation	vertical			horizontal
Ambient temperature	40 °C	50 °C	60 °C	40 °C
I_e = 3 A, CD = 30 %, start 3 x I_e/2 s	240	200	160	160
I_e = 3 A, CD = 70%, start 3 x I_e/2 s	180	150	120	120
CLASS 10				
Device orientation	vertical			horizontal
Ambient temperature	40 °C	50 °C	60 °C	40 °C
I_e = 3 A, CD = 30 %, start 3 x I_e/4 s	120	100	80	80
I_e = 3 A, CD = 70%, start 3 x I_e/4 s	80	70	60	60
3RK1301-0BB20-0AA2 (2.4 to 8 A)				
CLASS 10A				
Device orientation	vertical			horizontal
Ambient temperature	40 °C	50 °C	60 °C	40 °C
I_e = 8 A, CD = 30 %, start 3 x I_e/2 s	80	70	60	60
I_e = 8 A, CD = 70%, start 3 x I_e/2 s	60	50	40	40
3RK1301-0CB20-0AA2 (2.4 to 16 A)				
CLASS 10A				
Device orientation	vertical			horizontal
Ambient temperature	40 °C	50 °C	60 °C	40 °C
I_e = 3 A, CD = 30 %, start 3 x I_e/2 s	240	200	160	160
I_e = 3 A, CD = 70%, start 3 x I_e/2 s	180	150	120	120
I_e = 8 A, CD = 30 %, start 3 x I_e/2 s	80	70	60	60
I_e = 8 A, CD = 70%, start 3 x I_e/2 s	60	50	40	40
I_e = 16 A, CD = 30 %, start 3 x I_e/2 s	35	25	12	12
I_e = 16 A, CD = 70%, start 3 x I_e/2 s	25	14	6	6

Table 8-8: Switching frequency for DSS1e-x soft starter

8.4.4 Notes on configuration

In order for a motor to reach its rated speed, motor torque at any given time during run-up must be greater than the torque needed by the load, as otherwise a stable operating point would be reached before the motor achieved its rated speed (the motor would "drag to a stop"). The difference between motor torque and load torque is the accelerating torque that is responsible for the increase in the speed of the drive. The lower the accelerating torque, the longer is the time the motor needs to run up to its operating speed.

Starting torque

Reducing the terminal voltage of a three-phase asynchronous motor reduces the motor's starting current and the starting torque.
Current is directly proportional to voltage, whereas voltage is proportional to the square root of motor torque.

Example:
Motor = 5.5 kW, rated current = 11.4 A, starting current = 6.3 x rated current, motor torque = 36 Nm, starting torque = 2.4 x rated torque
Settings for the soft starter: starting voltage 50% of rated voltage for motor
The reductions are thus as follows:

- Starting current is reduced to half the starting current for a direct start: 50 % of (6.3 x 11.4 A) = 36 A
- Starting torque is reduced to 0.5 x 0.5 = 25 % of the starting torque for a direct start: 25% of 2.4 x 36 Nm = 21.6 Nm

---

Notes
On account of the ratio between starting voltage and torque, it is important to ensure that starting voltage is not too low. This applies particularly in the case of a pronounced pull-up torque, the lowest motor torque that occurs during run-up to rated speed.

If the current through the soft starter exceeds five times the current setting, there is an immediate shutdown. This can happen during the starting and run-down phases in particular. If this happens you should increase the starting time or the coasting down time, as applicable, and also reduce the starting voltage, if necessary.

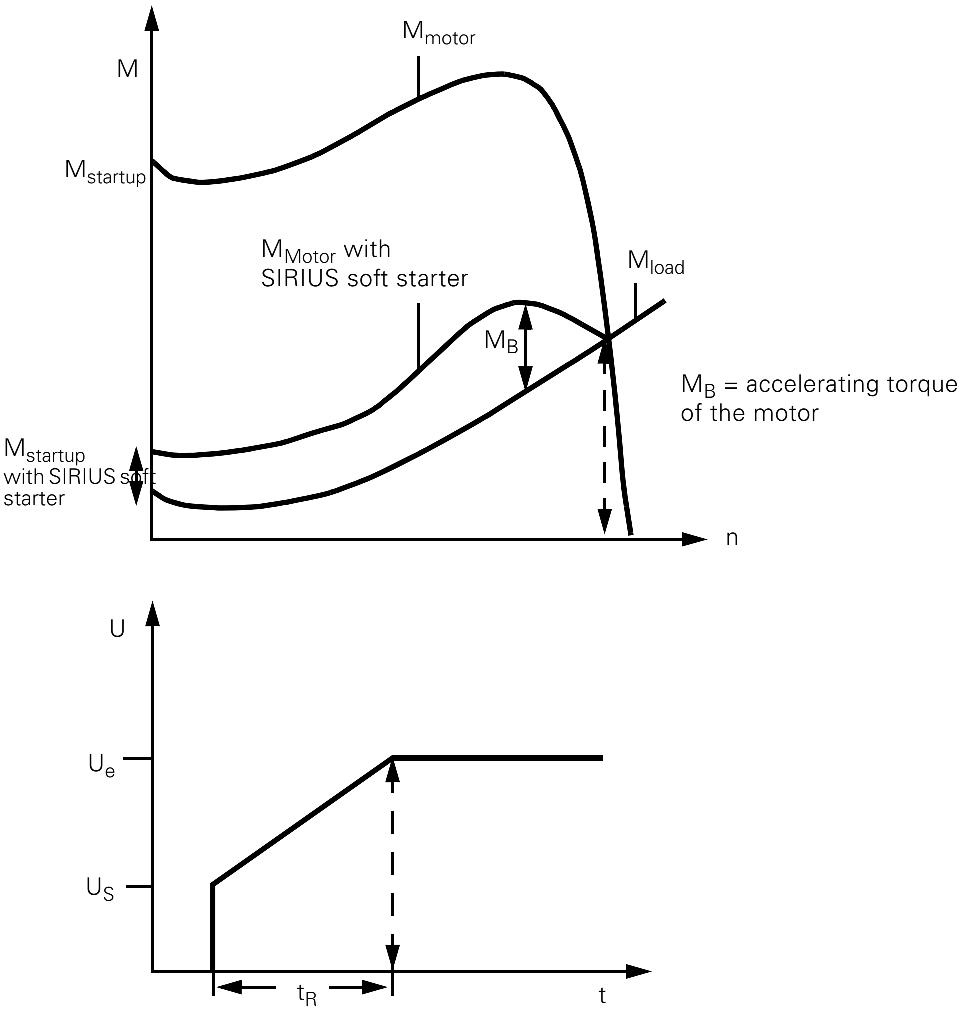


Figure 8-17: Load and motor torques and motor terminal voltage for operation with soft starter

Criteria for selection

Note
For the ET 200S DSS1e-x direct soft starter; high feature, the corresponding soft starter must be selected according to the rated current of the motor (rated current of the soft starter must be ≥ rated current of the motor).

The 3 potentiometers on the starter are used for setting the starting voltage, the starting time, and the coasting-down time.
The soft starter is correctly set when the motor starts smoothly and runs up rapidly to its rated speed.
The ramp time can be set to any value up to 20 seconds.

Starting time

In order to obtain optimum operating conditions for the DSS1e-x soft starter, the the starting time should be set approx. 1 s longer than the resultant motor run-up time, in order to ensure that the internal jumpering contacts do not have to carry the starting current. This protects the internal jumpering contacts and increases their service life. Longer starting times increase the thermal load on the devices and the motor unnecessarily and lead to a reduction in the permissible switching frequency.

8.4.5 Parameters

Parameter assignment

Define the parameters for the IM 151 interface module with the *STEP 7* parameterization software or COM PROFIBUS. To do this, you need the "SIEM806A.GSD" or "SIEM806B.GSD" device master file (see Section 6.1 in the "SIMATIC ET 200S Distributed I/O System" manual).

Parameters

A description of the parameters can be found in Section 10.

The table below lists the actions and value ranges that can be set with the various parameters for the DSS1e-x soft starter.

Parameters	Action, value range	Factory setting
Rated operating current • Range 1 • Range 2 • Range 3	(Increment 10 mA) • 0.3 to 3 A (0.05 to 1.1 kW) • 2.4 to 8 A (1.1 to 3 kW) • 2.4 to 16 A (1.1 to 7.5 kW)	 • 3 A • 8 A • 16 A
Non-resetting on voltage failure [1, 2]	• no • yes	yes
Prewarning limit value [1] (Motor heating)	• 0 ... 95 % I_e • 0 = deactivated (increment: 5 %)	0 = deactivated
Response to overload - thermal motor model	• Shutdown without restart • Shutdown with restart • Warning	Shutdown without restart
Tripping class	• CLASS 5 (10A) • CLASS 10 only at 0.3 -3 A	CLASS 5 (10A)
Recovery time [1, 2]	• 1 ... 30 min (increment: 0.5 min)	1.5 min
Idle time Reset the thermal overload model through functional switching	• 0 ... 255 s • 0 = deactivated (increment: 1 s)	0 (deactivated)
Prewarning limit value [1] (time-based triggering)	• 0 ... 500 s • 0 = deactivated (increment: 1 s)	0 (deactivated)
Response to current limit violation	• Warning • Disconnect	Warning
Lower current limit	• 18.75 ... 100 % [3] (increment: 3.125 %)	18.75 %
Upper current limit	• 50 ... 150 % Ie [3] • 50 ... 400 % Ie [1]) (increment: 3.125 %)	112.5 %

1) from order number suffix: -.A**B**4 present, and can be changed
2) Up to order number suffix: -.AA4: value present, but cannot be changed (fixed on factory setting)
3) Of rated operational current

Table 8-9: Parameters for the DS1e-x direct starter; high feature

Parameters	Action, value range	Factory setting
Blocking current [1,2]	• 150 ... 1000 % I_e (DS1e-x, RS1e-x) • 150 ... 800 % I_e (DSS1e-x) (increment: 50 %)	800 %
Blocking time [1, 2]	• 1 … 5 s Increment: 0.5 s)	1 s
Response with power supply switching element missing [1, 2]	• Group error • Group error only with ON command [4, 1] • Group warning[1]	Group error
Response to residual current detection	• Warning • Disconnect	Disconnect
Response with power switch OFF	• Group error • Group error with ON command [5, 1] • Group warning [1]	Group error
Asymmetry limit value [1, 2]	• 30 … 60 % I_e • 0 = deactivated (Increment 10 %)	30 %
Response to asymmetry	• Warning • Disconnect	Disconnect
Input signal extension [1]	• 0 … 200 ms (increment: 10 ms)	0 ms
Input signal delay [1]	• 10 … 80 ms (increment: 10 ms)	10 ms
Input 1, 2 - signal level (x-increment, expansion module) Input 3, 4 - signal level 2DI COM control module 2DI LC COM control module) (see Section 10)	• NC • NO	NO
Input 1 to 4 - action NO only NO only NO only NO only NO only	• No action • Shutdown without restart • Shutdown with restart • Shutdown at limit position, clockwise rotation • Shutdown at limit position, counter-clockwise rotation • General warning • Manual operation local • Quick stop[1] • Cold run[1] • Emergency start • Motor cw • Motor ccw • Trip reset [1]	No action

1) from order number suffix: -.A**B**4 present, and can be changed
2) Up to order number suffix: -.AA4: value present, but cannot be changed (fixed on factory setting)
5) Possible from order number suffix -.AA**4**

Table 8-9: Parameters for the DS1e-x direct starter; high feature (Contd.)

Parameters	Action, value range	Factory setting
Inputs 1 to 4 signal [1]	• non-retentive • Retentive	non-retentive
Response to CPU/master STOP	• Use dummy value • Keep last value	Use dummy value = disconnect
Replacement values [1]	• Motor cw • Motor ccw (only with reversing starters) • Brake actuation • Trip Reset • Emergency start • Self-test • Quick stop lock	No action
Wait for startup parameter - data record [1]	• no • yes	no
Enable delay of the brake when starting [1]	• -2.5 ... 2.5 s • (increment: 0.01 s)	0 s
Holding time of the brake when stopping [1]	• 0 ... 25 s • (increment: 0.01 s)	0 s
Group diagnosis	• Disable • Enable	Disable

[1] from order number suffix: -.A**B**4 present, and can be changed

Table 8-9: Parameters for the DS1e-x direct starter; high feature (Contd.)

Group diagnosis:
This parameter enables diagnosis messaging (error types are listed in Section 4.7).

Note
The "Disable group diagnosis" parameter also suppresses the display of faults on the SF-LED.

8.4.6 Technical specifications

Dimensions and weight		
Installation dimensions W x H x D (mm)		
• Reversing starter incl. terminal module		65 x 290 x 150
• Height with PE/N block		332
• Depth with 2DI COM control module		173
Weight		
• Reversing starter incl. terminal module		1 kg
• Direct starter incl. PE/N terminal block		1.1 kg
Module-specific data		
Assignment type		Type 1 to $I_e \leq 16$ A, IEC 60947-4-1, DIN VDE 0660, Part 102
Pollution degree at 400 V		3, IEC 60664 (IEC 61131)
Safety class		I, DIN EN 61140 (VDE 140-1)
Degree of protection		IP20, IEC 60529
Power loss P_v [1] at I_e	0.3 up to 3 A	approx. 12 W
	2.4 to 8 A	approx. 9 W
	2.4 to 16 A	approx. 16 W
Site altitude		see Figure 3-3.
Ambient temperature range		0°C to 60°C
• Derating, see Section 3.4		
• Order number suffix -.AB**4** UL/CSA (vertical installation on horizontal rails)		
without DM-V15		60°C/14A 55°C/16A
with DM-V15		60°C/15.2A
(horizontal installation on vertical rails)		
without DM-V15		40°C/14A
Control circuit		
Rated operating voltage for electronic components: U_1		24 VDC (20.4 to 28.8 VDC)
Reverse polarity protection		yes
Rated operating voltage for contactor: U_2		DC 24 V (DC 20.4 to 28.8 V at 0 to 60° C) [2]
Reverse polarity protection		yes
power input		
• From electronic component supply: U_1		approx. 40 mA
• From soft-starter supply U_2		approx. 30 mA
• From the backplane bus		approx. 30 mA
Main circuit		
Rated operating voltage U_e		
IEC 60947-1, EN 60947-1		480 V AC
UL, CSA		480 V AC
Rated insulation voltage U_i		500 V AC
Rated impulse strength U_{imp}		6 kV
Rated frequency		50/60 Hz

1) For motor starter and terminal module as a function of rated operating current I_e (upper setting range).
2) For motor starters with order number suffix -.AA**3** from revision level **E02** and order number suffix -.AA**4**, the frame potential of the contactor supply U_2 is connected to the frame potential of the electronics supply U_1. Connect the frame potential of U_1 and U_2 to the power module in order to prevent high compensating current.

Table 8-10: Technical specifications - DSS1e-x direct soft starter; high feature

Technical specifications - circuit breaker, soft-starter

Circuit breaker	
Rated operating current	3/8/16 A
Instantaneous overcurrent release	Fixed setting at 13 x $I_{e\ max}$
Rated short-circuit breaking capacity to I_e = 16 A (motor starter)	50 kA at 400 V
Mechanical life Electrical life	≥ 100,000 operating cycles 100,000 operating cycles
Soft starter	
Rated operational current I_e at 60°C • AC-53a • AC-53b	 3 A 8/16 A
Max. permissible output of the three-phase induction motors at 400 V AC	7.5 kW

Table 8-11: Technical specifications on DSS1e-x - power switch, soft starter

Reversing starters 9

9.1 Overview

Three versions of the ET 200S motor starters are available:

- Standard series (code: RS-x 1)
- High feature series, characterized by properties that boost system availability and improve diagnosis
  (code: RS1e-x).
  A distinction is made between the following:
  - If there is no communication interface at the front, the order number ends in: -.AA**2**
  - If there is a communication interface at the front, the order number ends in: -.AA**3** via the 2DI COM control module for the "Motor Starter ES" software (from Version 2.0)
  - If there is a communication interface at the front, the order number ends in: -.AA**3** from revision level **E02** via the 2DI COM/-2DI **LC** COM control module for the "Motor Starter ES" software (from Version 2.0)
- Fail-safe series that ensures safe shutdown of the motor starter after an emergency stop command by means of the mechanically selected SG bus (code: F-RS1e-x).
  A distinction is made between the following:
  - With front communication interface via the 2DI COM control module for the "Motor Starter ES" software (from Version 2.0).
  - With front communication interface from revision level **E05** via the 2DI COM/-2DI **LC** COM control module for the "Motor Starter ES" software (from Version 2.0)

All motor starters have full protection against short-circuit and overload.

Due to the integrated electronic overload protection, a cover of the power range up to 16 A with only two device versions is possible with motor starter; high feature/fail-safe. They also have more extensive diagnostics and additional parameters for system control and monitoring.

The motor starter series with installation widths of 45/90 mm and 65/130 mm; high feature can be used in conjunction with the ET 200S safety-integrated system components for safety applications to PL e.

The fail-safe motor starter series (F-DS1e-x and F-RS1e-x) in conjunction with fail-safe power modules (PM-D PROFIsafe and PM-D F X1) is suitable for use in safety applications up to PL e / SIL3.

Warning
If the circuit breaker or starter protection switch is switched on again after being tripped as a result of an overload or a short circuit, and there is a pending On signal for the contactor, the motor starts up.

Caution
Due to the operation of star-connected three-phase motors (especially if <1 kW), high EMC interference may occur. Interference above the IEC limit values can lead to an impairment of functions or failure of the electronics. In case of high EMC interference, we recommend the use of motors with EMC protection circuits. (Exception: electronic starters may not be operated with a EMC protection circuit). The best filtering effect is achieved with three-phase RC interference inversion modules. Varistor interference inversion modules should not be used since they only insufficiently filter out fast transients.

The table below presents an overview of the properties of the reversing starters.

Feature	**RS-x1**	**RS1e-x F-RS1e-x**
Installation width [mm]	90	130
for power rating up to [kW]	5.5	7.5
Integrated switching devices for SIRIUS components of the size	S00	S0
Short-circuit protection with 3RV circuit breaker with instantaneous overcurrent release	X	
Short-circuit protection with 3RV circuit breaker with instantaneous overcurrent release		X
Overload protection with thermal overload release integrated into circuit breaker	X	
Programmable electronic overload protection		X
Switching function	mechanical	
Rated operating current	0.14 - 12 A	0.3 - 16 A
Rated operating voltage	400 V	
Parameterizable	no	yes
Tripping class CLASS	10	10, 20
Asymmetry recognition	yes	
Residual current detection	no	yes
Parameterizable current limits	no	yes
Anti-blocking function with rapid shutdown	no	yes
Type of coordination (2 at 400 V)	2 (up to 1.6 A)	2
Use up to SIL (IEC 62 061)	SIL3 1)	SIL3 1) SIL2 3)
Up to performance level (DIN EN ISO 13849-1)	PLe 1)	PLe 2) PLd 3)
Extra safety auxiliary switch	with fail-safe kit 2	integral
Compatible expansion modules (brake control modules)	xB1 to 6	
Free inputs through 2DI COM control module	no	yes 3)
2DI LC COM control module usable?	no	yes 4)
"*Motor Starter ES*" usable?	no	yes 3)
Derating necessary at top end of performance range?	yes	yes 2)
Diagnosis, fault types see Section	4.7	

1) Only with failsafe kit and additional infeed contactor
2) With additional infeed contactor
3) As of order number suffix -.AA3 and for F-RS1e-x
4) As of order number suffix -.AA**3** and revision level **E02**, as well as for F-RS1e-x from revision level **E05**

Table 9-1: Overview of reversing starters

9.2 RS1-x reversing starter; standard

9.2.1 Features

ET 200S **RS1-x ...** reversing starter; standard (see Figure 9-2)

- Are motor starters for two directions of rotation that can be can be used in the ET 200S distributed I/O device.
- Are suitable for switching and protecting three-phase loads up to 5.5 kW at 400 and 500 VAC
- Are available with setting ranges of 0.14 - 0.2 A to 9 - 12 A
- Are equipped with electromechanical SIRIUS switchgear
- The contactor coils are controlled directly via integrated outputs.
- The switching states of circuit breaker and contactor are indicated via integrated inputs.
- Available diagnostic information of the reversing starter:
  - overload or short-circuit tripping/disconnection of the motor starter
  - fault at the motor starter
- The circuit state and status are displayed via LEDs.
- Mechanical locking of clockwise/counterclockwise rotation
- Integrated disconnection functions via circuit breaker
- Upgradable with fail-safe kit 2 for safety system applications
- Have an expansion interface (DO 0.2) for driving an additional module (e.g. brake control module xB1 to xB6)
  In the case of the xB3 and xB4 only the brake function is supported; the inputs have no effect.
- The inputs of the xB3, xB4 or xB6 brake control module (e.g. limit-position switches) act directly on the contactor and brake drive circuit (for signal response, see Section 12.3.4).

Important
A protection circuit for the contactor coils is already integrated in the motor starter. Additional protection circuits connected to the contactor are not permissible.

Important
When switching over from clockwise rotation to counterclockwise rotation and vice versa, a switch-over interval of >200 ms must be observed.
Please take into account this idle time in your user program.

Note
Input 1 (clockwise limit switch) has a direct effect on the contactor for clockwise rotation of the RS1-x and on the activation of the brake control module.
Input 2 (counter-clockwise limit switch) has a direct effect on the contactor for counter-clockwise rotation of the RS1-x and on the activation of the brake control module.

View

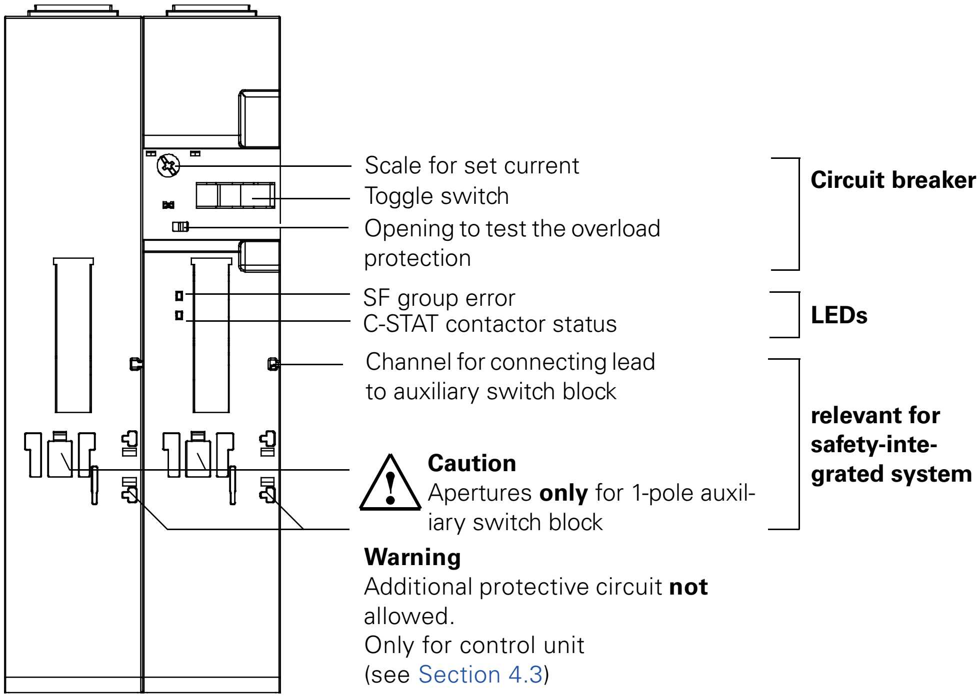


Figure 9-1: RS1-x reversing starter; standard

Circuit diagram

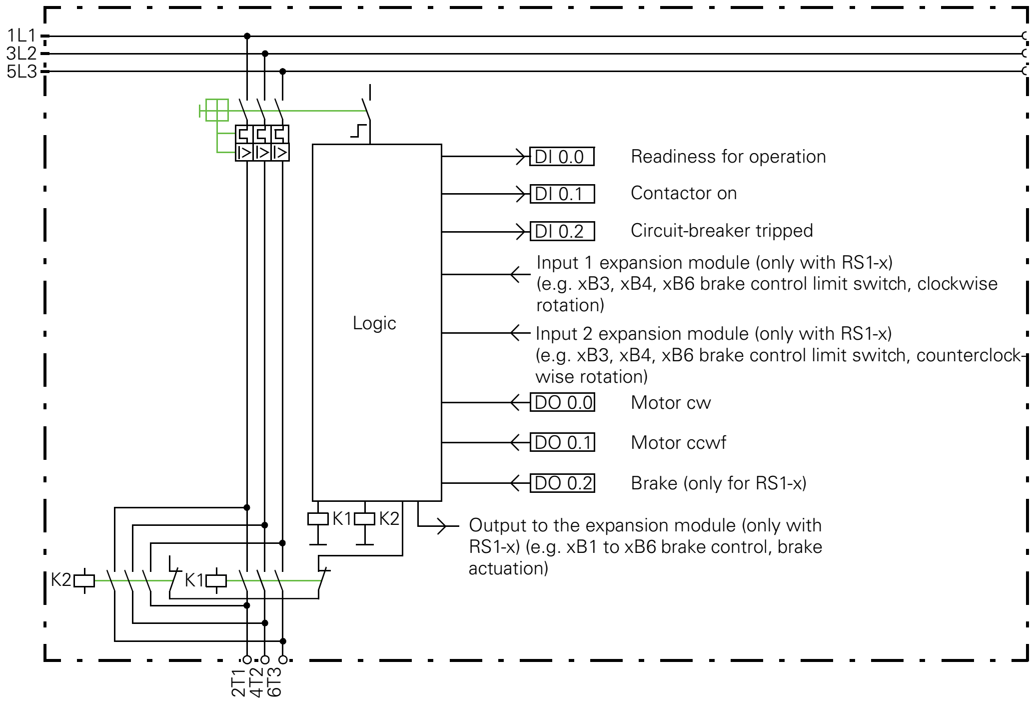


Figure 9-2: Circuit diagram for RS1-x reversing starter; standard

9.2.2 Parameters

The following table indicates the parameters that can be set for the reversing starter.

Parameters	Action, value range	Factory setting	Applicability
Group diagnosis	• Disable • Enable	Disable	Module
Response to CPU/ master STOP	• Disconnect • Keep circuit state	Disconnect	Module

Table 9-2: Parameters for RS1-x reversing starter; standard

Group diagnosis:
This parameter enables diagnosis messaging
(error types are listed in Section 4.7).

Note
The "Disable group diagnosis" parameter also suppresses the display of faults on the SF-LED.

9.2.3 Technical specifications

Dimensions and weight	
Installation dimensions W x H x D (mm)	
• Reversing starter incl. terminal module	90 x 264 x 120
• Height with PE/N block	306
• Depth with fail-safe kit (safety-integrated system)	144.5
Weight	
• Reversing starter incl. terminal module	1.6 kg
• Reversing starter incl. PE/N terminal block	1.8 kg
Module-specific data	
Assignment type	Type 1 to $I_e \leq 12$ A, IEC 60947-4-1, DIN VDE 0660, Part 102 Type 2 to $I_e \leq 1.6$ A
Pollution severity	
• At 400 V	3, IEC 60664 (IEC 61131)
• At 500 V	2, IEC 60664 (IEC 61131)
Safety class	I, DIN EN 61140 (VDE 140-1)
Degree of protection	IP20, IEC 60529
Power loss P_v [1)] at I_e ≤ 1.25 A	approx. 9 W
1.6 to 6.3 A	approx. 10 W
8 to 12 A	approx. 11 W
Control circuit	
Rated operating voltage for electronic components: U_1 Reverse polarity protection	24 VDC (20.4 to 28.8 VDC) yes
Rated operating voltage for contactor: U_2 Reverse polarity protection	24 VDC (20.4 to 28.8 VDC) yes
power input	
• From electronic component supply: U_1	approx. 20 mA
• From contactor supply: U_2	approx. 100 mA
• From the backplane bus	≤10 mA
Main circuit	
Rated operating voltage U_e	
• IEC 60947-1, EN 60947-1	400 V AC
• Protective separation between main and auxiliary circuits	400 V
• UL, CSA	600 V AC
Rated insulation voltage U_i	500 V AC
Rated impulse strength U_{imp}	6 kV
Rated frequency	50/60 Hz

1) For motor starter and terminal module as a function of rated operating current I_e (upper setting range).

Table 9-3: Technical specifications - RS1-x reversing starter; standard

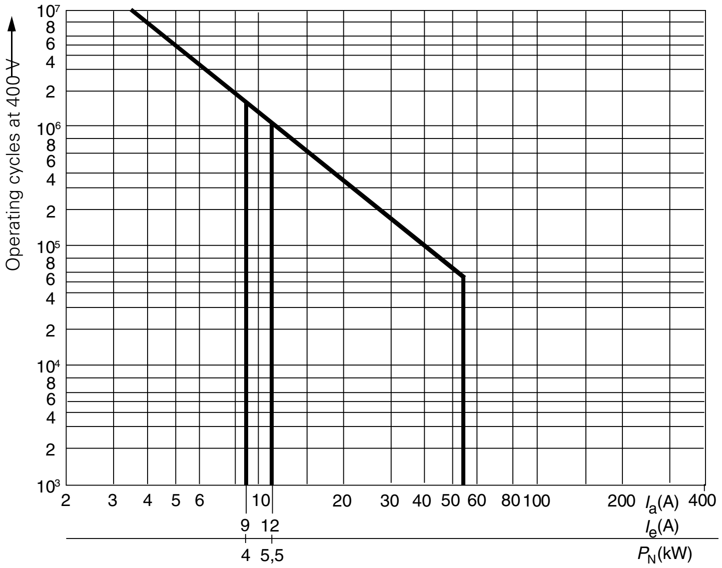
Technical specifications - circuit breaker, contactor

Circuit breaker	
Tripping class	Class 10
Max. rated operating current	12 A
Adjustment ranges • Thermal overload release • Instantaneous overcurrent release	 0.14 - 0.2 A to 9 - 12 A fixed setting at 12 x I_e
Rated short-circuit breaking capacity to I_e = 12 A	50 kA at 400 V
Mechanical life Electrical life	≥ 100 000 switching cycles 100 000
contactor	
Rated operational current I_e at 60°C • AC-1 • AC-2, AC-3 - At 400 V - At 500 V • AC-4 at 400 V	 12 A 12 A 9 A 4.1 A
Max. permissible output of the three-phase induction motors at 500 VAC	5.5 kW
Positively driven operation - auxiliary contacts, contactor	yes
Mechanical life • contactor • Contactor with safety functionality	 30 million switching cycles 10 million switching cycles
Electrical life B10	see Figure 9-3. 1,000,000 [1)]
Surge suppression	Zener diodes integrated
Operating times in the case of DC operation (total break time = contact parting time + arcing time) • At 0.85 to 1.1 x U_s - Closing time - Contact parting time • Arcing time	 25 to 100 ms 20 to 50 ms 10 to 15 ms
• At 1.0 x U_s - Closing time - Contact parting time	 typ. 25 ms typ. 30 ms

[1)] This information refers only to the mechanical switching element under its reference conditions.

Table 9-4: Technical specifications RS... - circuit breaker, contactor, auxiliary switch block

Electrical life



I_a = Breaking current

I_e = Rated operating current

P_N = Rated power of three-phase motors at 400 V

Figure 9-3: Electrical service life, contactor

9.3 RS1e-x reversing starter; high feature F-RS1e-x fail-safe reversing starter

9.3.1 Features

ET 200S **RS1e-x** reversing starter; high feature
ET 200S **F-RS1e-x** fail-safe reversing starter

- Are motor starters for two directions of rotation that can be can be used in the ET 200S distributed I/O device.
- Are suitable for switching and protecting three-phase loads up to 7.5 kW at 400 and 500 VAC
- Are available in 3 setting ranges with 0.3 - 3 A, 2.4 - 8 A, 2.4 - 16 A
- fitted with electro-mechanical SIRIUS switchgear (power switch, contactor)
- Have parameterizable electronic overload protection
- Upper and lower current limits can be defined and monitored for system and process supervision
- The motor starter can be parameterized for warning or shutdown as the response to an overload event or if a current limit is violated
- The integral protective mechanism recognizes a blocked motor and triggers a rapid shutdown
- Integrated residual current detection
- Integrated asymmetry detection
- The as-is current is measured and the information transmitted to analyzers
- The contactor coils are controlled directly via integrated outputs.
- The switching status of the power switch is registered by means of an auxiliary switch
- Detection of the circuit state of the contactor on the basis of current flow evaluation
  Detection of the circuit state in the F-RS1e-x using an auxiliary switch block as well
- Available diagnostic information of the direct starter (see Table 4-7)
- Circuit state and motor-starter status are indicated by LEDs
- Mechanical locking of clockwise/counterclockwise rotation
- Integrated disconnection functions via circuit breaker
- For RS1e-x:
  auxiliary switch for ET 200S safety engineering (failsafe kit) already integrated
  For F-RS1e-x:
  Fail-safe partial shutdown integrated
- The motor starters can be expanded with front-mounted standard SIRIUS accessories (e.g. auxiliary switch, time relay) for contactor size S0
- Have an expansion interface (DO 0.2) at the side for driving an expansion module (e.g. brake control module xB1 to xB6)
- Response to circuit breaker OFF parameterizable
  (from order number suffixes -.AA**4** and -.A**B**4)
- The 2 parameterizable inputs (DI 0.4 and DI 0.5, e.g. limit-position switches) of the expansion interface (expansion module, e.g. brake control module xB3, xB4, xB6) act directly on contactor and brake drive
- 2 additional parameterizable inputs (DI 0.6 and DI 0.7) are available through the 2DI COM/-2DI LC COM control module that can be plugged into the front
- Basic factory settings via the rotary switch of the power switch possible
  (see Section 10.18)

- Communication interface at the front for the RS1e-x with order numbers ending in: -.AA**3** and for F-RS1e-x via the 2DI COM control module for the "Motor Starter ES" software (from Version 2.0)
- With the 2DI LC COM control module for the "Manual Operation Local" mode for RS1e-x with order number suffix: -.AA**3** from revision level **E02** and for F-RS1e-x from revision level **E05**.

With RS1e-x from order number suffix -.A**B**4:

- Quick stop
- Cold run
- Integrated log book functions with 3 device log books
- Has expanded parameter options
- PROFIenergy
- Comprehensive diagnostics via data records
- I&M data

More information can be found in Section 10

View of RS1e-x reversing starter; high feature

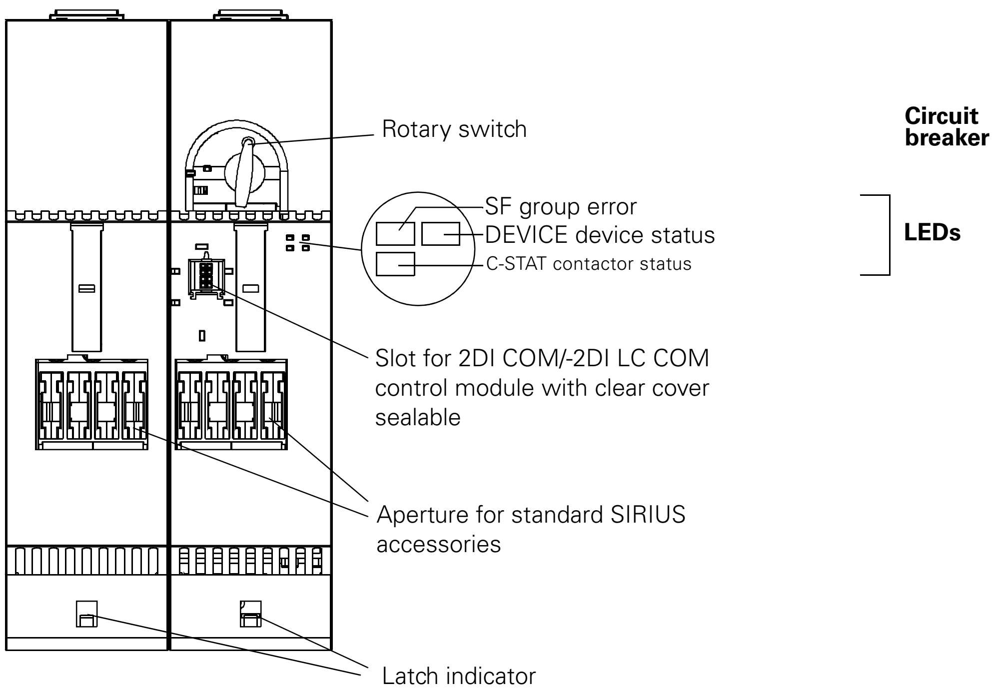


Figure 9-4: RS1e-x reversing starter; high feature

Circuit diagram of RS1e-x reversing starter; high feature

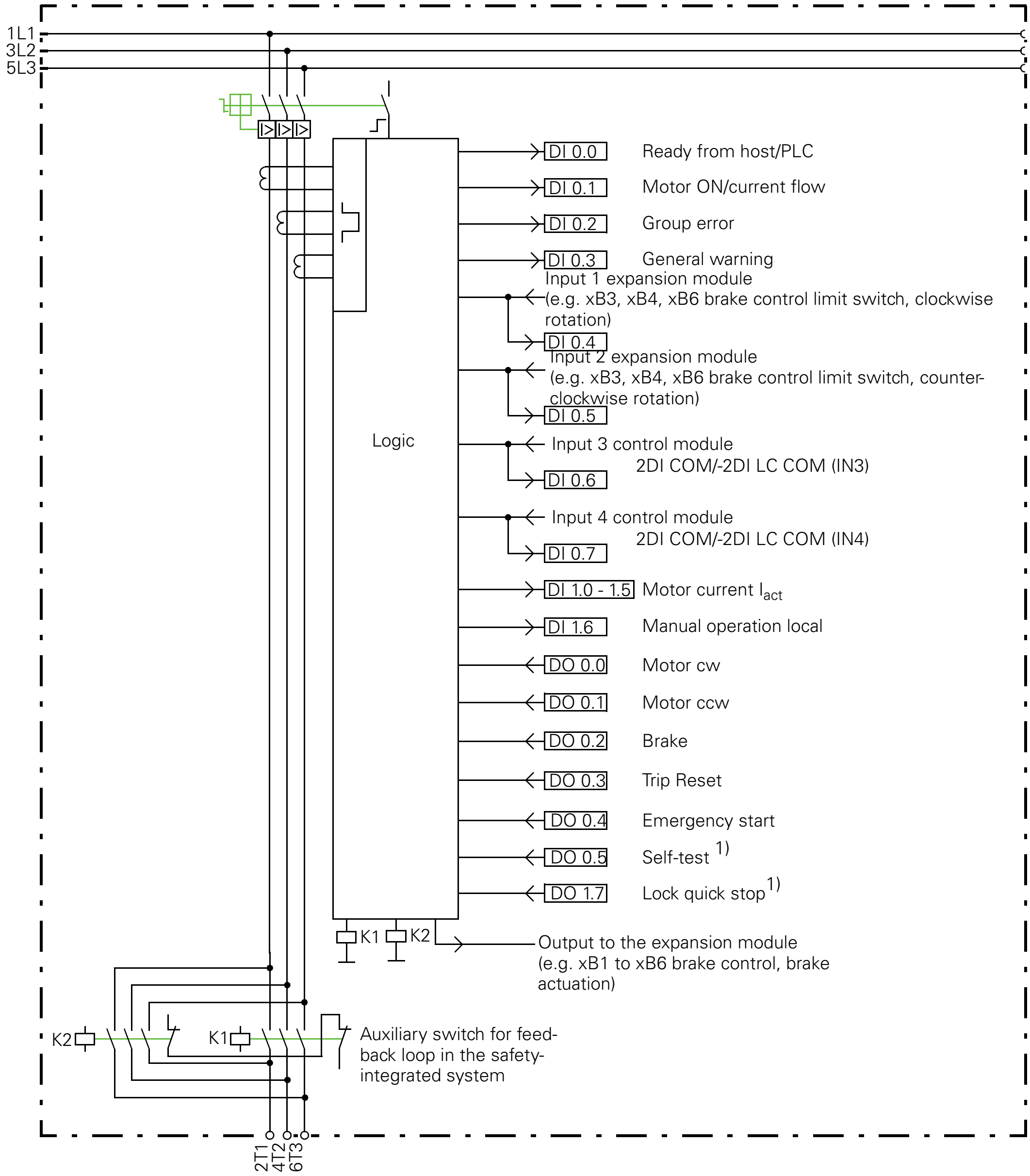


Figure 9-5: Circuit diagram of RS1e-x reversing starter; high feature

More detailed descriptions:

- Input signals, in section 4.9.2
- Output signals in section 4.9.2
- Motor current I_{Act} in section 10.3
- Inputs/actions in section 10.11
- Emergency start in section 10.13
- Trip reset in section 10.14

1) Order number suffix -.A**B**4

9.3.2 Additional features of the F-RS1e-x

Additional features that **only** apply to the fail-safe **F-RS1e-x** reversing starters are:

- 6 safety groups (SG1 to SG6) can be set using coding connectors in the terminal module
- The safety groups are supplied via a fail-safe power module with overvoltage protection (PM-D F PROFIsafe, PM-D F X1)
- 2 processors that monitor each other, for controlling the safety function: Safe shutdown in the event of emergency stop via the mechanically selected SG bus
- The motor starter is safely shut down if the two processors produce varying results
- A shunt release for the power switch is integrated to ensure a safe shutdown in the event of one of the contactors being welded. This feature can also be used in non-fail-safe mode to ensure a shutdown in the event of a welded contactor (see note)
- It is possible to test the shunt release/power switch via the bus (DO 0.5)
- Storage of the U_1 operating voltage using a capacitor to ensure a safe shutdown in the event of U_1 failure
- Monitoring of the functioning of the capacitor for the U_1
- Redundant configuration of the fail-safe components in the motor starter
- The fail-safe modules are identified by yellow labeling strips.

Note
A fail-safe motor starter can also be used in non-fail-safe mode with a PM-D power module. To do this, the coding for the safety group in the terminal module of the fail-safe motor starter must be set to SG3 and the U_1 and U_2 supply voltages must have the same potential.

Safety note
When using expansion modules (brake modules xB1 to xB6, 2DI COM/-2DI LC COM control module), make sure that these modules are **not** fail-safe modules with fail-safe technology.

Expansion module PL according to DIN EN ISO 13849-1 SIL according to IEC 62 061	Operating mode Non-fail-safe mode	PLc/ SIL1/	PLd/ SIL2	PLe /SIL3
xB1	X	X	X	X
xB2	X	X	X	X
xB3	X	X 1)	X 1)	
xB4	X	X 1)	X 1)	
xB5	X	X	X	X
xB6	X	X 1)	X 1)	
2DI COM control module 2DI LC COM control module	X	X 1)	X 1)	X 1)

1) No feedback to the fail-safe technology may occur through the inputs, i.e. cross-circuits to the sensor cables should be eliminated (cross-circuit proof cable installation)

Safety note
Only applies in fail-safe mode (fail-safe technology)
The F-RS1e-x can only be operated in the potential group of a PM-D F PROFIsafe or PM-D F X1 that safely limits the voltage to within the SIMATIC range.

Safety note
Cyclic test of the F-RS1e-x
- Shunt release/circuit breaker

Request self-test (DO 0.5)
Circuit breaker must be in "Trip" position
Turn circuit breaker to position "0"
Circuit breaker must remain in position "0" by itself
Turn circuit breaker to position "1"
Circuit breaker must remain in position "1" by itself
- Contactor

Execute ON/OFF cycle with the emergency stop command using the mechanically selected
SG bus. Carry out test for clockwise rotation
(DO 0.0 - motor cw - must be "1" for this purpose), then carry out test
for counter-clockwise rotation (DO 0.1 - motor ccw must be "1" for this purpose).

The tests should be carried out on **commissioning** and then at least **every 3-6 months** (intermittent operation).

Safety note
Only one SG bus can be selected in the terminal module for each motor starter.

Safety note
You must only use the F-RS1e-x motor starter to control motors that do not constitute a danger to persons or to the environment if they suddenly shut down.

Important
After U_1 has been applied, the F-RS1e-x requires approximately 30 s until the internal self-test is completed. DI 0.0 ready is then set in the process mapping via the host/PLC. Once the internal self-test is completed, the selected SG bus is monitored.

View of the F-RS1e-x fail-safe reversing starter

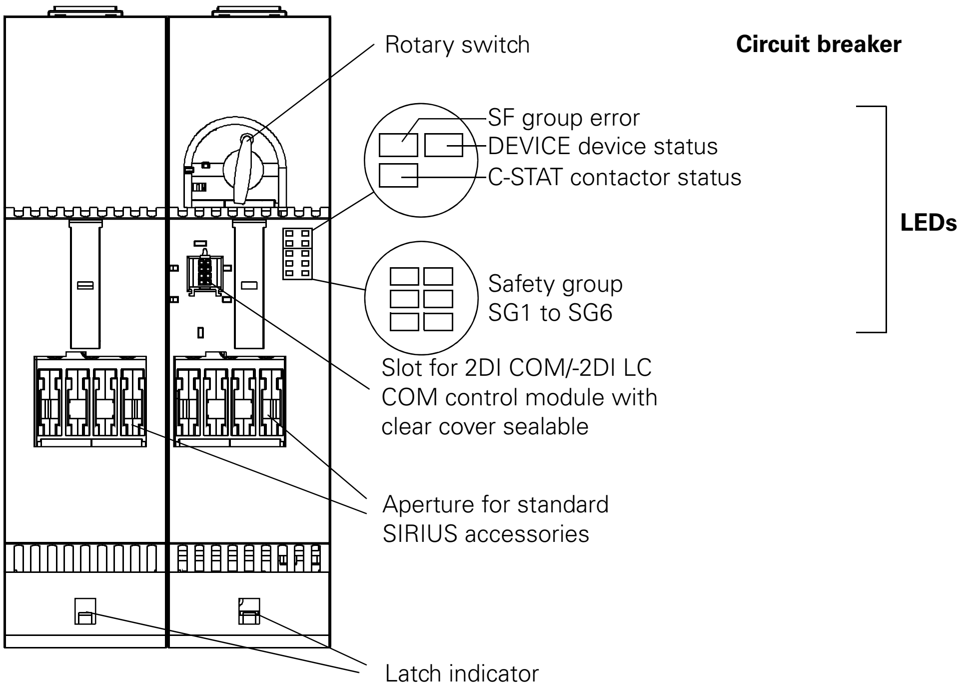


Figure 9-6: Fail-safe F-RS1e-x reversing starter

Circuit diagram of the F-RS1e-x fail-safe reversing starter

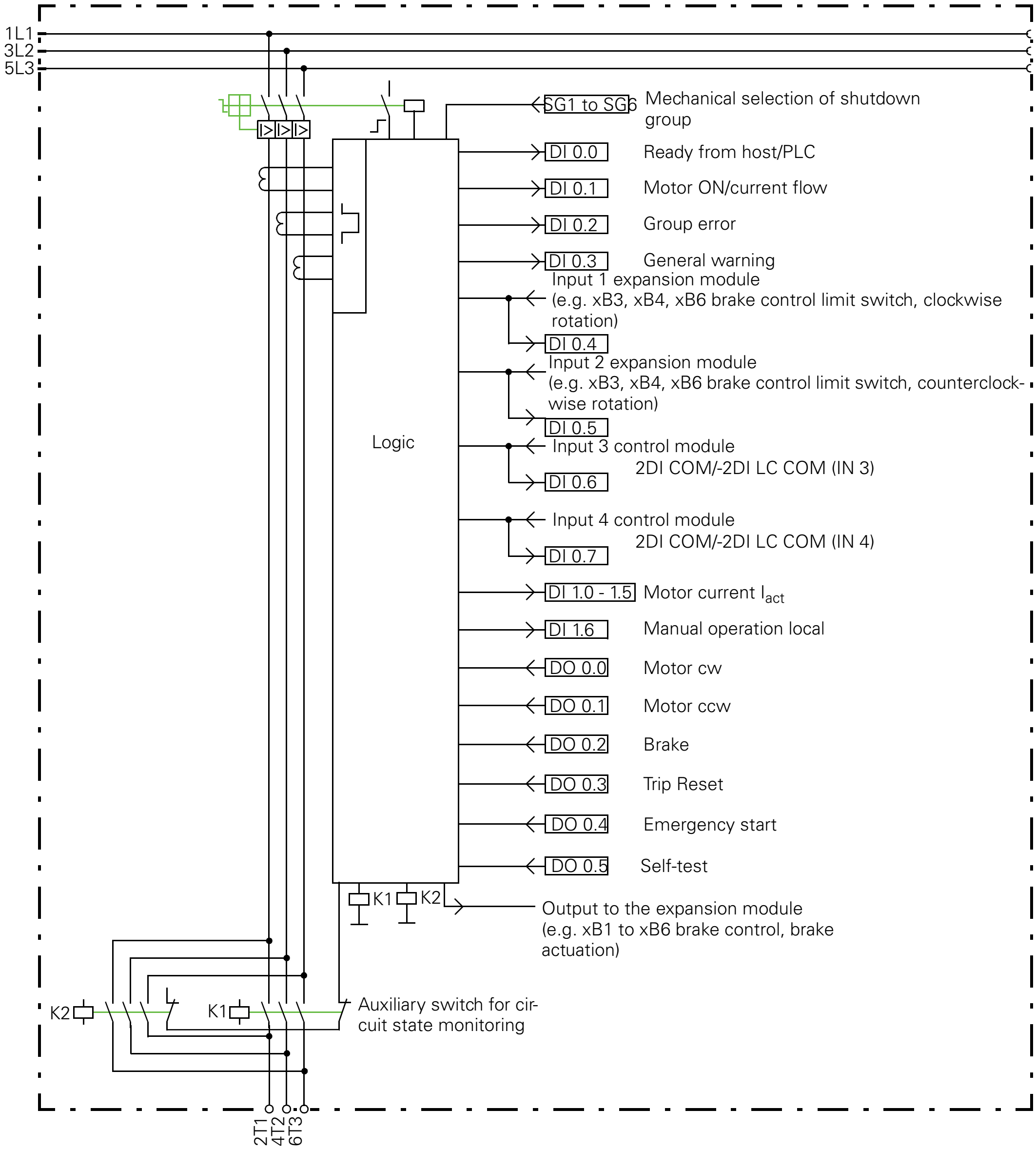


Figure 9-7: Circuit diagram of the fail-safe F-RS1e-x reversing starter

More detailed descriptions:

- Input signals, in section 4.9.2
- Output signals in section 4.9.2
- Motor current I_{Act} in section 10.3
- Inputs/actions in section 10.11
- Emergency start in section 10.13
- Trip reset in section 10.14

9.3.3 Module replacement

If a module has to be replaced, an acceptance test is not necessary. With the F-RS1e-x, however, it is necessary to repeat the safety function test (see cyclic test).

Warning
If there is a pending ON signal for the contactor, the motor starts up automatically.
This applies to an F-RS1e-x motor starter after the self-test if there is no emergency stop present on the selected SG bus.

9.3.4 Parameters

A description of the parameters can be found in Section 10.

The table below lists the actions and value ranges that can be set with the various parameters for the RS1e-x and F-RS1e-x reversing starters.

Parameters	Action, value range	Factory setting
Rated operating current • Range 1 • Range 2 • Range 3	(Increment 10 mA) • 0.3 to 3 A (0.05 to 1.1 kW) • 2.4 to 8 A (1.1 to 3 kW) • 2.4 to 16 A (1.1 to 7.5 kW)	 • 3 A • 8 A • 16 A
Load type [1,2]	• 3 - phase motor • 1 - phase motor (only with electromechanical starters)	3 - phase motor
Non-resetting on voltage failure [1, 2]	• no • yes	yes
Prewarning limit value [1] (Motor heating)	• 0 … 95 % I_e • 0 = deactivated (increment: 5 %)	0 = deactivated
Response to overload - thermal motor model	• Shutdown without restart • Shutdown with restart • Warning	Shutdown without restart
Tripping class	• CLASS 5 (10a) [1] • CLASS 10 • CLASS 15 [1] • CLASS 20	CLASS 10
Recovery time [1, 2]	• 1 … 30 min (increment: 0.5 min)	1.5 min
Idle time Reset the thermal overload model through functional switching	• 0 ... 255 s • 0 = deactivated (increment: 1 s)	0 (deactivated)
Prewarning limit value [1] (time-based triggering)	• 0 ... 500 s • 0 = deactivated (increment: 1 s)	0 (deactivated)
Response to current limit violation	• Warning • Disconnect	Warning
Lower current limit	• 18.75 to 100 % [3] (increment: 3.125 %)	18.75 %
Upper current limit	• 50 … 150 % Ie [3] • 50 … 400 % Ie [1]) (increment: 3.125 %)	112.5 %

1) from order number suffix: -.A**B**4 present, and can be changed
2) Up to order number suffix: -.AA4: value present, but cannot be changed (fixed on factory setting)
3) Of rated operational current

Table 9-5: Parameters for RS1e-x reversing starter; high feature and F-RS1e-x fail-safe reversing starter

Parameters	Action, value range	Factory setting
Blocking current [1,2)]	• 150 ... 1000 % I_e (DS1e-x, RS1e-x) • 150 ... 800 % I_e (DSS1e-x) (increment: 50 %)	800 %
Blocking time [1, 2]	• 1 ... 5 s (increment: 0.5 s)	1 s
Response with power supply switching element missing [1, 2)]	• Group error • Group error only with ON command [4, 1)] • Group warning[1)]	Group error
Response to residual current detection	• Warning • Disconnect	Disconnect
Response with power switch OFF	• Group error • Group error with ON command [5, 1)] • Group warning [1)]	Group error
Asymmetry limit value [1, 2)]	• 30 ... 60 % I_e • 0 = deactivated Increment: 10 %	30 %
Response to asymmetry	• Warning • Disconnect	Disconnect
Lock time [1,2)] (only with RS1e-x)	• 0 ... 60 s (increment: 1 s) Note: Lock time = 0 means a min. time of approx. 150 ms for safety reasons.	0 s
Input signal extension [1)]	• 0 ... 200 ms (increment: 10 ms)	0 ms
Input signal delay [1)]	• 10 ... 80 ms (increment: 10 ms)	10 ms
Input 1, 2 - signal level (x-increment, expansion module) Input 3, 4 - signal level 2DI COM control module 2DI LC COM control module) (see Section 10)	• NC • NO	NO

1) from order number suffix: -.A**B**4 present, and can be changed
2) Up to order number suffix: -.AA4: value present, but cannot be changed (fixed on factory setting)
5) Possible from order number suffix -.AA**4**

Table 9-5: Parameters for RS1e-x reversing starter; high feature and F-RS1e-x fail-safe reversing starter (Contd.)

Parameters	Action, value range	Factory setting
Input 1 to 4 - action NO only NO only NO only NO only NO only	• No action • Shutdown without restart • Shutdown with restart • Shutdown at limit position, clock-wise rotation • Shutdown at limit position, counter-clockwise rotation • General warning • Manual operation local • Quick stop 1) • Cold run 1) • Emergency start • Motor cw • Motor-ccw) • Trip reset 1)	No action
Inputs 1 to 4 signal 1)	• non-retentive • Retentive	non-retentive
Response to CPU/master STOP	• Use dummy value • Keep last value	Use dummy value = disconnect
Replacement values 1)	• Motor cw • Motor ccw (only with reversing starters) • Brake actuation • Trip Reset • Emergency start • Self-test • Quick stop lock	No action
Wait for startup parameter - data record 1)	• no • yes	no
Enable delay of the brake when starting 1)	• - 2.5 … 2.5 s • (increment: 0.01 s)	0 s
Holding time of the brake when stopping 1)	• 0 … 25 s • (increment: 0.01 s)	0 s
Group diagnosis	• Disable • Enable	Disable
Safe shutdown group 7)	• Not assigned • SG1 to SG6	Not assigned

1) from order number suffix: -.A**B**4 present, and can be changed
7) Only with F-DS1e-x and F-RS1e-x

Table 9-5: Parameters for RS1e-x reversing starter; high feature and F-RS1e-x fail-safe reversing starter (Contd.)

Group diagnosis:
This parameter enables diagnosis messaging (error types are listed in Section 4.7).

Note
The "Disable group diagnosis" parameter also suppresses the display of faults on the SF-LED.

9.3.5 Technical specifications

Reversing starters		**RS1e-x**	**F-RS1e-x**
Dimensions and weight			
Installation dimensions W x H x D (mm) • Reversing starter incl. terminal module • Height with PE/N block • Depth with 2DI COM control module		 130 x 290 x 150 332 173	
Weight • Reversing starter incl. terminal module • Reversing starter incl. PE/N terminal block		 2.2 kg 2.3 kg	
Module-specific data			
Assignment type (up to $I_e \le 16$ A at 400 V)	Type	2	
Pollution severity • At 400 V • • At 500 V		 3, IEC 60664 (IEC 61131) 2, IEC 60664 (IEC 61131)	
Safety class		I, DIN EN 61140 (VDE 140-1)	
Degree of protection		IP20, IEC 60529	
Power loss P_v [1]	at I_e 0.3 up to 3 A 2.4 to 8 A 2.4 to 16 A	approx. 9 W approx. 10 W approx. 18 W	
Ambient temperature range • For derating see Section 3.4 • Order number suffix -.AB**4** UL/CSA (vertical installation on horizontal rails) without DM-V15 with DM-V15 (horizontal installation on vertical rails) without DM-V15		0°C to 60°C 60°C/14A 55°C/16A 60°C/15.2A 40°C/16A	
Maximum attainable safety classes: [3]			
• IEC 61508 SIL[1]		–	3
• PL[2]		–	e
• Cat.[2] (DIN EN ISO 13849)		–	4

Table 9-6: Technical specifications - RS1e-x reversing starter; high feature and F-RS1e-x fail-safe reversing starter

Reversing starters	RS1e-x	F-RS1e-x
Safety parameters:		
• SFF (DIN EN / IEC 61508)	–	99.64 %/ 99.70 %
• DC (DIN EN ISO 13849)	–	>99
• HFT (DIN EN / IEC 61508	–	1
• n_{OP} (DIN EN ISO 13849)	–	1
• d_{OP} (DIN EN ISO 13849)	–	365
• h_{OP} (DIN EN ISO 13849)	–	24
• Low demand PFD_{AVG} (10a)		
Test interval 3 months	–	3.5×10^{-5}
Test interval 6 months	–	8.0×10^{-5}
• High demand/continuous mode PFH		
Test interval 3 months 1/hr	–	8.1×10^{-10}
Test interval 6 months 1/hr	–	1.8×10^{-9}
• Proof test interval years	–	20
• B10	1,000,000[3)]	

1) For motor starter and terminal module as a function of rated operating current I_e (upper setting range).
2) With safety-integrated system (see Section 11)
3) This information refers only to the mechanical switching element under its reference conditions.

Table 9-6: Technical specifications - RS1e-x reversing starter; high feature and F-RS1e-x fail-safe reversing starter (Contd.)

Reversing starters	RS1e-x	F-RS1e-x
Control circuit		
Rated operating voltage for electronic components U_1	24 VDC (20.4 to 28.8 VDC)	24 VDC (21.6 to 26.4 VDC)
Reverse polarity protection	yes	yes
Rated operating voltage for contactor: U_2	DC 24 V (DC 20.4 to 28.8 V) [1)]	
Reverse polarity protection	yes	yes
power input		
• From electronic component supply: U_1	approx. 40 mA	approx. 100 mA
• From contactor supply U_2 Pick-up: (for 800 ms) Hold-in:	 **250 mA** max. **150 mA**	
• From SG1 to SG6 Pick-up: (for 200 ms) Hold-in:		 approx. 250 mA approx. 55 mA
• Test function of the shunt release/power switch (50 ms) from U_1		approx. 1.5 A[2)]
• From the backplane bus	approx. 30 mA	approx. 30 mA
Main circuit		
Rated operating voltage U_e		
• IEC 60947-1, EN 60947-1	500 V AC	500 V AC
• Protective separation between main and auxiliary circuits	400 V	400 V
• UL, CSA	600 V AC	600 V AC
Rated insulation voltage U_i	500 V AC	500 V AC
Rated impulse strength U_{imp}	6 kV	6 kV
Rated frequency	50/60 Hz	50/60 Hz

1) For motor starters with order number suffix -.AA3 from revision level E02, the frame potential of the contactor supply U_2 is connected with the frame potential of the electronics supply U_1. Connect the frame potential of U_1 and U_2 to the power module in order to prevent high compensating current.

2) In the event of simultaneous activation of the test function of several starters, the currents are cumulative! This current also flows if the supply voltage U1 recovers.

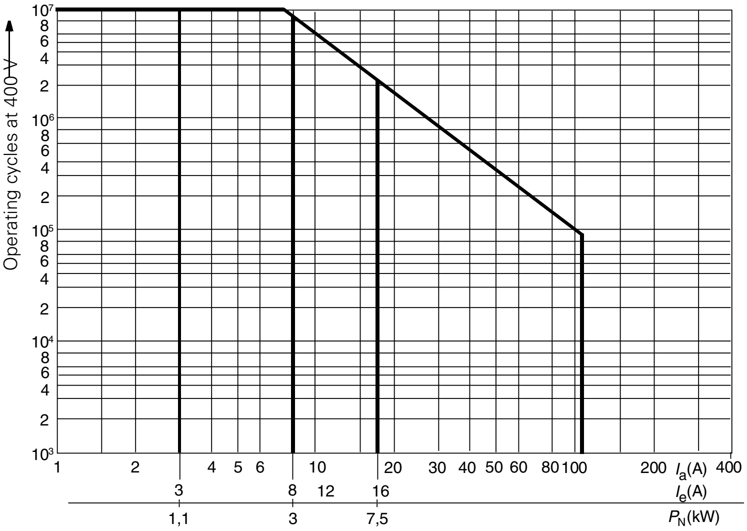
Table 9-6: Technical specifications - RS1e-x reversing starter; high feature and F-RS1e-x fail-safe reversing starter (Contd.)

Technical specifications - circuit breaker, contactor

Reversing starters	RS1e-x	F-RS1e-x
Circuit breaker		
Rated operating current	3/8/16 A	
Instantaneous overcurrent release	Fixed setting at 13 x $I_{e\ max}$	
Rated short-circuit breaking capacity to I_e = 16 A (motor starter)	50 kA at 400 V	
Mechanical life Electrical life	≥ 100,000 operating cycles 100,000 operating cycles	
contactor		
Rated operational current I_e at 60°C • AC-1 • AC-2, AC-3 - At 400 V - At 500 V • AC-4 at 400 V	 16 A 16 A 11 A 9 A	
Max. permissible output of the three-phase induction motors at 500 VAC	7.5 kW	
Positively driven operation - auxiliary contacts, contactor	yes	
Mechanical life contactor	 10 million switching cycles	
Electrical life Switching frequency	see Figure 9-8. 80/hr	
Surge suppression	Zener diodes integrated	
Operating times in the case of DC operation (total break time = contact parting time + arcing time) • At 0.85 to 1.1 x U_s - Closing time (ms) - Contact parting time (ms) • Arcing time (ms)	 25 to 100 20 to 50 10 to 15	 50 to 170 40 to 100 10 to 15
• At 1.0 x U_s - Closing time (ms) - Contact parting time (ms)	 typ. 25 typ. 20	 typ. 50 typ. 40

Table 9-7: Technical specifications of the RS1e-x, F-RS1e-x - power switch, contactor

Electrical life



I_a = Breaking current

I_e = Rated operating current

P_N = Rated power of three-phase motors at 400 V

Figure 9-8: Electrical service life, contactor

Functions

10

10.1 Functions - Overview

This section describes all parameters of the motor starters; high feature/fail-safe modules. A distinction is drawn between the permanently set values (fixed values) and the parameters that can be changed by the user.

ET200S **DS1e-x, RS1e-x, DSS1e-x, F-DS1e-x, F-RS1e-x**	to -.**A**A4	with F-starters	from -.**AB**4
Load type (Page 10-7):			
• 3-phase	✓	✓	✓
• 1-phase			✓
Non-resetting on voltage failure (can be changed) (Page 10-8)			✓
Response with "supply voltage switching element missing" adjustable (Page 10-8)			✓
Field bus interface (Page 10-9):	✓	✓	✓
• Dummy values			✓
• Wait for start-up parameter data records			✓
Reversing starter (Page 10-10)	✓	✓	✓
• Interlock time adjustable			✓
Brake output (only with the corresponding expansion module (xB1 to xB6) appropriate) (Page 10-11)	✓	✓	✓
• Setting the enable delay of the brake			✓
• Setting the holding time of the brake			✓
Motor protection (Page 10-13):			
• Response to overload - (thermal motor model)	✓	✓	✓
• Recovery time (adjustable)			✓
• Prewarning limit value motor heating			✓
• Prewarning limit value time trigger reserves			✓
• Idle time	✓	✓	✓
Plant monitoring (Page 10-18):			
• Response to residual current detection	✓	✓	✓
• Response to current limit violation	✓	✓	✓
• Set current limit values (upper/lower)	✓	✓	✓
• Variable blocking time			✓
• Variable blocking current			✓
• Non-symmetrical limit values (variable)			✓
• Response to asymmetry	✓	✓	✓

Table 10-1: Overview of the device functions

ET200S **DS1e-x, RS1e-x, DSS1e-x, F-DS1e-x, F-RS1e-x**	to -.**A**A4	with F-starters	from -.A**B**4
Inputs (only in combination with expansion module xB1 to xB6 and/or 2 DI COM/2 DI LC COM) (Page 10-38)	✓	✓	✓
• Input signal extension			✓
• Input signal delay			✓
• Retentive			✓
Input actions:			
• Shutdown without restart	✓	✓	✓
• Shutdown with restart	✓	✓	✓
• Shutdown at limit position, clockwise rotation	✓	✓	✓
• Shutdown at limit position, counterclockwise rotation	✓	✓	✓
• General warning	✓	✓	✓
• Manual operation local	✓	✓	✓
• Emergency start	✓	✓	✓
• Motor cw	✓	✓	✓
• Motor ccw	✓	✓	✓
• Quick stop			✓
• Cold run			✓
• Trip Reset			✓
Circuit breaker (Page 10-23): • Behavior with circuit breaker OFF variable	✓[1)]	✓[1)]	✓
Maintenance (Page 10-52)			✓
Communication (Page 10-27)	✓	✓	✓
Emergency start (Page 10-48)	✓	✓	✓
Trip reset (Page 10-49)	✓	✓	✓
Self-test (Page 10-50)		✓	✓
Cold run (Page 10-47)			✓
Log book (Page 10-53)			✓
Factory settings (Page 10-54)	✓	✓	✓
PROFIenergy (Page 10-34)			✓

1) from order number suffix: -.AA4 (group error/group error only with ON command)

Table 10-1: Overview of the device functions (Contd.)

10.2 Introduction

Device function

This section describes the device functions. All device functions have inputs, e.g. device parameters and outputs, e.g. messages.
The following scheme shows the principle of the device function:

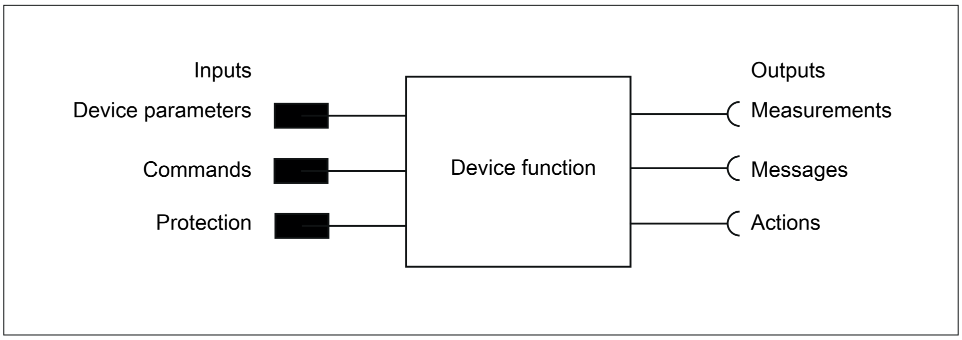


Figure 10-1: Principle of device function.

Further details on the device parameters and their alteration options can be found in the Parameterization section.

Intrinsic device protection

The motor starter protects itself against destruction thanks to the thermal motor model. If the self-protection is triggered,
- the motor and the brake output are shut down immediately,
- the message "Switching element overload" is generated.

It is not possible to switch on using "Emergency start".

Currents

Note
All currents (e.g. blocking current, current limit values) are percentage current values relative to the rated operating current that is set on the device (e.g. Ie= 2 A corresponds to 100 %).

10.3 Basic function / basic parameters

Basic parameters are "central" parameters required by several device functions.

10.3.1 Rated operating current

Here you specify the rated operating current that uninterrupted can result in the branch (switchgear and motor). This is normally the nominal current of the motor. The setting range depends on the performance class of the motor starter ET200S HF / F - starter (0.3 ... 3.0 A, 2.4 ... 8 A and 2.4 ... 16 A).

Notice
The rated operating current is an important central parameter.
The rated operating current must always be set so that the motor protection is ensured via the thermal motor model.

Actual motor current

The present current in the starter is returned for analysis by the process image.

Current is measured for all 3 phases and the highest value is obtained. The 6-bit value returned in the process specifies the motor current ratio I_{act} / I_{rated} (I_{rated} = parameterized rated operating current).
The value is shown with one place to the left of the decimal point (DI 1.5) and five places after the decimal point (DI 1.0 to DI 1.4). The maximum possible ratio of I_{act} / I_{rated} is therefore 1.96875 (approx. 197 %).
Resolution is 1/32 per bit (3.125 %).

DI 1.5	DI 1.4	DI 1.3	DI 1.2	DI 1.1	DI 1.0	
2^0	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	
1	0.5	0.25	0.125	0.0625	0.03125	Total=1.96875
0	0	0	0	0	0	I_{act} = 0
1	0	0	0	0	0	I_{act} = I_{rated} x 1
1	0	1	1	0	0	I_{act} = I_{rated} x 1.375
1	1	1	1	1	1	I_{act} = I_{rated} x 1.96875

I_{act} = rated operating current I_{rated} x value (DI 1.0 to DI 1.5)
I_{rated} = rated motor current

Table 10-2: Actual motor current

Default setting

The motor starter's rated operational current is set ex-works to the maximum value. This means that the motor can be tested without connection to the field bus and the starter does not trip. Correct motor protection might not necessarily be ensured under certain circumstances during this time.
In the GSD file the rated operational current is preset to the minimum value for safety reasons. This value has to be parameterized as part of the configuration procedure. If it is not parameterized the motor starter could trip on account of an overload when the motor is started for the first time.

Settings

Device parameters	Default setting	Adjustment range
Rated operating current	In the motor starter: maximum value In GSD / motor starter ES: minimal value	• 0.3 A ... 3.0 A • 2.4 A ... 8.0 A • 2.4 A ... 16.0 A Increment: 10 mA

Table 10-3: Actual motor current settings

Note
The setting range depends on the device type!

10.3.2 Load type

Here you enter whether the motor starter is to protect a 1-phase or 3-phase consumer.

- With a 1-phase load, the asymmetry detection is deactivated!
  With all mechanically switched motor starters, the 1-phase load can be connected between any two phases.
- With a 3-phase load, the asymmetry detection is activated! The three phase currents are compared with one another.

Note
The load type is only relevant to mechanical motor starters. Only 3-phase load types are permitted for connection to electronic starters.

Caution
It is not possible to connect multiple motors to a motor starter as otherwise the motor protection cannot be ensured.

Settings

Device parameters	Default setting	Adjustment range
Load type	3-phase	• 3-phase • 1-phase

Table 10-4: Load type settings

10.3.3 Non-resetting on voltage failure

These device parameters are used to determine whether the overload message is to be retained if the electronic voltage fails:

- Overload
- No overload

Settings

Device parameters	Default setting	Adjustment range
Non-resetting on voltage failure	yes	• yes • no

Table 10-5: Non-resetting on voltage failure settings

10.3.4 Behavior with supply voltage switching element missing

This parameter is used to determine which message the motor starter outputs when the supply voltage of the switching elements and the output fails.

Note
Supply voltage of the switching elements
The supply voltage of the switching elements (24 V) must be supplied via the voltage supply U_2 (PM-D: A1+ / A2-).

Settings

Device parameters	Default setting	Adjustment range
Behavior with supply voltage switching element missing	Group error	• Group error • Group error only for ON command • General warning

Table 10-6: Settings

10.4 Motor control

10.4.1 Electronic / mechanical switch technology

Electronic switch technology

The motor starter controls the 2-phase motors with thyristors. Phase L1 is not switched but is instead looped via the integrated repair switch from 400 V energy connection on the motor connection

---

Danger
Dangerous voltage.
Risk of death or serious injury
When a supply voltage is applied to the 400 V energy connection on the motor starter, dangerous voltage can occur at the motor starter output even without a starting command.
In the event of work on the feeder, this must be isolated via the repair switch.

Mechanical switching technology

The motor starter controls the 3-phase motors with contactors.

Switching element defective

In the event of a defective switching element (contactor welded / connected through thyristor), the motor starter is no longer able to switch off the motor.

Note
If necessary, evaluate the "Switching element defective" message and switch the branch through a previous switching element accordingly.

Messages and actions

Message	Actions
Switching element defective	Disconnect
Switching element shortcircuited (e.g. contactor welded, power semiconductor connected through)	Disconnect
Switching element overload (e.g. power semiconductor too hot)	Disconnect
Motor cw	—
Motor ccw (only with reversing starters)	—
Electronics power supply too low	—
Switching element power supply missing	—
Start-ready for motor on	—

Table 10-7: Messages and actions for switching technology

10.4.2 Reversing starter control function

Description

This control function can be used by the motor starter to control the motor rotation directions. An internal logic prevents both rotation directions being activated at the same time.
The time-delayed switchover from one rotation direction to the other direction is realized by the interlock time. This function is only relevant to reversing starters.

Interlock time

The interlock time effects the time-delayed switchover of the rotation direction. Within the interlock time, the centrifugal mass of a drive should come to a standstill before the next switching command can be executed.

Caution
An interlock time set to 0 is set internally to 150 ms for safety reasons.

Settings

Device parameters	Default setting	Adjustment range
Interlock time	0	0 ... 60 s Increment: 1 s

Table 10-8: Replacement value settings

Messages and actions

Message	Action
Motor ccw	—
Interlock active	—

Table 10-9: Messages and actions for reversing starter control function

10.5 Brake output (actuation via expansion modules)

Description

A mechanical disc brake or spring action brake fitted onto the motor brakes the motor. The brake is controlled via the brake output.
ET200S motor starters provide the option of switching the brake on a motor separately via external expansion modules (xB1 to xB6). This electronic output can be controlled independently of the switching status of the contactors / thyristors and thus from the motor status via the motor starter process image.

Enable delay of the brake when starting

Note
Only effective with a simultaneous ON switching command for brake and motor.

Positive time specifications: Delayed switching on of the brake output (brake venting) in relation to the motor.
Negative time specifications: Delayed switching on of the motor in relation to the brake output (brake venting)[1].
In reversing mode, the enabling delay only starts after the interlock time elapses.

Holding time of the brake when stopping

Note
Only effective with a simultaneous OFF switching command for brake and motor.

These device parameters effect a delayed shutdown[1] of the brake output in relation to the motor. It also has an effect if the PLC fails.

In reversing mode, the holding time and interlock time run simultaneously. Switching on in the opposite direction of rotation is only possible after the interlock time has elapsed. It is possible to switch on in the same rotation direction straight away as here the interlock time is aborted.

Priorities regulation

"Enable delay of the brake when starting" has priority over "Holding time of the brake when stopping". An elapsed holding time is aborted when the enable delay is re-started. (Via ON switching command for brake and motor)

[1] can only be realized with a separate externally-supplied brake.

Settings

Device parameters	Default setting	Adjustment range
Enable delay of the brake when starting	0 s	- 2.5 ... + 2.5 s Increment: 0.01 s
Holding time of the brake when stopping	0 s	0 ... + 25 s Increment: 0.01 s

Table 10-10: Brake output settings

Messages and actions

Message	Action
Brake output active	—

Table 10-11: Messages and actions for brake output

Caution
Negative enable delay and/or active holding time can only be realized with a separate, externally supplied brake.

10.6 Thermal motor model - motor protection

Description

An approximation of the heating status of the motor is calculated from the measured motor currents and the device parameters "Rated operational current" and "enable class". The data that indicates whether the motor is overloaded or working within its normal operating range is derived from this temperature.

Response to overload - thermal motor model

This device parameters is used to determine how the motor starter reacts to overload:

- Shutdown without restart (AUTO RESET = off)
- Following an overload, the shutdown command can only be reset after the motor model falls below the release threshold and a subsequent reset command (trip reset).
- Shutdown with restart (AUTO RESET = on)

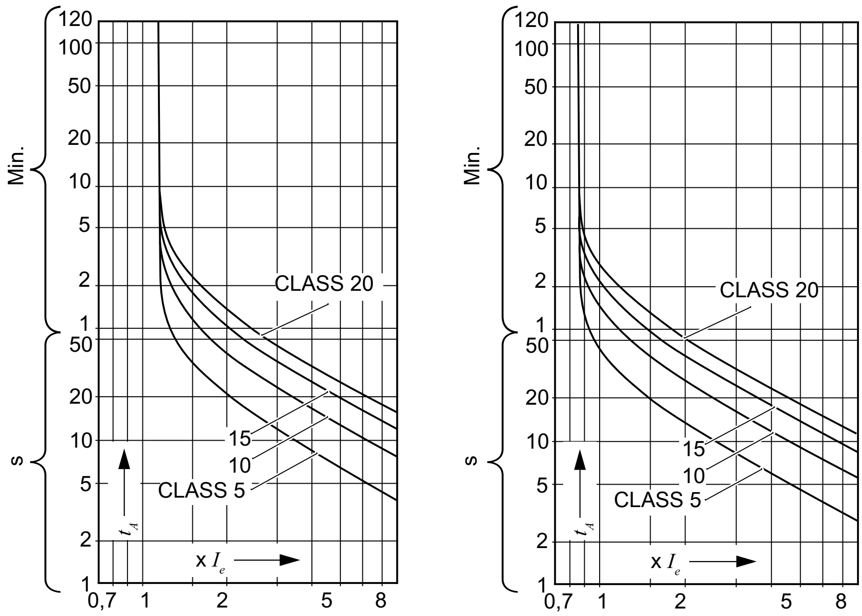
Warning
If "shut down with restart" is activated, the motor will start automatically.
Risk of death, serious injury or damage to property
In the event of a 'switch on' command to be dealt with, the motor starter will switch on automatically after the recovery time has elapsed. (Autoreset)
Ensure that no dangerous status conditions can occur.

- Warning

Caution
If the thermal motor model exceeds the limit value of 178 % for the intrinsic protection of the motor starter, a shutdown command is generated by the motor starter itself independently of the "Response on overload - thermal motor model" parameterization.

Tripping class

The tripping class (CLASS) defines the maximum time to disengagement within which a protective device must trip from cold at 7.2 times the setting current (motor protection to IEC 60947). The tripping characteristics plot time to disengagement as a function of operating current.



3-pole symmetrical load

2-pole load
(failure of a phase or
current asymmetry > 40 %)

Figure 10-2: Tripping class

Note
The options for the tripping classes depend on the motor starter and on the current range

---

The following tripping classes can be parameterized:

Motor starters	CLASS
F-DS1e-x F-RS1e-x	10/20
DS1e-x RS1e-x	5(10a)[1)] / 10 / 15[1)] / 20
DSS1e-x: 0.3 ... 3 A 2.4 ... 8 A 2.4 ... 16 A	 5(10a) / 10 5(10a) 5(10a)

1) from an order number suffix: -.A**B**4

Recovery time

Recovery time is the time defined for cooling after which a reset is possible following an overload trip.
During the recovery time, any trip reset signals present remain ineffective.
The recovery time after overload tripping is at least 1 minute. The recovery time can be parameterized and can be changed between 60 seconds and 1800 seconds. Power failures during this time extend the time specifications accordingly when the basic "Non-resetting on voltage failure" parameter is active.

Prewarning limit value motor heating

The motor starter also has the function of a prewarning, i.e. the motor starter warns if the motor heating limit is exceeded. This parameter can be used to specify a percentage motor heating process as a prewarning limit.
This function is deactivated with a motor heating prewarning limit of 0 %.

Prewarning limit value time-based trigger reserve

This parameter can be used to specify a time as a prewarning limit. The motor starter warns against an impending overload shutdown within the parameterized time if the current operating conditions are observed. This function is deactivated with a time-based trigger reserve of 0 s.

Idle time

Idle time is a time defined for cooling process following operational shutdown, in other words not after overload trips.
After this time elapses, the thermal memory of the motor starter is cleared. A cold start is possible.
This permits higher switching frequencies if the drive is of the correct size, without the motor model trigger limit being exceeded.

Caution
Higher switching frequencies result in greater motor heating. If the motor size (heat class) is not modified, motor protection can no longer be guaranteed.

The diagram below shows the cooling response with and without pause time:

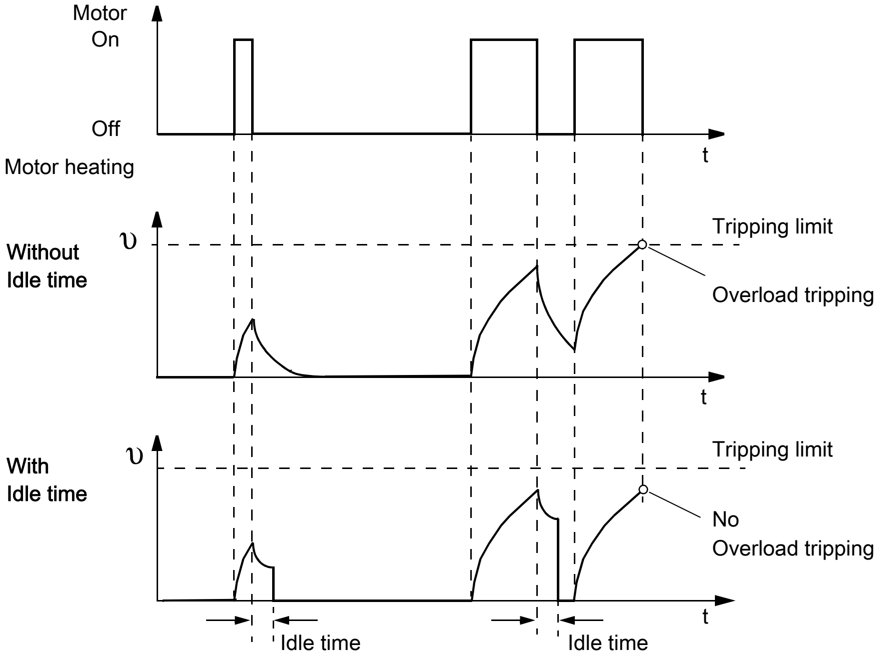


Figure 10-3: Idle time

The idle time can be set to a value in the range between 0 and 255 seconds.

Note
Motor heating
- Motor heating > 50 %: After the pause time, the storage value of the motor model is reduced to 50 %.
- Motor heating < 50 %: After the pause time, the storage value of the motor model is reduced to 0 %!

Settings

Device parameters	Default setting	Adjustment range
Response to overload - thermal motor model	Shutdown without restart	• Shutdown without restart • Shutdown with restart • Warning
Trigger class:		
DS1e-x / RS1e-x	CLASS 10	CLASS 5 (10a) [1)] CLASS 10 CLASS 15 [1)] CLASS 20
FDS1e-x / FRS1e-x	CLASS 10	CLASS 10 CLASS 20
DSS1e-x 0.3 ... 3 A 2.4 ... 8 A 2.4 ... 16 A	 CLASS 5 (10a) CLASS 5 (10a)	 CLASS 5 (10a) CLASS 10 CLASS 5 (10a)
Recovery time	90 s	60 ... 1800 s Increment: 30 s
Prewarning limit value motor heating	0 % (= deactivated)	0 ... 95 % Increment: 5 %
Prewarning limit value time-based trigger reserve	0 s (= deactivated)	0 ... 500 s Increment: 1 s
Idle time	0 s (= deactivated)	0 ... 255 s Increment: 1 s

1) from an order number suffix: -.A**B**4

Table 10-12: Thermal motor model settings

Messages and actions

Message	Action
Thermal motor model deactivated	—
Thermal motor model - overload	
Overload shutdown	Shutdown (overload present)
Pause time active	
Cooldown time active	
Advance warning limit - time-based trigger reserve not reached	
Advance warning limit - motor heating exceeded	

Table 10-13: Messages and actions for brake output

10.7 System monitoring

10.7.1 Current limits

Description

The motor current and the current limits can be used to derive information on a number of system states:

System state	Current value	Protection by:
Motor becomes more inert, for example on account of damaged bearings Motor becomes freer, for example because the processing material in the system has been used up.	Current is higher or lower than usual	Current limits
Motor is blocked!	Very high current flowing	Blocking protection
Motor running at no-load, e.g. due to system damage!	Very low level of current flowing (< 18.75 % of I_e)	Residual current detection

Response to residual current detection

The residual current detection is activated when the motor current falls below 18.75 % of the set rated operating current in all 3 phases.
This device parameter (from order number suffix -.AA3, and on the F-DS1-e-x and RS1e-x) is used to determine how the motor starter should respond to residual current detection:

- Warning
- Disconnect

Note
When switching on the motor, the zero current detection is suppressed for approx. 1 second!

Response to current limit violation

This device parameters is used to determine how the motor starter reacts to current limit violation:

- Warning
- Disconnect

Upper/lower current limit

You can enter an upper and /or lower current limit value.
Example:

- Substance for mixing too thick, i.e. current overshoots the upper current limit.
- No-load operation, because drive belt broken, i.e. current undershoots the lower current limit.

Notice
The current limits are only active – for startup monitoring – after the CLASS time has elapsed, e.g. after 10 seconds for CLASS 10.
For DSS1e-x:
The current limits are only active for startup monitoring after the ramp time and the CLASS time have elapsed.

The motor starter can be parameterized for warning or shutdown as the response to violation of the current limits.

Note
The current limits can also be deactivated.

Blocking time

The blocking time is the time in which a motor blocking must be present without shutdown. The motor starter shuts down if the blockage is still present after the blocking time expires.

Blocking current monitoring

The blocking current specifies how much current the motor (at nominal voltage) consumes when the axis is blocked.
If the motor current exceeds the parameterized value for the blocking current, the motor starter detects a blocking. The blocking time monitoring is started from the point when the value is exceeded. If the blocking current flows for longer than the parameterized blocking time, the motor starter generates the shutdown command itself.

Blocking protection principle during acceleration

The principle on which anti-blocking protection is based during acceleration, i.e. the interaction of blocking current and blocking time is illustrated below:

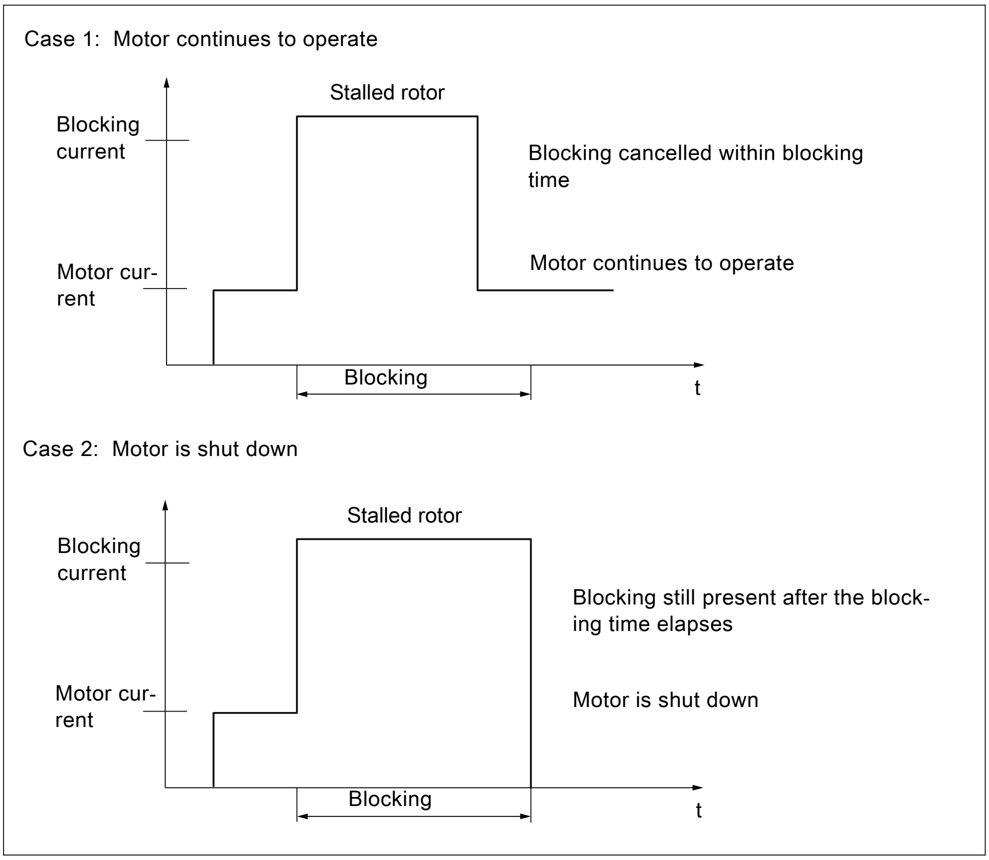


Figure 10-4: Blocking protection principle during acceleration

Blocking protection principle after acceleration

After acceleration, the blocking protection behaves as follows in continuous operation:

- The blocking time is reduced to 1 s regardless of the parameterized value.
- The blocking current is monitored to max. 400 %.
  With a parameterized blocking current < 400 %, the parameter value is valid.
- If the blocking protection engages, a shutdown command is generated by the motor starter itself.
- The messages "Motor blocking shutdown" and "Group error" are generated.
- The slave pointer "Number of motor overload trips" is increased by 1.

Settings

Device parameters	Default setting	Adjustment range
Response to residual current detection	Disconnect	• Warning • Disconnect
Response to current limit violation	Warning	• Warning • Disconnect
Lower current limit	18.75 %	• 18.75 ... 100 % of I_e • 0 % (= deactivated) Increment: 3.125 %
Upper current limit	112.5 %	• 50 ... 400[1)] % of I_e • 0 % (= deactivated) Increment: 3.125 %
Blocking current	800 %	• 150 ... 1000 % of I_e • 150 ... 800 % of I_e (DSS1e-x) Increment: 50 %
Blocking time	1 s	• 1 ... 5 s Increment: 0.5 s

1) for -xAAx: 150%

Table 10-14: Current limit value settings

Messages and actions

Message	Action
I_e limit value exceeded	—
I_e limit value not reached	—
I_e limit value shutdown	Shutdown (limit value violation present)
Residual current detected	—
Zero current shutdown	Shutdown (zero current detection)
Motor blocking shutdown	Shutdown (blocking protection)

Table 10-15: Messages and actions for current limit values

10.7.2 Asymmetry monitoring

Description

Higher asymmetric current consumption is the reaction of a three-phase asynchronous motor to slight asymmetry in the supply voltage. This causes an increase in temperature in the stator and rotor windings. In this case, the motor starter protects the motor against overload via a shutdown.

Note
When switching on the motor, the asymmetry evaluation is suppressed for approx. 0.5 s!

Asymmetrical limit value

The asymmetry limit is a percentage by which motor current can vary in the individual phases.
Asymmetry occurs when the difference between the smallest and largest phase current is greater than the parameterized asymmetry limit.
The reference value for the evaluation is the maximum phase current in one of the 3 phases.

Response to asymmetry

This device parameters is used to determine how the motor starter reacts to asymmetry:
- Warning
- Disconnect

Settings

Device parameters	Default setting	Adjustment range
Response to asymmetry	Disconnect	• Warning • Disconnect
Asymmetry limit values	30 %	• 30 ... 60 % • 0 = deactivated Increment: 10 %

Table 10-16: Asymmetry monitoring settings

Messages and actions

Message	Action
Asymmetry detected	—
Asymmetry shutdown	Shutdown (asymmetry present)

Table 10-17: Messages and actions for asymmetry monitoring

10.7.3 Shortcircuit protection (power switch / repair switch)

Description

The motor starter is fitted with an integrated power switch as shortcircuit protection to ensure the safety of the system and prevent personal injury. Monitoring is carried out on both a shortcircuit between a phase and earth (= earth protection), as well as between two phases.

Properties of the power switch

The power switch / repair switch is designed for the following individual functions:

- Disconnection of the series-connected starter and consumer from the mains supply
- Start lockout via a padlock on the rotary element
- Shortcircuit protection for series-connected consumers with power switch
- Reset with reactivation
- Restore basic factory settings, see Basic factory settings

Response with power switch OFF:

The device parameters are used to determine how the motor starter responds to a shortcircuit or manual shutdown of the power switch:

- Group error
- Group error only for ON command
- General warning

Settings

Device parameters	Default setting	Adjustment range
Response with power switch OFF		—
-.AA2 -.AA3 with version E01	Group error	—
-.AA3 with version E02	Group error only for ON command	—
-.AA4	Group error	• Group error • Group error only for ON command
-.AB4	Group error	• Group error • Group error only for ON command • General warning

Table 10-18: Settings for response with power switch OFF

Note

Can only be parameterized with order number suffixes -.AA4 / -.AB4, not with -.AA3 (fixed to group error only with ON command)

Messages and actions

Message	Action
Circuit-breaker tripped	—

Table 10-19: Messages and actions for plug monitoring

10.8 Field bus interface

10.8.1 Response to CPU/master STOP

This device parameter is used to determine how the motor starter should respond to a CPU/master STOP:

- Keep last value
- Use dummy value

Caution
This is only relevant in Automatic operating mode.

Dummy values

In the event of a bus failure or CPU / master STOP, an appropriate dummy process image of the motor starter outputs is controlled.

Note
This device parameter is only relevant if you have set the parameters "Response with CPU / master STOP" "Connect dummy value".

Note
Motor cw and motor ccw cannot be set simultaneously.

The dummy value can be switched individually for the following parameters:

- Motor cw
- Motor ccw (only with reversing starters)
- Brake actuation
- Trip Reset
- Emergency start
- Self-test
- Quick stop lock

Note
With dummy value "Motor cw" or "Motor ccw" set, the connected motor is switched on if the bus fails or with CPU/master STOP.

Settings

Device parameters	Default setting	Adjustment range
Response to CPU/master STOP	Use dummy value	• Use dummy value • Keep last value
Replacement value	0	7 x (0 or 1)

Table 10-20: Replacement value settings

Messages and actions

Message	Action
CPU/master STOP	—
Bus fault	—

Table 10-21: Messages and actions

10.8.2 Group diagnosis

This parameter is used to determine whether the diagnostics are to be enabled or locked via the field bus interface. If the parameter for the group diagnostics is set to "lock", no error messages will then be issued.

Settings

Device parameters	Default setting	Adjustment range
Group diagnosis	Disable	• Disable • Enable

Table 10-22: Group diagnostics settings

10.8.3 Wait for startup parameter data records (from order number suffix -.A**B**4)

This bit is set with a DPV1 configuration via STEP 7 directly by the object manager. The motor starter uses this to detect whether or not a data record transfer is carried out. The motor starter startup process is stopped until the data transfer is complete.

10.9 Communication

10.9.1 General

Description

The communication is a higher level function consisting of multiple sub-functions:

- Operating type monitoring
- Rear wall bus integration
- Commands
- Plausibility check of data
- Output of messages

Data channels

ET 200S motor starters have 3 different data channels:

- Local serial device interface via the expansion module 2 DI COM LC (see Section 4.4 and Section 4.5)
- mt control local control point in "Manual local" operating mode
  – Input action of the digital inputs [1)]
    (via xB3, xB4, xB6 brake expansion module and / or 2DI Com / 2DI LC COM control module)
- Via the rear wall bus connection

The control via the corresponding data channel depends on the operating mode.

Operating modes

The following operating modes are differentiated with increasing priority:

- "Automatic" operating mode (lowest priority)
  The motor starter can only be controlled with PLC via field bus.
- "Manual bus" operating mode
  The motor starter can only be controlled with B&B (e.g. PC) via field bus.
- "Manual local" operating mode
  Motor starter can be controlled with.
  – On-site control point on digital inputs
    ("Motor cw", "Motor ccw")
    Requirement: "Manual local" operating mode set
  – B&B device (e.g. PC, hand-held controller) via the local device interface
    (maximum priority)

Notice

A higher priority operating mode can take master control away from a lower priority operating mode at any time by a command or input action in "manual" operating mode, but the reverse is not possible.
A lower priority operating mode can only regain master control if the higher priority operating mode returns master control via the "automatic" operating mode command or by switching off the input action in "manual local" operating mode, with the motor switched off.

---

1) via xB3, xB4, xB6 brake expansion module or/and 2DI COM/2DI LC COM control module

Using the following signaling bits in diagnostics data record DS92, it is possible to uniquely detect which control source currently has control priority:

- "Automatic" operating mode
- "Manual bus" operating mode
- "Manual local" operating mode
- Input control
- Lost connection in "Manual" operating mode

Automatic	**Manual**				**Master control goes to**
	Manual bus	**Manual operation local**			
Automatic operating mode	Manual bus operating mode	Manual local operating mode	Control input	Lost connection in "Manual" operating mode	
0	0	1	0	0	PC via device interface
0	0	1	0	1	none
0	0	1	1	0	Digital input
0	1	0	0	0	PC via field bus
0	1	0	0	1	none
1	0	0	0	0	Control (PLC)

Table 10-23: Control priority of operating modes

Connection monitoring

The connection monitoring is active in the "Manual bus" and "Manual local" operating modes. A write data record must be sent within 5 seconds. Otherwise the motor starter switches off with the message "Connection lost in manual operating mode".
If you do not want to send any commands or control commands, you can send an empty data record, for example.
Use an empty data record 93 "command" for this purpose. Here, only the coordination is filled out as appropriate and the commands filled with "0".

Set manual local operating mode for a local control point on the digital inputs

The operating mode can be set as follows:

- Using a B&B device (e.g. PC) via the local device interface.
  Parameterize the input n-action "Motor cw" and "Motor ccw". Then remove the B&B device to activate the control via the digital inputs. The "Control input" signaling bit is set in the process.
- With a digital input on which you connect a switch for switchover to the "Manual local" operating mode
  This digital input then needs to be parameterized using the n -action "Manual local" input.

Relationships between the operating modes with different control tasks

The table below shows the relationships between the operating modes with different control tasks:

Control task	Control via	Automatic operating mode	Manual bus operating mode	Manual local operating mode
Control	PLC	X		
	PC / PG		X	
	Device interface			X
Parameterize	PLC	X		
	PC / PG	X	X	
	Device interface	X	X	X
Commands	PLC	X[1)]		
	PC / PG	X	X	
	Device interface	X	X	X
Diagnostics, measurements, statistics read	PLC	X	X	X
	PC / PG	X	X	X
	Device interface	X	X	X

X = function permitted
1) except basic factory setting and restart

Table 10-24: Control priority of operating modes

10.9.2 Commands

Commands and their meaning

The commands can be used to get the motor starter to complete certain actions. For example, the following commands can be sent to the motor starter using the Motor Starter ES configuration software:

Command	Meaning
Trip Reset	• Reset and acknowledgement of error messages • Delete signaling bits if there are no error messages • No effect
Emergency start ON	Switch on emergency start device function
Emergency start OFF	Switch off emergency start device function
Automatic operating mode	Control via PLC; cyclical and acyclical bus channel (C1)
Manual operating mode	• Control via PC; acyclical bus channel (C2) • Control via device interface
Factory setting	All parameters have basic factory setting again except for the communication parameters. Only possible in manual operating mode!
Clear slave pointer	Clear the "preventative diagnostics" statistics data
Re-start	Motor starter runs a restart (same action as Power OFF / ON). Only possible in manual operating mode!
Parameterization lock CPU / Master OFF	Motor starter accepts parameterization via master (PLC)
Parameterization lock CPU / Master ON	Motor starter ignores parameterization via master (PLC)
Clear log book trips	Clear log book with recorded causes of error.
Clear log book events	Clear log book with recorded warning messages and specific actions.
Cold run ON	Permits the activation of the switching contacts without main energy
Cold run OFF	Switches the "cold run" function off
Clear maintenance timer	Clears the timer for the maintenance function

Table 10-25: Commands and their meaning

10.9.3 Plausibility check of data

Description

The motor starter checks all incoming parameters for validity and plausibility.
For incorrect parameters

- during a startup (after power ON), the messages "Group error" and "Incorrect parameter value" are set.
  Motor and brake output remain switched off.
- in ongoing operation, the messages "Incorrect parameter value" or "Parameterization in ON status not permitted" are set. "Group error" is not set.
  Motor and brake output are not switched off.

Note

The current valid parameter values are retained.

10.9.4 Output of messages

Message	Meaning
General messages	
Ready (automatic)	Device can be actuated via BUS (e.g. PLC).
Group error	At least 1 error is set.
General warning	At least 1 warning exists.
Group prewarning	At least 1 prewarning exists.
Process image error	Process image of the outputs contains nonallowable bit combination, e.g. motor cw and motor ccw set simultaneously.
Field bus connection	
Bus fault	Response monitoring for field bus interface elapsed.
CPU/master STOP	PLC program no longer being processed
Acknowledgment	
Trip reset completed	Trip teset accepted, i.e. error has been acknowledged.
Trip reset not possible	Unable to acknowledge error as the reason for the shutdown is still present.
Operating type monitoring	
Automatic operating mode	Automatic (PLC control)
Manual operating mode - bus	Manual operation via field bus (B&B control)
Manual operation local	Manual local operation: • Manual operation via Motor Starter ES • B&B control • Input control
Lost connection in manual operating mode	During manual operation, the associated communication connection was interrupted for longer than 5 seconds.

Table 10-26: Maintenance messages and actions

Message	Meaning
Parameter assignment	
Parameterization active	Yes / no
Incorrect parameter value[1)]	Parameter not correct
Parameter change in ON status not permissible [1)]	Attempted parameter change not permissible when the motor is running.
Faulty parameter number[1)]	Specifies the first unaccepted parameter (object number of the parameter).
Parameterization lock CPU / Master active	Motor starter ignores parameters from the PLC, but informs the PLC that parameters are OK.
No external startup arameter er hold	After Power ON or a restart of the motor starter, new parameters are received by the PLC.
Statistics data	
Slave point cleared[1)]	Statistics data for preventative diagnostics have been cleared.

[1)] Signaling bits that can be cleared with trip reset

Table 10-26: Maintenance messages and actions

10.9.5 Local device interface

Description

The device interface on the 2DI COM / 2 DI LC COM (see Section 4.4 and 4.5) can be used to connect the motor starter to a PC or a hand-held device (order no. 3RK1922-3BA00; RS232 interface cable: 6ED1057-1AA00-0BA0). This control source has the highest priority level.

10.10 PROFIenergy

10.10.1 What is PROFIenergy

PROFIenergy (PE)

PROFIenergy (PE) supports the following two functions:
- PE_power saving function
  supports the targeted shutdown of consumers during pause times.
- PE_measurement function
  Power management is a suitable tool for securing the reduction in energy consumption and thus the energy costs systematically and in the long-term in the company. The aim of power management is to optimize the use of energy in a company - from purchasing energy to consuming energy - both in terms of financial and green aspects. The PE_measurement function supplies the measurements required for optimization.

10.10.2 PROFIenergy (version V1.0) in the ET 200S motor starter 1)

The ET200S motor starter supports the "PE_power saving function" and "PE_measurement function" for the motor current. These are referred to as commands as they trigger responses in the ET200S motor starter.
In addition, the ET200S motor starter delivers other what are known as services that provide information on the status of the motor starter, as defined for PROFenergy. These can then be evaluated and processed in the application program.

Commands

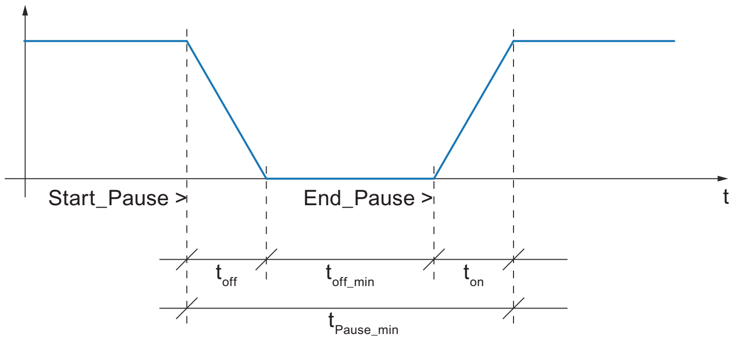
Control commands	
Start_Pause	The starter changes to energy-saving mode.
End_Pause	The starter changes back to operating mode.
Status commands	
PE_Identify	Delivers a list with the supported PROFIenergy commands / functions.
PEM_Status	Delivers the status of the current PE mode.
Query_Modes	
List_Energy_Saving_Modes	Delivers a list of supported power-saving modes.
Get_Mode	Delivers the paramter values with which the PE_energy saving function works.
Query_Measurement	
Get_Measurement_List	Delivers a list with the supported PE_Measurement
Get_Measurement_Values	Delivers the supported PE_measurements

Table 10-27: Messages and actions

1) from order number suffix: -.A**B**4

For data transfer, a distinction is made between two different status conditions with the ET 200S motor starter:

PE_Mode_ID = 255	Operating mode
PE_Mode_ID = 01	Energy-saving mode



t_{off}	Time_to_Pause	time required by the device to change to energy-saving mode.
t_{off_min}	Time_min_length_of_stay	MinI time for which the device is to be kept or remain in energy-saving mode.
t_{on}	Time_to_operate	Time that the device requires to change to operating mode.
t_{Pause_min}	Time_min_Pause	Time compared to t_{Pause} (sent to the motor starter together with the "Start_Pause" command); if $t_{Pause} \geq t_{Pause\_min,}$ then the device changes into energy-saving mode.

"PE_measurement function" command

For efficient energy management, energy measurements must be provided. Different measurements are available for selection by the PROFIenergy specifications, to which a measurement ID is assigned. With the ET 200S motor starter, the instantaneous measurements of the phase current and mean value of the phase currents are supported.
The measurements are uniquely identified using IDs. Measurement IDs 7, 8, 9 and 33 are supported:

- ID = 7: Instantaneous value of phase current a (L1)
- ID = 8: Instantaneous value of phase current b (L2)
- ID = 9: Instantaneous value of phase current c (L3)
- ID = 33: Mean value of the three phase currents (a+b+c) / 3

The current values are sent under the following accuracy specifications:

- Accuracy Domain (unsigned8) = 0x01 → percent of full-scale reading
- Accuracy Class (unsigned8) = 0x11 → 3 %
- Range (Float32) = I_{e_max} (fixed value parameter)

This means that the measurements with an accuracy of 3 % relative to the maximum adjustable rated operating current Ie is sent.

Local LED display on the ET 200S motor starter

The "Energy-saving mode active" status is displayed via the flashing device LED (flashing sequence: 0.25 s on / 1.75 s off → unique flashing rhythm for energy-saving mode).

Note
An error present is not acknowledged by changing to energy-saving mode, i.e. the error present is stored internally and can be exported. After exiting energy-saving mode, the error must be rectified and acknowledged.
The status displays for the bus and the supply voltages and the SF-LED are not affected by the active energy-saving mode.

Response of the starter on activating energy-saving mode:

Motor shutdown via suppression (masked) of the PAA bits Motor cw, Motor ccw, BRAKE). The other PAA bits (e.g. trip reset) are still active.

Interactions with the different operating modes

- PE is only effective in automatic mode
- manual operation is not affected by PE; → switching over to manual operation is still possible which means the motor can be controlled manually.
- Cyclical and acyclical data transfer (PAE, data records, diagnostics, alarms, etc.) to and from the motor starter are still possible.

Requirements for the starter to go to energy-saving mode (min. pause time,...)

The change to energy saving mode "Pause" is only effective if the sent pause time is greater than the device-specific minimum pause time. i.e. a change is only implemented if the pause is longer than the motor starter needs to switch off the main power for the motor.
With a soft starter, a parameterized slow-down ramp of the device-specific minimum pause time needs to be added.
The change to energy-saving mode is logged in the "Events" log book.
Entry: "Energy-saving mode active" In Motor Starter ES diagnostics tool, the change is entered into the log book in energy-saving mode with the event ID 1520.

Requirements for the "PROFIenergy" function

The following requirements need to be met for an ET 200S PROFINET to communicate via the PNO profile PROFIenergy:
- ET 200S Profinet header group with PROFIenergy support
- ET 200S high feature motor starter from order number suffix .-A**B**4

How do I use PROFIenergy in the ET 200S system

SIEMENS offers two functional modules for the use of PROFIenergy:
- PE_START_END (FB815) supports switching to energy-saving mode
- PE_CMD (FB816) supports the export of measurements and switching to energy-saving mode

These can be purchased online at the following link:
Example application for PROFIenergy. See Service & Support on the internet
- **http://support.automation.siemens.com/WW/view/en/41986454**
- **http://support.automation.siemens.com/WW/view/en/66829209**

More information
PROFIenergy: See PROFINET system description
- **http://support.automation.siemens.com/WW/view/en/19292127**

10.11 Inputs

Description

With the "Inputs" device function, the motor starter can execute various actions that you can parameterize. The signals at the digital inputs are evaluated for this purpose. Inputs 1 and 2 (DI 0.4, DI 0.5) are actuated via the expansion interface for expansion modules (e.g. brake control module xB3, xB4, xB6). Inputs 3 and 4 (DI 0.6, DI 0.7) can be used directly via the control module (2DI COM / 2DI LC COM (See Section 4.4 and 4.5) with switching elements or sensors (PNP).
The signal status conditions are sent in parallel via the process image.
The input actions of the individual digital inputs affect the motor starter functions independently from one another (= OR operand)

Input signal extension

A short input signal can be extended using this parameter in comparison to the actual input signal present. This makes it possible to ensure a reliable transfer (compensation of bus transfer times and processing time in the control).

Input signal delay

For interference immunity reasons, a debounce time can be set for the inputs.

n signal input

This device parameter is used to specify whether or not the input level of the digital inputs is to be saved.

- Retentive, i.e. self-holding operation (edge evaluation)
  The action can be deactivated again due to another event despite an input signal being present.
- Non-retentive, i.e. inching operation (level evaluation)
  This input action is active for as long as the input is activated.

n level input

This device parameter is used to specify the input logic:

- NC
- NO

Caution

With "n action input": "Emergency start", "Motor cw", "Motor ccw", "Cold run" and "Trip reset", "n level input" can only be parameterized as a normally open contact!

Notice

When "n level input" of normally closed contacts are parameterized to normally open and the associated "n action input" is parameterized to "Shutdown without restart" then, when the input is open, the "Input shutdown" signaling bit is set and shut down accordingly due to the input delay!

Notice

With the input voltage present (input active), a 1 is sent to the control, regardless of the "n level input" parameter, see figure "Overview of the input parameters"

n action input

A variety of actions can be triggered by an input signal. You can parameterize the actions below, depending on "n level input", "n signal input" and "Operating mode".

Notice

When "n signal input" = retentive and "n action input" = Motor cw / ccw, at least one input with input action "Shutdown..." or "Quick stop" always needs to be parameterized.
If this rule is not observed, the parameters of the motor starter and corresponding diagnostics report will be rejected!

<table>
<tr><th>Input, n action</th><th>level</th><th>signal</th><th>Operating mode</th><th>Description</th></tr>
<tr><td>No action</td><td>NO / NC</td><td>n.ret / ret</td><td>all</td><td>No direct action at the motor starter. Evaluation and processing by the process image are possible.</td></tr>
<tr><td>Shutdown without restart</td><td>NO / NC</td><td>n.ret / -</td><td>all</td><td>• Results in the shutdown of motor and brake.
• Acknowledgment necessary after the cause of the shutdown has been rectified (input status).</td></tr>
<tr><td>Shutdown with re-start (autoreset)</td><td>NO / NC</td><td>n.ret / -</td><td>all</td><td>• Results in the shutdown of motor and brake.
• Automatic acknowledgment after the cause of the shutdown has been rectified (input status).</td></tr>
<tr><td>Shutdown at limit position, clockwise rotation</td><td>NO / NC</td><td>n.ret / -</td><td>all</td><td rowspan="2">• Motor and brake output are shut down irrespective of the direction of rotation.
• Re-start of the brake output is possible after clearing the control commands"Brake" and "Motor cw / ccw".
• Shutdown at limit position, clockwise rotation Motor switch-on is possible only with the counter-command "motor ccw".
• Shutdown at limit position, counterclockwise rotation Motor switch-on is possible only with the counter-command "motor cw".</td></tr>
<tr><td>Shutdown end position ccw (RS1-x only)</td><td>NO / NC</td><td>n.ret / -</td><td>all</td></tr>
<tr><td>General warning</td><td>NO / NC</td><td>n.ret / ret</td><td>all</td><td>• The "General Warning" message is issued.
• The motor starter and the brake output are not shut down!
sp: The input action responds to the active edge of the input signal. Deactivation with active input signal present is therefore possible.
Action is deactivated with trip reset.</td></tr>
</table>

Table 10-28: Description of actions

Input, n action	level	signal	Operating mode	Description
Manual operation local	NO / NC	n.ret / -	all	• Control only possible via "Input n - action: Motor cw and motor ccw" (see below) possible! • Control via field bus ("Automatic" operating mode) not possible! • The automatic mode is only possible again once the manual local operation mode is canceled and "Input n action": "Motor cw" or "Motor ccw" is not active.
Emergency start	NO / -	n.ret / -	all	• Switches the motor on with ON switching command present despite an internal trip command being present. • When an ON switching command is present for the brake output, also switches this output on. • Intrinsic protection of the motor starter remains active and protects the device against being destroyed • Permissible only as NO contact.
Motor cw	NO / -	n.ret / ret	Manual operation local	• The motor starter must be in the "Manual local" operating mode for these actions. • The device parameters of the brake process are evaluated • "Motor cw": switches motor and brake output on and off together (clockwise rotation). • "Motor ccw": switches motor and brake output on and off together (counter-clockwise rotation). • Permissible only as NO contact. **sp:** *The input action is triggered provided that the active level of the input signal is present.* *The input trigger is cleared by the input action "Quick stop" or group error.*
Motor ccw (RS1e-x only)	NO / -	n.ret / ret	Manual operation local	
Quick stop	NO / NC	n.ret / ret	all	• Motor and brake output are switched off without a group error. • "Quick stop" has priority over "Motor cw" and "Motor ccw" **sp:** *The input action responds to the active edge of the input signal. Deactivation is therefore possible with the active input signal present.* *The input trigger is cleared by removing the control commands "Motor cw" and "Motor ccw"* *- With control via input actions Motor cw / ccw,* the quick stop function is always *evaluated for retentive independent of the parameterization.*
Trip Reset	NO / NC	n.ret / -	all	• "Trip reset" is triggered once • Only possible as NO contact.

Table 10-28: Description of actions (Contd.)

Input, n action	level	signal	Operating mode	Description
Cold run	NO / -	n.ret / -	all	• Permits switch-on without main power. If the main power is still on (current is flowing), an internal shutdown command is generated.

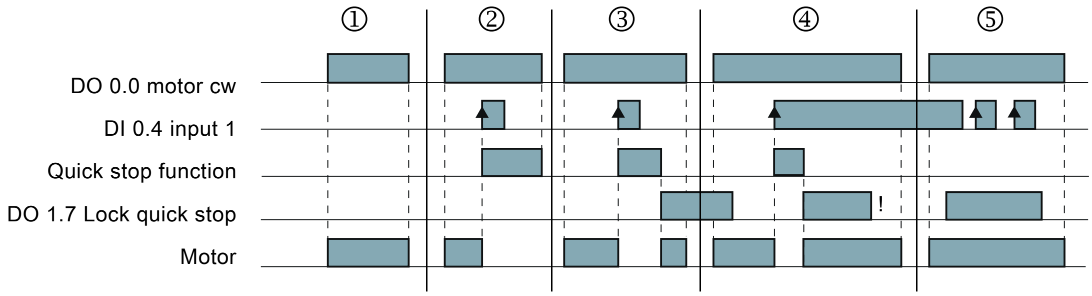
NO: Normally open contact
NC: Normally closed contact
sp: retentive
n.sp: non-retentive (activation and deactivation of the input action follows the status of the input signal (= inching mode))

Table 10-28: Description of actions (Contd.)

Quick stop

- Motor and brake output are switched off without a group error.
- "Quick stop" has priority over "Motor cw" and "Motor ccw"
- The input action responds to the active edge of the input signal. Deactivation with static "Quick stop" input signal present is therefore possible.
- The input trigger is cleared by removing the "Motor cw" and "Motor ccw" control commands or via "Lock quick stop" (in the process image).

Example 1:
Input 1–signal = retentive / edge-triggered



① Motor is switched on by "Motor cw".

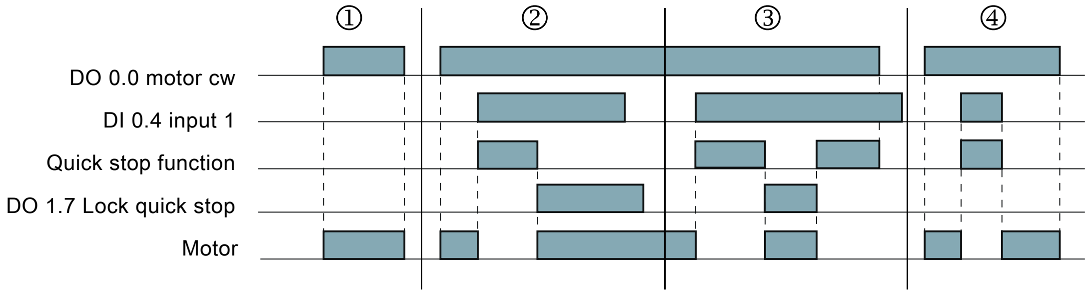
② Motor is switched on by "Motor cw", then switched off by the rising edge at the digital input 1 (parameterized to input action 1 = quick stop). The quick stop function is reset by removing the "Motor cw" command.

③ Motor is switched on by "Motor cw", then switched off by the rising edge at the digital input 1. The quick stop function is reset by setting "Lock quick stop" and the motor runs "clockwise" again until the "Motor cw" command is cleared.

④ Motor is switched on by "Motor cw", then switched off by the rising edge at the digital input 1. The quick stop function is reset by setting "Lock quick stop" and the motor runs "clockwise" again until the "Motor cw" command is cleared. Although digital input 1(DI2) remains statically activated, the motor continues to run and is only reset when the "Motor cw" command is cleared. Reason: The input action is edge triggered.

⑤ Motor is switched on by "Motor cw" and continues to run, uninterrupted, as "Lock quick stop" permanently overrides the edges of the digital input 1 (DI2) signal.

Example 2:
Input 1–signal = non-retentive



① Motor is switched on and off by "Motor cw".

② Motor is switched on by "Motor cw", then switched off by the level at the digital input 1 (parameterized with input action 1 = quick stop). The quick stop function is reset by "Lock quick stop".
Motor is switched on again, as "Motor cw" is still active.

③ Motor is switched off by the level at digital input 1. The quick stop function is reset by setting "Lock quick stop" and, as the "Motor cw" level is still present, the motor runs "clockwise" again until the "Motor cw" command is cleared.

④ Motor is switched on by "Motor cw", then switched off by the rising edge at the digital input 1. As long as the "Quick stop" function is activated, the motor remains switched off and starts running again when "Quick stop" is cleared, until "Motor cw" is switched off.

Settings

Device parameters	Default setting	Adjustment range
Input signal extension	0 ms	• 0 ... 200 ms Increment: 10 ms
Input signal delay	10 ms	• 10 ... 80 ms Increment: 10 ms
Input 1 - level	NO	• NC • NO
Input 2 - level		
Input 3 - level		
Input 4 - level		
Input 1 - action	No action	• No action • Shutdown without restart • Shutdown with restart • Shutdown at limit position, clockwise rotation • Shutdown end position ccw (RS1e-x only) • General warning • Manual operation local • Emergency start • Motor cw • Motor ccw (RS1e-x only) • Quick stop • Trip Reset • Cold run
Input 2 - action		
Input 3 - action		
Input 4 - action		
Input 1 - signal	non-retentive	• Retentive • non-retentive
Input 2 - signal		
Input 3 - signal		
Input 4 - signal		

Table 10-29: Input settings

Messages and actions

Message	Action
Input 1	—
Input 2	—
Input 3	—
Input 4	—
Input tripping	Shutdown (must be acknowledged with trip reset)
Shutdown input - clockwise end position	Shutdown (must be acknowledged with counter-command)
Shutdown input - counterclockwise end position	
Input control	—
Warning input	—
Sensor supply overload	Shutdown (must be acknowledged with trip reset)
Quick stop active	Shutdown without group error

Table 10-30: Messages and actions for inputs

10.12 Cold run

Description

This function allows the motor starter to be switched on without main power. The motor starter responds as if the main power is present on the system. For example, this means that during the commissioning phase, the corresponding control commands are accepted by the control and the corresponding messages are delivered.

Note
If the main power is still on (current is flowing), an internal shutdown command is generated.

The "cold run" function can be activated as follows:
- "Cold run" input action
- Commands: Cold run ON/OFF

With the "cold run" function is active, the motor switches off if
- a current flow is detected
- a main power flow present is detected.

Messages and actions

Message	Actions
Cold run active	
Cold run shutdown	Disconnect

Table 10-31: Messages and actions for cold run

10.13 Emergency start

Description

Emergency start enables a restart despite an internal shutdown command.
Emergency start is possible when

- On switching command present for the motor. The motor is switched on even if the reason for the shutdown persists. With end position shutdown, the motor starts in the opposite direction.
- On switching command present for brake output. The output is switched on ("Enable delay of brake when starting" parameter is taken into account).

Emergency start is not possible when

- OFF switching command present
- Device error present
  Signaling bit: "Error during self-test", "Switching element faulty"
- Intrinsic safety function of the motor starter has been triggered
  Signaling bit: "Overload switching element"
- Switched / unswitched DC24V-S / DC24V-NS supply voltage missing
  Signaling bit: "Power supply switching element missing"
  "Electronics power supply too low"
- Blocking protection has triggered
  Signaling bit: "Motor blocking shutdown"
- Process image error present
  Signaling bit: "Process image error"

The "Emergency start" function can be activated as follows:

- "Emergency start" input action
- Commands: Emergency start ON/OFF

Messages and actions

Message	Description
Emergency start active	Present when the emergency start is active, even when the motor and brake output are switched off.

Table 10-32: Messages and actions for emergency start

10.14 Trip Reset

Trip Reset acknowledges all the currently pending acknowledgable errors in the starter. An error can be acknowledged if it has been eliminated or no longer exists.
The Trip Reset can be triggered by:

- Remote reset via PLC (PAA DO 0.3 trip reset)
- Remote reset via input action (if parameterized)
- Local reset via device interface (hand-held device or ES tool)
  (only applies for starters from an order number suffix: -.AA3/-.AB4 and for all fail-safe motor starters)
- Power-on reset (switch off and reactivate the 24V-NS DC) only with non-reset on voltage failure deactivated (can be parameterized).
- Reset via power switch / repair switch
  To do this, switch the power switch from 0 to 1.

10.15 Self-test

Description

There are 3 self-test types:

- Self-test at start up:
  This is automatically activated when switching on or initializing the device!
- Self-test in operation:
  The motor starter monitors certain device components cyclically and signals the errors present.
- Self-test on request
  The self-test can be started via the process image (DO 0.5).

Test stages

The self-test consists of 3 test stages. The test stages are run depending on the signal duration of the test command:

Test stage	Signal duration	Test scope	Description
1	< 3 s	LED test	All LEDs are switched on for 2 seconds! • Check by user, no signaling bit
2	2 to 5s	HW test	The motor starter hardware is tested; current measurement with display on LED "device": • Current flowing: flashes red • Current not flowing: flickers red • Check by user, no signaling bit
3[1)]	>5 s	Shutdown	Switching elements are switched off.

1) This test stage is only run in the manual operating mode

Table 10-33: Messages and actions for plug monitoring

Self-test error

In the event of an error, the "DEVICE" LED is on in red. The error can only be acknowledged when switched on again. If the error is still present, the self-test will still run with an error when switched on. The motor starter must be replaced!

Messages and actions

Message	Actions
Self-test active	—
Self-test ok	—
Error during self-test	—

Table 10-34: Messages and actions for self-test

Note
Certain device components are continually monitored internally by the motor starter and the result is signalled with the self-test messages. The "Error on self-test" message can also occur in the event of an error with the internal monitoring, without the self-test having been activated.

10.16 Maintenance

Description

Maintenance functions are required to prevent wear-related failures of equipment and systems. This increases the availability of the system. The optimal use is that the motor starter promptly signals the intrinsic possible failure or a failure of the motor in stages. This makes regular checking by maintenance personnel as to whether or not maintenance is required unnecessary.

Note
The maintenance timer only increases when the motor is running.

Device parameters

Two maintenance timers are available that permit indirect detection of wear across the operating time. The maintenace timer are special operating hours counters that can be both deleted and parameterized using warning limit values.

Maintenance timer warning limit value 1

First warning. Maintenance requirements signalled.

Maintenance timer warning limit value 2

Second warning. Maintenance request is signalled.

Settings

Device parameters	Default setting	Adjustment range
Maintenance timer-Warning limit value_1	946.080.000 (30 years)	• 0 … 4.294.967.295 s Increment: 1 s
Maintenance timer-Warning limit value_2	946.080.000 (30 years)	• 0 … 4.294.967.295 s Increment: 1 s

Table 10-35: Maintenance settings

Messages and actions

Message	Action
Maintenance required	Group prewarning
Maintenance request	General warning
Maintenance timer limit value_1 exceeded	—
Maintenance timer limit value_2 exceeded	—

Table 10-36: Maintenance messages and actions

10.17 Log book

Description

The log book lists trips, device errors and events in chronological order, adds a time stamp and thus creates a protocol. This protocol is stored internally. This allows the causes to be evaluated later on.

Log books

There are 3 different log books that can be read as a data record:

- Log book trips
- Log book events
- Log book device errors

The current value for "Operating hours – device" is entered as a time stamp.
The object numbers of the respective messages can be found in the relevant data record.
The last 21 entries are stored in the log books. The entries can be read out with the relevant data record.
The log book is designed as a circular buffer. Over 21 entries, the oldest entry is overwritten.

Log book trips

All group errors are recorded in "Log book - trips". This involves entering the object numbers for the actual causes of error, e.g. "switching element overload".
Note that "Log book – trips" is cleared using the command "Clear log book – trips"

Log book events

All warnings, and certain actions, are entered in "Log book - events".
Please note the following points:

- "Incoming" and "outgoing" events are entered.
  "Incoming" means: The event is occurring.
  "Outgoing" means: The event is acknowledged.
  Entries are differentiated in the data record by sign:
  (+: incoming, –: outgoing).
- "Log book – events" is cleared using the command "Clear log book – events".

Log book device errors

All device errors that occur are recorded in the "Log book – device errors".
Note that "Log book – device errors" cannot be cleared.

10.18 Factory setting

We recommend you use the factory setting (default setting) in the following instances:

- Incorrect parameter assignment
- If ET 200S motor starters that have already been parameterized are to be used in other systems.

Note
If you do not, in certain circumstances some operating mechanisms may start up due to the existing parameter assignment.

You can reset parameterized motor starters to their factory setting without any additional tools.

A parameter assignment block set by the "*Motor Starter ES*" parameterization software is removed in the process.

You can find the parameters for the factory setting in the sections below:

- DS1e-x, F-DS1e-x in Section 8.3.4
- DSS1e-x in Section 8.4.5
- RS1e-x, F-RS1e-x in Section 9.3.4

Motor starter variants

The following motor starters can be reset:

- Motor starter; high feature in versions
  - DS1e-x
  - DSS1e-x
  - RS1e-x

  with the order number suffix -.AA**3**
- Variants of fail-safe motor starters
  - F-DS1e-x
  - F-RS1e-x

Restore factory settings

The factory setting can be established as follows:

- The "Basic factory settings" command (via data record 93 or Motor Starter ES).
  This is only possible if the "Manual" operating mode is set and the switching elements are switched off.
- Using the power switch

Procedure

To reset the factory setting, proceed as follows:

1.

Warning

Connect the motor starter on an appropriate terminal module so that a connected drive cannot start up as a result of the unknown parameter assignment of the motor starter.

Do **not** use a terminal module which has an expansion module (brake module xB3, xB4, xB6 with inputs) located directly to the right of it.

A 2DI-COM/-2DI LC COM control module may not be connected on this motor starter.

When connecting the motor starter on the terminal module, pay attention to the mechanical coding.

---

2. For this procedure outside of a plant, lay voltage U_1 via a power module. It is not necessary for the supply to come via the field bus and the power bus.
3. Turn the knob of the power switch within the specified time window of 2 to 4 seconds to ON and OFF, as illustrated in the timing diagram below, and check the LEDs on the motor starter.

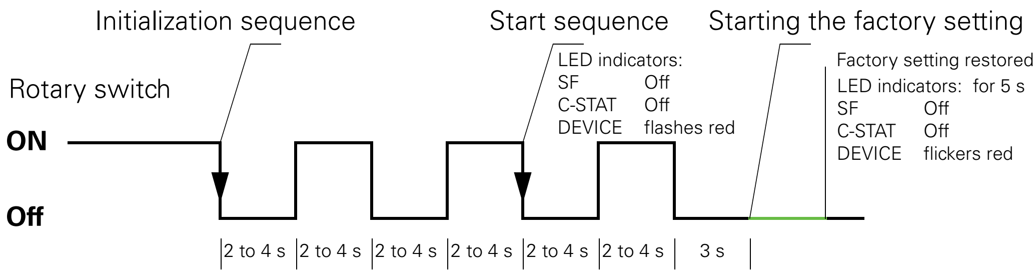


Figure 10-5: Factory setting

The initialization sequence prevents the factory setting being reset inadvertently.

The factory setting is initialized at the beginning of the start sequence. The LEDs indicate the following behavior:

- SF off
- C-STAT off
- DEVICE flashes red

Once the factory setting has been restored, the LEDs respond as follows for 5 seconds:

- SF off
- C-STAT off
- DEVICE flickers red

Safety Motorstarter ET 200S Local Solution

11

11.1 Features

The "Safety local" safety engineering integrated into the ET200S system makes it possible to carry out the emergency stop and protective door functions locally, i.e. without remote PLC, using motor starters in an ET200S substation

A safety function can be divided into the subsystems Detect – Evaluate – Respond.
In the ET200S system, the subfunctions are carried out as follows:
Detect – sensors that are connected to a PM-D F module, e.g. emergency stop command device
Evaluate – corresponds to the PM-D F module which reads the sensors, monitors the switching status of the actuators and switches the enabling circuit depending on the internal status of the module.
Respond – ensures the motor is shut down by means of protective separation of the power supply

- The emergency stop and protective door monitoring safety functions can be carried out on one or two channels.
- Attainable values according to DIN EN ISO 13849-1: PLc - PLe or SIL 1 - SIL 3 according to IEC 62061.
- The attainable value depends on the system architecture and the diagnostic coverage.

System architecture means single-channel or dual-channel sensor and actuator technology

- In the standard motor starter with an installation width of 65/90 mm, feedback loop monitoring – which oversees the switching status of the actuators (motor starters) – is carried out using failsafe kit 1 or 2.
- Feedback loop monitoring is already integrated into the high feature motor starter with an installation width of 65/90 mm.

The lack of feedback loop monitoring (lack of diagnostic coverage in the actuator circuit) in the high feature direct soft starter means that this can only be used to max. PLc according to ISO 13849-1 or SIL 1 according to IEC 62061.

Example: ET 200S "Safety local" configuration with standard starter

The diagram below shows the complete safety sequence.
It illustrates a dual-channel architecture in the sensor and actuator circuit. The sensor must be connected to the PM-D F module via two channels for this purpose. Redundant disconnection is effected by an infeed contactor connected to the PM-X module.
The feedback loop is carried to the PM-D F by the failsafe kits and a forced auxiliary contact of the infeed contactor which is wired to the PM-X module.
This configuration enables an emergency stop safety function in line with PLe (ISO 13849-1) or SIL 3 (IEC 62061).

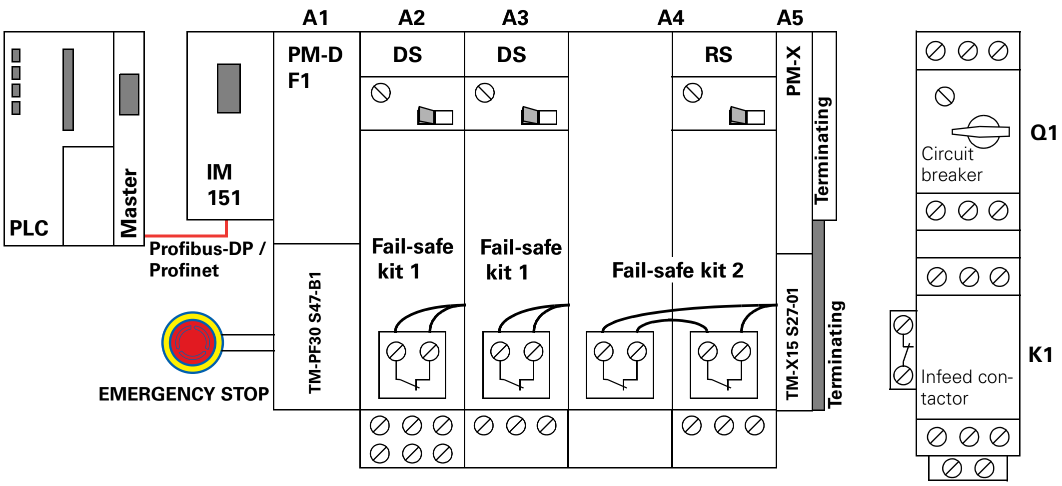


Figure 11-1: Design of the EMERGENCY STOP application to PLe in accordance with DIN EN ISO 13849-1 or SIL3 in accordance with IEC 62061

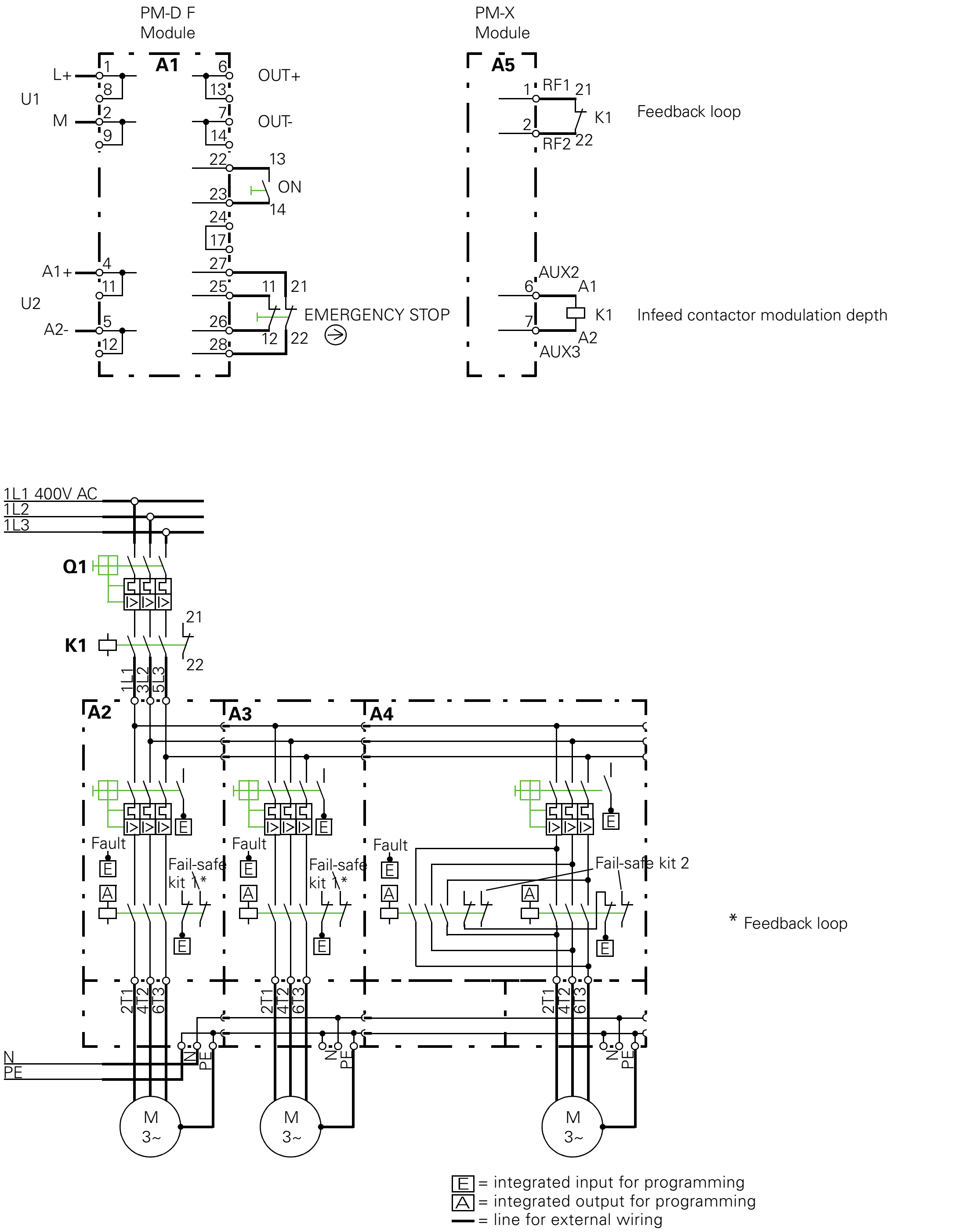


Figure 11-2: Wiring diagram for the EMERGENCY STOP application to PLe in accordance with DIN EN ISO 13849-1 or SIL3 in accordance with IEC 62061

11.2 Terminal modules TM-PF30 S47 and TM-X15 S27-01

11.2.1 Assignment of the terminal modules

Terminal modules are needed for wiring the PM-D F1 through 5 power modules and the PM-X connection module of the safety-integrated system.

The following table shows which power modules you can use with the various terminal modules.

You can find information on the terminal modules in the following sections:

- Section 6 for the PM-D power module and all motor starters
- Expansion modules, such as the brake control module, in Section 12
- Fail-safe modules in Section 13.

Power modules	Terminal modules for safety-integrated system					
	TM-PF30 S47					TM-X15 S27-01
	-B0 1)	-B1 2)	-C0 1)	-C1 3)	-D0	
PM-D F1	X	X				
PM-D F2	X	X				
PM-D F3			X	X		
PM-D F4			X	X		
PM-D F5					X	
PM-X						X

1) For suitable power module in subordinate, cascaded safety groups (potential subgroup).
2) For suitable power module in higher-order or standalone safety group (potential group).
3) For expansion with suitable power module in separate ET 200S stations (potential subgroup).

Table 11-1: Assignment of the terminal modules for the modules of the safety-integrated system

Color coding labels

1. You can apply the color coding labels in the opening provided next to the terminal directly from the strip.
2. Push the color coding labels onto the terminal module with your finger.

Looping the potentials through

Terminals 1/8, 2/9, 4/11, etc. are bridged in the terminal module and can be used to loop the potentials through (through-connection terminals).

11.2.2 Features

The following features apply only for the TM-PF30 S47 terminal modules

- TM-PF30 S47-**B** terminal modules for PM-D F1/F2 power modules
- TM-PF30 S47-**C** terminal modules for PM-D F3/F4 power modules
- TM-PF30 S47-**D0** terminal modules for PM-D F5 power modules
- The terminal module consists of a support and a terminal block.
- Connection by screw-type terminals
- Start of a group of motor starters with safety-integrated system (also see Section 11.6)
- Prewiring possible
- AUX1 cable fed through without terminals

11.2.3 Models

There are two TM-PF30 S47-**B** terminal-module models:

- TM-PF30 S47-**B0** (can be used to the right of a B0, B1, C1)
  Terminal module for **potential subgroup**,
  sensor connection; e.g. emergency stop, protective door
  (for function, see Section 11.6.3 and 11.6.6).
- TM-PF30 S47-**B1** (required at the beginning of a potential group)
  Terminal module for **potential group**,
  with infeed U_1, U_2, sensor connection,
  with terminating cover
  (for function, see Section 11.6.1 through 11.6.3 and 11.6.6 through 11.6.10).

There are two TM-PF30 S47-**C** terminal module models:

- TM-PF30 S47-**C0** (can be used to right of a B0, B1, C1)
  Terminal module for **potential subgroup**, infeed U_2
  (for function, see Section 11.6.7).
- TM-PF30 S47-**C1** (can be used to continue a potential group in a new row)
  Terminal module for **potential group**, infeed U_1, U_2,
  with terminating cover
  (for function, see Section 11.6.8).

The TM-PF30 S47-**D0** terminal module is suitable for:

- Connection of up to 4 external potential-free safety circuits
  (for function, see Section 11.6.9).

11.2.4 View of the TM-PF30 S47 terminal modules

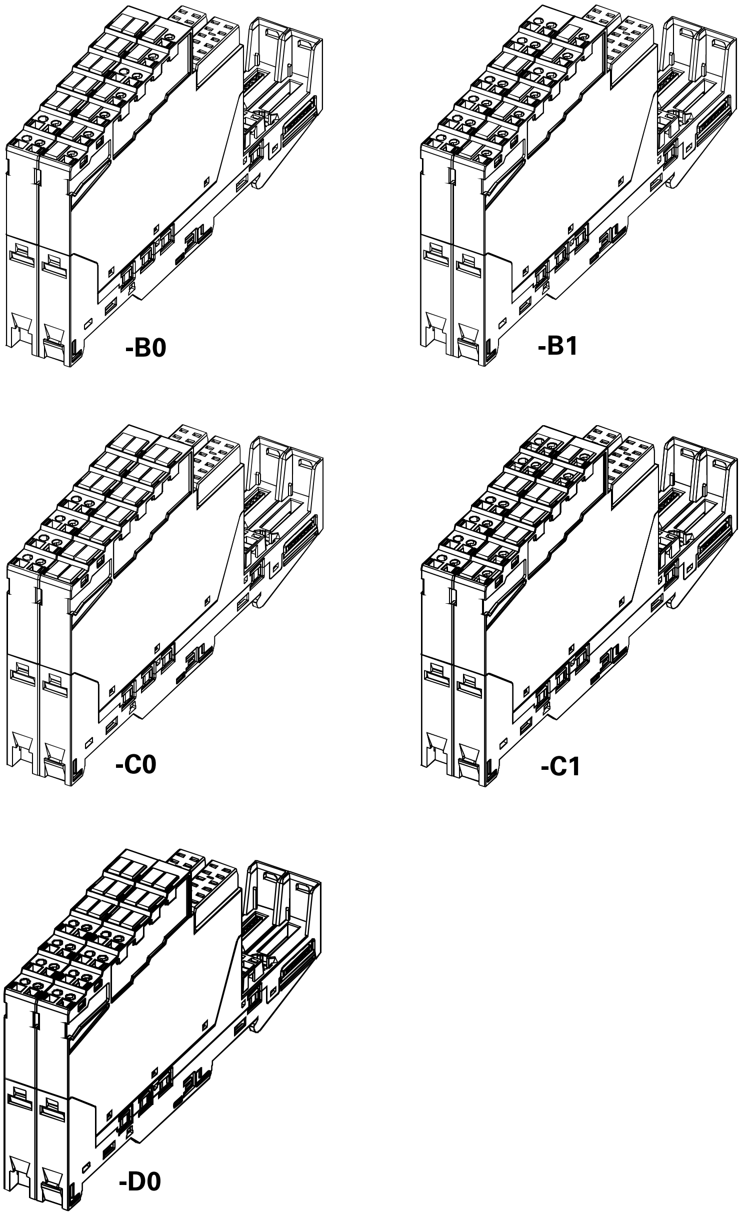


Figure 11-3: View of the TM-PF30 S47 terminal modules

11.2.5 Terminal assignments

TM-PF30 S47-B0

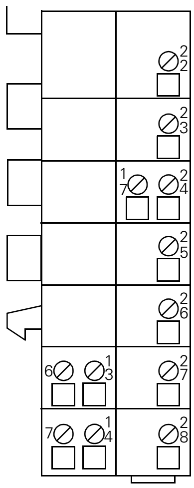
Terminal	Meaning		View	Terminal	Meaning	
1/8	—	Not used		**17/24**		Throughfeed terminal, potential-free
2/9	—	Not used		**22**	ON	ON button
3/10	—	Not used		**23**	ON	
4/11	—	Not used		**25**	Ch 1	Channel 1 for EMERGENCY STOP or protective door
5/12	—	Not used		**26**	Ch 1	
6/13	OUT+	Drive for other safety integrated devices with 24 VDC / 50 mA		**27**	Ch 2	Channel 2 for EMERGENCY STOP or protective door
7/14	OUT-			**28**	Ch 2	
-	AUX1	Fed through without terminals				

Table 11-2: Terminal assignment of the TM-PF30 S47-B0 terminal module

TM-PF30 S47-B1

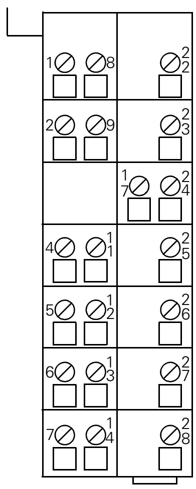
Terminal	Meaning		View	Terminal	Meaning	
1/8	L+	**U_1:** Supply voltage for electronic components U_{RATED} = 24 VDC		**17/24**		Throughfeed terminal, potential-free
2/9	M			**22**	ON	ON button
3/10	—	Not used		**23**	ON	
4/11	A1+	**U_2:** Contactor supply U_{RATED} = 24 V DC		**25**	Ch 1	Channel 1 for EMERGENCY STOP or protective door
5/12	A2-			**26**	Ch 1	
6/13	OUT+	Drive for other safety integrated devices with 24 VDC / 50 mA		**27**	Ch 2	Channel 2 for EMERGENCY STOP or protective door
7/14	OUT-			**28**	Ch 2	
-	AUX1	Fed through without terminals				

Table 11-3: Terminal assignment of the TM-PF30 S47-B1 terminal module

TM-PF30 S47-C0

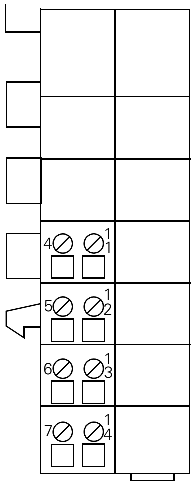
Terminal	Meaning		View	Terminal	Meaning	
1/8	—	Not used		**17/24**	—	Not used
2/9	—	Not used		**22**	—	Not used
3/10	—	Not used		**23**	—	Not used
4/11	A1+	**U_2:** Contactor supply U_{RATED} = 24 V DC		**25**	—	Not used
5/12	A2-			**26**	—	
6/13	OUT+	Drive for other safety integrated devices with 24 VDC / 50 mA		**27**	—	
7/14	OUT-			**28**	—	
-	AUX1	Fed through without terminals				

Table 11-4: Terminal assignment of the TM-PF30 S47-C0 terminal module

TM-PF30 S47-C1

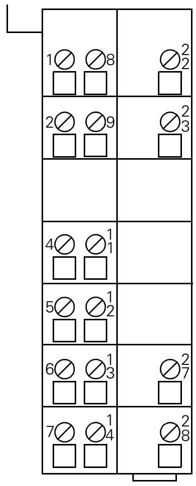
Terminal	Meaning		View	Terminal	Meaning	
1/8	L+	**U_1:** Supply voltage for electronic components U_{RATED} = 24 VDC		**17/24**	—	Not used
2/9	M			**22** **23**	RF1 RF2	Feedback loop
3/10	—	Not used		**25**	—	Not used
4/11	A1+	**U_2:** Contactor supply U_{RATED} = 24 V DC		**26**	—	
5/12	A2-			**27**	IN+	Drive from PM-D F1 to 4 OUT+
6/13	OUT+	Drive for other safety integrated devices with 24 VDC / 50 mA		**28**	IN-	Drive from PM-D F1 to 4 OUT-
7/14	OUT-					
-	AUX1	Fed through without terminals				

Table 11-5: Terminal assignment of the TM-PF30 S47-C1 terminal module

TM-PF30 S47-D0

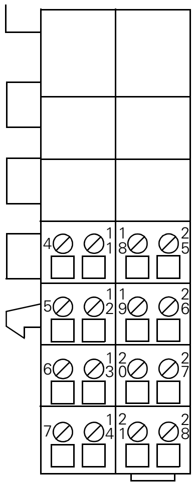
Terminal	Meaning		View	Terminal	Meaning	
1/8	—	Not used		**15/22**	—	Not used
2/9	—	Not used		**16/23**	—	Not used
3/10	—	Not used		**17/24**	—	Not used
4/11	OUT 1.1	Enabling circuit 1		**18/25**	OUT 3.1	Enabling circuit 3
5/12	OUT 1.2			**19/26**	OUT 3.2	
6/13	OUT 2.1	Enabling circuit 2		**20/27**	OUT 4.1	Enabling circuit 4
7/14	OUT 2.2			**21/28**	OUT 4.2	
-	AUX1	Fed through without terminals				

Table 11-6: Terminal assignment of the TM-PF30 S47-D0 terminal module

11.2.6 Technical specifications of the TM-PF30 S47 terminal modules

Dimensions and weight	
Installation dimensions W x H x D (mm)	30 x 196.5 x 102
Depth with power module (mm)	117.5
Weight (g)	approx. 350
Insulation voltages and rated currents	
Insulation voltage	500 V
Rated operating voltage	24 VDC
Rated operating current	10 A
Conductor cross-sections	
Single-core (mm^2)	1 x (0.14 to 2.5)
Finely stranded with wire end ferrule (mm^2)	1 x (0.14 to 1.5) to IEC 60947
AWG cables, single- or multi-core	1 x (18 to 22)
Wiring	
Tool required	Standard screwdriver, size 1
Tightening torque (Nm)	0.4 to 0.7

Table 11-7: Technical specifications of the TM-PF30 S47 terminal modules

11.2.7 TM-X15 S27-01 terminal module

Features

- TM-X15 S27-01 terminal module for PM-X connection module
- The terminal module consists of a support and a terminal block.
- Termination of a group of motor starters with safety-integrated system for connection of an external infeed contactor with auxiliary contact and switched supply voltage (also see Section 11.6.1)
- Connection of a group of motor starters with safety-integrated system to an external safety combination; only in conjunction with TM-P15 S27-01 (also see Section 11.6.5)
- Connection by screw-type terminals
- Prewiring possible
- AUX1 cable fed through without terminals

Models

For the two applications above, only one version is required.

View of TM-X15 S27-01

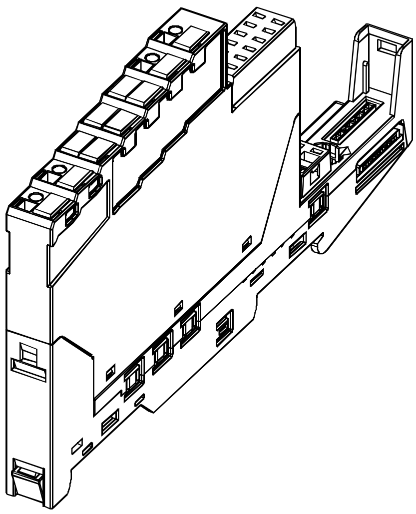


Figure 11-4: TM-X15 S27-01 terminal module

Terminal assignment

The following table illustrates the terminal assignment of the TM-X15 S27-01 terminal module for the PM-X connection module.

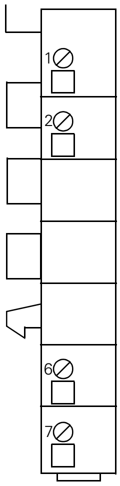
View	Terminal	Meaning	
	**1** **2**	RF1 RF2	Connection of the auxiliary switch to infeed contactor for monitoring the switch position (RF = feedback loop)
	6	AUX2	Connect to A1+ of the infeed contactor
	7	AUX3	Connect to A2- of the infeed contactor
	—	AUX1	Fed through without terminals

Table 11-8: Terminal assignment of the TM-X15 S27-01 terminal module for the PM-X connection module

Color coding labels

1. You can apply the color coding labels in the opening provided next to the terminal directly from the strip.
2. Push the color coding labels onto the terminal module with your finger.

Important
If there is no infeed contactor connected to the PM-X connection module, jumper the feedback loop with terminals 1 and 2.

Technical specifications - TM-X15 S27-01 terminal module

Dimensions and weight	
Installation dimensions W x H x D (mm)	15 x 102 x 196.5
Depth with connection module (mm)	117.5
Weight (g)	approx. 175
Insulation voltages and rated currents	
Insulation voltage	500 V
Rated operating voltage	24 VDC
Rated operating current	10 A
Conductor cross-sections	
Single-core (mm^2)	1 x (0.14 to 2.5)
Finely stranded with wire end ferrule (mm^2)	1 x (0.14 to 1.5) to IEC 60947
AWG cables, single- or multi-core	1 x (18 to 22)
Wiring	
Tool required	Standard screwdriver, size 1
Tightening torque (Nm)	0.4 to 0.7

Table 11-9: Technical specifications - TM-X15 S27-01

11.3 Power modules PM-D F1 through F5

Features

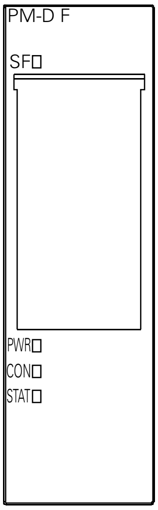
Feature	PM-D F				
	1	2	3	4	5
Basic units are	X	X			
Basic unit required for			X	X	X
Suitable for applications up to SIL (IEC 62061)	3	3	2	3	3
Suitable for applications up to PL (DIN EN ISO 13849-1)	e	e	d	e	e
Emergency stop circuit with monitored start.	X				
Guard door circuit with automatic start.		X			
Expansion with delay from 0.5 to 30 s (steplessly adjustable). Cover for time setting takes a lead seal.			X		
For integrating other ET 200S rails into an emergency stop circuit.			X	X	
2-channel sensor polling.	X	X			
All inputs cross-circuit-proof.	X	X			
Two enabling circuits as normally-open contacts (for shutting down the motor starters).	X	X	X	X	
Four enabling circuits as normally-open contacts (potential-free, for any use).					X
One output for driving plug-in devices (max. 50 mA).	X	X	X	X	
Each time the emergency stop device runs an emergency stop cycle, the switching elements of the motor starters are checked to ensure that they open and close correctly.	X		X	X	
Each time the guard door is actuated, the switching elements of the motor starters are checked to ensure that they open and close correctly.		X			
A short-circuit in the sensor circuit triggers the internal electronic fuse. The device is again fully operational as soon as the short-circuit has been rectified.	X	X			
Welded contacts in the respective release circuits are detected and prevent the device from restarting.	X	X			
Welded contacts in the respective circuits are detected and prevent the PM-D F1/F2 basic device from restarting.			X	X	X
Two redundant internal safety relays protect the contactor supply U_2 (CON).	X	X	X	X	
Plug-in for TM-PF30 S47-B0 and ...-B1.	X	X			
Plug-in for TM-PF30 S47-C0 and ...-C1.			X	X	
Plug-in for TM-PF30 S47-D0					X
The power module conducts the voltages for supplying the electronic components to the voltage buses of the terminal modules. It does this for all the motor starters in a potential group.	X	X	X	X	
Monitoring of the U_1 (PWR) and U_2 (CON) voltages (U_2 not in the case of PM-D F5). Voltage failures are displayed and reported.	X	X	X	X	X

Table 11-10: Features of the safety-integrated system of PM-D F1 to F5 power modules

Caution
Power modules may not be inserted or removed during operation.

Only **potential-free** contacts may be connected to:
- the ON-circuit (terminals 22/23)
- the sensor circuits (terminals 25/26 and 27/28)
- the feedback loop.

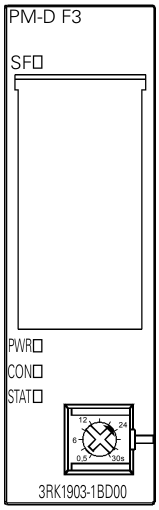
Views



LEDs:
SF group error

PWR (power) (U_1)
CON (contactor) (U_2)
STAT status indicator for safety relay

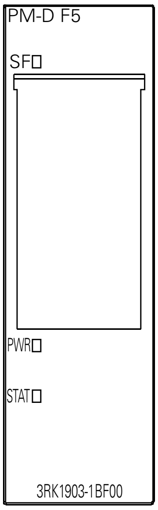
PM-D F1, F2, F4 power modules



LEDs:
SF group error

PWR (power) (U_1)
CON (contactor) (U_2)
STAT status indicator for safety relay
Delay 0.5 to 30 s

PM-D F3 power module



LEDs:
SF group error

PWR (power) (U_1)

STAT status indicator for safety relay

PM-D F5 power module

Figure 11-5: Views of the safety-integrated system of PM-D F1 to F5 power modules

Mechanical coding of the modules

When the module is first inserted, the terminal module is mechanically coded (two coding elements) to ensure that, in the event of a fault, it can only be replaced by a module with identical functions.

Note the configured structure when installing and identify the terminal modules with the labelling strips.

11.3.1 Parameters

The following table indicates the bus parameter that can be set for the PM-D F1 to F5 power modules.

Parameters	Action, value range	Factory setting	Applicability
Group diagnosis	• Disable • Enable	Disable	Module

Table 11-11: Parameters for the safety-integrated system of PM-D F1 to 5 power modules

Group diagnosis:
This parameter enables diagnosis messaging
(error types are listed in Section 4.7).

Note
The "Disable group diagnosis" parameter also suppresses the display of faults on the SF-LED.

Process and diagnostic interrupts

None

11.3.2 Electrical configuration

Block circuit diagram of the PM-D F1, F2

The circuit diagram below shows the basic configuration of the safety-integrated system of the power modules:

- PM-D F1, emergency stop with monitored start.
- PM-D F2, protective door with automatic start.

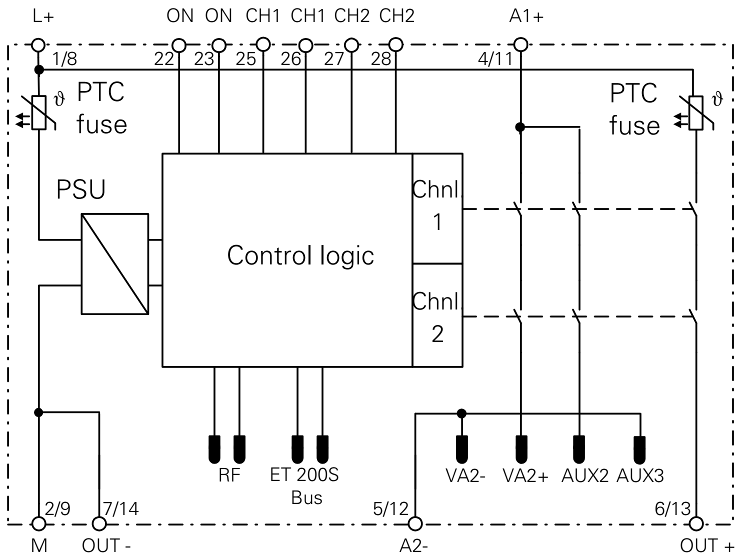


Figure 11-6: Basic circuit diagram of the safety-integrated system of the PM-D F1, F2 power modules with TM-PF30 S47-B1

Explanation

OUT +/- is a safe output for driving other safety-integrated devices (e. g. PM-D F3, F4).

The procedure for commissioning is as follows:

- Connect the supply voltage U_1 to the L+ and M terminals.
- Connect the supply voltage U_2 to the A1+ and A2- terminals.
- PM-D **F1**:
  The emergency stop circuits connected to the CH1 and CH2 terminals must be closed.
- PM-D **F2**:
  For automatic start operation, the terminals 22-23 (ON) must be bridged.
  The protective door connections to the CH1 and CH2 terminals must be closed.

The system starts up:

- PM-D **F1**:
  As soon as the ON button at the ON terminals is activated.
  Emergency stop circuits and ON button are monitored during operation for crossover. Permanent jumpering of the ON terminals is not permissible.
- PM-D **F2**:
  As soon as the ON terminals are closed.
  The protective door connections are monitored for crossover during operation.

During the cascading of several safety modules, the overall reaction time of the individual components should be added!

Block circuit diagram of the PM-D F3, F4

The following circuit diagram shows the basic configuration of the safety-integrated system of the PM-D F3, F4 power modules.

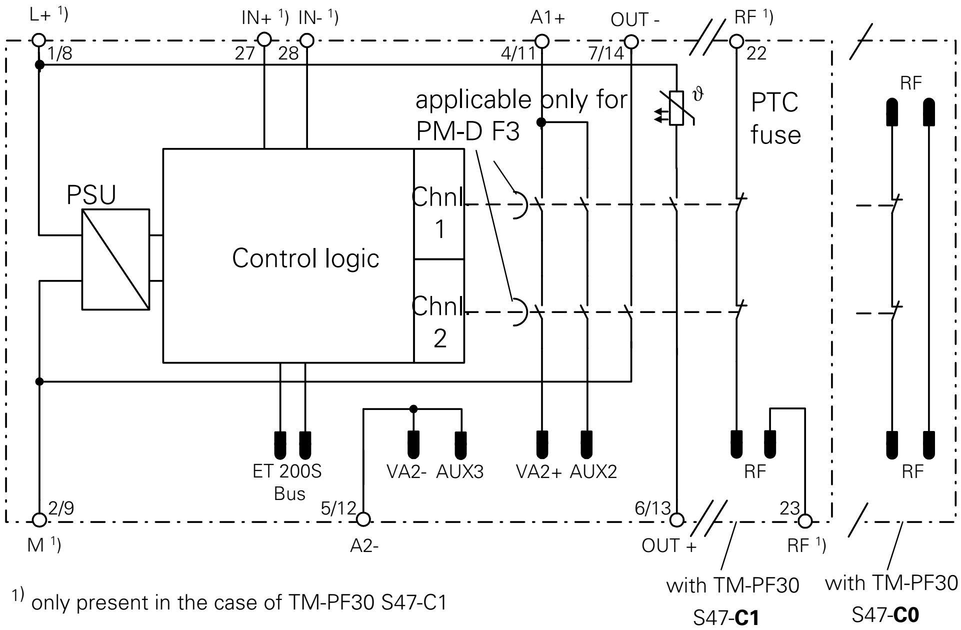


Figure 11-7: Basic circuit diagram of the safety-integrated system of the PM-D F3, F4 power modules with TM-PF30 S47-C1 or C0

Explanation

IN +/- is the input for safe driving by a primary safety-integrated device (e. g. PM-D F1 to F4).
OUT +/- is a safe output for driving other safety-integrated devices (e. g. PM-D F3, F4).
The procedure for commissioning is as follows:

- Connect the supply voltage U_1 to the L+ and M terminals [1)].
- Connect the supply voltage U_2 to the A1+ and A2- terminals.
- The PM-D F3/F4 power module must be integrated via the RF1 and RF2 terminals into the feedback loop of the PM-D F1/F2 basic device [1)].
- Connect the drive of the primary safety-integrated device (e.g. PM-D F1 to F4) to the IN+/- terminals [1)].

1) Applicable to TM-PF30 S47-C1 only.

PM-D **F3** only:

- The PM-D F3 power module shuts down when the preset time has elapsed.

During the cascading of several safety modules, the overall reaction time of the individual components should be added!

Block circuit diagram for PM-D F5

The following circuit diagram shows the basic configuration of the safety-integrated system of the PM-D F5 power module.

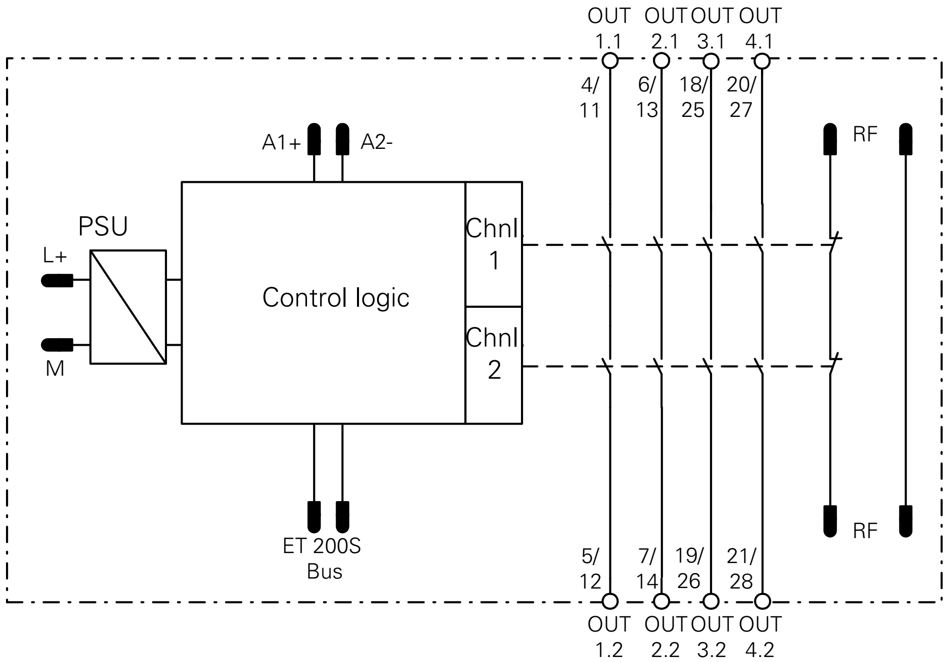


Figure 11-8: Block circuit diagram of the safety-integrated system of the PM-D F5 power module

Explanation

The ET 200S expansion module PM-D F5 can be used only in conjunction with a PM-D F1 to 4. The PM-D F5 can be installed at any position between a PM-D F1 to F4 and the associated PM-X.
The procedure for commissioning is as follows:

- The U_1 and U_2 supply voltages are carried by the internal wiring.
- Connect the potential-free enabling circuits to the OUT 1.1 - OUT 4.2 terminals.
- The PM-D F5 power module is integrated via the internal wiring into the feedback circuit of the PM-D F1, F2 basic device.

11.3.3 Technical specifications - PM-D F1 to F5

Dimensions and weight	
Installation dimensions W x H x D (mm)	
(incl. terminal module)	30 x 196.5 x 117.5
Weight (g)	approx. 190
Module-specific data	
Mechanical life	10 x 10^6 switching cycles
Electrical life	$\geq$ 200,000 switching cycles at I_e
Ambient temperature	0 to 60 °C
Degree of protection	IP20
Utilization category	DC-13
Control times	
• Minimum command duration, PM-D F1, F2	200 ms
• Switch-on delay, PM-D F3 to 5	< 150 ms
• Recovery time	
- PM-D F1, F2	< 1 s
- PM-D F3 to 5	< 50 ms
• Returning time:	
- PM-D F1, F2, F4	30 ms
- PM-D F5	15 ms
- PM-D F3	0.5 to 30 s (steplessly adjustable)
Setting accuracy	≤±15 % referenced to full-scale value
Voltages, currents, potentials	
Control circuit U_1 (PWR):	
Rated control supply voltage U_s	24 VDC
Working range DC up to 60°C	0.85 ... 1.2 x U_s
Power consumption	2.4 W
Recommended short-circuit protection	(gG)gL 2 A
Loadability of OUT+/-	24 VDC / < 50 mA (PTC fuse)
Switched auxiliary circuit U_2 (CON) for PM-D F1 up to 4 or potential-free release circuits for PM-D F5:	
Rated control supply voltage U_s	24 VDC
Working range DC up to 60°C	0.85 ... 1.2 x U_s
Rated operating current I_e	4 A 3 A, PM-D F5
• 13 to 24 VDC	
Thermal continuous current I_{th}	5 A 3 A, PM-D F5
Recommended short-circuit protection for enabling circuits	Cartridge fuses: NH type 3NA, DIAZED type 5SB NEOZED type 5SE Operating class (gG) gL 6 A
Supply of:	
• Motor starters	yes
• Electronic modules	no
• Ex[i] modules	no
power input	
From the backplane bus	≤10 mA
Connection	
Cable length	
for emergency stop and ON buttons	max. 1000 m
Conductor cross-section	2 x 1.5 mm^2
Standards, approbations	
BG	yes
UL, CSA certification	yes

Table 11-12: Technical specifications - PM-D F1 to 5

	Maximum attainable safety classes:					
		PM-D F 1	**PM-D F 2**	**PM-D F 3**	**PM-D F 4**	**PM-D F 5**
		3RK1903-1BA00	**3RK1903-1BB00**	**3RK1903-1BD00**	**3RK1903-1BC00**	**3RK1903-1BE00**
	SIL[1)]	3	3	2	3	3
	PL[1)]	e	e	d	e	e
DIN EN / IEC 61508						
	PFH_D	8.7×10^{-9}	9.0×10^{-9}	1.3×10^{-9}	9.0×10^{-9}	9.0×10^{-9}
	PFD(	1.6×10^{-5}	1.7×10^{-5}	2.4×10^{-6}	1.7×10^{-5}	1.7×10^{-5}
	T_1	20	20	20	20	20
	HFT	1	1	1	1	1
	SFF	> 99	> 99	> 99	> 99	> 99
DIN EN ISO 13849						
	DC	> 99	> 99	> 99	> 99	> 99
	Cat.[1)]	4	4	3	4	4
	n_{OP}	20000	20000	20000	20000	20000
	d_{OP}	365	365	365	365	365
	h_{OP}	24	24	24	24	24
	[1)] Max. achievable values					
	B10	DC13 24 V	DC13 24 V	DC13 24 V	DC13 24 V	DC13 24 V
	I_N 0.5 I_N 0.25 I_N	600.000 2.700.000 5.000.000	600.000 2.700.000 5.000.000	600.000 2.500.000 5.000.000	600.000 2.500.000 5.000.000	1.000.000 3.000.000 7.000.000

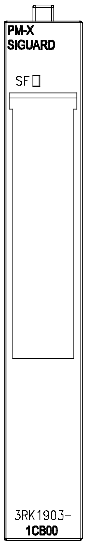
Table 11-13: Maximum attainable safety classes:

11.4 PM-X connection module

Features

- For connecting an external infeed contactor or other external actuators.
- For integrating into external safety circuits

View of PM-X



LED:
SF group error

Figure 11-9: PM-X connection module

Technical specifications - PM-X connection module

Dimensions and weight	
Overall W x H x D (mm) including terminal module	15 x 196.5 x 117.5
Weight (g)	approx. 130
Voltages, currents, potentials	
For information on the switched auxiliary circuit U_2 at terminals 6 and 7 of the TM-X15 S27-01, see PM-D F1 to F5.	
Power draw from the backplane bus	≤10 mA

Table 11-14: Technical specifications - PM-X

Important
If there is no infeed contactor connected to the PM-X connection module, jumper the feedback loop with terminals 1 and 2.

11.5 ET 200S with "local" safety-integrated system

Monitoring motor starters

The switching status of the switching elements in the motor starter is monitored in that the series-connected positively driven NC contacts of the feedback loop are connected by the terminal modules.

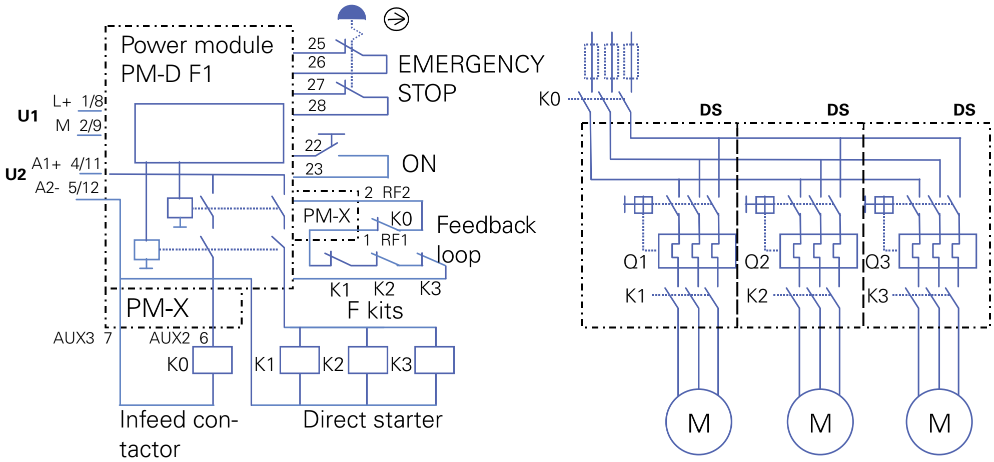


Figure 11-10: Circuit diagram for emergency stop circuit safety-integrated system

In order to continue using the standard and high feature motor starters, the ET 200S motor starters must be retrofitted with safety engineering.

DS1e-x and RS1e-x motor starters; high feature with installation widths of 65/130 mm already have integrated feedback loop monitoring.

Fail-safe kit 1 and 2 for standard motor starter

To ensure diagnostics for motor starters, a fail-safe kit must be used.

There are two fail-safe kits available and the components of both are listed below:

- Fail-safe kit 1 for DS1-x direct starter; standard:
  - An auxiliary switch block
  - A contact holder with a connecting lead for the direct starter
  - A contact carrier with two contacts for the terminal module (for infeed contactor)
  - A contact carrier with three contacts for the terminal module (for feedback loop)

- Fail-safe kit 2 for RS1-x reversing starter; standard:
  - Two auxiliary switch blocks
  - A contact holder with a connecting lead for the reversing starter
  - Two contact carriers with two contacts for the terminal module (for infeed contactor)
  - Two contact carriers with three contacts for the terminal module (for feedback loop)
  - A connecting lead

Installing and wiring fail-safe kit 1

To prepare the feedback loop for the emergency stop circuit, proceed as follows for a DS1-x direct starter; standard:

1. Insert the contact carrier for the feedback loop (3 contacts) offset slightly to the right into the top opening in the terminal module and then slide it to the left.
2. Seat the contact carrier for the infeed contactor (2 contacts) in the bottom opening of the terminal module .
3. Plug the contact holder with the connecting lead into the rear of the direct starter.
4. Route the connecting lead to the front of the direct starter as shown in the illustration.
5. Insert the auxiliary switch block into the appropriate opening in the direct starter.
6. Connect the connecting lead to the auxiliary switch block.

Safety notice
Make sure the auxiliary switch block properly locks into place!

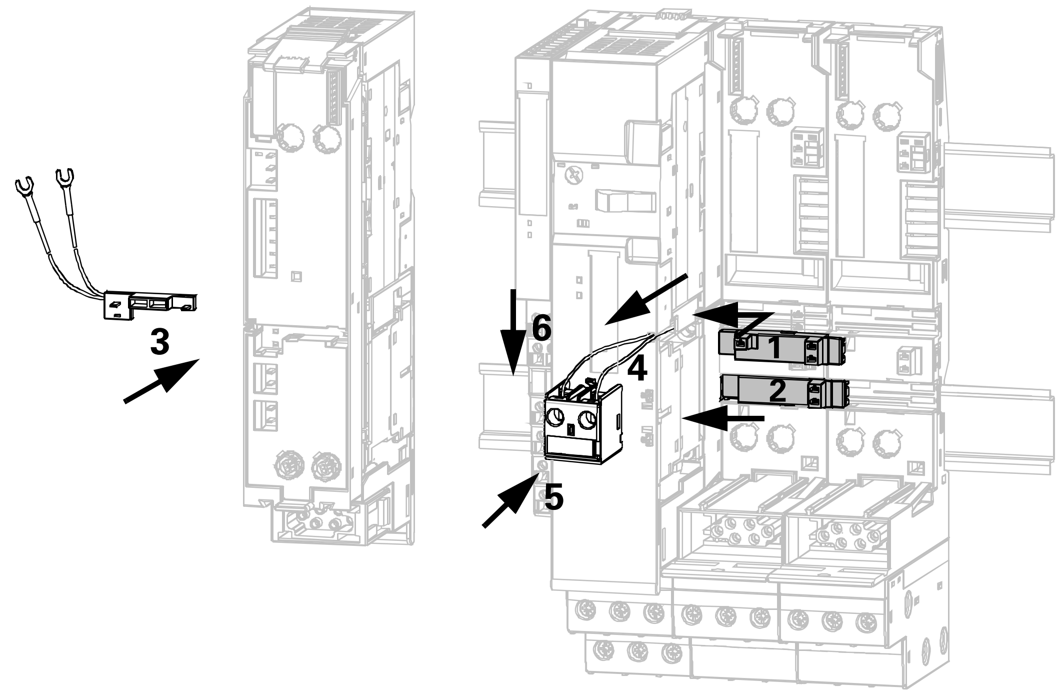


Table 11-15: Installing and wiring fail-safe kit 1 - direct starter; standard

Installing and wiring fail-safe kit 2

To prepare the feedback loop for the emergency stop circuit, proceed as follows for a RS1-x reversing starter; standard:

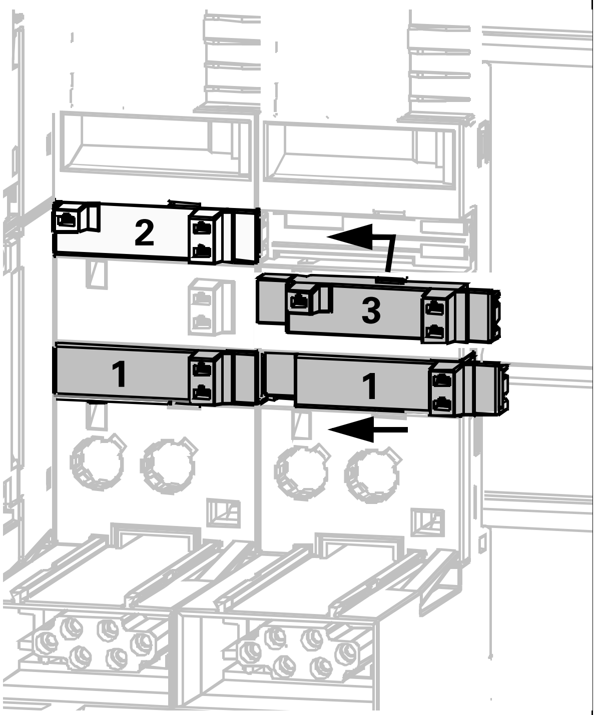
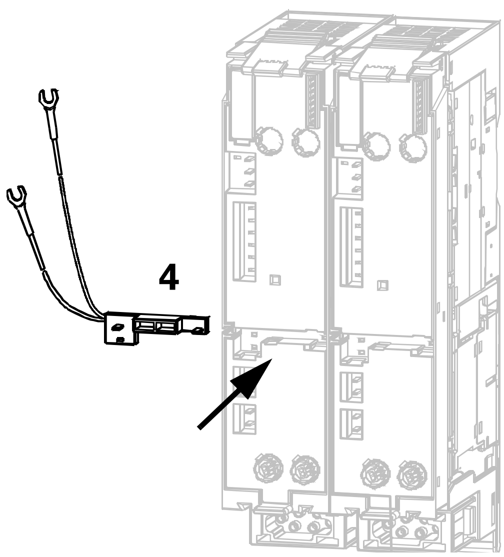
Drawing	Procedure
	**1** Starting at the left, insert the two contact carriers with two contacts for the infeed contactor into the two bottom openings of the terminal module and make sure they are correctly latched. **2** Insert a light gray contact carrier with three contacts into the top left opening **3** and a dark gray contact carrier with three contacts into the top right opening of the terminal module and make sure they are correctly latched.
	**4** Plug the contact holders with the connecting leads into the left opening in the rear of the reversing starter. Route the connecting leads through the channel to the front of the reversing starter.

Table 11-16: Installing and wiring fail-safe kit 2 - reversing starter; standard

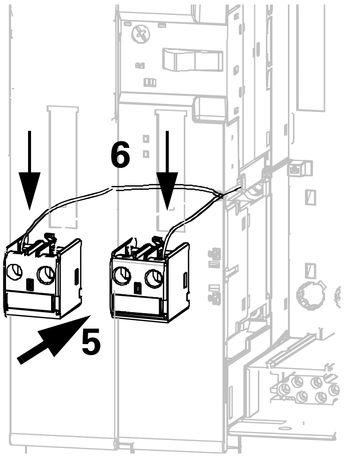
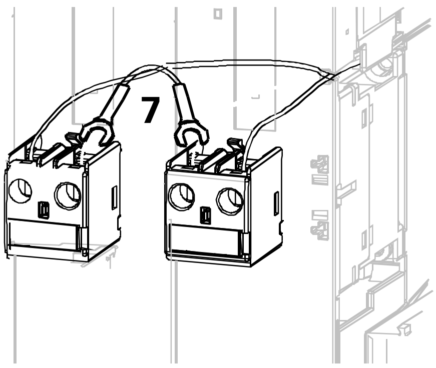
Drawing	Procedure
	**5** Plug the two auxiliary switch blocks into the appropriate openings in the reversing starter. **6** Connect the connecting leads to the auxiliary switch blocks.
	**7** Connect the auxiliary switch blocks by means of the connecting lead.

Table 11-16: Installing and wiring fail-safe kit 2 - reversing starter; standard (Contd.)

Safety notice
Make sure the auxiliary switch blocks properly lock into place!

11.6 Safety-integrated system configurations

In the following configurations, motor starters; standard with 45/90 mm installation widths have been used. These examples can also be used for motor starters; high feature with installation widths of 65/130 mm.

Motor starters; high feature/fail-safe with installation widths of 65/130 mm are already fitted with the fail-safe kit for the safety-integrated system. Fail-safe kits ensure the closing operation of the feedback loop and hence error discovery in the motor starter and the external infeed contactor.

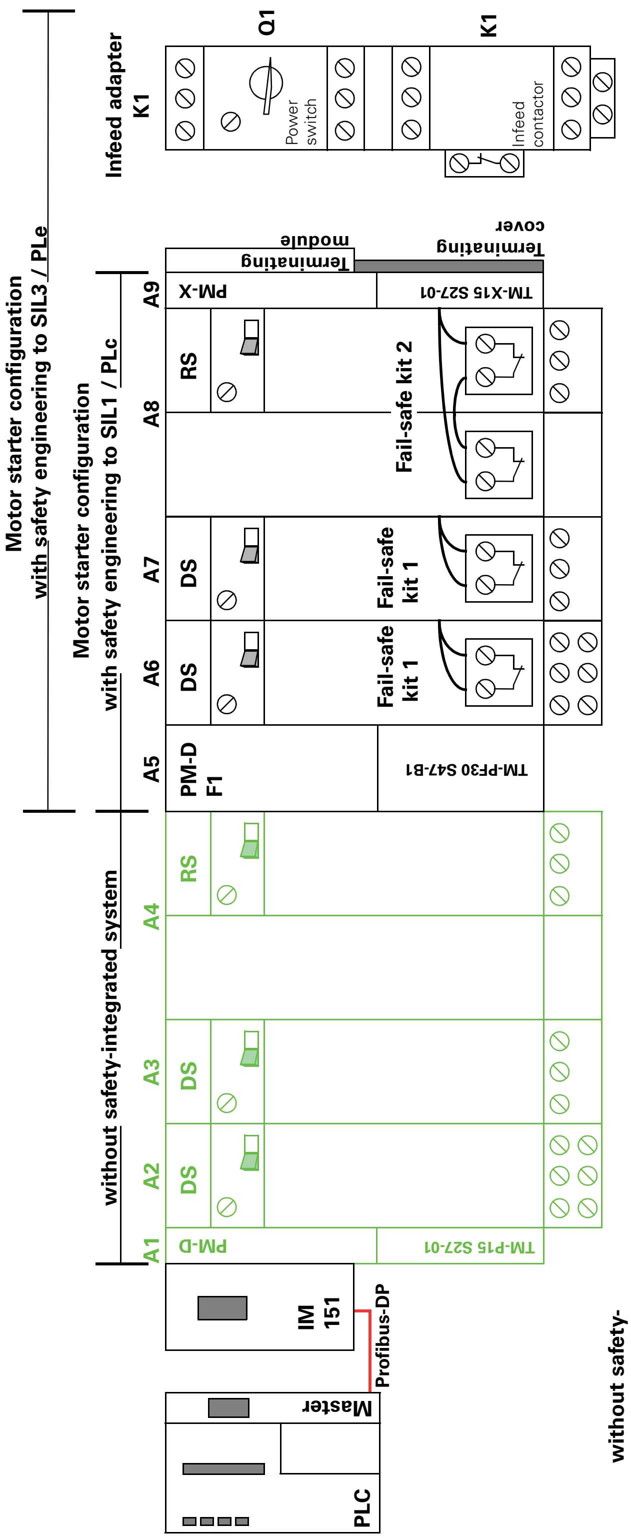
Caution
Derating (see Section 3.4) is not taken into account in these configurations.

Safety note
The following applications are used only as a suggestion of typical circuit diagrams.
No liability will be accepted for the proper functioning, compliance with certification requirements, or compatibility of the examples. Use at your own risk.

Caution
Due to the operation of star-connected three-phase motors, high EMC interference may occur. Interference above the IEC limit values can lead to an impairment of functions or failure of the electronics. In case of high EMC interference, we recommend the use of motors with EMC protection circuits. (Exception: soft starters may not be operated with a EMC protection circuit).

11.6.1 Safety circuit with safety-integrated system combination

Explanation: It is possible to mix motor starters with and without safety engineering in a substation.
To achieve SIL3 / PLe, an infeed adapter is required as a secondary shutdown path, the auxiliary contact of which must be included in the feedback loop and connected to the PM-X module.



The components required to set up this example are as follows:
(parts list for safety local motor starter configuration only)

No.	Order number	Description		
1	3RK1903-1BA00	PM-D F1		
1	3RK1903-1AA00	TM-PF30 S47-B1		
1	3RK1903-1CB00	PM-X		
1	3RK1903-1AB00	TM-X15 S27-01		
1	3RT1035-1BB40	Infeed protection for maximum complement 40 A		only for SIL3 / PLe
1	3RH1921-1DA11	Auxiliary switch for infeed contactor		
1	3RA1931-1BA00	DC connection module		
1	3RV1031-4HA10	Power switch as line protection at maximum complement 40 A		
2	3RK1301-xxB00-0AA2	DS	xx in accordance with current rating	
1	3RK1903-0AB00	TM-DS45 S32	with power bus infeed	
1	3RK1903-0AB10	TM-DS45 S31	with power bus throughfeed	
2	3RK1903-1CA00	Fail-safe kit 1		
1	3RK1301-xxB00-1AA2	RS	xx in accordance with current rating	
1	3RK1903-0AC10	TM-RS90 S31	with power bus throughfeed	
1	3RK1903-1CA01	Fail-safe kit 2		

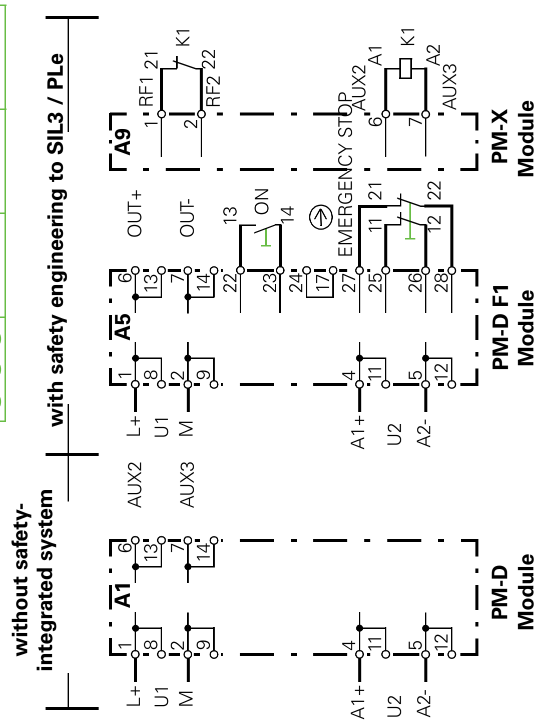


Figure 11-11: Safety circuit with safety-integrated system combination

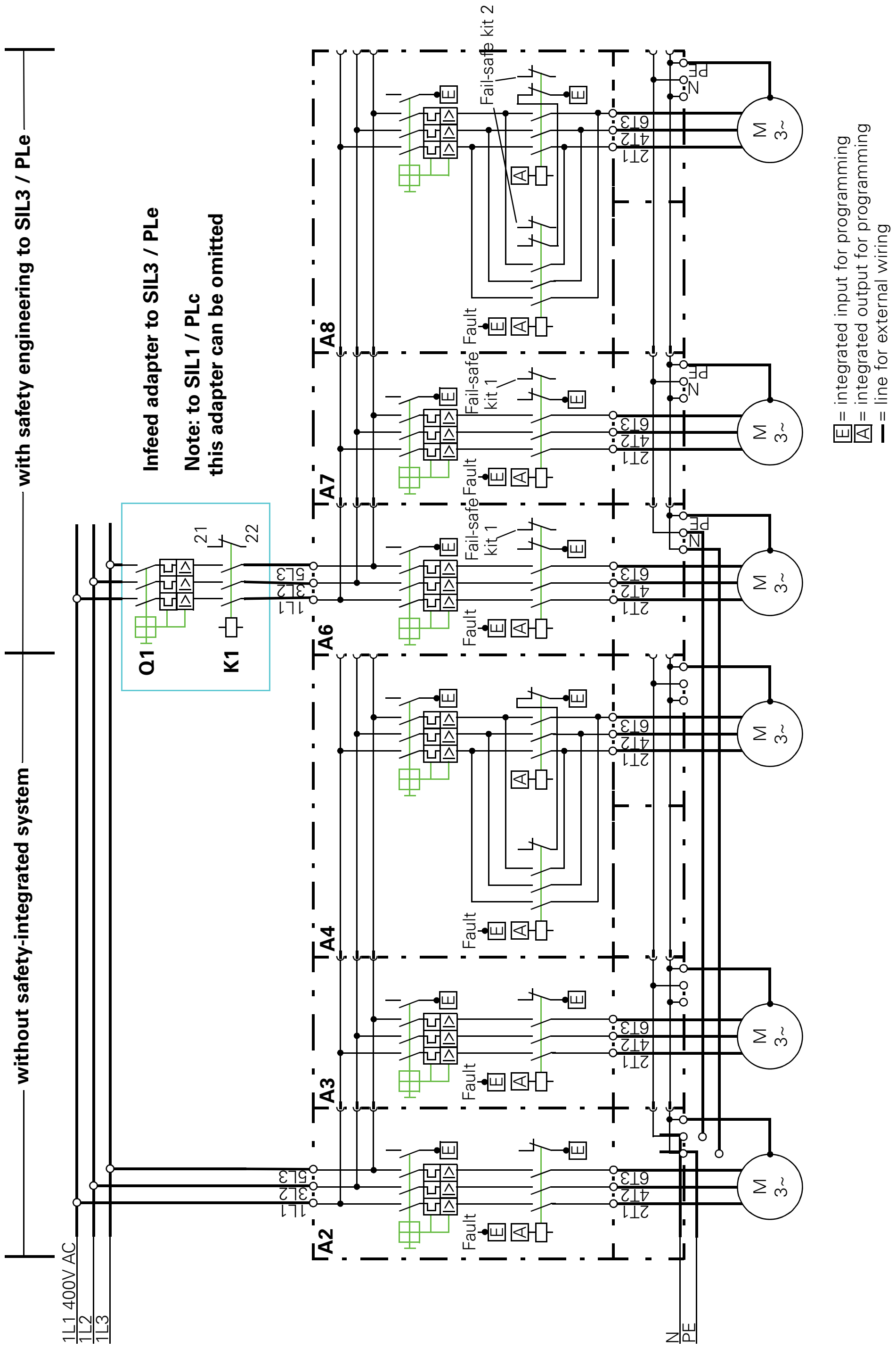
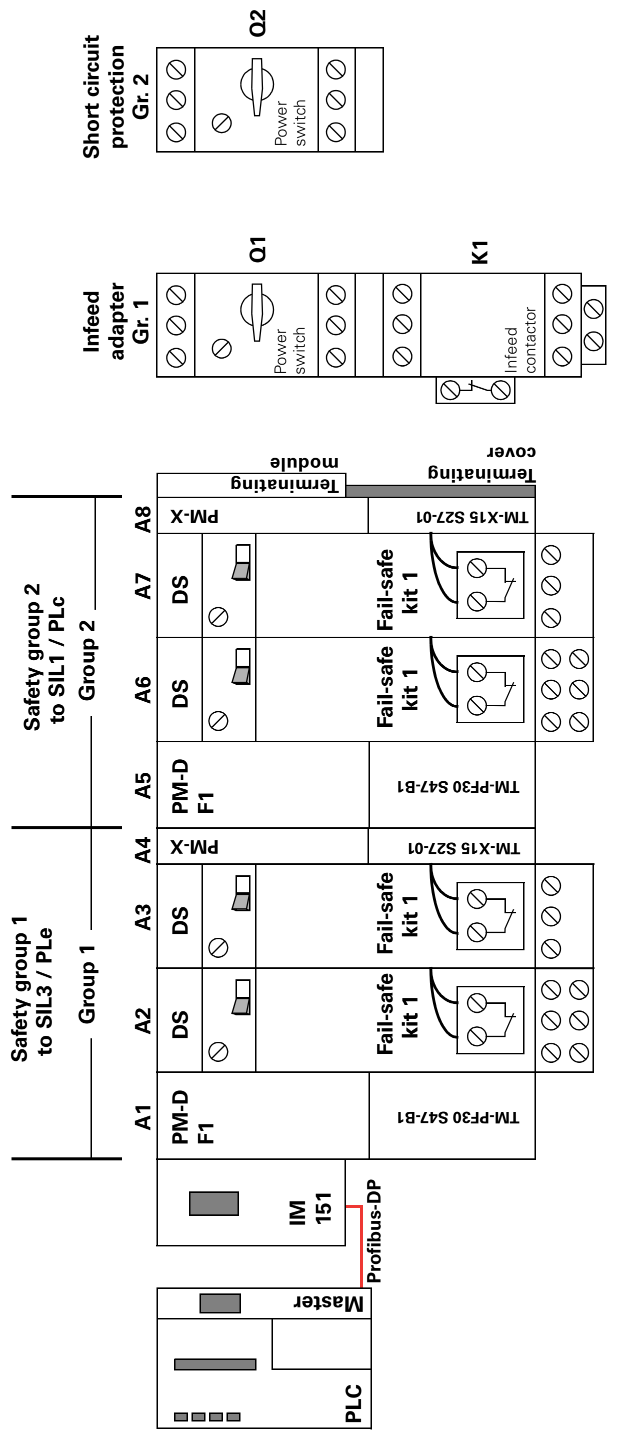
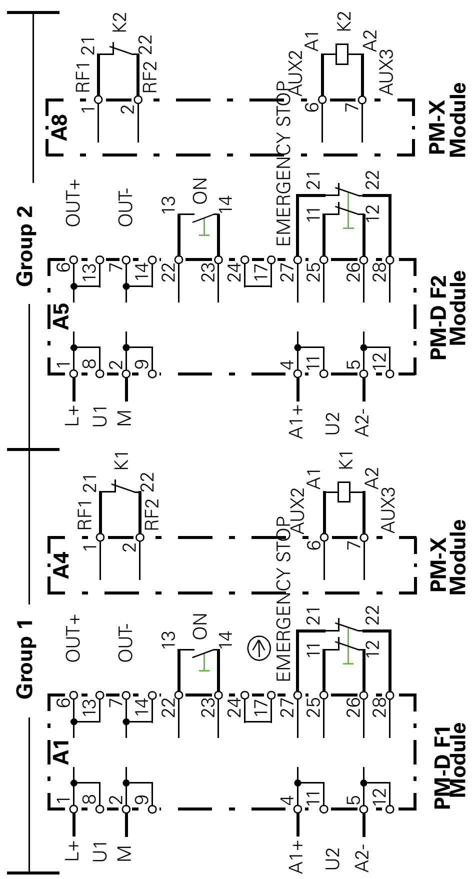


Figure 11-11: (Cont.) Safety circuit with safety-integrated system combination of PM-D F1, failsafe kits and standard motor starter

This circuit type fulfills the requirements up to SIL3 (IEC 62061) / PLe (DIN ISO 13849-1).

11.6.2 Two safety circuits with safety-integrated system combinations





The components required to set up this example are as follows:

No.	Order number	Description
3/4		
2	3RK1903-1BA00	PM-D F1
2	3RK1903-1AA00	TM-PF30 S47-B1
2	3RK1903-1CB00	PM-X
2	3RK1903-1AB00	TM-X15 S27-01
2	3RT1035-1BB40	Infeed protection for maximum complement 40 A
2	3RH1921-1DA11	Auxiliary switch for infeed contactor
2	3RA1931-1BA00	DC connection module
2	3RV1031-4HA10	Power switch as line protection with maximum complement 40 A
4	3RK1301-xxB00-0AA2	DS xx in accordance with current rating
2	3RK1903-0AB00	TM-DS45 S32 with power bus infeed
2	3RK1903-0AB10	TM-DS45 S31 with power bus throughfeed
4	3RK1903-1CA00	Fail-safe kit 1

Figure 11-12: Two safety circuits with safety-integrated system combinations

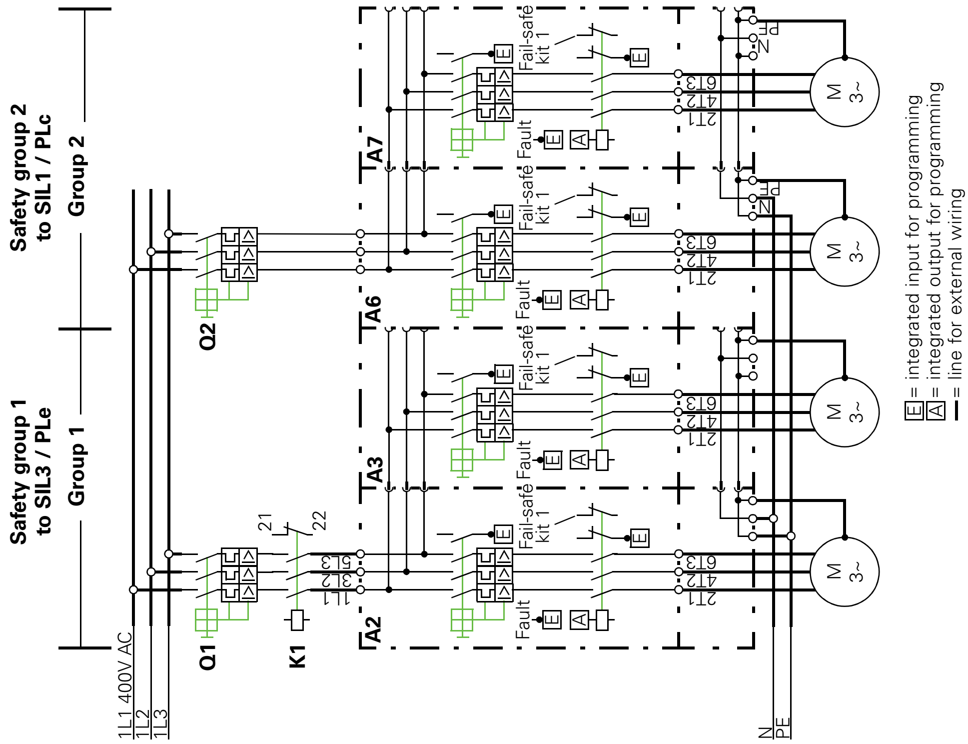


Figure 11-12: (Cont.) Two safety circuits with safety-integrated system combinations

This circuit type fulfills the requirements up to SIL3 / PLe in safety group 1 and the requirement according to SIL1 / PLc in safety group 2.

The emergency stop circuits are mutually independent:

- Emergency stop circuit 1 switches only group 1.
- Emergency stop circuit 2 switches only group 2.

The second shutdown path is omitted for SIL1 / PLc.
The failsafe kit achieves an increase in diagnostic coverage (diagnostic coverage level DC).

11.6.3 Two cascaded safety circuits with safety-integrated system combinations (potential group, potential subgroup)

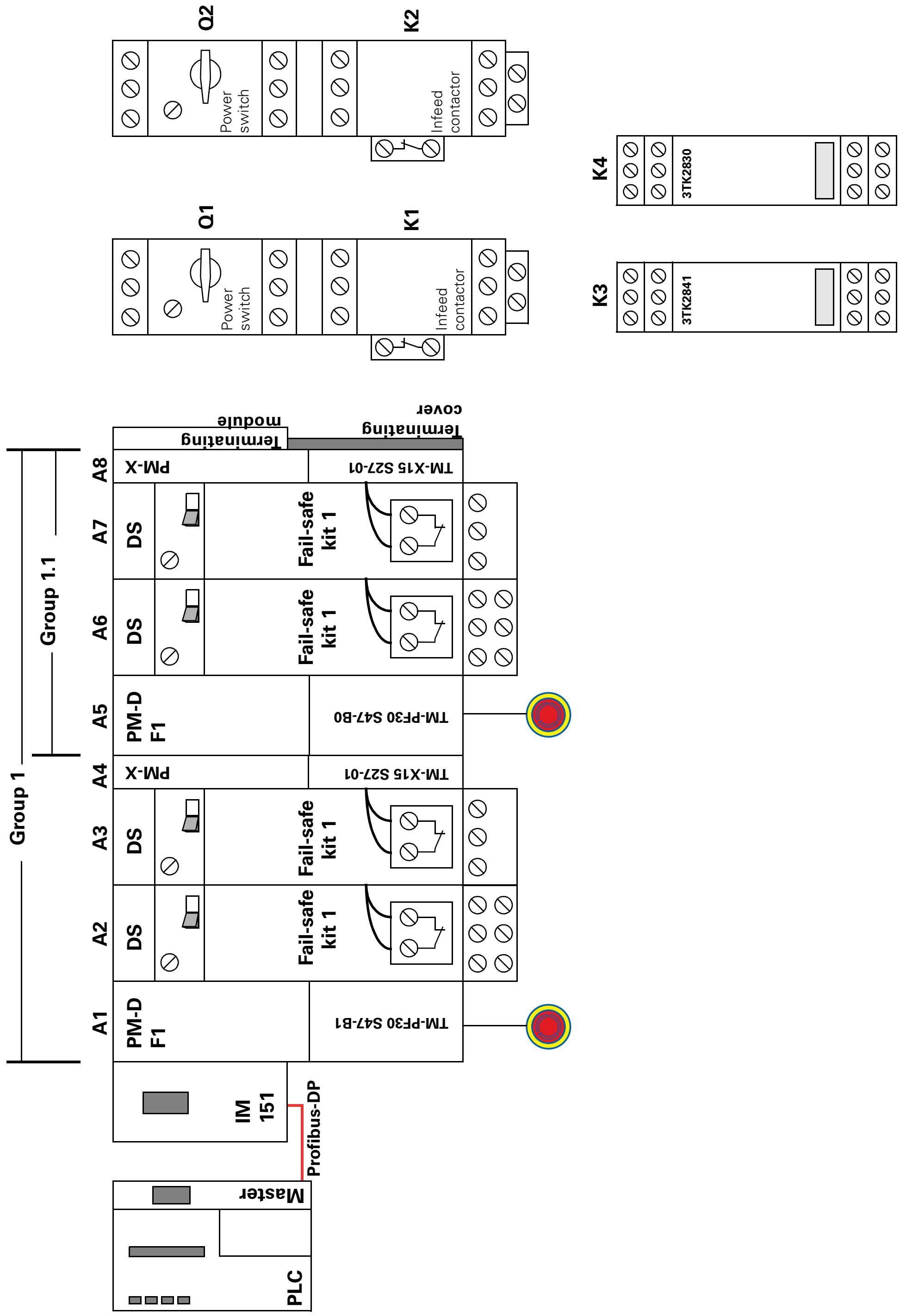


Figure 11-13: Two cascaded safety circuits with safety-integrated system combinations

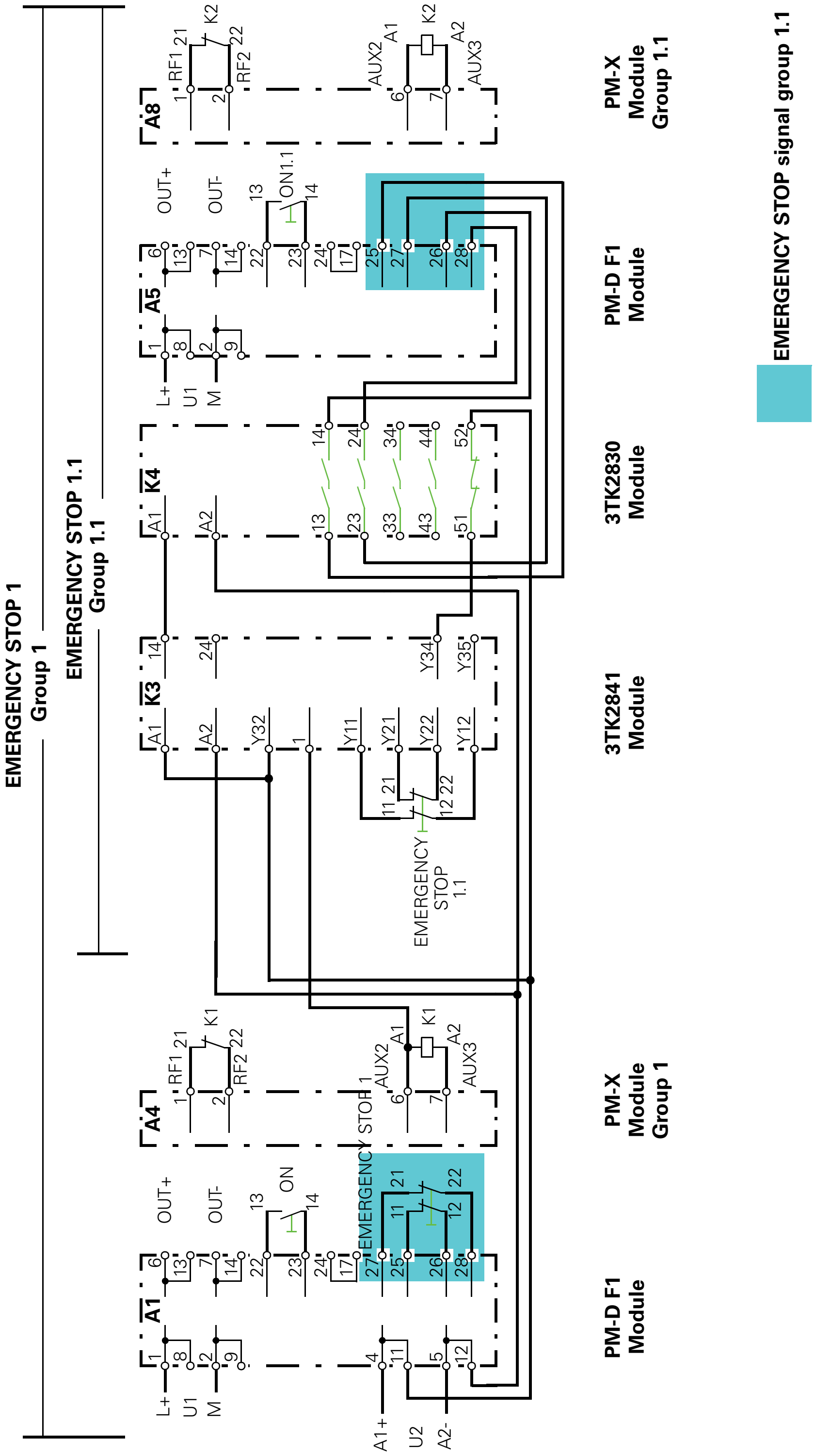


Figure 11-13: (Cont.) Two cascaded safety circuits with safety-integrated system combinations

The components required to set up this example are as follows:

No. 3/4	Order number	Description
2	3RK1903-1BA00	PM-D F1
1	3RK1903-1AA10	TM-PF30 S47-B0
1	3RK1903-1AA00	TM-PF30 S47-B1
2	3RK1903-1CB00	PM-X
2	3RK1903-1AB00	TM-X15 S27-01
2	3RT1035-1BB40	Infeed protection for maximum complement 40 A
2	3RH1921-1DA11	Auxiliary switch for infeed contactor
2	3RA1931-1BA00	DC connection module
2	3RV1031-4HA10	Power switch as line protection with maximum complement 40 A
4	3RK1301-xxB00-0AA2	DS xx in accordance with current rating
2	3RK1903-0AB00	TM-DS45 S32 with power bus infeed
2	3RK1903-0AB10	TM-DS45 S31 with power bus throughfeed
4	3RK1903-1CA00	Fail-safe kit 1
1	3TK2830-1CB30	Expansion module
1	3TK2841-1BB40	Safety switchgear

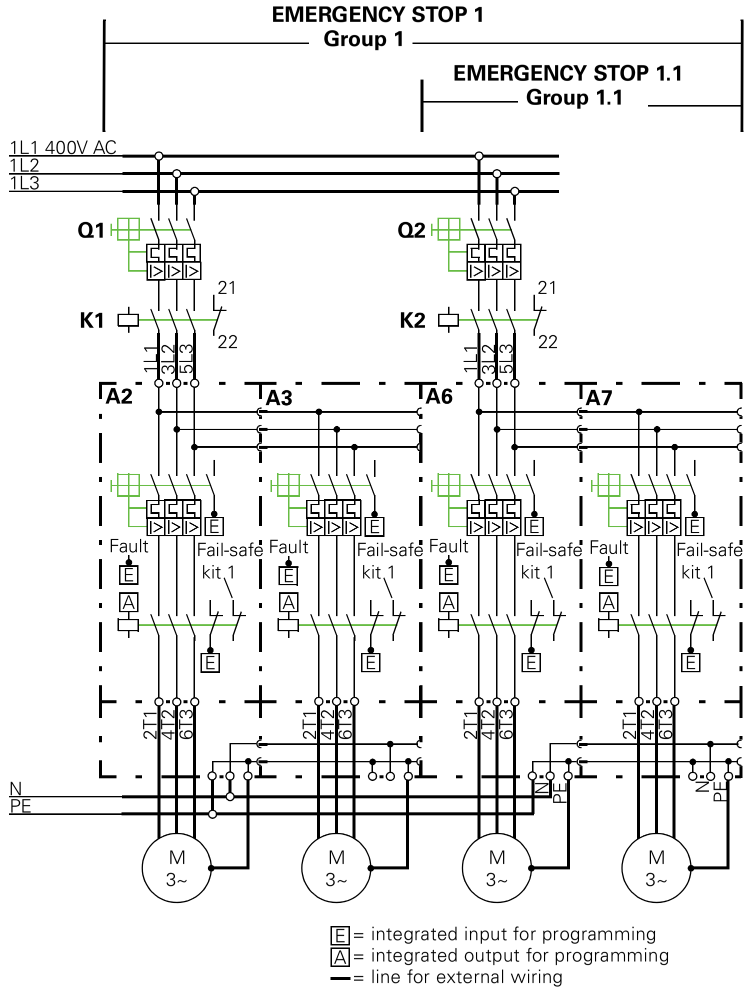


Figure 11-13: (Cont.) Two cascaded safety circuits with safety-integrated system combinations

To implement the cascade, the second PM-D F1 power module is plugged into the TM-PF30 S47-**B0** terminal module. Child potential groups are also wired with a SIRIUS safety switchgear 3TK2841 and an expansion device 3TK2830. Both additional devices are supplied from the U2 auxiliary voltage.

The circuits have to be cascaded if you use two emergency stop circuits which respond in the manner described below:

Function:
The emergency stop 1 (potential group) switches ALL motor starters (group shutdown).
The emergency stop 1.1 switches only motor starters A6/A7 (subgroup)

Description of group 1:
Operating "emergency stop 1" switches the PM-D F1 (A1) of motor starters A2 and A3. The safety switching device 3TK2841 (K3 via input 1) is also actuated. This in turn controls the expansion module 3TK2830 (K4 via A1). The potential-free contacts of module K4 activate the PM-D F module of group 1.1 (A5). This switches off motor starters A6 and A7.

Description of group 1.1 only:
Operating the "emergency stop 1.1" command device shuts down the electronic enabling circuit of K3 (terminal 14) and thus deenergizes the expansion module K4 (terminal A1). As a result, the potential-free enabling circuits are opened and the inputs to the PM-D F1 module (A5) are disconnected => emergency stop group 1.1

Reclosing group 1:
by operating the ON 1 button, the PM-D F1 module (A1) is reclosed. Safety switching device 3TK2841 (module K3) is supplied with voltage permanently via terminal A1.
As safety switching device 3TK2841 is wired to "automatic start" via terminal Y32, the electronic output from K3 (terminal 14) is set as soon as the cascade input of module K3 is active again.
The reclosing conditions for the PM-D F1 module (A5) are thus met. After acknowledgment at the ON 1.1 command device, the system is once more ready.

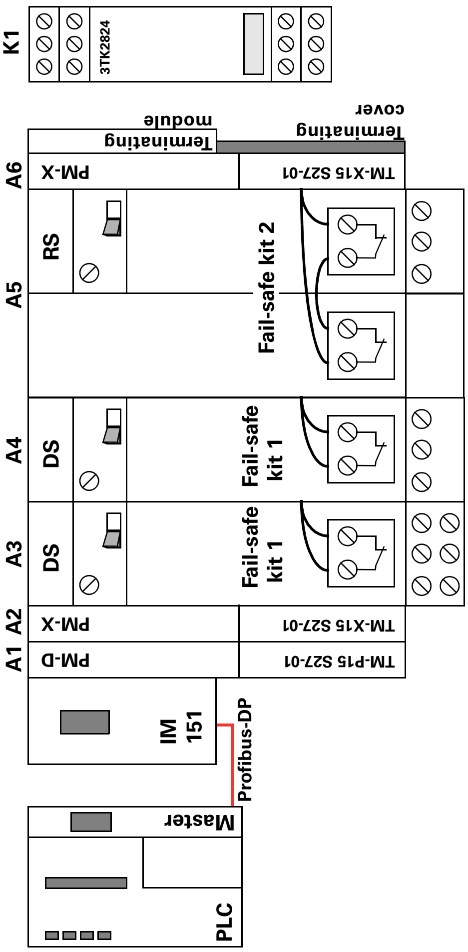
Reclosing group 1.1
Precondition: EMERGENCY STOP 1.1 unlocked and only group 1.1 safety-integrated system has been shut down.
After acknowledgment at the ON 1.1 command device, the PM-D F1 module is released.

11.6.4 Safety circuit with an external safety-integrated system combination 3TK2824

The components required to set up this example are as follows:

PL c	Order number	Description
1	3RK1903-0BA00	PM-D
1	3RK1903-0AA00	TM-P15 S27-01
2	3RK1903-1CB00	PM-X
2	3RK1903-1AB00	TM-X15 S27-01
2	3RK1301-xxB00-0AA2	DS xx in accordance with current rating
1	3RK1903-0AB00	TM-DS45 S32 with power bus infeed
1	3RK1903-0AB10	TM-DS45 S31 with power bus throughfeed
2	3RK1903-1CA00	Fail-safe kit 1
1	3RK1301-xxB00-1AA2	RS xx in accordance with current rating
1	3RK1903-0AC10	TM-RS90 S31 with power bus throughfeed
1	3RK1903-1CA01	Fail-safe kit 2
1	3TK2824-xCB30	External safety combination x in accordance with the connection

1) In this typical circuit diagram, PL c according to DIN EN ISO 13849-1 can only be met if a warning is issued automatically when the actuator fails or the machine control system initiates a safe status condition. Otherwise a second disconnection path is required.



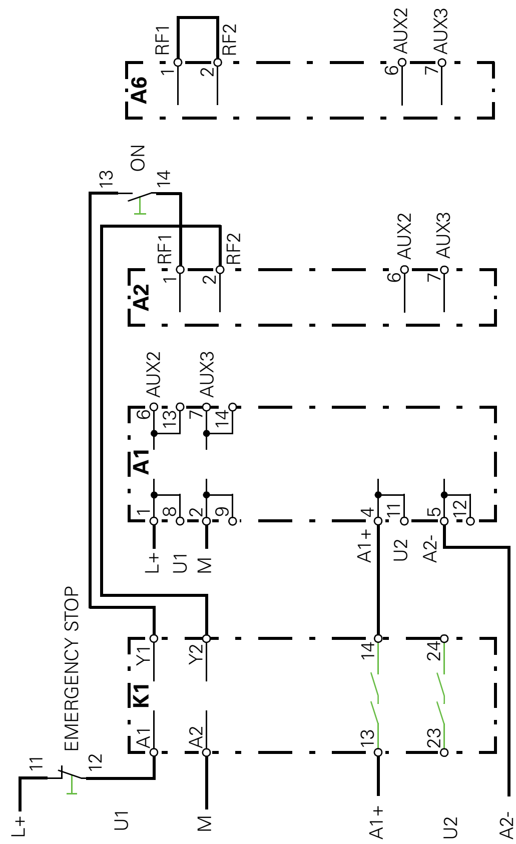


Figure 11-14: Safety circuit with an external safety-integrated system combination 3TK2824 PL c

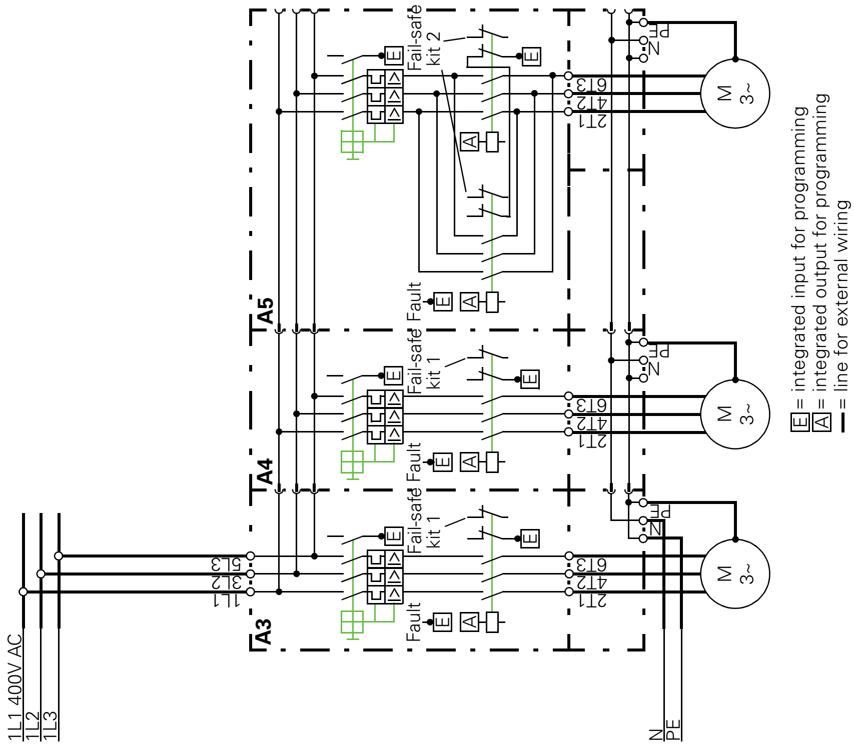
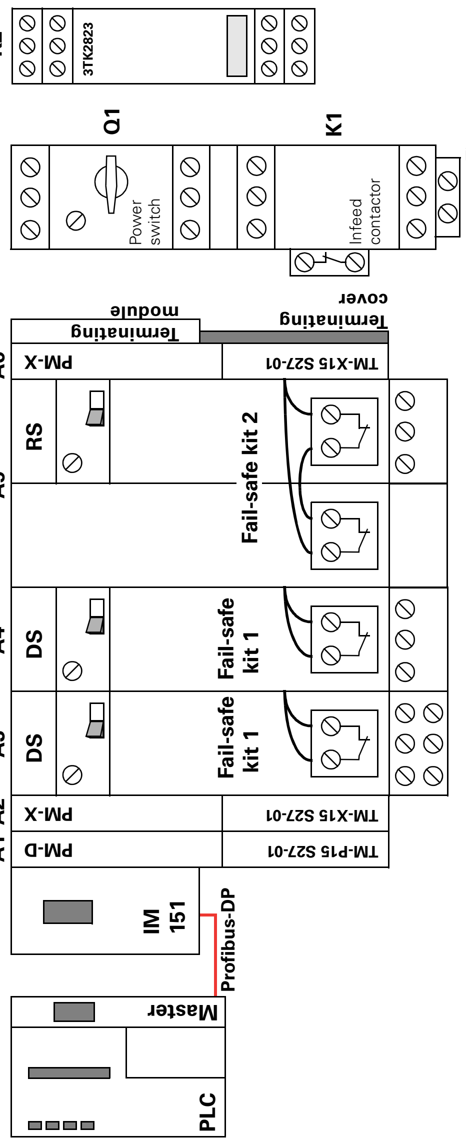


Figure 11-14: (Cont.) Safety circuit with an external safety-integrated system combination 3TK2824

This configuration integrates ET 200S components into external safety concepts. This circuit satisfies the requirements of PL c and employs a safety combination.
The monitored motor starters connect to the right of the load feeders.

Important
Please observe the current carrying capacity of the 3TK2824!

11.6.5 Safety circuit with an external safety-integrated system combination 3TK2823



The components required to set up this example are as follows:

PL			Order number	Description
b	c[1]	d/e		
1	1	1	3RK1903-0BA00	PM-D
1	1	1	3RK1903-0AA00	TM-P15 S27-01
	2	2	3RK1903-1CB00	PM-X
	2[2]	2	3RK1903-1AB00	TM-X15 S27-01
		1	3RT1035-1BB40	Infeed protection for maximum complement 40 A
		1	3RH1921-1DA11	Auxiliary switch for infeed contactor
		1	3RA1931-1BA00	DC connection module
		1	3RV1031-4HA10	Power switch as line protection with maximum complement 40 A
2	2	2	3RK1301-xxB00-0AA2	DS xx in accordance with current rating
1	1	1	3RK1903-0AB00	TM-DS45 S32 with power bus infeed
1	1	1	3RK1903-0AB10	TM-DS45 S31 with power bus throughfeed
	2	2	3RK1903-1CA00	Fail-safe kit 1
1	1	1	3RK1301-xxB00-1AA2	RS xx in accordance with current rating
1	1	1	3RK1903-1AC10	TM-RS90 S31 with power bus throughfeed
	1	1	3RK1903-1CA01	Fail-safe kit 2
		1	3TK2823-xCB30	External safety combination x in accordance with the connection

1) In this typical circuit diagram, PL c according to DIN EN ISO 13849-1 can only be met if a warning is issued automatically when the actuator fails or the machine control system initiates a safe status condition. Otherwise a second disconnection path is required.
2) With module A6, jumper between terminals 1,2.

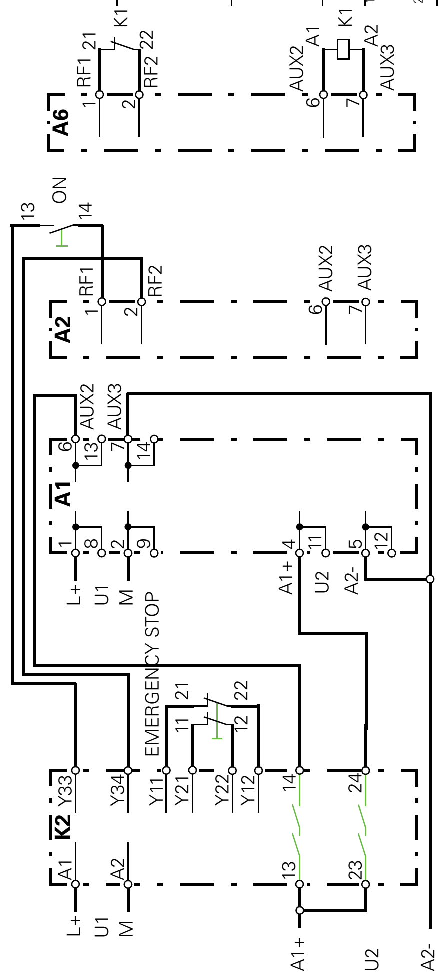


Figure 11-15: Safety circuit with an external safety-integrated system combination 3TK2823 PL e

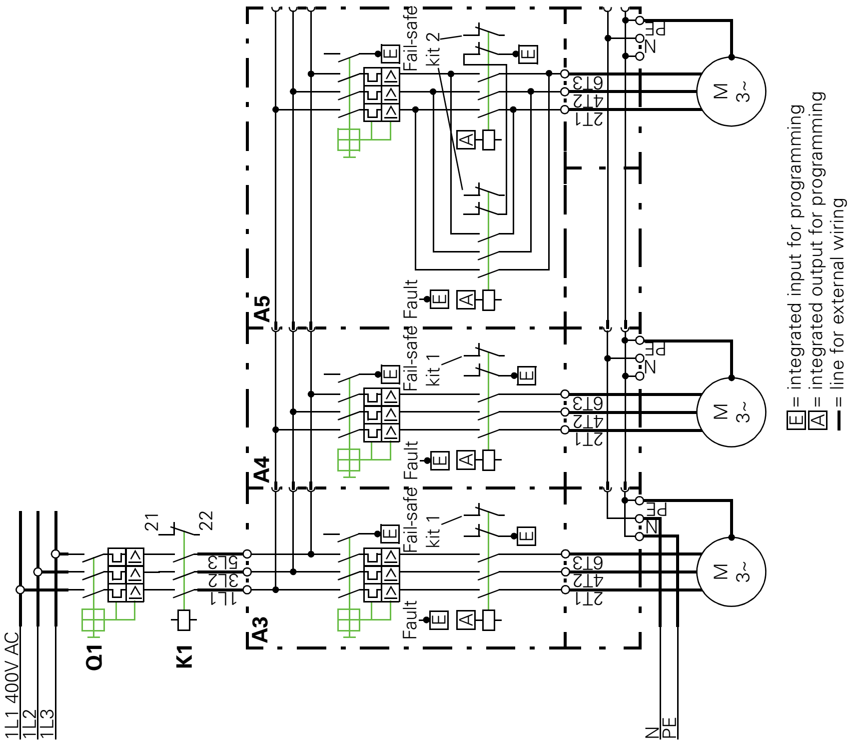


Figure 11-15: (Cont.) Safety circuit with an external safety-integrated system combination 3TK2823 PL e

This configuration integrates ET 200S components into external safety concepts. This circuit satisfies the requirements up to PL e and employs a safety combination.
The monitored motor starters connect to the right of the load feeders.

Important
Please observe the current carrying capacity of the 3TK2823!

11.6.6 Emergency stop combined with protective door

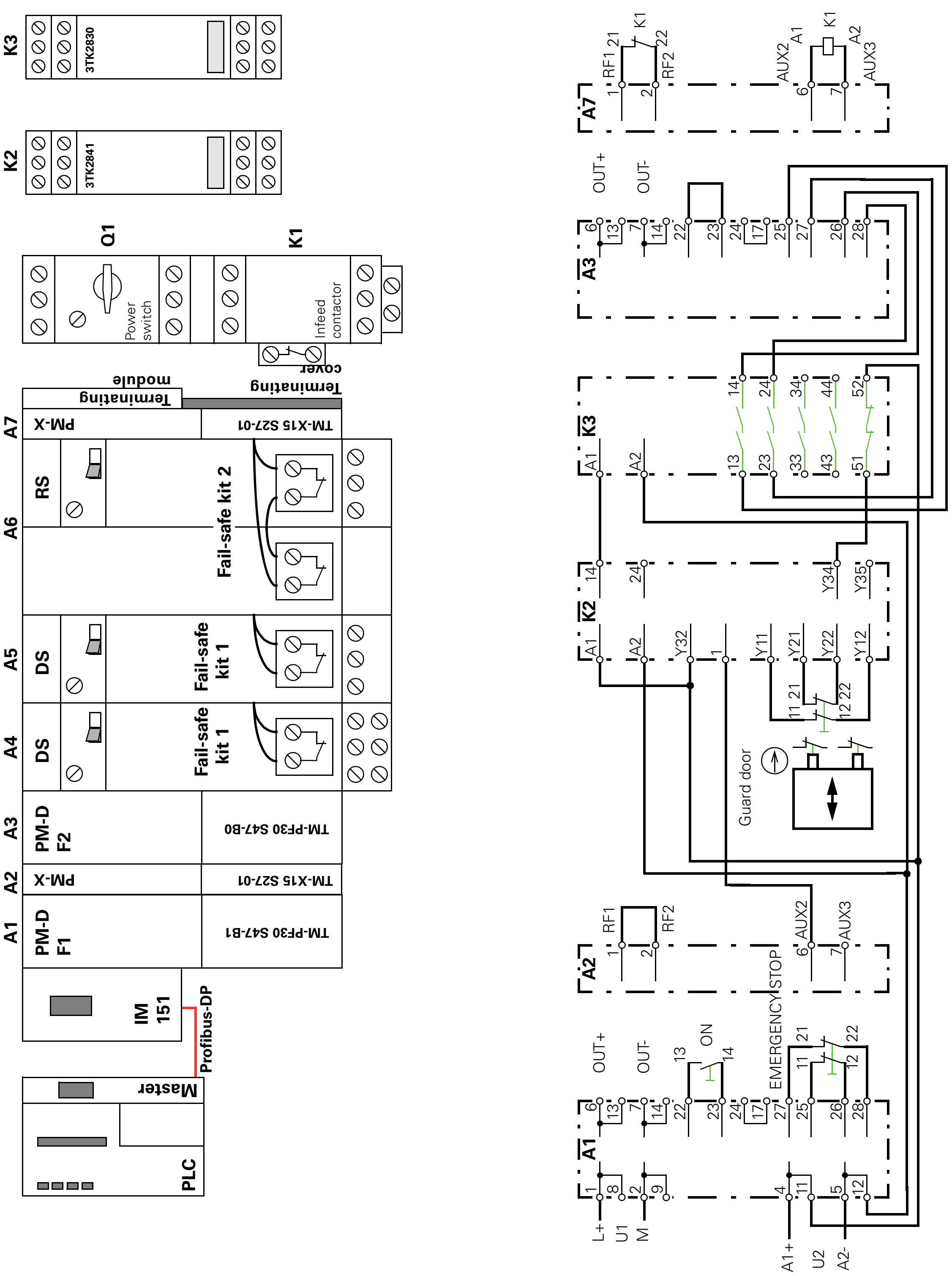
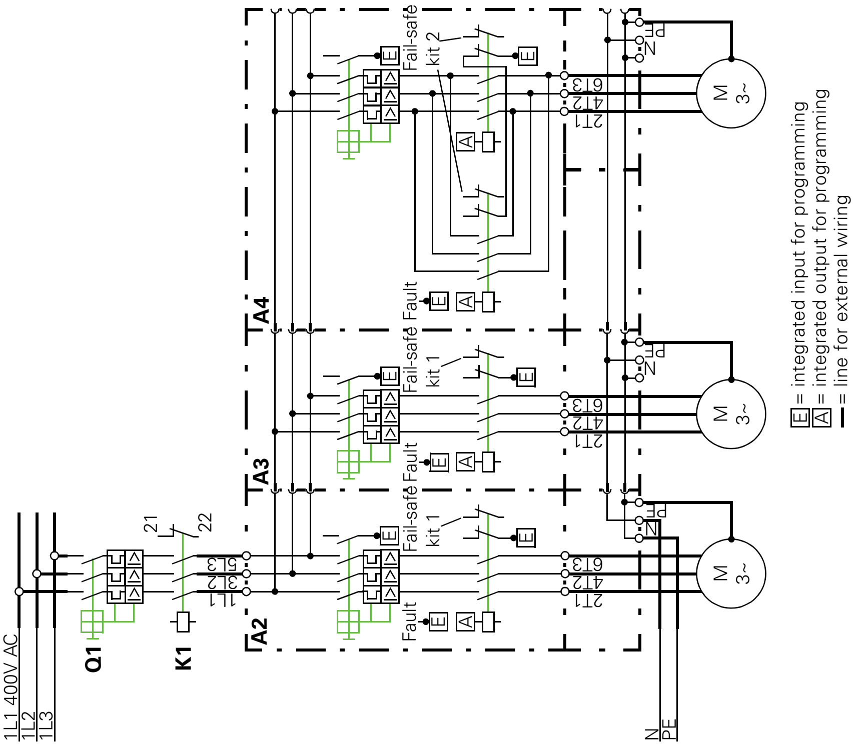


Figure 11-16: Emergency stop combined with protective door



The components required to set up this example are as follows:

PL b	PL c[1]	PL d/e	Order number	Description
1[2]			3RK1903-0BA00	PM-D
1			3RK1903-0AA00	TM-P15 S27-01
	1	1	3RK1903-1BA00	PM-D F1
	1	1	3RK1903-1AA00	TM-PF30 S47-B1
	1	1	3RK1903-1BB00	PM-D F2
	1	1	3RK1903-1AA10	TM-PF30 S47-B0
	2	2	3RK1903-1CB00	PM-X
	2[3]	2[3]	3RK1903-1AB00	TM-X15 S27-01
		1	3RT1035-1BB40	Infeed protection for maximum complement 40 A
		1	3RH1921-1DA11	Auxiliary switch for infeed contactor
		1	3RA1931-1BA00	DC connection module
		1	3RV1031-4HA10	Power switch as line protection with maximum complement 40 A
2	2	2	3RK1301-xxB00-0AA2	DS xx in accordance with current rating
1	1	1	3RK1903-0AB00	TM-DS45 S32 with power bus infeed
1	1	1	3RK1903-0AB10	TM-DS45 S31 with power bus throughfeed
	2	2	3RK1903-1CA00	Fail-safe kit 1
1	1	1	3RK1301-xxB00-1AA2	RS xx in accordance with current rating
1	1	1	3RK1903-0AC10	TM-RS90 S31 with power bus throughfeed
	1	1	3RK1903-1CA01	Fail-safe kit 2
1	1	1	3SBx x	Personnel safety switch xx design
	1	1	3TK2830-1CB30	Expansion module
	1	1	3TK2841-1BB40	Safety switchgear

1) In this typical circuit diagram, PL c according to DIN EN ISO 13849-1 can only be met if a warning is issued automatically when the actuator fails or the machine control system initiates a safe status condition. Otherwise a second disconnection path is required.
2) Emergency stop and protective door contacts looped in line for supply voltage U2 (A1+, A2-).
3) **Caution**
With the PM-X connection module to which no infeed contactor is connected, the feedback loop should be jumpered with terminals 1 and 2.

Figure 11-16: (Cont.) Emergency stop combined with protective door

This configuration combines emergency stop and protective door monitoring up to PL e according to DIN EN ISO 13849-1.

11.6.7 Emergency stop circuit with cascaded time delay PL d or PL e

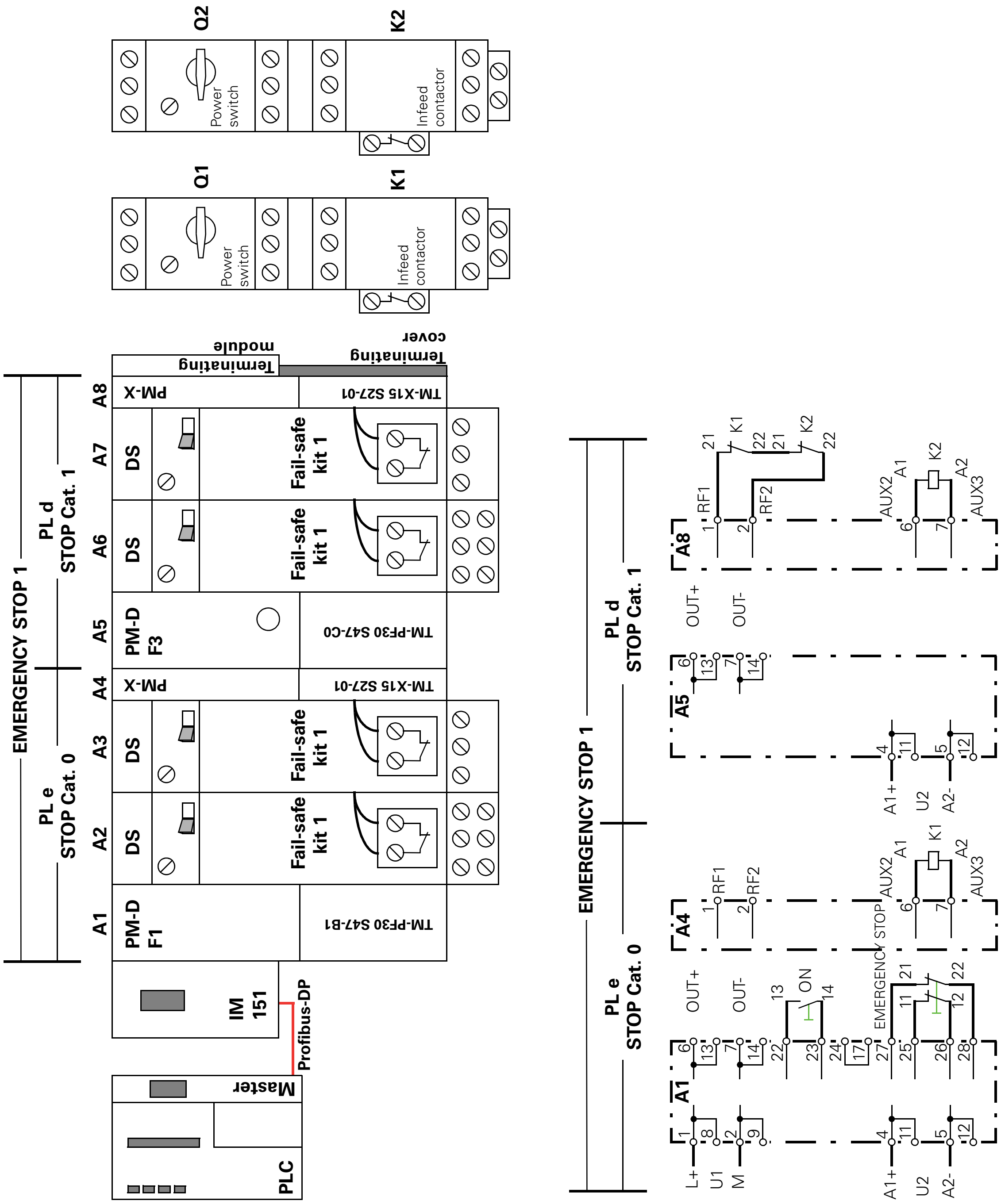
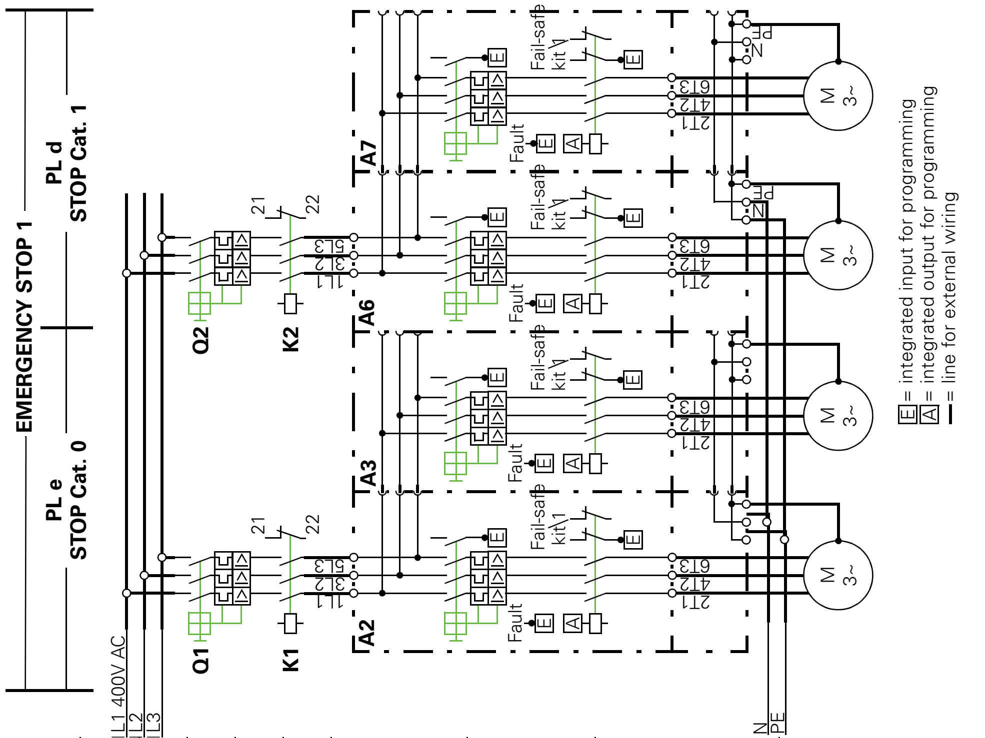


Figure 11-17: Emergency stop circuit with cascaded time delay PL d or PL e



The components required to set up this example are as follows:

PL b	PL c[1]	PL d/e	Order number	Description
2[2]			3RK1903-0BA00	PM-D
2			3RK1903-0AA00	TM-P15 S27-01
	1	1	3RK1903-1BA00	PM-D F1
	1	1	3RK1903-1AA00	TM-PF30 S47-B1
[3]	1	1	3RK1903-1BD00	PM-D F3
	1	1	3RK1903-1AC10	TM-PF30 S47-C0
	1	2	3RK1903-1CB00	PM-X
	1[4]	2[5]	3RK1903-1AB00	TM-X15 S27-01
		2	3RT1035-1BB40	Infeed protection for maximum complement 40 A
		2	3RH1921-1DA11	Auxiliary switch for infeed contactor
		2	3RA1931-1BA00	DC connection module
		2	3RV1031-4HA10	Power switch as line protection with maximum complement 40 A
4	4	4	3RK1301-xxB00-0AA2	DS xx in accordance with current rating
2	2	2	3RK1903-0AB00	TM-DS45 S32 with power bus infeed
2	2	2	3RK1903-0AB10	TM-DS45 S31 with power bus throughfeed
	4	4	3RK1903-1CA00	Fail-safe kit 1

1) In this typical circuit diagram, PL c according to DIN EN ISO 13849-1 can only be met if a warning is issued automatically when the actuator fails or the machine control system initiates a safe status condition. Otherwise a second disconnection path is required.
2) Emergency stop looped in line for supply voltage U2 (A1+, A2-).
3) Time delay with standard time relay.
4) **Caution**
Module A4 is not required. With PM-X connection module (A8 module) should be bridged with terminals 1 and 2.
5) **Attention**
For the PM-X connection module with module designation A4, terminals 1 and 2 must not be bridged.

Figure 11-17: (Cont.) Emergency stop circuit with cascaded time delay PL d or PL e

This configuration combines instantaneous (STOP category 0) and delayed (STOP category 1) shutdown. This configuration consists of 2 potential or load groups.

Important
The maximum attainable with delayed shutdown is PL d according to to DIN EN ISO 13849-1.

11.6.8 One emergency stop circuit for two or more ET 200S rails

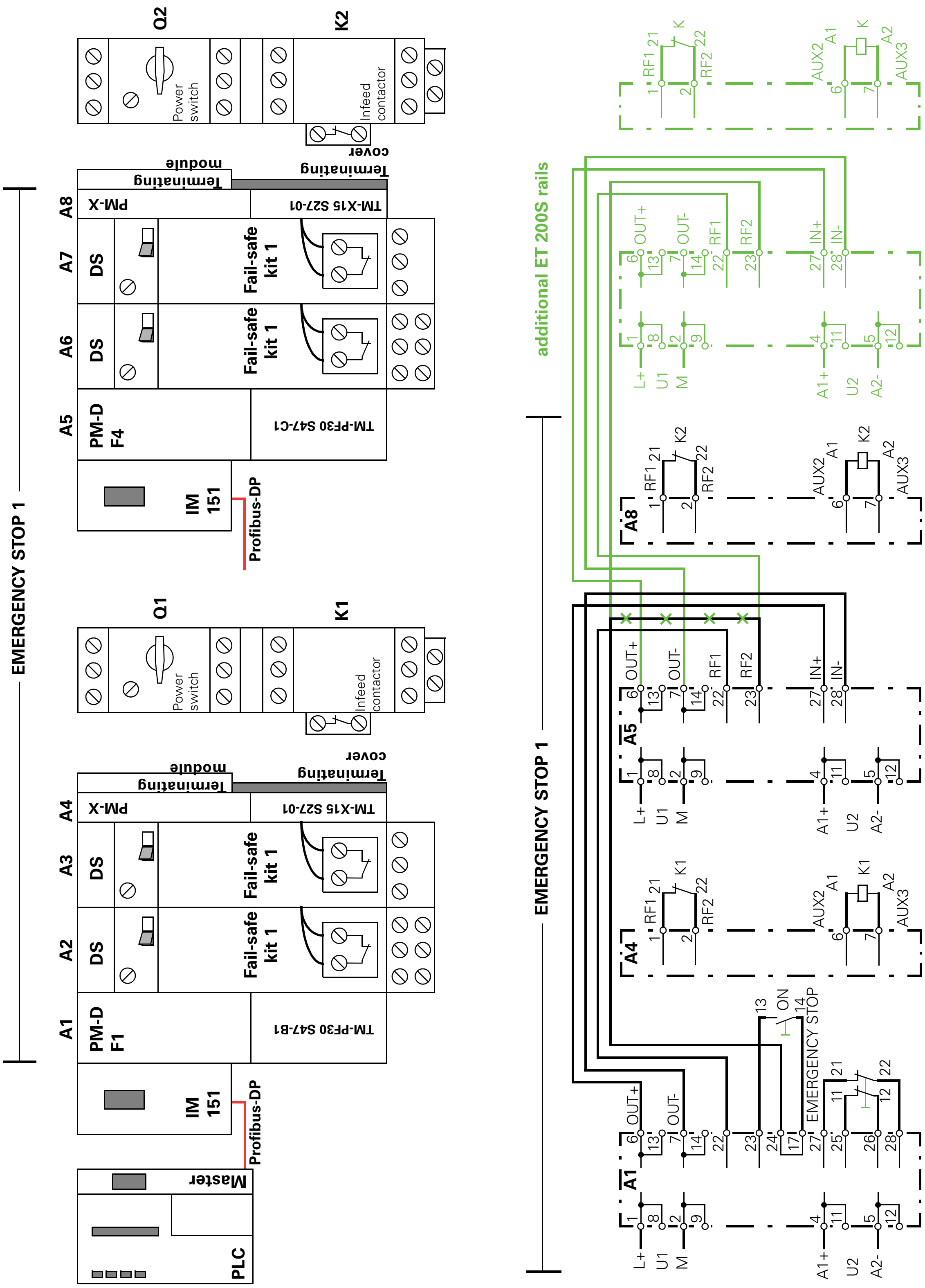
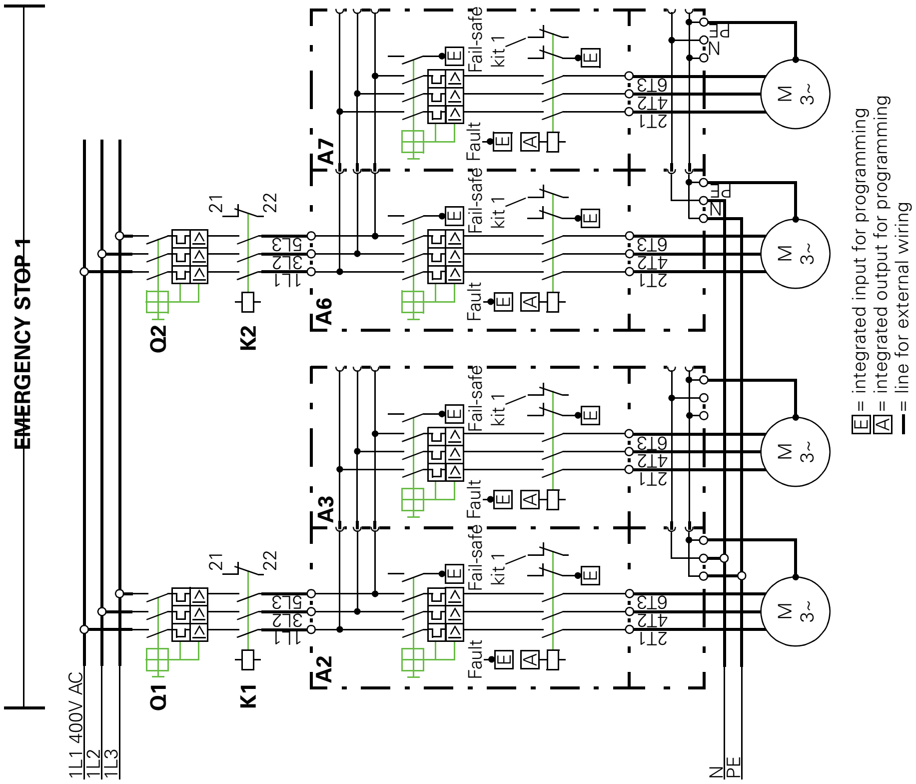


Figure 11-18: One emergency stop circuit for two or more ET 200S rails



The components required to set up this example are as follows:

PL b	PL c[1]	PL d/e	Order number	Description
1[2]			3RK1903-0BA00	PM-D
1			3RK1903-0AA00	TM-P15 S27-01
	1	1	3RK1903-1BA00	PM-D F1
	1	1	3RK1903-1AA00	TM-PF30 S47-B1
	1	1	3RK1903-1BC00	PM-D F4
	1	1	3RK1903-1AC00	TM-PF30 S47-C1
	2	2	3RK1903-1CB00	PM-X
	2[3]	2	3RK1903-1AB00	TM-X15 S27-01
		2	3RT1035-1BB40	Infeed protection for maximum complement 40 A
		2	3RH1921-1DA11	Auxiliary switch for infeed contactor
		2	3RA1931-1BA00	DC connection module
		2	3RV1031-4HA10	Power switch as line protection with maximum complement 40 A
4	4	4	3RK1301-xxB00-0AA2	DS xx in accordance with current rating
2	2	2	3RK1903-0AB00	TM-DS45 S32 with power bus infeed
2	2	2	3RK1903-0AB10	TM-DS45 S31 with power bus throughfeed
	4	4	3RK1903-1CA00	Fail-safe kit 1

1) In this typical circuit diagram, PL c according to DIN EN ISO 13849-1 can only be met if a warning is issued automatically when the actuator fails or the machine control system initiates a safe status condition. Otherwise a second disconnection path is required.
2) Emergency stop looped in line for supply voltage U2 (A1+, A2-).
3) **Caution**
With the PM-X connection module to which no infeed contactor is connected, the feedback loop should be jumpered with terminals 1 and 2.

Important

For each ET 200S rail the dropout time of the PM-D F4 increases by 30 ms.

Figure 11-18: (Cont.) One emergency stop circuit for two or more ET 200S rails

This configuration incorporates additional ET 200S rails into an emergency stop circuit for PL e according to DIN EN ISO 13849-1.

11.6.9 Potential-free connection between an ET 200S safety circuit and autonomous safety circuits

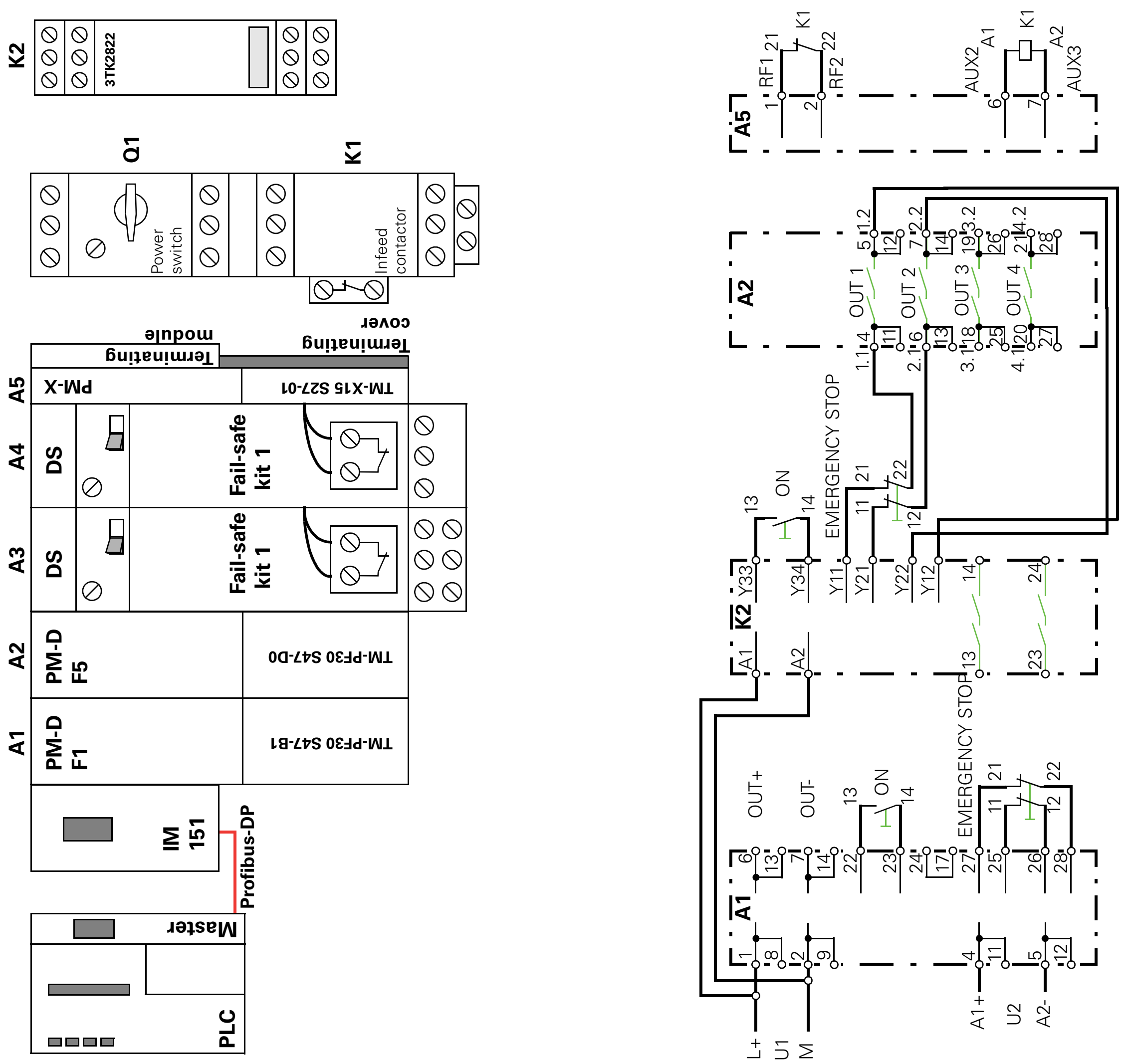
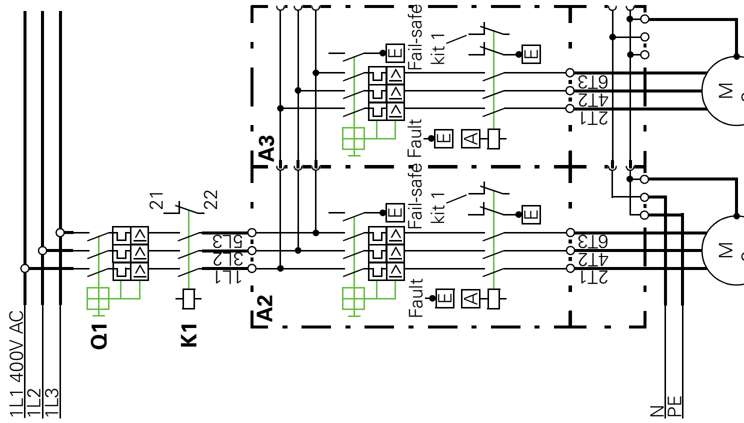


Figure 11-19: Potential-free connection between an ET 200S safety circuit and autonomous safety circuits



E = integrated input for programming
A = integrated output for programming
— = line for external wiring

The components required to set up this example are as follows:

PL b	PL c[1)]	PL d/e	Order number	Description
2[2)]			3RK1903-0BA00	PM-D
2			3RK1903-0AA00	TM-P15 S27-01
	1	1	3RK1903-1BA00	PM-D F1
	1	1	3RK1903-1AA00	TM-PF30 S47-B1
	1	1	3RK1903-1BE00	PM-D F5
	1	1	3RK1903-1AD10	TM-PF30 S47-D0
	1	1	3RK1903-1CB00	PM-X
	1[3)]	1	3RK1903-1AB00	TM-X15 S27-01
	1	1	3TK2822-xCB30	External safety combination x in accordance with the connection
		1	3RT1035-1BB40	Infeed protection for maximum complement 40 A
		1	3RH1921-1DA11	Auxiliary switch for infeed contactor
		1	3RA1931-1BA00	DC connection module
		1	3RV1031-4HA10	Power switch as line protection with maximum complement 40 A
2	2	2	3RK1301-xxB00-0AA2	DS xx in accordance with current rating
1	1	1	3RK1903-0AB00	TM-DS45 S32 with power bus infeed
1	1	1	3RK1903-0AB10	TM-DS45 S31 with power bus throughfeed
	2	2	3RK1903-1CA00	Fail-safe kit 1

1) In this typical circuit diagram, PL c according to DIN EN ISO 13849-1 can only be met if a warning is issued automatically when the actuator fails or the machine control system initiates a safe status condition. Otherwise a second disconnection path is required.
2) Emergency stop looped in line for supply voltage U2 (A1+, A2-).
3) With jumper between terminals 1 and 2.

Figure 11-19: (Cont.) Potential-free connection between an ET 200S safety circuit and autonomous safety circuits

This configuration shows how external safety components can be incorporated into the ET 200S safety concept.

Note
4 potential-free contacts are available on each PM-D F5.

Several PM-D F5s can be plugged in.

11.6.10 DSS1e-x direct soft starter; high feature to PL e

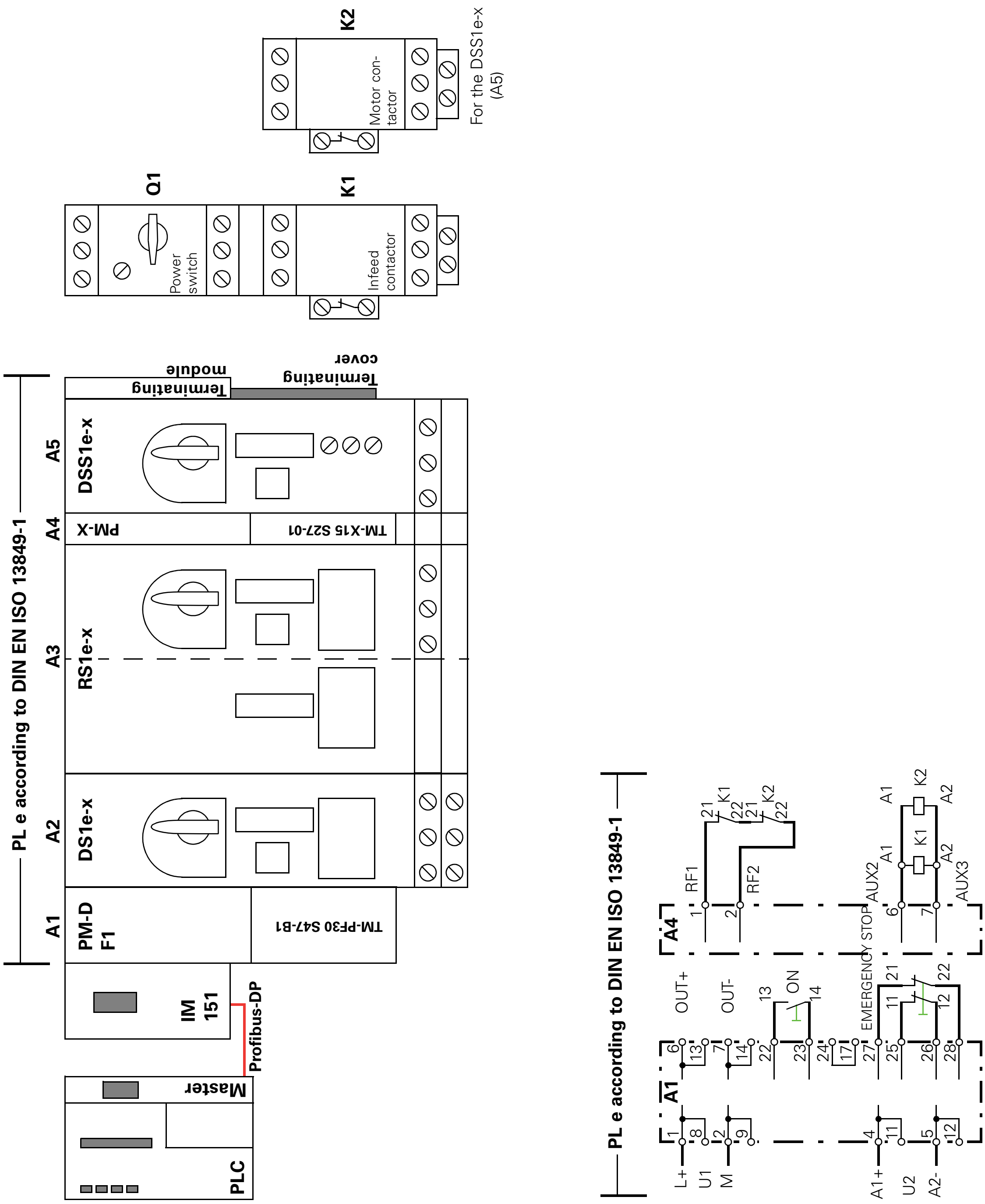
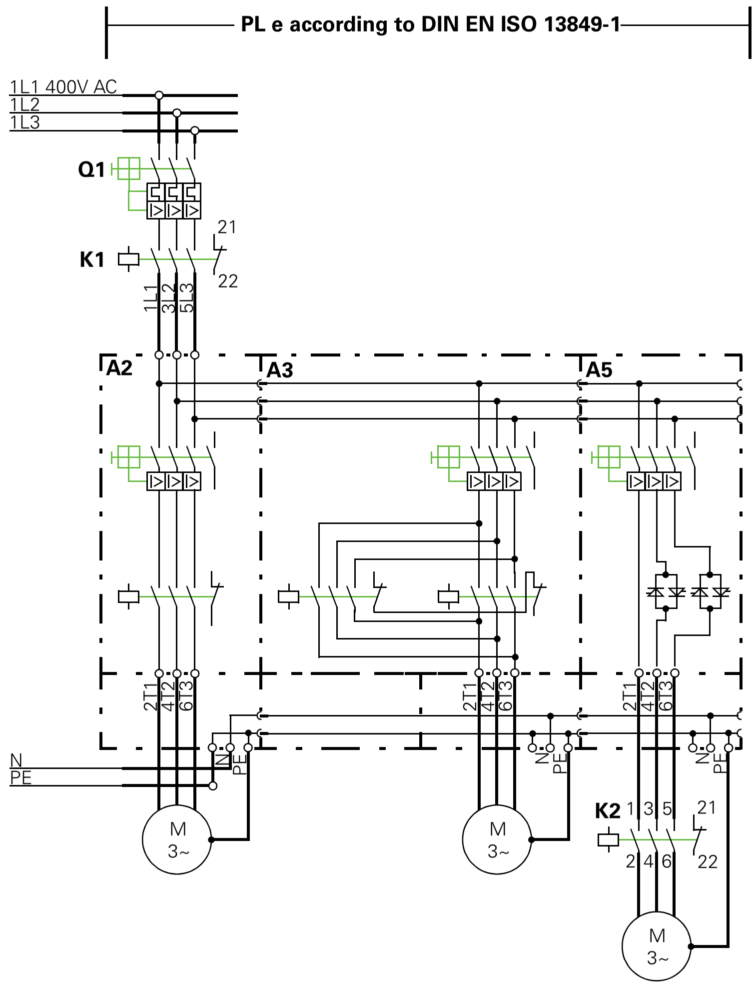


Figure 11-20: DSS1e-x direct soft starter; high feature to PL e



E = integrated input for programming
A = integrated output for programming
— = line for external wiring

The components required to set up this example are as follows:

PL			Order number	Description
b	c[1)]	d/e		
1[2)]			3RK1903-0BA00	PM-D
1			3RK1903-0AA00	TM-P15 S27-01
	1	1	3RK1903-1BA00	PM-D F1
	1	1	3RK1903-1AA00	TM-PF30 S47-B1
	1	1	3RK1903-1CB00	PM-X
	1	1	3RK1903-1AB00	TM-X15 S27-01
		1	3RT1044-1BB40	Infeed protection for maximum complement 40 A
		1	3RH1921-1DA11	Auxiliary switch for infeed contactor
		1	3RA1941-1BA00	DC connection module
		1	3RV1041-4HA10	Power switch as line protection with maximum complement 40 A
1	1	1	3RK1301-0xB10-0AA2	DS1e-x x in accordance with current range
1	1	1	3RK1903-0AK00	TM-DS65 S32 with power bus infeed
1	1	1	3RK1301-0xB10-1AA2	RS1e-x x in accordance with current rating
1	1	1	3RK1903-0AL10	TM-RS130 S31 with power bus throughfeed
1	1	1	3RK1301-0xB20-0AA2	DSS1e-x x in accordance with current rating
1	1	1	3RK1903-0AK10	TM-DS65 S31 with power bus throughfeed
	1	1	3RK1903-0AE00	15 mm jumper module
	1	1	3RT1034-1BB44	Motor contactor
	1	1		Auxiliary for motor protection (if required)

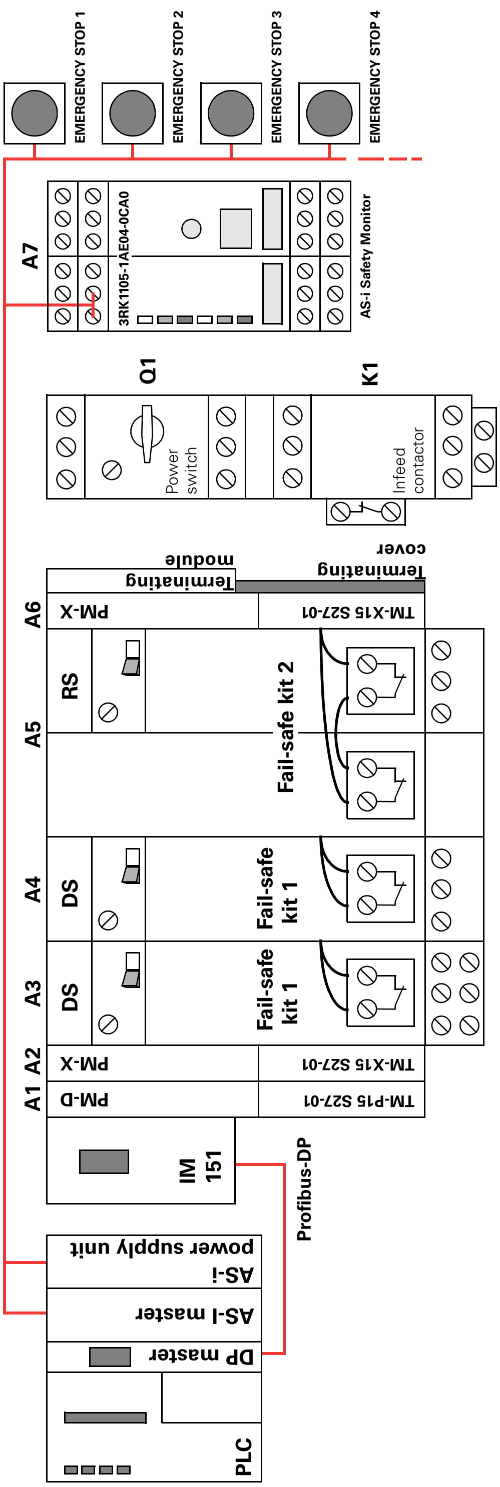
1) In this typical circuit diagram, PL c according to DIN EN ISO 13849-1 can only be met if a warning is issued automatically when the actuator fails or the machine control system initiates a safe status condition. Otherwise a second disconnection path is required.

2) Emergency stop looped in line for supply voltage U2 (A1+, A2-).

Figure 11-20: (Cont.) DSS1e-x direct soft starter; high feature to PL e

This configuration shows how to incorporate a DSS1e-x direct soft starter up to PL e according to DIN EN ISO 13849-1.

11.6.11 ET 200S safety-integrated system with AS-i Safety at work



The components required to set up this example are as follows:

PL b	PL c[1)]	PL d/e	Order number	Description
1	1	1	3RK1903-0BA00	PM-D
1	1	1	3RK1903-0AA00	TM-P15 S27-01
	2	2	3RK1903-1CB00	PM-X
	2[2)]	2	3RK1903-1AB00	TM-X15 S27-01
		1	3RT1035-1BB40	Infeed protection for maximum complement 40 A
		1	3RH1921-1DA11	Auxiliary switch for infeed contactor
		1	3RA1931-1BA00	DC connection module
		1	3RV1031-4HA10	Power switch as line protection with maximum complement 40 A
2	2	2	3RK1301-xxB00-0AA2	DS xx in accordance with current rating
1	1	1	3RK1903-0AB00	TM-DS45 S32 with power bus infeed
1	1	1	3RK1903-0AB10	TM-DS45 S31 with power bus throughfeed
	2	2	3RK1903-1CA00	Fail-safe kit 1
1	1	1	3RK1301-xxB00-1AA2	RS xx in accordance with current rating
1	1	1	3RK1903-0AC10	TM-RS90 S31 with power bus throughfeed
	1	1	3RK1903-1CA01	Fail-safe kit 2
1	1	1	3RK1105-1AE04-0CA0	AS-I Safety Monitor

1) In this typical circuit diagram, PL c according to DIN EN ISO 13849-1 can only be met if a warning is issued automatically when the actuator fails or the machine control system initiates a safe status condition. Otherwise a second disconnection path is required.

2) With module A6, jumper between terminals 1 and 2.

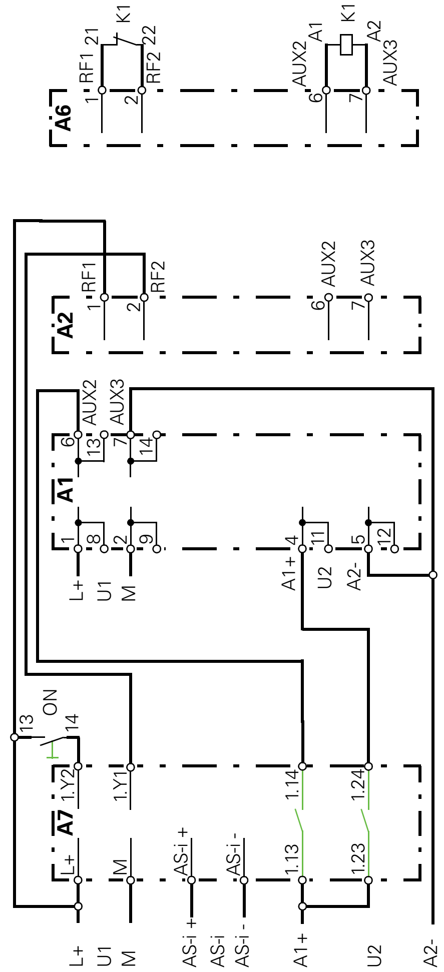


Figure 11-21: ET 200S safety-integrated system with AS-i Safety at work

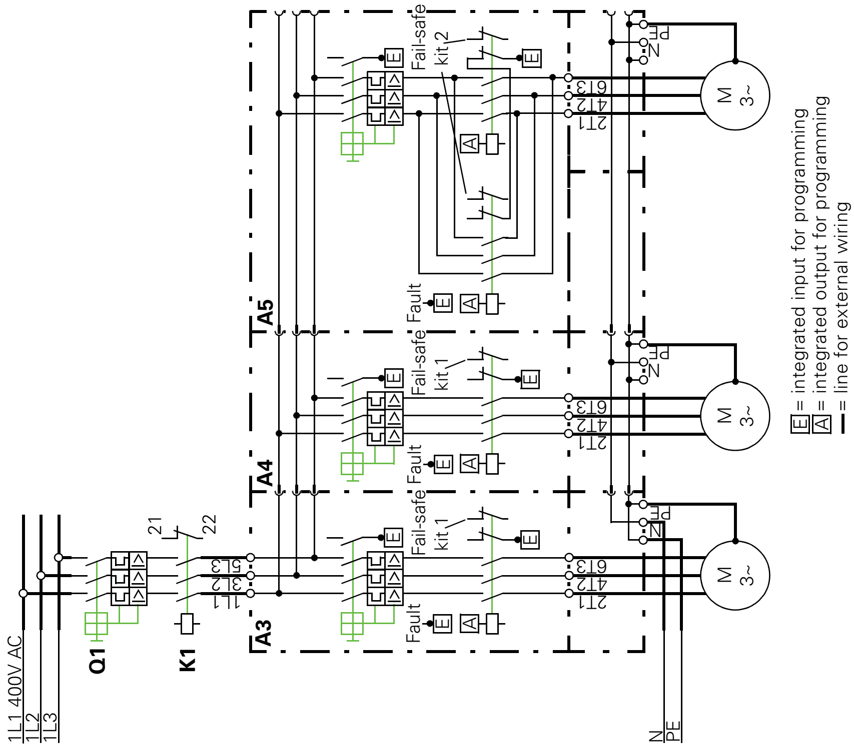


Figure 11-21: (Cont.) ET 200S safety-integrated system with AS-i Safety at work

This configuration shows how ET 200S components are incorporated into the AS-i Safety at work concept. This circuit satisfies the requirements up to PL e and employs an AS-i Safety Monitor.

It combines the advantages of AS-i Safety at work on the sensor side with the advantages of the ET 200S safety-integrated system on the actuator side in a way that makes best use of both.

Important
Observe the current carrying capacity of the AS-i Safety Monitor 3RK1105!

Expansion modules

12

12.1 Overview of expansion modules

Expansion modules can be operated only in conjunction with direct, reversing or soft starters of the following types:

- DS-x1
- DS1e-x
- F-DS1e-x
- DSS1e-x
- RS-x1
- RS1e-x
- F-RS1e-x

The table below lists the expansion modules currently available, complete with their functions:

Description		Function
Brake control modules	xB1	for 24 VDC/4 A brake (externally powered)
	xB2	for 500 VDC/0.7 A brake (internally powered)
	xB5	for brake AC 400 V/0.5 A
	xB3	for brake DC 24 V/4 A (externally supplied) also with 2 inputs [1)] (non-retentive[2)] / retentive[3)]) with diagnostics
	xB4	for brake DC 500 V/0.7 A (internally supplied) also with 2 inputs [1)] (non-retentive[2)] / retentive[3)]) with diagnostics
	xB6	for brake AC 400 V/0.5 A also with 2 inputs [1)] (non-retentive[2)] / retentive[3)])

1) Only in conjunction with DS1-x, DS1e-x, F-DS1e-x, DSS1e-x, RS1-x, RS1e-x, and F-RS1e-x
2) up to order number suffix: -.AA**4**
3) from order number suffix: -.A**B**4

Table 12-1: Overview of expansion modules

12.2 Terminal modules TM-xB15 S24-01 and TM-xB215 S24-01

12.2.1 Assignment of the terminal modules

The terminal modules are necessary for the wiring of the brake control modules xB1 to 6.

The following table shows which brake control modules you can use with the various terminal modules.

You can find information on the terminal modules in the following sections:

- Section 6 for the PM-D power module and all motor starters
- Safety-integrated systems in Section 11
- Fail-safe modules in Section 13

Expansion modules	**Terminal modules**	
	TM-xB15 S24-01	TM-xB215 S24-01
3RK1903	-0AG00	-0AG01
Brake control module xB1	X	
Brake control module xB2	X	
Brake control module xB3		X
Brake control module xB4		X
Brake control module xB5	X	
Brake control module xB6		X

Table 12-2: Assignment of the terminal modules for expansion modules

12.3 Brake control modules

12.3.1 Description

The brake control modules (xB1 to xB6) control the integrated DC spring-loaded brake of a three-phase motor. The brake is actuated by a solenoid which holds the brake in the off position when energized. When the circuit is deenergized the solenoid drops out and the brake is applied by spring force, blocking the motor.

Another possible application is the integration of external actuators such as DC valves. This applies particularly when the actuators are functionally dependent on the motor.

The brake control module installs on the right beside the motor starter in question. The terminal module of the brake control module connects the brake control module to the motor starter.

The brake control module is an add-on component for ET 200S motor starters (MS) with an expansion interface (DS1-x, DS1e-x, F-DS1e-x, DSS1e-x, RS1-x, RS1e-x, and F-RS1e-x).

Note
The brake control modules can be used only with ET 200S motor starters with an expansion interface (**DS1-x, DS1e-x, F-DS1e-x, DSS1e-x, RS1-x, RS1e-x, and F-RS1e-x**).

Caution
The DSS1e-x direct soft starter; high feature may **not** be used for internally powered brakes (xB2, xB4). Brakes xB5 and xB6 must only be used if the 400 V AC power supply is provided separately. (see Section 12.3.7)

Safety note
The brake control modules (xB1 to xB6) can only be used in conjunction with F-DS1e-x and F-RS1e-x depending on the performance level (see Section 8.3 and 9.3).

Caution
For xB3, xB4, xB6:
When connecting the U1 electronic power supply which supplies the brake, a high signal from the brake inputs may be present on an active header group for approx. 5 ms.

Modules and components

The brake control consists of the following modules:

- TM-xB15 S24-01 terminal module for xB1, xB2, xB5
- TM-xB215 S24-01 terminal module for xB3, xB4, xB6
- Brake control module (xB1 to xB6)

The components of the brake control module are illustrated below.

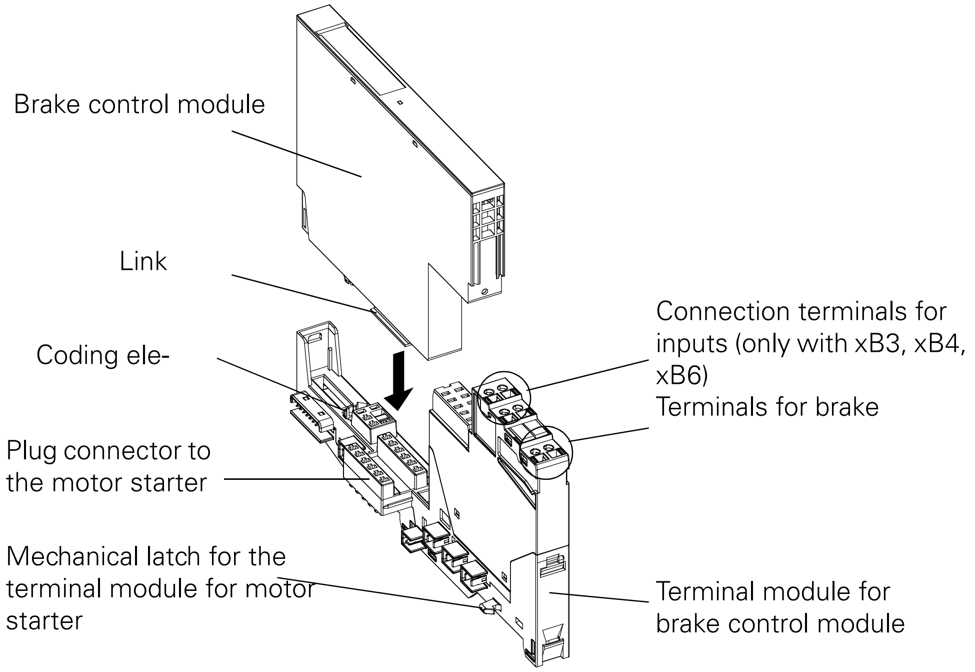


Figure 12-1: Brake control

Electronic switch

The brake control module has a single-pole electronic switch for driving a DC/AC[1] spring-loaded brake integrated into an electric motor.

Drive

The brake control module is driven via the ET 200S bus and its motor starter. The output (DO 0.2) required for driving the brake comes from the motor starter.

Important
If a brake is not driven via output DO 0.2 of the motor starter, the motor starts up with the brake applied and the circuit breaker/thermal motor model can be tripped.

Latch for mechanical locking

The brake control module is accommodated in a housing 15 mm wide. The link on the left-hand side of the brake control module (see Figure 12-1) ensures that the brake control module can be plugged in or pulled only when its motor starter has been pulled. This excludes the possibility of hot removal or insertion.

Coding

There is a coding element on the housing of the brake control module. This is a mechanical means of differentiating between different modules.

[1] Depending on the motor and the brake module

Indicators

The brake control module comprises

- A red LED for SF, group error (xB3, xB4, xB6),
- Two green LEDs as indicators for inputs 1 and 2 (xB3, xB4, xB6)
  Input 1, terminals 1 and 2, limit switch for clockwise rotation,
  Input 2, terminals 5 and 6, limit switch for counterclockwise rotation,
- A yellow LED which indicates the status for output DO 0.2 of the motor starter.
  The LED is on when output DO 0.2 of the motor signal is carrying a 1 signal. This means the electronic switch is closed and the brake is released.

For the diagnostics of xB3 and xB4, see Section 4.8.12.

Note
For xB1, xB2:
A response of the overload or short-circuit protection is not indicated if the instantaneous signal state of the LED for output DO 0.2 is not changed as a result.

For xB3, xB4:
The signal state of the inputs is indicated, and a response of the overload or short-circuit protection is also indicated.

Caution
For xB3, xB4, xB6:
When connecting the U1 electronic power supply which supplies the brake, a high signal from the brake inputs may be present on an active header group for approx. 5 ms.

View

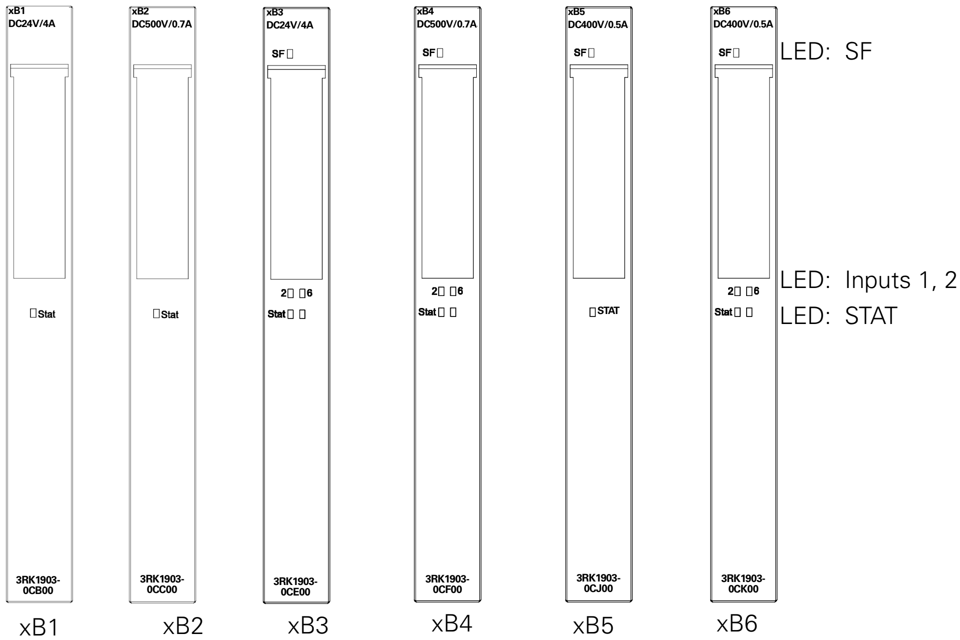


Figure 12-2: Brake control modules xB1 to 6

Common and distinguishing features of the brake control modules

Features	xB 1	2	3	4	5	6
For externally powered mechanical DC spring-loaded brake	X		X			
For mechanical AC spring-loaded brake					X	X
For 24 VDC/4 A	X		X			
Supply from a separate 24 VDC auxiliary voltage	X		X			
Brake can be released when the motor is switched off (so that the motor can be turned by hand)	X		X			
For internally powered mechanical DC spring-loaded brake. [1)]		X		X		
For 500 VDC/0.7 A		X		X		
for AC 400 V/0.5 A					X	X
Supply from a rectified voltage tapped from the electric motor		X		X		
Once the motor has been switched off, the brake can no longer be released		X		X		
Configurable			X	X		X
Parameterizable			X	X		X
Diagnostics capability			X	X		
2 inputs (functional scope depends on the associated motor starter)			X	X		X
Circuit status of the inputs shown by LEDs			X	X		X
Circuit status of the inputs can be analyzed by PLC			X	X		X
Diagnosis overload			X	X		

1) Brake control modules xB2 and xB4 can also be used with an external rectifier (in the control cabinet) for an externally powered mechanical DC spring-loaded brake.

Table 12-3: Features of the brake control modules

Parameters

The following table indicates the parameters that can be set for the xB3 and xB4 brake control modules.

Parameters	Action, value range	Factory setting	Applicability
Diagnostics of brake overload	• Disable • Enable	Disable	Module

Table 12-4: Parameters for brake control modules xB3, xB4

Group diagnosis:
This parameter enables diagnosis messaging
(error types are listed in Section 4.7).

Note
The "Disable group diagnosis" parameter also suppresses the display of faults on the SF-LED.

Note
The xB1 and xB2 modules are purely passive from the point of view of the IM 151 and require no parameterization.

Parameterization of the inputs for xB3, xB4, xB6

(Only applies if high feature/failsafe motor starters are used).

The inputs of the xB3, xB4, xB6 and expansion modules can be parameterized independently of each other for various actions via their respective motor starters. Parameterization is described in:

- 8.3.4 for direct starter; high feature/failsafe
- 8.4.5 for direct soft starter; high feature
- 9.3.4 for reversing starter; high feature/failsafe

Configuration with brake control module

Caution
See information on derating in Section 3.4.

The diagram below shows the layout of motor starters and brake control modules with the layout of a DM-V15 spacer module (only with standard motor starters with 45/90 mm installation width):

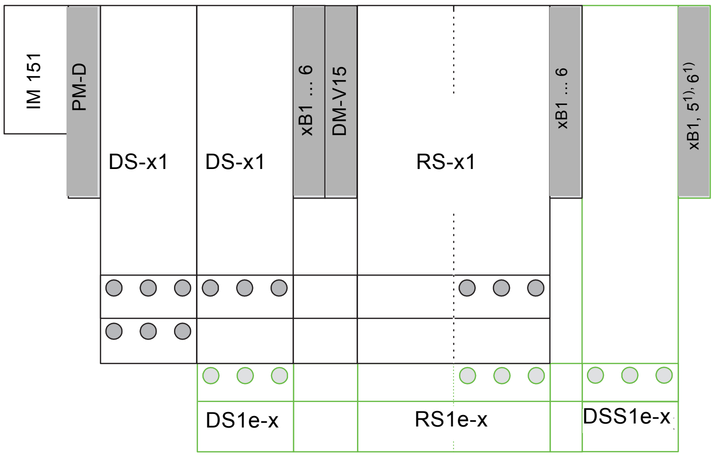


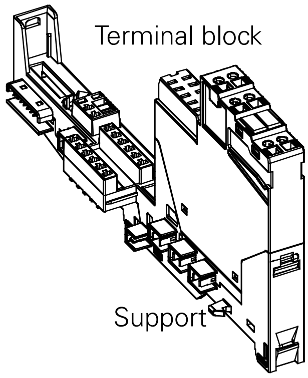
Figure 12-3: Configuration with brake control module and spacing module

[1] Only in combination with a separately protected power supply of the brake

12.3.2 Terminal modules TM-xB15 S24-01 and TM-xB215 S24-01

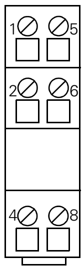
Features

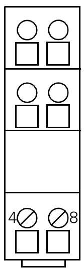
- The terminal module consists of a support and a terminal block.
- Terminal module TM-xB15 S24-01 for xB1, xB2 or xB5 brake control module
- Terminal module TM-xB215 S24-01 for xB3, xB4 or xB6 brake control module
- Connection by screw-type terminal
- AUX1 cable fed through without terminals

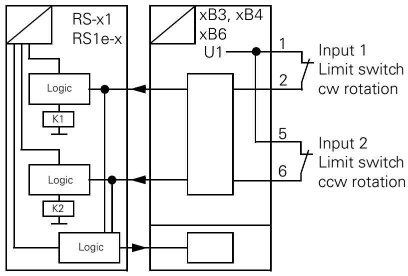
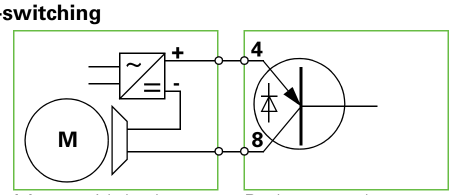


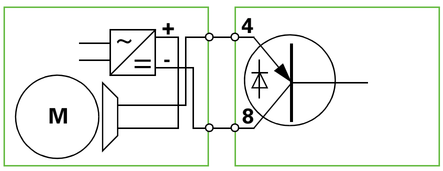
Terminal assignment

The following table illustrates the terminal assignment of the TM-xB15 S24-01 and TM-xB215 S24-01 terminal modules:

<table>
<tr><th>View</th><th>Terminal</th><th>Description</th><th>Basic circuit diagram</th></tr>
<tr><td rowspan="2">

TM-xB215 S24-01


TM-xB15 S24-01</td><td>1
2
3
5
6
7</td><td>Input 1 L+
Input 1
Not used
Input 2 L+
Input 2
Not used</td><td>TM-xB215 S24-01 only

</td></tr>
<tr><td>4
8</td><td colspan="2">Wiring options
P-switching


Motor with brake Brake control
M-switching


Motor with brake Brake control</td></tr>
</table>

Table 12-5: Terminal assignment of the TM-xB15 S24-01, TM-xB215 S24-01 terminal module

Technical specifications - TM-xB15 S24-01, TM-xB215 S24-01

Dimensions and weight	
Installation dimensions W x H x D (mm)	15 x 196.5 x 95
Depth with brake control module (mm)	117.5
Weight (g)	approx. 120
Rated currents	
Inputs (terminals 1 and 2, 5, and 6) - TM-xB215 S24-01 only	
Brake control (terminals 4 and 8)	
Conductor cross-sections	
Single-core (mm^2)	1 x (0.14 to 2.5) to IEC 60947 1 x 2.5
Finely stranded with wire end ferrule (mm^2)	1 x (0.14 to 1.5) to IEC 60947
AWG cables, single- or multi-core	1 x (18 to 22)
Wiring	
Tool required	Standard screwdriver, size 1
Tightening torque (Nm)	0.4 to 0.7

Table 12-6: Technical specifications - TM-xB15 S24-01, TM-xB215 S24-01

12.3.3 Signal response of xB3, xB4, xB6 brake control module and DS1-x, DS1e-x, and F-DS1e-x motor starters

The diagram below illustrates the dependencies between the individual signals

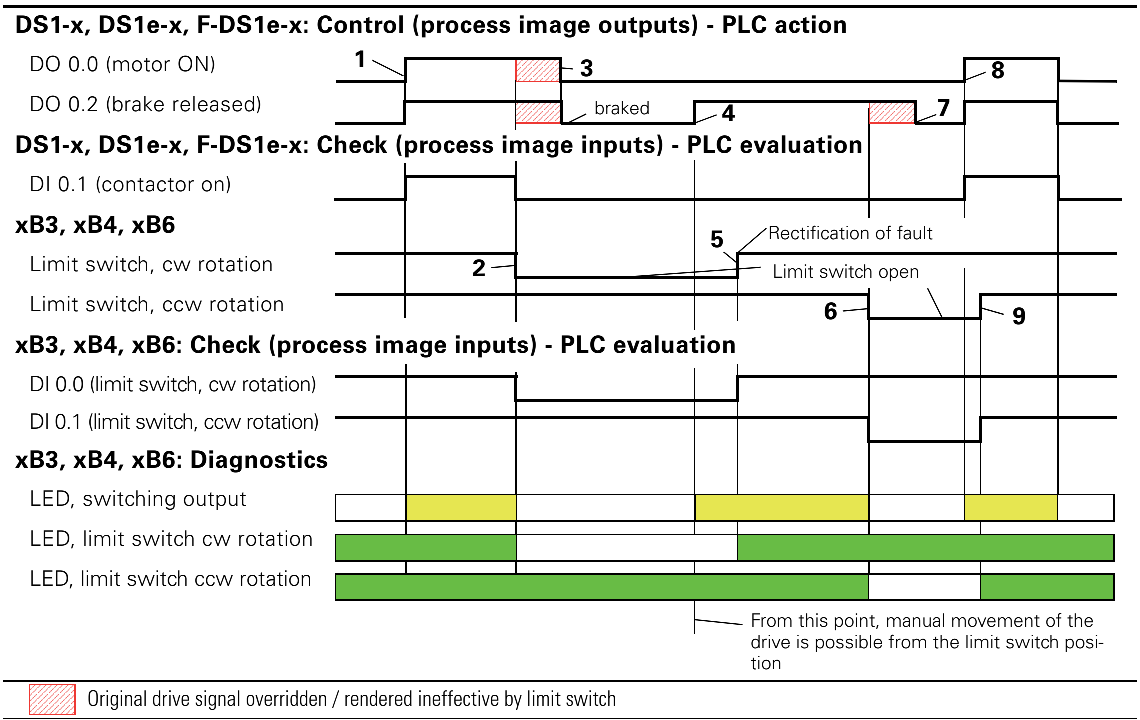


Table 12-7: Signal response of xB3 and xB4 brake control modules and DS1-x, DS1e-x, and F-DS1e-x motor starters

Explanation of the individual actions

1	Brake is released (DO 0.2) and motor (DO 0.0) is switched on by the application program in the PLC. PLC's switch-on command is drive signal for the contactor (DO 0.0). Command to release the brake effects drive of brake enabling signal (DO 0.2).
2	Limit position is passed, so the limit switch for clockwise rotation opens (occurrence of fault). When the limit switch opens the direct (no PLC intervention) result is discontinuation of the contactor drive signal and cancellation of brake enabling signal. The PLC's driver signals for the currently active contactor and the brake enabling signal become ineffective (overridden by limit switch). The motor contactor and the brake driver signal of the DS1-x are switched off.
3	The application program in the PLC cancels the switch-on command (DO 0.0) and optionally the brake enabling signal (DO 0.2).
4	Release the brake (DO 0.2) with the user program in the PLC. **It is only possible to withdraw from the limit switch by hand with externally supplied brakes.**
5	Rectification of fault. Limit switch closes.
6	Limit switch for counterclockwise rotation is overshot. Brake enabling signal is canceled.
7	PLC cancels brake enabling signal
8	See step 1
9	The limit switch for counterclockwise rotation recloses.

12.3.4 Signal response of the xB3, xB4, xB6 brake control module and RS1-x, RS1e-x, F-RS1e-x motor starters

The diagram below illustrates the dependencies between the individual signals

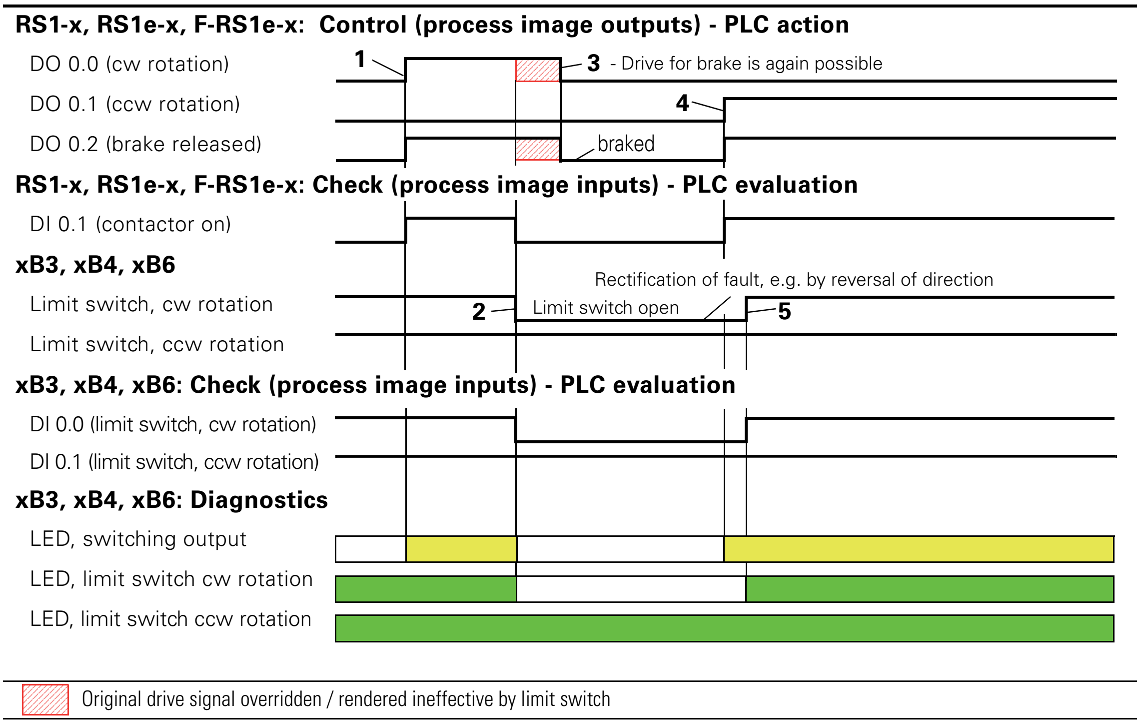


Table 12-8: Signal response of xB3 and xB4 brake control modules and RS1-x, RS1e-x, and F-RS1e-x motor starters

Explanation of the individual actions

1	The brake (DO 0.2) is released and the motor is activated (DO 0.0: clockwise rotation) by the user program of the PLC. PLC's switch-on command is drive signal for the contactor (DO 0.0). Command to release the brake effects drive of brake enabling signal (DO 0.2).
2	Limit position is passed, so the limit switch for clockwise rotation opens (occurrence of fault). When the limit switch opens the direct (no PLC intervention) result is discontinuation of the contactor drive signal. The PLC's driver signal for the currently active contactor becomes ineffective (overridden by limit switch). The motor contactor (DO 0.0: clockwise rotation) of the RS1-x is deactivated.
3	The application program in the PLC cancels the switch-on command (DO 0.0) and optionally the brake enabling signal (DO 0.2).
4	The brake (DO 0.2) is released and the direction of rotation is changed due to the activation of the motor (DO 0.1: counterclockwise rotation) by the user program of the PLC.
5	The limit switch for clockwise rotation recloses.

12.3.5 Externally powered brake xB1, xB3

For the actuation of an externally powered brake, the **xB1** or **xB3** brake control module is required.

Features of externally powered brake:

- Brake is released when voltage is applied.
- Brake can be released when the motor is switched off (so that the motor can be turned by hand).
- The brake control module is a single-pole breaker in the brake's circuit.
- External 24 VDC supply required.
- Maximum switching current is 4 A.

Circuit diagram

The figure below shows, by way of example, the circuit diagram of an externally powered DC spring-loaded brake (P-switching) with motor starter (DS1-x, DS1e-x, F-DS1e-x, DSS1e-x, RS1-x, RS1e-x, and F-RS1e-x) and brake control module (xB1, xB3).

Circuit diagram

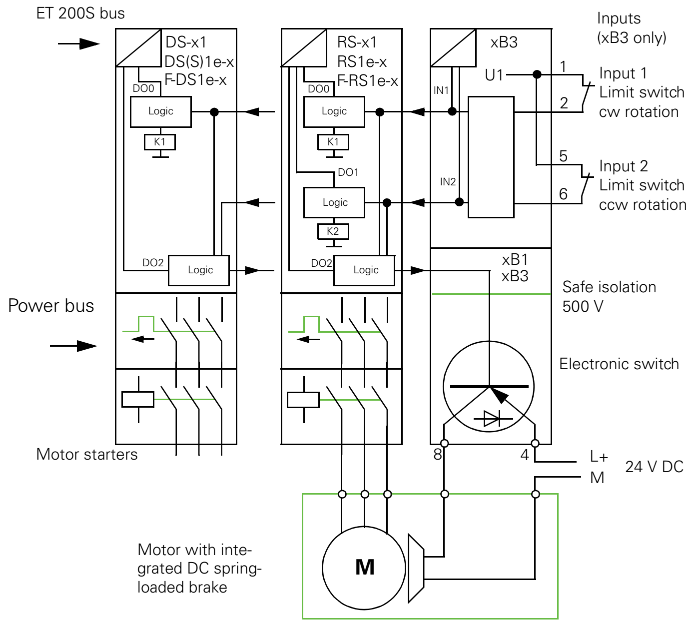


Figure 12-4: Sketched circuit diagram of externally powered brake

Technical specifications for xB1 and xB3

Module-specific data			
Ambient temperature	operation storage	0 to 60 °C -40 to 80 °C	
Degree of protection		IP20, IEC 60529	
Inputs (terminals 2 and 6) - xB3 only (non-retentive)			
Input characteristic curve to IEC 1131		Type 1	
Low input current	I_{in}	<1.5 mA	
High input current	I_{in}	>5 mA	
Max. input current		max. 8 to 10 mA	
Input delay (underline default value)	t_{in}	0.1 / 0.5 / <u>3</u> / 15 ms	
Sensor supply (terminals 1 and 5) short-circuit-proof and overload proof			
Operating voltage range (referenced to U_1-)		20.4 to 28.8 VDC	
Current limitation in the event of a short-circuit to U_1-		approx. 1 A	
Isolation			
Between drive and brake circuit Surge withstand capability		500 V AC 8 kV	
Switching element of the brake control module (terminals 4 and 8)			
Rated operating voltage		24 VDC	
Peak voltage (periodic)		<35 VDC	
Continuous current [1)] Switch-on current Switch-off current DC 13, at 24 V (with ext. induction protection) Off-state current	 at t <120 ms	≤4 A ≤8 A ≤4 A <10 mA	
Voltage drop	at I_{load} <4 A	<0.3 V	
Permissible power of brake at 24 V		≤95 W	
Indication by LED (yellow) - Motor braked - Motor unbraked	 Brake active Brake released	 LED off (switch open) LED on (switch closed)	 DO 0.2 = 0 DO 0.2 = 1
Error message if brake not driven		no	

Table 12-9: Technical specifications, brake control module xB1, xB3

Protective measures		
Overload protection 2) Short-circuit protection 2) (according to EN 60947-5-1 with 24 V/ 1 kA)		Integrated current limitation yes
Reverse polarity protection 3)		no
Induction protection	Internal	Protective diode
External protection circuit for inductive load 4)	≤ 40 W > 40 W	Recommended Required
In case of a single high-energy pulse (surge) at the digital inputs according to IEC 61000-4-5, lightning protection elements (e.g. those manufactured by Dehn: DCO RK D 5 24 order number: 919986) are recommended (see the DP master manual and the description of the SIMATIC NET PROFIBUS networks).		

1) Note information on derating in Section 3.4 for installation
2) Electronic shutdown (cannot be reactivated until output DO 0.2 of the motor starter has been switched off)
3) If polarity is reversed current flows (via protective diode parallel to switching element), the brake is released and overload and short-circuit protection have no effect.
4) Circuit with RC element, protective diode or varistor

Table 12-9: Technical specifications, brake control module xB1, xB3 (Contd.)

12.3.6 Internally powered brake xB2 and xB4

For the actuation of an internally powered brake, the **xB2** or **xB4** brake control module is required.

The brake control module is for electric motors connecting to three-phase supplies with a rated voltage of 230/400 V to max. 290/500 V.

Features of internally powered brake:

- Brake is released when voltage is applied.
- Once the motor has been switched off, the brake can no longer be released.
- The brake control module is a single-pole breaker in the brake's circuit.
- The brake receives a rectified supply tapped from the motor's terminal board.
- Maximum switching current is 0.7 A.

Warning
The brake control module does **not** isolate the brake circuit from the power supply.

For a motor starter with low setting range, the additional asymmetrical loads on the overcurrent tripping system caused by the brake must also be taken into account.

Soft starters may **not** be used in connection with internally powered brakes.

Circuit diagram

The diagram below shows an internally powered DC spring-loaded brake with motor starter (DS1-x, DS1e-x, F-DS1e-x, RS1-x, RS1e-x, and F-RS1e-x) and brake control module (xB2, xB4).

Circuit diagram

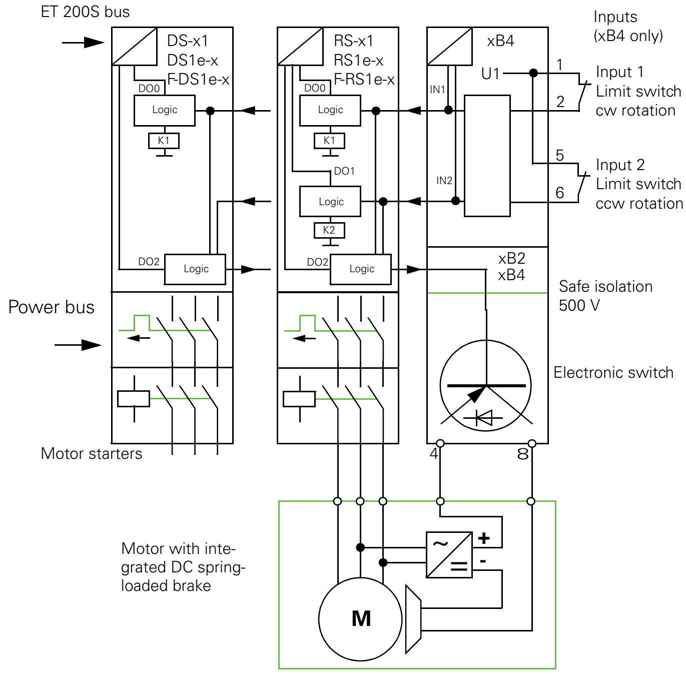


Figure 12-5: Sketched circuit diagram of internally powered brake

Technical specifications for xB2 and xB4

Module-specific data			
Ambient temperature	operation storage	0 to 60 °C -40 to 80 °C	
Degree of protection		IP20, IEC 60529	
Inputs (terminals 2 and 6) - xB4 only (non-retentive)			
Input characteristic curve to IEC 1131		Type 1	
Low input current	I_{in}	<1.5 mA	
High input current	I_{in}	>5 mA	
Max. input current		max. 8 to 10 mA	
Input delay (underline default value)	t_{in}	0.1 / 0.5 / <u>3</u> / 15 ms	
Sensor supply (terminals 1 and 5) short-circuit-proof and overload proof			
Operating voltage range (referenced to U_1-)		20.4 to 28.8 VDC	
Current limitation in the event of a short-circuit to U_1-		approx. 1 A	
Isolation			
Between drive and brake circuit Surge withstand capability		500 V AC 8 kV	
Switching element of the brake control module (terminals 4 - 8)			
Rated operating voltage		500 VDC	
Peak voltage (periodic)		<710 V_s	
Continuous current [1)] Switch-on currentat t <120 ms Switch-off current DC 13, at 220 V_{eff} [2)] (with ext. induction protection) Residual current		≤0.7 A ≤5 A ≤0.7 A <1 mA	
Voltage drop	at I_{load} <0.7 A	<1.4 V	
Approved brakes (examples) with half-wave rectification for 230 V AC equals 100 V_{eff}, T <40 °C 400 V AC equals 170 V_{eff} 500 V AC equals 220 V_{eff}		 ≤70 W ≤100 W ≤135 W	
Indication by LED (yellow) - Motor braked - Motor unbraked	 Brake active Brake released	 LED off (switch open) LED on (switch closed)	 DO 0.2 = 0 DO 0.2 = 1
Error message if brake not driven		no	

Table 12-10: Technical specifications, brake control module xB2, xB4

Protective measures		
Overload protection [3] Short-circuit protection [3] (according to EN 60947-5-1 with 230 V/1 kA)		Integrated current limitation yes
Reverse polarity protection [4]		no
Induction protection	Internal	Varistor
External protection circuit for inductive load [5]	≤ 40 W > 40 W	Recommended Required
In case of a single high-energy pulse (surge) at the digital inputs according to IEC 61000-4-5, lightning protection elements (e.g. those manufactured by Dehn: DCO RK D 5 24 order number: 919986) are recommended (see the DP master manual and the description of the SIMATIC NET PROFIBUS networks).		

1) Note information on derating in Section 3.4 for installation
2) Half-wave rectification for a 500 V AC supply
3) Electronic shutdown (cannot be reactivated until output DO 0.2 of the motor starter has been switched off)
4) Module maps short-circuit without current limitation, the brake is released and overload and short-circuit protection have no effect.
5) Circuit with RC element or protective diode at the brake coil or varistor at brake rectifier

Table 12-10: Technical specifications, brake control module xB2, xB4 (Contd.)

12.3.7 Brake xB5, xB6

For the actuation of a brake, the **xB5** or **xB6** brake control module is required.

The brake control module is for electric motors connecting to three-phase supplies with a rated voltage of 230/400 V to max. V.

Features of externally powered brake:

- The brake is powered either by the outgoing motor side via two phases (internally powered) or separately[2] (externally powered) via the 400 V AC power supply.
- Brake is released when voltage is applied.
- With an externally powered brake, this can also be triggered if the motor is switched off (for moving the motor by hand) [1].
- The brake control module is a single-pole breaker in the brake's circuit.
- Maximum switching current is 0.5 A.

Warning
The brake control module does **not** isolate the brake circuit from the power supply.

For a separate brake supply system, care should be taken to protect the cable and device/motor brake appropriately using a fuse.

For a motor starter with low setting range, the additional asymmetrical loads on the overcurrent tripping system caused by the brake (for internally powered brakes) must also be taken into account.

Soft starters may **not** be used in connection with internally powered brakes.

---

[1] Assuming there is a separate [2] power supply to the brake

[2] Line protection and a device contactor must be fitted accordingly.

Circuit diagram

Figure 12-6 shows the circuit diagram for an spring-loaded brake with motor starter internally powered via the motor output (DS1-x, DS1e-x, F-DS1e-x, RS1-x, RS1e-x, F-RS1e-x) and brake control module (xB5, xB6). In Figure 12-7, this brake is powered separately (external power supply.

Circuit diagram

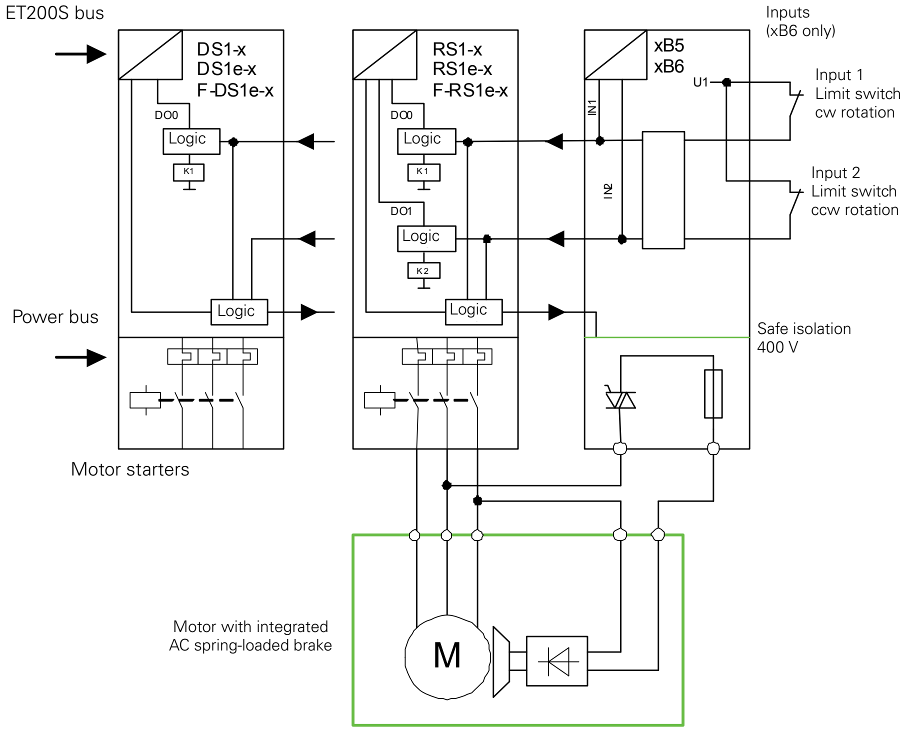


Figure 12-6: Circuit diagram for brake powered internally via the motor output

Circuit diagram

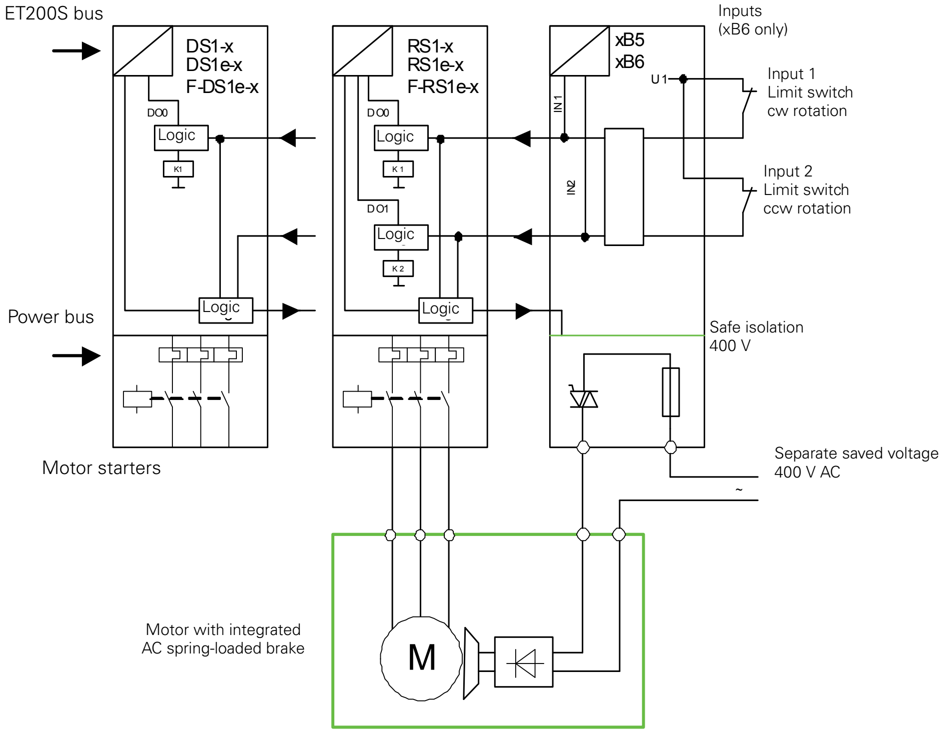


Figure 12-7: Circuit diagram for brake powered via separate external supply

Technical specifications for xB5, xB6

Module-specific data		
Ambient temperature	operation storage	0 to 60 °C -40 to 80 °C
Degree of protection		IP20, IEC 60529
Inputs (terminals 2 and 6) - xB6 only		
Input characteristic curve to IEC 1131		Type 1
Low input current		I_{in} <1.5 mA
High input current		I_{in} >5 mA
Max. input current		max. 8 to 10 mA
Input delay (underline default value)		t_{in} 0.1 / 0.5 / <u>3</u> / 15 ms
Sensor supply (terminals 1 and 5) short-circuit-proof and overload proof		
Operating voltage range (referenced to U_1-)		20.4 to 28.8 VDC
Current limitation in the event of a short-circuit to U_1-		approx. 1 A
Isolation		
Between drive and brake circuit Surge withstand capability		400 V AC 4 kV
Switching element of the brake control module (terminals 4 - 8)		
Brake design		400 V AC
Rated operating voltage		400 V AC
Continuous current		≤ 0.5 A
Voltage drop with continuous current		7 V
Switch-on current with t < 120 ms		< 5 A
Switching capacity according to IEC60947-5-1 - AC 15, at 400 V AC		0.4 A
Signaling via LED (yellow)		
Motor braked, brake active		LED off (switch open) DO 0.2 = 0
Motor unbraked, brake tripped		LED on (switch closed) DO 0.2 = 1
Error message if brake not driven		no

Table 12-11: Technical specifications for xB5, xB6 brake control module

Protective measures		
Shortcircuit protection, yes		1 A slow-blow fuse
Surge suppression		integrated varistors
External protection circuit		
for inductive load [1]	≤ 40 W > 40 W	Recommended Required
In case of a single high-energy pulse (surge) at the digital inputs according to IEC 61000-4-5, lightning protection elements (e.g. those manufactured by Dehn: DCO RK D 5 24 order number: 919986) are recommended (see the DP master manual and the description of the SIMATIC NET PROFIBUS networks).		
1) Circuit with RC element or protective diode at the brake coil or varistor at brake rectifier		

Table 12-11: Technical specifications for xB5, xB6 brake control module (Contd.)

12.3.8 Installation

Installing terminal module for brake control module

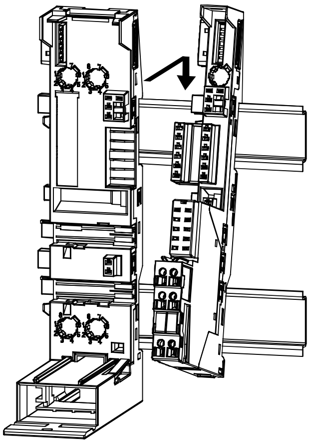
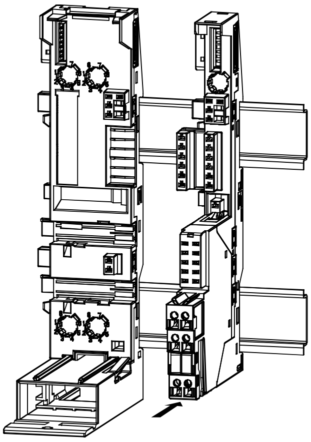
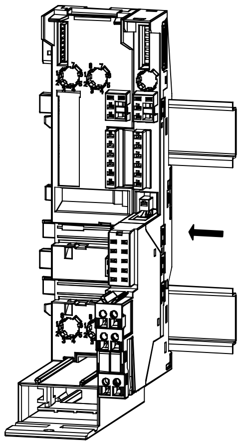
Drawing	Procedure
	**1** Hang the terminal module on the upper rail.
	**2** Tilt the terminal module backwards into the lower rail until you hear it engage.
	**3** Push the terminal to the left with both hands towards the module you have already installed, keeping it straight, until you can hear it engage with the adjacent module.

Table 12-12: Installing terminal module for brake control module

Connecting the brake control module

Requirement

The terminal module for the brake module must be installed.

Mechanical coding

When the brake control modules are plugged in, the terminal modules are mechanically coded to ensure that, in the event of a fault, they can only be replaced by brake control modules with identical functions.

You must therefore bear the configured layout in mind when you insert the modules.

If necessary, code elements can be removed from the terminal module using a 3 mm screwdriver.

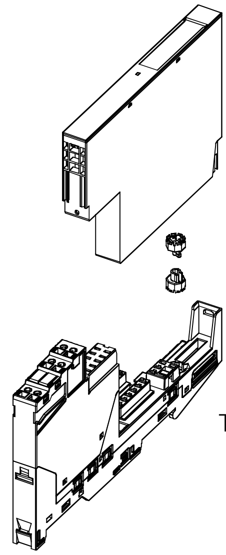


Figure 12-8: Mechanical coding of terminal modules

Note
If a brand-new brake control module is plugged into a terminal module that is already coded, the part of the code element for the terminal module must be removed from the brake control module beforehand.

Connecting the brake control module

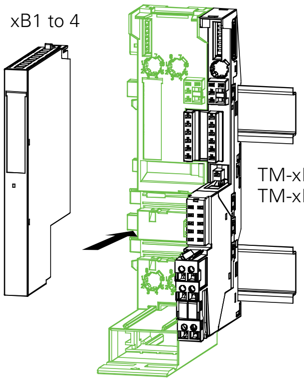
Drawing	Procedure
	**4** Insert the brake control module onto the installed and prewired terminal module as shown in the drawing. Brake control modules can only be connected to the correct terminal modules regardless of the code element.

Table 12-13: Connecting the brake control module

Connecting the motor starter

Requirement

The brake control module (xB1 to 4) has to be connected before the motor starter (DS1-x, F-DS1e-x, DSS1e-x, RS1-x, and F-RS1e-x) is connected.

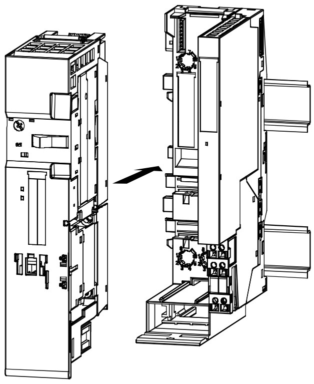
Drawing	Procedure
	**5** Insert the motor starter onto the installed and prewired terminal module as shown in the drawing. For the procedure, see Section 3.7.

Table 12-14: Connecting the motor starter

12.3.9 Removing the brake control module

The brake control module can be removed only when its motor starter has been removed.

For the removal of the motor starters, see Section 3.7.

Fail-safe modules

13

13.1 General description

Safety note
Fail-safe modules **cannot** be used in conjunction with the safety-integrated system.

Fail-safe means: the F-DS1e-x, F-RS1e-x, and F-CM interrupt the main conducting path/enabling circuits if an emergency stop is requested via the mechanically selected SG bus. A device error is detected and the safe state is established.

ET 200S Motor Starter Safety - Local Solution

The ET 200S Motor Starter Safety - Local Solution is preferably used for locally limited safety applications from the viewpoint of the safety-integrated system.
The ET 200S Motor Starter Safety - Local Solution always consists of PM-D F1 through 5 power modules, the standard or high feature motor starters, and a PM-X connection module.
For the configuration of this safety solution, the PM-D F1 through 5 power modules are used. These modules monitor the U1 (PWR) and U2 (CON) voltages (U2 not in the case of PM-D F5). They contain the complete function of a safety relay. The power module conducts the voltages for the electronic supply via the terminal modules to the motor starters of a potential group.
The standard or high feature motor starter can be used to configure a safety solution of this kind to SIL3 in accordance with IEC 62061 / PL e in accordance with DIN EN ISO 13849-1.
Every standard motor starter must be equipped with a fail-safe kit (F-kit) for monitoring the switching status. In the case of the high feature motor starter, the fail-safe kit has already been integrated.

Fail-Safe Motor Starters

The fail-safe motor starters (TÜV-certified, self-monitored, and with internally redundant deactivation) are always used in conjunction with a fail-safe power/expansion module PM-D F X1/power module PM-D F PROFIsafe. In contrast to the power modules of the ET 200S Motor Starter Safety - Local Solution, these power modules actuate the SG1 through 6 safety groups.
The fail-safe motor starters evaluate the SG1 through 6 safety groups located in the terminal modules.
While the PM-D F X1 is switched using external safety switchgear (AS-i Safety Monitor or the 3TK28 safety switchgear), the PM-D F PROFIsafe is switched using a parent fail-safe control system (F-PLC).

13.1.1 Overview

The table below lists the fail-safe modules currently available together with the corresponding functions:

Description		Function
Power/expansion module	PM-D F X1	... supplies external safety devices ... loops the 6 SG buses and U_1 and M through
contact replicator	F-CM	... used in conjunction with a fail-safe power module PM-D F PROFIsafe or PM-D F X1 ... makes 4 floating relay contacts available
Power module	PM-D F PROFIsafe	See the "*ET 200S Distributed I/O Device for Fail-Safe Modules*" manual
Fail-safe direct starters	F-DS1e-x	see Section 8.3.
Fail-safe reversing starters	F-RS1e-x	see Section 9.3.

Table 13-1: Overview of the fail-safe modules

13.2 Terminal modules TM-PFX30 S47 and TM-FCM30-S47

13.2.1 Assignment of the terminal modules

Terminal modules are required for wiring the PM-D F X1 fail-safe power/expansion module and the F-CM contact replicator.

The following table shows which fail-safe modules you can use with the various terminal modules.

You can find information on the terminal modules in the following sections:

- Section 6 for the PM-D power module and all motor starters
- Safety-integrated systems in Section 11
- Expansion modules such as the brake control module, in Section 12.

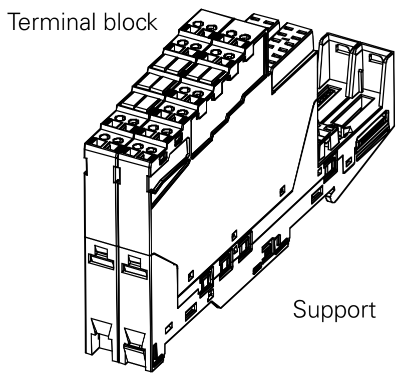
<table>
<tr><th rowspan="3">Fail-safe modules</th><th colspan="2">Terminal modules</th></tr>
<tr><td>TM-PFX30 S47-G1</td><td rowspan="2">TM-FCM30 S47</td></tr>
<tr><td>TM-PFX30 S47-G0</td></tr>
<tr><td>3RK1903</td><td>-3AE00
-3AE10</td><td>-3AB10</td></tr>
<tr><td>PM-D F X1 power/expansion module</td><td>X</td><td></td></tr>
<tr><td>F-CM contact replicator</td><td></td><td>X</td></tr>
</table>

Table 13-2: Assignment of the terminal modules for fail-safe modules

13.2.2 TM-PFX30 S47 terminal modules for PM-D F X1 power/expansion module

Features

- The terminal modules consist of a support and a terminal block.
- TM-PFX30 S47-**G0** terminal module with infeed from the left to forward U_1 and M as well as SG1 to SG6.
- TM-PFX30 S47-**G1** terminal module without infeed from the left in order to start a new group.
- Connection by screw-type terminal.
- Prewiring of the terminal module.
- AUX1 cable fed through without terminals.
- The fail-safe modules are identified by yellow labeling strips.



Color coding labels

1. You can apply the color coding labels in the opening provided next to the terminal directly from the strip.
2. Push the color coding labels onto the terminal module with your finger.

Looping the potentials through

Terminals 1/8, 2/9, 6/13, 7/14, 15/22, 16/23, 18/25, 19/26, 20/27, and 21/28 are bridged in the terminal module and can be used to loop the potentials through.

Terminal assignment

The following table illustrates the terminal assignment of the TM-PFX30 S47-**G0/G1** terminal modules:

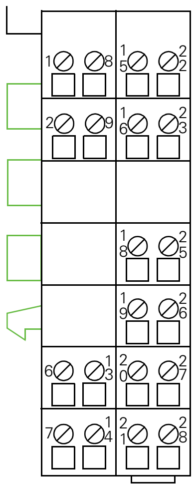
Terminal	Meaning		View	Terminal	Meaning	
1/8	+ IN/OUT	**U_1:** Fused 24 VDC limited to SIMATIC range		**15/22**	SG1	
2/9	M IN/OUT			**16/23**	SG2	
3/10	—	Not used		**17/24**	—	Not used
4/11	—	Not used		**18/25**	SG3	
5/12	—	Not used		**19/26**	SG4	
6/13	L+	**U_{in}:** For connecting an external power supply unit 24 VDC SELV/PELV		**20/27**	SG5	
7/14	M			**21/28**	SG6	
—	AUX1	Fed through without terminals				

Table 13-3: Terminal assignment of the TM-PFX30 S47-G0/G1 terminal modules for the PM-D F X1 power module

Technical specifications - TM-PFX30 S47

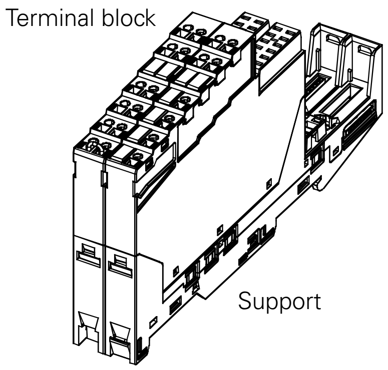
Dimensions and weight	
Installation dimensions W x H x D (mm)	30 x 196.5 x 102
Depth with power module (mm)	117.5
Weight (g)	approx. 375
Insulation voltages and rated currents	
Insulation voltage	500 V
Rated operating voltage	24 VDC
Rated operating current	10 A
Conductor cross-sections	
Single-core (mm^2)	1 x (0.14 to 2.5) to IEC 60947 1 x 2.5
Finely stranded with wire end ferrule (mm^2)	1 x (0.14 to 1.5) to IEC 60947
AWG cables, single- or multi-core	1 x (18 to 22)
Wiring	
Tool required	Standard screwdriver, size 1
Tightening torque (Nm)	0.4 to 0.7

Table 13-4: Technical specifications - TM-PFX30 S47

13.2.3 Terminal module TM-FCM30-S47 for the F-CM contact replicator

Features

- The terminal module consists of a support and a terminal block
- TM-PFX30 S47 terminal module with throughfeed for the F-CM contact replicator
- Connection by screw-type terminal
- Prewiring of the terminal module
- AUX1 cable fed through without terminals
- SG bus selection using the wire jumper provided
- The fail-safe modules are identified by yellow labeling strips.



Color coding labels

1. You can apply the color coding labels in the opening provided next to the terminal directly from the strip.
2. Push the color coding labels onto the terminal module with your finger.

Terminal assignment

The following table illustrates the terminal assignment of the TM-FCM30-S47 terminal module:

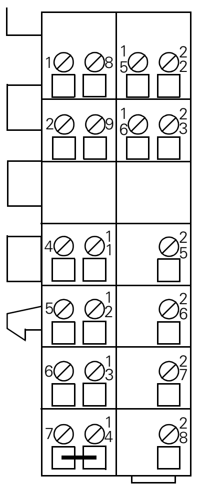
Terminal	Meaning		View	Terminal	Meaning	
1--8	SG1			**15**	OUT	1.1
2--9	SG2			**16**	OUT	1.2
3/10	—	Not used		**17-21, 24**	—	Not used
4--11	SG3			**22**	OUT	2.1
5--12	SG4			**23**	OUT	2.2
6--13	SG5			**25**	OUT	3.1
7--14	SG6	Jumped in the factory		**26**	OUT	3.2
—	AUX1	Fed through without terminals		**27**	OUT	4.1
				28	OUT	4.2

Table 13-5: Terminal assignment of the TM-FCM30-S47 terminal modules for the F-CM contact replicator

Technical specifications - TM-FCM30-S47

Dimensions and weight	
Installation dimensions W x H x D (mm)	30 x 196.5 x 102
Depth with power module (mm)	117.5
Weight (g)	approx. 375
Insulation voltages and rated currents	
Insulation voltage	500 V
Rated operating voltage	24 VDC
Rated operating current	10 A
Conductor cross-sections	
Single-core (mm^2)	1 x (0.14 to 2.5) to IEC 60947 1 x 2.5
Finely stranded with wire end ferrule (mm^2)	1 x (0.14 to 1.5) to IEC 60947
AWG cables, single- or multi-core	1 x (18 to 22)
Wiring	
Tool required	Standard screwdriver, size 1
Tightening torque (Nm)	0.4 to 0.7

Table 13-6: Technical specifications - TM-FCM30-S47

Safety note
Only one SG bus can be selected.

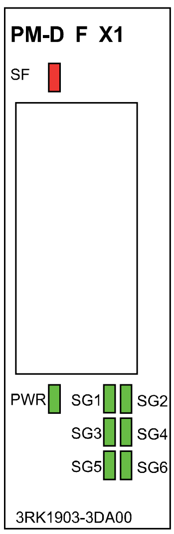
13.3 PM-D F X1 power/expansion module

Features

- A new fail-safe potential group begins with the power/expansion module together with the associated terminal module. The fail-safe motor starters/ F-CM contact replicators of a fail-safe potential group are connected to the right of the power/expansion module.
- The PM-D F X1 has redundant overvoltage protection that trips the internal fuse just outside the upper SIMATIC voltage limit, thus ensuring that the entire system downstream is deenergized.
- The PM-D F X1 conducts the fused voltage (U_1) for the supply to the electronic components and the safety groups SG1 to SG6 to the potential buses of the terminal modules for all the fail-safe motor starters and F-CM contact replicators of a fail-safe potential group.
- External safety devices can be supplied with a fused voltage U_1 from the PM-D F X1. This ensures that overvoltage cannot occur in the system (there must be no disturbances).
- Switching through the 6 safety groups SG1 to SG6 as well as from U_1 and M.
- The state of safety groups SG1 to SG6 is indicated by an LED.
- Transfer of diagnostic messages to the coordinating controller.
- The PM-D F X1 with a terminal module is a forwarding node. The fail-safe potential group can be switched to an additional ET 200S row.
- The fail-safe modules are identified by yellow labeling strips.

Caution
Power/expansion modules must not be either inserted or removed during operation.

View



LEDs:
SF group error

PWR (power) (U_1)
SG1 to SG6 (safety group 1 to 6)

Figure 13-1: PM-D F X1 power/expansion module

13.3.1 Parameters

The following table describes the parameters that can be set for the PM-D F X1 power/expansion module.

Parameters	Action, value range	Factory setting	Applicability
Group diagnosis	• Disable • Enable	Disable	Module

Table 13-7: Parameters for the PM-D F X1 power/expansion module

Group diagnosis:
This parameter enables diagnosis messaging
(error types are listed in Section 4.7).

Note
The "Disable group diagnosis" parameter also suppresses the display of faults on the SF-LED.

13.3.2 Electrical configuration

Block circuit diagram for the PM-D F X1

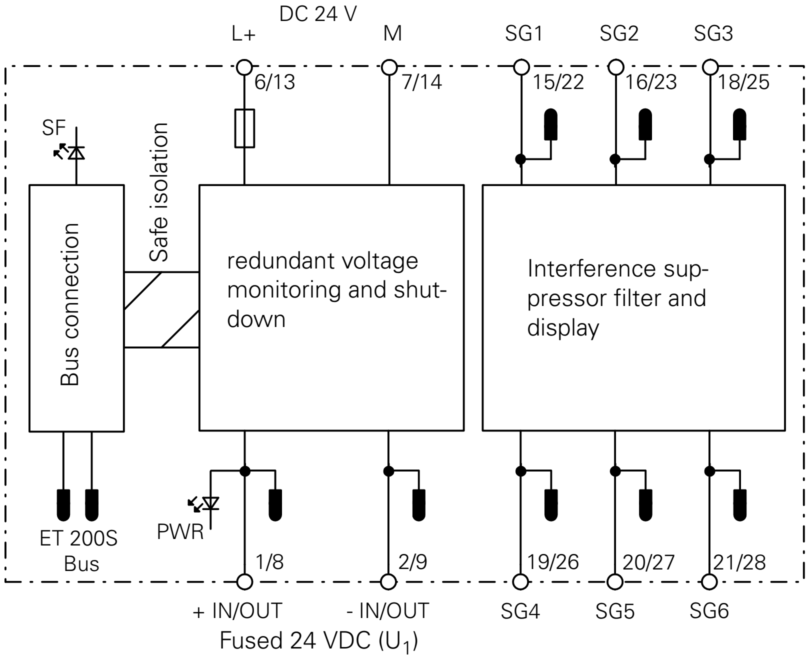


Figure 13-2: Block circuit diagram for the PM-D F X1

Explanation

The PM-D F X1 is inserted at the start of a potential group or a new row (TM-PFX30 S47-**G1**) or is inserted to loop through a potential group (TM-PFX30 S47-**G0**).

You can connect voltage (U_{in}) to the PM-D F X1 at terminals 6/13 and 7/14.

You can feed a fused voltage of 24 VDC (U_1) in and out at terminals 1/8 and 2/9.

Safety groups SG1 to SG6 can be fed in and out at terminals 15/22, 16/23, 18/25, 19/26, 20/27, and 21/28.

The PM-D F X1 module consists of the following system components:

- System components not related to safety:
  - Bus connection with communication
  - Diagnostic messages via the bus
  - Display of switching and error states
- Safety-related system components:
  - Monitoring of the U_1 voltage for overvoltage
  - Disconnection of the U_1 voltage in the event of overvoltage (<100 ms)

Laying regulations for lines

Safety note
The user must ensure that a cross-circuit between the individual safety groups SG1 to SG6 or U_1 and U_{in} or other cables cannot occur by complying with the correct cable-laying rules.

Safety regulations

Safety note
If the PM-D F X1 power/expansion module is supplied via U_{in}, a PELV power pack must be used that will output max. 60 VDC in the event of a fault.

For surge stability, an external protective circuit (surge filter) is required between the load voltage supply (power pack) and the load voltage input (U_{in}) of the terminal module. e.g. Blitzductor VT (order no. 918 402 from Dehn + Söhne)

Safety note
When PM-D F X1, PM-D F PROFIsafe, F-CM, F-DS1e-x, and F-RS1e-x are part of a single potential group, they must be in the same switch cabinet. Cables for SG1 to SG6, U_1, U_{in} can only be laid in this switch cabinet.

Safety note
If external safety devices (non-ET 200S, e.g. 3TK28, AS-i Safety Monitor) are connected to the PM-D F X1, ensure that they have **no effect** on the potential group, even in the event of a fault.

The external safety devices then switch U_{1+} (terminal 1/8) to the SG rails (emergency stop signal).

An appropriate safety device should be chosen, depending on the performance level required.

Please ensure you comply with the regulations for each safety device.

Module replacement

If a PM-D F X1 module has to be replaced, an acceptance test is not necessary.

13.3.3 Technical specifications - PM-D F X1

Dimensions and weight	
Installation dimensions W x H x D (mm) (incl. terminal module)	30 x 196.5 x 117.5
Weight (g)	approx. 100
Module-specific data	
Ambient temperature (°C)	0 to 60
Degree of protection	IP20
Maximum attainable safety classes:	
• IEC 61508 SIL[1)] • PL • Cat. (DIN EN ISO 13849) • HFT (DIN EN / IEC 61508 • n_{OP} (DIN EN ISO 13849) • d_{OP} (DIN EN ISO 13849) • h_{OP} (DIN EN ISO 13849)	3 e 4 1 20000 365 24
Safety parameters:	
• Low demand PFD$_{AVG}$ (10a) Test interval 3 mos. • High demand/continuous mode PFH Test interval 3 mos 1/h • Proof test interval years	 2.5×10^{-6} 5.7×10^{-11} 20

Table 13-8: Technical specifications - PM-D F X1

Voltages, currents, potentials	
Rated control supply voltage U_s	21.6 to 26.4 VDC up to 60 °C
Rated operating current I_e • Internal protection through fusing	6 A 7 A (quick-response)
Recommended upstream short-circuit protection: • Fuse	 gL/gG 6.3 A [1)]
Supply of: • Fail-safe motor starters • Motor starters for safety-integrated systems • Electronic modules • Ex[i] modules	 yes no no no
Current consumption: • From the backplane bus • From U_1 • From SGx	 ≤10 mA ≤35 mA ≤15 mA
Status, interrupts, diagnostics	
Interrupts	None
Diagnostic functions: • Group error/device fault • Monitoring of the supply voltage for electronic components U_1 (PWR) • Monitoring of the 6 safety groups • Diagnostic information readable	yes red SF LED green PWR LED Green LED SG1 to SG6 yes
Standards, approbations	
TÜV UL, CSA certification	yes yes

1) The fuse must be selected such that the connected power supply unit can provide the required current to interrupt it.

Table 13-8: Technical specifications - PM-D F X1 (Contd.)

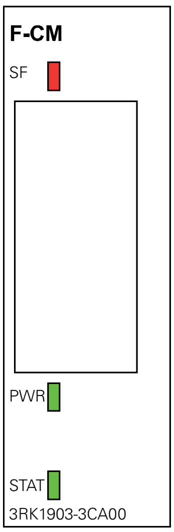
13.4 F-CM contact replicator

Features

- The F-CM contact replicator closes its enabling circuits unless there is an emergency stop on the selected SG bus.
- Redundant circuit design with two output relays with positively driven contacts.
- Can be set to safety group SG1 to SG6 (default setting = SG6).
- Four separate floating enabling circuits as normally open contacts.
- At each on/off cycle of the contact replicator, the switching elements of the F-CM are checked to ensure that they open and close correctly.
- Welded contacts in any enabling circuits are detected by the F-CM when the enabling circuits are opened, and a reboot of the device is avoided by the positively driven operation of the contacts.
- Transfer of diagnostic messages to the coordinating controller.
- The fail-safe modules are identified by yellow labeling strips.

Caution
Contact replicators cannot be either inserted or removed during operation.

View



LEDs:
SF group error

PWR (power) (U_1)

STAT (status)

Figure 13-3: F-CM contact replicator

13.4.1 Parameters

The following table indicates the parameter that can be set for the F-CM contact replicator.

Parameters	Action, value range	Factory setting	Applicability
Group diagnosis	• Disable • Enable	Disable	Module

Table 13-9: Parameters for the F-CM contact replicator

Group diagnosis:
This parameter enables diagnosis messaging
(error types are listed in Section 4.7).

Note
The "Disable group diagnosis" parameter also suppresses the display of faults on the SF-LED.

13.4.2 Electrical configuration

Block diagram for the F-CM

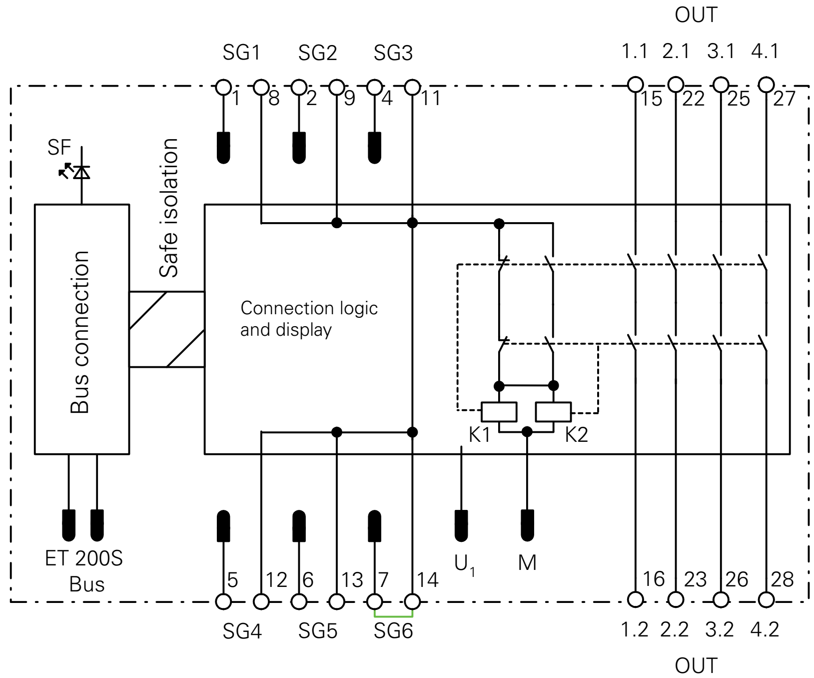


Figure 13-4: Block diagram for the F-CM

Explanation

The F-CM contact replicator consists of the following system components:

- Non-safety-related system components:
  - Bus connection with communication
  - Diagnostic message via the bus
  - Display of switching and error states
  - Connection logic
- Safety-related system components:
  - Disconnection of the enabling circuits if there is no voltage on the selected SG bus
  - Mutual interlocking of the positively driven relays
  - Prevention of reclosing if there is an error in the enabling circuit

The F-CM contact replicator can be inserted anywhere in the corresponding potential group to the right of a fail-safe power module.

Use the wire jumper to set the desired safety group (SG1 to SG6) on the terminal with the following terminals:
- 1/8 for SG1,
- 2/9 for SG2,
- 4/11 for SG3,
- 5/12 for SG4,
- 6/13 for SG5,
- 7/14 for SG6 The F-CM contact replicator is preset to safety group SG6 using the wire jumper.

You can connect additional actuators or devices to the floating contacts with the terminals OUT 1.1 - OUT 4.2.

Safety regulations

Safety note
Only **one** of the 6 SG buses can be selected with a jumper.

Safety note
Only applies in fail-safe mode (fail-safe technology)
The F-CM can only be operated in the potential group of a PM-D F PROFIsafe or PM-D F X1 that safely limits the voltage to within the SIMATIC range.

Safety note
You must only use the F-CM contact replicator to control devices that do not pose any direct danger to persons or the environment if suddenly disconnected.

Safety note
Cyclic test
The F-CM must be tested at **commissioning** and then at least **every 3 to 6 months** by means of an on/off cycle using the selected emergency stop bus.

Safety note
The enabling circuits must be appropriately protected against overloading (with fuses, for example; see Section 13.4.3).

Please note:
If the enabling circuits are integrated into the sensor circuits of an external safety device, overload protection might not be necessary if there is protection in the sensor circuits of the external safety device. For more information, consult the operating instructions of the external safety device.

Safety note
The F-CM is designed in such a way that in the event of an emergency stop it is safely shut down by the selected SG bus.
In the event of a fault, a defined switch on **cannot** be guaranteed.

Safety note
Make sure that any potential that builds up between the control circuit of the F-CM (U_1/SGx/M) and the main conducting paths (OUT) is not greater than the safe, functional extra-low voltage.
This can be achieved, for example, by using suitable grounding measures.

Module replacement

If you replace an F-CM module, an acceptance test is not necessary but the F-CM must be tested (see cyclic test).

13.4.3 Technical specifications - F-CM

Dimensions and weight	
Installation dimensions W x H x D (mm) (incl. terminal module)	 30 x 196.5 x 117.5
Weight (g)	approx. 190
Module-specific data	
Mechanical life Electrical life	10×10^6 switching cycles $\geq$ 200,000 switching cycles at I_e
Ambient temperature	0 to 60 °C
Degree of protection	IP20
Utilization category	DC-13
Control times • On-delay • Release time	 < 80 ms (typ. 50 ms) < 60 ms (typ. 35 ms)
Maximum attainable safety classes:	
• IEC 61508 SIL • PL • Cat. (DIN EN ISO 13849)	3 e 4
Safety parameters:	
• SFF (DIN EN / IEC 61508) • DC (DIN EN ISO 13849) • HFT (DIN EN / IEC 61508 • n_{OP} (DIN EN ISO 13849) • d_{OP} (DIN EN ISO 13849) • h_{OP} (DIN EN ISO 13849)	99.77 % >99 1 1 365 24
• Low demand PFD_{AVG} (10a) Test interval 3 months Test interval 6 months • High demand/continuous mode PFH Test interval 3 months 1/hr Test interval 6 months 1/hr • Proof test interval years	 1.8×10^{-5} 3.0×10^{-5} 4.0×10^{-10} 6.9×10^{-10} 20
• $B10_D$ I_N 0.5 I_N 0.25 I_N	 90.000 200.000 300.000

Table 13-10: Technical specifications - F-CM

Voltages, currents, potentials	
Control circuit U_1 (PWR):	
Rated control supply voltage U_s	21.6 to 26.4 VDC up to 60 °C
Power consumption	1.8 W
Floating enabling circuits	
Rated operating current I_e	
13 to 24 VDC	2 A
Thermal continuous current I_{th}	4 A
Recommended short-circuit protection for enabling circuits	
• Fuse	gL/gG 6.3 A
Current consumption:	
• From the backplane bus	≤10 mA
• From U_1	≤15 mA
• From SGx	≤70 mA
Status, interrupts, diagnostics	
Interrupts	None
Diagnostic functions:	yes
• Group error/device fault	red SF LED
• Monitoring of the supply voltage for electronic components U_1 (PWR)	green PWR LED
• Monitoring of the circuit state of the enabling circuit	green/red LED STAT
• Diagnostic information readable	yes
Standards, approbations	
TÜV	yes
UL, CSA certification	yes

Table 13-10: Technical specifications - F-CM (Contd.)

13.5 Examples with fail-safe modules

Safety note
The following applications are used only as a suggestion of typical circuit diagrams.
No liability will be accepted for the proper functioning, compliance with certification requirements, or compatibility of the examples. Use at your own risk.

Safety note
For PL d or PL e or SIL 2 or 3, a PELV power supply unit that provides a maximum output voltage of 60 VDC (secure functional extra-low voltage) in the event of a fault must be used for U_1 ext.

Caution
Due to the operation of star-connected three-phase motors, high EMC interference may occur. Interference above the IEC limit values can lead to an impairment of functions or failure of the electronics. In case of high EMC interference, we recommend the use of motors with EMC protection circuits. (Exception: soft starters may not be operated with a EMC protection circuit).

Safe functional extra-low voltage

Warning
The fail-safe modules must be operated with safe functional extra-low voltage. That means that these modules may only be operated with maximum voltage of 60 V in the event of an error.

All system components that can deliver electrical energy in any form must fulfill these conditions.

Every other electrical circuit (DC 24 V) utilized in the system must have a safe, functional extra-low voltage. Please observe the appropriate data sheets or contact the manufacturer.

Warning
All voltage sources, e.g. electronics power supply, external load power supply, or bus power supply, must be electrically isolated from one another externally. This is necessary so that even at low potential differentials no additive voltage which could exceed the 60 V develops from the individual voltage sources. Please observe the ET 200S installation guidelines to ensure that the electrical isolation is sufficient in regard to the electrical wiring's cross-section.

13.5.1 Example with PM-D F PROFIsafe and 4 emergency stop circuits

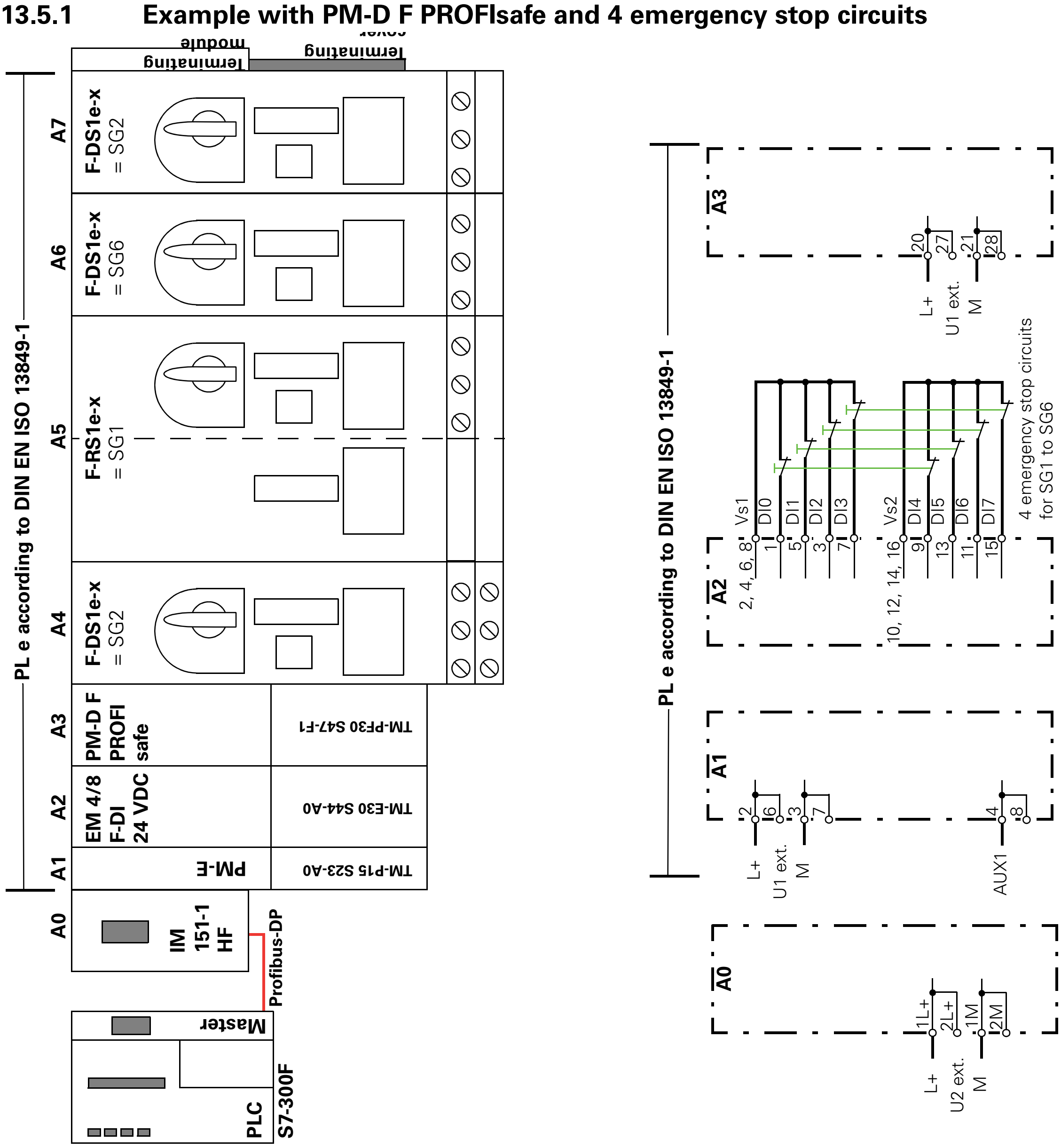
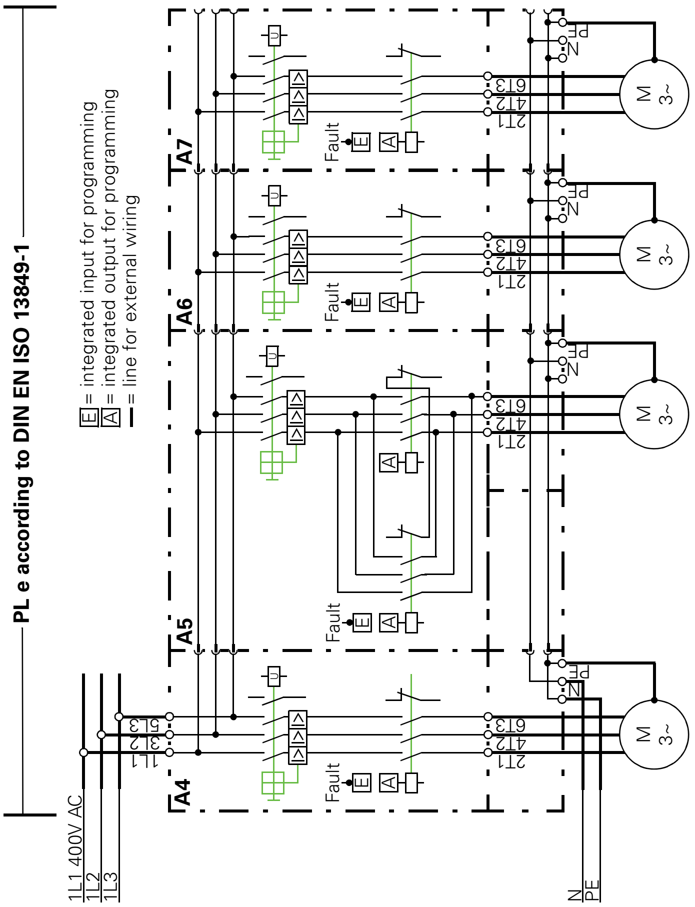


Figure 13-5: Example with PM-D F PROFIsafe and 4 emergency stop circuits up to PL e / SIL3



The components required to set up this example are as follows:

PL up to e	Order number	Description
1	3RK1 903-3BA01	PM-D F PROFIsafe
1	3RK1 903-3AA00	TM-PF30 S47-**F1**
1	6ES7 138-4CB10-0AB0	PM-E
1	6ES7 193-4CD20-0AA0	TM-P15 S23-A0
1	6ES7 138-4FA00-0AB0	EM 4/8 F-DI DC24V PROFIsafe
1	6ES7 193-4CK20-0AA0	TM-E30 S44-A0
3	3RK1 301-0xB13-0AA2	F-DS1e-x x in accordance with current range
1	3RK1 903-3AC00	TM-FDS65 S32 with power bus infeed
2	3RK1 903-3AC10	TM-FDS65 S31 with power bus throughfeed
1	3RK1 301-0xB13-1AA2	F-RS1e-x x in accordance with current rating

Figure 13-5: (cont.) Example with PM-D F PROFIsafe and 4 emergency stop circuits up to PL e / SIL3

This example illustrates the configuration with fail-safe motor starters and the safety group set accordingly. The motor starters can be arranged in any order. They are supplied by a PM-D F PROFIsafe [1] power module. The emergency stop switches are connected to a fail-safe digital input module [1] supplied by a separate PM-E power module.

The example shows the circuit for PL e / SIL3.

You can use your user program to determine which emergency stop switch affects which safety group(s).

[1] See the '*ET 200S Distributed I/O Device for Fail-Safe Modules*' manual.

13.5.2 Example with the PM-D F X1 power/expansion module and external safety combinations

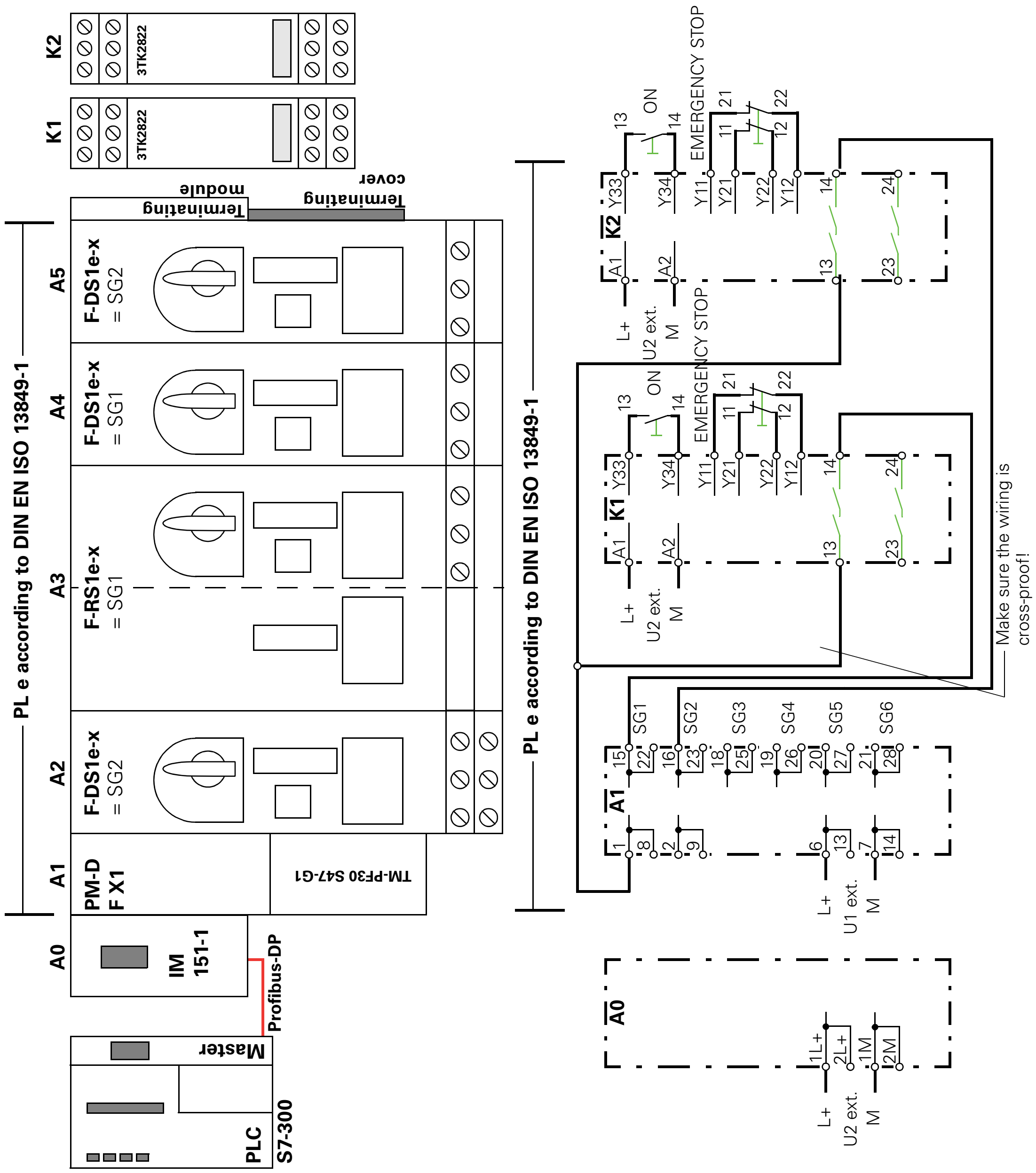
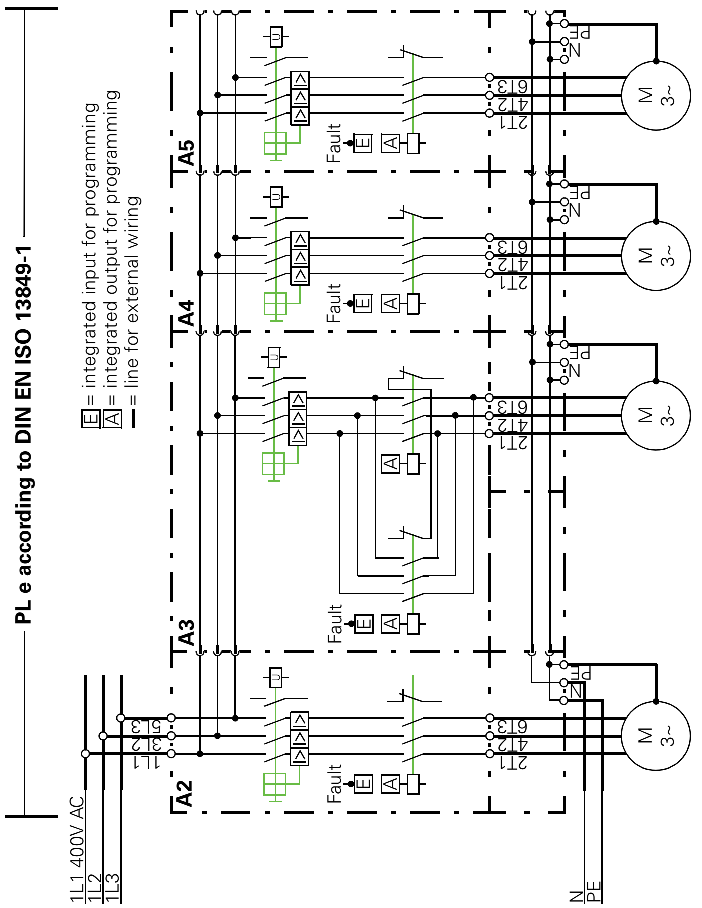


Figure 13-6: Example with the PM-D F X1 power/expansion module and external safety combinations

Safety note
A fuse for K1/K2 enabling circuits is not necessary here because the internal fuse of the PM-D F X1 is sufficient in this instance. If other external safety combinations are used, it might be necessary to add a fuse to the enabling circuits to prevent the occurrence of the common mode fault of contact welding of the enabling circuits.



The components required to set up this example are as follows:

PL up to e	Order number	Description
1	3RK1 903-3DA00	PM-D F X1
1	3RK1 903-3AE00	TM-PFX30 S47-**G1**
2	3TK2 822-xCB30	External safety combination x in accordance with the connection
3	3RK1 301-0xB13-0AA2	F-DS1e-x x in accordance with current range
1	3RK1 903-3AC00	TM-FDS65 S32 with power bus infeed
2	3RK1 903-3AC10	TM-FDS65 S31 with power bus throughfeed
1	3RK1 301-0xB13-1AA2	F-RS1e-x x in accordance with current rating

Figure 13-6: (cont.) Example with the PM-D F X1 power/expansion module and external safety combinations

This example illustrates the configuration with fail-safe motor starters and the safety group set accordingly. The motor starters can be arranged in any order. The motor starter is supplied by a PM-D F X1 power/expansion module. The emergency stop buttons are connected to external safety combinations that switch the U_1 voltage to the SG buses.

The example shows the circuit for PL e.

13.5.3 Example with PM-D F PROFIsafe and several stations

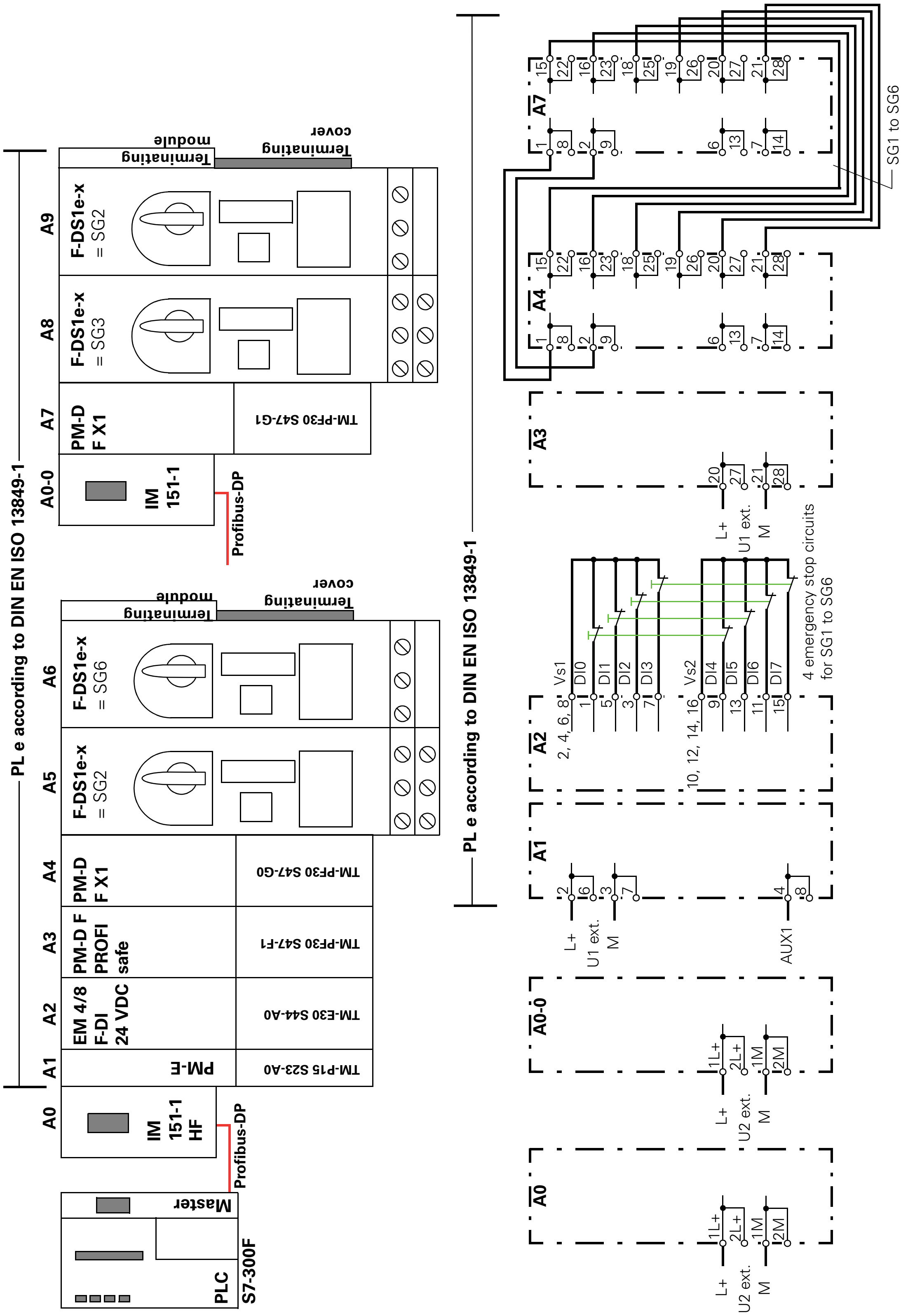
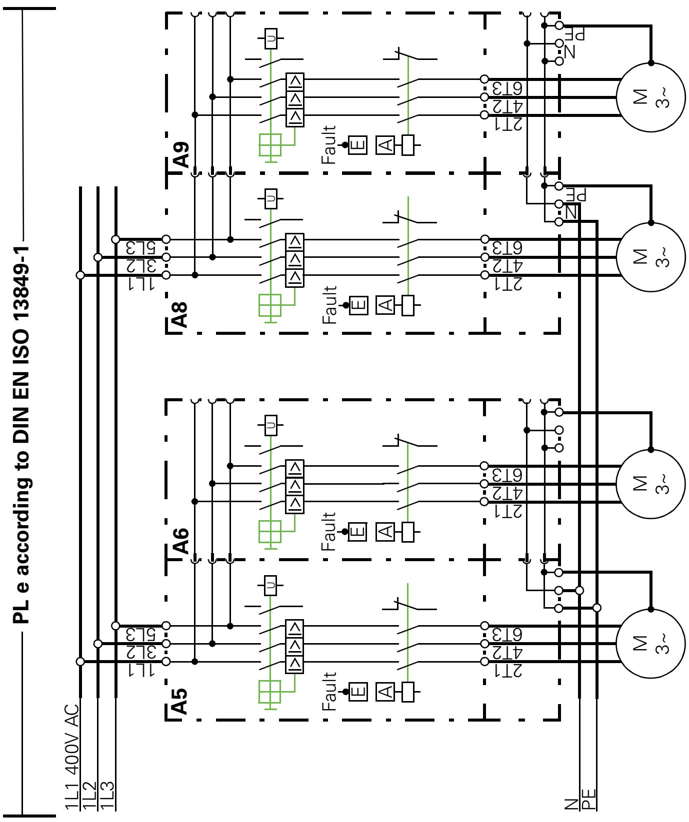


Figure 13-7: Example with PM-D F PROFIsafe and several substations up to PL e / SIL3



The components required to set up this example are as follows:

PL up to e	Order number	Description
1	3RK1 903-3BA01	PM-D F PROFIsafe
1	3RK1 903-3AA00	TM-PF30 S47-**F1**
1	6ES7 138-4CB10-0AB0	PM-E
1	6ES7 193-4CD20-0AA0	TM-P15 S23-A0
1	6ES7 138-4FA00-0AB0	EM 4/8 F-DI DC24V PROFIsafe
1	6ES7 193-4CK20-0AA0	TM-E30S44-A0
2	3RK1 903-3DA00	PM-D F X1
1	3RK1 903-3AE10	TM-PFX30 S47-**G0**
1	3RK1 903-3AE00	TM-PFX30 S47-**G1**
2	3TK2 822-xCB30	External safety combination x in accordance with the connection
4	3RK1 301-0xB13-0AA2	FDS1e-x x in accordance with current range
2	3RK1 903-3AC00	TM-FDS65 S32 with power bus infeed
2	3RK1 903-3AC10	TM-FDS65 S31 with power bus throughfeed

E = integrated input for programming
A = integrated output for programming
▬ = line for external wiring

Figure 13-7: (cont.) Example with PM-D F PROFIsafe and several substations up to PL e / SIL3

This example illustrates the configuration with fail-safe motor starters and the safety group set accordingly. The motor starters can be arranged in any order. They are supplied by a PM-D F PROFIsafe [1] power module. The emergency stop switches are connected to a fail-safe digital input module [1] supplied by a separate PM-E power module.

Additional ET 200S buses are also supplied by a PM-D F X1.

The example shows the circuit for PL e / SIL3.

You can use your user program to determine which emergency stop switch affects which safety group(s).

1) See the '*ET 200S Distributed I/O Device for Fail-Safe Modules*' manual.

13.5.4 Example with PM-D F PROFIsafe and contact replicator

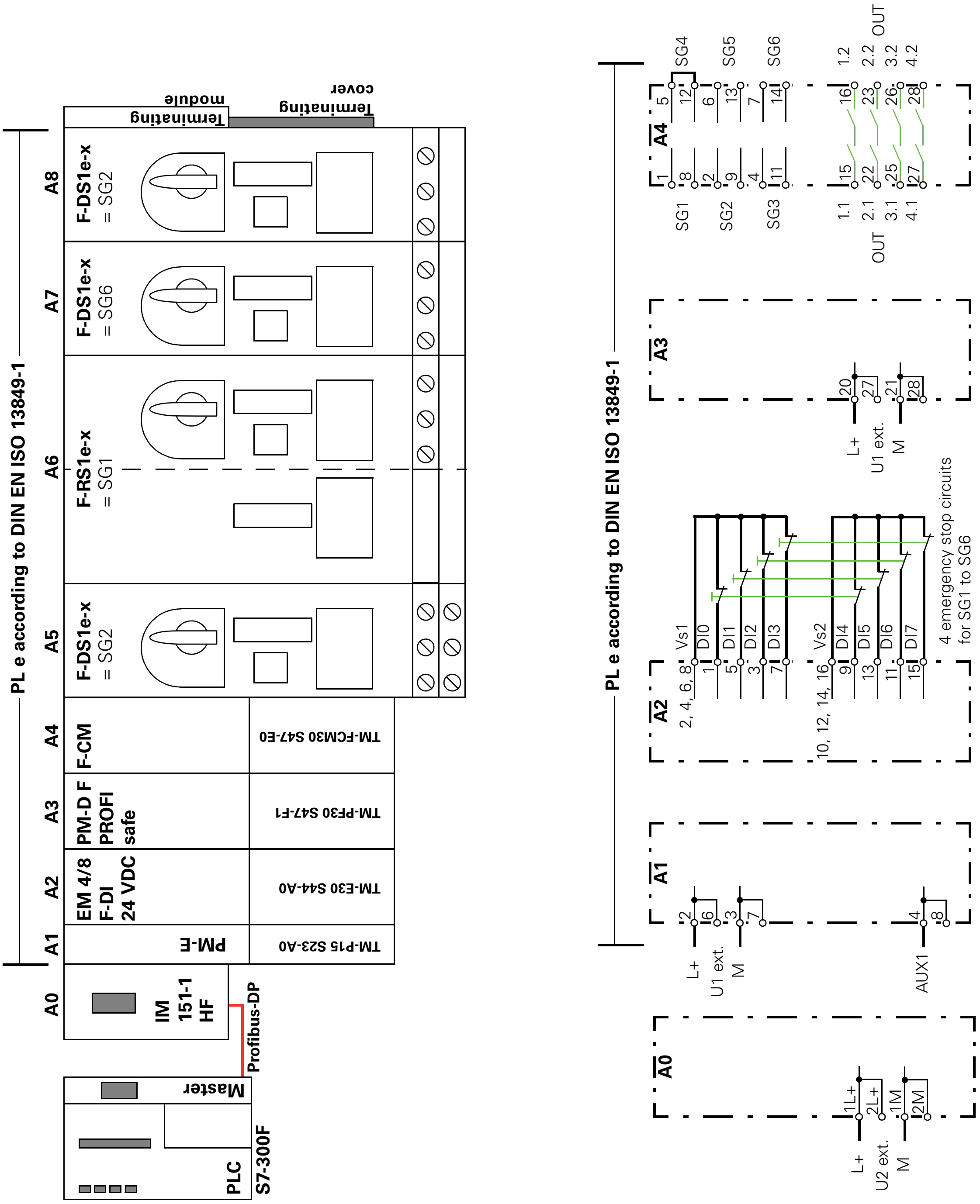
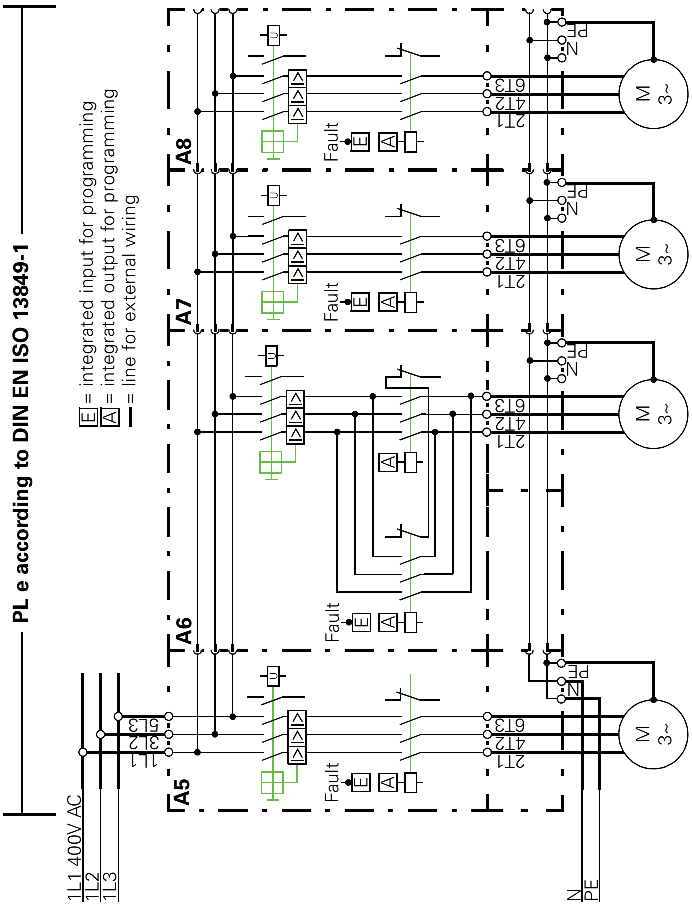


Figure 13-8: Example with PM-D F PROFIsafe and contact replicator up to PL e / SIL3



The components required to set up this example are as follows:

PL up to e	Order number	Description
1	3RK1 903-3BA01	PM-D F PROFIsafe
1	3RK1 903-3AA00	TM-PF30 S47-**F1**
1	6ES7 138-4CB10-0AB0	PM-E
1	6ES7 193-4CD20-0AA0	TM-P15 S23-A0
1	6ES7 138-4FA00-0AB0	EM 4/8 F-DI DC24V PROFIsafe
1	6ES7 193-4CK20-0AA0	TM-E30S44-A0
1	3RK1 903-3CA00	F-CM
1	3RK1 903-3AB10	TM-FCM30 S47-**E0**
3	3RK1 301-0xB13-0AA2	F-DS1e-x x in accordance with current range
1	3RK1 903-3AC00	TM-FDS65 S32 with power bus infeed
2	3RK1 903-3AC10	TM-FDS65 S31 with power bus throughfeed
1	3RK1 301-0xB13-1AA2	F-RS1e-x x in accordance with current rating

Figure 13-8: (cont.) Example with PM-D F PROFIsafe and contact replicator up to PL e / SIL3

Based on the example in 11.4.1, a contact replicator is added to this example in order to achieve fail-safe disconnection of additional enabling circuits. You can determine which safety group (SG) controls the contact replicator using the wire jumper.

Safety note

Only **one** of the 6 SG buses can be selected with a jumper on the F-CM.

13.5.5 Example with PM-D F X1 power module and contact replicator

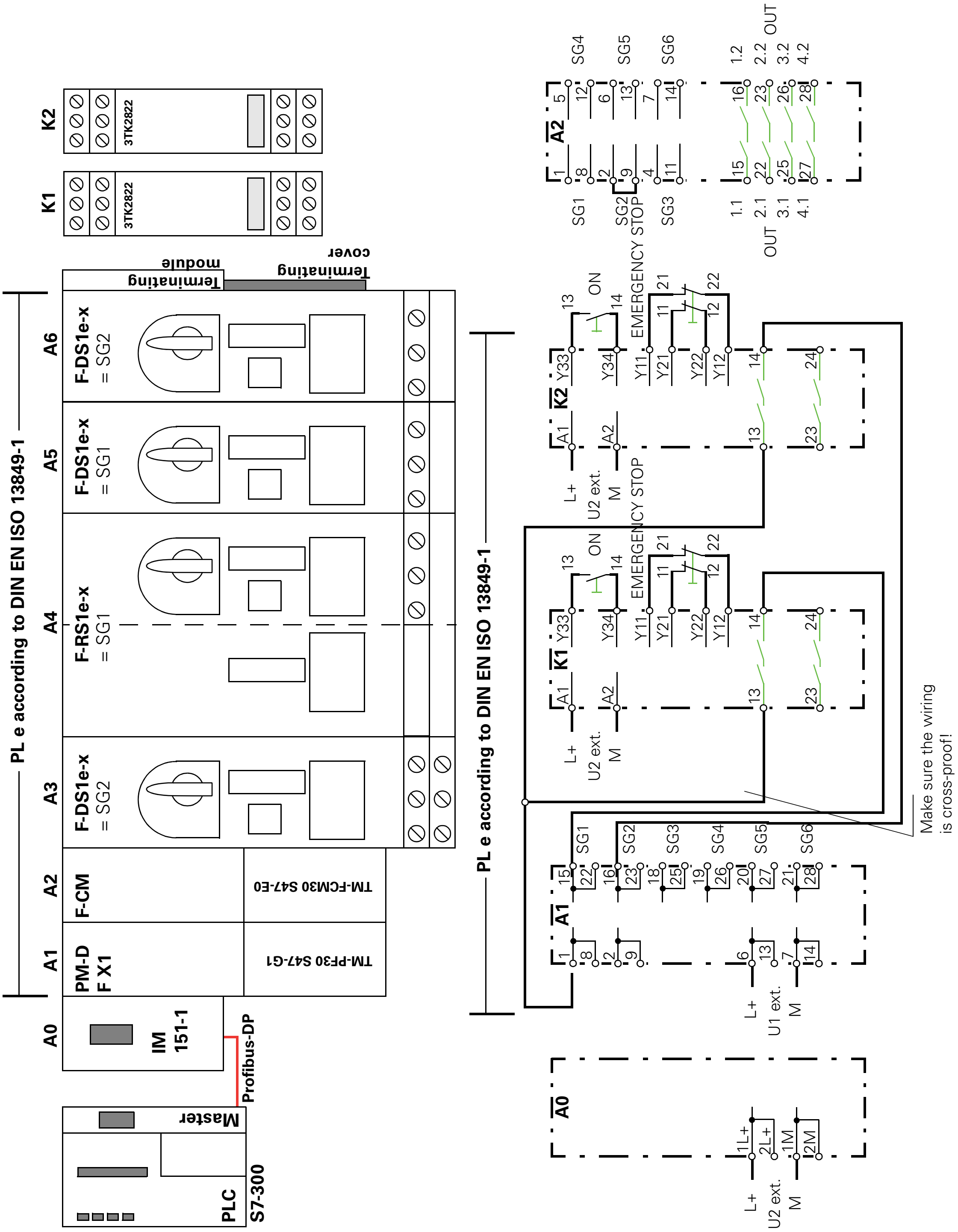
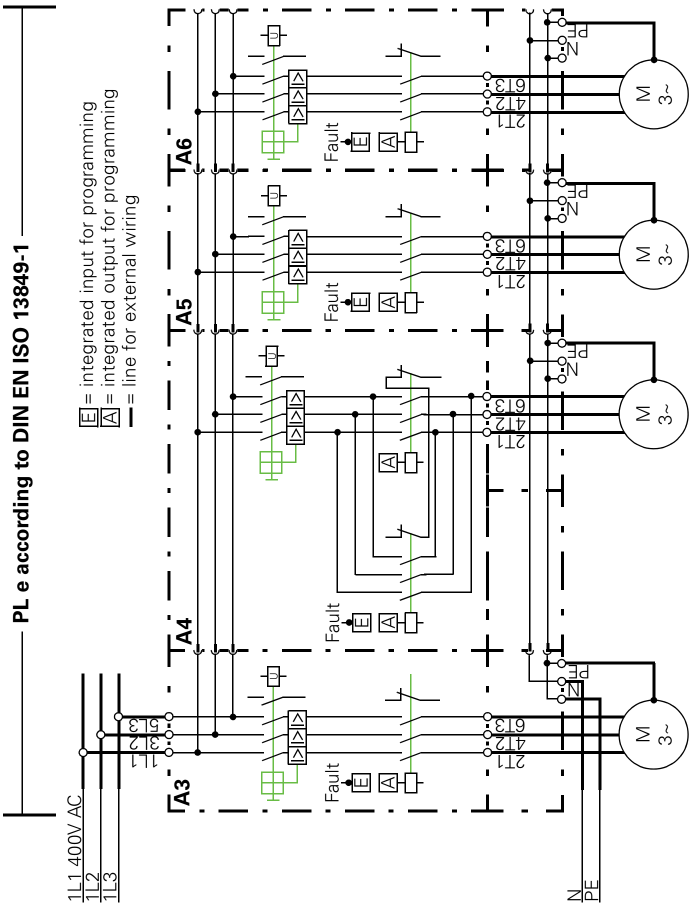


Figure 13-9: Example with PM-D F X1 power module and contact replicator up to PL e



The components required to set up this example are as follows:

PL up to e	Order number	Description
1	3RK1 903-3DA00	PM-D F X1
1	3RK1 903-3AE00	TM-PFX30 S47-**G1**
1	3RK1 903-3CA00	F-CM
1	3RK1 903-3AB10	TM-FCM30 S47-**E0**
2	3TK2 822-xCB30	External safety combination x in accordance with the connection
3	3RK1 301-0xB13-0AA2	F-DS1e-x x in accordance with current range
1	3RK1 903-3AC00	TM-FDS65 S32 with power bus infeed
2	3RK1 903-3AC10	TM-FDS65 S31 with power bus throughfeed
	3RK1 301-0xB13-1AA2	F-RS1e-x x in accordance with current rating
	3RK1 903-3AD10	TM-RS130 S31 with power bus throughfeed

Figure 13-9: (cont.) Example with PM-D F X1 power module and contact replicator up to PL e

Based on the example in 11.4.2, a contact replicator is added to this example in order to achieve fail-safe disconnection of additional enabling circuits. You can use the wire jumper to set which of the two safety groups (SG1 or SG 2), switched via the external safety combinations, controls the contact replicator.

Safety note

Only **one** of the 6 SG buses can be selected with a jumper on the F-CM.

13.5.6 ET 200S fail-safe motor starter with AS-i Safety at work

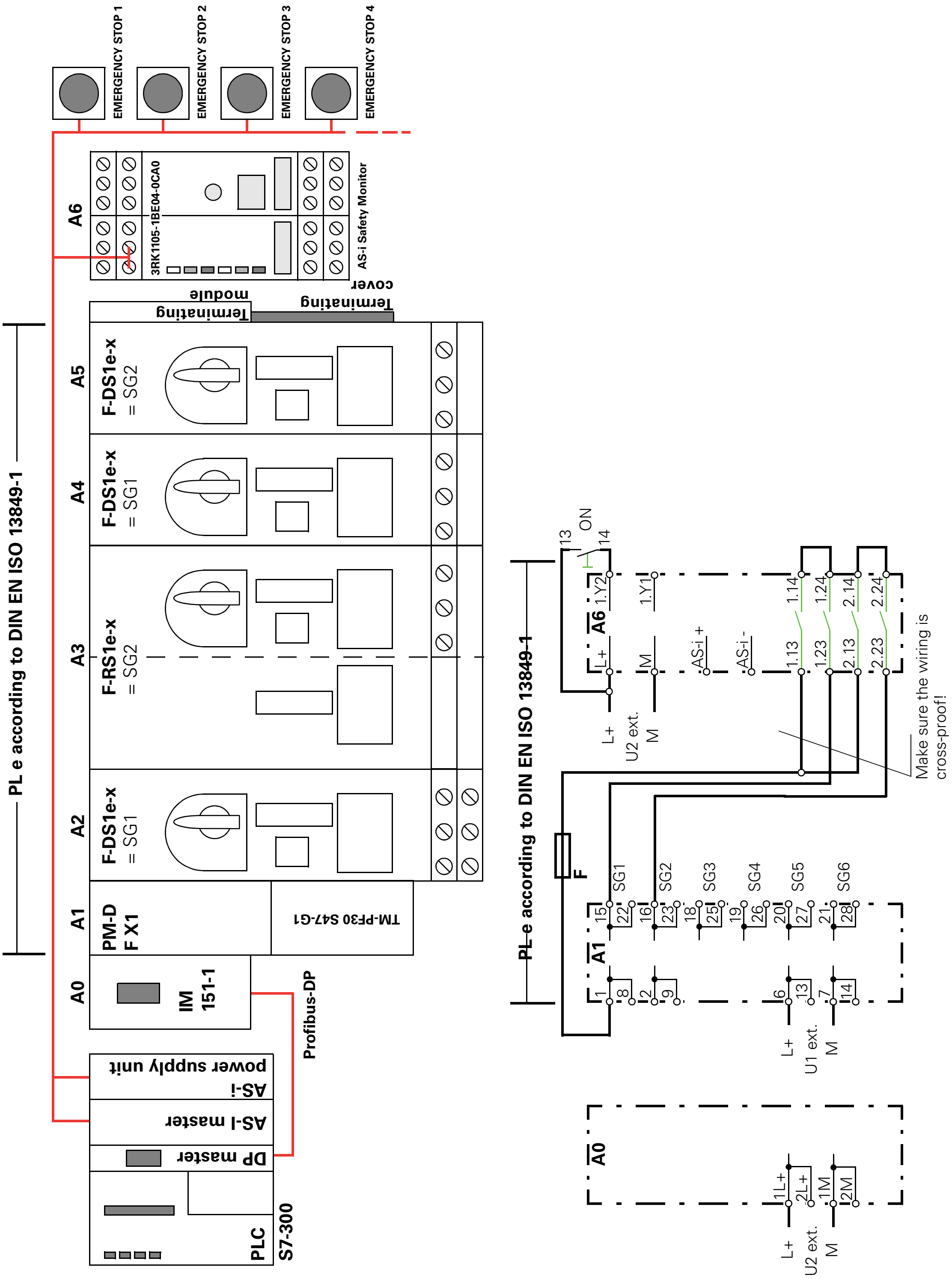
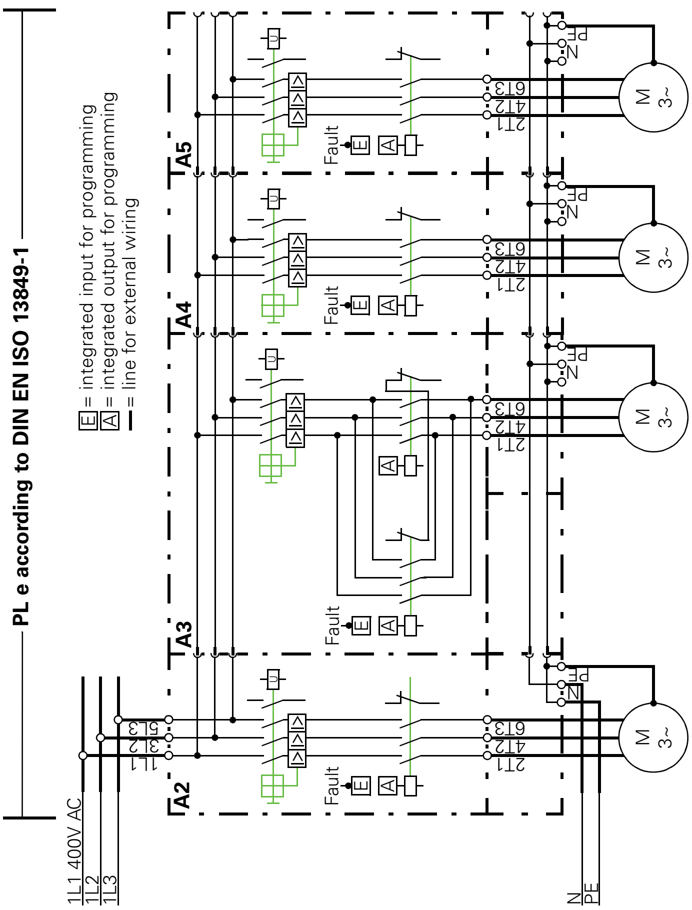


Figure 13-10: Example with PM-D F X1 power module and AS-i Safety at work up to PL e / SIL3



The components required to set up this example are as follows:

PL up to e	Order number	Description
1	3RK1 903-3DA00	PM-D F X1
1	3RK1 903-3AE00	TM-PFX30 S47-**G1**
1	3RK1 105-1BE04-0CA0	AS-i Safety Monitor
3	3RK1 301-0xB13-0AA2	F-DS1e-x x in accordance with current range
1	3RK1 903-3AC00	TM-FDS65 S32 with power bus infeed
2	3RK1 903-3AC10	TM-FDS65 S31 with power bus throughfeed
1	3RK1 301-0xB13-1AA2	F-RS1e-x x in accordance with current rating
1	3RK1 903-3AD10	TM-RS130 S31 with power bus throughfeed

Figure 13-10: (cont.) Example with PM-D F X1 power module and AS-i Safety at work up to PL e / SIL3

This configuration integrates an AS-i safety monitor in an ET 200S system. The configuration satisfies the requirements of all categories up to category 4/SIL3.

It combines the advantages of AS-i Safety at work on the sensor side with the advantages of ET 200S on the actuator side in a way that makes best use of both.

Safety note
To prevent a common mode fault (contact welding of the enabling circuits) occurring with the AS-i safety monitor, add a 4 A MT fuse.

13.5.7 Example with the PM-D F X1 power/expansion module and external safety combinations

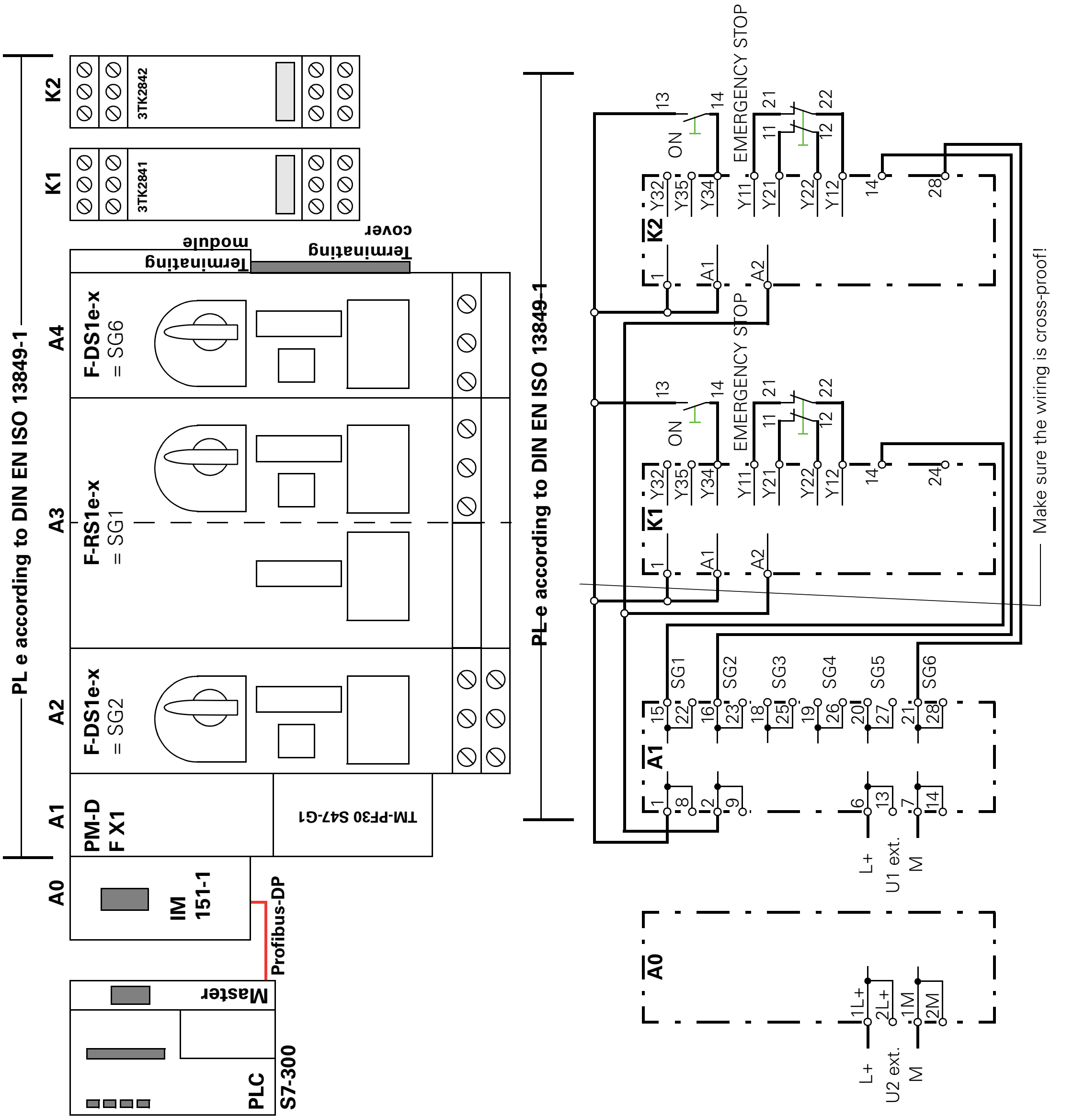
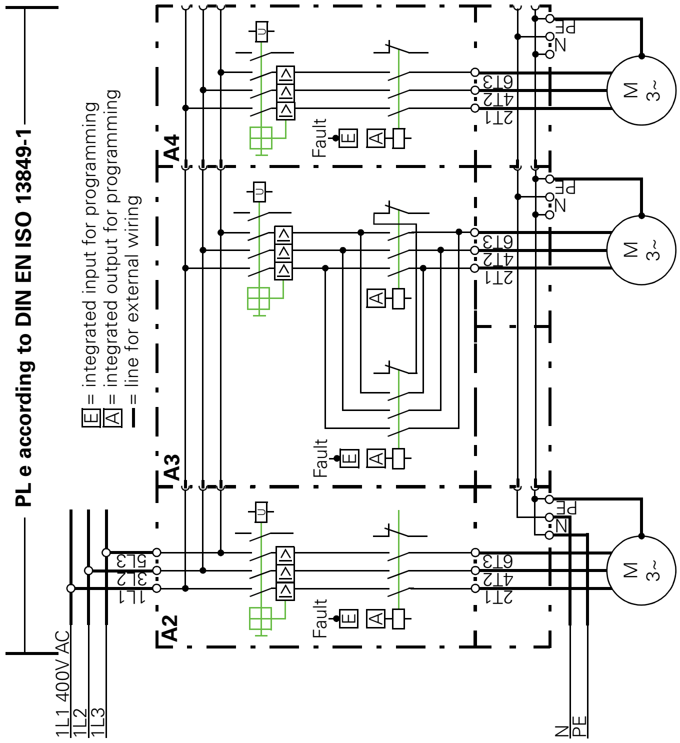


Figure 13-11: Example with the PM-D F X1 power/expansion module and external safety combinations up to PL e / SIL3



The components required to set up this example are as follows:

PL up to e	Order number	Description
1	3RK1 903-3DA00	PM-D F X1
1	3RK1 903-3AE00	TM-PF30 S47-**G1**
2	3RK1 301-0xB13-0AA2	F-DS1e-x x in accordance with current range
1	3RK1 903-3AC00	TM-FDS65 S32 with power bus infeed
1	3RK1 903-3AC10	TM-FDS65 S31 with power bus throughfeed
1	3RK1 301-0xB13-1AA2	F-RS1e-x x in accordance with current rating
1	3RK1 903-3AD10	TM-RS130 S31 with power bus throughfeed
1	3RK2 841-1BB40	Electronic safety combination

Figure 13-11: (cont.) Example with the PM-D F X1 power/expansion module and external safety combinations up to PL e / SIL3

Note

The external safety combinations are also supplied by the PM-D F X1 power/expansion module.

13.5.8 ET 200S fail-safe motor starters and PM-D F X1 with central safety PLC

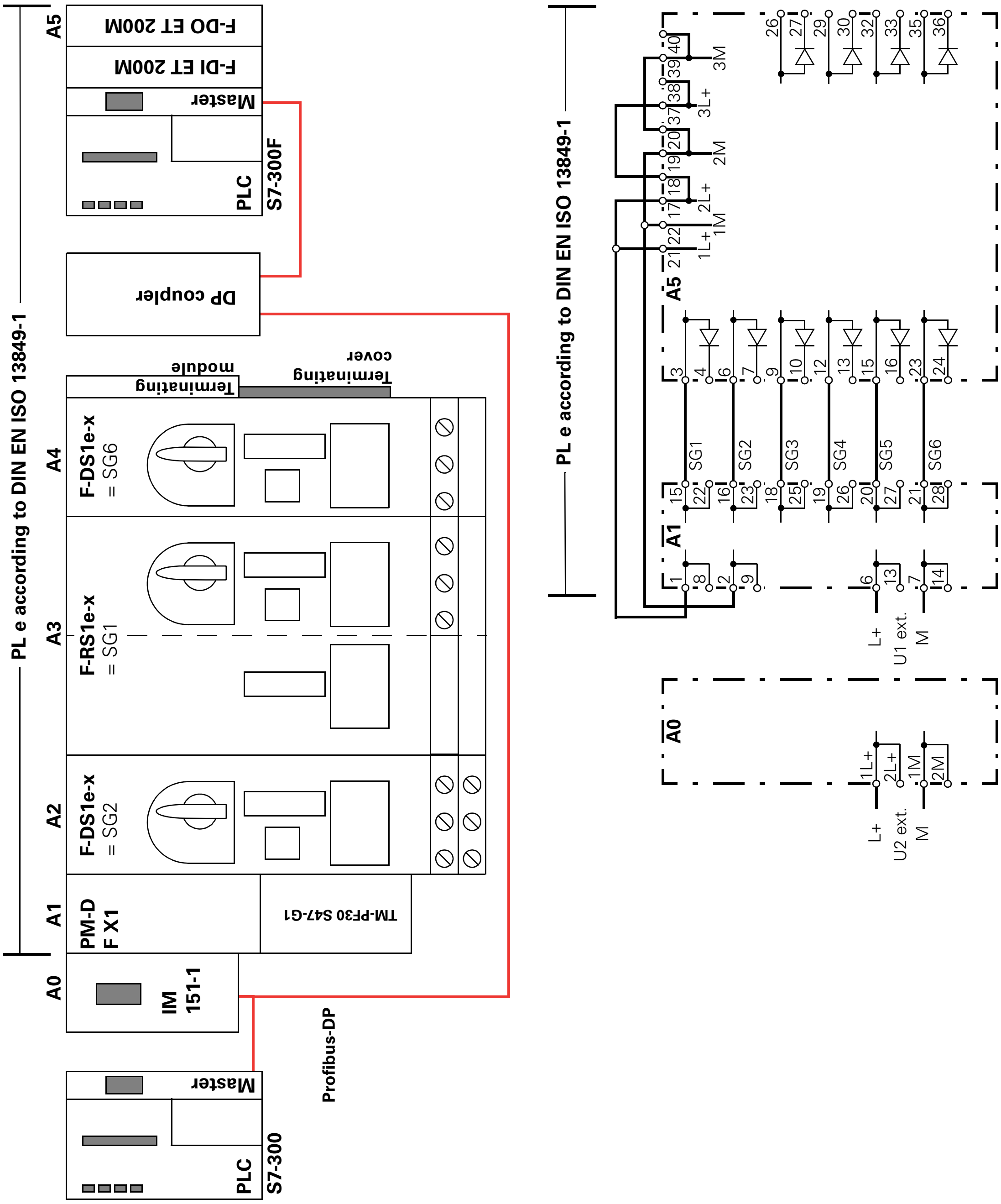
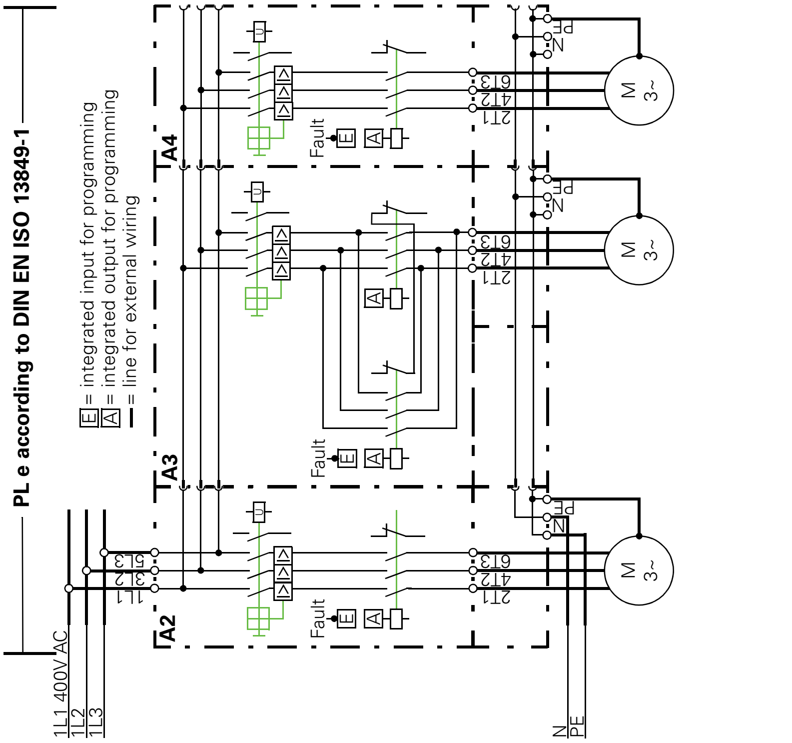


Figure 13-12: ET 200S fail-safe motor starters and PM-D F X1 with central safety PLC



The components required to set up this example are as follows:

PL up to e	Order number	Description
1	3RK1 903-3DA00	PM-D F X1
1	3RK1 903-3AE00	TM-PF30 S47-**G1**
1	6ES7 326-1BK00-0AB0	F-DI ET 200M
1	6ES7 326-1BF00-0AB0	F-DO ET 200M
2	3RK1 301-0xB13-0AA2	F-DS1e-x x in accordance with current range
1	3RK1 903-3AC00	TM-FDS65 S32 with power bus infeed
1	3RK1 903-3AC10	TM-FDS65 S31 with power bus throughfeed
1	3RK1 301-0xB13-1AA2	F-RS1e-x x in accordance with current rating

Figure 13-12: (cont.) ET 200S fail-safe motor starters and PM-D F X1 with central safety PLC

This example illustrates a configuration with a central safety PLC with local safe inputs and safe outputs that shut down the motor starters safely. The link from the safe inputs to the safe outputs is implemented in the user program on the safety PLC.

The standard PLC is responsible for operational switching and motor control and is thus not burdened with lengthy calculations of fail-safe links.

See also the *S7-300 Programmable Controller, Fail-Safe Signal Modules* manual.

13.5.9 Distributed selective detection of safety signals

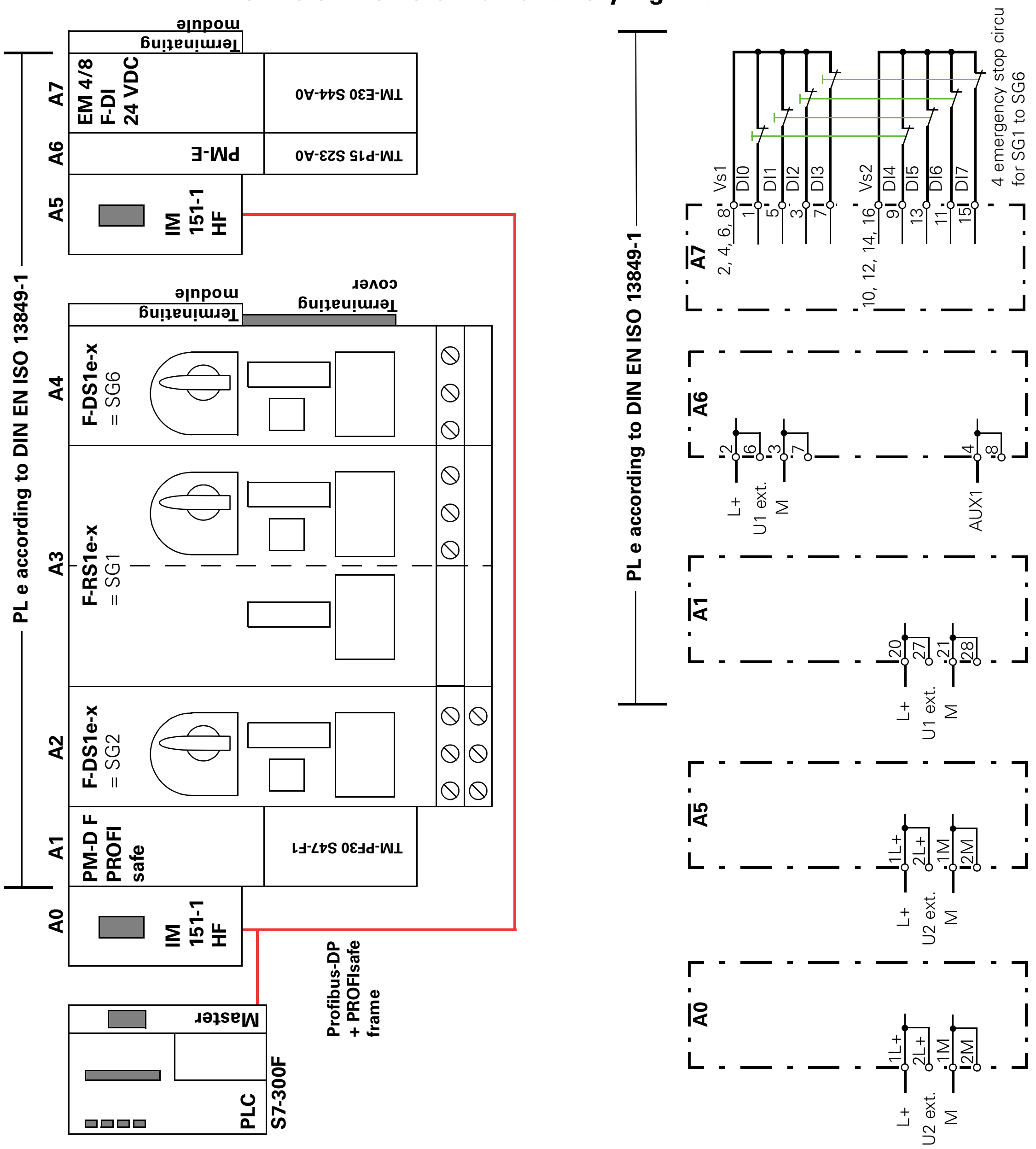
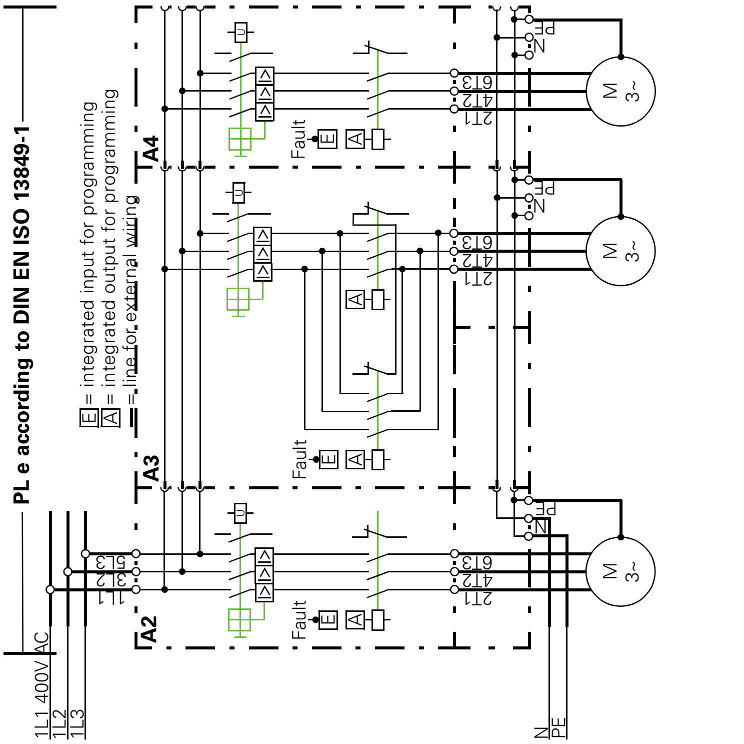


Figure 13-13: Distributed selective detection of safety signals



The components required to set up this example are as follows:

PL up to e	Order number	Description
1	3RK1 903-3BA01	PM-D F PROFIsafe
1	3RK1 903-3AA00	TM-PF30 S47-**F1**
1	6ES7 138-4CB10-0AB0	PM-E
1	6ES7 193-4CD20-0AA0	TM-P15 S23-A0
1	6ES7 138-4FA00-0AB0	EM 4/8 F-DI DC24V PROFIsafe
1	6ES7 193-4CK20-0AA0	TM-E30 S44-A0
2	3RK1 301-0xB13-0AA2	F-DS1e-x x in accordance with current range
1	3RK1 903-3AC00	TM-FDS65 S32 with power bus infeed
1	3RK1 903-3AC10	TM-FDS65 S31 with power bus throughfeed
1	3RK1 301-0xB13-1AA2	F-RS1e-x x in accordance with current rating
1	3RK1 903-3AD10	TM-RS130 S31 with power bus throughfeed

Figure 13-13: (cont.) Distributed selective detection of safety signals

This example describes the distributed selective detection of safety signals and the selective safe shutdown of motor starters.

The motor starters can be arranged in any order. They are supplied by a PM-D F PROFIsafe [1)] power module. The emergency stop switches/position switches/rope-operated switches are connected to a fail-safe digital input module [1)] supplied by a separate PM-E power module.

The example shows the circuit for PL e / SIL3.

The sensors (on the fail-safe digital input module) and the actuators (power module PM-D F PROFIsafe, fail-safe motor starter) are in different ET 200S stations.

You can use your user program to determine which emergency stop switch affects which safety group(s).

1) See the '*ET 200S Distributed I/O Device for Fail-Safe Modules*' manual.

Data formats and data records

A

A.1 Data formats

Features

The motor starter obtains a variety of operating, diagnostic and statistics data. Control data are sent to the motor starter.

Control data

Data sent to the motor starter, e.g. motor ccw switching command, trip reset, etc.

Data format: Bit

Messages

Data sent from the motor starter and that display the current operating condition, e.g. motor ccw, etc.

Data format: Bit

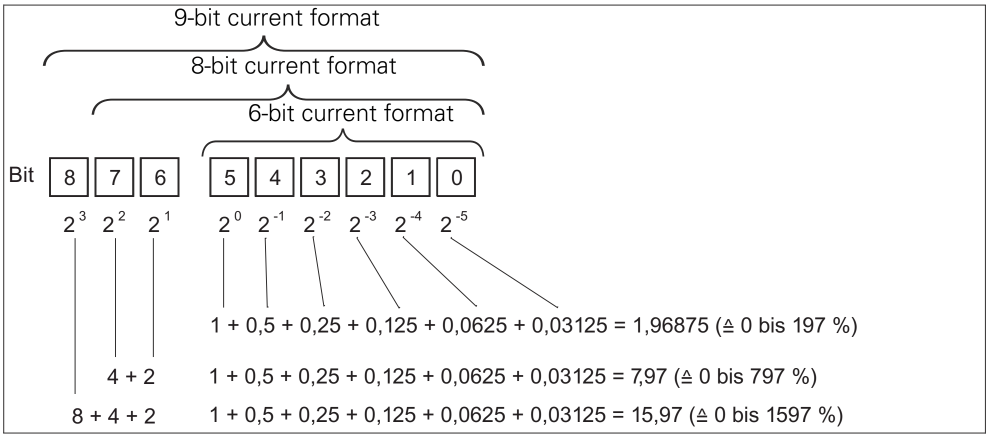
Diagnostics

Data sent from the motor starter and that display the current operating condition, e.g. overload fault, etc.

Data format: Bit

Current values

Current values are coded in different current formats, in the 6 bit current format, in the 8 bit current format and in the 9 bit current format:



Current values are

- Motor current I_{max} (6 bit current format)
- Phase currents $I_{L1\ max}$, $I_{L2\ max}$, $I_{L3\ max}$ (8 bit current format)
- Last tripping current (9 bit current format)
- Maximum tripping current (9 bit current format)

Statistics data on device service life

- Operating hours
  The motor starter records 2 operating hour values:
  - The operating hours of the motor.
    This indicates how long the motor was switched on.
  - The operating hours of the equipment (motor starter).
    This indicates how long the DC24V-NS supply voltage of the motor starter was switched on.
- Number of overload trips
  The motor starter counts the number of overload trips in the range from 0 to 65.535.
- Number of motor cw / ccw starts
  The motor starter counts the number of starts in the range from 0 to 16,777,215.
  Example: If the current in the main circuit is flowing after the "Motor ON" command, the value is increased by 1.
- Motor current $I_{max.}$
  The motor starter measures the current in all 3 phases and displays the current of the highest loaded phas in percent [%] of the current set I_e.
  Datenformat: 1 byte, 8 bit current format
  Example: Current set I_e = 10 A
  Motor current displayed 110 %
  then corresponds to 10 A x 1.1 = 11 A
  All 3 phase currents are available in data record 94
- Last tripping current
  The motor starter measures the current in all 3 phases and displays the current flowing at the time of tripping in the maximum loaded phase in percent [%] of the current set I_e and in amperes [A]
  Datenformat: 2 byte, 9 bit current format
  Example: Current set I_e = 10 A
  Motor current displayed 455 % then corresponds to 10 A x 4.55 = 45.5 A

Statistics data for slave pointer

Slave points are used for preventative diagnostics:
The maximum measurement is stored on the device.
The higher level PLC can obtain the measurement at any time.
The higher-level PLC can reset the measurement at any time.

The data below are available as slave pointer:

- Number of motor overload trips
- Operating hours motor current = 18 ... 49.9 % of I_e
- Operating hours motor current = 50 ... 89.9 % of I_e
- Operating hours motor current = 90 ... 119.9 % of I_e
- Operating hours motor current = 120 ... 1000 % of I_e
- Maximum trip current $I_{A\ max}$ (%)
- Maximum trip current $I_{A\ max}$ (eff)
- Phase current $I_{L1\ max}$ to $I_{L3\ max}$. Maximum phase current as a percentage [%] of current setting I_e and in amperes [A].
  Data format: Each 1 byte, 8 bit current format.
  The maximum phase current measured is saved per phase.

A.2 Error codes

Error codes with negative data record acknowledgement

Description

When a data record is rejected, an error code is sent with the negative acknowledgement, both via the device interface and via the bus interface. This provides information on the reason for the negative acknowledgement.

The error codes conform to the PROFIBUS-DPV1 standard assuming they apply to the motor starter.

Evaluation via local device interface with Motor Starter ES

The error codes are evaluated by the Motor Starter ES parameterization and diagnostics software and displayed in plain text.

More information on this can be found in the Motor Starter ES online help system.

Evaluation via field bus

The error codes are sent in the field bus response telegram.

Error codes

The following error codes are generated by the motor starter:

Byte error codes		Error message	Cause
high	low		
00_H	00_H	No faults	—
Communication interface			
80_H	$A1_H$	Negative acknowledgement with "Write data record"	• Data record only readable
80_H	$A2_H$	Protocol error	• Layer 2 (field bus) • Device interface • Incorred coordination
80_H	$A9_H$	Function not supported	• DPV1 service does not support read / write data record
80_H	$B5_H$	PROFIenergy data record read without prior writing	• Invalid status
80_H	CF_H	Incorrect data record	• Incorrect coordination with list parameterization via DS128 • Incorrect data record sequence with list parameterization via DS128
Access to technology			
80_H	$B0_H$	Unknown data record number (DS-Nr)	• DS no. in motor starter not known
80_H	$B1_H$	Incorrect data record length during writing	• DS length and specified DS length do not match
80_H	$B2_H$	Incorrect slot number	• Slot not 1 or 4
80_H	$B4_H$	Incorrect data record length during reading	• DS length ≠ specified DS length Ask for DS with correct length
80_H	$B6_H$	Communication partner has declined the data transfer	• Incorrect operating mode (automatic, manual bus, manual local) • Data record is only readable • Parameter change in ON status not permissible
80_H	$B8_H$	Invalid parameter	• Invalid parameter value

Byte error codes		Error message	Cause
high	low		
Device resources			
80_H	$C2_H$	Temporary resource lack in device	• No free reception buffer • Data record currently being updated • Data record job currently active on another interface

A.3 Data records

Writing / reading of data records with STEP 7

Note
Data sets can only be used for motor starters with article numbers 3RK1301-xxxxx-xAB4!

You can access the motor starter data records from the user program.

- Writing data records:
  S7-DPV1 Master: By calling the SFB 53 "WR_REC" or SFC 58
  S7-Master: By calling the SFC 58
- Reading data records:
  S7-DPV1 Master: By calling the SFB 52 "RD_REC" or SFC 59
  S7-Master: By calling the SFC 59

Note
SFC 58 and 59 cannot be used with PROFINET. These modules **only** function with PROFIBUS.
For PROFINET, modules SFB 52 and 53 should be used. These also function with PROFIBUS.

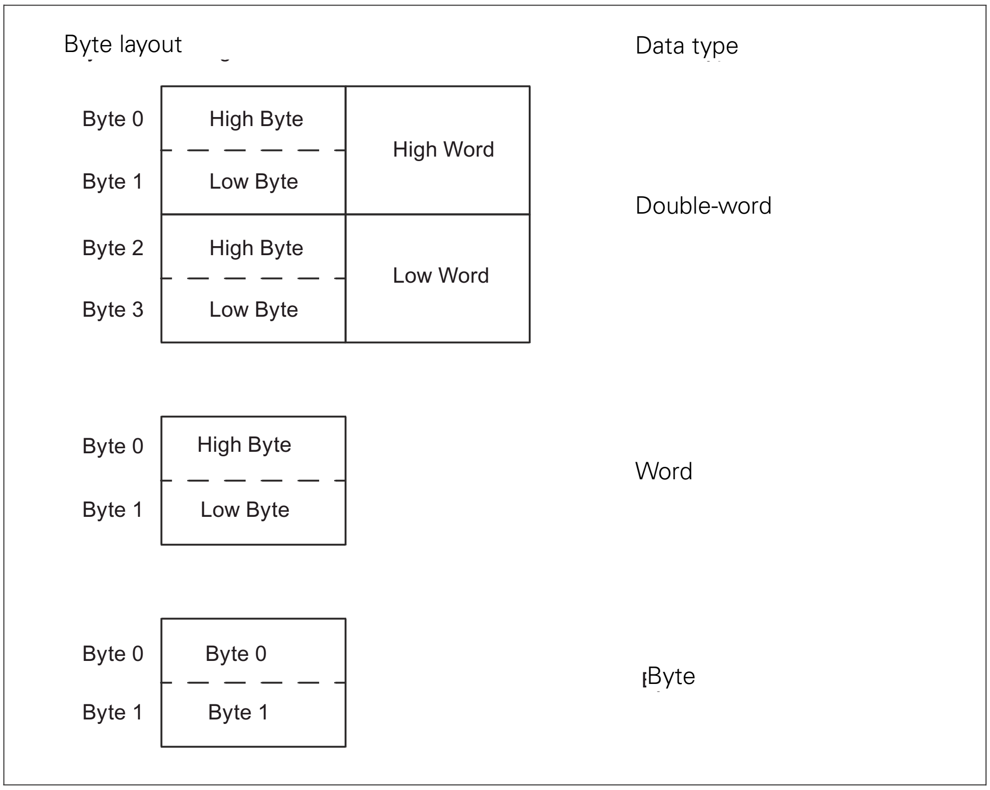
More information

Other information on the SFBs can be found

- in the reference manual "System software for S7-300 / 400, system and standard functions"
- in the STEP 7 online help

Byte layouts

If data that are longer than a byte are stored, the bytes have the following layouts ("big endian"):



A.4 DS68 - Read/write process output images

Note
Note that data record 68 in automatic operating mode is overwritten by the cyclical process image!

Byte	Meaning	
	Header	
0	Coordination	0x21 writing via C1 channel (PLC)
1	Reserved	
2	Reserved	
3	Reserved	
	Process output images	
4	Process data DO 0.0 to DO 0.7, bottom table	
5	Process data DO 1.0 to DO 1.7, bottom table	
6	Reserved	
7	Reserved	

Byte. bit	Coding	Process data	Meaning	Relevant for
4.0	1 = active	DO 0.0	Motor cw	all
4.1		DO 0.1	Motor ccw	RS1e-x
4.2		DO 0.2	Brake actuation	all [1)]
4.3		DO 0.3	Trip Reset	all
4.4		DO 0.4	Emergency start	all
4.5		DO 0.5	Self-test	all
4.6		DO 0.6	—	—
4.7		DO 0.7	—	—
5.0	1 = active	DO 1.0	—	—
5.1		DO 1.1	—	—
5.2		DO 1.2	—	—
5.3		DO 1.3	—	—
5.4		DO 1.4	—	—
5.5		DO 1.5	—	—
5.6		DO 1.6	—	—
5.7		DO 1.7	Quick stop lock	all [3)]

[1)] Only relevant in conjunction with a brake xB1 to xB6
[3)] Only in conjunction with 2DI COM/2DI LC COM control module (optional)

A.5 DS69 - Read/write process input images

Byte	Meaning
Process input images	
0	Process data DI 0.0 to DI 0.7, bottom table
1	Process data DI 1.0 to DI 1.7, bottom table
2	Reserved
3	Reserved

Byte. bit	Coding	Process data	Meaning	Relevant for
0.0	1 = active	DI 0.0	Ready (automatic)	all
0.1		DI 0.1	Motor on	all
0.2		DI 0.2	Group error	all
0.3		DI 0.3	General warning	all
0.4		DI 0.4	Input 1	all [1)]
0.5		DI 0.5	Input 2	all [1)]
0.6		DI 0.6	Input 3	all [3)]
0.7		DI 0.7	Input 4	all [3)]
1.0	1 = active	DI 1.0	Actual motor current I_{act} [%] bit 0	all
1.1		DI 1.1	Actual motor current I_{act} [%] bit 1	all
1.2		DI 1.2	Actual motor current I_{act} [%] bit 2	all
1.3		DI 1.3	Actual motor current I_{act} [%] bit 3	all
1.4		DI 1.4	Actual motor current I_{act} [%] bit 4	all
1.5		DI 1.5	Actual motor current I_{act} [%] bit 5	all
1.6		DI 1.6	Manual operation local	all [3)]
1.7		DI 1.7	Ramp operation	DSS1e-x

[1)] Only relevant in conjunction with a brake xB6
[3)] Only in conjunction with 2DI COM/2DI LC COM control module (optional)

A.6 DS72 Read log book - device errors

Byte	Coding	Meaning	Value range	Increment
		Net data (= technology data)		
		Entry 1 (= latest entry)		
0 ... 3	Unsign. 32	Operating hours device	0 ... 4,294,967,295	1 s
4 ... 5	Unsign. 16	Object number	0 ... 32,767	1
		Entry 2		
6 ... 9	Unsign. 32	Operating hours device	0 ... 4,294,967,295	1 s
10 ... 11	Unsign. 16	Object number	0 ... 32,767	1
... ...				
		Entry 21		
120 ... 123	Unsign. 32	Operating hours device	0 ... 4,294,967,295	1 s
124 ... 125	Unsign. 16	Object number	0 ... 32,767	1

This data record can take up to 21 inputs. When all positions have been described, the oldest entry is overwritten.

Note
The most recent entry is entered at the first position in the data record. The remaining entries are moved downwards one entry.

The following object numbers are supported:

Object no.	Device error - Messages
453	Interface for current detection faulty
456	EEPROM: Memory faulty
457	EEPROM: CRC error "Fixed value parameter"
458	EEPROM: CRC error "Device parameter"
460	EEPROM: contains invalid data!
461	EEPROM: Value for "Parameterization lock CPU / master" invalid
462	EEPROM: Pointer for device parameter memory invalid
308	Switching element defective
1414	Switching element shortcircuited

A.7 DS73 Read log book - trips

Byte	Coding	Meaning	Value range	Increment
		Net data (= technology data)		
		Entry 1 (= latest entry)		
0 ... 3	Unsign. 32	Operating hours device	0 ... 4,294,967,295	1 s
4 ... 5	Unsign. 16	Object number	0 ... 32,767	1
		Entry 2		
6 ... 9	Unsign. 32	Operating hours device	0 ... 4,294,967,295	1 s
10 ... 11	Unsign. 16	Object number	0 ... 32,767	1
... ...				
		Entry 21		
120 ... 123	Unsign. 32	Operating hours device	0 ... 4,294,967,295	1 s
124 ... 125	Unsign. 16	Object number	0 ... 32,767	1

This data record can take up to 21 inputs. When all positions have been described, the oldest entry is overwritten.

Note
The most recent entry is entered at the first position in the data record. The remaining entries are moved downwards one entry.

The following object numbers are supported:

Object no.	Trips - Messages
309	Overload switching element
317	Electronics power supply too low
318	Switching element power supply missing
327	Thermal motor model overload
333	Circuit-breaker tripped
334	I_e limit value exceeded
335	I_e limit value not reached
338	Zero current shutdown
341	Asymmetry shutdown
348	Input tripping
354	Sensor supply overload
355	Process image error
365	Invalid parameter value
381	Error during self-test (= device error)
1406	Cold run shutdown
1201	Blocking protection triggered during startup
1202	Blocking protection triggered during operation

A.8 DS75 Read log book - events

Byte	Coding	Meaning	Value range	Increment
		Net data (= technology data)		
		Entry 1 (= latest entry)		
0 ... 3	Unsign. 32	Operating hours device	0 ... 4,294,967,295	1 s
4 ... 5	Unsign. 16	Object number	± 0 ... 32,767	1
		Entry 2		
6 ... 9	Unsign. 32	Operating hours device	0 ... 4,294,967,295	1 s
10 ... 11	Unsign. 16	Object number	± 0 ... 32,767	1
... ...				
		Entry 21		
120 ... 123	Unsign. 32	Operating hours device	0 ... 4,294,967,295	1 s
124 ... 125	Unsign. 16	Object number	± 0 ... 32,767	1

This data record can take up to 21 inputs. When all positions have been described, the oldest entry is overwritten.

Note
The most recent entry is entered at the first position in the data record. The remaining entries are moved downwards one entry.

The following object numbers are supported:

Object no.	Event - Messages
	Advance warnings
1419	± prewarning limit - time-based trigger reserve not reached
1420	± prewarning limit - motor heating exceeded
1457	± maintenance required
	Warnings
327	± Thermal motor model overload
333	± Power switch triggered
334	± I_e limit value not reached
335	± I_e limit value exceeded
337	± Zero curernt detected
340	± Asymmetry detected
351	± Warning input
318	± Switching element power supply missing
1458	± Maintenance required
	Actions
310	± Emergency start active
357	Automatic operating mode
358	Manual operating mode - bus
1443	Manual bus - PC controlling
359	Manual operation local
1444	Manual local - input controlling
1446	Manual local - PC controlling
360	± Lost connection in manual operating mode
363	Slave pointer deleted
365	Invalid parameter value
366	Parameter change in ON status not permissible
368	± Parameterization lock CPU/Master active
369	Factory setting restored
1302	Log book - trips cleared
1303	Log book - events cleared
1520	± Energy-saving mode active

±: Event is entered as an "incoming" (+) and "outgoing" (-) event, other messages are only entered as "incoming" messages

A.9 DS81 Read basic (factory) setting

In layout and content, data record 81 matches data record 131. Data record 81 provides the default values for all parameters of DS131.

A.10 DS92 Read device diagnostics

Byte.bit	Coding	Meaning	Relevant (X) for	
			DS1e-x / RS1e-x	**DSS1e-x**
0.0	1 = active	Ready (automatic)	X	X
0.1		Motor cw	X	X
0.2		Motor ccw	only RS1e-x	—
0.3		Overload switching element	X	X
0.4		Switching element defective	X	X
0.5		Emergency start active	X	X
0.6		Group error	X	X
0.7		General warning	X	X
1.0	1 = active	Switching element power supply missing	X	X
1.2		Interlock active	only RS1e-x	—
1.3		Startup active	—	X
1.4		Run-down active	—	X
1.5		Brake output active	X	X
2.3	1 = active	Thermal motor model overload	X	X
2.4		Overload shutdown	X	X
2.5		Pause time active	X	X
2.6		Cooldown time active	X	X
3.2	1 = active	Circuit-breaker tripped	X	X
3.7		Input control	X	X
4.0		Asymmetry detected	X	X
4.1		Asymmetry shutdown	X	X
4.2		I_e limit value exceeded	X	X
4.3		I_e limit value not reached	X	X
4.4		I_e limit value shutdown	X	X
4.5		Residual current detected	X	X
4.6		Zero current shutdown	X	X
4.7		Motor blocking shutdown	X	X
5.0	1 = active	Input 1	X	X
5.1		Input 2	X	X
5.2		Input 3	X	X
5.3		Input 4	X	X

Byte.bit	Coding	Meaning	Relevant (X) for	
			DS1e-x / RS1e-x	DSS1e-x
5.4	1 = active	Input tripping	X	X
5.5		Shutdown input at limit position, clockwise rotation	X	X
5.6		Warning input	X	X
5.7		Shutdown input at limit position, counterclockwise rotation	X	X
6.3	1 = active	Sensor supply overload	X	X
6.4		Trip reset completed	X	X
6.5		Trip reset not possible	X	X
6.6		Slave pointer deleted	X	X
6.7		Electronics power supply too low	X	X
7.0	1 = active	Bus fault	X	X
7.1		CPU/master STOP	X	X
7.2		Automatic operating mode	X	X
7.3		Manual bus operating mode (remote control)	X	X
7.4		Manual local operating mode (local control)	X	X
7.6		Lost connection in manual operating mode	X	X
7.7		Process image error	X	X
8.0	1 = active	Parameterization active	X	X
8.1		Invalid parameter value	X	X
8.2		Parameter change in ON status not permissible	X	X
8.3		Parameterization lock CPU / Master active	X	X
8.4		No external startup arameter er hold	X	X
9.0	1 = active	Self-test active	X	X
9.1		Self-test ok	X	X
9.2		Error during self-test	X	X
9.3		Factory setting restored	X	X
10		Object no. (low byte) (= incorrect parameter name)	X	X
11	0x00	Object no. (high byte)	X	X
18.0	1 = active	BO output active	X	X

Byte.bit	Coding	Meaning	Relevant (X) for	
			DS1e-x / RS1e-x	**DSS1e-x**
		Switching / controlling		
19.1	1 = active	Start-ready for motor on	X	X
19.2		Switching element shortcircuited	X	X
		Communication		
22.0	1 = active	Automatic operating mode (redundant to bits 7.2)	X	X
22.1		Manual bus operating mode (redundant to bits 7.3)	X	X
22.2		Manual bus - PC controlling	X	X
22.3		Manual local operating mode (redundant to bits 7.4)	X	X
22.4		Manual local - input controlling	X	X
22.6		Manual local - PC controlling	X	X
Advance warnings				
24.0	1 = active	Group prewarning	X	X
24.2		Advance warning limit - time-based trigger reserve not reached	X	X
24.3		Advance warning limit - motor heating exceeded	X	X
		Maintenance		
26.0	1 = active	Maintenance required	X	X
26.1		Maintenance request	X	X
27.0	1 = active	Maintenance timer limit value_1 exceeded	X	X
27.1		Maintenance timer limit value_2 exceeded	X	X

A.11 DS93 Write command

Structure of the command data record:

Byte	Meaning	Note
Command data record		
Header		
0	Coordination	0x21 writing via C1 channel (PLC)
1	Reserved	
2	Reserved	
3	Reserved	
Command		
4	No. of commands	Value range 1 ... 5 Number of subsequent valid commands
5	Command 1	coding, see table below
6	Command 2	optional (coding, see table below)
7	Command 3	optional (coding, see table below)
8	Command 4	optional (coding, see table below)
9	Command 5	optional (coding, see table below)

Write command

Object no.	Coding	Command	Meaning
1-byte commands			
0	0	Reserved	no function
703	1	Trip Reset	Reset and acknowledgement of error messages
713	2	Emergency start ON	—
714	3	Emergency start OFF	—
709	4	Automatic operating mode	Transfer to automatic operating mode (control via DP master)
 710 711 712	5	Operating mode - Manual - Bus - On-site	Transfer to manual operating mode. In the process, the motor starter switches over in manual bus operating mode or manual local operating mode, depending on the interface via which the command is received.
701	6	Factory setting	Restore factory setting of the parameters from DS131. (Only possible in "Manual" operating mode.)
704	7	Clear slave pointer	The measurements for preventative diagnostics are cleared (= 0).
702	9	Re-start	Trigger re-start (as after mains ON), e. g. nach re-assignment of the station address. (Only possible in "Manual" operating mode.)
707	10	Parameterization lock CPU / Master ON	No parameterization possible via parameterizing master, or its parameters will be ignored
708	11	Parameterization lock CPU / Master OFF	Parameterization possible via parameterizing master

Object no.	Coding	Command	Meaning
		1-byte commands	
705	13	Clear log book trips	Clear log book with recorded causes of error.
706	14	Clear log book events	Clear log book with recorded warning messages and specific actions.
717	15	Cold run ON	Permits the activation of the switching contacts without main energy
718	16	Cold run OFF	Switches the "cold run" function off
719	17	Clear maintenance timer	Clears the timer for the maintenance function
	18 ... 255	Reserved	

A.12 DS94 Read measurements

Byte. bit	Meaning	Value range / [coding]	Incre- ment	Relevant for
		Measurements (= volatile!)		
0	Phase current $I_{L1(\%)}$	0 ... 797 %	3.125 %	all
1	Phase current $I_{L2(\%)}$	0 ... 797 %	3.125 %	all
2	Phase current $I_{L3(\%)}$	0 ... 797 %	3.125 %	all
4 ... 5	Remaining cool-down time of the motor	0 ... 30 min	100 ms	all
6.0 ... 6	Motor heating	0 ... 200 % / [0 ... 100]	2 %	all
6.7	Asymmetry	[0]: No asymmetry [1]: Asymmetry (≥ 40 %)	—	all
7	Value for asymmetry	0 ... 100 % / [0 ... 100]	1 %	all
28 ... 31	Phase current $I_{L1(eff)}$	0 ... 20 A	0.01 A	all
32 ... 35	Phase current $I_{L2(eff)}$	0 ... 20 A	0.01 A	all
36 ... 39	Phase current $I_{L3(eff)}$	0 ... 20 A]	0.01 A	all
46 ... 47	Time-based triggering of the thermal motor model	0 ... 6.500 s	0.1 s	all

A.13 DS95 Read statistics

Byte	Meaning	Value range / [coding]	Incre-ment	Rele-vant for
0	Motor current I_{max}	0 ... 797 %	3.125 %	all
1	Reserved	—	—	—
2 ... 3	Last trigger current	0 ... 1000 %	3.125 %	all
4 ... 7	Operating hours device	0 ... 4,294,967,295	1 s	all
8 ... 11	No. of starts, motor cw	0 ... 4,294,967,295	1	all
12 ... 15	No. of starts, motor ccw	0 ... 4,294,967,295	1	only RS1e-x
16 ... 17	Number of overload trips	0 ... 65535	1	all
20 ... 23	Motor current $I_{max(eff)}$	0 ... 20 A	0.01 A	all
24 ... 27	Last trip current $I_{A(eff)}$	0 ... 20 A	0.01 A	all
28 ... 31	Operating hours - motor	0 ... 4,294,967,295	1 s	all
32 ... 35	Operating hours - motor current = 18 ... 49.9 % x I_{emax}	0 ... 4,294,967,295	1 s	all
36 ... 39	Operating hours - motor current = 50 ... 89.9% x I_{emax}	0 ... 4,294,967,295	1 s	all
40 ... 43	Operating hours - motor current = 90 ... 119.9 % x I_{emax}	0 ... 4,294,967,295	1 s	all
44 ... 47	Operating hours - motor current = 120 ... 1000% x I_{emax}	0 ... 4,294,967,295	1 s	all
50 ... 51	Number of switching element overload trips	0 ... 65,535	1	all
54 ... 55	No. of short-circuit trips	0 ... 65,535	1	all
56 ... 59	No. of stops with mechanical braking	0 ... 4,294,967,295	1	all
80 ... 83	No. of starts output BO	0 ... 4,294,967,295	1	all
84 ... 87	Maintenance timer	0...4.294.967.295 s	1 s	all

Operating hours
The motor starter records 2 operating hours values:
The operating hours of the motor indicate how long the switching elements and therefore the motor were switched on.
The operating hours of the equipment (motor starter) indicate how long the DC24V-NS supply voltage of the motor starter was switched on.

A.14 DS96 Read slave pointer

The slave pointers store the extreme values of individual measurements in the time sequence. Slave pointers can be cleared or reset to "0" by the user using the "Clear slave pointer" command.

Statistics data on preventative diagnostics (slave pointer)

Byte	Slave pointer	Value range / [coding]	Incre-ment
0	Reserved	no function	
1	Reserved	no function	
2	Reserved	no function	
3	Reserved	no function	
4	Phase current $I_{L1\ min}$(%)	0 ... 796.9 %	3.125 %
5	Phase current $I_{L2\ min}$(%)	0 ... 796.9 %	3.125 %
6	Phase current $I_{L3\ min}$(%)	0 ... 796.9 %	3.125 %
8	Phase current $I_{L1\ max}$(%)	0 ... 796.9 %	3.125 %
9	Phase current $I_{L2\ max}$(%)	0 ... 796.9 %	3.125 %
10	Phase current $I_{L3\ max}$(%)	0 ... 796.9 %	3.125 %
12 ... 13	Maximum trip current $I_{A\ max}$(%)	0 ... 1,000 %	3.125 %
14 ... 15	Number of motor overload trips	0 ... 65,535	1
16 ... 19	Maximum trip current $I_{A\ max}$(eff)	± 0 ... 20 A	0.01 A
20 ... 23	Phase current $I_{L1\ min}$(eff)	± 0 ... 20 A	0.01 A
24 ... 27	Phase current $I_{L2\ min}$(eff)	± 0 ... 20 A	0.01 A
28 ... 31	Phase current $I_{L3\ min}$(eff)	± 0 ... 20 A	0.01 A
32 ... 35	Phase current $I_{L1\ max}$(eff)	± 0 ... 20 A	0.01 A
36 ... 39	Phase current $I_{L2\ max}$(eff)	± 0 ... 20 A	0.01 A
40 ... 43	Phase current $I_{L3\ max}$(eff)	± 0 ... 20 A	0.01 A
64 ... 67	Operating hours - motor current = 18 ... 49.9 % x I_e	0 ... 4,294,967,295	1 s
68 ... 71	Operating hours - motor current = 50 ... 89.9 % x I_e	0 ... 4,294,967,295	1 s
72 ... 75	Operating hours - motor current = 50 ... 119.9 % x I_e	0 ... 4,294,967,295	1 s
76 ... 79	Operating hours - motor current = 120 ... 1000 % x I_e	0 ... 4,294,967,295	1 s

A.15 DS 100 Read device identification

Byte	Length	Value	Meaning
			Header
0 ... 3	4	0x00	Reserved
			Device identification (TF)
4 ... 11	8	...	Time stamp[1)]
12 ... 31	20	Siemens AG	Manufacturer
32 ... 55	24	—	MLFB
56	1	0x01	Device range: load branch
57	1	0x01	Device sub-range: Motor starters
58	1	0x01 0x02 0x03	Device class: e. g. direct starter/reversing starter/direct soft starter
59	1	0x48	System: PROFIBUS
60	1	0x4B	Functional group
61	1	0x00	Reserved
62 ... 77	16	—	Product code
78 ... 81	4	E ...	Hardware verion
82	1	DS1e-x 0x01 RS1e-x 0x11 DSS1e-x 0x21	ID number (Byte0)
83	1	0x00	ID number (Byte1)
84	1	0x00	ID number (Byte2)
85	1	0x00	ID number (Byte3)
88 ... 95	8	...	Service number
96 ... 99	4	V ...	Firmware version

1) Time stamp: Time of the factory initialization with basic factory settings, see table below

Object name		id_date							
Object length		8 bytes							
Bits	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
Octet									
1	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	0 to 59 999 milliseconds
2	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	
3	res	res	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	0 to 59 minutes
4	SU	res	res	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	0 to 23 hours SU: 0: Normal time, 1: Summer time
	Day of the week			Day of the month					1 to 7; 1 = Monday, 7= Sunday
5	2^{2}	2^{1}	2^{0}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	1 to 31
6	res	res	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	1 to 12 months
7	res	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	0 to 99 years; 0 = 2000
8	res	res	res	res	res	res	res	res	Reserved

A.16 DS131 Read / write device parameters

Complete data records can be exchanged with the system via the acyclical channel (PROFIBUS) and the NRT channel (PROFINET) during ongoing operation.
It is advisable that you first export data record 131 with the current parameters from the motor starter, change the relevant parameters and then write them back to the motor starter.

DS131 Byte	Parameters	Value range	Incre-ment	default	Rele-vant for
0	Coordination	with startup parameterization: 0x20 writing via C1 channel (PLC) with parameterization in operation: 0x21 writing via C1 channel (PLC)			
1...3	Reserved	not used		[0]	
4...7	Devicefunctions_2	Content MLFB-specific			
8...11	Devicefunctions_1				
14 and 15	Rated operating current Ie A	0.15 ... 2.0 A 1.5 ... 12 A	10 mA	0.15[1)] / 2.0[2)] 1.5[1)] / 12.0[2)]	all starters
16.0	Load type	[0] 3-phase motor [1] 1-phase motor		[0]	DS1e-x RS1e-x
16.1	Non-resetting on voltage failure	[0] No [1] Yes		[1]	all starters
17	Prewarning limit value - motor heating	0 ... 95%; 0 = deactivated	5%	[0]	all starters
18	Response with overload Thermal motor model	[0] shutdown without re-start [1] shutdown with re-start [2] Warning		[0]	all starters
19	Tripping class (2 A, 12 A)	0] CLASS 10 [1] CLASS 20 [3] CLASS 5 (10a) [4] CLASS 15 [15] CLASS OFF	5, (10a) 10, 15, 20 CLASS OFF	[0]	all starters
20	Recovery time	1min … 30min	0.5min	[3]	all starters
21	Idle time	0s ... 255s; 0 = deactivated	1s	[0]	all starters
22 ... 23	Prewarning limit - time trip reserve	0s ... 500s; 0 = deactivated	1s	[0]	all starters

1) Configuring using GSD / HSP
2) Device factory setting

DS131 Byte	Parameters	Value range	Incre-ment	default	Rele-vant for
24.0 ... 24.1	Response on overload - temperature sensor	[0] shutdown without re-start [1] shutdown with re-start [2] Warning		[0]	all starters
24.4 ... 24.6	Temperature sensor	[0] deactivated [1] thermoclick [2] PTC type A		[0]	all starters
24.7	Temperature sensor monitoring	[0] No [1] Yes		[1]	all starters
28	Lower current limit	[6-32] 18.75%...100% [0] deactivated	3.125%	18.75%	all starters
29	Upper current limit	[16-128] 50%... 400% [0] deactivated	3.125 %	112.5%	all starters
30	Blocking current	150% ... 1000%	50%	[16]	all starters
		150%...800%			DSS1e-x
32.0 ... 32.3	Blocking time	1s ... 5s	0.5s	[2]	all starters
32.4 ... 32.5	Response with supply voltage switching ele-ments missing	[0] Group error [1] Group error only with ON command [2] Group warning		[0]	all starters
32.6	Response to current limit violation	[0] Warning [1] Shutdown		[0]	all starters
32.7	Response to residual current detection	[0] Warning [1] Shutdown		[1]	all starters
33.0 ... 33.1	Response with power switch OFF	[0] Group error [1] Group error only with ON command [2] Group warning		[0]	all starters
34.0...2	Asymmetrical limit value	30% ... 60% [0] deactivated	10%	[3]	all starters
34.6	Response to asymme-try	[0] Warning [1] Shutdown		[1]	all starters
36	Interlock time	0s - 60 s Note: Lock time = 0 means a min. time of approx. 150 ms for safety reasons!	1s	[0]	RS1e-x
37	Input signal extension	0ms - 200ms	10ms	[0]	all starters
38.0 ... 38.2	Input signal delay	10ms - 80ms	10ms	10ms	all starters

DS131 Byte	Parameters	Value range	Incre-ment	default	Rele-vant for
38.4	Input 1 - level	[0] NC contact [1] NO contact	—	[1]	all starters
38.5	Input 2 - level	[0] NC contact [1] NO contact	—	[1]	all starters
38.6	Input 3 - level	[0] NC contact [1] NO contact	—	[1]	all starters
38.7	Input 4 - level	[0] NC contact [1] NO contact			all starters
39.0 ... 39.3	Input 1 - action NO contact / NC contactr NO contact / NC contactr NO contact / NC contactr NO contact / NC contactr NO contact / NC contactr NO contact / NC contactr NO NO NO NO contact / NC contactr NO NO	[0] no action [1] Shutdown without re-start [2] Shutdown with re-start [3] Shutdown end position clockwise [4] Shutdown end position counter-clockwise [5] Group warning [6] Manual operation local [7] Emergency start [8] Motor cw [9] Motor ccw (with RS only) [11] Quick stop [12] Trip reset [13] Cold run	—	[0]	all starters
39.4 ... 39.7	Input 2 - action NO contact / NC contactr NO contact / NC contactr NO contact / NC contactr NO contact / NC contactr NO contact / NC contactr NO contact / NC contactr NO NO NO NO contact / NC contactr NO NO	[0] no action [1] Shutdown without re-start [2] Shutdown with re-start [3] Shutdown end position clockwise [4] Shutdown end position counter-clockwise [5] Group warning [6] Manual operation local [7] Emergency start [8] Motor cw [9] Motor ccw (with RS only) [11] Quick stop [12] Trip reset [13] Cold run	—	[0]	all starters

DS131 Byte	Parameters	Value range	Incre-ment	default	Rele-vant for
40.0 ... 40.3	Input 3 - action NO contact / NC con-tactr NO contact / NC con-tactr NO contact / NC con-tactr NO contact / NC con-tactr NO contact / NC con-tactr NO contact / NC con-tactr NO NO NO NO contact / NC con-tactr NO NO	[0] no action [1] Shutdown with-out re-start [2] Shutdown with re-start [3] Shutdown end position clockwise [4] Shutdown end position counter-clockwise [5] Group warning [6] Manual operation local [7] Emergency start [8] Motor cw [9] Motor ccw (with RS only) [11] Quick stop [12] Trip reset [13] Cold run	—	[0]	all starters
40.4 ... 40.7	Input 4 - action NO contact / NC con-tactr NO contact / NC con-tactr NO contact / NC con-tactr NO contact / NC con-tactr NO contact / NC con-tactr NO contact / NC con-tactr NO NO NO NO contact / NC con-tactr NO NO	[0] no action [1] Shutdown with-out re-start [2] Shutdown with re-start [3] Shutdown end position clockwise [4] Shutdown end position counter-clockwise [5] Group warning [6] Manual operation local [7] Emergency start [8] Motor cw [9] Motor ccw (with RS only) [11] Quick stop [12] Trip reset [13] Cold run	—	[1]	all starters
41.0	Input 1 - signal	[0] non-retentive / [1] retentive		[0]	all starters
41.1	Input 2 - signal	[0] non-retentive / [1] retentive		[0]	all starters
41.2	Input 3 - signal	[0] non-retentive / [1] retentive		[0]	all starters
41.3	Input 4 - signal	[0] non-retentive / [1] retentive		[0]	all starters
46	starting time	0 ... 30 s [0] minimum ramp (100 ms)	0.25 s	5s [20]	DS1e-x RS1e-x

DS131 Byte	Parameters	Value range	Incre-ment	default	Rele-vant for
47	Coasting down time	0 ... 30 s [0] function deactivated	0.25 s	[0s]	DS1e-x RS1e-x
48	starting voltage	20 ... 100 % [4 ... 20]	5%	[40%]	DS1e-x RS1e-x
49	Stop voltage	20 ... 90 % [4 ... 18]	5%	[40%]	DS1e-x RS1e-x
50	Current limiting value	125 ... 600 % Where $I_e \geq 9$ A → 125 % ... 50 %	3.125%	[600%]	DS1e-x RS1e-x
51.0 ... 51.3	Startup mode	[0] direct [1] voltage ramp [4] current limit [5] voltage ramp + current limit		[0]	DS1e-x RS1e-x
51.4 ... 51.7	Ramp-down mode	[0] free ramp-down [1] voltage ramp		[0]	DS1e-x RS1e-x
52 ... 53	Replacement value	→ see POI		[0]	all starters
56.6	Group diagnosis	[0] lock [1] enable		[0]	all starters
56.7	Response to CPU/ master STOP	[0] Switch replace-ment value [1] Retain last value		[0]	all starters
58 ... 59	Enable delay of the brake when starting	- 2.5s...2.5s	0.01s	0s	all starters
60 ... 61	Holding time of the brake when stopping	0...25s	0.01s	0s	all starters
73	reserved (for input level)				
93.0 ... 93.1	Output 1 - level	[0]: not inverted [1]: inverted [2 ... 3]: Reserved		[0]	
93.2 ... 93.3	Output 2 - level	[0]: not inverted [1]: inverted [2 ... 3]: Reserved		[0]	
94.0 ... 94.3	Output 1 - level	[0]: steady [1]: flashing [6 ... 15]: Reserved		[0]	
94.4 ... 94.7	Output 2 - level	[0]: steady [1]: flashing [6 ... 15]: Reserved		[0]	

DS131 Byte	Parameters	Value range	Incre-ment	default	Rele-vant for
96	Output 1 - action	[00]: No action [01]: Control source POI DO 1.0 [02]: Control source POI DO 1.1 [03]: Control source POI DO 0.2 [06]: Control source input 1 [07]: Control source input 2 [08]: Control source input 3 [09]: Control source input 4 [10]: Ramping up [11]: Operation / jumper [12]: Ramp-down [13]: Duty cycle (RUN) [14]: Control com-mand "motor ON" (ON) [17]: Brake output [18]: Device ON [30]: Group prewarn-ing [31]: General warning [32]: Group error [33]: Bus fault [34]: Device fault [35]: Maintenance required [36]: Maintenance request [38]: Start-ready for motor on		[0]	all starters all starters all starters all starters all starters all starters all starters all starters DS1e-x RS1e-x DS1e-x RS1e-x DS1e-x RS1e-x all starters all starters all starters all starters all starters all starters all starters all starters all starters all starters all starters all starters
97	Output 2 - action	[00]: No action [01]: Control source POI DO 1.0 [02]: Control source POI DO 1.1 [03]: ...[38]: see byte 96		[0]	all starters all starters all starters

DS131 Byte	Parameters	Value range	Incre-ment	default	Rele-vant for
137.0 ... 137.3	Plug monitoring	[0]: deactivated [1]: supply-side		[0]	all starters
137.4 ... 137.7	Response to plug removed	[0]: Group error [1]: Group error only for ON command [2]: General warning		[0]	all starters

MLFB		Device function_2				Device function_1			
		Byte 0	Byte 1	Byte 2	Byte 3	Byte 0	Byte 1	Byte 2	Byte 3
3RK1301-0AB10-0AB4	DS1e-x HF	0x05	0x03	0x00	0x00	0xD9	0xB8	0x08	0x4C
3RK1301-0AB10-1AB4	RS1e-x HF	0x05	0x03	0x00	0x00	0xD9	0xB9	0x08	0x4C
3RK1301-0AB20-0AB4	DSS1e-x HF	0x05	0x03	0x00	0x00	0xD9	0xB8	0x08	0x4C
3RK1301-0BB10-0AB4	DS1e-x HF	0x05	0x03	0x00	0x00	0xD9	0xB8	0x08	0x4C
3RK1301-0BB10-1AB4	RS1e-x HF	0x05	0x03	0x00	0x00	0xD9	0xB9	0x08	0x4C
3RK1301-0BB20-0AB4	DSS1e-x HF	0x05	0x03	0x00	0x00	0xD9	0xB8	0x08	0x4C
3RK1301-0CB10-0AB4	DS1e-x HF	0x05	0x03	0x00	0x00	0xD9	0xB8	0x08	0x4C
3RK1301-0CB10-1AB4	RS1e-x HF	0x05	0x03	0x00	0x00	0xD9	0xB9	0x08	0x4C
3RK1301-0CB20-0AB4	DSS1e-x HF	0x05	0x03	0x00	0x00	0xD9	0xB8	0x08	0x4C

A.17 DS134 Read / write maintenance

Byte	Parameters	Value range	Incre-ment	Factory set-ting
		Header		
0	Coordination	with startup parameterization: 0x20 writing via C1 channel (PLC) with parameterization in operation: 0x21 writing via C1 channel (PLC)		
1 ... 7	Reserved			
		User data		
8 ... 11	Maintenance timer-Warn-ing limit value_1	0 … 4.294.967.295 s	1 s	946.080.000 (30 years)
12 ... 15	Maintenance timer-Warn-ing limit value_2	0 … 4.294.967.295 s	1 s	946.080.000 (30 years)
16 ... 27	Reserved			

A.18 DS165 Read / write comment

Components in a system are assigned a unique identifier by the user during the system configuration that provides information on the installation location and the usage type. The individual components are then assigned the corresponding identification sign local.

Byte	Parameters	Value range	Incre-ment	Factory set-ting
		Header		
0	Coordination	with startup parameterization: 0x20 writing via C1 channel (PLC) with parameterization in operation: 0x21 writing via C1 channel (PLC)		
1 ... 3	Reserved	not used		[0]
4 ... 199		ASCII		

A.19 I&M data

The following I&M (Identification & Maintenance Function) data are supported by all
ET200S[1)] motor starters:

Number	Name	Note
I&M 0	Device identification	Stored by the manufacturer
I&M 1	Equipment identification	entered into the hardware config by the user during the configuration process via the device properties screen
I&M 2	Installation	
I&M 3	Description	

1) from order number suffix: -.A**B**4

A.19.1 DS231 Read device identification

I&M 0

The following data are prepared in data record 231:

Byte	Coding	Meaning	Note
		I&M header	
0 ... 9	0x00	Reserved = 0	—
		I&M0 - data block 0	
10 ... 11	0x002A	MANUFACTURER_ID	42 = m anufacturer name SIEMENS
12 ... 31		ORDER_ID	Order number (MLFB)
32 ... 47		SERIAL_NUMBER	Serial number
48 ... 49		HARDWARE-REVISION	Hardware revision status or product version
50 ... 53		SOFTWARE_REVISION	Firmware version
54 ... 55	0x0000	REV_COUNTER	Not supported
56 ... 57	0x5E10	PROFILE_ID	Device range: Motor starters
58 ... 59	DS1e-x 0x1011 RS1e-x 0x1012 DSS1e-x 0x1013	PROFILE_SPECIFIC_TYPE	Addition to object "PROFILE_ID"
60 ... 61	0x0101	IM_VERSION	I&M version status (01 01hex = version 1.1).
62 ... 63	0x000E	IM_SUPPORTED	supports I&M1, I&M2, I&M3

A.19.2 DS232 Read / write equipment identifier

I&M 1

The following data are saved in data record 232:

Byte	Coding	Meaning	Note
I&M header			
0 ... 9	0x00	Reserved	—
I&M - data block 1			
10 ... 41	ASCII	TAG-FUNCTION	System identifier fill unused positions with blank (ASCII = 0x20)
42 ... 63	ASCII	TAG-LOCATION	Location identifier fill unused positions with blank (0x20)

A.19.3 DS233 Read / write installation

I&M 2

The following data are saved in data record 233:

Byte	Coding	Meaning	Note
I&M header			
0 ... 9	0x00	Reserved	—
I&M - data block 2			
10 ... 25	ASCII	INSTALLATION_DATE	Installation date
26 ... 63	0x00	Reserved	—

A.19.4 DS234 Read / write description

I&M 3

The following data are saved in data record 234:

Byte	Coding	Meaning	Note
I&M header			
0 ... 9	0x00	Reserved	—
I&M - data block 3			
10 ... 63	ASCII	DESCRIPTOR	custom additional information and notes fill unused positions with blank (0x20)

Order numbers

B

B.1 Motor starters

B.1.1 ET 200S DS1-x direct starter; standard / ET 200S RS1-x reversing starter; standard

Adjustment range		Order number	
kW	**A**	**Direct starter (DS1-x)**	**Reversing starter (RS1-x)**
< 0.06	0.14 - 0.20	3RK1301-**0B**B00- 0AA2	3RK1301-**0B**B00- 1AA2
0.06	0.18 - 0.25	3RK1301-**0C**B00- 0AA2	3RK1301-**0C**B00- 1AA2
0.09	0.22 - 0.32	3RK1301-**0D**B00- 0AA2	3RK1301-**0D**B00- 1AA2
0.10	0.28 - 0.40	3RK1301-**0E**B00- 0AA2	3RK1301-**0E**B00- 1AA2
0.12	0.35 - 0.50	3RK1301-**0F**B00- 0AA2	3RK1301-**0F**B00- 1AA2
0.18	0.45 - 0.63	3RK1301-**0G**B00- 0AA2	3RK1301-**0G**B00- 1AA2
0.21	0.55 - 0.80	3RK1301-**0H**B00- 0AA2	3RK1301-**0H**B00- 1AA2
0.25	0.70 - 1.00	3RK1301-**0J**B00- 0AA2	3RK1301-**0J**B00- 1AA2
0.37	0.90 - 1.25	3RK1301-**0K**B00- 0AA2	3RK1301-**0K**B00- 1AA2
0.55	1.10 - 1.60	3RK1301-**1A**B00- 0AA2	3RK1301-**1A**B00- 1AA2
0.75	1.40 - 2.00	3RK1301-**1B**B00- 0AA2	3RK1301-**1B**B00- 1AA2
0.90	1.80 - 2.50	3RK1301-**1C**B00- 0AA2	3RK1301-**1C**B00- 1AA2
1.10	2.20 - 3.20	3RK1301-**1D**B00- 0AA2	3RK1301-**1D**B00- 1AA2
1.50	2.80 - 4.00	3RK1301-**1E**B00- 0AA2	3RK1301-**1E**B00- 1AA2
1.90	3.50 - 5.00	3RK1301-**1F**B00- 0AA2	3RK1301-**1F**B00- 1AA2
2.20	4.50 - 6.30	3RK1301-**1G**B00- 0AA2	3RK1301-**1G**B00- 1AA2
3.00	5.50 - 8.0	3RK1301-**1H**B00- 0AA2	3RK1301-**1H**B00- 1AA2
4.00	7.00 - 10.0	3RK1301-**1J**B00- 0AA2	3RK1301-**1J**B00- 1AA2
5.50	9.00 - 12.0	3RK1301-**1K**B00- 0AA2	3RK1301-**1K**B00- 1AA2

B.1.2 ET 200S High Feature motor starters for Motor Starter ES

The following motor starters are suitable for the "Motor Starter ES" software as of V2.0

Adjustment range		Order number		
kW	**A**	**Direct starter (DS1e-x)**	**Direct soft starter (DSS1e-x)**	**Reversing starter (RS1e-x)**
< 1.1	0.3 - 3	3RK1301-**0A**B**1**0- 0AA3	3RK1301-**0A**B**2**0- 0AA3	3RK1301-**0A**B**1**0- **1**AA3
3	2.4 - 8	3RK1301-**0B**B**1**0- **0**AA3	3RK1301-**0B**B**2**0- **0**AA3	3RK1301-**0B**B**1**0- **1**AA3
7.5	2.4 - 16	3RK1301-**0C**B**1**0- 0AA3	3RK1301-**0C**B**2**0- 0AA3	3RK1301-**0C**B**1**0- **1**AA3
New design with expanded parameterization (see Section 10.6, 'Tripping class')				
< 1.1	0.3 - 3	3RK1301-**0A**B**1**0- 0AA4	3RK1301-**0A**B**2**0- 0AA4	3RK1301-**0A**B**1**0- **1**AA4
3	2.4 - 8	3RK1301-**0B**B**1**0- **0**AA4	3RK1301-**0B**B**2**0- **0**AA4	3RK1301-**0B**B**1**0- **1**AA4
7.5	2.4 - 16	3RK1301-**0C**B**1**0- 0AA4	3RK1301-**0C**B**2**0- 0AA4	3RK1301-**0C**B**1**0- **1**AA4
New design with new functions and extended parameterizations and DPV1 functionality (see Section 10.1, 'Functions - Overview')				
< 1.1	0.3 - 3	3RK1301-0AB10- 0A**B**4	3RK1301-0AB20- 0A**B**4	3RK1301-0AB10- 1A**B**4
3	2.4 - 8	3RK1301-0BB10- 0A**B**4	3RK1301-0BB20- 0A**B**4	3RK1301-0BB10- 1A**B**4
7.5	2.4 - 16	3RK1301-0CB10- 0A**B**4	3RK1301-0CB20- 0A**B**4	3RK1301-0CB10- 1A**B**4

B.1.3 ET 200S fail-safe motor starters with electronic overload protection (F-DS1e-x, F-RS1e-x)

Suitable for the "Motor Starter ES" software

Adjustment range		Order number	
kW	**A**	**Fail-safe direct starter (F-DS1e-x)**	**Fail-safe reversing starter (F-RS1e-x)**
< 1.1	0.3 - 3	3RK1301-**0A**B**13**- 0AA2	3RK1301-**0A**B**13**- **1**AA2
3	2.4 - 8	3RK1301-**0B**B**13**- **0**AA2	3RK1301-**0B**B**13**- **1**AA2
7.5	2.4 - 16	3RK1301-**0C**B**13**- 0AA2	3RK1301-**0C**B**13**- **1**AA2
New design with expanded parameterization (see Section 10.6, 'Tripping class')			
< 1.1	0.3 - 3	3RK1301-**0A**B**13**- 0AA4	3RK1301-**0A**B**13**- **1**AA4
3	2.4 - 8	3RK1301-**0B**B**13**- **0**AA**4**	3RK1301-**0B**B**13**- **1**AA**4**
7.5	2.4 - 16	3RK1301-**0C**B**13**- 0AA4	3RK1301-**0C**B**13**- **1**AA4

B.2 Components for ET 200S motor starters

Description		Model	Order number
Power module	PM-D	for direct and reversing starters	3RK1903-0BA00
Terminal modules	TM-P15 S27-01	for the PM-D power module with terminating cover	3RK1903-0AA00
	TM-DS45-S32	for DS1-x, with power bus infeed, with caps	3RK1903-0AB00
	TM-DS45-S31	for DS1-x, with power bus throughfeed	3RK1903-0AB10
	TM-RS90-S32	for RS1-x, with power bus infeed, with caps	3RK1903-0AC00
	TM-RS90-S31	for RS1-x, with power bus throughfeed	3RK1903-0AC10
	TM-DS65-S32 -01 FS L	for DS1e-x and DSS1e-x, with power bus infeed, with caps	3RK1903-0AK00
	TM-DS65-S31 -01 S	for DS1e-x and DSS1e-x, with power bus throughfeed	3RK1903-0AK10
	TM-RS130-S32 -01 FS L	for RS1e-x, with power bus infeed, with caps	3RK1903-0AL00
	TM-RS130-S31 -01 S	for RS1e-x, with power bus through-feed	3RK1903-0AL10
	TM-FDS65-S32 -01 FS L	for F-DS1e-x, with power bus infeed, with caps	3RK1903-3AC00
	TM-FDS65-S31 -01 S	for F-DS1e-x, with power bus through-feed	3RK1903-3AC10
	TM-FRS130-S32 -01 FS L	for F-RS1e-x, with power bus infeed, with caps	3RK1903-3AD00
	TM-FRS130-S31 -01 S	for F-RS1e-x, with power bus through-feed	3RK1903-3AD10
Spacing module	DM-V15	for installing direct starters with derat-ing	3RK1903-0CD00
Accessories	Caps		3RK1903-0AF00
	Terminal block L1/L2/L3	30 mm, jumper module	3RK1903-0AF00
	L1/L2/L3 terminal block	15 mm, jumper module	3RK1903-0AE00
	PE/N termi-nal block	45 mm, infeed module, with caps	3RK1903-2AA00
	PE/N termi-nal block	45 mm, infeed and jumper module	3RK1903-2AA10
	PE/N termi-nal block	30 mm, jumper module	3RK1903-0AJ00
	PE/N termi-nal block	15 mm, jumper module	3RK1903-0AH00

Description		Model	Order number
Accessories	PE/N terminal block M65-PEN-F	65 mm, infeed module, with caps	3RK1903-2AC00
	PE/N terminal block M65-PEN-S	65 mm, infeed and jumper module	3RK1903-2AC10
	3-phase feed-in terminal for S0	if necessary for power bus infeed for wiring: • solid or stranded: 2.5 to 25 mm^2 • finely stranded with end sleeve: 2.5 to 25 mm^2 • solid or stranded: 12 to 4 AWG	3RV1925-5AB
	Control kit	manual actuation for contactors (only for DS1-x, RS1-x) (5 pcs.)	3RK1903-0CA00
	Control unit	for direct drive of the contactor coils of ET 200S devices (only for DS1-x, RS1-x)	3RK1903-0CG00
Accessories	2DI COM control module	digital 2DI COM input module for local operation of the computer interface (only for DS1e-x, DSS1e-x, RS1e-x, F-DS1e-x, and F-RS1e-x)	3RK1903-0CH10
	2DI LC COM control module	digital 2DI LC COM input module with computer interface for manual local operation (only for DS1e-x, DSS1e-x, RS1e-x, F-DS1e-x, and F-RS1e-x)	3RK1903-0CH20
	LOGO! PC cable	for the connection of the computer to the 2DI COM/-2DI LC COM control module	6ED1057-1AA00-0BA0
	"*Motor Starter ES*" diagnostics and commissioning tool	Software for diagnostics and commissioning for motor starter - Basic package, floating license - Standard package, floating license - Premium package, floating license	 3ZS1310-**4**CC10-0YA5 3ZS1310-**5**CC10-0YA5 3ZS1310-**6**CC10-0YA5

B.3 Components for the safety-integrated system (local safety)

Description		Model	Order number
Power modules	PM-D F1	fail-safe, up to PL e DIN EN ISO 13849-1 for emergency stop	3RK1903-1BA00
	PM-D F2	fail-safe, up to PL e, DIN EN ISO 13849-1 for autostart for protective door monitoring;	3RK1903-1BB00
	PM-D F3	fail-safe, up to PL d, DIN EN ISO 13849-1 for expansion, with time delay of 0.5 to 30 s	3RK1903-1BD00
	PM-D F4	fail-safe, up to PL e, DIN EN ISO 13849-1 for expansion	3RK1903-1BC00
	PM-D F5	contact replicator, up to PL e, DIN EN ISO 13849-1	3RK1903-1BE00
Connection module	PM-X	connection unit for infeed contactor, fail-safe up to PL e (DIN EN ISO 13849-1)	3RK1903-1CB00
Terminal modules	TM-PF30 S47-**B1** for PM-D F1,2	for potential group, infeed U1, U2, sensor connection with terminating cover	3RK1903-1AA00
	TM-PF30 S47-**B0** for PM-D F1,2	for potential subgroup, sensor connection	3RK1903-1AA10
	TM-PF30 S47-**C1** for PM-D F3,4	for potential group, infeed U1, U2 with terminating cover	3RK1903-1AC00
	TM-PF30 S47-**C0** for PM-D F3,4	for potential subgroup, infeed U2	3RK1903-1AC10
	TM-PF30 S47-**D0** for PM-D F5	for contact replicator	3RK1903-1AD10
	TM-X15 S27-01	for PM-X connection module connection unit for infeed contactor, PL d and PL e (DIN EN ISO 13849-1)	3RK1903-1AB00
Fail-safe kit	Fail-safe kit 1	for DS1-x direct starter, up to Category 4 (DIN EN ISO 13849-1) • 1 auxiliary switch block • 1 contact holder with connecting lead for direct starter • 1 contact support for terminal module (feedback loop) • 1 contact support for terminal module (infeed contactor)	3RK1903-1CA00
	Fail-safe kit 2	for RS1-x reversing starter, up to PL e, (DIN EN ISO 13849-1) • 2 auxiliary switch blocks • 1 contact holder with connecting lead for reversing starter • 1 light gray contact support for terminal module (feedback loop) • 1 dark gray contact support for terminal module (feedback loop) • 2 contact support for terminal module (infeed contactor) • 1 connecting lead	3RK1903-1CA01

B.4 Components for expansion modules

Description		Model	Order number
Brake control modules	xB1 xB3	for brake 24 VDC/4 A with 2 extra inputs	3RK1903-0CB00 3RK1903-0CE00
	xB2 xB4	for brake 500 VDC/0.7 A with 2 extra inputs	3RK1903-0CC00 3RK1903-0CF00
	xB5 xB6	for 400 V AC / 0.5 A brake also with 2 inputs	3RK1903-0CJ00 3RK1903-0CK00
Terminal modules	TM-xB15 S24-01	for brake control modules xB1, xB2, xB5	3RK1903-0AG00
	TM-xB215 S24-01	for brake control modules xB3, xB4, xB6	3RK1903-0AG01

B.5 Fail-safe components (PM-D F PROFIsafe, PM-D F X1)

Description		Model	Order number
Power module	PM-D F PROFIsafe	With overvoltage protection With diagnostics (for a description see the *ET 200S Distributed I/O Device for Fail-Safe Modules* manual)	3RK1903-3BA01 3RK1903-3BA02
Power/expansion module	PM-D F X1	With overvoltage protection for the infeed of external emergency stop signals	3RK1903-3DA00
contact replicator	F-CM	With 4 safe, floating contacts	3RK1903-3CA00
Terminal modules	TM-PF30 S47-**F1** for PM-D F PROFIsafe	For potential group, with infeed U1, SG1 to SG6, with terminating cover (for a description see *ET 200S Distributed I/O Device for Fail-Safe Modules*)	3RK1903-3AA00
	TM-PFX30 S47-**G1** for PM-D F X1	for potential group, without infeed from the ccw for U1, SG1 to SG6 with terminating cover	3RK1903-3AE00
	TM-PFX30 S47-**G0** for PM-D F X1	for potential group, with infeed from the ccw for U1, SG1 to SG6,	3RK1903-3AE10
	TM-FCM30 S47-**E0** for F-CM	With throughfeed U1, SG1 to SG6,	3RK1903-3AB10

B.6 Manuals for ET 200S distributed I/O system

Description	Order number
Documentation package for the ET 200S, consisting of • Manuals, operating instructions, and product information for the "SIMATIC *ET 200S Distributed I/O Device"* • Manual "*SIMATIC ET 200S. Fail-safe motor starters: Safety-Integrated System* • System manual *SIMATIC PROFINET System Description* • Programming Manual *"SIMATIC PROFINET IO. From PROFIBUS DP to PROFINET IO"*	Only available on the Internet
Manual "*SIMATIC ET 200S Interface Module IM 151-7 CPU*" and the S7-300 operation list	Only available on the Internet
Manual *SIMATIC ET 200S Process-Related Functions*	Only available on the Internet
Operating instructions "*SIMATIC ET 200S Positioning*"	Only available on the Internet
Operating instructions "*SIMATIC ET 200S Serial Interface Modules"*	Only available on the Internet
Installation and operating manual "*SIMATIC* ET 200S Distributed I/O Device for Fail-Safe Modules"	Only available on the Internet

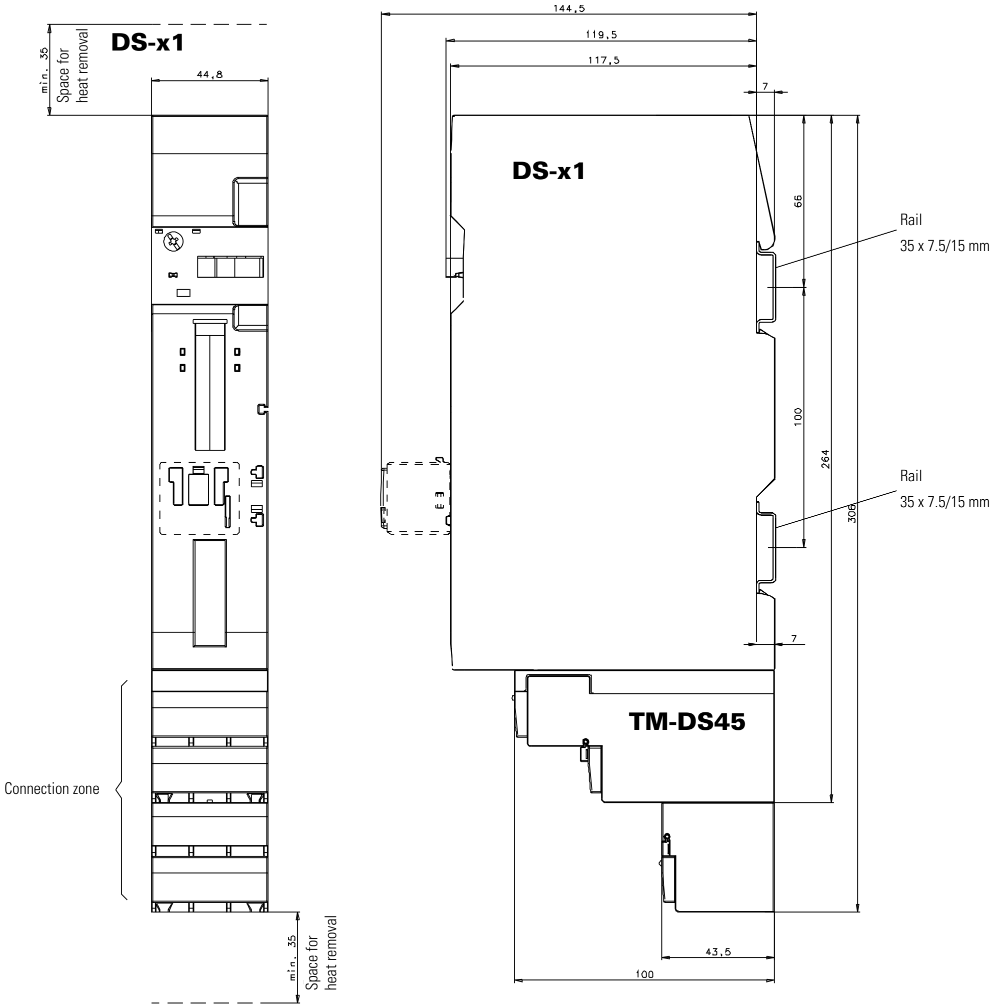
A table of contents for the individual manuals can be befound at the beginning of this manual under "*Important Information."*

Dimensioned drawings

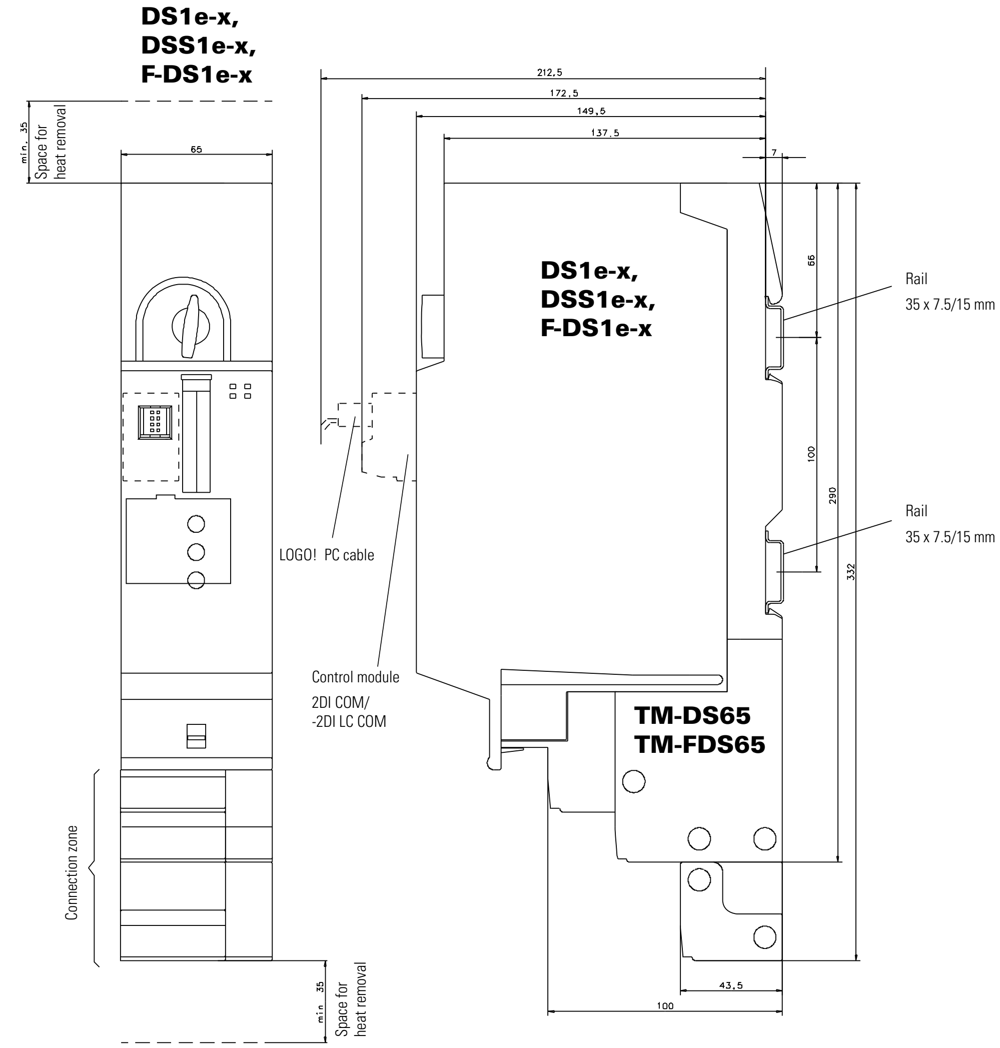
C

C.1 Motor starters

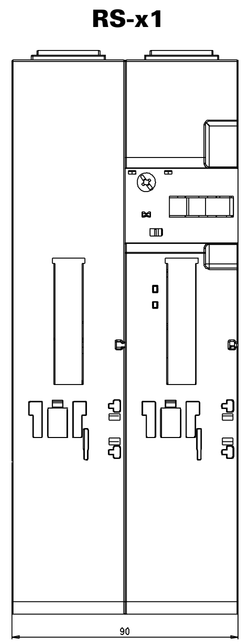
C.1.1 DS1-x direct starter; standard and TM-DS45 terminal module

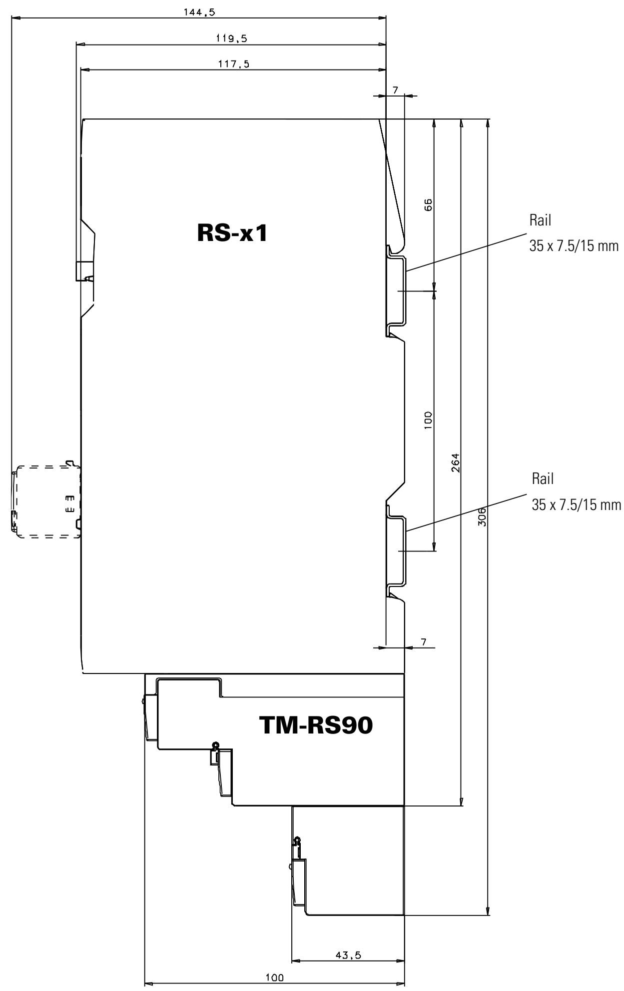


C.1.2 DS1e-x direct starter; high feature, DSS1e-x direct soft starter; high feature and TM-DS65 terminal module; F-DS1e-x fail-safe direct starter and TM-FDS65 terminal module

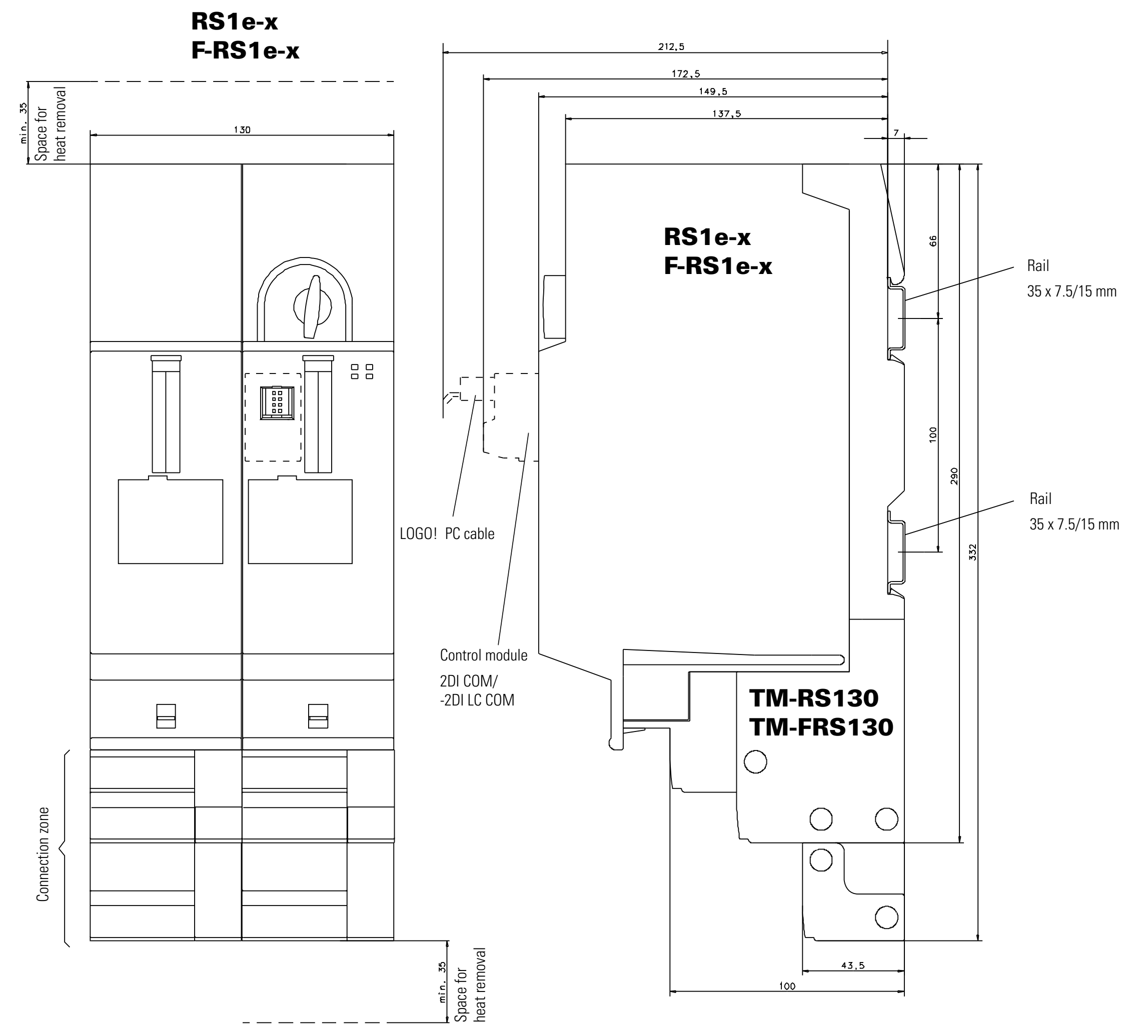


C.1.3 RS1-x reversing starter; standard and TM-RS90 terminal module



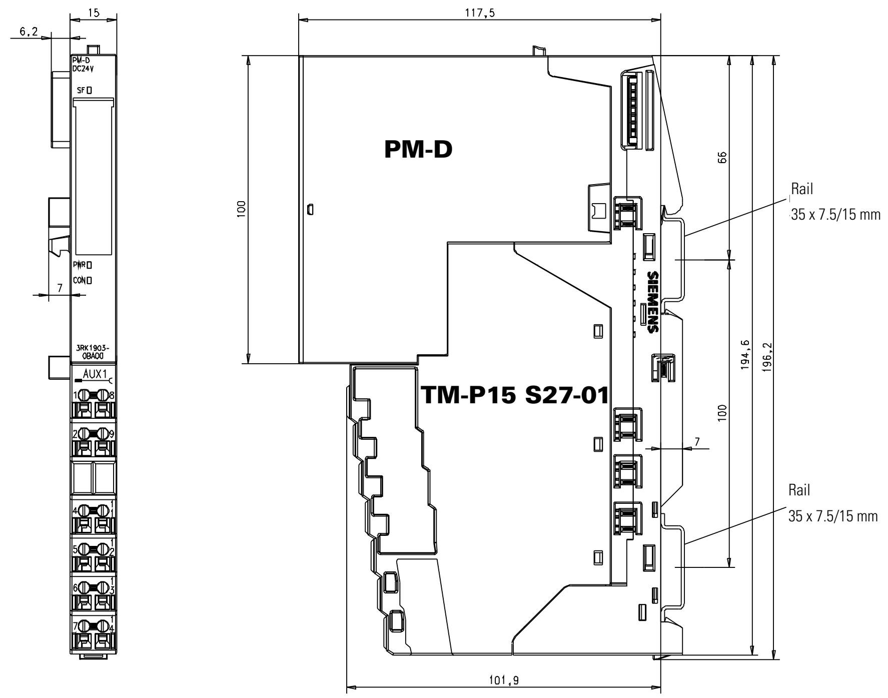


C.1.4 RS1e-x reversing starter; high feature and TM-RS130 terminal module F-RS1e-x fail-safe reversing starter and TM-FRS130 terminal module

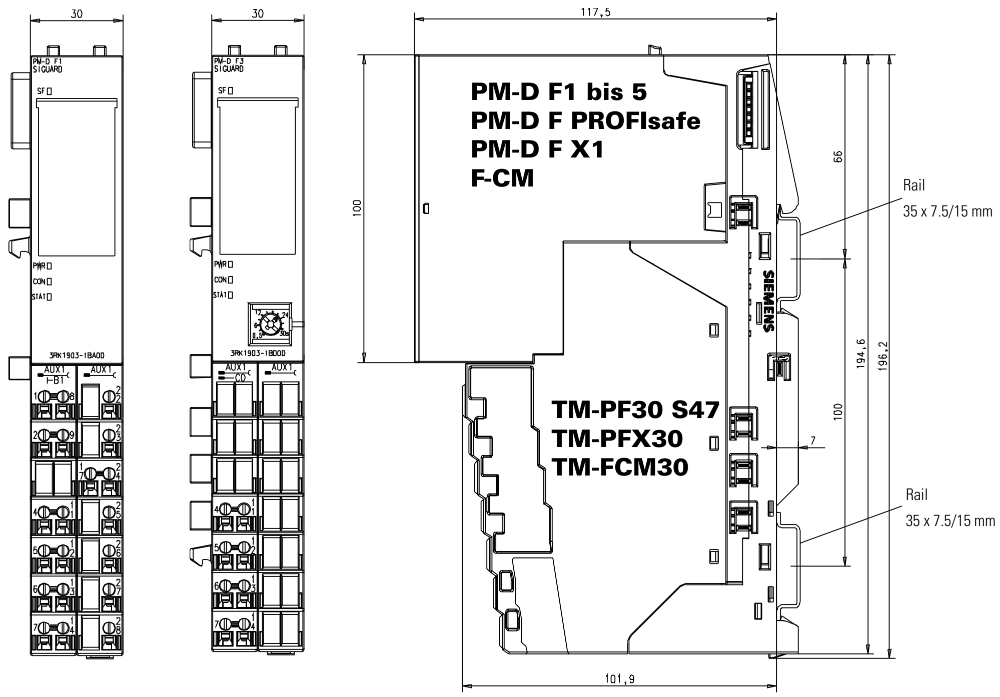


C.2 Power modules, connection module

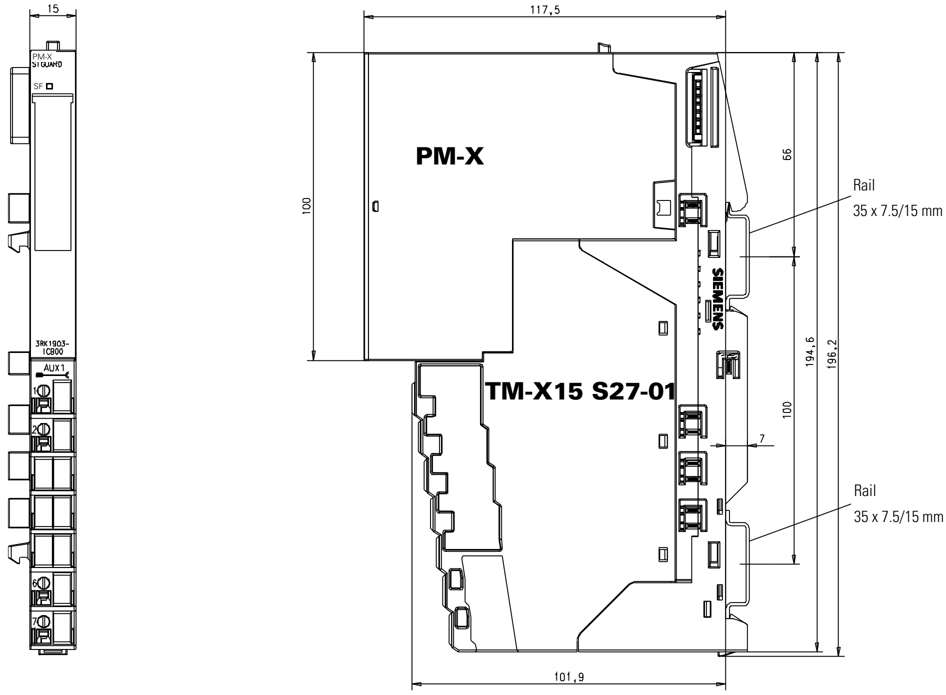
C.2.1 PM-D power module and TM-P15 S27-01 terminal module



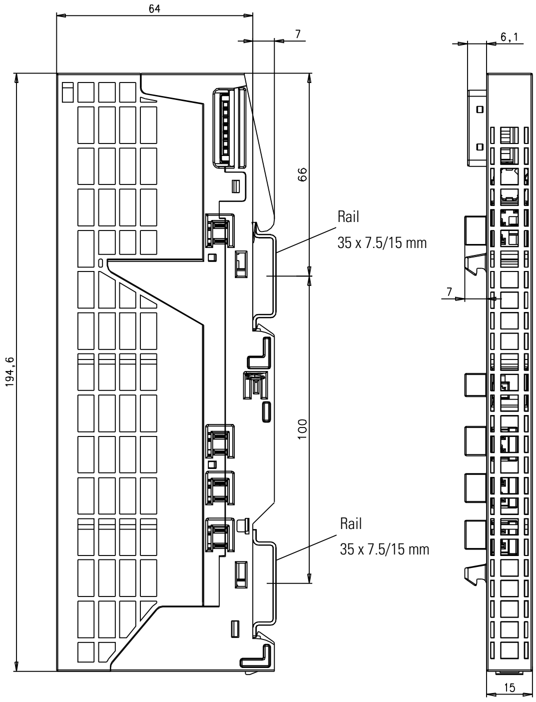
C.2.2 Power modules PM-D F1 to 5 and terminal modules TM-PF30 S47-B0/-B1/-C0/-C1/-D0; PM-D F PROFIsafe power module and TM-PF30 S47-F1 terminal module; PM-D F X1 power/expansion module and terminal modules TM-PFX30 S47-G0/-G1; F-CM contact replicator and TM-FCM30 S47-E0 terminal module



C.2.3 PM-X connection module and TM-X15 S27-01 terminal module

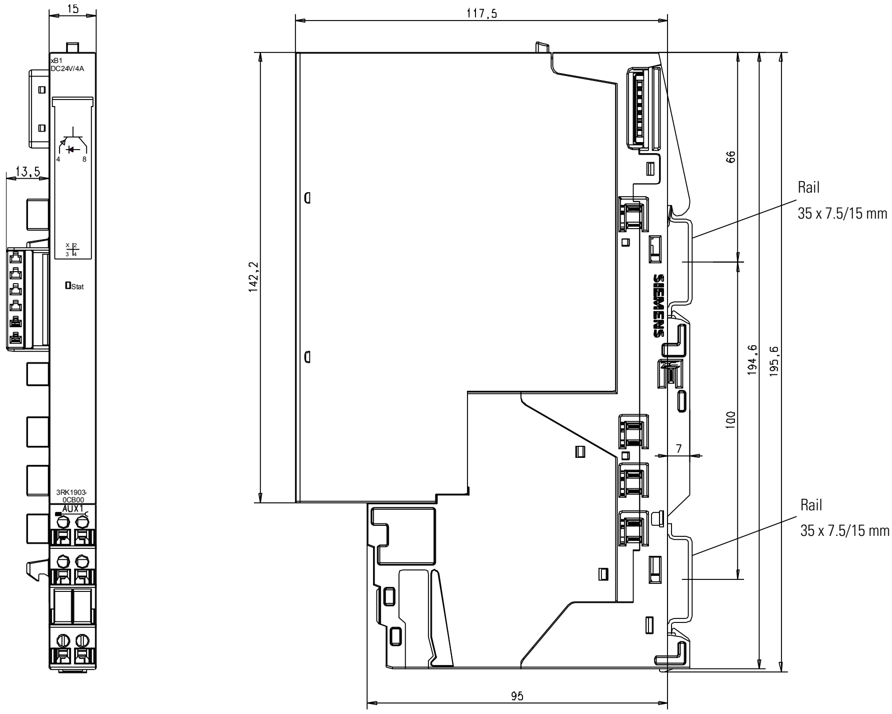


C.3 DM-V15 spacing module



C.4 Expansion modules

C.4.1 Brake control module xB1 to 4 and terminal module TM-xB15 S24-01, TM-xB215 S24-01



Applications

D

Safety note
The following applications are used only as a suggestion of typical circuit diagrams.
No liability will be accepted for the proper functioning, compliance with certification requirements, or compatibility of the examples. Use at your own risk.

Caution
Derating (see Section 3.4) is not taken into account in the following examples.

Caution
Due to the operation of star-connected three-phase motors, high EMC interference may occur. Interference above the IEC limit values can lead to an impairment of functions or failure of the electronics. In case of high EMC interference, we recommend the use of motors with EMC protection circuits. (Exception: soft starters may not be operated with a EMC protection circuit).

D.1 Examples with brake control modules

D.1.1 Example with 2 directions of rotation and limit-switch operation without brake

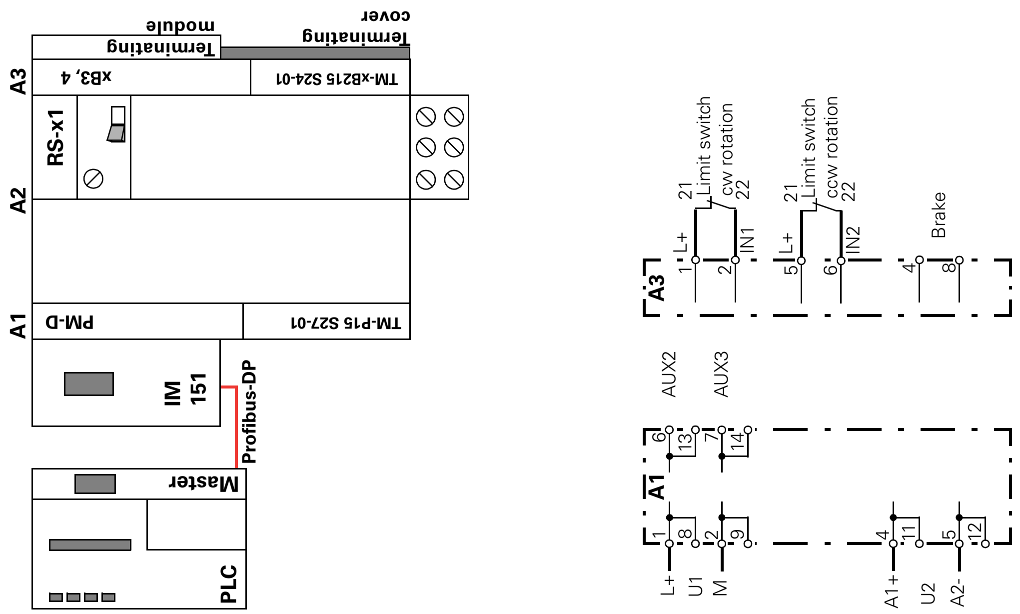
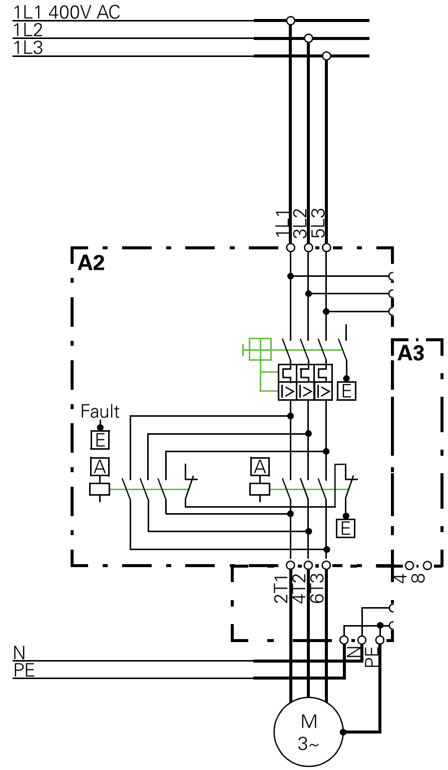


Figure D-1: Example with 2 directions of rotation and limit-switch operation without brake



E = integrated input for programming
A = integrated output for programming
— = line for external wiring

The components required to set up this example are as follows:

Number	Order number	Description
1	3RK1 903-0BA00	PM-D
1	3RK1 903-0AA00	TM-P15 S27-01
1	3RK1 301-xxB00-1AA2	RS1-x xx in accordance with the current rating
1	3RK1 903-0AC00	TM-RS90 S32 with power bus infeed
1	3RK1 903-0AG01	TM-xB215 S24-01terminal module for xB3, 4
1	3RK1 903-0CE00	xB3 [1] brake control
1	3RK1 903-0CF00	xB4 [1] brake control
2	XXX	Limit switch for brake control module

1) either xB3 or xB4

Figure D-1: (cont.) Example with 2 directions of rotation and limit-switch operation without brake

D.1.2 Example with 2 directions of rotation, 2 speeds and 24 V brake with external power supply

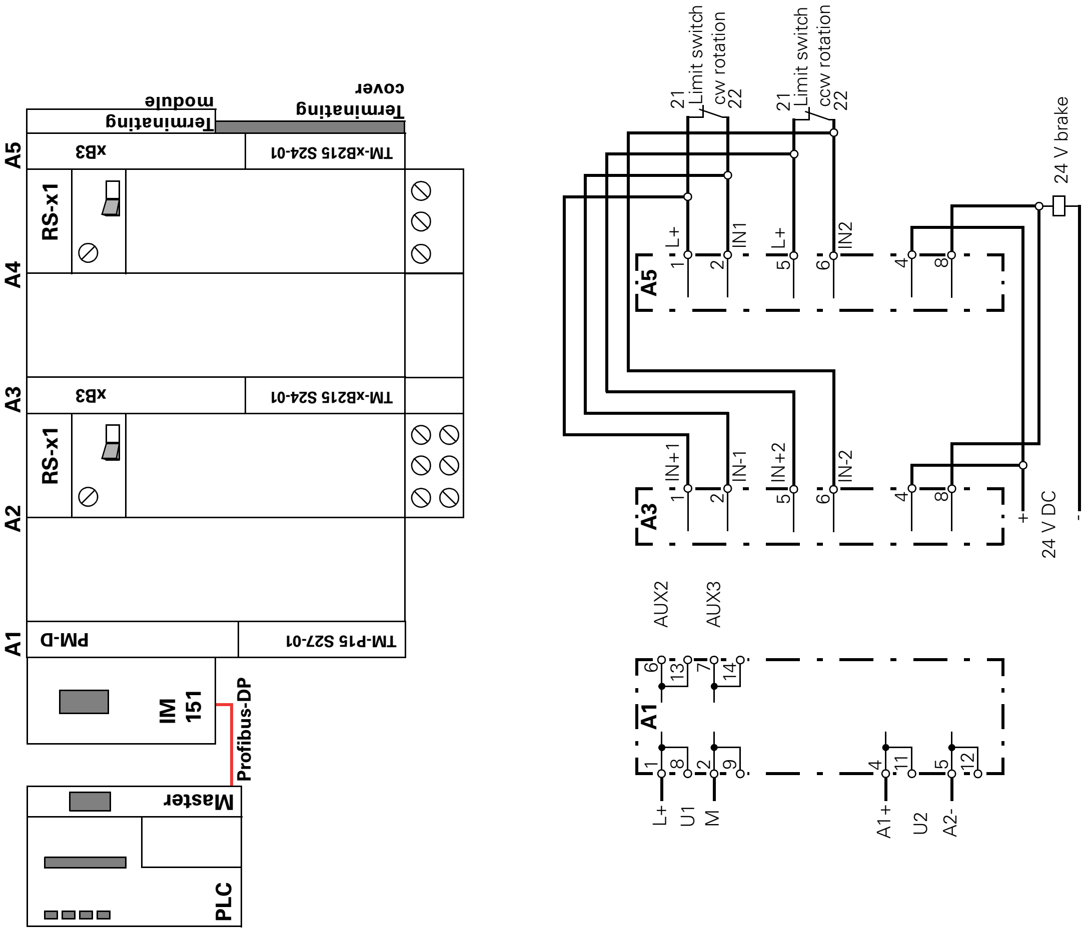


Figure D-2: Example with 2 directions of rotation, 2 speeds and 24 V brake with external power supply

The components required to set up this example are as follows:

Number	Order number	Description
1	3RK1 903-0BA00	PM-D
1	3RK1 903-0AA00	TM-P15 S27-01
2	3RK1 301-xxB00-1AA2	RS1-x xx in accordance with the current rating
1	3RK1 903-0AC00	TM-RS90 S32 with power bus infeed
1	3RK1 903-0AC10	TM-RS90 S31 with power bus throughfeed
2	3RK1 903-0AG01	TM-xB215 S24-01 terminal module for xB3
2	3RK1 903-0CE00	xB3 brake control
1	3RK1 903-0AE00	15 mm jumper module L1,2,3
2	XXX	Limit switch for brake control module

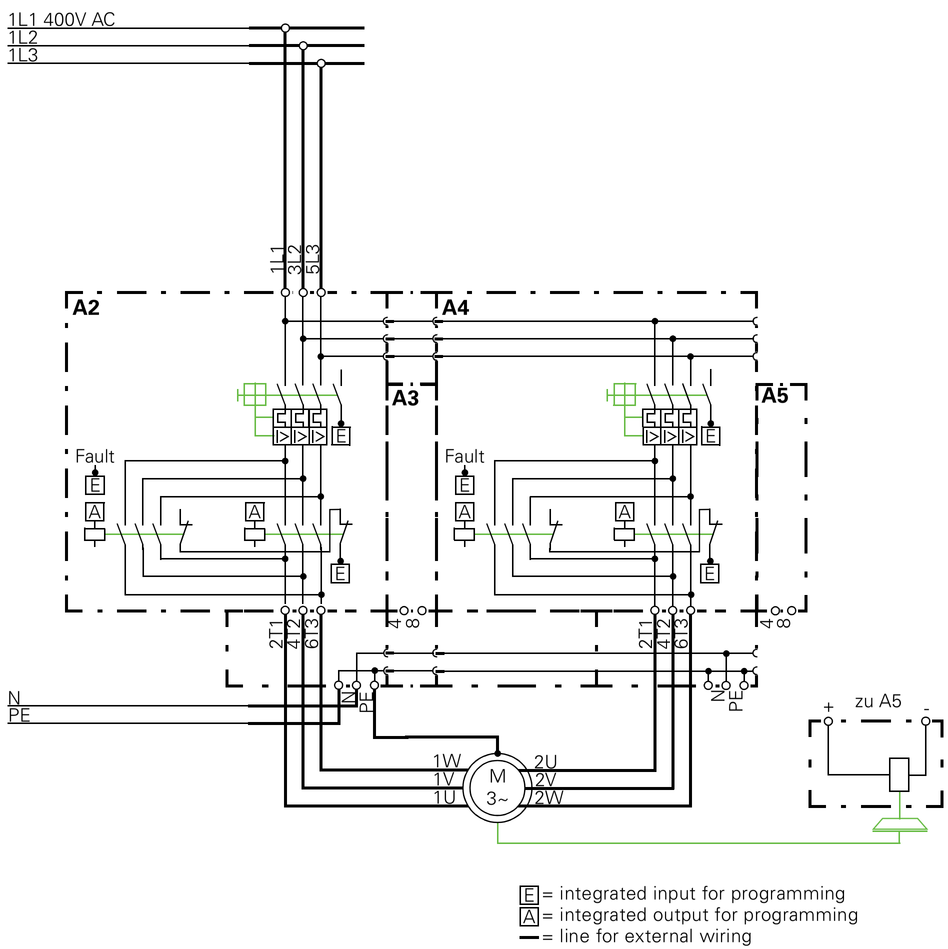


Figure D-2: (cont.) Example with 2 directions of rotation, 2 speeds and 24 V brake with external power supply

D.1.3 Example with 2 directions of rotation, 2 speeds and 400 V brake with internal power supply

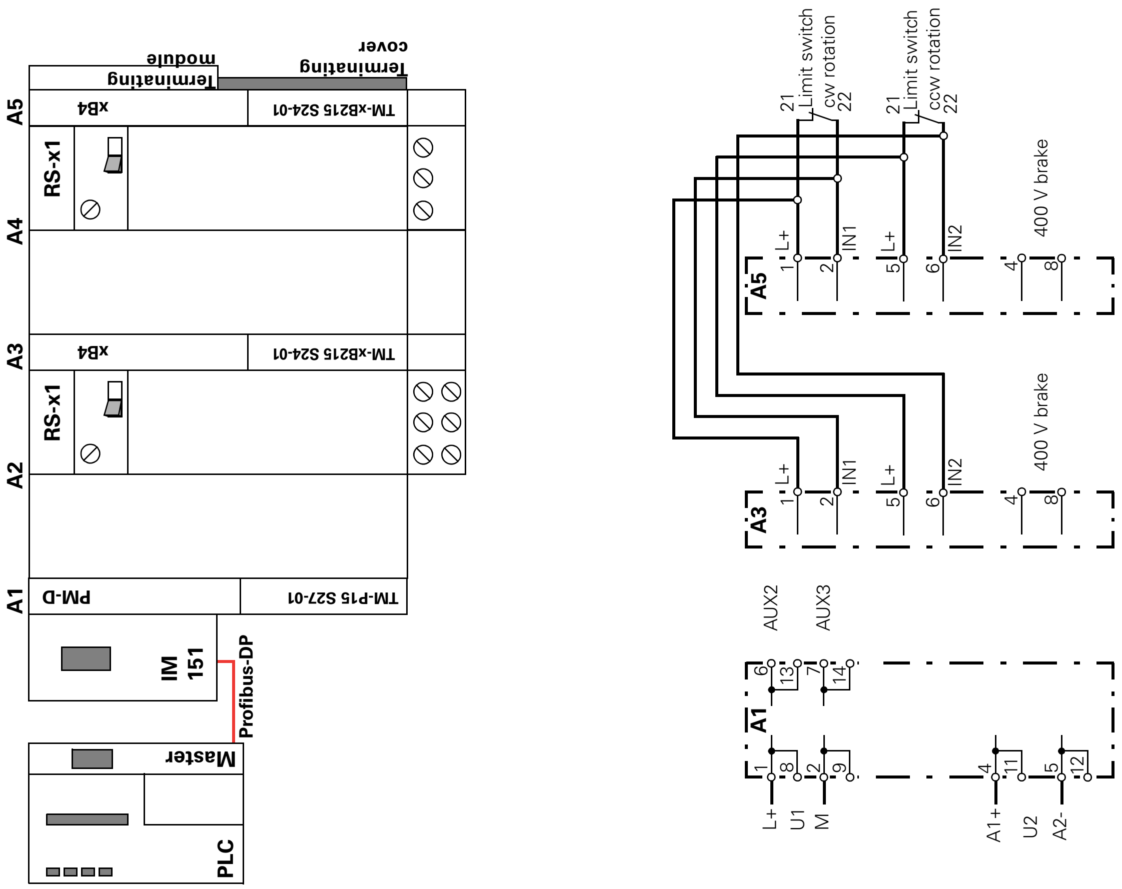
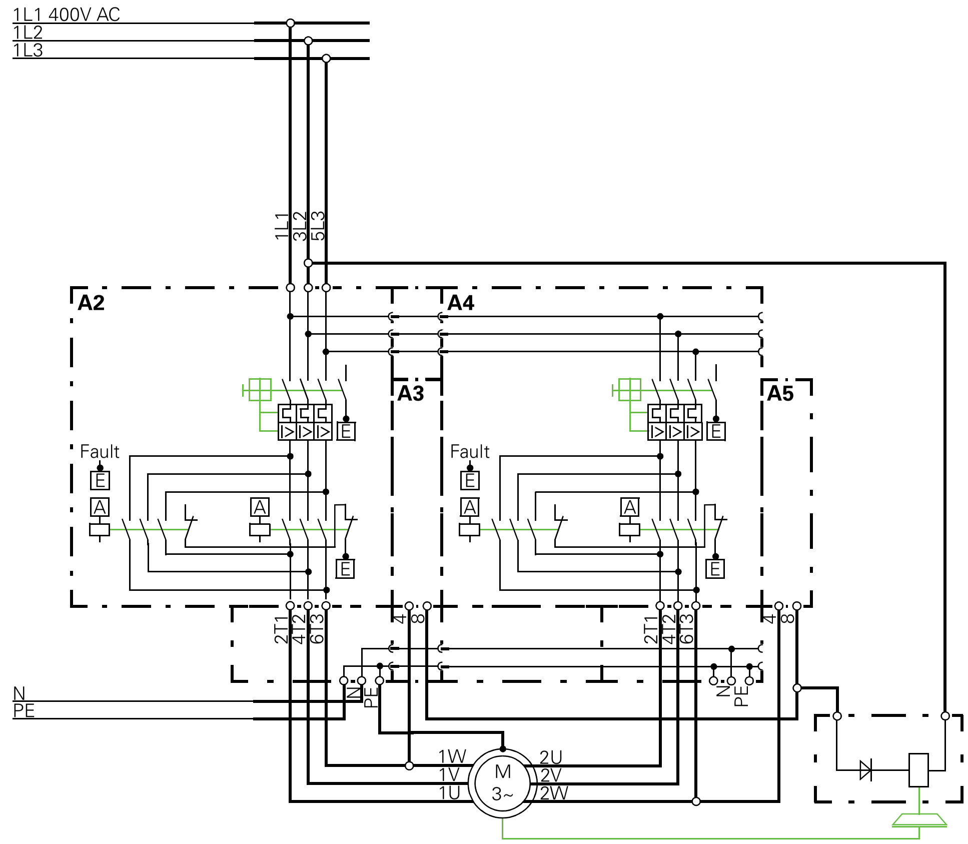


Figure D-3: Example with 2 directions of rotation, 2 speeds and 400 V brake with internal power supply



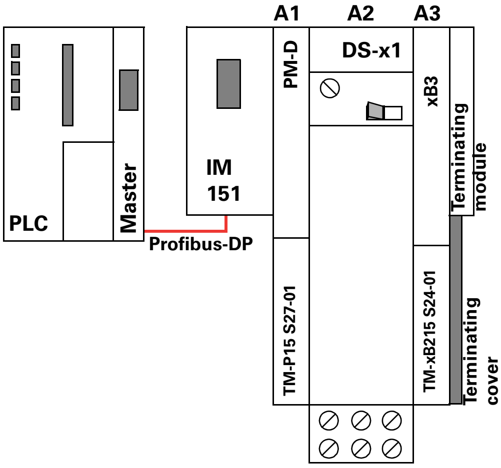
E = integrated input for programming
A = integrated output for programming
— = line for external wiring

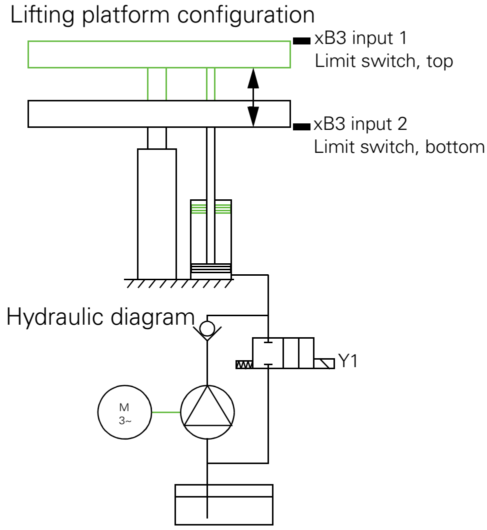
The components required to set up this example are as follows:

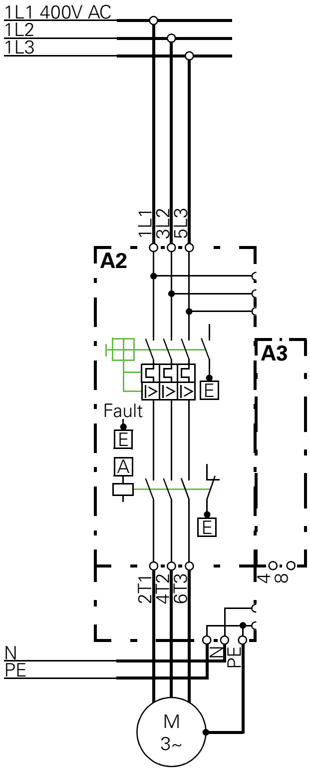
Number	Order number	Description
1	3RK1 903-0BA00	PM-D
1	3RK1 903-0AA00	TM-P15 S27-01
2	3RK1 301-xxB00-1AA2	RS1-x xx in accordance with the current rating
1	3RK1 903-0AC00	TM-RS90 S32 with power bus infeed
1	3RK1 903-0AC10	TM-RS90 S31 with power bus throughfeed
2	3RK1 903-0AG01	TM-xB215 S24-01 terminal module for xB4
2	3RK1 903-0CF00	xB4 brake control
2	3RK1 903-0AE00	15 mm jumper module L1,2,3
2	XXX	Limit switch for brake control module

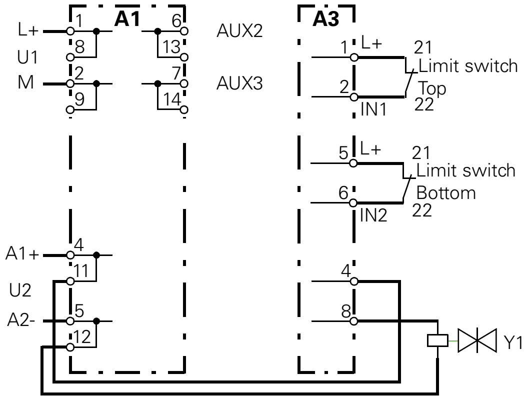
Figure D-3: (cont.) Example with 2 directions of rotation, 2 speeds and 400 V brake with internal power supply

D.1.4 Example of lifting platform - up with motor, down with valve









E = integrated input for programming
A = integrated output for programming
— = line for external wiring

The components required to set up this example are as follows:

Number	Order number	Description
1	3RK1 903-0BA00	PM-D
1	3RK1 903-0AA00	TM-P15 S27-01
1	3RK1 301-xxB00-0AA2	DS1-x xx in accordance with the current rating
1	3RK1 903-0AB00	TM-DS45 S32 with power bus infeed
1	3RK1 903-0AG01	TM-xB215 S24-01 terminal module for xB3
1	3RK1 903-0CE00	xB3 brake control
2	XXX	Limit switch for brake control module
1	XXX	Valve (Y1)

Figure D-4: Example of lifting platform - up with motor, down with valve

The diagram below illustrates the dependencies between the individual signals

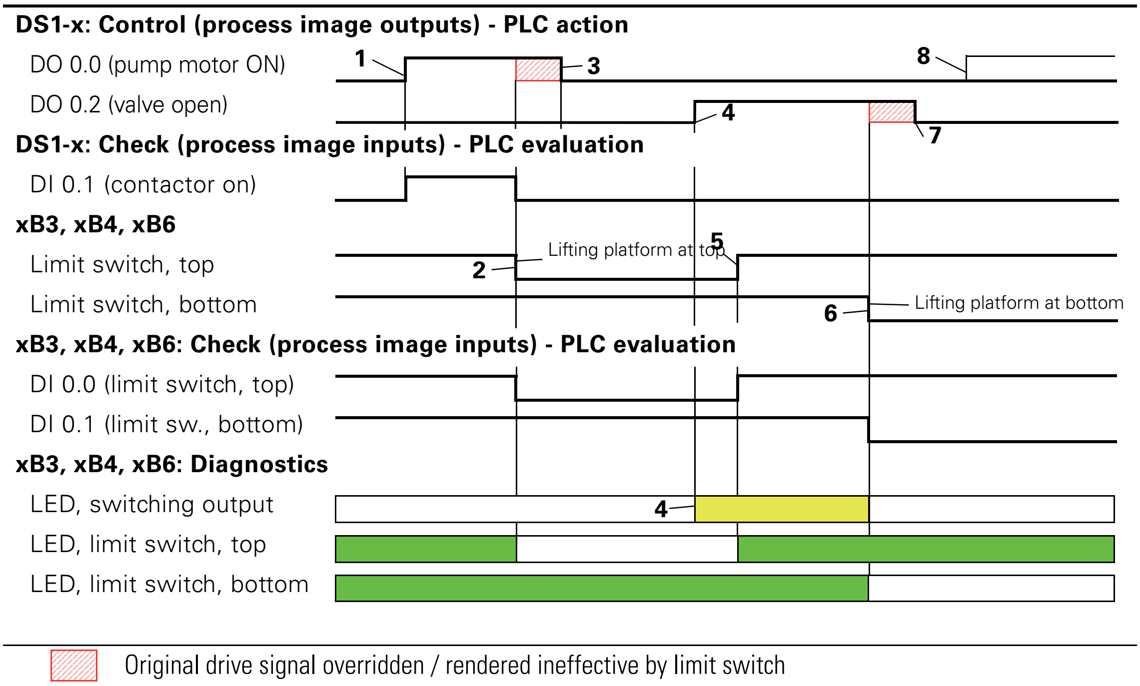
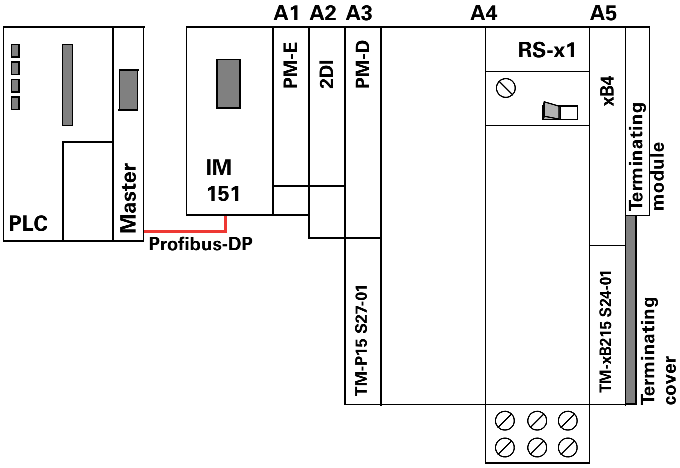


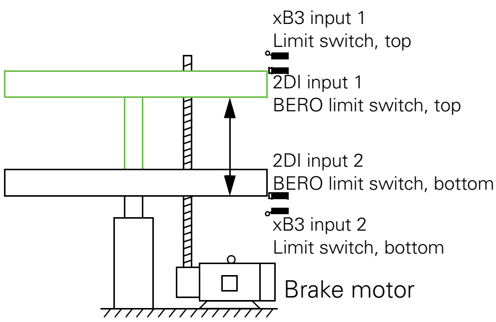
Figure D-4: (cont.) Example of lifting platform - up with motor, down with valve

1	Switch on the pump motor (DO 0.0) with the user program in the PLC. The switch-on command from the PLC is a drive signal for the contactor.
2	Limit position is passed, so the limit switch for lifting table at top opens. When the limit switch opens the direct (no PLC intervention) result is discontinuation of the contactor drive signal. The PLC's drive signal for the contactor is rendered ineffective (overridden by limit switch). The motor contactor is switched off.
3	The application program in the PLC cancels the switch-on command (DO 0.0).
4	The valve for lowering the lifting platform is opened (DO 0.2) by the application program in the PLC.
5	The limit switch for lifting platform at top position recloses.
6	The limit switch for lifting platform at bottom opens. The switching output for the valve is disabled.
7	The application program in the PLC cancels the switch-on command for DO 0.2.
8	See step 1 Each upward or downward action of the platform can take place individually within the limits of travel.

D.1.5 Example of lifting platform - up and down with brake motor



Lifting platform configuration



The components required to set up this example are as follows:

Number	Order number	Description
1	6ES7 138-4CA00-0AA0	PM-E DC24V
1	6ES7 193-4CE00-0AA0	TM-P15S22-01
1	6ES7 131-4BB00-0AA0	2DI DC24V
1	6ES7 193-4CB00-0AA0	TM-E15S23-01
1	3RK1 903-0BA00	PM-D
1	3RK1 903-0AA00	TM-P15 S27-01
1	3RK1 301-xxB00-1AA2	RS1-x xx in accordance with the current rating
1	3RK1 903-0AC00	TM-RS90 S32 with power bus infeed
1	3RK1 903-0AG01	TM-xB215 S24-01terminal module for xB4
1	3RK1 903-0CF00	xB4 brake control
2	XXX	Limit switch for brake control module
2	XXX	BERO

Figure D-5: Example of lifting platform - up and down with brake motor

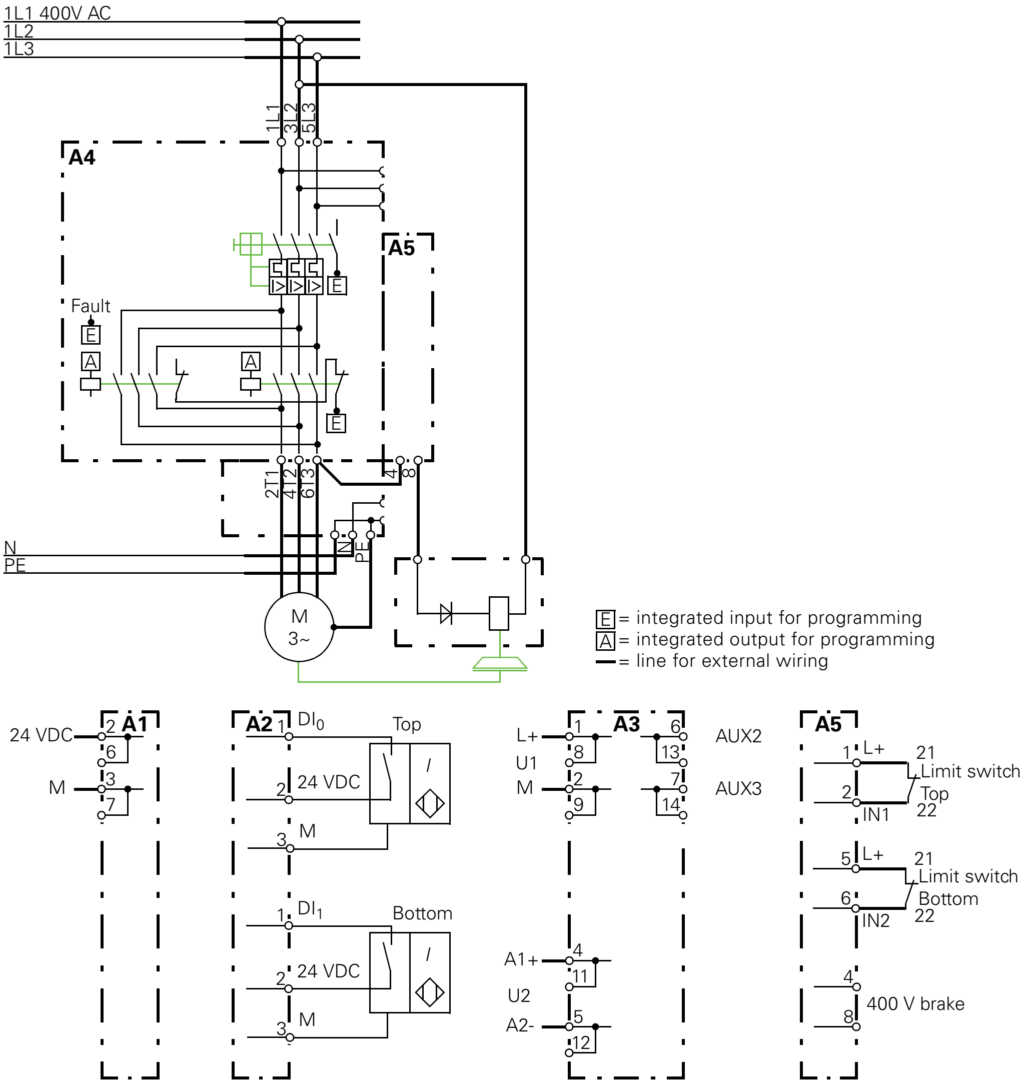
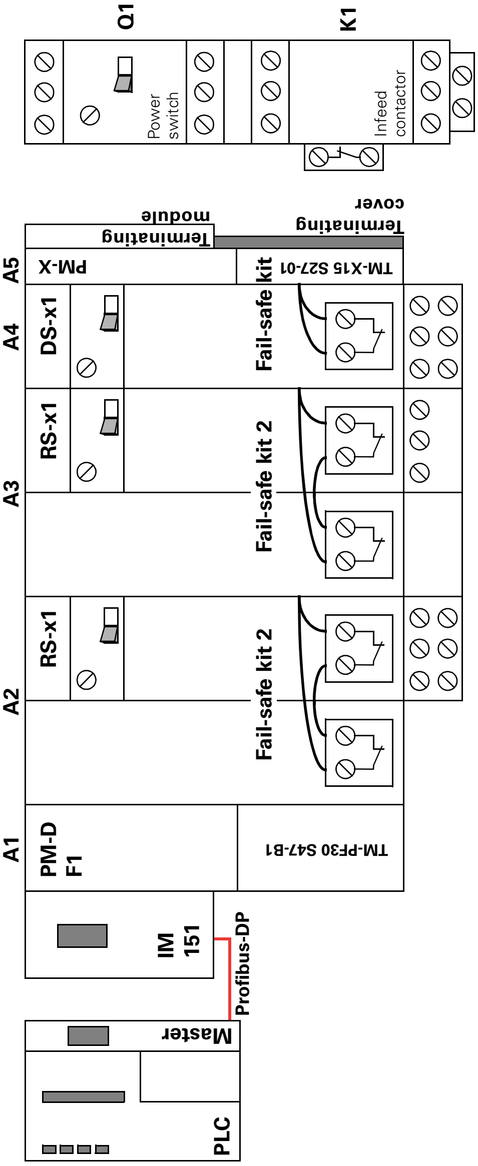


Figure D-5: (cont.) Example of lifting platform - up and down with brake motor

At each limit position, the lifting platform is controlled by a BERO limit switch. If a limit switch fails, the position switch acts directly on the RS1-x reversing starter through the xB4 brake control module. The starter is switched off immediately and the brake is activated. This rapid shutdown acts by bypassing the PLC user program. With the position switch actuated, the starter can only be switched on in the opposite direction by the PLC. The process image of the inputs at the brake control module is also made available to the PLC. There, the operation can be adapted to the situation.

D.2 Examples with reversible-pole motors

D.2.1 Example with 2 directions of rotation and 2 speeds with one Dahlander winding



The components required to set up this example are as follows:

PL b	PL c[1)]	PL d/e	Order number	Description
1[2)]			3RK1903-0BA00	PM-D
1			3RK1903-0AA00	TM-P15 S27-01
	1	1	3RK1903-1BA00	PM-D F1
	1	1	3RK1903-1AA00	TM-PF30 S47-B1
	1	1	3RK1903-1CB00	PM-X
	1	1	3RK1903-1AB00	TM-X15 S27-01
		1	3RT1035-1BB40	Infeed protection for maximum complement 40 A
		1	3RH1921-1DA11	Auxiliary switch for infeed contactor
		1	3RA1931-1BA00	DC connection module
		1	3RV1031-4HA10	Power switch as line protection with maximum complement 40 A
1	1	1	3RK1301-xxB00-0AA2	DS1-x xx in accordance with the current rating
1	1	1	3RK1903-0AB00	TM-DS45 S32 with power bus infeed
	1	1	3RK1903-1CA00	Fail-safe kit 1
2	2	2	3RK1301-xxB00-1AA2	RS1-x xx in accordance with the current rating
1	1	1	3RK1903-0AB00	TM-RS90 S32 with power bus infeed
1	1	1	3RK1903-0AC10	TM-RS90 S31 with power bus throughfeed
	2	2	3RK1903-1CA01	Fail-safe kit 2

1) In this typical circuit diagram, PL caccording to DIN EN ISO 13849-1 can only be met if a warning is issued automatically when the actuator fails or the machine control system initiates a safe status condition. Otherwise a second disconnection path is required.

2) Emergency stop looped in line for supply voltage U2 (A1+, A2-)

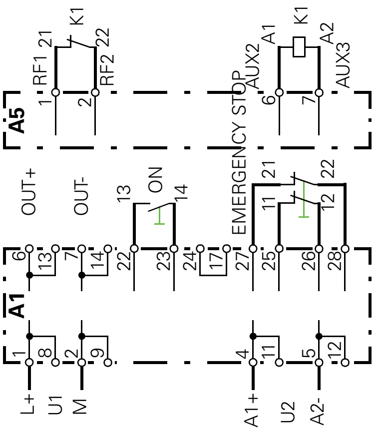


Figure D-6: Example with 2 directions of rotation and 2 speeds with one Dahlander winding

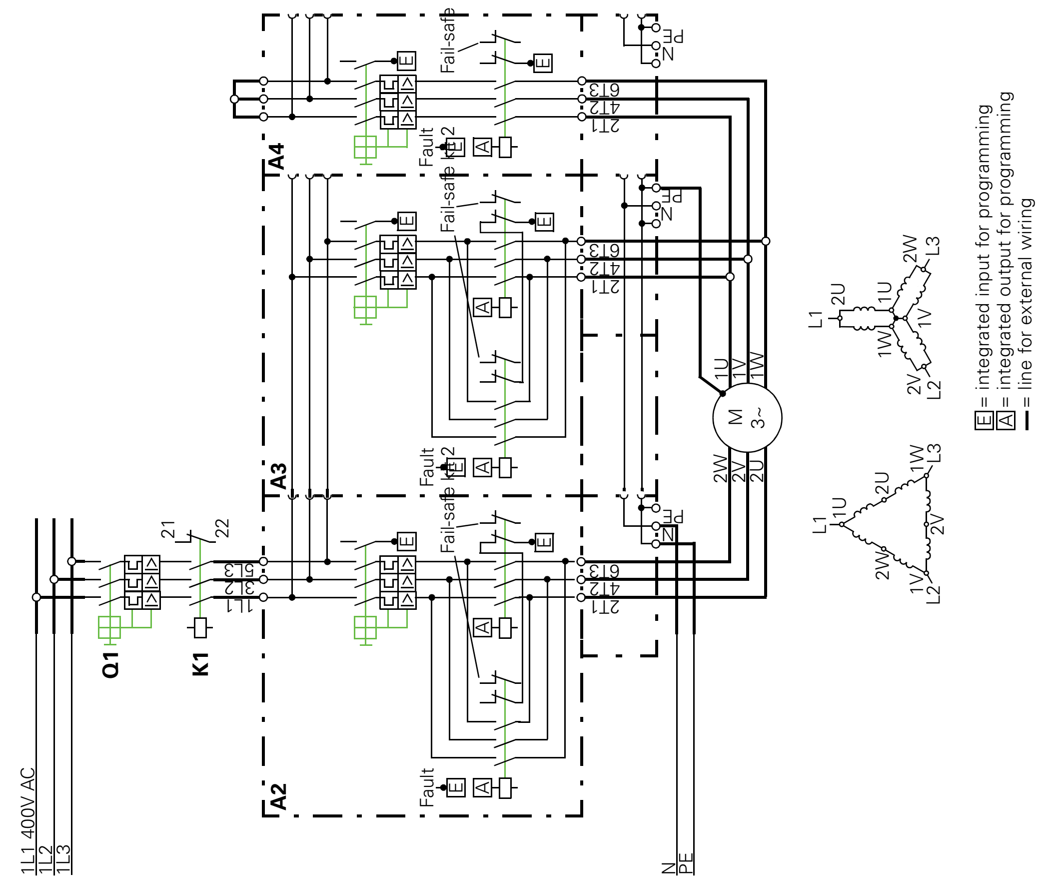
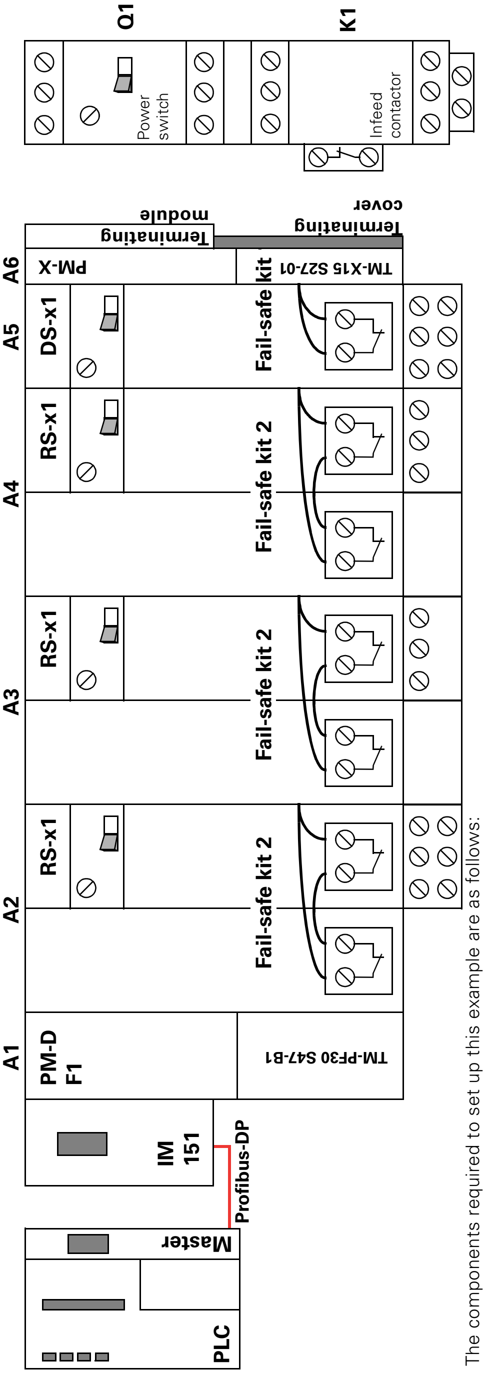
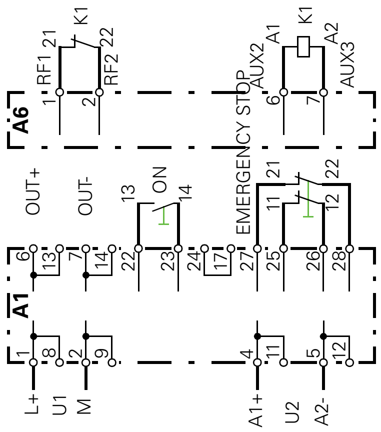


Figure D-6: (cont.) Example with 2 directions of rotation and 2 speeds with one Dahlander winding

Warning
You must ensure that there is an appropriate, software-specific interlocking with a sufficiently apportioned time delay between module A3 and A4.

D.2.2 Example with 2 directions of rotation and 3 speeds with 2 Dahlander windings





The components required to set up this example are as follows:

PL b	PL c[1]	PL d/e	Order number	Description	
1[2]			3RK1903-0BA00	PM-D	
1			3RK1903-0AA00	TM-P15 S27-01	
	1	1	3RK1903-1BA00	PM-D F1	
	1	1	3RK1903-1AA00	TM-PF30 S47-B1	
	1	1	3RK1903-1CB00	PM-X	
	1	1	3RK1903-1AB00	TM-X15 S27-01	
		1	3RT1035-1BB40	Infeed protection for maximum complement 40 A	
		1	3RH1921-1DA11	Auxiliary switch for infeed contactor	
		1	3RA1931-1BA00	DC connection module	
		1	3RV1031-4HA10	Power switch as line protection with maximum complement 40 A	
1	1	1	3RK1301-xxB00-0AA2	DS1-x rating	xx in accordance with the current
1	1	1	3RK1903-0AB00	TM-DS45 S32	with power bus infeed
	1	1	3RK1903-1CA00	Fail-safe kit 1	
3	3	3	3RK1301-xxB00-1AA2	RS1-x rating	xx in accordance with the current
1	1	1	3RK1903-0AB00	TM-RS90 S32	with power bus infeed
2	2	2	3RK1903-0AC10	TM-RS90 S31	with power bus throughfeed
	3	3	3RK1903-1CA01	Fail-safe kit 2	

[1] In this typical circuit diagram, PL c according to DIN EN ISO 13849-1 can only be met if a warning is issued automatically when the actuator fails or the machine control system initiates a safe status condition. Otherwise a second disconnection path is required.

[2] Emergency stop looped in line for supply voltage U2 (A1+, A2-).

Figure D-7: Example with 2 directions of rotation and 3 speeds with 2 Dahlander windings

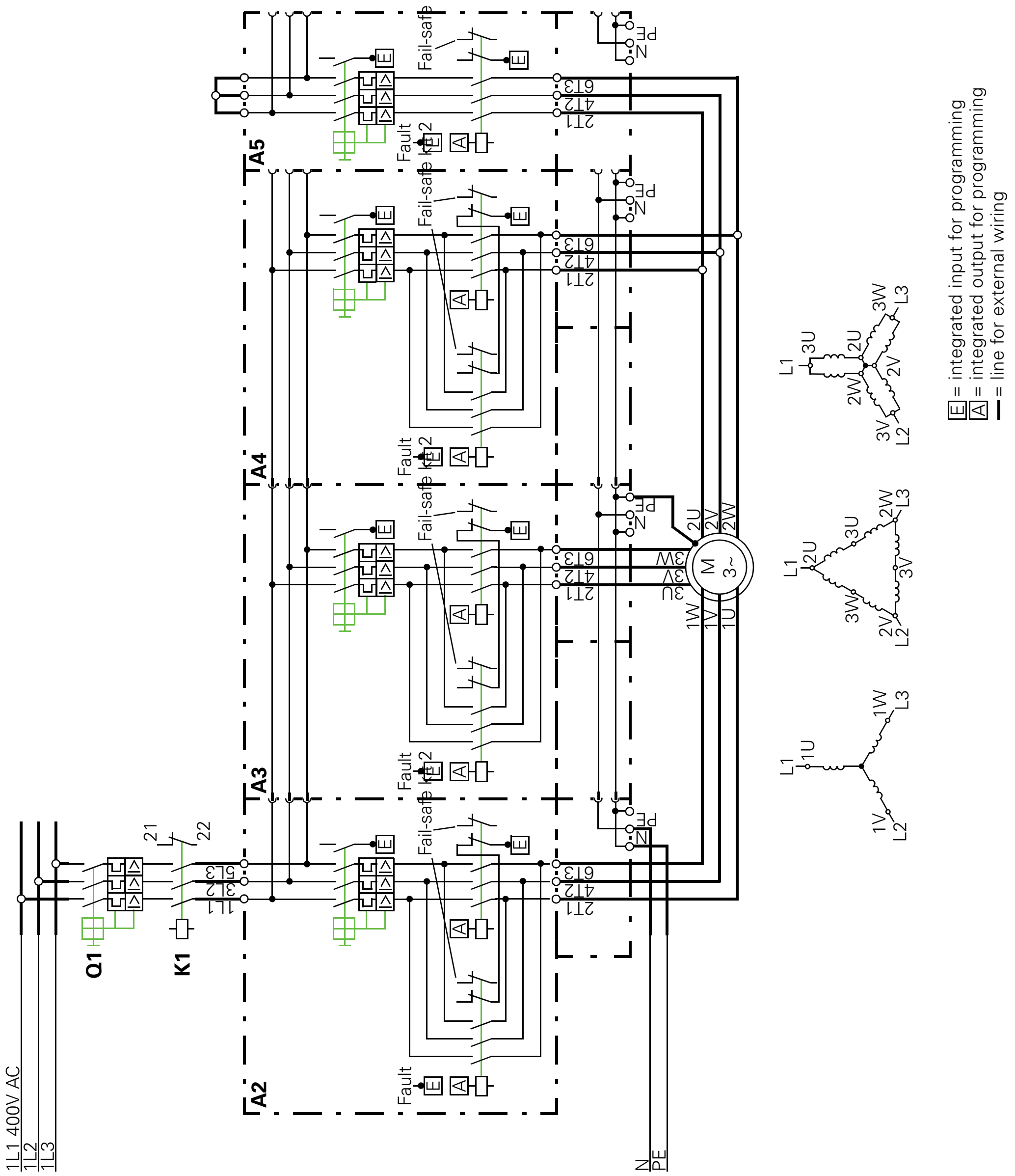


Figure D-7: (cont.) Example with 2 directions of rotation and 3 speeds with 2 Dahlander windings

Warning
You must ensure that there is an appropriate, software-specific interlocking with a sufficiently apportioned time delay between module A4 and A5.

Glossary

2-channel (contactor control)

A two-channel contactor drive circuit is accessible when at least two release circuits are available and the primary current is disconnected redundantly.

2-channel (sensor)

The emergency stop switch is polled by means of two contacts, and the results are sent separately to the evaluation unit.

AUX1

Freely usable potential line carried through all modules.
Only the PM-E modules have connecting terminals.

AUX2

Supply for infeed contactor, connect to A1+.

AUX3

Supply for infeed contactor, connect to A2-.

CON

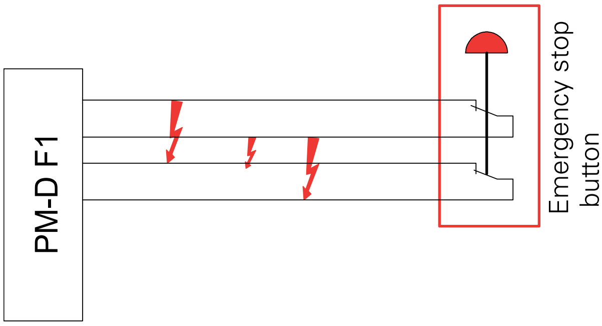
See U_2.

Direct starter

A direct starter is a –> motor starter for a single direction of rotation that switches a motor on or off directly. It consists of a circuit breaker and a contactor.

Cross-circuit proof

In the event of a short circuit between the cables of the emergency stop button, all the safety-related components of the ET 200S are switched off.



The operating status of the ET 200S cannot be restored until the problem has been rectified.

Fail-safe systems

See fail-safe systems.

Fail-safe modules

ET 200S modules that can be used for safety-related operation in the ET 200S distributed I/O device. These modules have integrated safety functions.

Fail-safe systems

Fail-safe systems are characterized by the fact that they remain in a safe state or transfer directly into another safe state when certain failures occur.

Fail-safe motor starter

Fail-safe motor starters have the following characteristics:

- Device designations: F-DS1e-x, F-RS1e-x
- Usable up to 7.5 kW
- Installation width:65 mm for F-DS1e-x
  130 mm for RS1e-x

Enabling circuit

A positively driven output with redundant, monitored normally open contacts that drives other switchgear such as motor starters or infeed contactors.

Load group

A group of motor starters supplied by **a single** power bus infeed. A load group can be within a → potential group or comprise parts of two potential groups.

Monitored start-up

At start-up, the emergency stop switch must always be closed first and the supply voltage switched on. Only then can the on switch be pressed. If the ON switch is jumpered, the PM-D F1 evaluation unit detects an error, which is indicated by a channel LED.

Motor starter; high feature

Motor starters; high feature have the following features:

- Device designations: DS1e-x, DSS1e-x, RS1e-x
- Usable up to 7.5 kW
- Installation width:65 mm for DS1e-x and DSS1e-x
  130 mm for RS1e-x

Motor starter; standard

Motor starters; standard have the following features:

- Device designations: DS1-x, RS1-x
- Usable up to 5.5 kW
- Installation width:45 mm for DS1-x
  90 mm for RS1-x

MS (motor starter)

Motor starter is the generic term for direct and reversing starters.
With motor starters the start-up and direction of rotation of a motor is determined.

OUT+/-

A positively driven output that drives other safety devices such as expansion units (PM-D F4) or a time-delayed safety combination (PM-D F3).

PELV

Protective Extra-Low Voltage. A DIN VDE 0100 T410 protective measure against accidental contact.

Potential group

A group of motor starters and/or electronic modules that are supplied by **a single** power module.

Potential subgroup

A potential subgroup exists if the auxiliary voltage U_2 can be partially switched off within a potential group.

PROFIenergy

The PROFINET profile supports energy management systems in process plants by exporting measurements or, for example, via short-term shutdown of the overall plant in pause times via standardized PROFIenergy commands.ROFI

PWR

See U_1.

Redundancy

All the components required for a function are duplicated.
In order to achieve complete redundancy in the enabling circuits in the ET 200S, two normally open contacts are connected in series in the PM-D F1 to 5 power module. If there is a failure of a normally open contact - if it is welded, for example - safe switching off is guaranteed.

Reversing starters

A reversing starter is a –> motor starter for two directions of rotation of a motor. It consists of a circuit breaker and two contactors.

Feedback loop

The operation of the actuated contactors can be monitored by monitoring the slave auxiliary contacts (normally closed contacts) of the motor starter from the PM-D F1 to 5 power module. If a contactor is welded, the emergency stop segment can no longer be started.

SELV

Safety Extra Low Voltage. A circuit that is designed and protected in such a way that when under normal conditions just one error occurs the following can be ensured: The voltage between any two accessible parts, one of which can either be a grounded or a conductive accessible part, does not exceed the safety extra-low voltage and no overvoltage is produced that is greater than the safety extra-low voltage.

SGx

SG stands for safety group. Six safety groups (SG1 to SG6) can be encoded using the corresponding terminal module of the motor starters.

U_1

(PWR) supply voltage for electronics.

U_2

(CON) supply voltage for contactor control.

Index

Sender (please complete)
Name
Company / Office
Address
Phone
Fax

To
Siemens AG
DF CP PRM IM 2

92220 Amberg

Fax: 09621 / 80-3337

SIMATIC ET 200S motor starter safety-integrated system manual

Have you come across any errors in this manual?
Please describe the errors on this form.
We will be very grateful to you for any ideas and suggestions for improvements.

- -

- -

- -

- -

- -

- -

- -

- -

- -

- -

- -

- -