SIEMENS

SIMATIC

ET 200pro
Motor starters

Manual

Release 12/2022
NEB950566102000/RS-AB/008

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:

Safety note
Contains important information for the acceptance test and the safety-related use of the product.

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 warning triangle, this 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.

Qualified personnel

The corresponding device / system must only be set up and operated in connection with this documentation. Commissioning and operating of a device / system may only be carried out by **qualified personnel**. Qualified personnel within the scope of the safety-related notices of this documentation are persons who have the authorization to commission, earth, and label devices, systems, and power circuits according to the standards of safety technology.

Correct usage

Note the following:

Warning
This device may only be used for the applications described in the catalog or the technical descriptions and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens.

This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

Brands

All designations labelled with a 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 our best efforts, 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.

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Preface

Purpose of the manual

This manual is an addition to the manual *'ET 200pro distributed I/O device'*.

The manual describes all functions of the ET 200pro motor starters. The manual does not cover general ET 200S functions. Descriptions of these can be found in the *'SIMATIC ET 200pro distributed I/O device'* manual.

Target group

This manual describes the ET 200pro motor starter hardware. It is aimed at configuration engineers, commissioning engineers and maintenance personnel.

Scope of validity

This manual is valid for the ET 200pro 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.

Guide

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

- At the start of the manual is a table of contents as well as lists of figures and tables included in the manual.
- A glossary explaining the key terms, and an index, can be found at the end of the manual.

Recycling and disposal

The ET 200pro can be recycled thanks to its low-pollutant equipment. To ensure the environmentally friendly recycling and disposal of your old equipment, please contact a certified disposal company for electronics waste.

Certification

The ET 200pro motor starter distributed I/O device product range conforms to the following regulations:

- EC Directive 73/23/EEC on low voltage
- EC Directive (89/336/EEC) 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

Detailed information on the relevant standards and approvals can be found in the SIMATIC *'ET 200pro distributed I/O device'* manual and on the internet: ***https://support.industry.siemens.com/cs/ww/en/ps/cert***

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, signalling 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 referred to as "Siemens") are not in a position to guarantee all features of a higher-order 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.

Note

This is a product for environment A. This equipment may cause undesirable radio interference in household environments.
In this case, you are required to complete appropriate measures.

Position in the information landscape

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

Note

A list of the contents of the SIMATIC ET 200pro manuals can be found in chapter 1.5 of this manual.

We recommend that you begin by reading this section so as to find out which parts of which manuals are most relevant to you in helping you to do what you want to do.

Aids to accessing information

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

- There is a list of contents at the front of the manual.
- Each chapter 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 the latest release of the manual, at the following Internet address:

https://support.industry.siemens.com/cs/ww/en/view/22332388

Abbreviated designations

The following abbreviated designations are used for motor starters and special modules:

DSe	Direct starters	RSe	Reversing starters
sDSSte/ sDSte	Direct soft starters / electronic direct starters	sRSSte/ sRSte	Reversing soft starters / electronic reversing starters
RSM	Repair switch module	F-RSM	Safety local repair switch module
ASM 400	Trip module		

Table of contents

Description

1

1.1 Overview

1.1.1 Basic components

The following table shows the essential components required to construct motor starters.

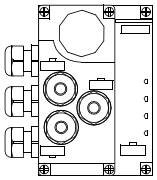
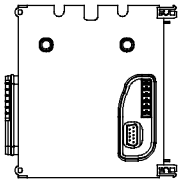
Component	Function	Drawing
Module carrier, wide (for motor starters)	… is the mechanical carrier in which the ET 200pro rear wall bus modules are butt-mounted and the electronic modules and motor starters are screw-mounted. … can be ordered in the lengths 0.5 m, 1 m, 2 m (see manual *ET 200pro Distributed I/O Device*).	
Interface module IM 154-. DP standard / high feature	… connects the ET 200pro with the PROFIBUS DP master and prepares the data for the fitted electronic modules and motor starters. (see manual *ET 200pro Distributed I/O Device*).	
Terminating module	… seals the bus on the last module (included with the IM 154-. interface module).	
Rear wall bus module for motor starters and special modules	… provides bus supply, forwards the supply voltages for the electronics and actuator control and houses: • a special module • a DSe (standard or high feature), sDSSte / sDSte motor starter • a RSe (standard or high feature), sRSSte / sRSte reversing starter (see chapter 6).	

Table 1-1: Basic components

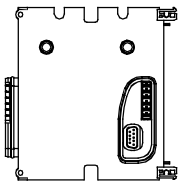
Component	Function	Drawing
Rear wall bus module for safety local repair switch module	… houses a safety local repair switch module.	

Table 1-1: Basic components (Contd.)

1.1.2 Special modules

Special modules are used if you
- … require a shutdown of the series-connected motor starters.
- … require safety up to category 4.

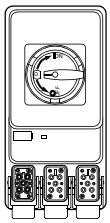
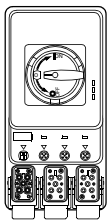
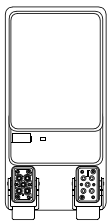
Component	Function	Drawing
Repair switch module (RSM)	… with bus connection … without digital inputs … with SF-LED … switches the power bus for the following motor starters … lockable disconnection function for the main circuit … for short-circuit protection (see chapter 7.2).	
Safety local repair switch module (F-RSM)	… with bus connection … with 3TK2841 functionality for emergency stop … with 2 digital inputs … with 1 digital output … with SF-LED … switches the power bus for the following motor starters … lockable disconnection function for the main circuit … for short-circuit protection (see chapter 7.3).	
400V shutdown module (ASM-400V)	… with bus connection … without digital inputs … with SF-LED … switches off the power bus for the following motor starters safely (see chapter 7.4).	

Table 1-2: Special modules

1.1.3 Motor starters

The table below shows the motor starter versions:

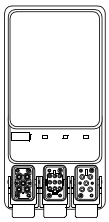
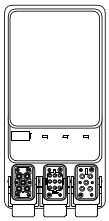
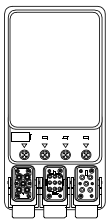
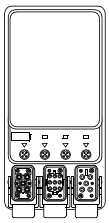
Component	Function	Drawing
Direct starter DSe; Standard	Direct starter; Standard with electronic overload protection … switches a motor on or off. … protects three-phase motors up to 5.5 kW in the event of overloading and short circuiting. … either with brake control, 400 V external power supply. … with SF-LED (see chapter 8).	
Reversing starter RSe; Standard	Reversing starter; Standard with electronic overload protection … 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. … either with brake control, 400 V external power supply. … with SF-LED (see chapter 8).	
Direct starter DSe; High feature	… has the same features as a direct starter; standard … has an additional 4 digital inputs. (see chapter 8).	
Reversing starter RSe; High feature	… has the same features as a reversing starter; standard … has an additional 4 digital inputs. (see chapter 8.	

Table 1-3: Motor starters

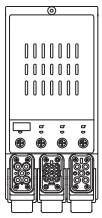
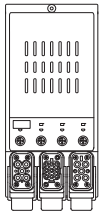
Component	Function	Drawing
Electronic starter sDSSte, sDSte High feature	Direct soft-starter; high feature with electronic overload protection … switches a motor on or off. … protects three-phase motors up to 5.5 kW in the event of overloading and short circuiting. … either with brake control, 400 V external power supply. … with SF-LED (see chapter 8).	
Electronic reversing starter sRSSte, sRSte High feature	Reversing soft starter; high feature with electronic overload protection … 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. … either with brake control, 400 V external power supply. … with SF-LED (see chapter 8).	

Table 1-3: Motor starters (Contd.)

1.1.4 Accessories

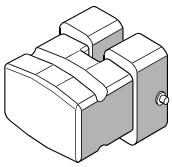
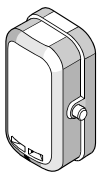
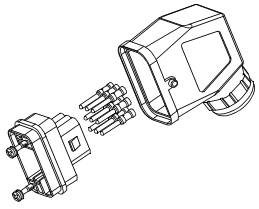
Component	Function	Drawing
Energy jumper plug	… for forwarding the energy bus from connection X3 to the next special module or motor starter on connection X1.	
Cap for power bus	… seals the power bus on any connections not required (not for power infeed on connection X1)	
Plug sets	… used to produce power cables and cables for consumer connection. … HAN Q4/2 is available with socket and pin contacts. … HAN Q8/0 is available with pin contacts.	

Table 1-4: Accessories

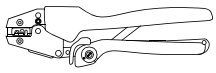
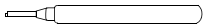
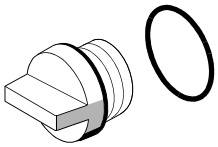
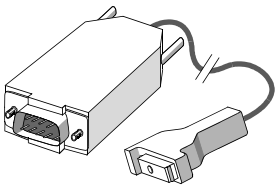
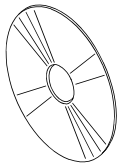
Component	Function	Drawing
Crimping tools	… used to secure the socket and pin contacts onto the ends of the cables. … available for 0.14 - 4 mm^2 and 4 - 6 mm^2.	
Removal tools	… are used to remove the contacts from the plug housings. … available for HAN Q4/2 and HAN Q8/0.	
M12 cap with O-ring	… used to cover the inputs not required.	
PC cable with RS232	… with optical interface for the communication with motor starters	
Motor starter ES software on CD-ROM	… for: • Parameterization • Operate and observe • Diagnostics • Monitoring during ongoing operation • Output of statistics data on preventative maintenance, e.g. operating hours (see chapter 4.6)	

Table 1-4: Accessories (Contd.)

1.2 ET 200pro configuration options

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

- Motor starter; Standard and motor starter; High feature can be combined together in any way.

ET 200pro with motor starters

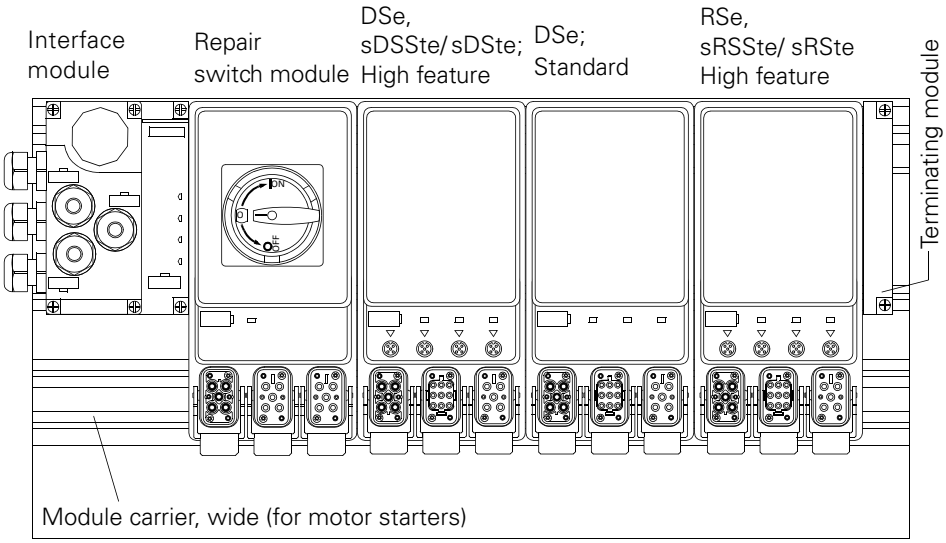


Figure 1-1: ET 200pro with motor starters

ET 200pro with motor starters and electronic modules

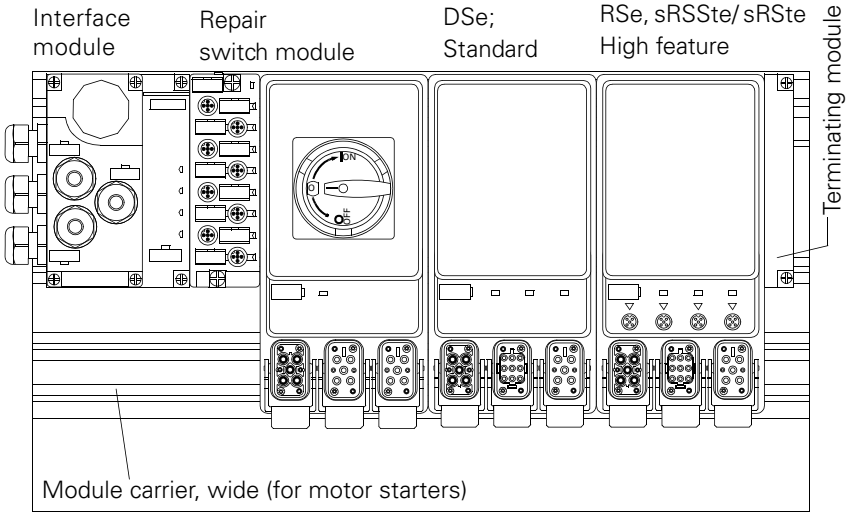


Figure 1-2: ET 200pro with motor starters and electronic modules

ET 200pro with motor starters up to category 4

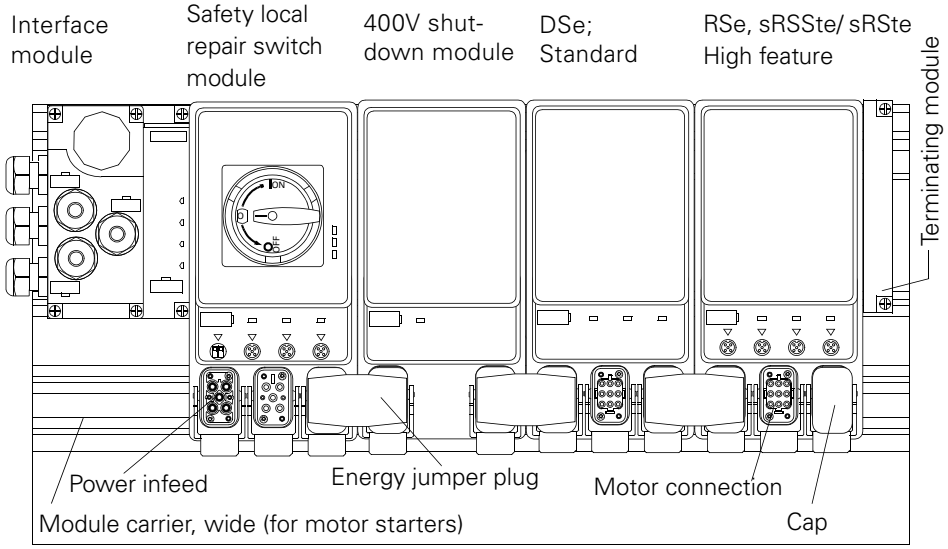


Figure 1-3: ET 200pro with motor starters up to category 4

Parts list

The parts list below gives a list of all components required for an ET 200pro sample configuration with motor starters (see figure 1-3).

Abbreviation	Order number	Description
—	6ES7194-4GB10-0AA0	Module carrier, wide (for motor starters), (length 1 m)
—	6ES7154-2AA00-0AB0	Interface module IM 154-2 DP high feature with terminating module
—	3RK1922-2BA00	Rear wall bus module for special modules and motor starters
—	3RK1922-2BA01	Rear wall bus module for safety local repair switch module
F-RSM	3RK1304-0HS00-7AA0	Safety local repair switch module
ASM -400	3RK1304-0HS00-8AA0	400V shutdown module
DSe-ST	3RK1304-5**x**S40-4AA0[1)]	DSe direct starter; Standard
RSe-HF	3RK1304-5**x**S40-3AA0[1)]	RSe reversing starter; High feature
—	3RK1922-2BQ00	Energy jumper plug
—	3RK1902-0CJ00 3RK1902-0CK00	Cap for power bus (x 10) (x 1)
—	3RX9802-0AA00	Cap for unused M12 connections
—	3RK1911-2BE10	Plug set for power infeed (X1) for 4 mm^2 HAN Q4/2
—	3RK1902-0CE00	Plug set for motor connection (X2) for 1.5 mm^2 HAN Q8/0

1) **x** = the current range should be selected according to your connected load

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

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

- The maximum number of modules totals 16.
  This includes:
  - Interface modules
  - Electronic modules
  - Modules for reserve
  - Max. 8 special modules / motor starters permitted
- The maximum width is 1 m.
- The maximum current-carrying capacity of the power infeed is 25 A (4 mm^2)

The table below shows the number of parameters of the individual modules in bytes:

Module	**PAA/PAE** (bytes)
Repair switch module	0/1
Safety local repair switch module	0/1
400V shutdown module	0/1
DSe; Standard	2/2
RSe Standard	2/2
sDSSte/ sDSte High feature	2/2
sRSSte/ sRSte High feature	2/2

Table 1-5: Number of parameters of the modules

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

Component	**Maximum current-carrying capacity**	**Modules that can be connected**
all motor starters	25 A	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.
Repair switch module		
Safety local repair switch module		
400V shutdown module		

Table 1-6: 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 manufacturer-nonspecific PROFIenergy profile defined on PROFINET makes an active contribution to environmental protection.

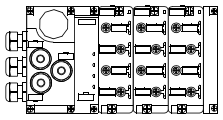
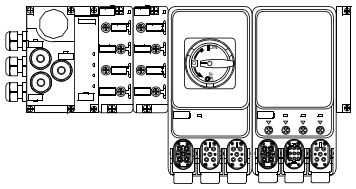
PROFIenergy (Version1.0) in ET200pro motor starter

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 PROFIenergy functions 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 200pro manuals

The ET 200pro components are described in two manuals. The examples below show the possible configurations of ET 200pro and the required manuals.

You use the following components …

ET 200pro consists of the following components:	**You need the information from the following manuals:**
	*ET 200pro Distributed I/O Device*
	*ET 200pro Distributed I/O Device* + *ET 200pro Motor Starters*

The manuals are available in other languages 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 200pro Motor Starters	**ET 200pro Distributed I/O Device**
ET 200pro components	1	2
Brief commissioning instructions	2	—
Installation	3	4
Commissioning and diagnostics	4	7
General technical specifications	5	11
Rear wall bus module	6	—
Special modules	7	—
Motor starters	8	—
Connection	9	5
Device functions	10	9
Order numbers	A	A
Dimensioned drawings	B	A
Applications	C	—
Data formats and data records	D	—
Glossary	Gl	Glossary

Brief instructions 2

2.1 Brief commissioning instructions

Introduction

The example below illustrates how to commission the ET 200S with motor starters step by step.
DSe direct starter; By default is controlled by an ON button and an OFF button, connected to an 8 DI 24V DC ST module.
The *'HW Config'* software in *'STEP 7'* is used for configuration.

Objective of the example

This example shall

1. show you how to commission a basic DSe direct starter; using ET 200pro by default in just 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 200pro are always:

- 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 200pro
- Evaluation of the diagnostics

2.2 ET 200pro components

Required components

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

Number	Order number	Description
1	6ES7194-4GB00-0AA0 6ES7194-4GB10-0AA0	Module carrier, wide - length 0.5 m Module carrier, wide - length 1 m (either possible)
1	6ES7154-2AA00-0AB0	Interface module IM 154-2 DP high feature with terminating module
1	6ES7194-4CB00-0AA0	Connection module CM 8xM12
1	6ES7141-4BF00-0AA0	Electronics module 8 DI 24V DC
2	3RK1922-2BA00	Rear wall bus module for special modules and motor starters
1	3RK1304-0HS00-6AA0	Repair switch module
1	3RK1304-5**x**S40-4AA0[1)]	DSe direct starter; standard
1	3RK1922-2BQ00	Energy jumper plug
2	3RK1902-0CK00	Cap for energy bus
1	3RK1911-2BE50	Connector set for power infeed (2.5 mm^2)
1	3RK1902-0CC00	Connector set for motor connection (2.5 mm^2)

1) **x** = 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 DPV1 compatible master (e.g. CPU 315-2 DP(1), order number: 6ES7315-2AG10-0AB0).
  For this example, a CPU 315-2 DP(1) was used as the DP master.
  Every other DPV1 master (IEC 61784-1:2002 Ed1 CP 3/1 standard) can also be used, of course.
- On your PG, STEP 7 (from V 5.3 with SP2) is fully installed. You have STEP 7 knowledge.
- 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.
Unused connections must be sealed using standard accessory components.

The following image shows you in which order you should mount the ET 200pro components onto the module carrier.

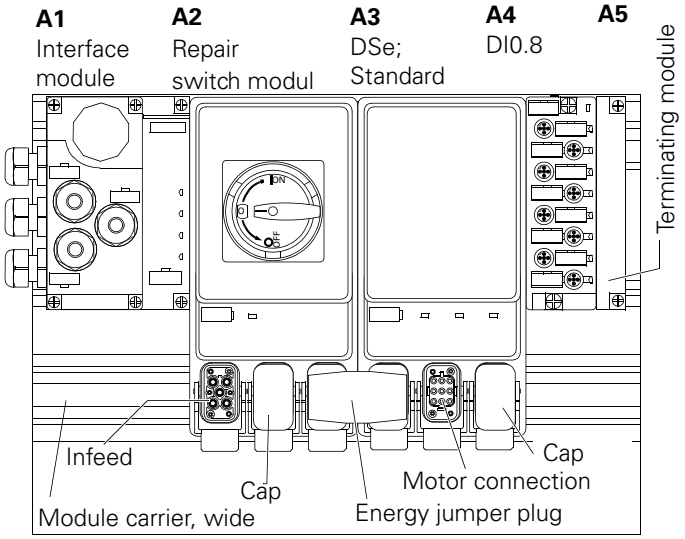


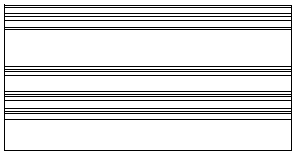
Figure 2-1: Components and setup for the example

Mounting order

A precise mounting description can be found for the following:

- IM 154 Installation of DP High Feature and digital modules in the manual *'ET 200pro Distributed I/O Device'*
- Installation of rear wall bus modules in chapter 3.4
- Installation of repair switch modules and motor starters in chapter 3.5

For mounting, proceed as follows:



1. Install the module carrier on a solid base.
2. Start installing the individual modules onto the module carrier from the left.
   Observe the following order:
   - IM 154-. interface module DP High Feature
   - 8 DI 24V DC electronics module
   - Rear wall bus module for repair switch module
   - Rear wall bus module for DSe direct starters; Standard
   - Terminating module
3. Place the relevant function module onto the rear wall bus module and secure using bolts.
4. On the IM 154-. DP High Feature interface module, set the PROFIBUS address 6.

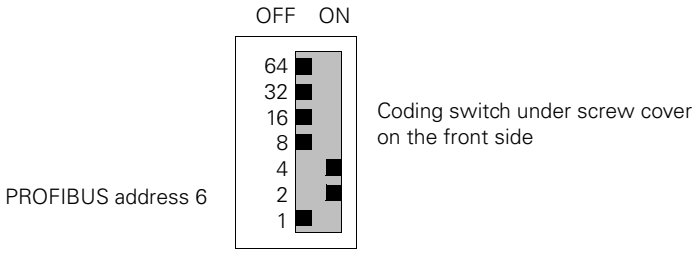


Figure 2-2: Set PROFIBUS address 6

2.4.1 Circuitry of the example setup

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

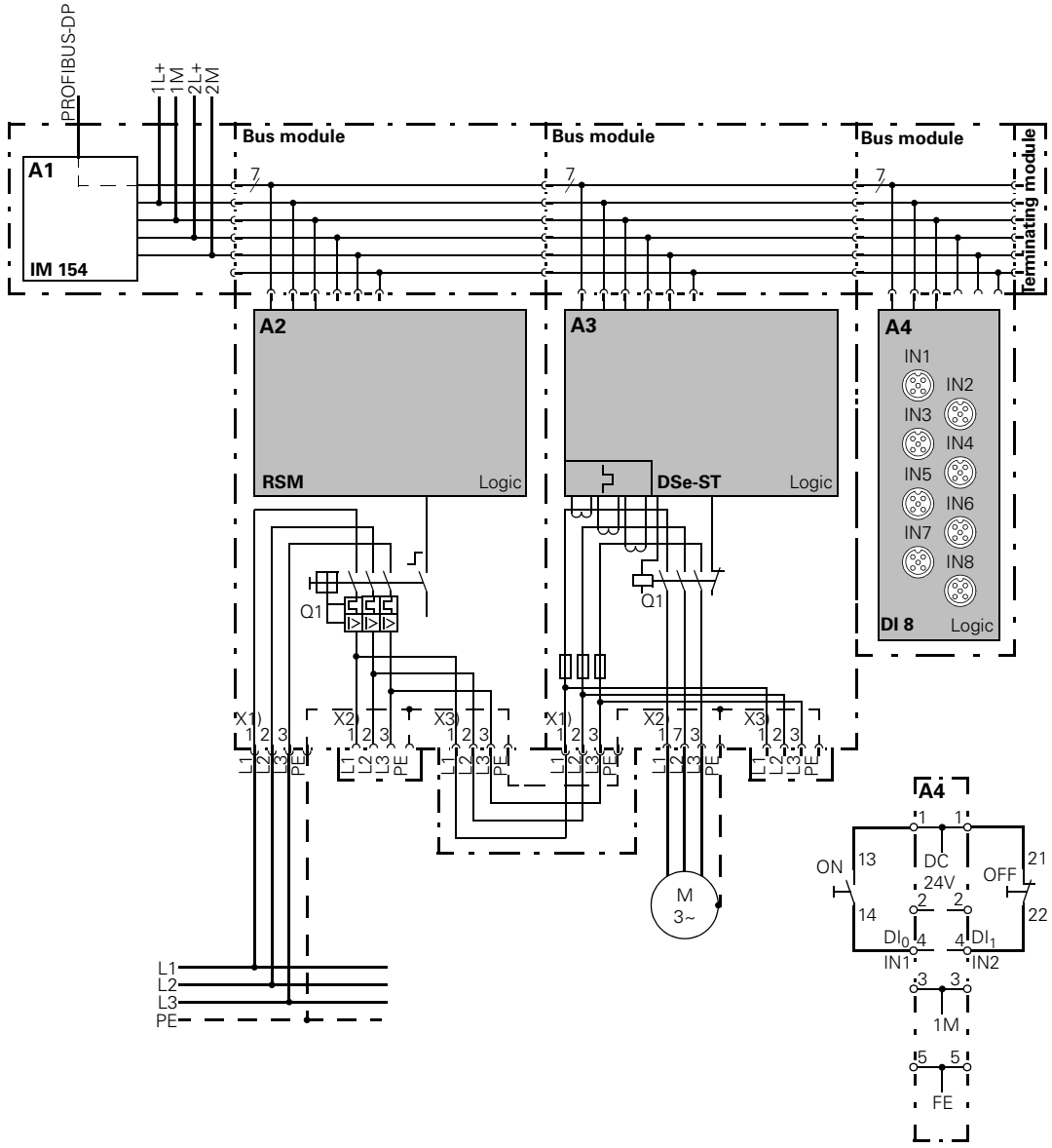


Figure 2-3: Circuitry for the example

2.5 Cabling and fitting

Perform the following steps:

1.

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

2. Cable the ET 200pro as shown in figure 2-3. Only the external lines shown in bold should be connected. The functions are:
   – 400 V AC and PE (power supply) on connection X1 of the repair switch module
   – Consumer (motor) on connection X2 of the motor starter
   – Energy jumper plug between connection X3 of the repair switch and connection X1 of the motor starter
   – both switches for ON (NO contact) and OFF (NC contact) on electronics module 8 DI 24V DC
3. Seal the connection X2 of the repair switch module with a cap
4. Seal the connection X3 on the motor starter using a cap
5. Connect the DP Master to the ET 200pro using the PROFIBUS bus connection cable. The PROFIBUS DP interface is on the IM 154-. DP High Feature.
6. Switch on the voltage supply for the DP master.
7. Observe the status LEDs on the DP master.
   CPU 315-2 DP:
   - 5 V DC green
   - SF DP off
   - BUSF flashes red

2.6 Configuration

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. Insert the ET 200pro on the PROFIBUS from the hardware catalog.
4. Set the PROFIBUS address 6 for ET 200pro.
5. If not already carried out, update your software (see chapter 4.2 - *'Updating the software'*), so that the ET 200pro modules are visible. Drag the individual ET 200pro modules from the hardware catalog into the configuration table (see figure 2-4).
6. For complete display of the parameter set for motor starters, in the screen for the module IM 154-. under *'Operating parameters'*, set the DP Alarm Mode of *'DPV0'* (=preset) on *'DPV1'*. If this is not possible, the CPU used is not suitable for DPV1.
7. Parameterize the *'Response to residual current detection'* for the motor starter for this example to "warning".

Module / DP code	Order number	Input address	Output address	Comment
2	3RK1304-0HS00-8AA0	0.0 - 0.7		Disconnecting module
3	3RK1304-5**x**S40-4AA0[1)]	1.0 - 1.3	0.0 - 0.3	DSe motor starter
4	6ES7141-4BF00-0AA0	3.0 - 3.7		Electronics module 8 DI 24V DC

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

Table 2-2: Configuration table in *'HW Config'*quot;

This should produce the following image.

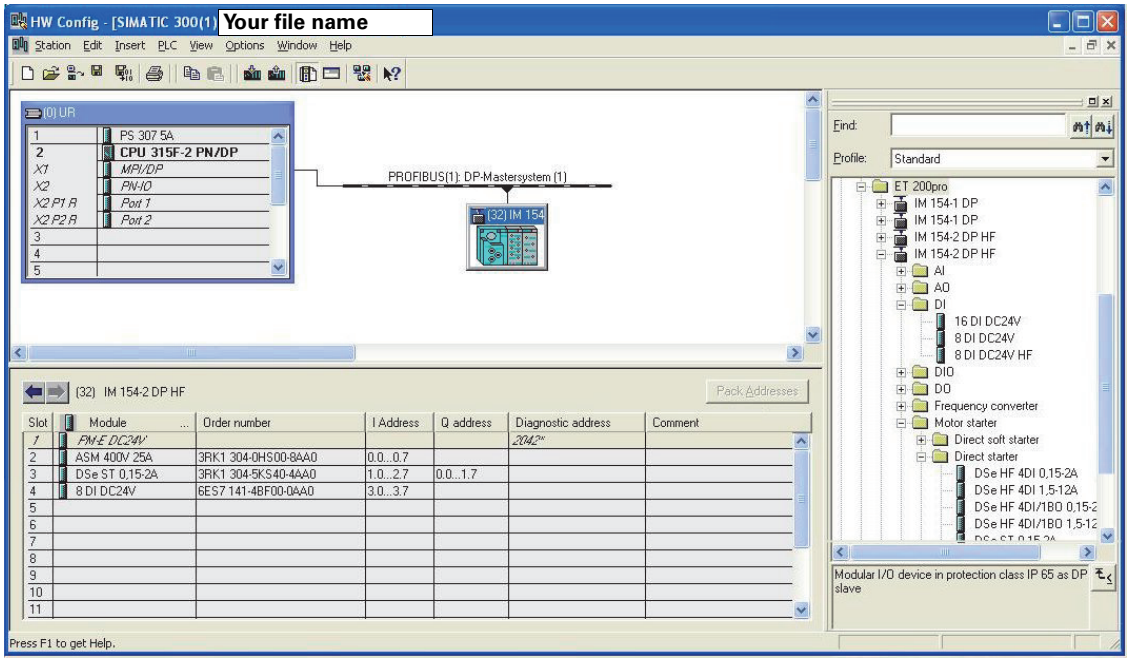


Figure 2-4: Modules in *'HW Config'*

Setting the parameters for DP slave

8. To obtain diagnoses of the modules, set the following parameters for the individual modules:
   - In the properties of DP slave for ET 200pro dialog box Start at setpoint <> actual setup: enable, module change in operation: Enable
   - in the dialog box Properties DP Slave for DSe, module / DP code 4 (in the configuration table), diagnostics: Enable group diagnosis
   - for the motor starter, set the basic parameter for the rated operating current
9. Save the configuration.

Setting the parameters for motor starters

10. As a minimum, set the rated operating current in the basic parameters of the motor being operated on the motor starter. Other parameters can be set as an option.

2.7 Integration into the user program

1. Create the user program using the KOP / AWL / FUP-Editor in the 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 200pro.
   - 1L+ and 2L+ via the IM 154-. module
   - Do **not** switch on the 400 V AC power supply!
2. Observe the status LEDs on the DP master and ET 200pro
   - CPU 315-2 DP:
     5V DC: Lights up
     SF DP: off
     BF: Off
3. Observe the status LEDs on the IM 154-. DP high feature.
   - SF off
   - BF off
   - ON green
   - 24 V DC green
4. Observe the status LEDs on the 8 DI 24V DC
   - DI_0 off
   - DI_1 green
   - DI_2 off
   - DI_3 off
5. Observe the status LEDs on the DSe motor starter
   - SF off
   - STATE off
   - DEVICE green

Checking the wiring

Check the correct wiring of the ON and OFF buttons.

6. Press the ON switch
   Observe the LEDs
   - 8 DI 24V DC, DI_0 green
   - DSe motor starter, STATE green.
   - DSe motor starter, DEVICE flashing in yellow.
   - If on the motor starter DSe, SF is red, the parameter for *'Response to residual current detection'* should be set to "shut down". Remove the ON command and to reset the fault, switch the 1L+ voltage off for a brief time.

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

7. Switch on the supply voltage 400 V AC for the motor starter.

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

8. Repeat step 6 and observe the response of the connected consumer.
9. Press the OFF switch
   Observe the LEDs
   - 8 DI 24V DC, DI_1 off
   - DSe motor starter, STATE off.
   - DSe motor starter, DEVICE green

2.9 Diagnostic options

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

- Via the DP diagnostics modules for SIMATIC S7 "FB125" or "FC125".
  You can download both modules or a description in *.pdf format on the Internet under:
  https://support.industry.siemens.com/cs/ww/en/view/387257
- Via *'HW Config'* S7.
  See the following chapter 2.9.1
- Via the easy-to-use parameterization and diagnostics software *'ES Motor Starter'*.
  Using this software, which can be integrated into the S7, the ET 200pro motor starters; parameterization, operation and monitoring (diagnostics) can be carried out quickly and easily.
  The software can be ordered online:
  https://support.industry.siemens.com/cs/ww/en/ps/16713/td

2.9.1 Diagnostics via *'HW Config'* of STEP 7

1. Open the *'HW Config'* window in the SIMATIC Manager on your computer or programming device.
2. Open the "Online" station.
3. Simulate various windows and observe the messages in the *'DP Slave Diagnostics'* status window, for example:
   - Shut down the voltages 1L+ and / or 2L+

In the image below, for example, a motor starter is diagnosed on slot 2 and 3.

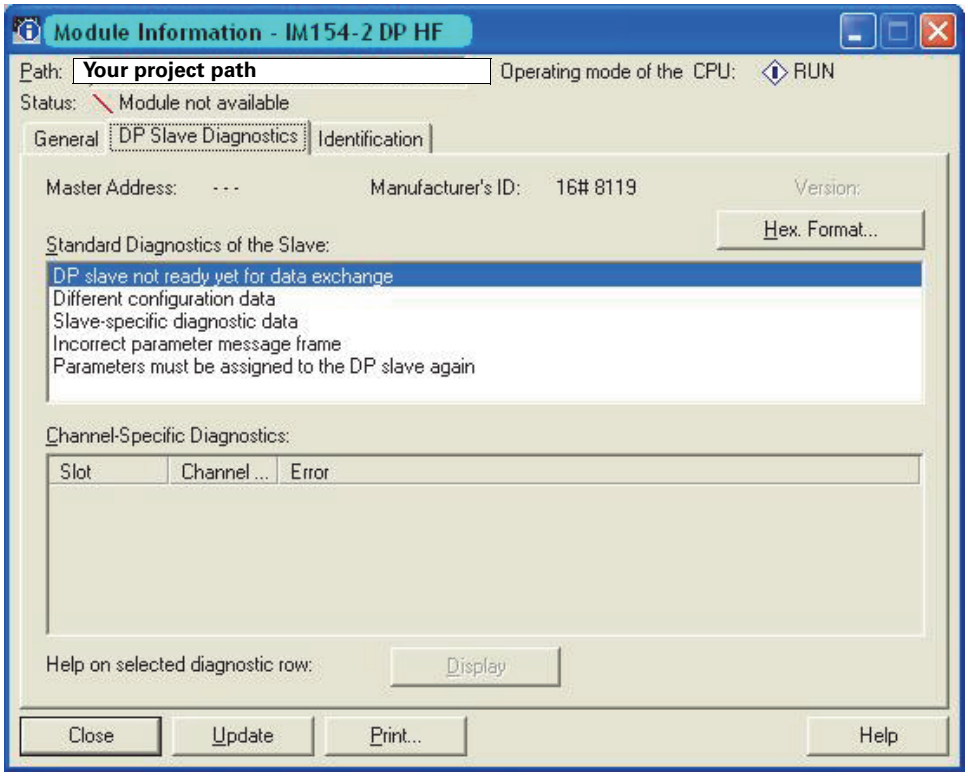


Figure 2-5: View of the *'DP-Slave Diagnostics'* status window

4. After every performed action, press the F5 on the computer/programming device to update the status window. The IM 154-. module is identified in a fault message via a red dot with a white cross.
5. Double-clicking on the faulty station will display the module status of the IM 154-. (*'General'* tab). For precise fault diagnosis, select *'DP Slave Diagnostics'*. The individual diagnoses of the malfunctioning slave are shown in text form.

2.10 Help

If you have problems or questions, please contact:

SIEMENS AG	
Online Support	siemens.com/online-support
Support Request	siemens.com/support-request

Installation 3

3.1 Installation rules

Install module carrier, wide

Information on the installation of the module carrier, wide, can be found in the manual *'ET 200pro' Distributed I/O Device*.
Note the following during the installation process:

- Maximum permissible device length: 1 m
- A maximum of 8 motor starter modules can be operated on an ET 200pro interface module

Easy installation

The ET 200pro distributed I/O device is designed for simple installation.

ET 200pro motor starters are designed as a complete device together with a rear wall bus module (110 mm) on a module carrier, wide (press-drawn section).
First fit the ET 200pro interface module IM 154-. onto the module carrier.
Then fit required rear wall bus modules in succession onto the right-hand side of interface module IM 154-.

The function modules are fitted onto the rear wall bus modules in stages by fitting them onto the right-hand side of the interface module IM 154-. or the preceding module by fitting them on and then screwing them on using 3 Phillips bolts.

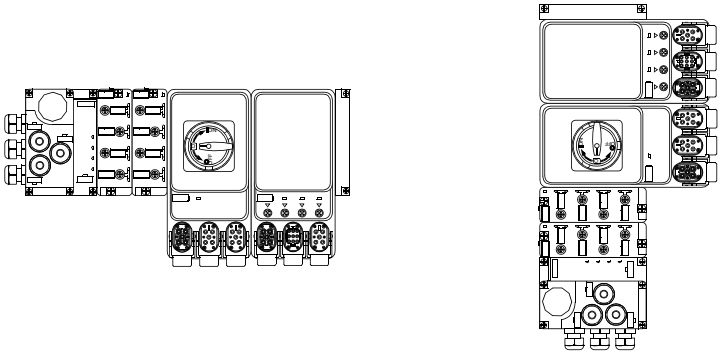
Installation rules for the configuration of an ET 200pro with motor starters

Observe the following rules for installation (see also figures in chapter 1.2 "ET 200pro configuration options"):

- The components are arranged in a single line on a module carrier, wide.
- Each line begins on the left with an IM 154-. interface module
- The ET 200pro distributed I/O device ends with the terminating module, motor starter in addition with a cap for the X3 connection.

Installation position

The distributed I/O device is suitable for the following installations on a vertical wall:



vertical horizontal

Figure 3-1: Installation position

Please note:

During configuration, please observe the following points:

From an ambient temperature of T_u 40 °C, a derating may be required for motor starters (see chapter 3.3).

3.2 Installation measurements and clearances

Measurements	Module	mm
Installation width	Rear wall bus module for motor starters and special modules	110
Installation height	No power plug: • Special modules • Motor starter; standard • Motor starter high feature	 230 230 230
Installation depth	On module carrier, wide, with rear wall bus module for: • Special modules - Repair switch module - Safety local repair switch module - 400V shutdown module • Motor starter; standard • Motor starter high feature with sensor cables	 190 190 170 170 180
Minimum spacing for installation and wiring	• Above and below the rear wall bus modules • To the left of the IM 154- interface module. • To the right of the ET 200pro terminating module • Below the motor starter and special modules	25 15 15 50

Table 3-1:Installation measurements and clearances

3.3 Derating

3.3.1 What is derating?

Derating refers to the use of devices in difficult operating conditions by selectively limiting their performance. With special modules and motor starters, these are operated at high ambient temperatures (>40 °C).

3.3.2 Derating factors

In the case of the ET 200pro special modules and motor starters, the following factors must be taken into account and balanced against one another when used in challenging ambient conditions:

- Ambient temperature T_u:
  The ambient temperature T_u is the temperature surrounding the housing of a special module and motor starter.
  The lower the maximum ambient temperature T_u, the higher the current load in the special modules and motor starters can be.
- Absolute current load I_e:
  The lower the current through a special module and motor starter, the lower the heat loss (= heat) within the device. If the device does not generate much heat, the ambient temperature T_u can be higher.

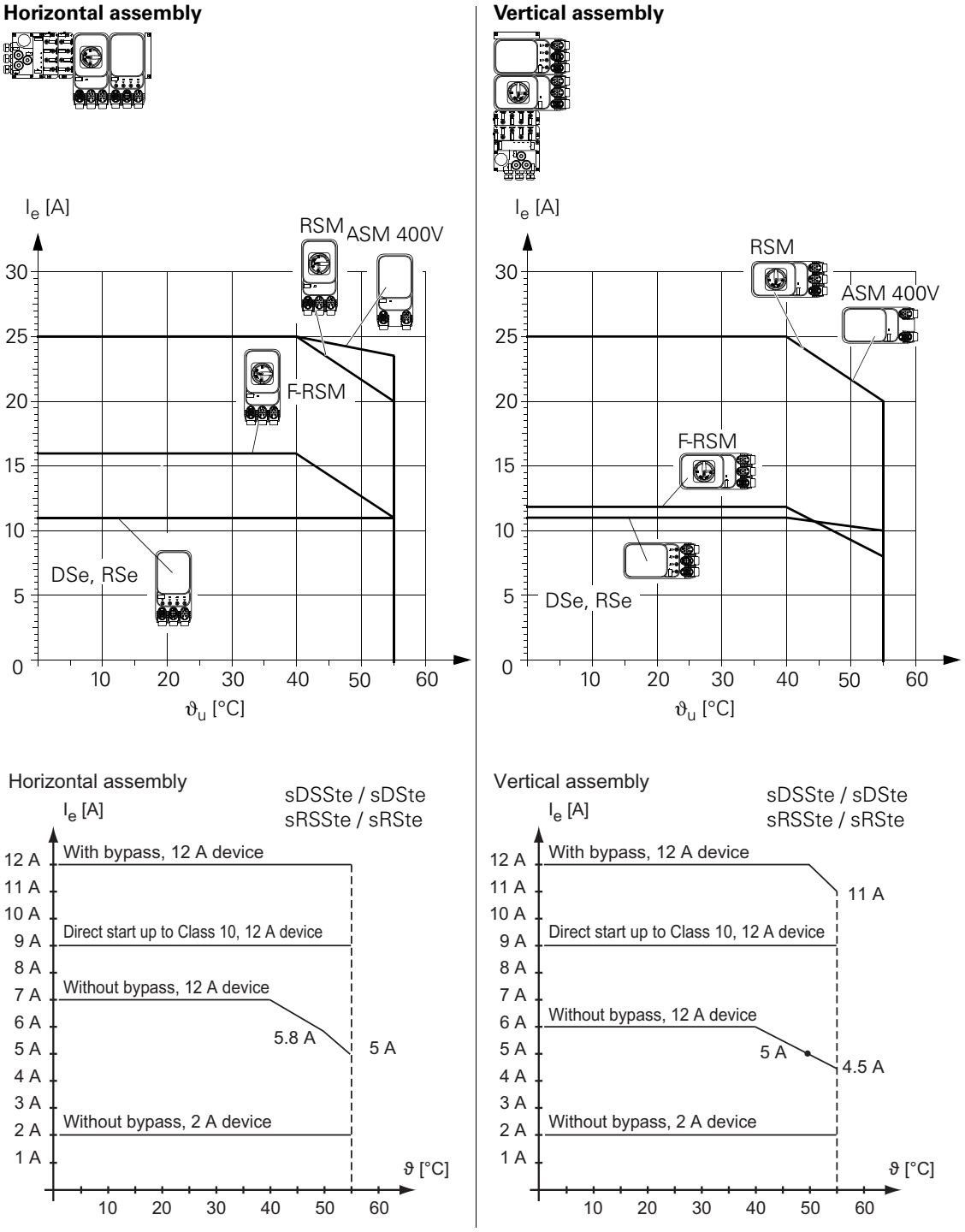


Figure 3-2: Derating diagrams

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	**3RK1304-5KS***	**3RK1304-5LS41**	**3RK1304-5LS71**
≤ 8-fold I_e	2 A	12 A	12 A
9-fold I_e	1,7 A	10 A	8 A
10-fold I_e	1,5 A	9 A	7 A

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 reductions in rated current and rated operating voltage as a function of site altitude:

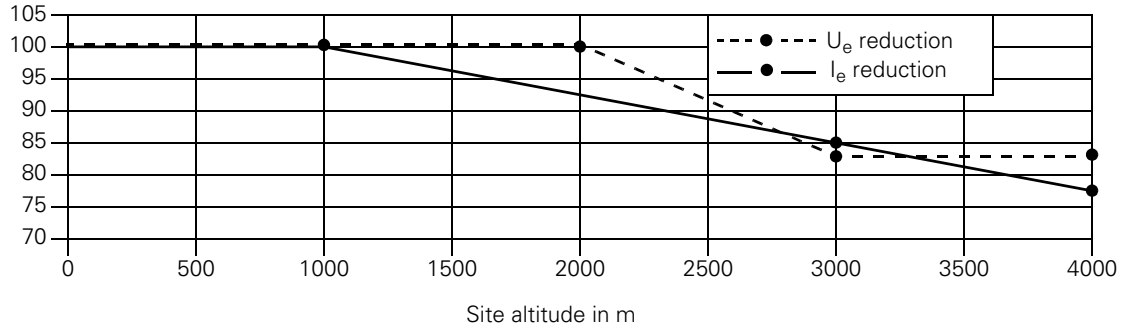


Figure 3-3: Reductions as a function of site altitude

3.4 Rear wall bus module installation

Features

Rear wall bus modules are used for the electrical connection of the special modules and motor starters to the top module.

Requirements

Space is left for the IM 154 interface module.

Installing rear wall bus module for special modules and motor starters

The example below shows the installation of a rear wall bus module.

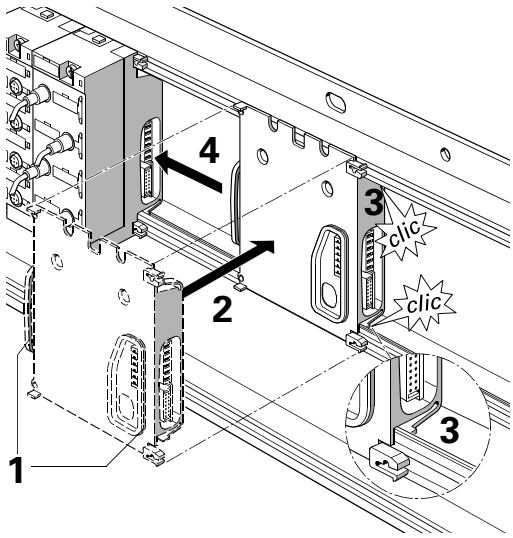
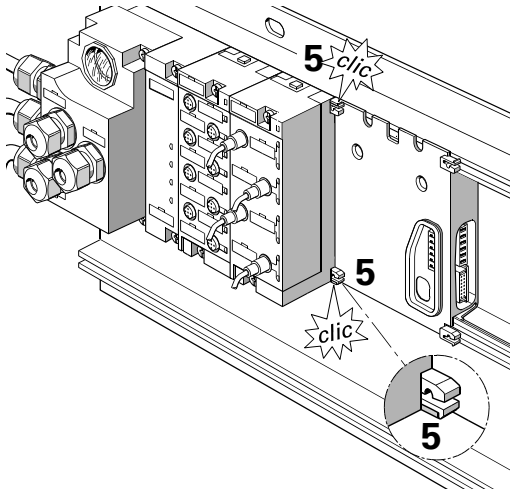
Drawing	Procedure
	**1** Check that the seals on the rear wall bus module are correctly seated. **2** Insert the rear wall bus module into the installation plate and **3** allow the rear wall bus module to engage into the installation plate. **4** Slide the rear wall bus module to the left onto the modules already installed.
	**5** Allow the rear wall bus module to engage into the adjacent module.

Table 3-2: Rear wall bus module installation

3.5 Installation of special modules and motor starters

Requirements

All rear wall bus modules for electronics modules, special modules and motor starters are installed.

Installation of special modules and motor starters

The special modules and motor starters are inserted onto the installed rear wall bus modules and screwed onto the module carrier using 3 Phillips bolts.
The Phillips bolts are pre-fitted onto the special modules and motor starters to avoid loss. A maximum of 3 ASM modules are permitted to be driven by one F-RSM module.

Caution
Ensure that the seal is securely seated and observe the tightening torque of the Phillips bolts of 1.5 Nm to ensure that the construction is fully sealed.

The table below uses an example of installing a repair switch module.

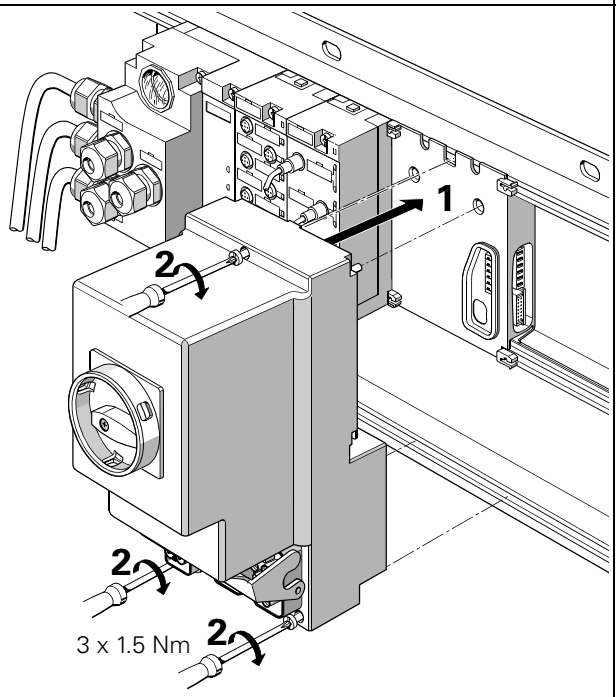
Drawing	Procedure / description
	**1** Set the repair switch with the trunnion into both retainers on the rear wall bus module. **2** Use a size 2 screwdriver to screw the repair switch module using the 3 Phillips bolts with a tightening torque of 1.5 Nm.

Table 3-3: Repair switch module installation

3.6 Installing the terminating module

The last module to be installed with the ET 200pro distributed I/O device must be the terminating module. The ET 200pro is ready for operation only when the terminating module is inserted. The terminating module is included in the delivery of the IM 154-.interface module. More information can be found in the *SIMATIC ET 200pro Distributed I/O Device* manual.

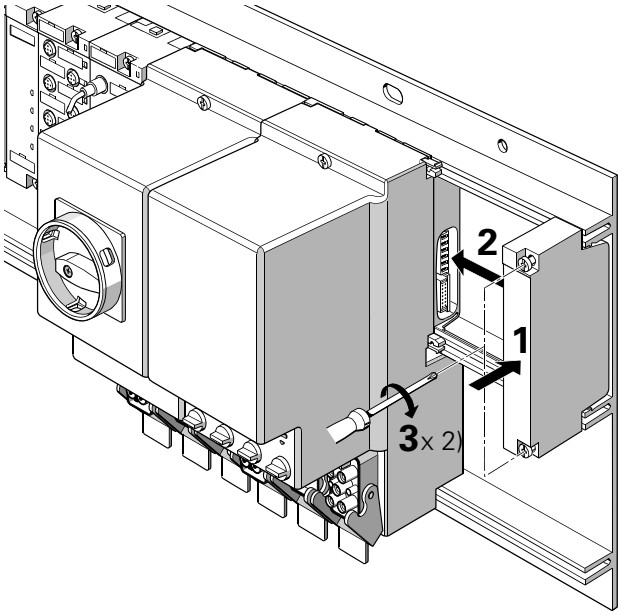
Drawing	Procedure / description
	**1** Insert the terminating module onto the module carrier until it engages. **2** Slide the terminating module to the left until it engages into the last module. **3** Use a size 2 screwdriver to secure the terminating module using the 2 Phillips bolts at a tightening torque of 1.5 Nm.

Table 3-4:Installing the terminating module

3.7 Connecting the cables

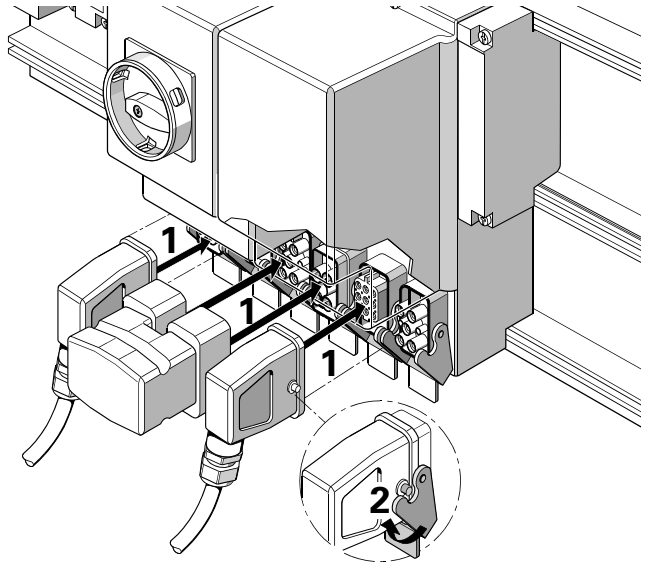
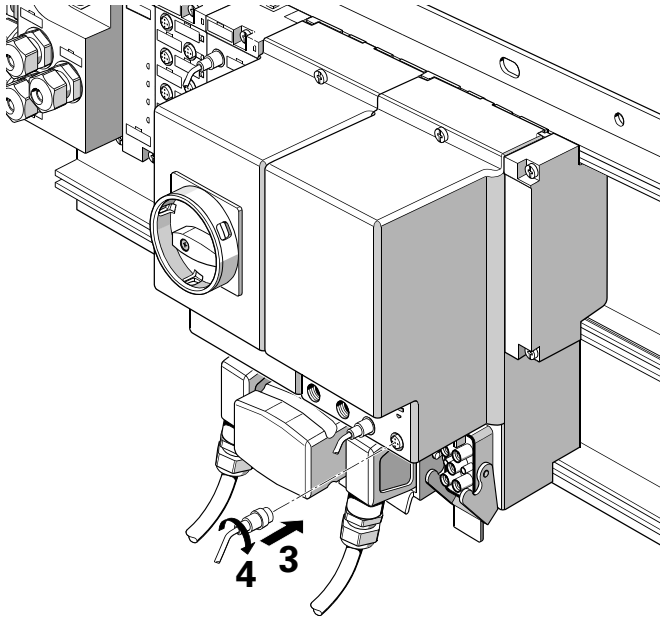
Drawing	Procedure / description
	**1** Insert the cables and energy jumper plugs onto the relevant connections depending on your construction. **2** Then lock the inserted cables and energy jumper plugs.
	**3** Insert the M12 cables into the relevant connections according to your construction. **4** Tighten the securing ring by hand as far as it will go.

Table 3-5:Connecting the cables

Caution
The plug insert on the X1 connection of the repair switch is installed rotated 180° against the plug insert on the X1 connection of a motor starter.
This prevents an X1 connection cable for the repair switch being inserted onto a motor starter.

3.8 Fitting the caps

With special modules and with motor starters, unused connections with caps do not need to be sealed to protect open contacts against dirt and to seal the ET 200pro securely in line with IP65.

The caps should be ordered separately.

Unused M12 connections must also be sealed using caps.

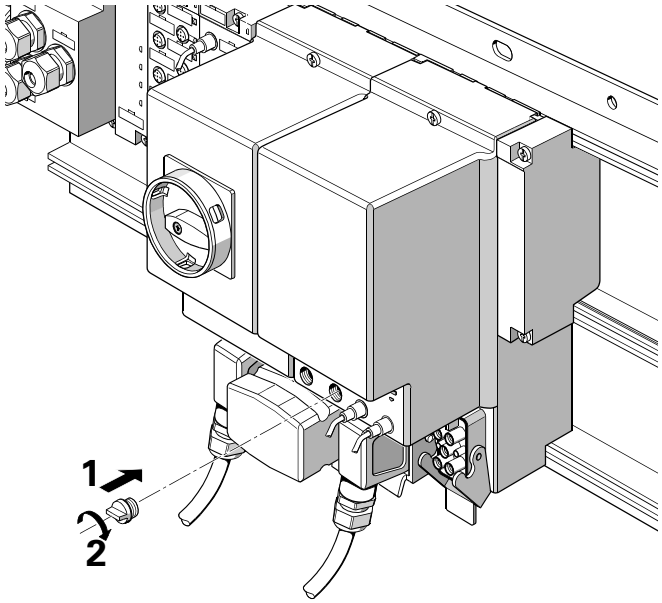
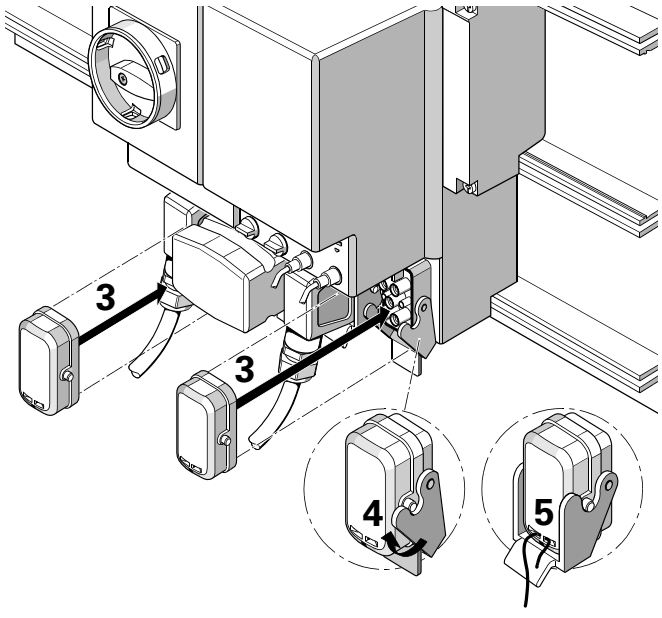
Drawing	Procedure / description
	**1/2** Screw the cap onto unused M12 connections manually as far as it will go.
	**3/4** Seal unused connections of the energy bus using caps. **5** The caps can be secured against loss using a cord.

Table 3-6:Fitting the caps

3.9 Removing the motor starters

A motor starter can be removed from the rear wall bus module during operation. The feeder must be de-energized, e.g. repair switch switched off. Remove the cable to the motor and both energy jumper plugs on the left and right from the motor starter to be replaced. Press the relevant locking lever on the plugs downwards. Unfasten the 3 Phillips bolts as shown in the figure below and remove the motor starter from the rear wall bus module.

Caution
If you remove more than one module from the ET 200pro, the station switches to STOP.

The table below describes how to remove motor starters using the example of a direct starter.

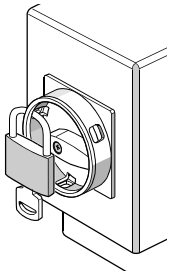
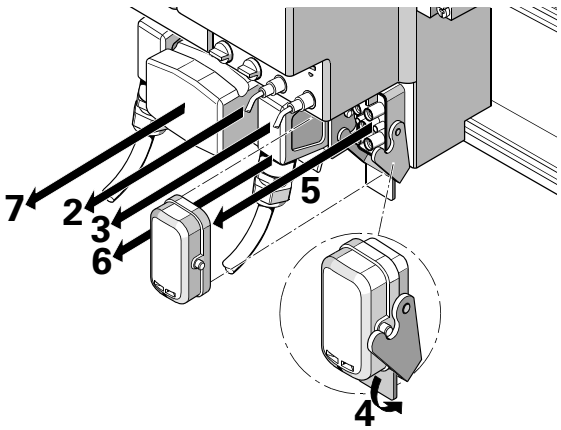
Drawing	Procedure / description	
	**1**	Ensure that the 400 V supply is shut off (e.g. on the repair switch). If required, the repair switch can be secured against reactivation using a padlock.
	**2/3** **4** **5/6/7**	Unscrew the connections for the M12 cables. Unlock the plugs or covers from X1 to X3. Remove the plugs and covers.

Table 3-7:Removing motor starters

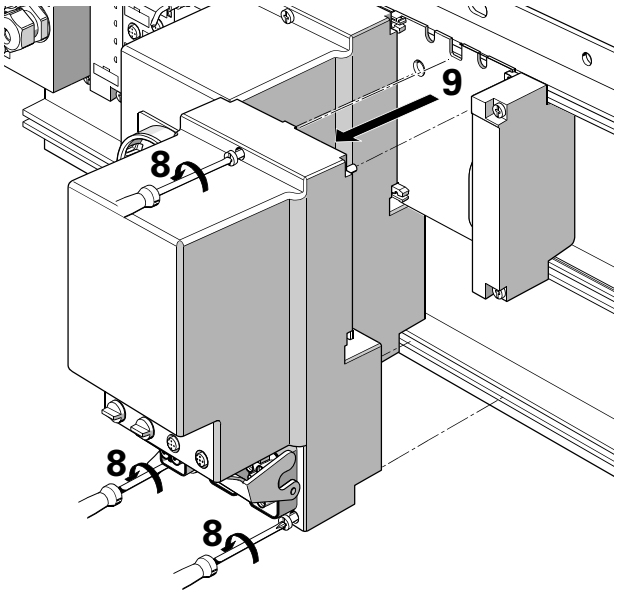
Drawing	Procedure / description
	**8** Unfasten the 3 Phillips bolts on the motor starter. **9** Remove the motor starter forwards.

Table 3-7:Removing motor starters (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 200pro can be deployed from the start.

Commissioning and diagnostics 4

4.1 Commissioning

The motor starter modules are parameterized via the field bus standard procedure during startup. A change of parameters and B&B (operation and monitoring) can also be carried out during ongoing operation alternatively via bus and the DP V1 mechanism or via the optical device interface on-site.

The group diagnostics parameter can be parameterized to disable or enable. With disable, no fault messages are issued. In this case, the SF-LED when a device diagnostics message occurs is no longer driven by the IM 154-. interface module.

A device fault can only be acknowledged via Power Off / On (1L+). If a faulty response occurs repeatedly, the motor starter is faulty.
All other faults can be acknowledged via trip reset.

Attention
It is essential that the voltage tolerance for the 2L+ load power supply (contactor and power electronics) is observed up to 55 °C: 20.4 V to 28.8 V.

Current set

With all motor starters you parameterize the current set via the relevant configuration and parameterization tool (e.g. GSD file, HW config, motor starter ES, TIA portal, etc.).

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 (100 kA/400 V) of the integrated fuses, you must provide additional external short-circuit protection (fuse or circuit breaker), see also chapter 7.4.

After overload or short-circuit tripping

- After a **short-circuit**, the internal fuses and the switching elements may be faulty in motor starters.
- After an **overload trip** - fuses OK - you have the option to reset the overload trip via a reset.
  Reset options are:
  – Remote reset (via bus interface)
  - cyclical process image (trip reset)
  - via command *'trip reset'*
  – Local reset (via command)
  – Trip reset via a parameterized input action on inputs 1-4 (only with motor starters, high feature)

Caution
A reset is only accepted if the parameterized recovery time previously set is not reached.

- Repair switch module or local safety module with integrated power switch of size I_e 25 A.
  Actuation value of the short-circuit protection at 13 x I_e.
  Reset by pressing the rotary switch.

Disconnecting a load from the power supply

Pressing the rotary switch on the repair switch module in the OFF position gives you the option to disconnect downstream consumers from the power supply.

Caution
Unplugging or plugging in a consumer during ongoing operation (i.e. under load) is not permitted.

Reversing starters

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

4.2 Configuration

Configuring means configuring and parameterizing the ET 200pro.

More information can be found in chapter 5 of the manual *'SIMATIC ET 200pro Distributed I/O Device'.*

The table below shows which STEP 7 version is required for operating the modules.

Product label	Order number	Product brief	STEP 7 version from
RSM	3RK1304-0HS00-6AA0	Repair switch module	5.3 SP2
F-RSM	3RK1304-0HS00-7AA0	Safety local repair switch module	5.3 SP2
ASM -400	3RK1304-0HS00-8AA0	400V shutdown module	5.3 SP2
DSe-ST	3RK1304-5xS40-4AA0	Direct starter; standard	5.3 SP2
DSe-ST	3RK1304-5xS40-4AA3	Direct starter; standard with brake control	5.3 SP2
DSe-HF	3RK1304-5xS40-2AA0	Direct starter; High feature with 4 inputs	5.3 SP2
DSe-HF	3RK1304-5xS40-2AA3	Direct starter; High feature with brake control and 4 inputs	5.3 SP2
RSe ST	3RK1304-5xS40-5AA0	Reversing starter; standard	5.3 SP2
RSe ST	3RK1304-5xS40-5AA3	Reversing starter; Standard with brake control	5.3 SP2
RSe-HF	3RK1304-5xS40-3AA0	Reversing starter; High feature with 4 inputs	5.3 SP2
RSe-HF	3RK1304-5xS40-3AA3	Reversing starter; High feature with brake control and 4 inputs	5.3 SP2
sDSSte/ sDSte	3RK1304-5KS70-2AA0 3RK1304-5LS70-2AA0	Electronic starter; High feature with 4 inputs	5.3 SP2
sDSSte/ sDSte	3RK1304-5KS70-2AA3 3RK1304-5LS70-2AA3	Electronic starter; High feature with brake control and 4 inputs	5.3 SP2
sRSSte/ sRSte	3RK1304-5KS70-3AA0 3RK1304-5LS70-3AA0	Electronic reversing starter; High feature with 4 inputs	5.3 SP2
sRSSte/ sRSte	3RK1304-5KS70-3AA3 3RK1304-5LS70-3AA3	Electronic reversing starter; High feature with brake control and 4 inputs	5.3 SP2

Table 4-1: Configuring motor starters

Caution
If during the configuration process, the interface module IM 154-. and the ET 200pro motor starters are not visible, a software update is required.

Observe the following sequence during installation:
[1] Hardware updates for ET 200pro IM 154-. - install.
[2] Hardware updates ET 200pro motor starter 3RK1304… - install.

Software update

To update your software via the internet, proceed as follows:

1. Open the STEP 7 software *'HW config'*
2. Open the menu option *'Tools'* > *'Install HW Updates'*
3. In the screen that is opened, activate the *'Download from the internet'* option (ensure that there is an active connection to the internet)
4. In the table, select the required updates or click the *'Select all'* button
5. Click *'Run'*
6. The updates will be installed

4.3 Diagnostics

4.3.1 Diagnostics and monitoring through the user program

Diagnostics and monitoring for ET 200pro take place via the user program and/or the diagnostics channel of the PROFIBUS DP.

Any group faults (DI 0.2=1) and group warnings (DI 0.3=1) are sent to the input process image.

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

The S7 blocks 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 the following addresses:

https://support.industry.siemens.com/cs/ww/en/view/387257
https://support.industry.siemens.com/cs/ww/en/view/5362473

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

Fault types for special modules

	Fault type	Meaning/cause	Remedy
Repair switch module	11000 Actuator shutdown (F24)	• Module switched off by hand • tripped via short-circuit	Rectify short-circuit.
Safety local repair switch module	11000 Actuator shutdown (F24)	• Module switched off by hand • tripped via short-circuit	Rectify short-circuit.
400V shutdown module	01001: Fault (F9)	• Switching element defective	Replace device

Table 4-2: Fault types for special modules

Fault types for motor starters

Motor starters	Fault type	Meaning/cause	Remedy
Direct starter DSe, sDSSte / sDSte Reversing starter RSe, sRSSte / sRSte	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	Switch the 1L+ supply voltage on and off, if fault continues, replace motor starter.
	11000: Actuator shutdown (F24)	• Asymmetry • Motor blocked • Residual current detected • Or in conjunction with another type of fault in this table	Check phases L1 to L3. Clear stalled rotor. Check main phases L1 to L3 for interruption.
	11010: External fault (F26)	• Input tripping • Input tripping limit position	Eliminate the external fault (withdraw from limit position, for example)
	00101 Overload switching element (F5)	• Thermal motor model is at >178% load. Shutdown as device protection if "Thermal motor model" parameter setting = warning.	Check plant configuration
	10001: (F17)	• Switching element power supply missing	Check 2L+

Table 4-3: Fault types for motor starters

4.4 LED indicators

4.4.1 Repair switch module (RSM) diagnostics

Red	Group fault	SF	

LED SF[1)]	Status / cause of fault
	Operating status
Red	Device fault (device diagnostics from interface module IM 154-. detected)

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

4.4.2 Safety local repair switch module (F-RSM) diagnostics

Red	Group fault	SF[1)]			POWER	L2 present	Green
Yellow	1-channel operation activated	1-CHANNEL			RUN	Output / F0 bar active	Green
Yellow	2-channel operation activated	2-CHANNEL			FAULT[2)]	Emergency stop / emergency shut-down	Red
Green	Start signal present	START					
Green	Output set	OUT1					

1) Status of the LEDs in this form only when group diagnostics activated
2) Flashes after starting operation for approx. 7 s due to self-test, change of the connection assignment in operation or fault in the electronics

4.4.3 400V shutdown module (ASM-400 V) diagnostics

Red	Group fault	SF	

LED SF[1)]	Status / cause of fault
	Operating status
Red	Group fault (set by the IM 154-.) / device fault

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

4.4.4 DSe, sDSSte / sDSte, RSe, sRSSte / sRSte motor starter diagnostics

Red	Group fault	SF			DEVICE	Device status	Red/ green/ yellow
Red/ green/ yellow	Contactor status	STATE			In1-4	Input 1 to 4	Green

LEDs			Status / cause of fault
SF	**STATE**	**Device**	
			Device status / operating mode Control by bus
Off	Green	Green	Motor on; no fault (cw or ccw with RSe)
Off	Off	Green	Motor off; No faults
Off	flickers green[2)]	Green	Motor on; Input control
Off	flashes yellow[1)]	Green	Manual mode lost connection without return to automatic mode
Off	flickers yellow[2)]	Green	Shutdown via input control function (e.g. Quick-Stop)
Off	Off	flashes red	Firmware update
Off	Off	flashes green[3)]	Energy-saving mode active

1) Flash frequency: 0.5 Hz
2) Flicker frequency: 8 to 10 Hz
3) Flashing sequence: 0.25 s on / 1.75 s off => unique flashing rhythm for energy-saving mode

Table 4-4: Status and fault displays via LEDs for DSe, sDSSte / sDSte, RSe, sRSSte / sRSte

LEDs			Status / cause of fault
SF	**STATE**	**Device**	
Off	Off	flickers red[2)]	Self-test running
Off	Off	flashes green[1)]	Device not initialized (send back device for repair)
			Device fault (fault sets group fault)
Red	Red	Red	Current flow present without switch-on command (e.g. contactor welded shut)
Red	Off	Red	Electronics faulty, self-test fault
Red	Off	Off	No connection to rear wall bus interface inside the device
			Plant fault / warning (device sets group fault)
Red	Off	Yellow	• No current flow despite switch-on command (zero current detected) • Internal shutdown
Off	green (with switching element ON)	flashes yellow[1)]	Group warning due to: • Thermal motor model overload • Asymmetry • Current limit violation • Group warning via input action • Maintenance timer limit value exceeded
Red	Off	Off	Switching element power supply missing
Off	Off	flashes yellow	Switching element power supply missing Parameterization (2)group warning
Red	Off	Off	No connection rear wall bus interface inside the device (rear wall bus voltage missing)
Off	Off	Off	Electronics power supply too low
Red	Off	Yellow	external short-circuit in transmitter supply
			Plant fault (top module sets group fault)
Red	Off	Off	Device diagnostics present (only if group diagnostics are enabled)

1) Flash frequency: 0.5 Hz
2) Flicker frequency: 8 to 10 Hz

Table 4-4: Status and fault displays via LEDs for DSe, sDSSte / sDSte, RSe, sRSSte / sRSte (Contd.)

4.5 Process image

4.5.1 Process image for special modules

Input signals

	Repair switch module	Safety Local repair switch module	400V shutdown module
DI 0.0	**Module status:**	**Module status:**	**Module status:**
0	ON	ON	OFF
1	OFF	OFF	ON
DI 0.1		**Status of the safety bar**	**Status of the safety bar**
0	Not used	Bar not powered	Bar not powered
1		Bar powered	Bar powered
DI 0.2			
0			
1			
DI 0.3			
0			
1			
DI 0.4			
0			
1	Not used	Not used	Not used
DI 0.5			
0			
1			
DI 0.6			
0			
1			
DI 0.7			
0			
1			

4.5.2 Process image for motor starters

Input signals

DI 0.0	**Ready (automatic)**	**DI 1.0**	**Motor current I_{act}** [2]
0	Starter not ready via host / PLC		Bit 0
1	Starter can be operated by host		
DI 0.1	**Motor on** [1]	**DI 1.1**	**Motor current I_{act}** [2]
0	Off		Bit 1
1	On (clockwise/ counterclockwise rotation)		
DI 0.2	**Group fault (short-circuit / overload)**	**DI 1.2**	**Motor current I_{act}** [2]
	(If one or more faults described in table 4-6 occur, "Group fault" is reported irrespective of whether the "Group diagnosis" parameter (see chapter 7.6.1 and chapter 8.2.4) 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}** [2]
0	No warning		Bit 3
1	Warning		
DI 0.4	**Input 1**	**DI 1.4**	**Motor current I_{act}** [2]
0	Not active		Bit 4
1	Active		
DI 0.5	**Input 2**	**DI 1.5**	**Motor current I_{act}** [2]
0	Not active		Bit 5
1	Active		
DI 0.6	**Input 3**	**DI 1.6**	**Manual local operating mode**
0	Not active	0	Not active
1	Active	1	Manual operation local
DI 0.7	**Input 4**	**DI 1.7**	**Ramp operation (for soft starter)**
0	Not active	0	Not active
1	Active	1	Active

1) Signal is 1 if the motor current is >18.75% of the set rated current
2) See chapter 10.3.1
For a description of the parameters, see chapter 10.3

Output signals

DO 0.0	**Motor cw**	**DO 1.0**	Not used
0	Motor off		
1	Motor on		
DO 0.1	**Motor ccw** (for RSe)	**DO 1.1**	Not used
0	Motor off		
1	Motor on		
DO 0.2	**Brake actuation**	**DO 1.2**	Not used
0	No drive - brake active - motor braked		
1	Drive - 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**	**DO 1.5**	Not used
0	Not active		
1	Active		
DO 0.6	Not supported	**DO 1.6**	Not used
DO 0.7	Not used	**DO 1.7**	**Disable quick stop**[1)]
		0	not activated
		1	activated

1) High feature starter only

Log book entries

The following log book entries are stored in the starter and can be exported via *'ES Motor Starter'* from version 2006:

- DS 72 device fault
- DS 73 trips
- DS 75 events

The 3 log books are organized as a ring buffer each of 126 bytes. The entries are made together with the corresponding current operating hours of the device. For each entry, 6 bytes are required, meaning that the last 20 entries remain legible.

Format of the entries:

Byte	Meaning
0-3	Operating hours on device (h:mm:ss; storage in 1 s increments)
4-5	ID no. of device fault, trip, event

Table 4-5: Log book entries

Measurements (DS 94)

The measurements give the current operating status of the motor. Measurements are transient values.

The following data are saved in data record 94 on the motor starter:

- Remaining cool-down time of the motor[1)]
- Motor heating
- Asymmetry[1)]
- Phase current I_{L1} (eff)
- Phase current I_{L2} (eff)
- Phase current I_{L3} (eff)
- Phase current I_{L1} (%)
- Phase current I_{L2} (%)
- Phase current I_{L3} (%)
- Time-based triggering of the thermal motor model

1) only with HF starters

Statistics data (DS 95)

The following data are stored in the DS 95 of the starter:

- Operating hours device
- Operating hours - motor
- Operating hours motor current = 18 ... 49.9 % of $I_{e\ max}$ [1)]
- Operating hours motor current = 50 ... 89.9 % x $I_{e\ max}$ [1)]
- Operating hours motor current = 90 ... 119.9 % x $I_{e\ max}$ [1)]
- Operating hours motor current = 120 ... 1000 % of $I_{e\ max}$ [1)]
- No. of starts, motor cw
- No. of starts, motor ccw
- Number of motor overload trips
- Number of switching element overload trips
- Last trip current I_A (%)
- Last trip current I_A (eff)
- Motor current I_{max} (%)
- Motor current I_{max} (eff)
- Number of starts output BO[1)]
- Maintenance timer[1)]

With all ET 200pro motor starters, the operating hours are secured if the voltage fails (a maximum of 6 minutes is lost). Statistics data can be exported via *'ES Motor Starter'* or via PLC DPV-1 with SFC59 or SFB 53.

Slave pointer (DS 96)

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.

The following data are stored in the DS 96:

- Number of motor overload trips
- Operating hours motor current = 18 ... 49.9 % of I_e [1)]
- Operating hours motor current = 50 ... 89.9 % of I_e [1)]
- Operating hours motor current = 90 ... 119.9 % of I_e [1)]
- Operating hours motor current = 120 ... 1000 % of I_e [1)]
- Maximum trip current $I_{A\ max}$(%)
- Maximum trip current $I_{A\ max}$(eff)
- Phase current $I_{L1\ max}$(eff)
- Phase current $I_{L2\ max}$ (eff)
- Phase current $I_{L3\ max}$ (eff)
- Phase current $I_{L1\ min}$(eff)
- Phase current $I_{L2\ min}$ (eff)
- Phase current $I_{L3\ min}$ (eff)
- Phase current $I_{L1\ max}$ (%)
- Phase current $I_{L2\ max}$ (%)
- Phase current $I_{L3\ max}$ (%)
- Phase current $I_{L1\ min}$ (%)
- Phase current $I_{L2\ min}$ (%)
- Phase current $I_{L3\ min}$ (%)

1) only with HF starters

System diagnostics (see also manual *'ET 200pro Distributed I/O Device'*)

In diagnostics-compatible ET 200pro devices, device-specific diagnostics are recorded via assigned PROFIBUS fault numbers. The relevant fault number is issued to the ET 200pro interface module IM 154-. .

The system diagnostics show if there is a channel fault. Information on whether or not channel-related information is present is also provided.

In the diagnostics data record (see manual "ET 200pro Distributed I/O Device"), the channel-related diagnostics start from byte 19.
For each channel-related diagnostics, 3 bytes are always inserted. The associated DP fault number (= fault type) is binary-coded, inserted in each case in the third byte on bit positions 0 … 4.
The stored values are extracted by the starter from the diagnostics recorded in data record 92. As there are insufficient uniquely defined DP fault numbers for the starters, different DS92 diagnostics must be mapped to one and the same number (= multiple assignment; see table).

Channel-specific diagnostics Single fault	**DP** Fault no.	**DS92:** Byte no.	**Supported by ET 200pro motor starters /** DS92 meaning
Reserved			
Short-circuit	1	2^2 3^2	Temperature sensor short-circuit power switch tripped (repair switch module)
Overload	4	2^3	Thermal motor model overload
Excess temperature	5	0^3	Overload switching element
Upper limit exceeded	7	4^2	I_e limit exceeded
Lower limit violated	8	4^3	I_e limit value violated
Fault	9	0^4	Switching element defective
Parameterization fault	16	8^1 8^2	Invalid parameter value Parameter change in ON status not permissible
Transmitter or load voltage not present	17	1^0	Switching element power supply missing
Actuator shutdown	24	2^4 4^1 4^4 4^6 4^7	Overload shutdown Asymmetry shutdown I_e limit value shutdown Zero current shutdown Motor blocking shutdown
External fault	26	3^3 5^4 5^5 5^7	Current limitation active (sDSSte / sDSte and sRSSte / sRSte) Input tripping Shutdown input (ccw end position) Shutdown input (cw end position)

Table 4-6: System diagnostics

Device diagnostics

In the input process image for the starters, the current group fault (DI 0.2) and group warning messages (DI 0.3) are sent cyclically where necessary. More in-depth information on the fault type are accessible where necessary via a diagnostics call (V1-system diagnostics).

All device-specific diagnostics are summarized in the data record 92 (29 bytes). The content of DS 92 can be exported using *'ES Motor Starter* via the device interface or online via DP V1 using the 'Read data record' function.

4.6 Software *'ES Motor Starter'*

Features

The *'ES Motor Starter'* software (from version 2006) offers you:

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

Local commissioning and monitoring on site such as:

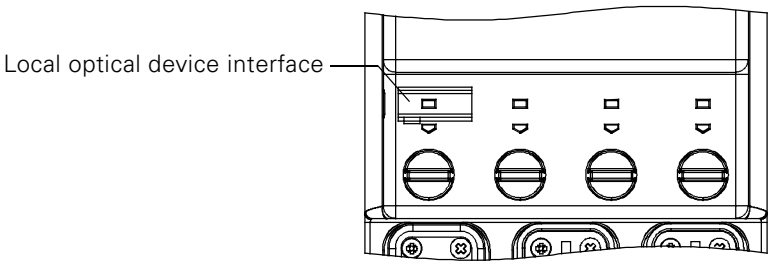
- Parameter assignment during operation of the programmable controller and control system
- Observation
- Diagnostics and testing
- Factory setting
- Read individual phase currents as direct values
- Residual current detection
- A parameterization block can be set
- Integrated online help
- Read statistics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

Application

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

- DSe, RSe
- High feature DSe, sDSSte / sDSte, RSe, sRSSte / sRSte

The connection between the PC or programming device and the motor starter is set up using an infrared RS232 PC cable.



Caution
To ensure fault-free data transfer, ensure that the infrared interface is clean.

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

Order Numbers

The order numbers for the RS232 interface cable, USB cable, the ES Motor Starter software can be found in the appendix under Components for ET 200pro motor starters.

General technical specifications

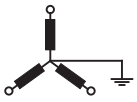
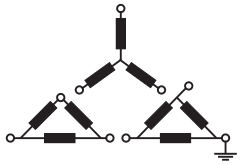
5

5.1 Requirements for switching high-efficiency motors

The increased requirements for protection devices and switchgear when switching high-efficiency motors are covered by the new utilization category AC-3e introduced in the IEC 60947-4-1 product standard.
The utilization category AC-3e takes into account the higher switch-on characteristic of efficiency-enhanced motors. This is reflected, for example, in a higher starting current when starting squirrel-cage motors.
All SIRIUS protection devices and switchgear that are subject to the IEC 60947-4-1 product standard meet the increased requirements in accordance with utilization category AC-3e and are suitable for use with high-efficiency motors.

5.2 Voltages

The specifications for 3-phase line supply according to IEC 60947-4-1 are valid for the following line system configurations:

Voltage specification Ue in the Equipment Manual	**Line system configurations**	
	Three-phase four-wire systems	**Three-phase three-wire systems**
		
[V]	[V]	[V]
230	—	230
400	230 / 400	400
440	260 / 440	440
500	—	500

— not specified

5.3 Notes on the protection of device connections

The specifications for short-circuit protection (fuses, circuit breakers, or miniature circuit breakers) are available for the device connections of the main circuit and the auxiliary circuit.
In order to ensure a holistic view for the protection of the device connections, the manufacturer is obliged to provide all relevant information for short-circuit protection and overcurrent protection.
If, for example, device connections for the control supply voltage, the supply voltage, or digital inputs/digital outputs are not connected to self-limiting current sources or energy sources, you can find the relevant information in the Equipment Manual or the technical data sheet.

5.4 Shipping and storage conditions

Shipping and storage conditions

The motor starters fulfil the requirements according to IEC 61131, Part 2, in regard to shipping and storage conditions. The following information applies to modules that are shipped or stored in the 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

5.5 Mechanical and climatic environmental conditions

Installation position

Horizontal installation on a vertical wall at a maximum inclination angle of 22.5°.

Mechanical environmental conditions

Oscillations tested in accordance with IEC 60068, Parts 2-6	
• Oscillation type:	Frequency sweeps with a rate of change of 1 octave a minute
-5 Hz ≤ f ≤ 9 Hz	Constant amplitude: 7 mm
-9 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 to IEC 60068, Parts 2-27	
• Type of shock:	Half sine
• Intensity of shock:	10 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

Temperature	-25 to 55 °C	
Temperature variation	10 K/h See installation rules chapter 3.1 ff.	
Permissible rated current	see chapter 3.3	
Relative humidity	from 5 to 95 %	
Air pressure	from 1080 to 660 hPa	Corresponds to an altitude of -1000 to 3500 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

Rear wall bus modules

6

6.1 Rear wall bus modules for special modules and motor starters

Features

- The 3RK1922-2BA00 rear wall bus module is suitable for housing a special module or motor starter
- The 3RK1922-2BA01 rear wall bus module is suitable for housing a safety local repair switch module
- Connection via plug
- Transfers the voltage for electronics / transmitter supply (1L+)
- Transfers the voltage for load power supply (2L+)
- Transfers the voltage for actuating the 400V shutdown module (ASM-400V)
- Transfers the data bus

Rear wall bus module layout

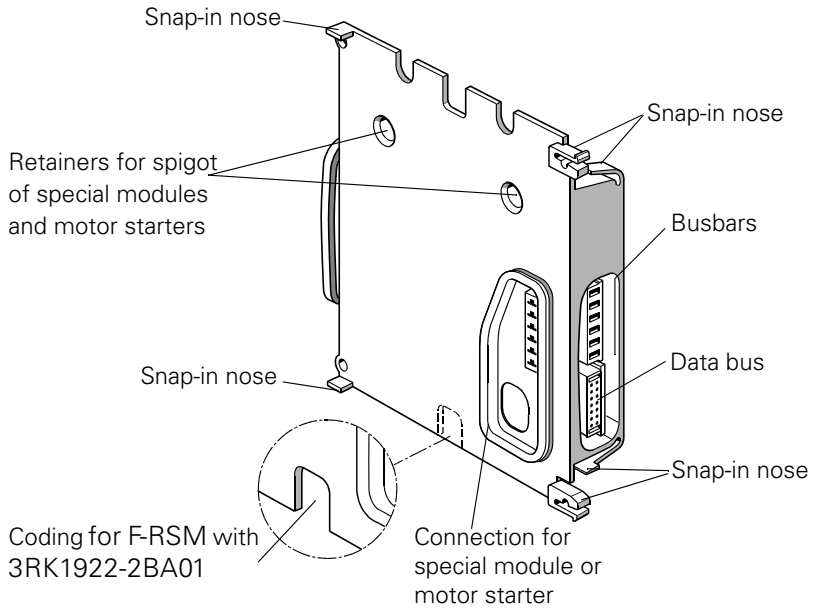


Figure 6-1: Rear wall bus module

6.1.1 Technical specifications

Dimensions and weight	
Installation dimensions W x H x D (mm)	110 x 130 x 22.5
Weight (g)	approx. 210
Shock protection	
Type of protection according to IEC 60529	IP65 (following correct installation)
Rated data of the busbars	
Power supply 1L+, 2L+	24 V DC
Current-carrying capacity I_e	10 A

Table 6-1: Technical specifications for rear wall bus module

Special modules

7

Special modules are intended for power infeed, short-circuit protection and shutdown for a series of downstream motor starters.

With the special modules *'Safety Local repair switch module'* and *'400V shutdown'*, the safety level of category 4 can be achieved with the relevant wiring.

7.1 Overview

The following special modules are available:

- Repair switch module (RSM) (see chapter 7.2)
- Safety local repair switch module (F-RSM) (see chapter 7.3)
- 400V shutdown module (ASM-400V) (see chapter 7.4)

Parameters and technical specifications for the special modules, see chapter 7.6.

7.2 Repair switch module (RSM)

7.2.1 Features

The repair switch module is designed for the following individual functions:

- Disconnect the downstream starters from the power supply
- Start lockout via a padlock on the rotary element
- Shortcircuit protection for series-connected consumers with 25 A power switch

7.2.2 View of repair switch module

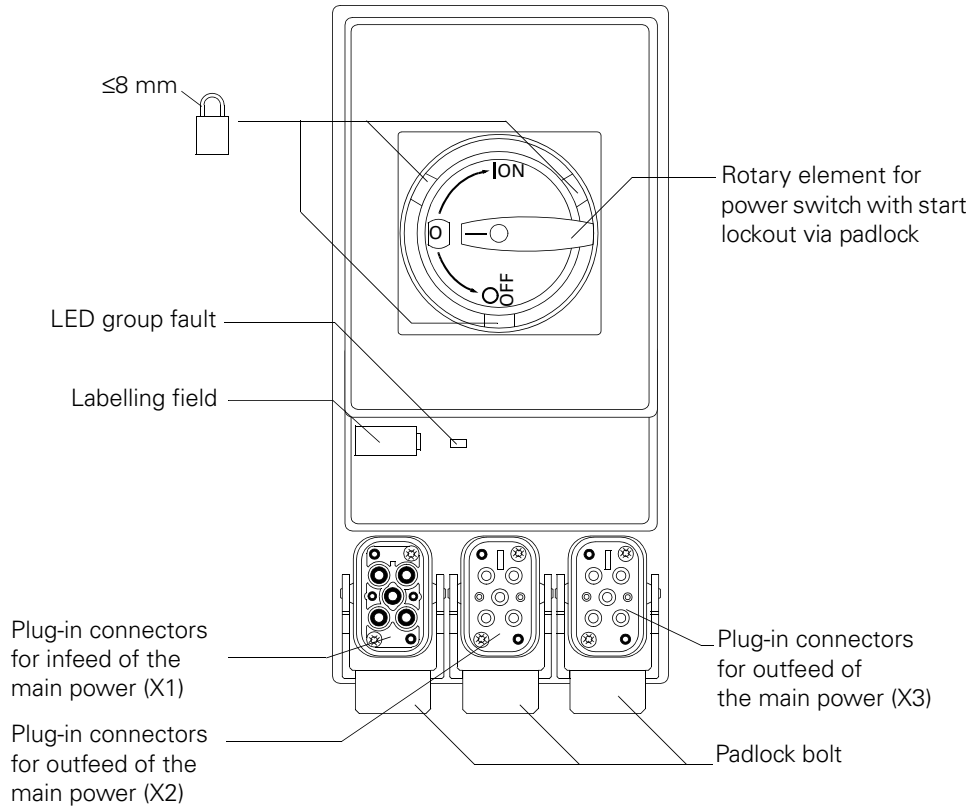


Figure 7-1: View of repair switch module

7.2.3 Circuit diagram

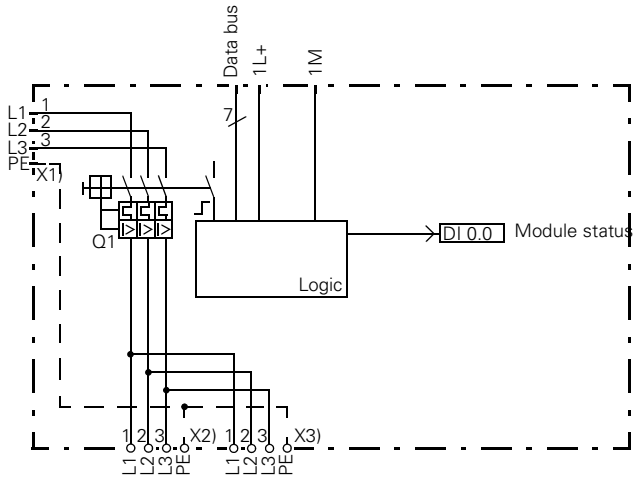
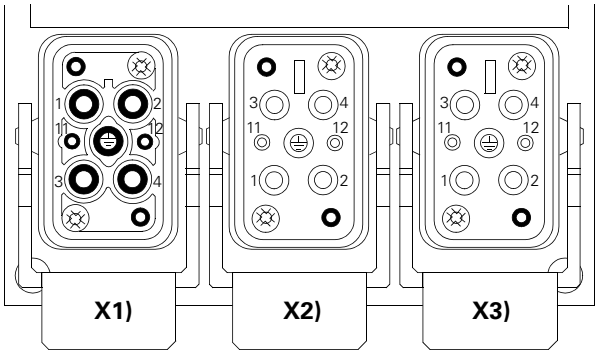


Figure 7-2: Circuit diagram for repair switch module

7.2.4 Assignment of the main power connections



Number	X1 connection HAN Q4/2 (pin)	X2 connection HAN Q4/2 (socket)	X3 connection HAN Q4/2 (socket)
1	Phase L1	Phase L1	Phase L1
2	Phase L2	Phase L2	Phase L2
3	Phase L3	Phase L3	Phase L3
4	—	—	—
11	—	—	—
12	—	—	—
⏚	PE	PE	PE

Figure 7-3: Assignment of the main power connections on the repair switch module

7.3 Safety local repair switch module (F-RSM)

7.3.1 Features

Safety note
The module should be tested during commissioning and then every 12 months. For the test, proceed as follows:
- Press the emergency stop switch
- Check that the OUT output has been switched off
- Check that the 400 V AC has been switched off
- Release the emergency stop switch
- With a monitored start, check that the OUT output and the 400 V are still switched off; then press the START button

Repeat the test with the next emergency stop switch until all emergency stop switches have been pressed.

The module with local safety function is designed for the following individual functions:

- Has the same functions as a repair switch module
- 2 safe inputs for:
  – Emergency stop / emergency off or safety door contacts, 2-channel
  – Monitored start-up
- 2 safe outputs, incl.:
  – 1 output on the front
  – 1 output on the back with power infeed on 1 safety RW channel
- 2 sliding switches for setting the basic functions
  – 1-channel / 2-channel
  – Autostart / monitored start
- Low-demand and high-demand operating mode
- Use up to safety category 4 conforming to EN 954-1 or SIL 3 conforming to IEC 61508

Caution
The safety local repair switch module can only be installed on the rear wall bus module 3RK1922-2BA01.

7.3.2 Description

The safety local repair switch module includes a 3TK2841 module and is equipped with M12 connections for connecting external safety components.

Either 1-channel or 2-channel emergency stop / emergency shutdown circuits or safety door circuits can be connected to connection 1 (IN 1 / IN 2).

Both mechanical switches and electronic sensors can be connected. Electronic sensors must be operated in the "1-channel mode" operating mode.

An external switch (NO contact) for monitored START can be connected (START) on connection 2. The connected switch must not be pressed when switching on or enabling the emergency stop / emergency shutdown function. The OUT output or F0 bar is activated when the switch is released. The length of pressing the switch should be in the range 200 ms ... 5 s, otherwise this start command is not accepted.

There is a safe output for connecting a door tumbler available (OUT) on connection 3.

The required safety function can be set via 2 sliding switches located underneath the left-hand M12 opening.

The safe inputs are assigned to connection numbers 2 and 4.

The safe outputs are supplied with voltage via the rear wall bus module.
An output is looped through on the front and can be used to actuate a door tumbler, for example (OUT).

The 2nd output switches the supply to the contactor coils (2L+) for the downstream motor starters via the rear wall bus module (F0).

Caution
The door tumbler above is only a simple mechanical lock, in other words this door tumbler does not conform to the safety applications of category 4 conforming to EN 954-1, as a feedback of the mechanical lock bolts is not possible.

When connecting an electronic sensor with two outputs, ensure that the cross-circuit detection is realized in the sensor.
The electronic sensor and the ET 200pro station must be supplied from the same power supply unit.

7.3.3 View of the safety local repair switch module

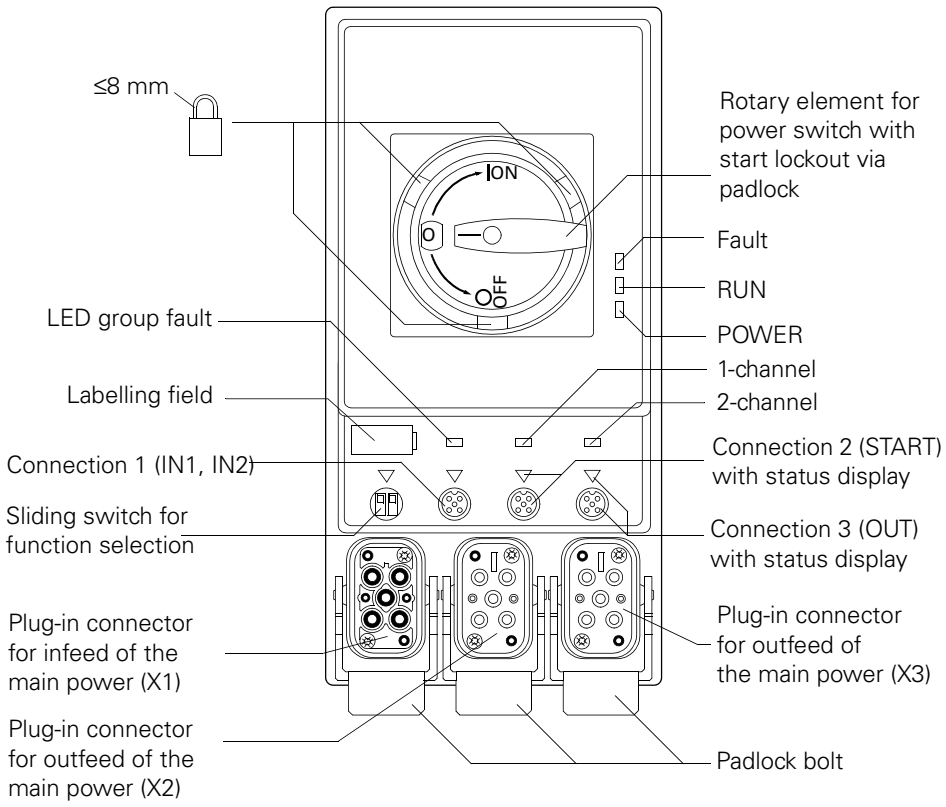


Figure 7-4: View of the safety local repair switch module

7.3.4 Circuit diagram

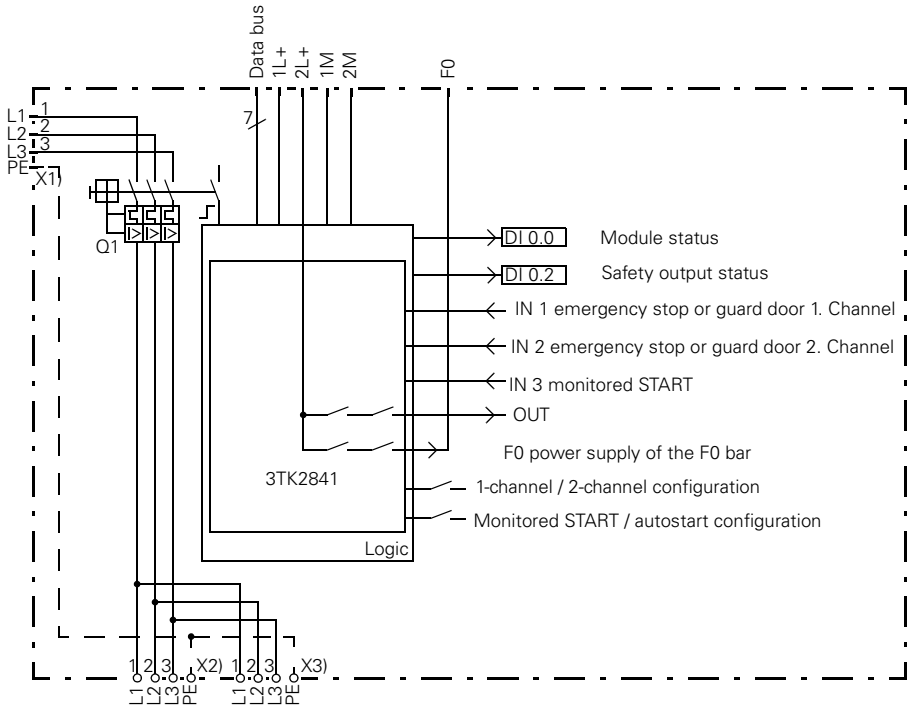
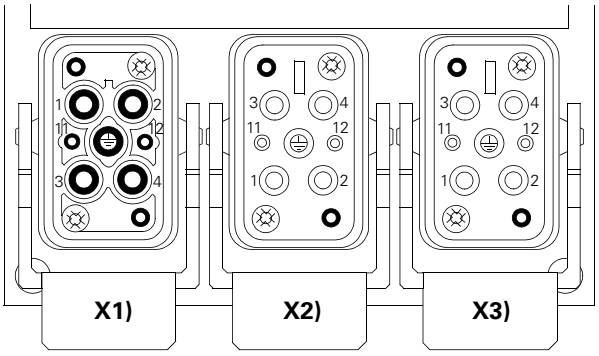


Figure 7-5: Circuit diagram for safety local repair switch module

7.3.5 Connection technology

Assignment of the main power connections



Number	X1 connection HAN Q4/2 (pin)	X2 connection HAN Q4/2 (socket)	X3 connection HAN Q4/2 (socket)
1	Phase L1	Phase L1	Phase L1
2	Phase L2	Phase L2	Phase L2
3	Phase L3	Phase L3	Phase L3
4	—	—	—
11	—	—	—
12	—	—	—
⏚	PE	PE	PE

Figure 7-6: Assignment of the main power connections on the safety local repair switch module

Assignment of the auxiliary circuits

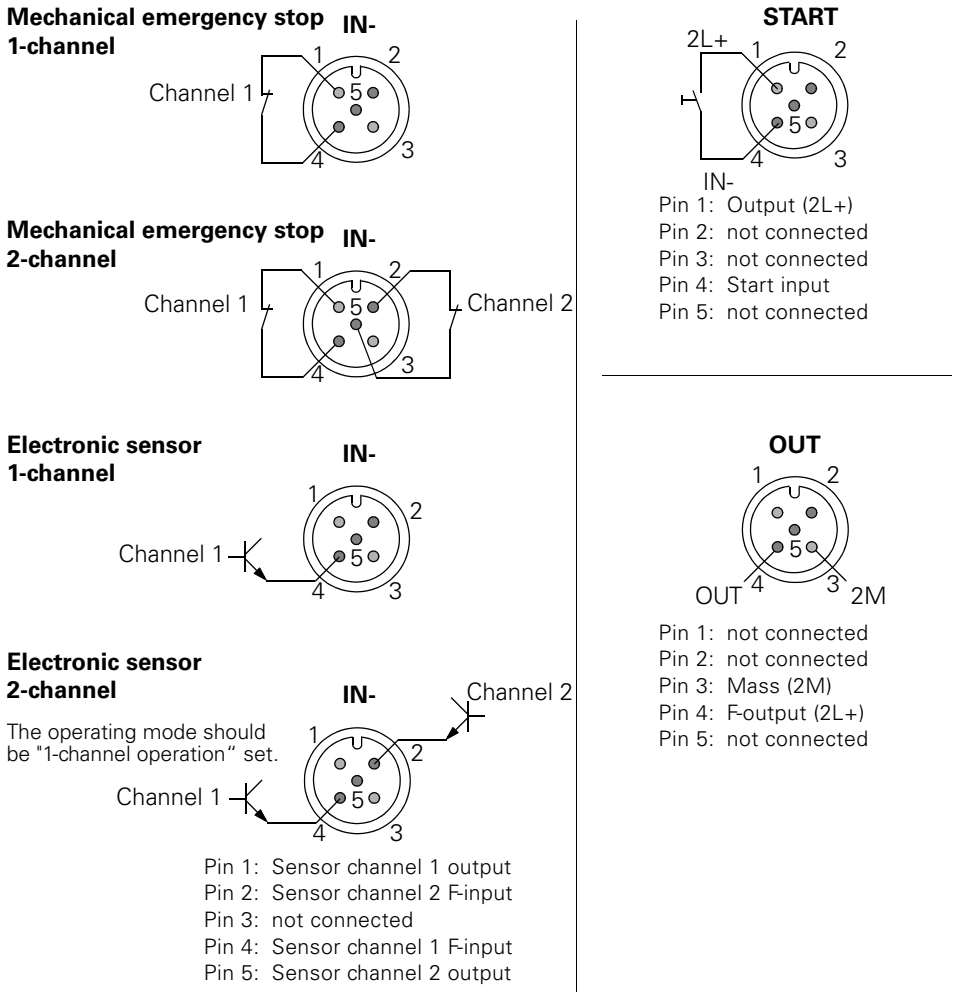
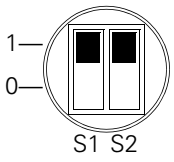


Figure 7-7: Assignment of the auxiliary circuits on the safety local repair switch module

Configuration

Sliding switch



	S1	S2
1	2-channel operation	autostart;
0	1-channel operation	Monitored START

Figure 7-8: Configuration of the safety local repair switch module

Safety note

The set configuration should be checked with the '1-channel' and '2-channel' displays. One of these two displays should always be lit.
If both are lit at the same time or are off at the same time, the device is no longer ready for operation and should be replaced immediately.

Caution
Configuration changes must be carried out with the 2L+ power supply switched off.
Changes with 2L+ power supply present result in a fault message and to shut down the outputs. To reset the fault message and to transfer the changed configuration, the 2L+ power supply must be switched off and back on again.
Electronic sensors must be operated in the "1-channel mode" operating mode.

7.3.6 Response in the case of a fault

With an internal or external fault (e.g. cross-circuit of the emergency stop lines), the outputs are shut down and the fault is signalled via the *'FAULT'* LED.

With an external fault, the *'FAULT'* LED is on continuously. After the fault has been corrected (e.g. enable emergency stop), the module can be operated again.

With an internal fault, the *'FAULT'* LED flashes. If the fault cannot be resolved by switching on and off, e.g. when changing the configuration in operation, the module must be replaced.

7.4 400V shutdown module (ASM-400V)

7.4.1 Features

Safety note
The module should be tested on commissioning and after that, every 12 months.
For the test, proceed as follows:
- The safety module supplying the F0 bar should be shut down.
- Check that the 400 V has been shut off.
- The safety module supplying the F0 bar should be switched on.

The 400V shutdown module is designed for the following individual functions:

- 2-way shutdown of the main circuit supply (category 4)
- Return message of the module functional status via bus
- Return message of the switching status of the contactor via bus

7.4.2 Description

The 400V shutdown module must only be used in combination with the safety local repair switch module for local safety applications. It includes 2 series-connected contactors for the safety-oriented shutdown of the main supply circuit. The operational switching of the connected consumer must be carried out via a downstream motor starter. The auxiliary circuit supply of the device is provided via a safety bar in the rear wall bus module.

The 400V shutdown module can be used in combination with the safety local repair switch module for safety applications up to category 4 conforming to EN 954-1 or SIL 3 conforming to IEC 61508.

The operating mode is low-demand and high-demand.

Caution
The aggregate current via the 400V shutdown module must be max. 25 A.

Warning
With a load-side short-circuit (power switch on the F-RSM has tripped), there is a risk of both contactors being welded in the ASM.
After a short-circuit shutdown, the ASM must therefore be checked for correct functioning.
In switched off status, there must be no electrically conductive connection between pins 1, 2 and 3 on the X1 connection and sockets 1, 2 and 3 on X2 connection.
Welding the contactors in the event of a short-circuit must be avoided via an additional protection in the energy infeed with fuses (max. 16 A gL/gG NH type 3NA, DIAZED type 5SB or NEOZED type 5SE).

7.4.3 View of 400 V shutdown module

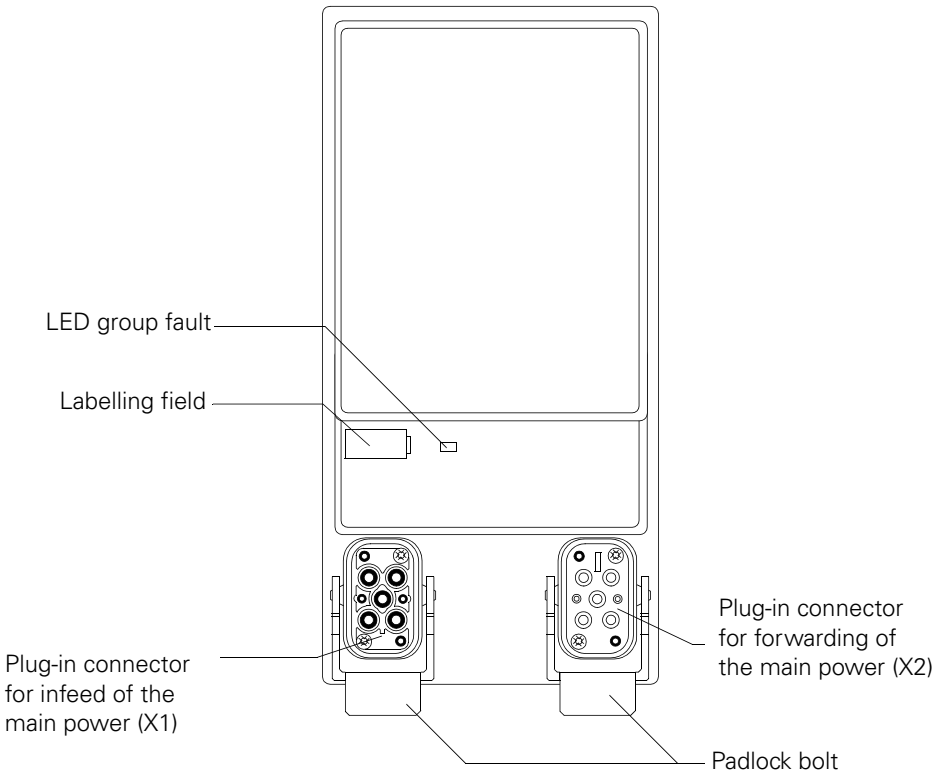


Figure 7-9: View of 400 V shutdown module

7.4.4 Circuit diagram

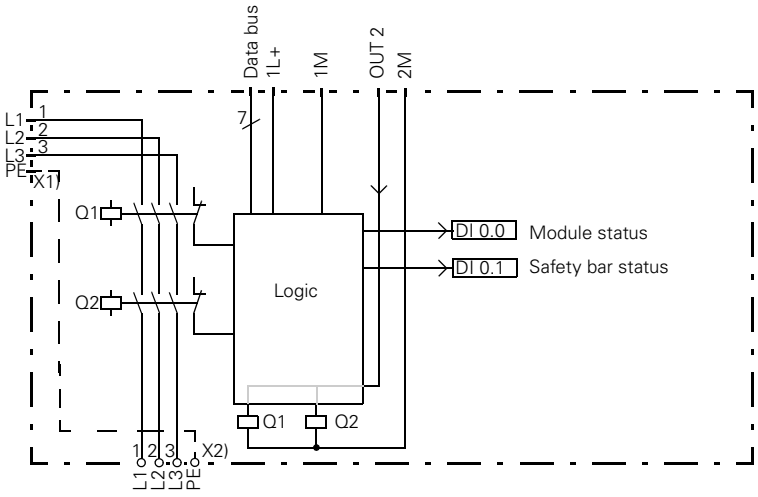
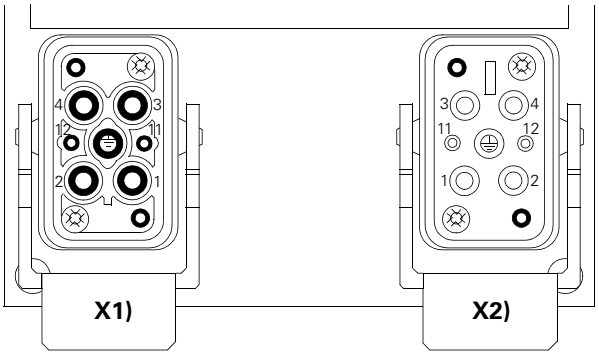


Figure 7-10: 400V shutdown module circuit diagram

7.4.5 Assignment of the main power connections



Number	X1 connection HAN Q4/2 (pin)	X2 connection HAN Q4/2 (socket)
1	Phase L1	Phase L1
2	Phase L2	Phase L2
3	Phase L3	Phase L3
4	—	—
11	—	—
12	—	—
⏚	PE	PE

Figure 7-11: Assignment of the plugs on the 400V shutdown module

7.4.6 Response in the case of a fault

If an internal fault occurs, the outputs remain without power and the fault is signalled with the *'SF'* LED and notified via bus as diagnostics alarm. In this case, the faulty module must be replaced.

7.5 Power bus

Load group

All motor starters supplied via **one** power bus infeed are referred to as a "load group". Within a group of motor starters, another power bus infeed may be required, for example to ensure that the rated operating current (aggregate current) does not exceed the internal power bus.

The aggregate current of the power bus via the special modules and motor starters must be max. 25 A.

Current flow via the power bus

The graphic below shows the current flow via the power bus using the example of a repair switch module and a motor starter:

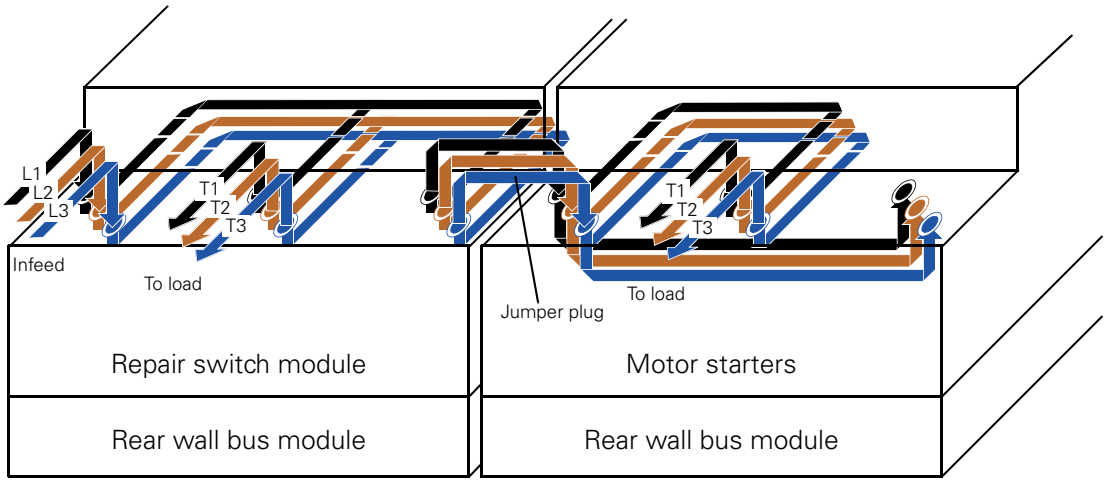


Figure 7-12: Current flow in the power bus

Warning
With special modules and with motor starters, unused connections with caps do not need to be sealed to protect open contacts against dirt and to seal the ET 200pro securely in line with IP65.

7.6 Parameters and technical data

7.6.1 Parameters

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

The following table indicates the parameters that can be set for the special modules.

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

Table 7-1: Parameters of the special modules

7.6.2 Technical specifications

Special module		Repair switch module	Safety local repair switch module	400V shutdown module
Dimensions and weight				
Installation measurements (mm):	Width Height Depth	110 230 170		110 230 150
Weight (g)		1405	1600	2200
Module-specific data				
Permissible position for use		any		
Vibrostability conforming to IEC 60068, parts 2-6		2 g		
Shock-proofing conforming to IEC 60068, parts 2-27		Half-sine 10 g / 11 ms		
Assignment type conforming to IEC 947-4-1		2		1
Degree of contamination conforming to IEC 60664 (IEC 61131)		3		
Overvoltage category conforming to IEC 60664		II		
Type of protection conforming to IEC 60529		IP65		
Shock protection		finger-proof		

Table 7-2: Technical specifications for the special modules

Special module	**Repair switch module**	**Safety local repair switch module**	**400V shutdown module**
Utilization category	—	—	For conducting and shutting down the rated operating current when the safety device is pressed (emergency stop)
Maximum duration of use	no restriction	10 years	
Safety guidelines			
Category conforming to EN 954-1	—	4	4
conforming to IEC 61508 (SIL level)	—	3	3
Performance level (DIN EN ISO 13849-1)	—	e	e
Failure probability (PFH) (PFD)	— —	5.358×10^{-11} 2.347×10^{-6}	1×10^{-15} 1×10^{-15}
T1	—	10 years	10 years
B10	—	—	6×10^{5}
Recovery time with emergency stop (enable)	—	min. 200 ms	—
Release time with emergency stop (trip)	—	30 ms	—
Response time (start)	—	40 ms	—
Control circuit			
Rated operating voltage for electronics L+ / M	24 V DC (20.4 V - 28.8 V)		
Rated operating current from rear wall bus from electronics supply 1L+ / 1M (no load) from load voltage 2L+ / 2M (no load)	 max. 3 mA max. 4 mA max. 20 mA	 max. 3 mA max. 4 mA max. 120 mA	 max. 3 mA max. 4 mA max. 600 mA
max. permissible line length	—	100 m	—
Main circuit			
Rated operating current I_e (see chapter 3.3)	25 A	16 A	25 A
Rated operating voltage • Approval conforming to EN 60947-1 Appendix N • Approval conforming to CSA and UL	400 V up to 400 V up to 600 V		
Rated short-circuit breaking capacity I_{CU}	50 kA at 400 V		
Instantaneous overcurrent release	fixed setting at 13 x I_e		—
Connection cross-section power infeed	max. 6 x 4 mm²		

Table 7-2: Technical specifications for the special modules (Contd.)

Special module	**Repair switch module**	**Safety local repair switch module**	**400V shutdown module**
Switching times at 0.85 … 1.1 x U_e • Closing time • Open delay	—	—	425… 525 ms[1)] 40 … 60 ms[1)]
Insulation resistance			
Rated impulse strength U_{imp}	6 kV		
Rated insulation voltage U_i	400 V		
Protective separation between main and auxiliary circuits	400 V, conforming to DIN EN 61140		
Circuits with rated voltage U_e against other circuits or earth • 0 V < U_e < 50 V • 300 V < U_e < 600 V	Test voltage conforming to IEC 61131, Part 2 500 V DC 2.6 kV DC to ground		
[1)] These values apply in combination with the F-RSM module			

Table 7-2: Technical specifications for the special modules (Contd.)

Motor starters

8

8.1 Overview

Due to the integrated electronic overload protection, a cover of the power range up to 12 A with only two device versions is possible. The ET 200pro motor starters can be parameterized and permit access to comprehensive diagnostic and statistics data. The PC configuration tool *'ES motor starters'* is available for this purpose from version 2006.

A connection to the motor starters can be established in two ways:
1. Locally on-site via the optical device interface of the motor starter
2. Remote on PROFIBUS DP via DPV1

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.

8.1.1 Motor starters

The ET 200pro motor starters are offered as direct (DSe) and reversing starters (RSe) each in two versions:

- Standard series (code: DSe, RSe
  - either with control for externally supplied brake with 400 V
  - without digital inputs
- High feature range (short name for direct starters: DSe, RSe
  - either with control for externally supplied brake with 400 V
  - with 4 digital inputs
  - with advanced parameterization options

8.1.2 Electronic starters

The ET 200pro electronics starters are available as direct (sDSSte / sDSte) and reversing starters (sRSSte / sRSte) in the high feature version with the following equipment.

- 4 digital inputs
- with soft start and soft coasting-down function
- with deactivated soft start function as electronic starter for applications with high switching frequency
- either with control for externally supplied brake with 400 V
- with advanced parameterization options

The table below provides an overview of the various properties of the motor starters.

Feature	Standard	High feature	Electronic starters
Installation width [mm]	110		
For power ratings up to [kW] at 400 V AC	5.5		
Integrated switchgear	SIRIUS contactor S00		Reversing contactor and bypass relay
Short-circuit protection via permanently installed fuses	yes		
Programmable electronic overload protection	yes		
Switching function of main and auxiliary contacts	mechanical		electronic
Rated operating current	0.15 - 2.0 / 1.5 - 12 A		
Rated operating voltage	400 V AC		
Parameterizable	yes		
CLASS tripping class	10 (fixed)	5, 10, 15, 20	
Asymmetry recognition	yes		
Residual current detection	yes		
Parameterizable current limits	no	yes, 2 limit values	
Anti-blocking function with rapid shutdown	no	yes	
Assignment type conforming to IEC 947-4-1	1		
4 digital inputs	no	yes	
Variant with / without brake function	yes		
'ES Motor Starter' usable?	yes		
Derating in upper power range?	yes (from t_u = 40 °C)		yes (from t_u = 40 °C)
Diagnostics, fault types, see	chapter 4.3		

Table 8-1: Motor starter overview

8.2 Motor starter properties

8.2.1 ET 200pro motor starters DSe ST, RSe ST

- **DSe ST** are motor starters for a direction of rotation that can be used in the ET 200pro distributed I/O device
- **RSe ST** are motor starters for two directions of rotation with mechanical lock on cw and ccw motion that can be used in the ET 200pro distributed I/O device
- Are suitable for switching and protecting three-phase loads up to 5.5 kW at 400 V AC
- Are available in setting ranges of 0.15 - 2 A and 1.5 - 12 A
- are equipped with SIRIUS contactors
- Have parameterizable electronic overload protection
- Integrated residual current detection
- Asymmetry detection integrated (fixed limit value 30 % I_e)
- The as-is current is measured and the information transmitted to analyzers
- Detection of the switching status of the contactor
- Available diagnostic information of the motor starter (see chapter 4.3)
- Integrated log book functions with 3 device log books
- Integrated statistics data memory
- Circuit state and motor-starter status are indicated by LEDs
- Available either with control for externally supplied brake with 400 V AC
- Short-circuit protection via 3 fuses, meaning they can only be operated without repair switch module / external short-circuit protection
- Separate supply voltage for
  - Bus interface, electronics
  - Contactor coils
- Manual control and local parameterization possible via optical device interface
- The power infeed, energy forwarding via a loop and load branch is provided via power plug-in connector with padlock
- Firmware update via the optical device interface possible via specialist personnel

8.2.2 ET 200pro motor starters DSe HF, RSe HF

- Have the same basic properties as the DSe ST and RSe ST motor starters
- Also have 4 digital inputs for 2-wire and 3-wire sensors with LED display. The inputs can also be used for parameterized local control functions
- Have advanced parameterization options
- Upper and lower current limits can be defined and monitored for system and process supervision

8.2.3 Electronic starters ET 200pro sDSSte / sDSte, sRSSte / sRSte

- Have the same basic properties as the DSe HF and RSe HF motor starters
- Also have soft start and coasting down functions
- With the soft start function deactivated, the motor starter can be used as an electronic direct and reversing starter
- Current limitation function
- Thermistor motor protection

8.2.4 View of DSe and RSe motor starters; Standard and high feature

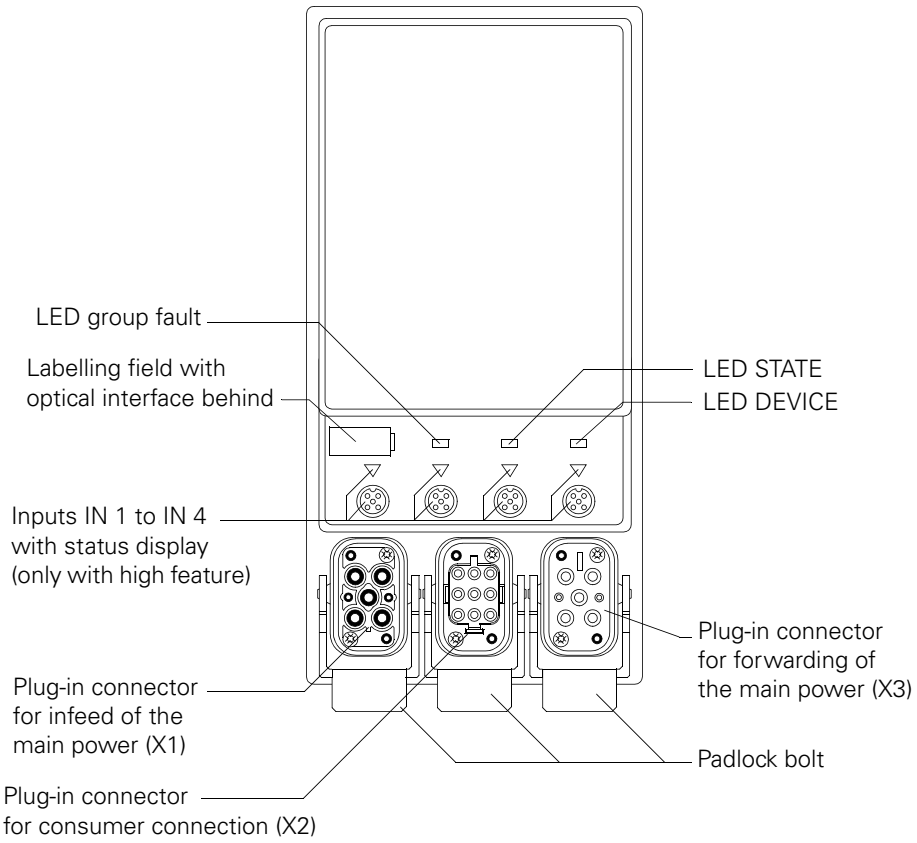


Figure 8-1: View of DSe and RSe motor starters; Standard and high feature

8.2.5 View of electronic sDSSte / sDSte und sRSSte / sRSte starters

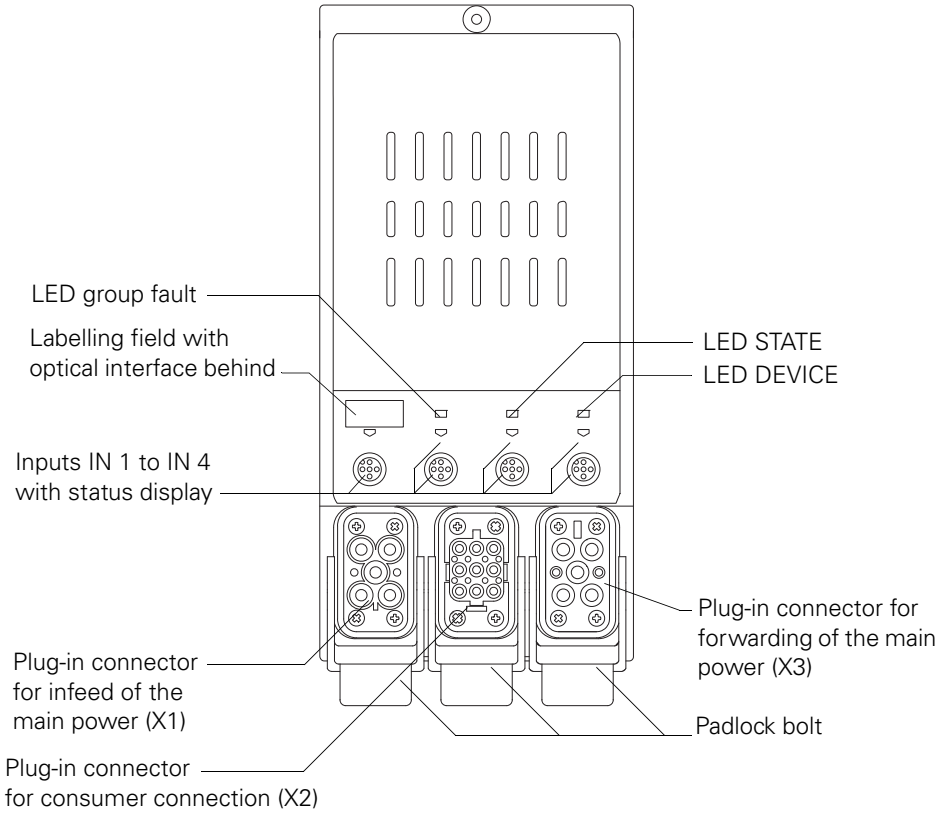
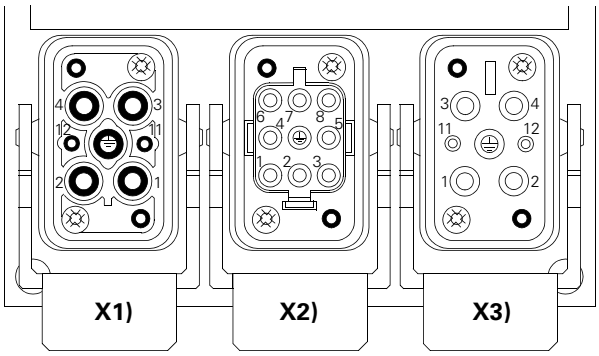


Figure 8-2: View of electronic sDSSte / sDSte und sRSSte / sRSte starters

8.2.6 Connection technology

Assignment of the main power connections



Number	X1 connection HAN Q4/2 (pin)	X2 connection HAN Q8/0 (socket)	X3 connection HAN Q4/2 (socket)
1	Phase L1	L1 out	Phase L1
2	Phase L2	Not used	Phase L2
3	Phase L3	L3 out	Phase L3
4	Not used	Brake L1 (switched)	Not used
5	—	Temperature sensor[1)]	—
6	—	Brake L3 (direct)	—
7	—	L2 out	—
8	—	Temperature sensor[1)]	—
11	Not used	—	Not used
12	Not used	—	Not used
⏚	PE	PE	PE

1) only sDSSte / sDSte and sRSSte / sRSte

Figure 8-3: Assignment of the main power connections on the motor starter

Notes on securing the device connections

X1, X2, X3	Main circuit	The specifications for short-circuit protection (fuses or miniature circuit breakers) are available for the device connections of the main circuit and the auxiliary circuit. You can find the technical specifications for the product in Siemens Industry Online Support (https://support.industry.siemens.com/cs/ww/en/ps/td) The line protection of the main circuit on the load side is realized by the integrated circuit breaker without additional protective devices. In the main circuit on the line side and in auxiliary and control circuits, line protection must be considered in line with the configuration standards.
IN1, IN2, IN3, IN4	Digital input	Short-circuit and overload-proof. Maximum current 200 mA in total

Auxiliary circuits

There are the following auxiliary circuits on a ET 200pro motor starter:

- 1L+ Electronic voltage supply via the rear wall bus module to supply electronics and connected sensors on inputs IN 1 to IN 4.
- 2L+ Load power supply (24 V DC) via the rear wall bus module for actuation of the contactor.
- Sensor supply via M12 plug-in connector. Connections 2 and 4 are bridged. Connection 5 is inside the device connection to functional earth.
  The image below shows the assignment

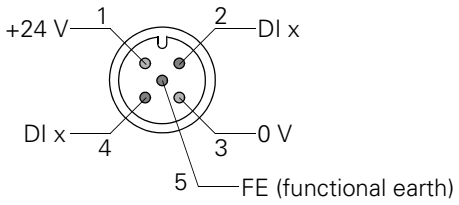


Figure 8-4: Assignment of the M12 plug-in connector on the motor starter

Diagram for DSe (ST and HF) direct starters and electron. sDSSte / sDSte starters

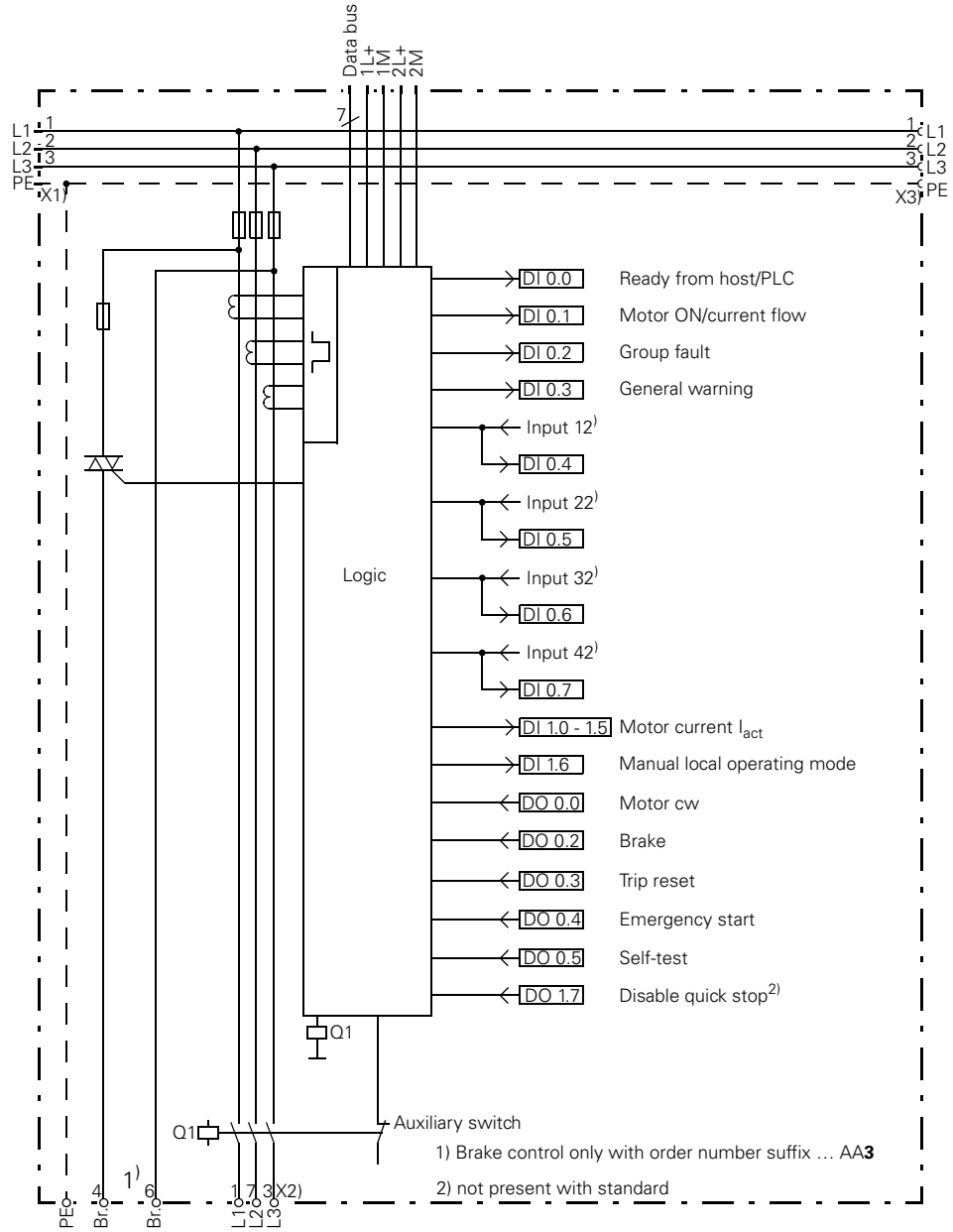


Figure 8-5: Circuit diagram - DSe direct starter; Standard and high feature

More detailed descriptions:

- Motor current I_{act} in 'Actual motor current', page 10-3
- Inputs / actions in chapter 10.7
- Emergency start in chapter 10.12

Diagram for rev.-starter RSe (ST and HF) and electron. rev.-starter sRSSte / sRSte

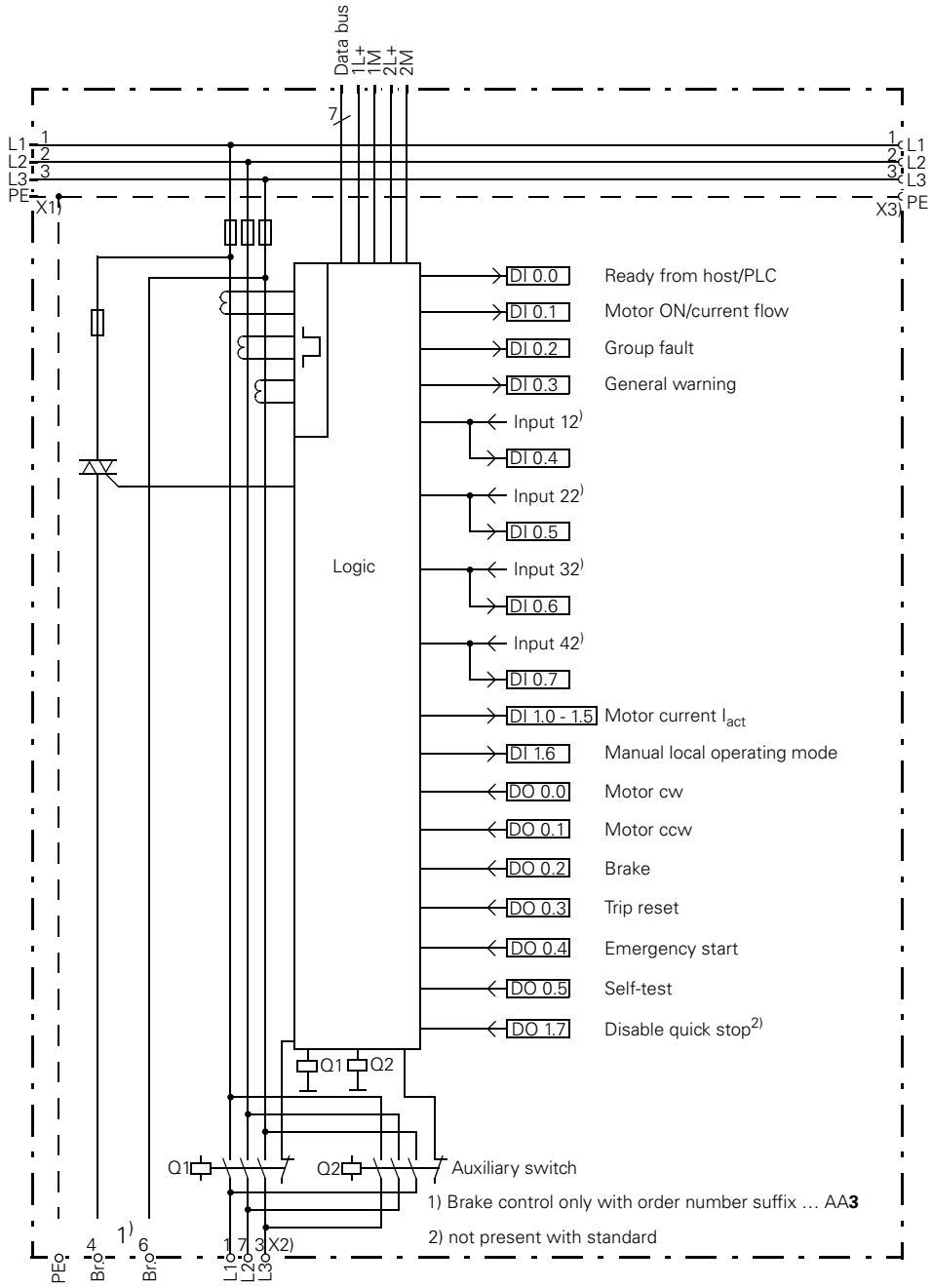


Figure 8-6: Circuit diagram - RSe reversing starter; Standard and high feature

More detailed descriptions:
- Motor current I_{act} in 'Actual motor current', page 10-3
- Inputs / actions in chapter 10.7
- Emergency start in chapter 10.12

Danger
Hazardous voltage. Danger of death or risk of serious injury.
Before starting work, de-energize the plant and device.
Phase L1 is not run via the semiconductor in the sDSSte / sDSte and sRSSte / sRSte.

8.2.7 Parameters

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

The table below shows which actions or value ranges can be set for the relevant parameters for motor starters DSe / sDSSte / sDSte and RSe / sRSSte /sRSte.

Parameters	Action, value range	Factory setting
Rated operating current • Range 1 • Range 2	Increment 10 mA • 0.15 to 2 A (0.07 to 0.9 kW) • 1.5 to 12 A (0.7 to 5.5 kW)	GSD/device • 0.15 / 2 A • 1.5 / 12 A
Behavior with supply voltage switching element missing	• Group fault • Group fault for ON command • General warning	Group fault
Load type	• 3 - phase motor • 1-phase motor (not with electronic starters)	3 - phase motor
Response on overload - thermal motor model[1)]	• Shutdown without restart • Shutdown with restart • Warning	Shutdown without restart
Warning limit value[1)] • Motor heating • time-based trigger reserve	 0% … 95% 0s … 500s	 0% 0 s
Recovery time	• 1.5 min. (ST) • 1 min. … 30 min. (HF) increment 0.5 min.	1.5 min.
Non-resetting on voltage failure[)]	• yes • no	yes
Interlock time with reversing starter	• 150 ms fixed • 0 s … 60 s[1)]	
Tripping class	• CLASS 10 • CLASS 5, 10, 15, 20[1)]	CLASS 10
Idle time Deletion of the thermal overload model during switching while in operation	Increment 1 s 0 to 255 s 0 = deactivated	0
Response on current value violation[1)]	• Warning • Disconnect	Warning
Temperature sensor[4)]	• Deactivated • Thermoclick • PTC type A	Deactivated
Lower current limit[1)]	Increment 3.125 % 18.75 to 100 %[2)]	18.75%
Upper current limit[1)]	Increment 3.125 % 50 to 150 %[2)]	112.5%
Response to residual current detection	• Warning • Disconnect	Disconnect
Current asymmetry limit value	• 30 % I_e • 30 % … 60 % I_e[1)]	30 %
Response to asymmetry	• Warning • Disconnect	Disconnect
Blocking current limit value[1)]	150 % … 1000 % I_e, with soft starter only 800 %	800 %
Blocking time limit value[1)]	1s … 5s	1 s

Table 8-2: Parameters for DSe, RSe motor starters (standard and high feature); sDSSte/sDSte, sRSSte/sRSte

Parameters	Action, value range	Factory setting
Start-up type[4]	• direct • Voltage ramp • Current limitation • Voltage ramp and current limitation	Voltage ramp and current limitation
Coast type[4]	• free coasting • Voltage ramp	free coasting
Current limit	• 0.15 A - 9 A 0 - 600 % • 9 A - 12 A 0 - 550 %	600%
Startup time[4]	0s … 120s	20 s
Coast time[4]	0s … 120s	0 s
Start voltage[4]	20 % … 100 %	40 %
Stop voltage[4]	20 % … 90 %	40 %
Response to CPU/master STOP	• Use dummy value • Keep last value	Use dummy value
Group diagnostics	• Disable • Enable	Disable
Digital inputs[1]	4 inputs	
• Signal	• Retentive • non-retentive	non-retentive
• Level	• NC • NO	NO
• Signal delay	10ms 80ms	10 ms
• Signal extension	0 s … 200 ms	0 s
• Action	• No action • Shutdown without restart • Shutdown with restart • Shutdown at limit position, clockwise rotation • Shutdown at limit position, counterclockwise rotation • General warning • Operating mode local manual • Emergency start • Motor cw • Motor ccw • Quick stop • Trip reset • Cold run	No action
NO contact only NO contact only NO contact only NO contact only NO contact only		
400 V brake output[3]		
• Brake enabling delay	–2.5 s … 2.5 s	0 s
• Holding time when stopping	0s … 25s	0 s

1) High feature motor starters only
2) Of rated operational current
3) Order option
4) Only with soft starters

Table 8-2: Parameters for DSe, RSe motor starters (standard and high feature); sDSSte/sDSte, sRSSte/sRSte

Group diagnosis:
This parameter enables diagnosis messaging (fault types are listed in chapter 4.3).

Note
The "Disable group diagnostics" parameter is also used to suppress the SF-LED displays of faults set by the header. The changed fault detection and display via SF-LED remains active.

Note
For electronic starters sDSSte / sDSte, sRSSte / sRSte, the following applies: With the brake delay activated, the brake delay must be greater than the coasting time when the coasting time is set.

8.2.8 Technical specifications

Special module		DSe-ST RSe ST	DSe-HF RSe-HF	sDSSte/ sDSte sRSSte/ sRSte
Dimensions and weight				
Installation measurements (mm):Width Height Depth		110 230 150		110 230 160
Weight (g)	DSe / sDSSte / sDSte: RSe / sRSSte/ sRSte:	1385 1655	1395 1665	1700 1875
Module-specific data				
Permissible position for use		vertical, horizontal		
Vibrostability conforming to IEC 60 068, parts 2-6		2 g		
Shock-proofing conforming to IEC 60 068, parts 2-27		Half-sine 10 g / 11 ms		
Assignment type conforming to IEC 947-4-1		1		
Degree of contamination conforming to IEC 60 664 (IEC 61 131)		3		
Type of protection according to IEC 60 529		IP65		
Shock protection		finger-proof		
Control circuit				
Rated operating voltage for electronics L+ / M		24 V DC (20.4 - 28.8 V)		
Rated operating voltage for electronics 1L+ / 1M		ca. 40 mA		
Rated operating voltage for contactor control 2L+ / 2M		ca. 200 mA		
Main circuit				
Rated power of three-phase motors at 400 V		max. 5.5 kW		max. 5.5 / 4 kW [1]
Usage categories		AC-1, AC-2, AC-3, AC-4		AC-53a [2] (max. 9 A with deact. soft start function up to class 10)
Rated operational current I_e (up to 40 °C see chapter 3.3) • AC-1 / 2 / 3 - at 400 V - at 500 V • AC-4 at 400 V		 0.15 A ... 2 A / 1.5 A ... 12 A 0.15 A ... 2 A / 1.5 A ... 9 A 0.15 A ... 2 A / 1.5 A ... 4 A		see chapter 3.3 and chapter 8.3, switching frequencies
Rated operating voltage U_e • Approval conforming to EN 60947-1 Appendix N • Approval conforming to CSA and U_L		 up to 400 V up to 600 V		 up to 400 V up to 480 V
Connection cross-section power infeed		max. 6 x 4 mm²		
Switching times at 0.85 ... 1.1 x U_e • Closing time • Open delay		 11ms 50ms 5ms 45ms		—
Mechanical service life, contactor		30 million switching cycles		—
Electrical service life, contactor		see figure 8-7		—

[1] With parameterization as electronic starter max. 4 kW.

[2] 8-hour operation

Table 8-3: Technical specifications for the motor starters

Permissible switching frequency	80 H	see table 8-6 up to table 8-7
Insulation resistance		
Rated impulse strength U_{imp}	6 kV	
Rated insulation voltage U_i	400 V	
Protective separation between main and auxiliary circuits	400 V, conforming to EN 60947-1 Appendix N	
Circuits with rated voltage U_e against other circuits or earth • 0 V < U_e < 50 V • 300 V < U_e < 600 V	Test voltage conforming to IEC 61131, Part 2 500 V DC 2.6 kV DC to ground	
Short-circuit protection		
Rated operating current	16 A	
Rated short-circuit breaking capacity I_{CU}	100 kA at 400 V	

Table 8-3: Technical specifications for the motor starters (Contd.)

Note
This is a product for environment A (industrial area). This equipment may cause undesirable radio interference in household environments. In this case, the user may be required to complete appropriate measures.

Technical specifications for brake actuation

(only with order number suffix …AA**3**)

Rated operating voltage		400 V AC
Continuous current Switch-on current t < 120 ms Switch-off current AC 15, at 400 V_{eff}		≤ 0.5 A ≤ 5 A ≤ 0.5 A
Permissible brake (example) with half-wave rectification at 400 V ACT < 40 °C		≤ 100 W
fault message if brake not driven		no
Protective measures		
Short-circuit protection		yes, 1 A slow-blow fuse
Induction protection	Internal	Varistor
External protection circuit at inductive load		required

Table 8-4: Technical specifications for brake actuation

Caution

The brake actuation and the motor control are laid in the same cable. Non-permissibly high levels of induction voltages can arise when the motor is switched off, and these are coupled to the brake actuation in the motor cable and in this way can result in electrical component faults in the starter.
Brake motors controlled via starter …AA**3**, should therefore always be fitted with suppressors (e.g. RC combinations) for the main circuit (exception: Electronic starters must not be operated with an EMC protective circuit).

Technical specifications for inputs

(only with high feature motor starters)

Input characteristic curve to IEC 61131	Type 1
Input voltage	
• Nominal value	24 V DC
• for signal "0"	-3 … +5
• for signal "1"	11 … 30
Input current	
• with signal "1"	7 mA
Connection of 2-wire BEROs	possible
Permissible residual current	max. 1.5 mA
Input signal delay	10 ms … 80 ms parameterizable
Power supply from 1L+ short-circuit and overload-proof	
• Operating voltage range (relative to 1M)	20.4 to 28.8 V DC
• Aggregate current	200 mA
Connection	M12 plug-in connector
Assignment of the inputs	
IN 1	Input 1 (DI 0.4)
IN 2	Input 2 (DI 0.5)
IN 3	Input 3 (DI 0.6)
IN 4	Input 4 (DI 0.7)

Table 8-5: Technical specifications for inputs

Electrical service life, contactor

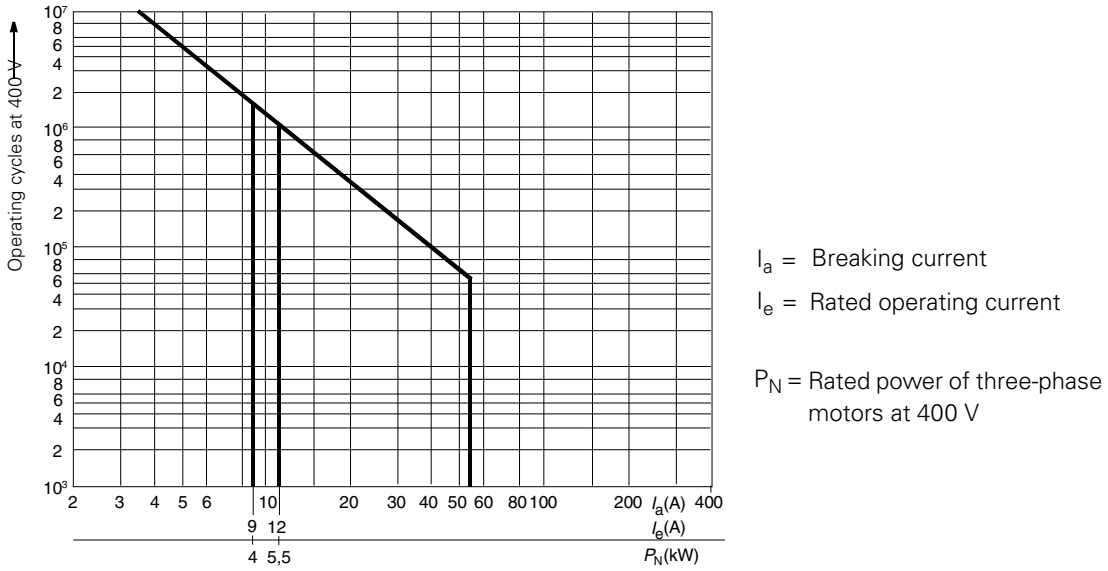


Figure 8-7: Electrical service life, contactor

8.3 sDSSte / sDSte / sRSSte / sRSte electronic starters

The electrical properties of the DSSe direct soft starters are comparable to those of the 2-phase SIRIUS soft starters.
From type 1, the following device variants are available:
- 2 A without bypass
- 12 A with bypass

8.3.1 Physical principles

Starting current

Rotary current asynchronous motors have a high switch-on current $I_{(Anlauf)}$. 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 operating current can be postulated as typical.

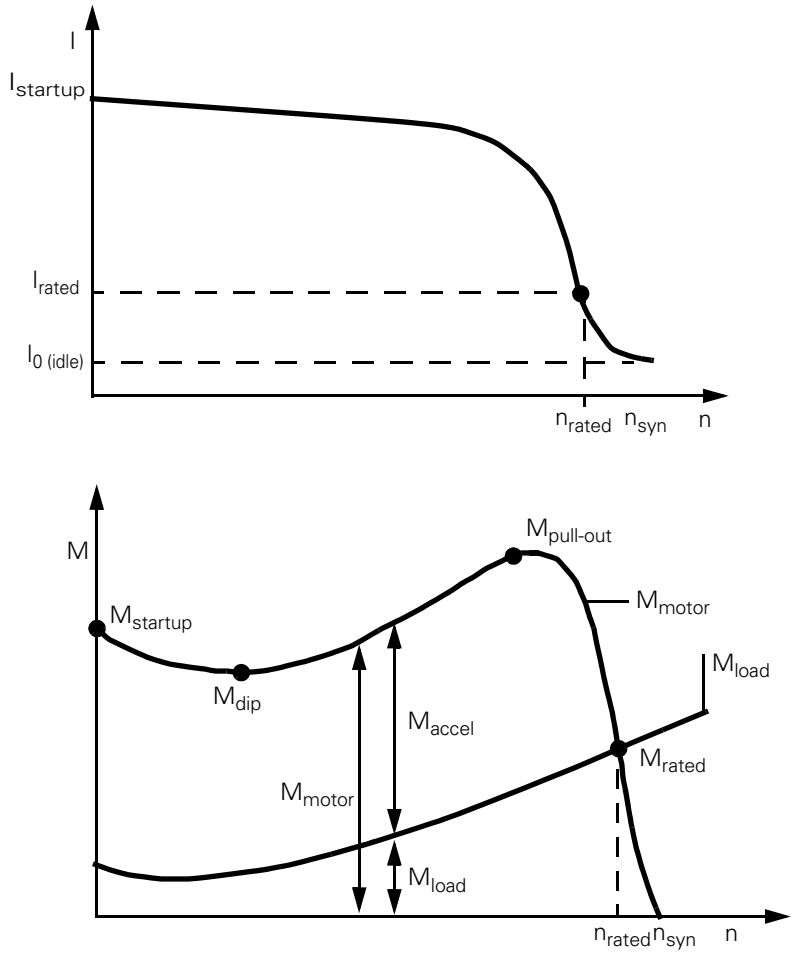


Figure 8-8: Typical current and torque curve of a three-phase asynchronous motor

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 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

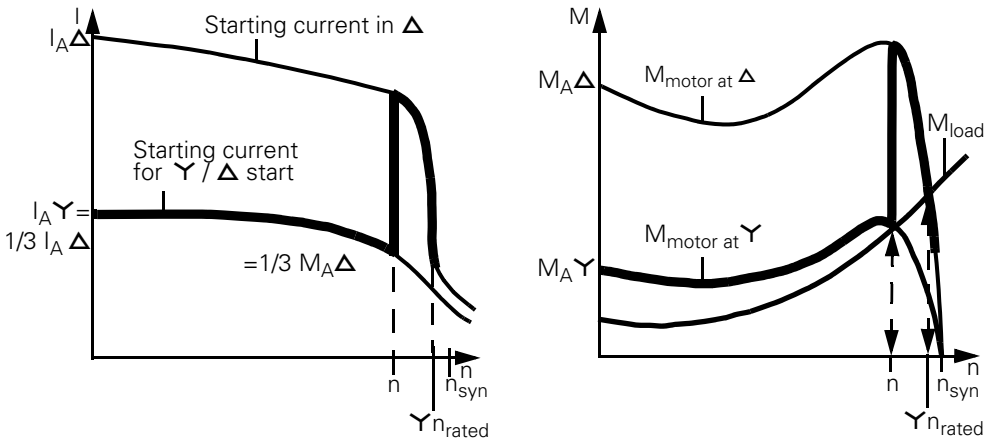


Figure 8-9: Current and torque curves for star-delta starting

sDSSte / sRSSte soft starters (soft start function activated)

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 sDSSte / sRSSte soft starter works:

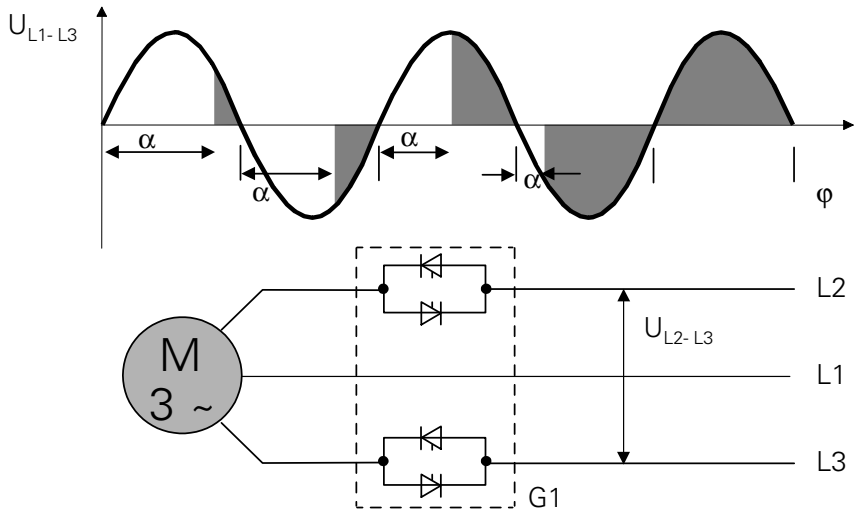


Figure 8-10: Phase firing of the supply voltage by semiconductor elements in the sDSSte / sRSSte soft starters

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

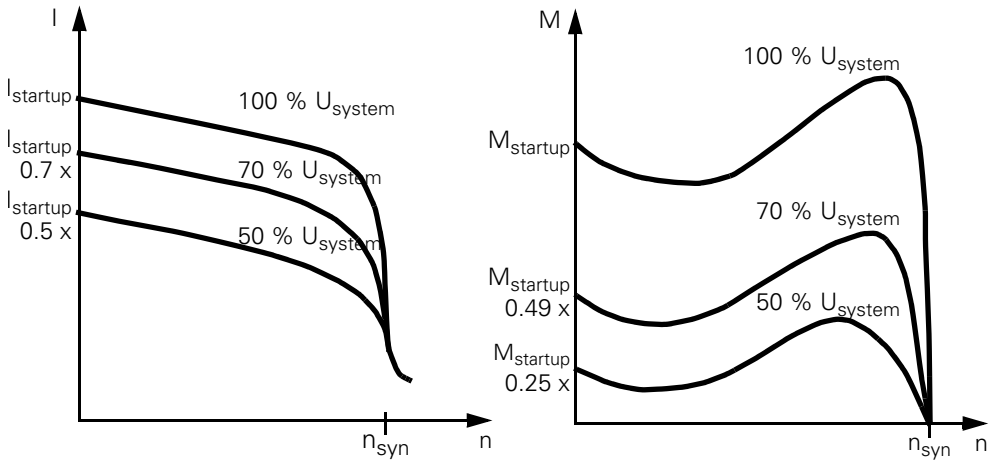


Figure 8-11: Current and torque curves for a soft starter

sDSte / sRSte direct starters (soft start function deactivated)

Via direct switching (instantaneous switching), the motor is placed onto the network without delay and reaches its maximum torque in a short time.
Advantage: Very high switching frequency
Disadvantage: High loading of the connection lines and the mechanical motor bearing

8.3.2 Application and use

Areas of application and criteria for selection

The ET 200pro sDSSte / sDSte and sRSSte / sRSte electronic starters provide an alternative to star-delta starters, frequency converters and to mechanical switchgear (comparison and advantages, see chapter 8.3.1).
The most important advantages with activated soft start function are soft starting and coasting, interruption-free changeover without current spikes that could interfere with the supply system and small dimensions.
Many drives that needed frequency converters in the past, can be changed to soft-start operation with the sDSSte / sRSSte, if the applications do not call for variations in speed.

Applications

Typical applications include, for example:

Conveyor belts, conveyor systems:
- smooth starting
- smooth slowing,
- high switching frequency

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

The most important advantages with deactivated sDSte / sRSte soft-start function are direct switching on and off (instantaneous switching) and high switching frequency.

8.3.3 Features

Electronic starters ET 200pro **sDSSte / sDSte and sRSSte / sRSte**

- Are suitable for switching and protecting three-phase loads up to 5.5 kW at 400 V AC
- Are available in setting ranges of 0.15 - 2 A and 1.5 - 12 A
- The power electronics have a 2-phase design (L2 and L3 are controlled, L1 is bridged)
- After the motor startup, the soft starter power thyristors are bridged via integrated relay from I_e > 7 A
- Have parameterizable electronic overload protection
- Upper and lower current limits for system and process monitoring can be set and monitored
- 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
- Available diagnostic information of the soft starter (see chapter 4)
- Circuit state and motor-starter status are indicated by LEDs
- Have different starting and coasting types (soft start and coasting, and mixtures of the two)
- Have direct switching on and off (instantaneous switching) of motors for applications with high switching frequency

Danger
Hazardous voltage. Danger of death or risk of serious injury.
Before starting work, de-energize the plant and device.
Phase L1 is not run via the semiconductor in the sDSSte / sDSte and sRSSte / sRSte.

Soft start function with automatic startup detection

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.

Automatic startup detection:
With a motor current of 1.5 x I_e or after 4 s startup, the startup detection is activated and switches at 1.2 x I_e to the bypass or fully controls the semiconductor with devices without bypass.

Soft coasting-down function

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

Warning
Following a shutdown function with a motor brake, the soft coasting down and time delay work against the halted motor.

Direct start function

Direct start for rotary current asynchronous motors without torque reduction with the goal of higher switching frequency.

time ramp

The graphic below shows the time ramp of sDSSte / sDSte, sRSSte / sRSte with parameterized ramp operation (DI 1.7 = 1):

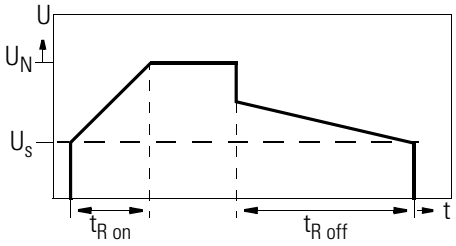


Figure 8-12: Time ramp / time diagram, sDSSte / sDSte, sRSSte / sRSte

Starting voltage

The start voltage should be parameterized so that the motor starts running rapidly.

Ramp time (start time)

The ramp time should be parameterized so that the motor can run up to speed within this 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" parameter is used to set the duration of the voltage ramp on 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.

If the value 0 is set, there is a free coasting down process.

Stop voltage

The "Stop voltage" parameter is used to set the voltage value where this is cancelled with the "voltage ramp" coasting down type, i.e. switched off.

Current limiting value

The "Current limitation value" parameter is used to limit the startup current to the set value.

Cyclic duration factor CD

The cyclic duration factor CD in % is the ratio between load duration and freewheeling 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.

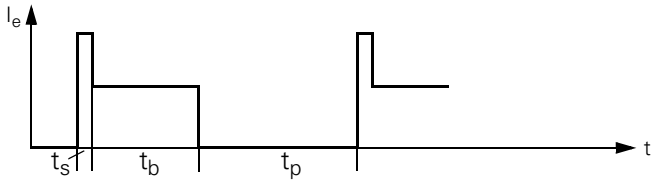


Figure 8-13: Cyclic duration factor CD

Switching frequency

It is essential to comply with the maximum permissible switching frequency in order to avoid exposing the devices to thermal overload. To do this, the "Response to overload - thermal motor model" parameter must 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 chapter 8.2.7, "Idle time parameters").

The tables below provide an overview of the switching frequencies/hour according to the influencing factors.

3RK1304-5KS70-..... (0.15 A to 2 A)

CLASS 10A

Device orientation	vertical						horizontal					
Rated current I_e / Ambient temperature	2 A 40 °C		2 A 50°C		2 A 55°C		2 A 40 °C		2 A 50°C		2 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/1 s	250	910	250	910	250	910	250	910	250	910	250	910
CD = 70 %, start 4xI_e/1 s	150	460	150	460	150	460	150	460	150	460	150	460
CD = 30 %, start 4xI_e/2 s	120	420	120	420	120	420	120	420	120	420	120	420
CD = 70 %, start 4xI_e/2 s	70	210	70	210	70	210	70	210	70	210	70	210

Class 10

Device orientation	vertical						horizontal					
Rated current I_e / Ambient temperature	2 A 40 °C		2 A 50°C		2 A 55°C		2 A 40 °C		2 A 50°C		2 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/1 s	120	450	120	450	120	450	120	450	120	450	120	450
CD = 70 %, start 4xI_e/1 s	70	230	70	230	70	230	70	230	70	230	70	230
CD = 30 %, start 4xI_e/2 s	60	210	60	210	60	210	60	210	60	210	60	210
CD = 70 %, start 4xI_e/2 s	37	100	37	100	37	100	37	100	37	100	37	100

Class 15

Device orientation	vertical						horizontal					
Rated current I_e / Ambient temperature	2 A 40 °C		2 A 50°C		2 A 55°C		2 A 40 °C		2 A 50°C		2 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/1 s	80	300	120	450	120	450	120	450	120	450	120	450
CD = 70 %, start 4xI_e/1 s	50	150	70	230	70	230	70	230	70	230	70	230
CD = 30 %, start 4xI_e/2 s	40	140	60	210	60	210	60	210	60	210	60	210
CD = 70 %, start 4xI_e/2 s	25	70	37	100	37	100	37	100	37	100	37	100

Class 20

Device orientation	vertical						horizontal					
Rated current I_e / Ambient temperature	2 A 40 °C		2 A 50°C		2 A 55°C		2 A 40 °C		2 A 50°C		2 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/1 s	60	220	60	220	60	220	60	220	60	220	60	220
CD = 70 %, start 4xI_e/1 s	37	110	37	110	37	110	37	110	37	110	37	110
CD = 30 %, start 4xI_e/2 s	30	100	30	100	30	100	30	100	30	100	30	100
CD = 70 %, start 4xI_e/2 s	18	50	18	50	18	50	18	50	18	50	18	50

1) Load cycle current effective value corresponds to 1.15 x I_e => motor protection

2) Load cycle limit for motor starter. The motor should be protected against overload here using thermistors

Table 8-6: Switching frequencies with activated soft start function

3RK1304-5LS70-..... (1.5 A to 12 A)

CLASS 10A

Device orientation	vertical						horizontal					
Rated current I_e / Ambient temperature	5 A 40 °C		5 A 50°C		5 A 55°C		5 A 40 °C		5 A 50°C		4.5 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/1 s	250	910	250	780	250	650	250	860	250	650	250	650
CD = 70 %, start 4xI_e/1 s	150	460	150	400	150	300	150	460	150	280	150	280
CD = 30 %, start 4xI_e/2 s	120	420	120	370	120	320	120	420	120	320	120	320
CD = 70 %, start 4xI_e/2 s	70	210	70	190	70	150	70	210	70	140	70	140

Class 10

Device orientation	vertical						horizontal					
Rated current I_e / Ambient temperature	5 A 40 °C		5 A 50°C		5 A 55°C		5 A 40 °C		5 A 50°C		4.5 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/2 s	120	450	120	380	120	320	120	430	120	320	120	320
CD = 70 %, start 4xI_e/2 s	70	230	70	180	70	130	70	230	70	140	70	140
CD = 30 %, start 4xI_e/4 s	60	210	60	190	60	160	60	210	60	160	60	160
CD = 70 %, start 4xI_e/4 s	37	100	37	100	37	70	37	100	37	70	37	70

Class 15

Device orientation	vertical						horizontal					
Rated current I_e / Ambient temperature	5 A 40 °C		5 A 50°C		5 A 55°C		5 A 40 °C		5 A 50°C		4.5 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/3 s	80	300	80	250	80	220	80	280	80	210	80	210
CD = 70 %, start 4xI_e/3 s	50	150	50	130	50	100	50	150	50	95	50	95
CD = 30 %, start 4xI_e/6 s	40	140	40	130	40	110	40	140	40	105	40	105
CD = 70 %, start 4xI_e/6 s	25	70	25	65	25	50	25	70	25	50	25	50

Class 20

Device orientation	vertical						horizontal					
Rated current I_e / Ambient temperature	5 A 40 °C		5 A 50°C		5 A 55°C		5 A 40 °C		5 A 50°C		4.5 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/4 s	60	220	60	190	60	160	60	210	60	160	60	160
CD = 70 %, start 4xI_e/4 s	37	110	37	100	37	70	37	115	37	70	37	70
CD = 30 %, start 4xI_e/8 s	30	100	30	95	30	80	30	105	30	80	30	80
CD = 70 %, start 4xI_e/8 s	18	50	18	50	18	35	18	50	18	35	18	35

1) Load cycle current effective value corresponds to 1.15 x I_e => motor protection

2) Load cycle limit for motor starter. The motor should be protected against overload here using thermistors.

Table 8-6: Switching frequencies with activated soft start function (Contd.)

3RK1304-5LS70-..... (1.5 A to 12 A)

CLASS 10A

Device orientation	vertical						horizontal					
Rated current I_e / Ambient temperature	7 A 40 °C		5.8 A 50°C		5 A 55°C		6 A 40 °C		5 A 50°C		4.5 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/1 s	250	580	250	600	250	650	250	650	250	650	250	650
CD = 70 %, start 4xI_e/1 s	150	260	150	260	150	300	150	280	150	280	150	280
CD = 30 %, start 4xI_e/2 s	120	290	120	300	120	320	120	320	120	320	120	320
CD = 70 %, start 4xI_e/2 s	70	130	70	130	70	150	70	140	70	140	70	140

Class 10

Device orientation	vertical						horizontal					
Rated current I_e / Ambient temperature	7 A 40 °C		5.8 A 50°C		5 A 55°C		6 A 40 °C		5 A 50°C		4.5 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/2 s	120	290	120	300	120	320	120	320	120	320	120	320
CD = 70 %, start 4xI_e/2 s	70	130	70	130	70	130	70	140	70	140	70	140
CD = 30 %, start 4xI_e/4 s	60	145	60	150	60	160	60	160	60	160	60	160
CD = 70 %, start 4xI_e/4 s	37	65	37	65	37	70	37	70	37	70	37	70

Class 15

Device orientation	vertical						horizontal					
Rated current I_e / Ambient temperature	7 A 40 °C		5.8 A 50°C		5 A 55°C		6 A 40 °C		5 A 50°C		4.5 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/3 s	80	190	80	200	80	220	80	210	80	210	80	210
CD = 70 %, start 4xI_e/3 s	50	85	50	85	50	100	50	95	50	95	50	95
CD = 30 %, start 4xI_e/6 s	40	95	40	100	40	110	40	105	40	105	40	105
CD = 70 %, start 4xI_e/6 s	25	45	25	45	25	50	25	50	25	50	25	50

Class 20

Device orientation	vertical						horizontal					
Rated current I_e / Ambient temperature	7 A 40 °C		5.8 A 50°C		5 A 55°C		6 A 40 °C		5 A 50°C		4.5 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/4 s	60	145	60	150	60	160	60	160	60	160	60	160
CD = 70 %, start 4xI_e/4 s	37	65	37	65	37	70	37	70	37	70	37	70
CD = 30 %, start 4xI_e/8 s	30	72	30	75	30	80	30	80	30	80	30	80
CD = 70 %, start 4xI_e/8 s	18	33	18	33	18	35	18	35	18	35	18	35

1) Load cycle current effective value corresponds to 1.15 x I_e => motor protection

2) Load cycle limit for motor starter. The motor should be protected against overload here using thermistors.

Table 8-6: Switching frequencies with activated soft start function (Contd.)

3RK1304-5LS70-..... (1.5 A to 12 A)

CLASS 10A

Device orientation	vertical						horizontal					
Rated current I_e / Ambient temperature	9 A 40 °C		9 A 50°C		9 A 55°C		9 A 40 °C		9 A 50°C		9 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/1 s	250	340	250	250	210	210	250	290	210	210	170	170
CD = 70 %, start 4xI_e/1 s	150	290	150	200	150	160	150	240	150	170	125	125
CD = 30 %, start 4xI_e/2 s	120	170	120	120	105	105	120	145	105	105	88	88
CD = 70 %, start 4xI_e/2 s	70	140	70	100	70	80	70	120	70	82	63	63

Class 10

Device orientation	vertical						horizontal					
Rated current I_e / Ambient temperature	9 A 40 °C		9 A 50°C		9 A 55°C		9 A 40 °C		9 A 50°C		9 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/2 s	120	170	120	120	105	105	120	145	105	105	88	88
CD = 70 %, start 4xI_e/2 s	70	140	70	100	70	80	70	120	70	82	63	63
CD = 30 %, start 4xI_e/4 s	60	85	60	60	53	53	60	72	53	53	44	44
CD = 70 %, start 4xI_e/4 s	38	72	38	50	38	38	38	60	38	41	31	31

Class 15

Device orientation	vertical						horizontal					
Rated current I_e / Ambient temperature	9 A 40 °C		9 A 50°C		9 A 55°C		9 A 40 °C		9 A 50°C		9 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/3 s	80	115	80	85	70	70	80	97	71	71	58	58
CD = 70 %, start 4xI_e/3 s	50	95	50	65	50	52	50	80	50	55	42	42
CD = 30 %, start 4xI_e/6 s	40	57	40	42	35	35	40	48	35	35	29	29
CD = 70 %, start 4xI_e/6 s	26	48	26	33	26	26	25	40	25	27	21	21

Class 20

Device orientation	vertical						horizontal					
Rated current I_e / Ambient temperature	9 A 40 °C		9 A 50°C		9 A 55°C		9 A 40 °C		9 A 50°C		9 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/4 s	60	85	60	60	53	53	60	72	53	53	44	44
CD = 70 %, start 4xI_e/4 s	38	72	38	50	38	38	38	60	38	41	31	31
CD = 30 %, start 4xI_e/8 s	30	42	30	30	26	26	30	36	26	26	22	22
CD = 70 %, start 4xI_e/8 s	18	36	18	25	18	18	19	30	19	20	15	15

1) Load cycle current effective value corresponds to 1.15 x I_e => motor protection

2) Load cycle limit for motor starter. The motor should be protected against overload here using thermistors.

Table 8-6: Switching frequencies with activated soft start function (Contd.)

3RK1304-5LS70-..... (1.5 A to 12 A)

CLASS 10A

Device orientation	vertical						horizontal					
Rated current I_e	12 A		12 A		12 A		12 A		12 A		11 A	
Ambient temperature	40 °C		50°C		55°C		40 °C		50°C		55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/1 s	215	215	155	155	125	125	175	175	125	125	120	120
CD = 70 %, start 4xI_e/1 s	150	150	100	100	70	70	125	125	70	70	70	70
CD = 30 %, start 4xI_e/2 s	107	107	77	77	63	63	88	88	63	63	60	60
CD = 70 %, start 4xI_e/2 s	70	80	50	50	35	35	62	62	36	36	33	33

Class 10

Device orientation	vertical						horizontal					
Rated current I_e	12 A		12 A		12 A		12 A		12 A		11 A	
Ambient temperature	40 °C		50°C		55°C		40 °C		50°C		55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/2 s	107	107	77	77	63	63	88	88	63	63	60	60
CD = 70 %, start 4xI_e/2 s	70	80	50	50	35	35	62	62	36	36	33	33
CD = 30 %, start 4xI_e/4 s	54	54	38	38	312	31	44	44	31	31	31	31
CD = 70 %, start 4xI_e/4 s	38	40	25	25	18	18	31	31	18	18	18	18

Class 15

Device orientation	vertical						horizontal					
Rated current I_e	12 A		12 A		12 A		12 A		12 A		11 A	
Ambient temperature	40 °C		50°C		55°C		40 °C		50°C		55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/3 s	72	72	52	52	42	42	59	59	42	42	40	40
CD = 70 %, start 4xI_e/3 s	50	54	34	34	24	24	41	41	24	24	24	24
CD = 30 %, start 4xI_e/6 s	36	36	26	26	21	21	29	29	21	21	20	20
CD = 70 %, start 4xI_e/6 s	25	27	17	17	12	12	20	20	12	12	12	12

Class 20

Device orientation	vertical						horizontal					
Rated current I_e	12 A		12 A		12 A		12 A		12 A		11 A	
Ambient temperature	40 °C		50°C		55°C		40 °C		50°C		55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD = 30 %, start 4xI_e/4 s	54	54	38	38	31	31	44	44	31	31	31	31
CD = 70 %, start 4xI_e/4 s	38	40	25	25	18	18	31	31	18	18	18	18
CD = 30 %, start 4xI_e/8 s	27	27	19	19	15	15	22	22	15	15	15	15
CD = 70 %, start 4xI_e/8 s	18	20	12	12	9	9	15	15	9	9	9	9

1) Load cycle current effective value corresponds to 1.15 x I_e => motor protection

2) Load cycle limit for motor starter. The motor should be protected against overload here using thermistors.

Table 8-6: Switching frequencies with activated soft start function (Contd.)

3RK1304-5KS70-..... (0.15 A to 2 A)												
CLASS 10A												
Device orientation	vertical						horizontal					
Rated current I_e Ambient temperature	2 A 40 °C		2 A 50°C		2 A 55°C		2 A 40 °C		2 A 50°C		2 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD=30 % ($8xI_e$) / 0.2 s	300	2000	300	2000	300	2000	300	2000	300	2000	300	2000
CD=70 % ($8xI_e$) / 0.2 s	180	1000	180	1000	180	1000	180	1000	180	1000	180	1000
CD=30 % ($8xI_e$) / 0.4 s	150	1000	150	1000	150	1000	150	1000	150	1000	150	1000
CD=70 % ($8xI_e$) / 0.4 s	90	520	90	520	90	520	90	520	90	520	90	520

Class 10												
Device orientation	vertical						horizontal					
Rated current I_e Ambient temperature	2 A 40 °C		2 A 50°C		2 A 55°C		2 A 40 °C		2 A 50°C		2 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
Direct start CD=30 % ($8xI_e$) / 0.4 s	150	1000	150	1000	150	1000	150	1000	150	1000	150	1000
CD=70 % ($8xI_e$) / 0.4 s	90	500	90	500	90	500	90	500	90	500	90	500
CD=30 % ($8xI_e$) / 0.8 s	75	490	75	490	75	490	75	490	75	490	75	490
CD=70 % ($8xI_e$) / 0.8 s	45	250	45	250	45	250	45	250	45	250	45	250

3RK1304-5LS70-..... (1.5 A to 12 A)												
CLASS 10A												
Device orientation	vertical						horizontal					
Rated current I_e Ambient temperature	5 A 40 °C		5 A 50°C		5 A 55°C		5 A 40 °C		5 A 50°C		4.5 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD=30 % ($8xI_e$) / 0.25 s	240	1300	240	1000	240	800	240	1150	240	840	240	840
CD=70 % ($8xI_e$) / 0.25 s	150	800	150	500	150	350	150	650	150	380	150	380
CD=30 % ($8xI_e$) / 0.5 s	120	700	120	500	120	400	120	580	120	430	120	430
CD=70 % ($8xI_e$) / 0.5 s	70	380	70	270	70	200	70	340	70	200	70	200

Class 10												
Device orientation	vertical						horizontal					
Rated current I_e Ambient temperature	5 A 40 °C		5 A 50°C		5 A 55°C		5 A 40 °C		5 A 50°C		4.5 A 55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD=30 % ($8xI_e$) / 0.5 s	120	700	120	520	120	420	120	580	120	430	120	430
CD=70 % ($8xI_e$) / 0.5 s	70	400	70	280	70	200	70	340	70	200	70	200
CD=30 % ($8xI_e$) / 1 s	60	350	60	260	60	220	60	290	60	220	60	220
CD=70 % ($8xI_e$) / 1 s	37	190	37	140	37	100	37	170	37	100	37	100

1) Load cycle current effective value corresponds to 1.15 x I_e => motor protection

2) Load cycle limit for motor starter. The motor should be protected against overload here using thermistors.

Table 8-7: Switching frequencies with deactivated soft start function (direct start)

3RK1304-5LS70-…… (1.5 A to 12 A)												
CLASS 10A												
Device orientation	vertical						horizontal					
Rated current I_e	7 A		5.8 A		5 A		6 A		5 A		4.5 A	
Ambient temperature	40 °C		50°C		55°C		40 °C		50°C		55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD=30 % ($8xI_e$) / 0.3 s	200	630	200	670	200	740	200	700	200	700	200	700
CD=70 % ($8xI_e$) / 0.3 s	120	280	120	290	120	330	120	320	120	320	120	320
CD=30 % ($8xI_e$) / 0.6 s	100	320	100	330	100	370	100	350	100	350	100	350
CD=70 % ($8xI_e$) / 0.6 s	60	140	60	140	60	160	60	160	60	160	60	160

Class 10												
Device orientation	vertical						horizontal					
Rated current I_e	7 A		5.8 A		5 A		6 A		5 A		4.5 A	
Ambient temperature	40 °C		50°C		55°C		40 °C		50°C		55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD=30 % ($8xI_e$) / 0.6 s	100	320	100	330	100	370	100	350	100	350	100	350
CD=70 % ($8xI_e$) / 0.6 s	60	140	60	140	60	160	60	160	60	160	60	160
CD=30 % ($8xI_e$) / 1.2 s	50	160	50	170	50	190	50	170	50	170	50	170
CD=70 % ($8xI_e$) / 1.2 s	30	70	30	70	30	80	30	80	30	80	30	80

3RK1304-5LS70-…… (1.5 A to 12 A)												
CLASS 10A												
Device orientation	vertical						horizontal					
Rated current I_e	9 A		9 A		9 A		9 A		9 A		9 A	
Ambient temperature	40°C		50°C		55°C		40°C		50°C		55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD=30 % ($8xI_e$) / 0.35 s	170	330	170	240	170	200	170	280	170	200	170	170
CD=70 % ($8xI_e$) / 0.35 s	100	280	100	190	100	150	100	230	100	155	100	120
CD=30 % ($8xI_e$) / 0.7 s	85	170	85	120	85	100	85	140	85	105	85	85
CD=70 % ($8xI_e$) / 0.7 s	52	140	52	95	52	75	52	120	52	82	52	62

Class 10												
Device orientation	vertical						horizontal					
Rated current I_e	9 A		9 A		9 A		9 A		9 A		9 A	
Ambient temperature	40°C		50°C		55°C		40°C		50°C		55°C	
Degree of protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
CD=30 % ($8xI_e$) / 0.75 s	85	160	85	115	85	95	80	130	80	95	80	80
CD=70 % ($8xI_e$) / 0.75 s	52	130	52	90	52	70	50	110	50	75	50	57
CD=30 % ($8xI_e$) / 1.5 s	40	80	40	59	40	48	40	67	40	48	40	40
CD=70 % ($8xI_e$) / 1.5 s	25	67	25	47	25	37	25	56	25	38	25	29

1) Load cycle current effective value corresponds to 1.15 x I_e => motor protection

2) Load cycle limit for motor starter. The motor should be protected against overload here using thermistors.

Table 8-7: Switching frequencies with deactivated soft start function (direct start) (Contd.)

8.3.4 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: Start 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

Note
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 for a pronounced saddle torque, the lowest motor torque that occurs during run-up to rated speed.

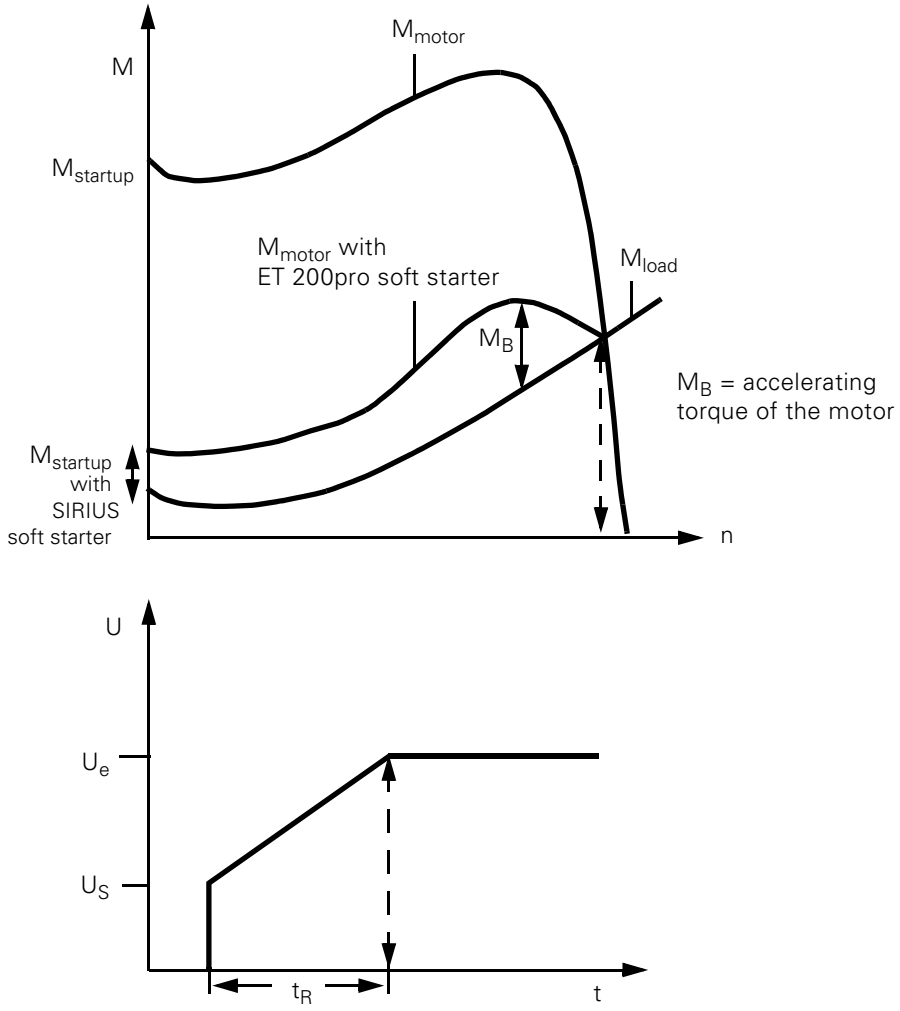


Figure 8-14: Load and motor torques and motor terminal voltage for operation with soft starter

Criteria for selection

Note
With the ET 200pro soft starters sDSSte / sDSte and sRSSte / sRSte, the corresponding soft starter must be chosen according to the rated motor current (soft starter rated current must be ≥ rated motor current).

Starting time

To achieve optimal operating conditions for the sDSSte / sRSSte soft starters, the set startup time should be approx. 1 s longer than the resultant motor startup time. Longer starting times increase the thermal load on the devices and the motor unnecessarily and lead to a reduction in the permissible switching frequency.

Connection

9

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

Danger
Ensure that the wiring is correct and carefully carried out! ET 200pro components may otherwise be destroyed! There is a **danger of death!**

Shock protection

The HAN Q4/2 plug-in connectors used for power supply and HAN Q8/0 for consumer connection have sufficient shock protection (finger-proof) in accordance with DIN VDE 0106, Part 100.

9.1 Rules for wiring

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

9.1.1 Selecting the energy lines

The core cross-section of the energy lines must be modified for the relevant ambient conditions. The key factors for the core cross-section are:
- the current set on the device,
- the installation type,
- the ambient temperature,
- the material type (PVC, rubber).

For PVC energy lines, the following maximum current loading capacity applies, e.g. with installation in the cable duct, depending on the ambient temperature:

mm²	**T_U**				
	30 °C	**40 °C**	**45°C**	**50°C**	**55°C**
1.5	14 A	12.2 A	11.1 A	9.9 A	A
2.5	19 A	16.5 A	15.0 A	13.5 A	11.6 A
4.0	26 A	22.6 A	20.5 A	18.5 A	15.9 A

Observe the following rules during installation:

Rules for flexible lines	**Data**	
Current-loading capacity of the plug-in connector depending on the connectable core cross-sections and the ambient temperature	T_u = 55 °C	40 °C
1.5 mm²	12 A	15 A
2.5 mm²	20 A	25 A
4.0 mm²	30 A	35 A

Table 9-1: Rules for wiring

9.1.2 Unused connections

Connect unused connections with caps; this is the only way to ensure protection rating IP65. order number 3RK1902-0C**J**00 (x 10) or 3RK1902-0C**K**00 (x 1).

9.2 Energy cable preparation

9.2.1 The following is required for preparation work:

- for assembly of the sockets and pins on the individual cores, a crimping tool (see chapter A.2).

As well as the following accessories:

- for supply to special modules (assignment of X1, see chapter 9.2.2), for supply to motor starters (assignment of X1, see chapter 9.2.3):
  – a flexible Cu cable with 4 x 2.5 mm^2 / 4 mm^2 / 6 mm^2 (3-core + PE)
  – an energy plug-in connector HAN Q4/2 socket
    - for 2.5 mm^2: 3RK1911-2B**E5**0
    - for 4.0 mm^2: 3RK1911-2B**E1**0
    - for 6 mm^2: **3RK1911-2BE30**
- for energy forwarding via a loop to the RSM and F-RSM special modules (assignment of X2 see chapter 9.2.2):
  – a flexible Cu cable with 4 x 2.5 mm^2 / 4 mm^2 (3-core + PE)
  – an energy plug-in connector HAN Q4/2 pin
    - for 2.5 mm^2: 3RK1911-2B**F5**0
    - for 4.0 mm^2: **3RK1911-2BF10**
- for consumer connection on the motor starter (assignment of X2 see chapter 9.2.3):
  – a flexible Cu cable with 1.5 mm^2 or 2.5 mm^2
    - without brake control: 3-core + PE
    - with brake control: 5-core + PE
  – an energy plug-in connector HAN Q8/0 pin
    - for 1.5 mm^2: 3RK1902-0C**E**00
    - for 2.5 mm^2: **3RK1902-0CC00**

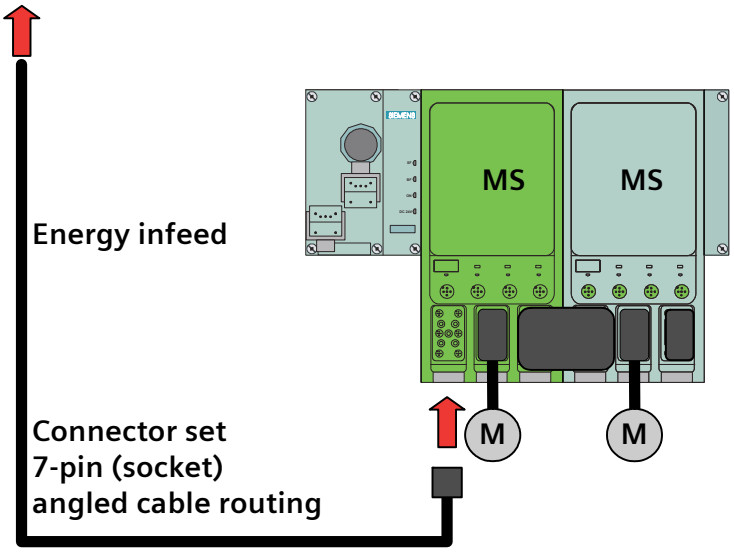


Figure 9-1: Example: Power infeed

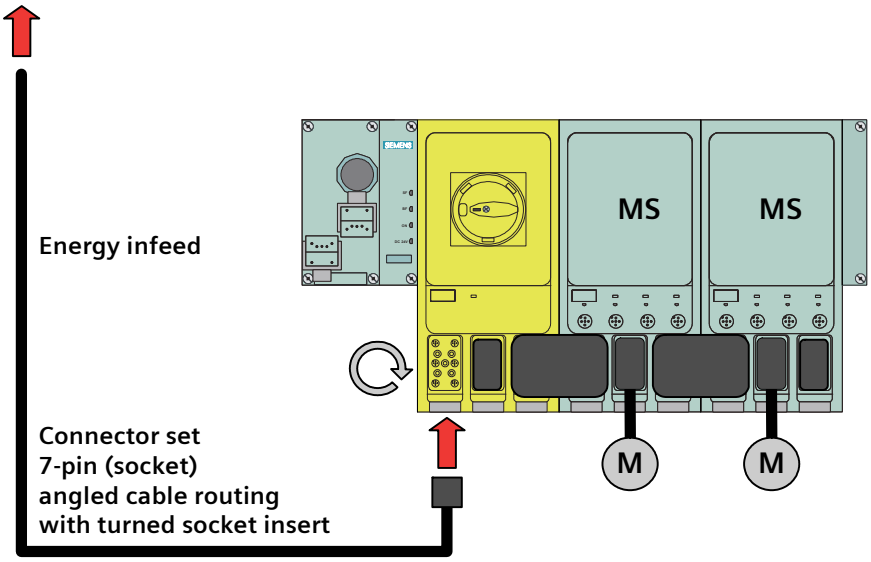


Figure 9-2: Example: Power infeed with rotated socket insert

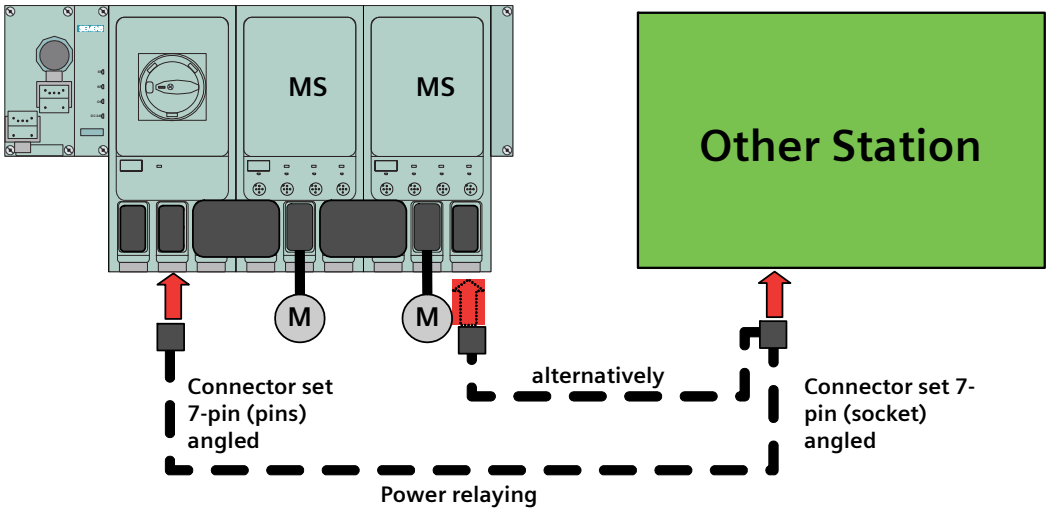


Figure 9-3: Example: Power forwarding

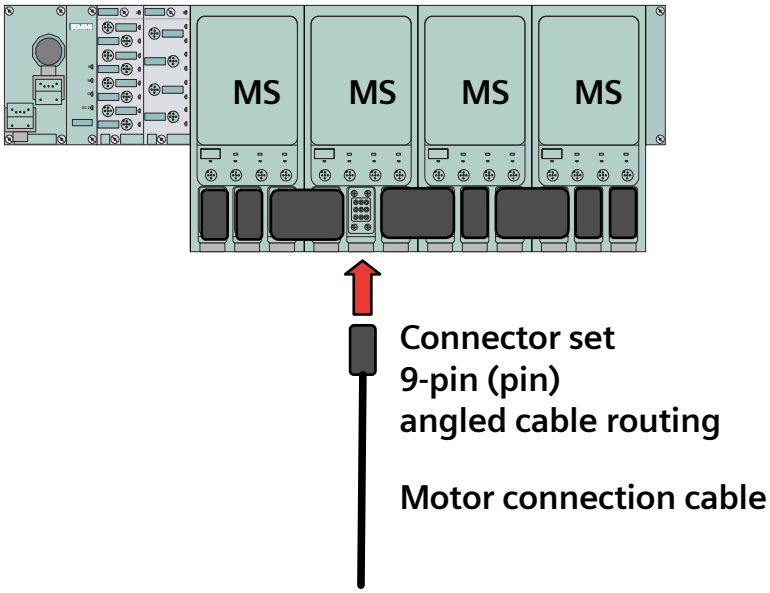
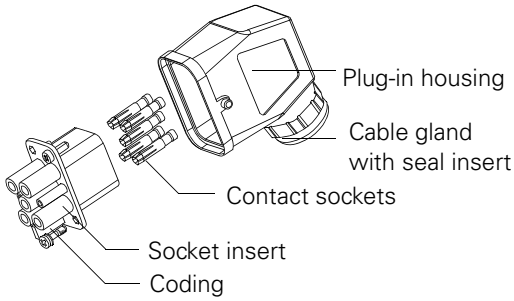


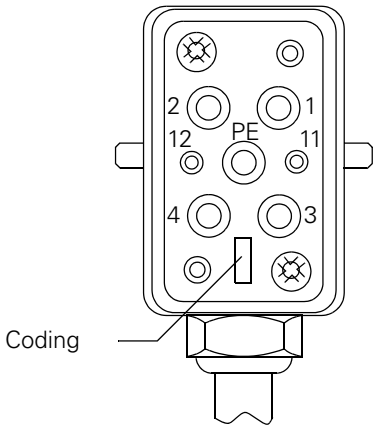
Figure 9-4: Example: Motor connection cable

9.2.2 Plug-in connector for RSM and F-RSM special modules

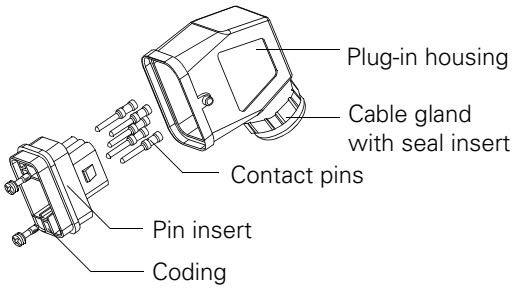
The X1 energy plug-in connector for infeed or X2 for forwarding via a loop to special modules RSM and F-RSM consist of the following components:

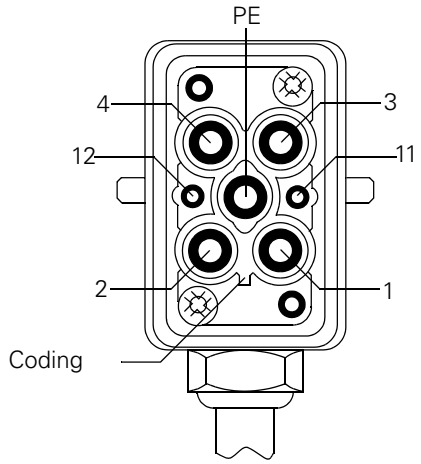
X1 infeed HAN Q4/2 socket





X2 forwarding via a loop HAN Q4/2 pin





Socket / pin	Assignment X1 and X2
1	Phase L1
2	Phase L2
3	Phase L3
4	Not used
11	Not used
12	Not used
⏚	PE (yellow / green)

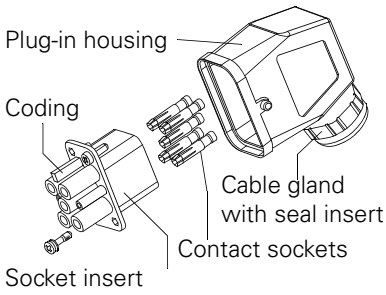
Figure 9-5: Plug-in connector for RSM and F-RSM special modules

Caution
Ensure that the coding position when inserting the pin insert or socket insert into the plug-in housing.

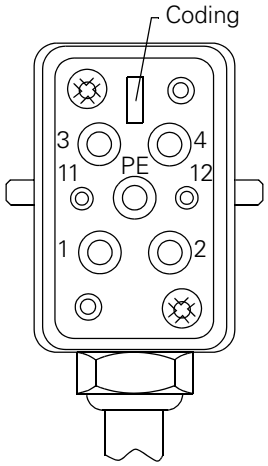
9.2.3 Plug-in connector for motor starters

The X1 energy plug-in connector for X2 infeed for consumer connection to the motor starters consist of the following components:

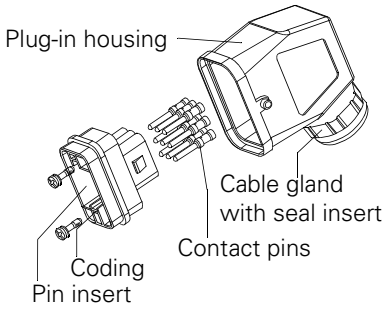
X1 infeed HAN Q4/2 socket



Socket	X1 assignment
1	Phase L1
2	Phase L2
3	Phase L3
4	Not used
11	Not used
12	Not used
⏚	PE (yellow / green)



X2 consumer connection HAN Q8/0 pin



Pin	X2 assignment
1	Phase L1
2	Not used
3	Phase L3
4	Brake L1 (switched)
5	Temperature sensor[1)]
6	Brake L3 (direct)
7	Phase L2
8	Temperature sensor[1)]
⏚	PE (yellow / green)

1) only sDSSte / sDSte and sRSSte / sRSte

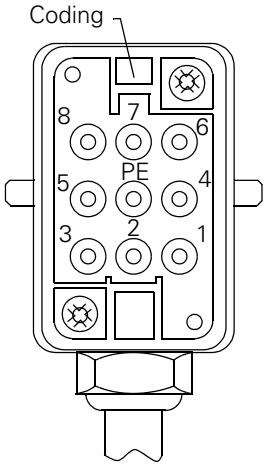


Figure 9-6: Plug-in connector for motor starters

Caution
Ensure that the coding position when inserting the pin insert or socket insert into the plug-in housing.

9.2.4 Installing and wiring energy plug-in connectors

Installing and wiring the energy plug-in connectors according to the following specifications:

<table>
<tr><th>Step</th><th>Procedure</th></tr>
<tr><td>1</td><td>Insert the cable through the cable gland, the relevant seal insert provided, and the plug-in housing.
The seal insert is available in the following graduations:
<table>
<tr><td>Permissible external diameter of the cable</td><td>Seal insert</td></tr>
<tr><td>7.0 to 10.5 mm
9.0 to 13.0 mm
11.5 to 15.5 mm</td><td>Green
Red
white</td></tr>
</table></td></tr>
<tr><td>2</td><td>Strip the cable to a length of 20 mm.</td></tr>
<tr><td>3</td><td>Strip the cable to a length of 8 mm.</td></tr>
<tr><td>4</td><td>Fasten the contact sockets / contact pins on the cores via crimping using a suitable tool (see chapter A.2) or solder.</td></tr>
<tr><td>5</td><td>Sort the contact sockets / contact pins into the socket insert / pin insert according to the assignments as shown in chapter 9.2.2 and chapter 9.2.3. The contact sockets / contact pins should not yet be engaged. Check the correct assignment. Slide the contact sockets / contact pins into the socket insert / pin insert until they engage.
Contact sockets / contact pins already fitted can be removed again using a removal tool (see chapter A.2).</td></tr>
<tr><td>6</td><td>Ensure that the coding position is correct, pull back the cable and screw the socket insert / pin insert into the plug-in housing using the Phillips bolts provided.</td></tr>
<tr><td>7</td><td>Screw the cable gland tight. Ensure that the cable is not turned against the plug-in housing.</td></tr>
</table>

Table 9-2: Installing and wiring energy plug-in connectors

9.3 Energy jumper plug

The energy jumper plug is used to forward the main power via a loop from one special module or motor starter to the next motor starter.
The table below shows the contact assignments:

Pin	Socket	Assignment
1	1	Phase L1
2	2	Phase L2
3	3	Phase L3
4	4	Not used
⏚	⏚	PE (yellow / green)

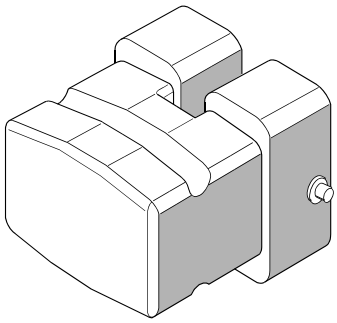
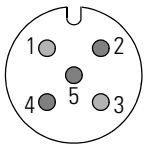


Table 9-3: Energy jumper plug

9.4 Inputs with M12 connection

The motor starters; High feature have 4 digital inputs for 2-wire and 3-wire sensors using M12 connection technology. The inputs can be parameterized for different functions (see chapter 10.7).

The table below shows the M12 plug assignments:M12



Socket	Assignment
1	+24 V
21[1)]	DI x
3	0 V
41[1)]	DI x
5	FE

1) Sockets 2 and 4 are bridged inside the device

Table 9-4: M12 connection assignment

Device functions

10

10.1 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:

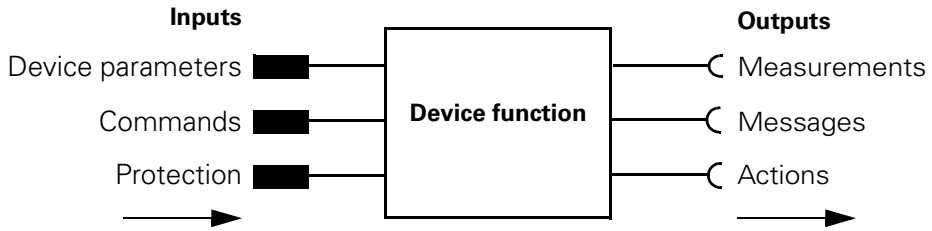


Figure 10-1: Principle of device function

Self-protection

The motor starter protects itself against destruction thanks to the thermal motor model and temperature measurements with electronic switching elements. If the self-protection is triggered,

- the brake output and the motor are shut down immediately
- the message *'Switching element overload'* is generated

It is not possible to switch on using *'Emergency start'*

Currents

All currents (e. g. blocking current, current limit values) are percentage current values relative to the rated operating current.

10.2 Basic parameters

Definition

Basic parameters are "central" parameters required by several device functions. The number of device functions and the performance class depend on the device version and cannot be parameterized.

10.2.1 Device parameters

Rated operating current

Here you specify the rated operating current that uninterrupted can result in the branch (switchgear and motor). The setting range depends on the performance class.

Attention
The rated operating current is the most important central parameter! The rated operating current must be set **in all cases** to ensure motor protection!

Special feature:

- In the **motor starter**, the rated operating current is factory-set to **maximum** value (For tests with commissioning without a field bus and without advance parameterization).
- In the **GSD / GSDmL / MDD** and the **software *'ES motor starter'***, the rated operating current is set to **minimum** value for safety reasons. This value must therefore be parameterized in the configuration process. Otherwise, the motor starter could trip due to an overload when the motor is started for the first time.

Actual motor current

The maximum 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 indicates 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

Table 10-1: Actual motor current

I_{act} = rated operational current I_{rated} x value (DI 1.0 to DI 1.5)

Response with switching element power supply missing

This parameter is used to set which message the motor starter issues if the power supply fails (2L+).

- Group fault
- Group fault only for ON command
- General warning

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.

Non-resetting on voltage failure
(can only be parameterized with high feature motor starters)

These device parameters are used to determine whether the last overload message is to be retained if the electronic voltage fails:

- Overload
- No overload

10.2.2 Parameter – settings

The table below shows the basic parameter settings:

Device parameters	Default setting	Adjustment range
Rated operating current[1)]	2.0 A 12.0 A	Increment: 10 mA 0.15 A to 2.0 A 1.5 A to 12.0 A
Load type	3-phase	3-phase / 1-phase
Non-resetting on voltage failure	yes	Yes / no

1) Rated power of the motor at 400 V AC

Table 10-2: Basic parameter – settings

10.3 Thermal motor model

Description

An approximation of the heating status of the motor is calculated electronically from the measured motor currents and the device parameters *'Rated operational current'* und *'enable class'*. The data that indicates whether the motor is overloaded or working within its normal operating range is derived from this temperature.

10.3.1 Device parameters

Response to overload – thermal motor model

(can only be parameterized with high feature motor starters)

This device parameters is used to determine how the motor starter reacts to overload:

- *'Shutdown without restart'*
- *'Shutdown with restart'*
- *'Warning'*

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, DO 0.3).

Danger

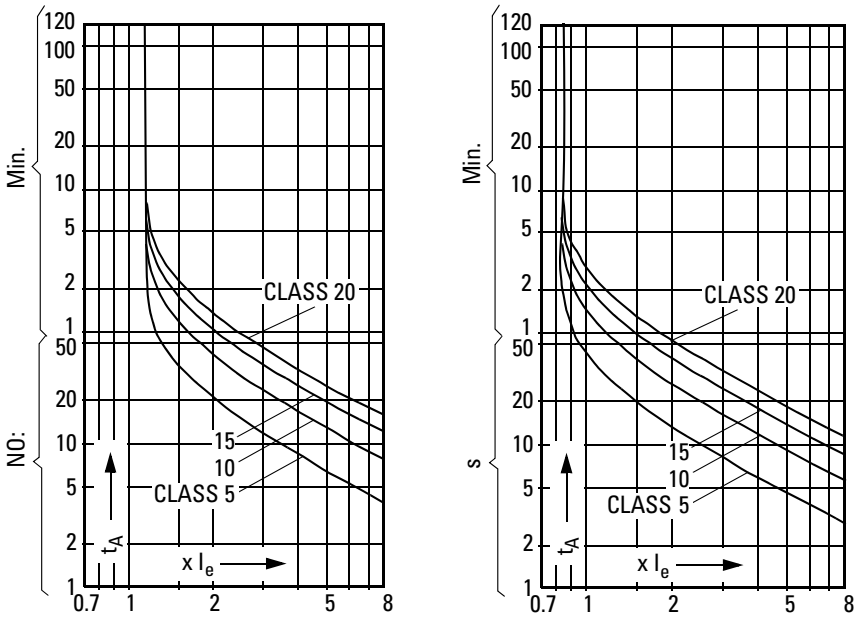
Shutdown with restart means that **if a switch-on command** is pending the motor starter switches on **automatically** (auto-reset).

Attention

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 (can only be parameterized with high feature motor starters)

The *'tripping class'* (CLASS) defines the maximum tripping time within which a protective device must trip from cold at 7.2 times the setting current (motor protection to IEC60947). 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: Trip classes

Note

The setting options for the tripping classes depend on the motor starter and on the current range:

Motor starters	CLASS
DSe, RSe	10 fixed
High feature DSe, sDSSte / sDSte, RSe, sRSSte / sRSte	5, 10, 15, 20 parameterizable

Recovery time (can only be parameterized with high feature motor starters)

The *'recovery time'* is the time defined for cooling after which a reset is possible following an overload trip.

Trip reset signals received during the recovery time (DO 0.3) have no effect.

The motor starters are set to the following times:

- with DSe ST, RSe ST:
  Setting fixed to 90 s.
- with DSe HF, RSe HF, sDSSte / sDSte and sRSSte / sRSte:
  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.
  Factory setting: 90 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 for motor heating

This parameter can be used to specify a percentage motor heating process as a prewarning limit. The motor starter issues a warning if the parameterized motor heating limit is exceeded. A shutdown is implemented at 100 %.

Range: 0 % to 95 %.

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.

Range: 0 seconds to 500 seconds.

Idle time (can only be parameterized with high feature motor starters)

The *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 idle time:

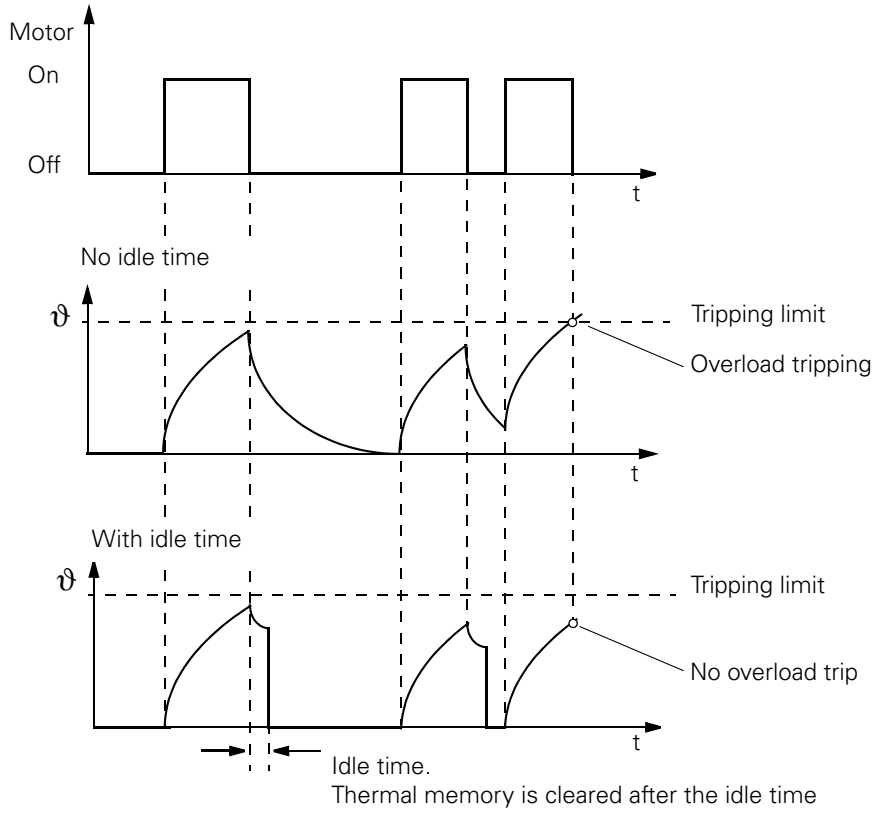


Figure 10-3: Cooling response with and without idle time

10.3.2 Thermal motor model – settings

The table below shows the basic device parameter settings:

Device parameters	Default setting	Adjustment range
Response to overload - thermal motor model	Shutdown without restart	Shutdown without restart / Shutdown with restart / warning
Tripping class	10	5, 10, 15, 20 (only with DSe HF, RSe HF, sDSSte / sDSte, sRSSte / sRSte)
Recovery time	1.5 min.	1 min. … 30 min.
Idle time	0	0 to 255 seconds

Table 10-3: Thermal motor model device parameters - settings

10.3.3 Messages and actions, measurements and statistics data

The device functions *'Thermal motor model'* supplies the following messages and measurements and statistics data:

Messages and actions

Message	Action
Thermal motor model - overload	—
Overload shutdown	Shutdown (overload present)
Idle time active	—
Cooldown time active	—

Table 10-4: Thermal motor model – messages and actions

Measurements and statistics data

Measurements	Description
Remaining cool-down time	—
Phase current $I_{L1\ act}$	Current phase current, phase 1
Phase current $I_{L2\ act}$	Current phase current, phase 2
Phase current $I_{L3\ act}$	Current phase current, phase 3
Motor heating	Current motor heating in %

Statistics data	Description
Last trigger current	—
Motor current I_{max}	—

Preventative diagnostics	—
Number of overload trips	—
Maximum trip current	—
Phase current $I_{L1\ max}$	Maximum phase current, phase 1
Phase current $I_{L2\ max}$	Maximum phase current, phase 2
Phase current $I_{L3\ max}$	Maximum phase current, phase 3

Table 10-5: Thermal motor model – Measurements and statistics data

10.4 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:
System becomes more inert, for example on account of damaged bearings System becomes freer, for example because the processing material in the system has been used up.	Current is higher or lower than usual	Current limits
System 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

10.4.1 Device parameters

Response with zero current violation

(can be parameterized with standard and high feature motor starters)

The zero current detection function is activated when the motor current in all 3 phases becomes lower than 18.75 % of the set rated operating current. This device parameters is used to determine how the motor starter reacts to zero current detection:

- Warning
- Disconnect

Caution

When switching on the motor, the zero current detection is suppressed for approx. 1 second!

Response with current limit violation

(can only be parameterized with high feature motor starters)

This device parameters is used to determine how the motor starter reacts to current limit violation:

- Warning
- Disconnect

Upper / lower current limit (can only be parameterized with high feature motor starters)

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.

Caution
The current limits are – for startup bridging – only active after the class time elapses, e.g. class 10 after 10 seconds.

The motor starter can be parameterized for warning or shutdown as the response to violation of the current limits.

Range for lower current limit:
18.75 % to 100 % of the rated operational current

Range for upper current limit:
50 % to 150 % of the rated operational current

Blocking time (can only be parameterized with high feature motor starters)

Time for which a blockage can persist without initiating a shutdown. The motor starter shuts down if the blockage is still present after the blocking time expires.

Range: 1 second to 5 seconds.

Blocking current (can only be parameterized with high feature motor starters)

The motor starter detects a blockage if the parameterized blocking current is exceeded. 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.

Caution
The motor starter shuts down if the blockage is still present after the blocking time expires.

Range:	150 % to 1000 % of the rated operating current. For sDSSte / sDSte and sRSSte / sRSte, 150 % - 800 % applies.

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:

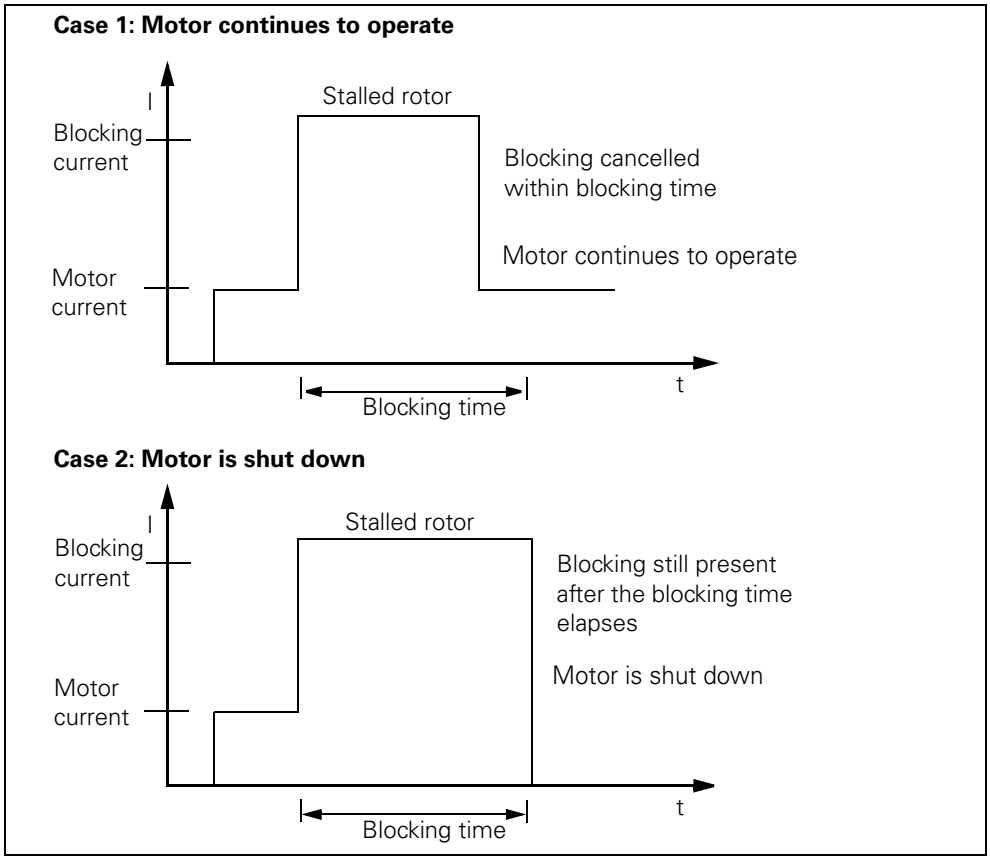


Figure 10-4: Principle of anti-blocking function

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 limited 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 fault" are generated.
- The slave pointer "Number of switching element overload trips" is increased by 1.

10.4.2 Device parameters for current limit values – settings

The table below shows the basic device parameter settings:

Device parameters	Default setting	Adjustment range
Response to current limit violation	Warning	Warning / shutdown
Lower current limit	18.75%	18.75 % to 100 % increment: 3.125%
Upper current limit	112.5%	50 % to 150 % increment: 3.125%
Blocking current	800%	50 % to 1000 % increment: 50%
Blocking time	1 second	1 sec. to 5 seconds increment: 0.5 sec.
Response to residual current detection	Disconnect	Warning / shutdown

Table 10-6: Device parameters for current limit values – settings

10.4.3 Messages and actions

The *'current limit values'* device function delivers the following 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 10-7: Current limit values – messages and actions

10.4.4 Temperature sensor

Task

Temperature sensors are located directly in the motor stator winding. They are used for direct temperature monitoring of the motor windings. This is used to detect whether the motor is working normally or is overloaded.

Caution
Electronic starters sDSSte / sDSte and sRSSte / sRSte can evaluate **one** temperature sensor circuit!

Temperature sensor device parameters – descriptions

Temperature sensor

You can deactivate these parameters if there is no temperature sensor in the motor.
You can activate this parameter if there is a temperature sensor in the motor.
Two types of temperature sensor are supported:

- Thermoclick. This is a switch that opens at a specific winding temperature
- PTC - type A. This is a PTC thermistor with defined characteristic according to VDE 0660 Parts 302 and 303

Range:

- Deactivated
- Thermoclick (switch with fixed switch-on temperature)
- PTC - type A (PTC thermistor with fixed resistance range)

Caution
If you parameterize "Deactivated", the following parameters are ignored:

- Response to overload – temperature sensor
- Temperature sensor monitoring

If you parameterize "Thermoclick", the following parameters must be deactivated:

- Temperature sensor monitoring

Caution
Temperature sensor circuit is electrically connected to "24 V DC supply voltage is not switched".

Response on overload - temperature sensor

This parameter is used to determine how the motor starter responds to a temperature sensor overload and if the temperature sensor monitoring is actuated:

- Shutdown without restart
- Shutdown with restart
- Warning

Caution
Restart means that with a switch-on command present, the motor starter will automatically be re-started when the cause of the fault has been rectified (autoreset).

Temperature sensor monitoring

This device parameter is used to determine whether the temperature sensor line is monitored for interruption and short-circuit.

Range: Yes / no

Temperature sensor parameter – settings

The table below shows the device parameter settings:

Device parameters	Default setting	Adjustment range
Temperature sensor	Deactivated	Deactivated / Thermoclick / PTC - type A
Response on overload - temperature sensor	Shutdown without restart	Shutdown without restart / shutdown with restart / warning
Temperature sensor monitoring	yes	Yes / no

Table 10-8: Temperature sensor parameter – settings

Messages and actions

The "Temperature sensor" function delivers the following messages and actions:

Message	Action
Temperature sensor overload	Warning or shutdown
Temperature sensor wire break	Warning or shutdown
Temperature sensor short-circuit	Warning or shutdown
Overload shutdown	Shutdown (overload, wire break or short-circuit present), depending on parameterization

Table 10-9: Temperature sensor – Messages and actions

10.5 Asymmetry

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.

Caution
When switching on the motor, the asymmetry evaluation is suppressed for approx. 500 milliseconds

10.5.1 Asymmetry parameter – descriptions

Asymmetry limit (can only be parameterized with high feature motor starters)

The *'asymmetry limit'* is a percentage by which motor current can vary in the individual phases.
Asymmetry has occurred when the difference between the lowest and the highest phase currents is greater than the parameterized asymmetry limit value. The datum for evaluation is the maximum phase current in one of the three phases.

Range: 30 % to 60 % of the rated operational current

Response with asymmetry

(can be parameterized with standard and high feature motor starters)

This device parameters is used to determine how the motor starter reacts to asymmetry:

- Warning
- Disconnect

10.5.2 Asymmetry parameter – settings

The table below shows the device parameter settings:

Device parameters	Default setting	Adjustment range
Response to asymmetry	Disconnect	Warning / shutdown
Asymmetrical limit value	30%	30 % to 60 % increment: 10%

Table 10-10: Asymmetry parameter – settings

10.5.3 Messages, actions and measurements

The *'Asymmetry* function delivers the following messages, actions and measurements:

Messages, actions

Message	Action
Asymmetry detected	—
Asymmetry shutdown	Shutdown (asymmetry present)

Table 10-11: Asymmetry – Messages and actions

Measurements

Measurements	Description
Asymmetry	Asymmetry 0 to 100 % increment: 1%

Table 10-12: Asymmetry – measurements

10.6 Trip reset

'Trip reset' acknowledges all faults currently present on the starter that can be acknowledged. A fault can be acknowledged if it has been eliminated or no longer exists.

The Trip Reset can be triggered by:

- the user application via the DO 0.3 process image
- via the local device interface with the *'ES Motor Starter'* software

10.7 Inputs (can only be parameterized with high feature motor starters)

Description

With the *'Inputs'* device function, the motor starter can run various actions that can be parameterized. The signals at the digital inputs are evaluated for this purpose. The inputs can be wired directly to sensors (PNP) in 2-core and 3-core technology.
The input actions of the individual digital inputs affect the motor starter functions independently from one another (= OR operand)

10.7.1 Device parameters

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).

Range: 0 milliseconds to 200 milliseconds

Input signal delay

For interference immunity reasons, a debounce time can be set for the inputs.

Range: 10 milliseconds to 80 milliseconds

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, e.g. self-holding operation
- non-retentive, i.e. inching operation.

Input n level

This parameter can be used to specify the input logic.

Range: NO contact / NC contact

Caution
With *'n input – action'*: *'Emergency start'*, *'Motor cw'*, *'Motor ccw'* and *'Trip reset'*, *'n input – level'* can only be parameterized as a NO contact!

Caution
If *'n input – level'* of normally closed and normally open contacts and the associated *'n input – action'* are parameterized to *'Shutdown without restart'*, with an *open input* the *'shutdown input'* signaling bit is and shut down accordingly due to the input signal delay!

Caution
The input level of the digital inputs is always sent to the control (PLC) as a NO contact, regardless of parameter *'n input – level'* (process image of the inputs in data record 69 and diagnostics in data record 92).

Input n action

A variety of actions can be triggered by an input signal. The following actions can be parameterized, depending on *'n input – level'*, *'n input – signal'* and *'Operating mode'*.

Caution
When *'n input– signal'* = retentive and *'n input– action'* = motor cw / ccw, at least one input with input action *'Shutdown ...'* or *'Quick stop'* always needs to be parameterized.
If this rule is violated, the parameters are rejected with the relevant diagnostics message!

Input n action	– level	– signal	Operating mode	Description
No action	NO / NC	n.ret / ret	all	—
Shutdown without restart	NO / NC	n.ret / -	all	• Results in the shutdown of motor and brake. • Acknowledgment necessary after the cause of the shutdown has been rectified (input status).
Shutdown with re-start (autoreset)	NO / NC	n.ret / -	all	• Results in the shutdown of motor and brake. • Automatic acknowledgment after the cause of the shutdown has been rectified (input status).
Shutdown at limit position, clockwise rotation	NO / NC	n.ret / -	all	• 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	NO / NC	n.ret / -	all	• Shutdown at limit position, counterclockwise rotation Motor switch-on is possible only with the counter-command *'Motor cw'*.
General warning	NO / NC	n.ret / ret	all	• The *'Group warning'* message is set. • 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.*
Manual local operating mode	NO / NC	n.ret / -	all	• Control only possible via *'n input – action'*: Motor cw and motor ccw (see below) possible! • Control via field bus (*'Automatic'* operating mode) not possible! • *'Automatic'* operating mode is only possible again if *'manual local'* operating mode has been cancelled and there is no *'n input – action'*: Motor cw or motor ccw is active.
Emergency start	NO / -	n.ret / -	all	• Switches the motor on with ON switching command present despite an internal shutdown command being present. • With an ON switching command present for the brake output, also switches this output on. • Permissible only as NO contact.

Table 10-13: Description of n input – action

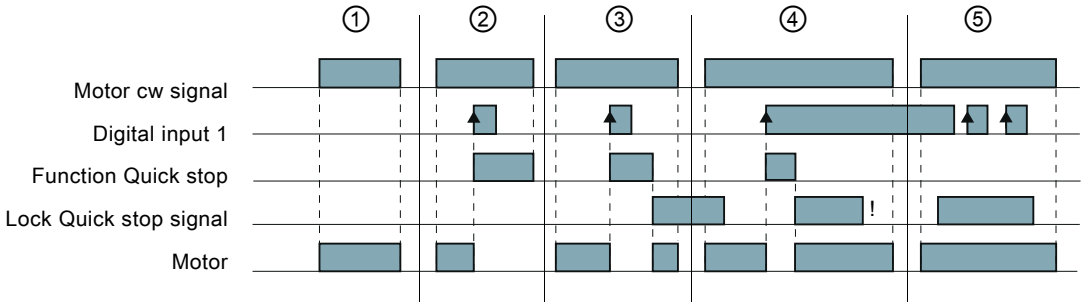
Input n action	– level	– signal	Operating mode	Description
Motor cw	NO / -	n.ret / ret	Manual local	• The motor starter must be in *'Manual local'* operating mode for these actions. • The device parameters of the brake process are evaluated • Motor cw: switches motor and brake output on and off together (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 when the active level of the input signal is present. Input trigger is cleared via input action 'quick stop' or group fault.*
Motor ccw	NO / -	n.ret / ret	Manual local	
Quick stop	NO / NC	sp:	all	• Motor and brake output are switched off without a group fault. • *'Quick stop'* has priority over *'Motor cw'* and *'Motor ccw'* ***sp:*** *The input action responds to the active edge of the input signal. Deactivation with active input signal present is therefore possible. The input trigger is cleared by* - *Clearing the control commands / input actions 'motor cw' and 'motor ccw'* - *With control via input actions motor cw / ccw, the quick stop function is always evaluated retentively regardless of the parameterization.*
Trip reset	NO / -	n.ret / -	all	• *'Trip reset'* triggered once
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.
Legend:	NO: NO sp: Retentive			NC: NC n.ret: non-retentive Activation and deactivation of the input action follows the status of the input signal (= inching mode)

Table 10-13: Description of n input – action (Contd.)

Quick stop

- Motor and brake output are switched off without a group fault.
- "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:
Digital input 1–signal = retentive / edge-triggered



① Motor is switched on by "Motor cw".

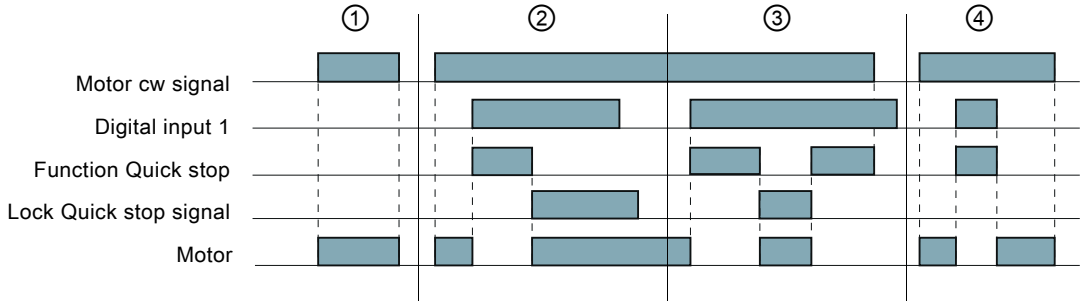
② Motor is switched on via "Motor cw", then switched off via the rising edge on digital input 1 (parameterized on input action1 = quick stop). Removing the "Motor cw" command resets the quick stop function.

③ Motor is switched on via "Motor cw", then switched off via the rising edge on digital input 1. Setting lock quick stop resets the quick stop function and the motor runs "cw" again until the "motor cw" command is cancelled.

④ Motor is switched on via "Motor cw", then switched off via the rising edge on digital input 1. Setting lock quick stop resets the quick stop function and the motor runs "cw" again. Although digit input 1 (DI2) is still static, the motor continues to run and is only reset after cancelling the "motor cw" command.
Reason: The input action is edge-triggered.

⑤ Motor is switched on via "Motor cw" and continues to run uninterrupted as lock quick stop overwrites the edges of the signals of digital input 1 (DI2).

Example 2:
Digital input 1 signal = non-retentive / level-triggered (preset)



① Motor is switched on and off via "Motor cw".

② Motor is switched on via "Motor cw", then switched off via the level on digital input 1 (parameterized with input action1 = quick stop). The quick stop function is reset via lock quick stop.
Motor is switched on again as "Motor cw" is still active.

③ Motor is switched off via the level on digital input 1. Setting "lock quick stop " resets the quick stop function and as the "motor cw" level is still present, the motor continues to run "cw" until the "lock quick stop" command is cancelled.

④ Motor is switched on via "Motor cw", then switched off via the rising edge on digital 1.
When the "quick stop" function is active, the motor remains switched off and after "quick stop" is cancelled, runs again until "motor cw" is switched off.

Cold run

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 10-14: Messages and actions for cold run

10.7.2 Input parameters – settings

The table below shows the device parameter settings:

Device parameters	Default setting	Adjustment range
Input signal extension	0 milliseconds	0 milliseconds to 200 milliseconds Increment: 10 ms
Input signal delay	10 milliseconds	10 milliseconds to 80 milliseconds Increment: 10 ms
Input 1 - level	NO	NO contact / NC contact
Input 2 - level		
Input 3 – level		
Input 4 – level		
Input 1 - action	No action	No action / shutdown without restart / shutdown with restart / shutdown cw end position / shutdown ccw end position / group warning / manual local operating mode / emergency start / motor cw / motor ccw / 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 10-15: Input parameters – settings

10.7.3 Messages and actions

The *'Inputs'* device function delivers the following 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)

Table 10-16: Inputs – Messages and actions

10.8 Soft-starter control function

Description

Soft starters work according to the principle of phase control.
Soft startup and coasting down can be specified with an adjustable voltage ramp.
The image below shows the principle:

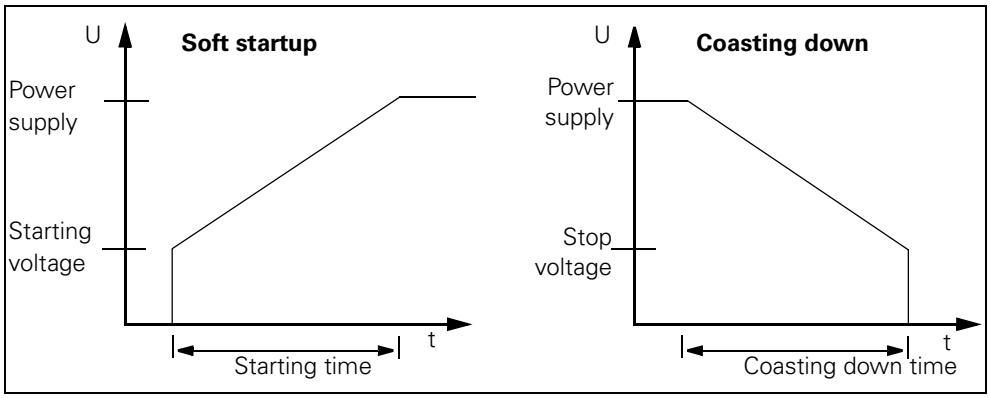


Figure 10-5: Soft startup / coasting down principle

Deactivate soft starter control function

Parameterizing the startup and coasting down time to zero has no direct effect on switching on the motor. The switch-on current is still limited to the parameterized value, ensuring a smooth startup of the motor!
If the motor is to be switched on directly, the "Direct" startup type must be selected.

Caution
With the control function deactivated, soft starters need to observe the following derating:
Reduction in the rated operating current from 12 A to 9 A to class 10.

Soft starter control function parameter – description

Start type

There are four ways of starting the motor:
- direct: The motor is switched on without regulation.
- Voltage ramp: The motor is started up on a linear, positive voltage ramp.
- Current limitation: The motor switch-on current is limited to a specified value.
- Voltage ramp + current limitation: If the motor current exceeds the specified value during startup, the voltage ramp is cancelled and the current limited.

Range: 125 % to 600 % of the rated operating current

Caution
With the "direct" startup type, the following derating must be observed:
- Reduction in the rated operating current from 12 A to 9 A
- Only CLASS 5 or CLASS 10 possible.

Coast type

There are two ways of coasting down or stopping the motor:
- free coasting: The motor is switched on without regulation.
- Voltage ramp: The motor is shut down on a linear, negative voltage ramp.

Starting time

The motor terminal voltage is increased linearly from the start voltage to full mains voltage during the parameterizable starting time.

Range: 0 to 30 seconds.

Coasting down time

The motor terminal voltage is reduced linearly from the start voltage to full mains voltage during the parameterizable starting time.
0 s = direct shutdown without voltage ramp

Range: 0 to 30 seconds.

Starting voltage

Start value of the voltage ramp for soft starting.

Range: 20 % to 100 % of the mains voltage.

Stop voltage

End value of the voltage ramp for soft coasting down.

Range: 20 % to 90 % of the mains voltage.

Current limiting value

The motor current is limited during the start to
a maximum value.

Range: 125 % to 600 % of the rated operating current

Caution
At a rated operating current of > I_e = 9 A, the current limiting value is automatically reduced to 550 % by the motor starter.

Soft starter control function parameter – settings

The table below shows the device parameter settings:

Device parameters	Default setting	Adjustment range
Starting time	5 s	0 to 30 seconds increment: 0.25 s
Coasting down time	0	0 to 30 seconds increment: 0.25 s
starting voltage	40%	20 % to 100 % increment: 5%
Stop voltage	40%	20 % to 90 % increment: 5%
Current limiting value	600%	125 % to 600 % 3.125 increment:

Table 10-17: Soft starter control function parameter – settings

10.9 Field bus interface

10.9.1 Device parameters

Response to CPU/master STOP

This device parameters is used to determine how the motor starter reacts to a CPU/master STOP:

- Keep last value
- Use dummy value

Caution
This parameter is only relevant in the *'Automatic'* operating mode.

Group diagnostics

This parameter is used to determine whether the diagnostics are to be enabled or locked via PROFIBUS DP (fault type).

Group warning diagnostics

Already included for preparation for future I&M (Identification and Maintenance), currently has no practical effect.

Wait for start-up parameter data records

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 record transfer is complete.

Replacement value

If the bus fails, controlled by a corresponding replacement process image of the motor starter outputs.
Example:

Replacement value			
☑	Motor cw	☐	Reserved
☐	Motor ccw	☐	Reserved
☑	Brake	☐	Reserved
☐	Trip reset	☐	Reserved
☐	Emergency start	☐	Reserved
☐	Self-test	☐	Reserved
☐	Reserved	☐	Lock quick stop (only with HF starters)

Caution
This device parameter is only relevant if you have parameterized *'Response to CPU/master STOP' 'Use dummy value'*.

10.9.2 Device parameters for response on bus failure – settings

The table below shows the device parameter 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 10-18: Device parameters for response on bus failure – settings

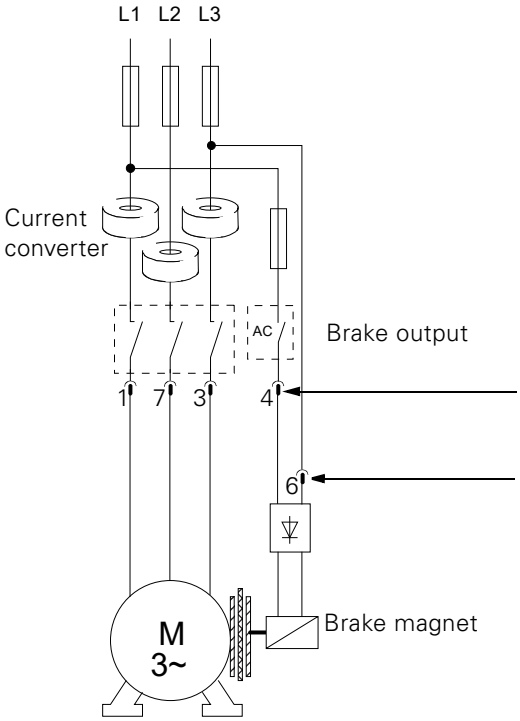
10.10 Mechanical brake process

Description

A mechanical disc brake or spring action brake fitted onto the motor brakes the motor. The brake is controlled via the brake output.

Switching example

The image below shows a switching example for mechanical brake process:



Pin	Assignment
1	Phase L1
2	Not used
3	Phase L3
4	Brake L1 (switched)
5	Not used
6	Brake L3 (direct)
7	Phase L2
8	Not used
⏚	PE (yellow / green)

Figure 10-6: Switching example for mechanical brake process

10.10.1 Device parameters

Enable delay of the brake when starting

Caution
Only effective with **simultaneous** ON switching command for brake and motor.

Caution:

- Positive time specifications: Delayed switching on of the brake output in relation to the motor.
- Negative time specifications: Delayed switching on of the motor in relation to the brake output.

In reversing mode, the enabling delay only starts after the interlock time elapses.

Range: –2.5 seconds to +2.5 seconds.

Holding time of the brake when stopping

Caution
Only effective with **simultaneous** OFF switching command for brake and motor.

This device parameter effects a delayed shutdown of the brake output in relation to the motor. Also effective with PLC failure.

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.

Range: 0 to 25 seconds.

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 an ON switching command for brake and motor).

10.10.2 Parameters – settings

The table below shows the device parameter settings:

Device parameters	Default setting	Adjustment range
Enable delay of the brake when starting	0	-2.5 s to 2.5 s increment: 0.01 s
Holding time of the brake when stopping	0	0 s to 25 s increment: 0.01 s

Table 10-19: Device parameters for mechanical brake process – Settings

10.10.3 Message

The mechanical brake process delivers the following message when the brake output is switched on:

Message
Mechanical brake process active

Table 10-20: Mechanical brake process – message

10.11 Self-test

Description

There are 2 self-test types:

- Self-test cyclical in operation
  Carried out cyclically during operation
- Self-test on command
  Activated by the user via bit DO 0.5 *'self-test'* in the process image of the outputs.

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	Explanations
1	< 2 sec.	LED test	All LEDs are switched on for 2 seconds! • Check by user, no signaling bit
2	2 … 5 sec.	HW test	The motor starter hardware is tested; Current measurement with display via *'DEVICE'* LED: • Current flowing: flashes red • Current not flowing:flickers red • Check by user, no signaling bit
	> 5 sec.	No action	—

Table 10-21: Self-test – test stages

Self-test fault

In the event of a fault, the *'DEVICE'* LED is on in red.
The fault can only be acknowledged when switched on again.
If the fault is still present, the self-test will still run with a fault when switched on.
The motor starter must be replaced!

10.11.1 Messages

This device function delivers the following messages:

Messages
Self-test active
Self-test OK
Fault during self-test

Table 10-22: Self-test – Messages

Caution
Certain device components are continually monitored internally by the motor starter and the result is signalled with the self-test messages.
The *'Fault on self-test'* message can also occur in the event of a fault with the internal monitoring, without the self-test having been activated.

10.12 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.
- *'ON switching command'* present for brake output. This is switched on via the emergency start (*'Enable delay of brake when starting'* parameter is taken into account).

Emergency start is **not possible** when

- *'OFF switching command'* present
- *'Device fault'* present
  Signaling bit: *'Fault during self-test'*, *'Switching element faulty'*
- Intrinsic safety function of the motor starter has been triggered
  Signaling bit: *'Overload switching element'*
- Switched / unswitched 24V-S DC / 24V-NS DC 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 fault present
  Signaling bit: *'Process image fault'*

Control options for emergency start

– Commands *'Emergency start ON'*, *'Emergency start OFF'*
– Parameter *'n input – action'* –> *'Emergency start'* parameterized
– Bit DO 0.4 *'Emergency start'* in the process image.

Commands

Emergency start can be controlled via the following commands:

Commands
Emergency start ON
Emergency start OFF

Table 10-23: Emergency start – commands

10.12.1 Message

'Emergency start' delivers the following message:

Message	Description
Emergency start active	Present when the emergency start is active, even when the motor and brake output are switched off

Table 10-24: Emergency start – message

10.13 Factory setting

Description

The *'Factory setting'* is used to restore factory settings that the motor starter had in the status on delivery. This provides the option of resetting the motor starter if the parameterization is incorrect.

Restore factory settings

The factory setting can be restored with the *'factory setting'* command.

This is only possible if the *'Manual'* operating mode is set and the switching elements are switched off.

Messages

This device function delivers the following messages:

Messages	Meaning
Factory setting restored[1)]	All parameters will have their factory-set values again

1) Signaling bits that can be cleared with trip reset

Table 10-25: Factory setting – messages

10.14 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 in good time or the failure of the motor in stages. This makes regular checking by maintenance personnel as to whether or not maintenance is required unnecessary.

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.

Warning limit value 1 maintenance timer

First warning. Maintenance**requirement** signalled.
Input format: YYYY:DDD:SS:MM (Years:Days:Hours:Minutes)

Warning limit value 2 maintenance timer

First warning. Maintenance **request** is signalled.
Input format: YYYY:DDD:SS:MM (Years:Days:Hours:Minutes)

10.15 Reversing starter control function

Description

This control function can be used by the RSe motor starter to control the motor rotation directions. An internal logic prevents both contactors being switched on at the same time.
The time-delayed switchover from one rotation direction to the other direction is realized by the interlock time.

10.15.1 Device parameters

Interlock time (can only be parameterized with high feature motor starters)

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.

Range: 0 to 60 seconds

Caution
An interlock time of 0 means 150 milliseconds for safety reasons.

10.15.2 Parameters – settings

The table below shows the device parameter settings:

Device parameters	Default setting	Adjustment range
Interlock time	0	0 to 60 seconds increment: 1 sec. (only with RSe HF)

Table 10-26: Device parameters for reversing starter control function – settings

10.15.3 Messages

The reversing starter control function delivers the following messages:

Message
Motor ccw
Interlock active

Table 10-27: Reversing starter control function – messages

10.16 Electronic / mechanical switch technology

Electronic switch technology

The motor starter controls the 2-phase motor with power semiconductors using thyristors

Mechanical switching technology

The motor starter controls the 3-phase motors with contactors.

10.16.1 Messages and actions

These device functions deliver the following messages

Message	Action
Switching element faulty (e.g. contactor welded, power semiconductor connected through)	Disconnect
Switching element overload (e.g. power semiconductor too hot)	Disconnect

Table 10-28: Electronic / mechanic switch technology – messages and actions

10.17 Local device interface

Description

Via the local optical device interface, the motor starter can be connected to a PC (accessory cable required) or a handheld device. The local optical device interface is located on the front underneath the labeling field.

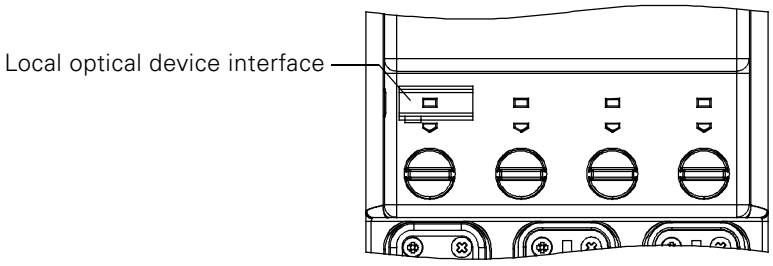


Figure 10-7: Local device interface

Caution
To ensure fault-free data transfer, ensure that the infrared interface is clean.

10.18 Communication

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

10.18.1 Operating type monitoring

Data channels

ET 200pro motor starters have 3 different data channels:

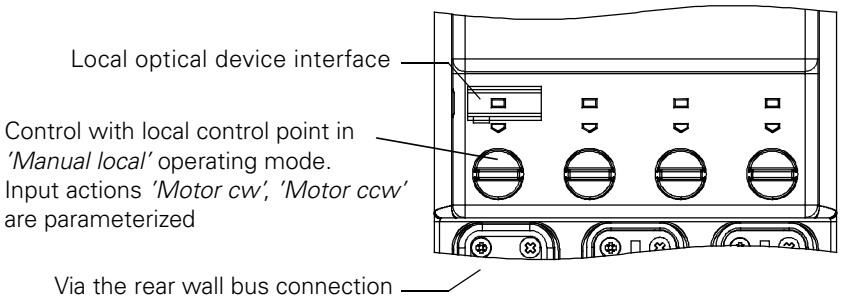


Figure 10-8: Data channels

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 device (e.g. PC) via field bus.
- *'Manual local' operating mode*
  Motor starter can be controlled with
  – Local - control point on digital inputs (*'Motor cw'*, *'Motor ccw'*, e.g. with switch module from test plug set or with external switches)
  Requirement: *'Manual local'* operating mode set (see below).
  – B&B device (e.g. PC, hand-held controller) via the local device interface **(highest priority)**

Caution

An operating mode of higher priority can override the control supremacy via command or an input action of *'Manual'* operating mode of a lower priority **at any time** , but not vice versa.
An operating mode of higher priority can only delay the control priority if **with the motor switched off** the higher priority operating mode returns control priority via the *'Automatic'* operating mode or switching off the input action *'Manual local'* operating mode.

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**				**Control priority**
	Manual bus	**Manual operation local**			
Automatic operating mode	Manual bus operating mode	Manual local operating mode	Input control	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 10-29: Control priority of operating modes

Connection monitoring

The connection monitoring is active with the operating modes *'Manual bus'* and *'Manual local'*. At least one 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.
To do this, use the empty data record 93 - *'command'*. 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 manual local operating mode can be set as follows:

- Using a B&B device (e.g. PC) via the local device interface.
  Parameterize the input n -actions *'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.
- Use a digital input on which you connect a switch to change over to the *'Manual local'* operating mode.
  This digital input then needs to be parameterized using *'n input – action' 'Manual local'* operating mode.

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 operation local
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 10-30: Operating modes

10.18.2 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 ES Switch configuration software:

Command	Meaning
Trip reset	• Reset and acknowledgement of fault messages • Clear signaling bits[1)] if there is no fault message • No effect
Clear slave pointer	Clear the 'preventative diagnostics' statistics data
Clear log book trips	Clear log book with recorded causes of fault.
Clear log book events	Clear log book with recorded warning messages and specific actions.
Factory setting	All parameters have basic factory setting again except for the communication parameters. **Only possible in *'Manual'* operating mode!**
Parameterization lock CPU / Master ON	Motor starter ignores parameterization via master (PLC)
Parameterization lock CPU / Master OFF	Motor starter accepts parameterization via master (PLC)
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
Re-start	Motor starter runs a restart (same action as Power OFF / ON). **Only possible in *'Manual'* operating mode!**

1) Signaling bits, see table on next page

Table 10-31: Commands and their meaning

Caution
Command is run immediately!
The changeover from *'Manual'* to *'Automatic'* operating mode is only possible if the motor and brake output is switched off.

10.18.3 Plausibility check of data

Description

The motor starter checks all incoming parameters for validity and plausibility.
In the case of incorrect parameters

- during a startup (after power ON) the messages *'Group fault'* 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 fault'* is not set.
  Motor and brake output are not switched off.

10.18.4 Output of messages

This device function delivers the following messages:

Messages	Meaning
General messages	
Ready (automatic)	Device can be operated via host (e.g. PLC)
Group fault	At least 1 fault is set.
General warning	At least 1 warning exists
Process image fault	Process image of the outputs contains nonallowable bit combination, e.g. *'Motor cw'* and *'Motor ccw'* set simultaneously
Field bus connection	
Bus fault	Device has no rear wall bus communication (ESSA3 interface to the controller interrupted)
CPU/master STOP	PLC program no longer being processed
Acknowledgement	
Trip reset completed	Trip teset accepted, i.e. fault has been acknowledged.
Trip reset not possible	Unable to acknowledge fault as the reason for the shutdown is still present.
Operating type monitoring	
Automatic operating mode	Automatic (PLC control)
Manual bus operating mode	Manual operation via field bus (B&B control)
Manual local operating mode	Manual operation via local device interface (B&B control)
Lost connection in manual operating mode	During manual operation, the associated communication connection was interrupted for longer than 5 seconds.

Table 10-32: Communication – Messages

Messages	Meaning
Parameter assignment	
Parameterization active	Yes / no
Incorrect parameter value[1)]	Parameter not correct
Parameter change not permissible in ON status[1)]	Attempted parameter change not permissible when the motor is running.
Faulty parameter number[1)]	Specifies the first unaccepted parameter (ID 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	Message that 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 10-32: Communication – Messages (Contd.)

Messages are stored, by type, in:

- Data record DS 75 (see chapter D.5.3)
- Data record DS 92 (see chapter D.5.5)
- Process image for the PAE inputs

10.19 PROFIenergy

10.19.1 What is PROFIenergy

PROFIenergy (PE)

PROFIenergy (PE) supports the following two functions:

- PE_power saving function
  supports the targeted shutdown of consumers during idle 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.

10.19.2 PROFIenergy (version V1.0) in the ET 200pro motor starter

The ET200pro 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 ET200pro motor starter.
In addition, the ET200pro 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.

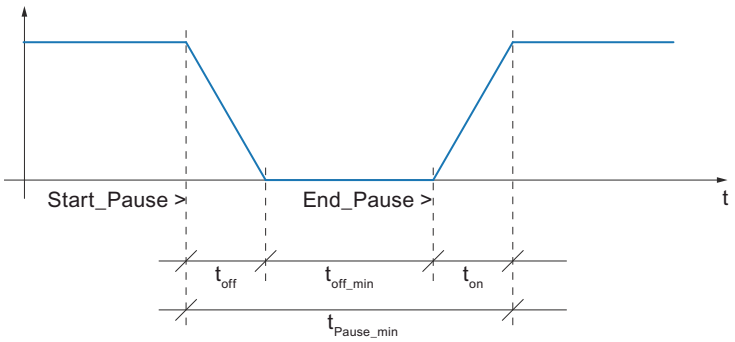
Commands

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_Measurements
Get_Measurement_Values	Delivers the supported PE_measurements

Table 10-33: Messages and actions

For data transfer, a distinction is made between two different status conditions with the ET200pro 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 for the change to energy-saving mode.
t_{off_min}	Time_min_length_of_stay	Time during which the device stays or should stay in energy-saving mode as a minimum.
t_{on}	Time_to_operate	Time required by the device for the change to the 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 to 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 ET200pro 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 ET200pro 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
A fault present is not acknowledged by changing to energy-saving mode, i.e. the fault present is stored internally and can be exported. After exiting energy-saving mode, the fault must be corrected and acknowledged.
The status displays for the bus and the power supplies 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 mode is not affected by PE; → switching over to manual mode 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. idle time, ...)

Changing to "Pause" energy-saving mode is only effective if the idle time sent is greater than the device-specific minimum idle time. I.e. a change is only carried out when the idle 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 idle time needs to be added. The minimum idle times for DSe/RSe are 100 ms and for sDSSte/sRSSte 100 ms to 30 s depending on the parameterized coasting down time.
The change to energy-saving mode is logged in the "Events" log book.
Entry: "Energy-saving mode active" In ES motor starter 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 ET200pro PROFINET to communicate via the PNO profile PROFIenergy:

- ET200pro Profinet top module with PROFIenergy support
- ET200pro motor starter
  - DSe/RSe 3RK1304-..S40.... with event status E06 or higher
  - sDSSte/sDSte/sRSSte/sRSte 3RK1304-..S70.... with event status E07 or higher

How do I use PROFIenergy in the ET200pro 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
https://support.industry.siemens.com/cs/ww/en/view/41986454
More information
PROFIenergy: See PROFINET system description
https://support.industry.siemens.com/cs/ww/en/view/19292127

10.20 Log book

Description

The log book lists trips, device faults 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: Data record 73
- Log book - events Data record 75
- Log book - device faults: Data record 72
  Device faults are entered.

The current *'Device operating hours'* value is entered as a time stamp.
The last 21 entries are saved in the log books. The entries can be exported using the relevant data records.
The log book is designed as a ring memory. Over 21 entries, the oldest entry is overwritten.

Log book - trips

All group faults are recorded in "Log book - trips". In the process, the object numbers of the actual causes of fault are entered, e.g. *'Overload switching element'*.
Please note the following points:

- The "Log book – trips" is cleared using the *'Log book – clear trips'* command

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 occurs.
  "Outgoing" means: The event is acknowledged.
  The entries are differentiated in the data record using plus and minus signs (+: incoming, –: outgoing).
- The "Log book – Events is cleared using the *'Log book – Clear events'* command.

Log book - device faults

All device faults occurring are recorded in "Log book - device faults".
Please note the following points:
The log book – device faults cannot be cleared.

Order numbers

A

A.1 Motor starters

A.1.1 ET 200pro direct starters; Standard without inputs

Adjustment range		Order number	
kW	**A**	**Direct starters (DSe)**	**Direct starters with brake drive (DSe)**
0.9 kW	0.15 - 2 A	3RK1304-5KS40-4AA0	3RK1304-5KS40-4AA3
5.5 kW	1.5 - 12 A	3RK1304-5LS40-4AA0	3RK1304-5LS40-4AA3

A.1.2 ET 200pro direct starters; High feature with 4 inputs

Adjustment range		Order number	
kW	**A**	**Direct starters (DSe)**	**Direct starters with brake drive (DSe)**
0.9 kW	0.15 - 2 A	3RK1304-5KS40-2AA0	3RK1304-5KS40-2AA3
5.5 kW	1.5 - 12 A	3RK1304-5LS40-2AA0	3RK1304-5LS40-2AA3

A.1.3 ET 200pro reversing starters; Standard without inputs

Adjustment range		Order number	
kW	**A**	**Reversing starters (RSe)**	**Reversing starters with brake drive (RSe)**
0.9 kW	0.15 - 2 A	3RK1304-5KS40-5AA0	3RK1304-5KS40-5AA3
5.5 kW	1.5 - 12 A	3RK1304-5LS40-5AA0	3RK1304-5LS40-5AA3

A.1.4 ET 200pro reversing starters; High feature with 4 inputs

Adjustment range		Order number	
kW	**A**	**Reversing starters (RSe)**	**Reversing starters with brake drive (RSe)**
0.9 kW	0.15 - 2 A	3RK1304-5KS40-3AA0	3RK1304-5KS40-3AA3
5.5 kW	1.5 - 12 A	3RK1304-5LS40-3AA0	3RK1304-5LS40-3AA3

A.1.5 ET 200pro electronic starters; High feature with 4 inputs

Adjustment range		Order number	
kW	**A**	**electronic starters (sDSSte / sDSte)**	**electronic starters with brake drive (sDSSte / sDSte)**
0.9 kW	0.15 - 2 A	3RK1304-5KS70-2AA0	3RK1304-5KS70-2AA3
5.5 kW	1.5 - 12 A	3RK1304-5LS70-2AA0	3RK1304-5LS70-2AA3

A.1.6 ET 200pro electronic reversing starters; High feature with 4 inputs

Adjustment range		Order number	
kW	**A**	**electronic reversing starters (sRSSte / sRSte)**	**electronic reversing starters with brake drive (sRSSte / sRSte)**
0.9 kW	0.15 - 2 A	3RK1304-5KS70-3AA0	3RK1304-5KS70-3AA3
5.5 kW	1.5 - 12 A	3RK1304-5LS70-3AA0	3RK1304-5LS70-3AA3

A.2 Components for ET 200pro motor starters

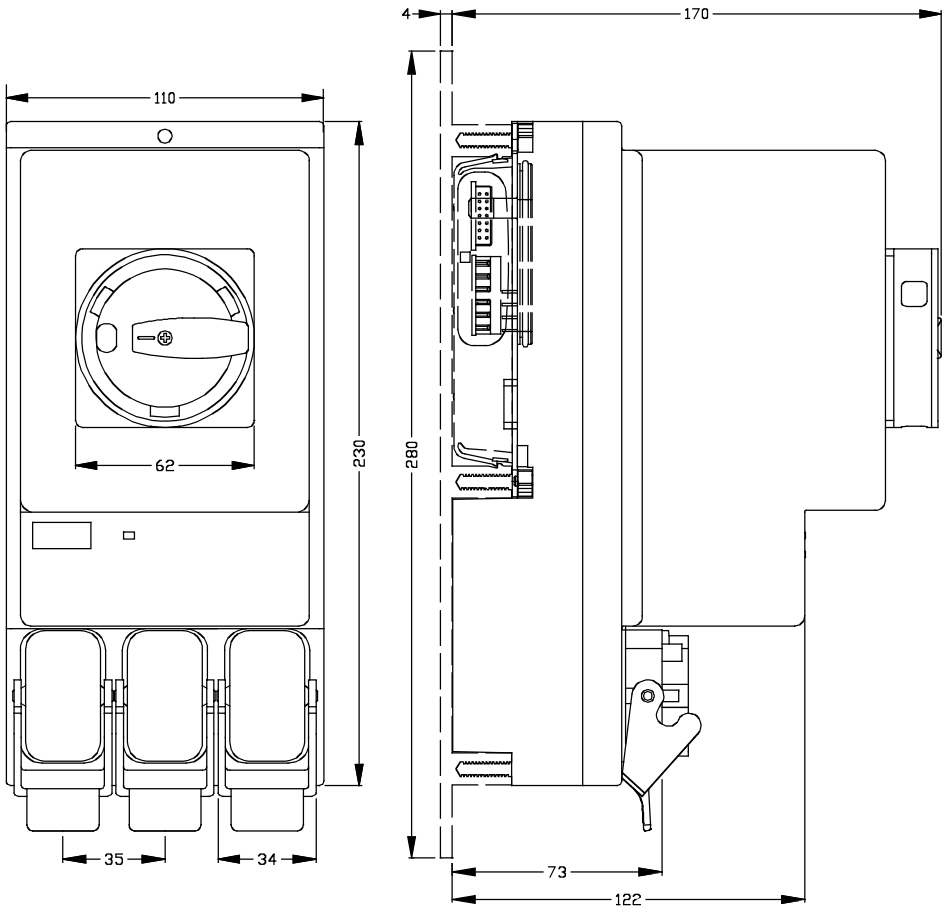
Description	Model	Order number
Repair switch module	A.25	**3RK1304-0HS00-6AA0**
Safety Local repair switch module	with 3TK2841 functionality	**3RK1304-0HS00-7AA0**
400 V shutdown module	Safety shutdown module with 2 contactors	**3RK1304-0HS00-8AA0**
Module carrier, wide (for motor starters)	0.5 m length (ready for installation) 1 m length (ready for installation) 2 m length	**6ES7194-4GB00-0AA0** **6ES7194-4GB10-0AA0** **6ES7194-4GB20-0AA0**
Rear wall bus module for special modules and motor starters	110 mm wide	**3RK1922-2BA00**
Rear wall bus module for safety local repair switch module	110 mm wide	**3RK1922-2BA01**
Energy jumper plug		**3RK1922-2BQ00**
Connector set for power infeed (X1)	2.5 mm^2 (HAN Q4/2) 4 mm^2 (HAN Q4/2) 6 mm^2 (HAN Q4/2)	**3RK1911-2BE50** **3RK1911-2BE10** **3RK1911-2BE30**
Connector set for power forwarding via a loop (X2 with RSM, F-RSM)	2.5 mm^2 (HAN Q4/2) 4 mm^2 (HAN Q4/2)	**3RK1911-2BF50** **3RK1911-2BF10**
Connector set for motor connection (X2)	1.5 mm^2 (HAN Q8/0) 2.5 mm^2 (HAN Q8/0)	**3RK1902-0CE00** **3RK1902-0CC00**
Cap	for power bus (x 10) for power bus (x 1) for M12 (x 10)	**3RK1902-0CJ00** **3RK1902-0CK00** **3RX9802-0AA00**
Crimping tool for contact pins and sockets	4 and 6 mm^2	**3RK1902-0CW00**
Removal tool for contact pins and sockets	HAN Q8/0 HAN Q4/2	**3RK1902-0AJ00** **3RK1902-0AB00**
RS232 interface cable	for optical data transfer	**3RK1922-2BP00**
USB-to-serial-adapter	for connecting a serial PC cable to USB interface	**3UF7 946-0AA0-0**
USB interface cable [1)]	for optical data transfer to USB interface	**6SL3555-0PA00-2AA0**
Diagnostics and commissioning tool	**https://support.industry.siemens.com/cs/ww/en/ps/16713/td**	**3ZS1310-4CC10-0YA5** **3ZS1310-5CC10-0YA5** **3ZS1310-6CC10-0YA5**

1) cannot be used for the hand-held controller

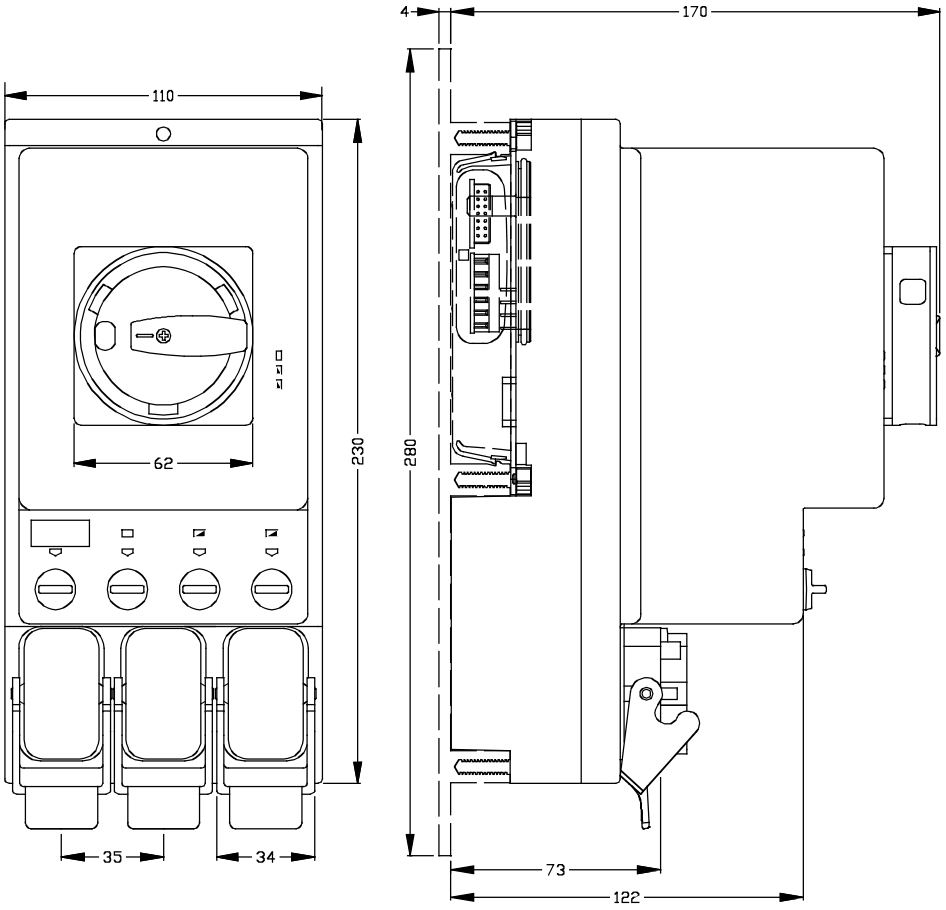
Dimensioned drawings

B

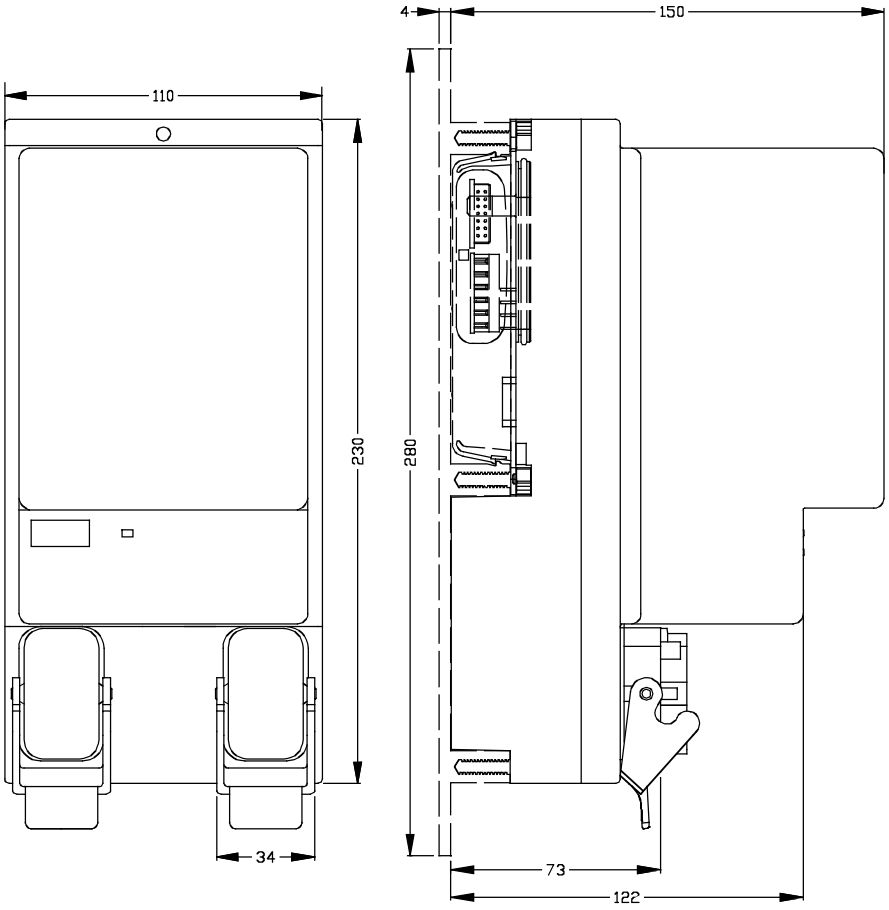
B.1 Repair switch module



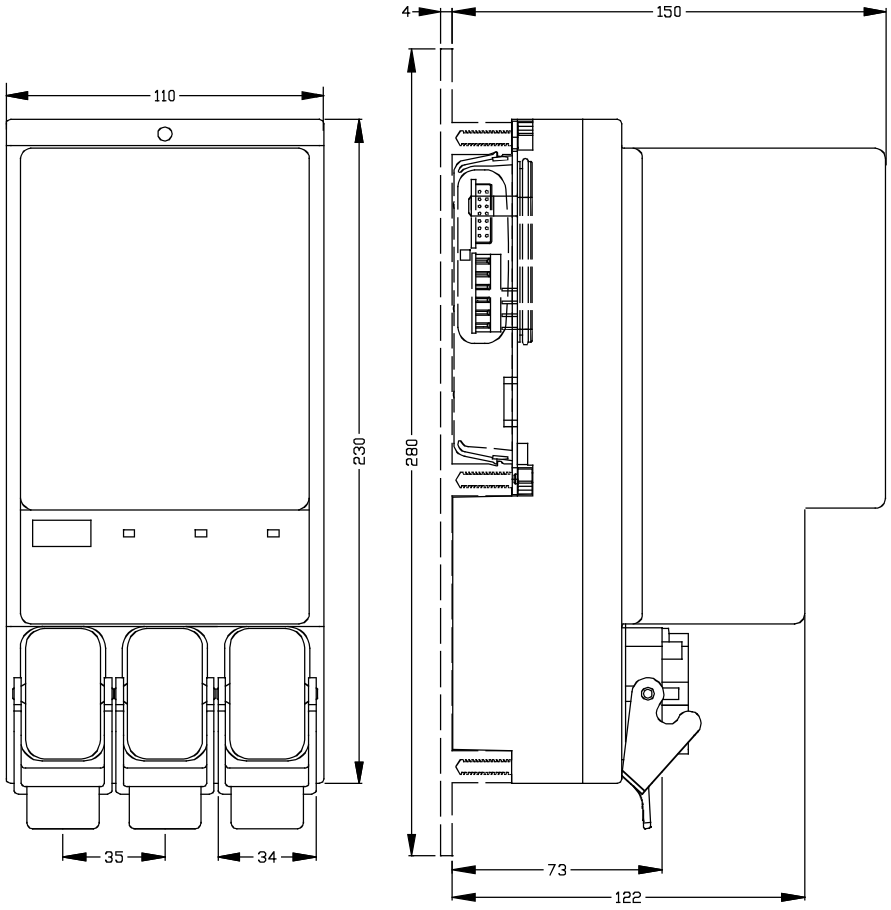
B.2 Safety local repair switch module



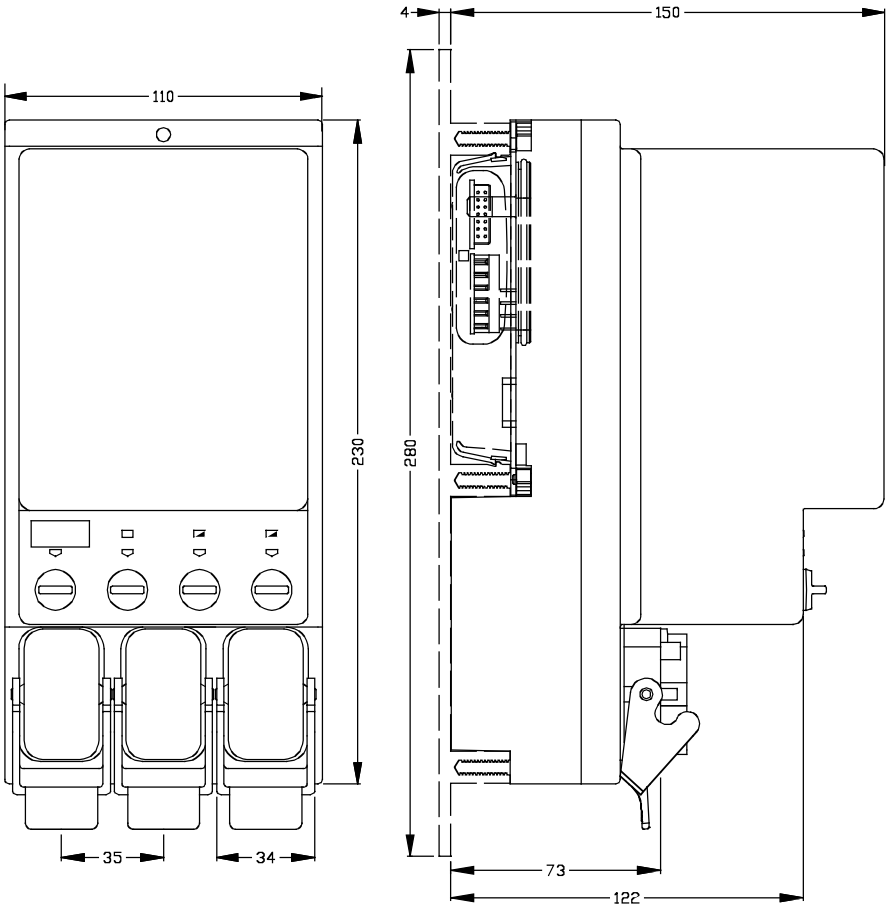
B.3 400 V shutdown module



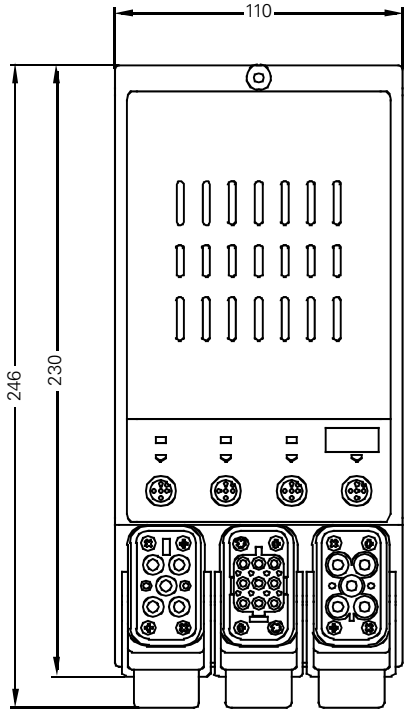
B.4 DSe ST, RSe ST motor starters

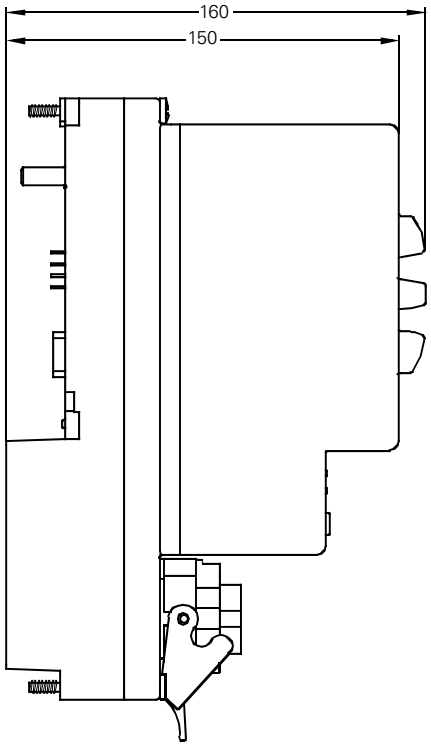


B.5 DSe HF, RSe HF motor starters



B.6 sDSSte/sDSte, sRSSte/sRSte electronic starters





Applications

C

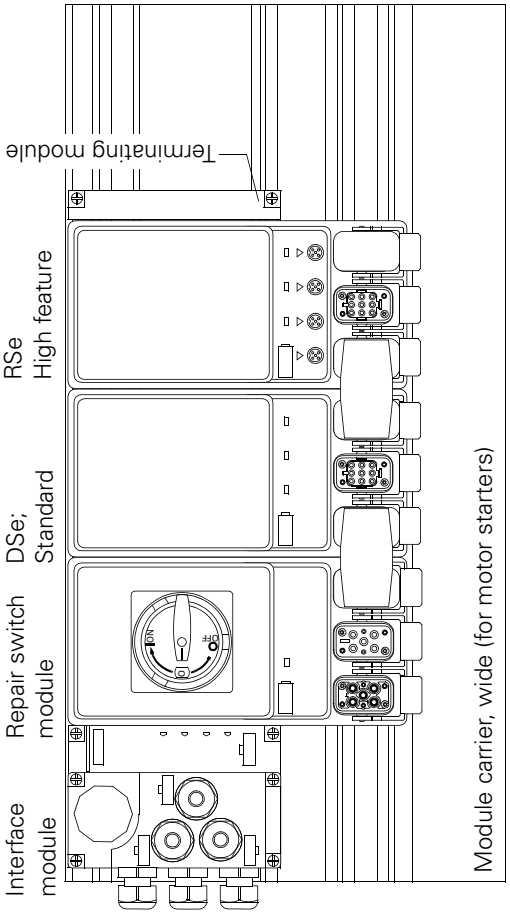
Safety note
The following applications are only some examples of typical circuits.
No liability is accepted for the reliability, certification or compatibility of the examples. Use at your own risk.

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.

C.1 Standard applications

C.1.1 With repair switch module and ECOFAST connection

The example below shows a layout with infeed via a repair switch module into the motor starters. A motor with ECOFAST starter is connected to the X2 connection on the repair switch module.



Number	Order number	Description
1	6ES7194-4GB10-0AA0	Module carrier, wide, 1 m
1	6ES7154-2AA00-0AB0	IM 154-2 DP interface module with terminating module
3	3RK1922-2BA00	Bus module
1	3RK1304-0HS00-7AA0	RSM repair switch module
1	3RK1304-5xS40-4AA0	DSe-ST motor starter[1]
1	3RK1304-5xS40-3AA3	RSe-HF motor starter[1]
2	3RK1922-2BQ00	Energy jumper plug
1	3RK1902-0CK00	Cap for energy bus
1	3RK1911-2BEx0	Connector set for energy supply[1]
2	3RK1902-0Cx00	Connector set for motor connection[1]
1	XXX	Motor with ECOFAST starter[1]

1) x = according to model

Figure C-1: Design with repair switch module and ECOFAST connection

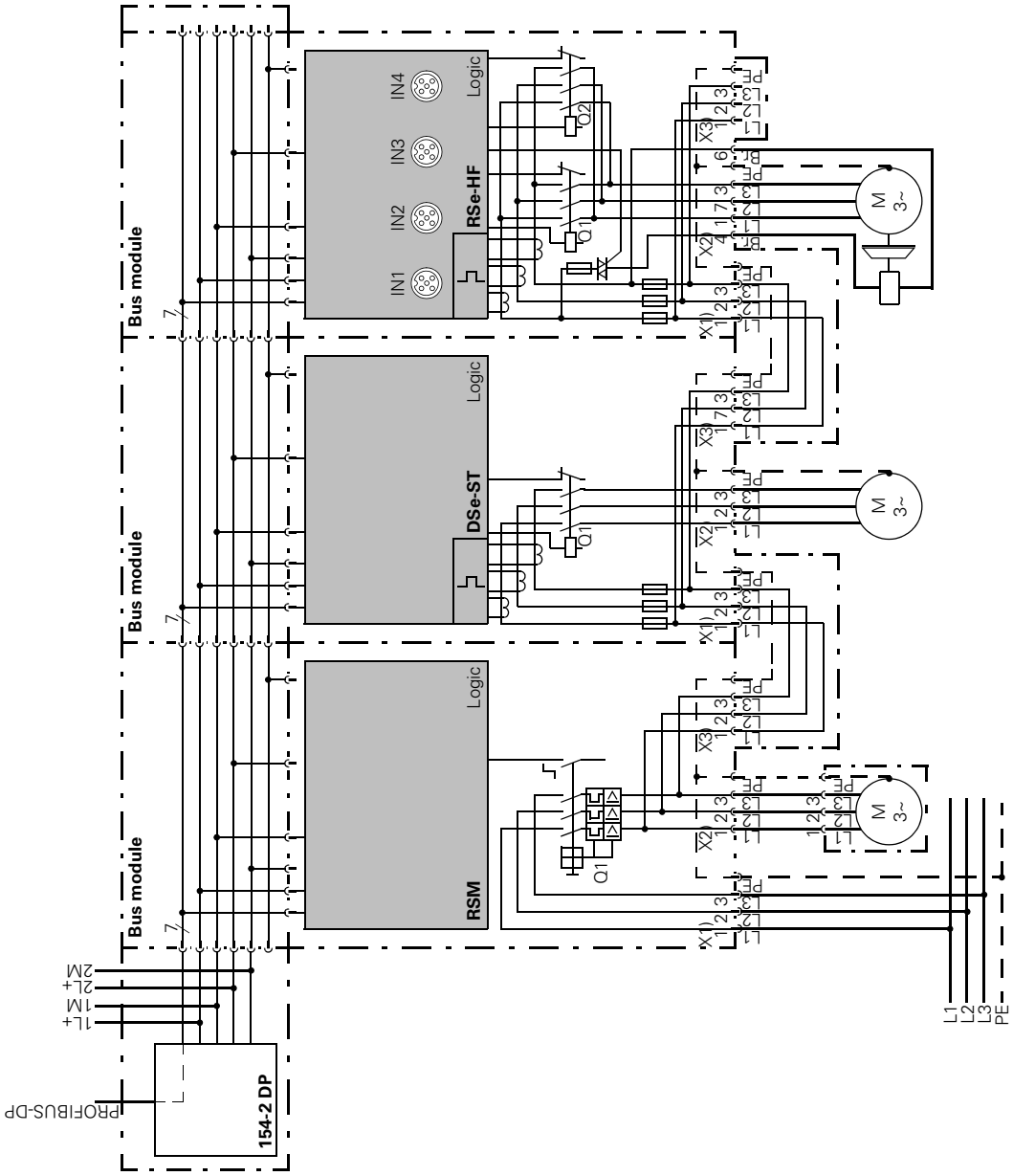
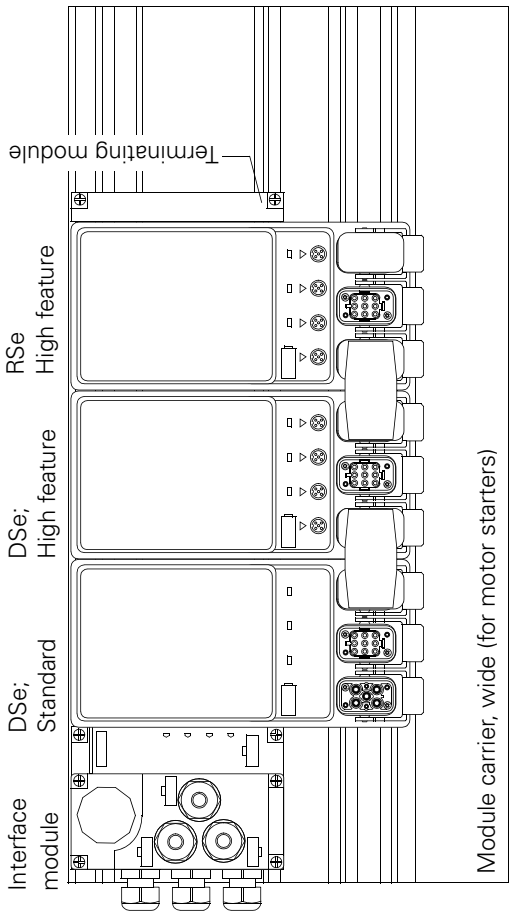


Figure C-1: (cont.) Design with repair switch module and ECOFAST connection

C.1.2 No repair switch module

The example below shows a layout with direct infeed into the motor starter. Short-circuit protection of the layout is provided outside the ET 200pro.



Number	Order number	Description
1	6ES7194-4GB10-0AA0	Module carrier, wide, 1 m
1	6ES7154-2AA00-0AB0	IM 154-2 DP interface module with terminating module
3	3RK1922-2BA00	Bus module
1	3RK1304-5xS40-4AA0	DSe-ST motor starter[1)]
1	3RK1304-5xS40-2AA0	DSe-HF motor starter[1)]
1	3RK1304-5xS40-3AA3	RSe-HF motor starter[1)]
2	3RK1922-2BQ00	Energy jumper plug
1	3RK1902-0CK00	Cap for energy bus
1	3RK1911-2BEx0	Connector set for energy supply[1)]
3	3RK1902-0Cx00	Connector set for motor connection[1)]

1) x = according to model

Figure C-2: Design without repair switch module

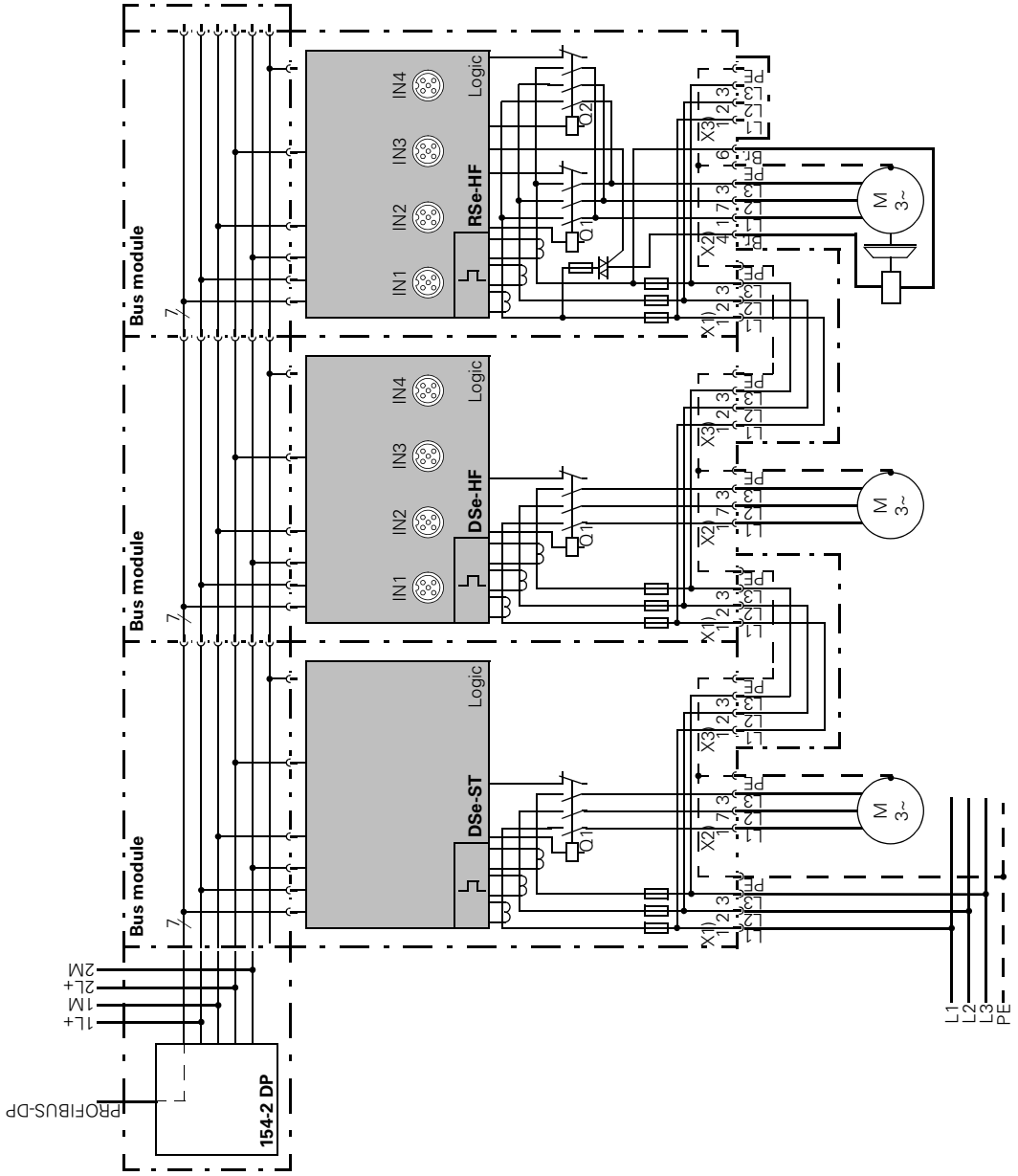
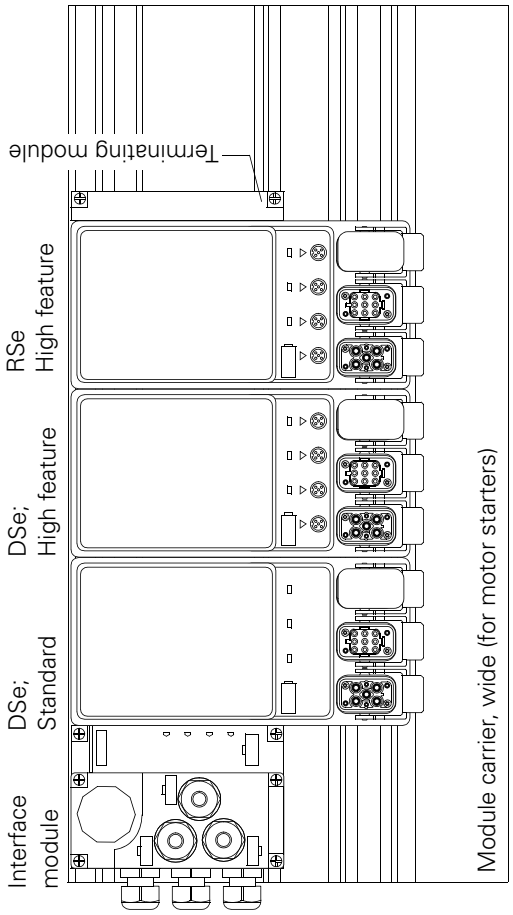


Figure C-2: (cont.) Design without repair switch module

C.1.3 For hot swapping

The example below shows a layout with direct infeed into each motor starter. Short-circuit protection of the layout is provided outside the ET 200pro.
The direct infeed in every motor starter can be used to exchange each individual motor starter. On the motor starter, every X3 connection on the energy bus must be covered with a cap.



Number	Order number	Description
1	6ES7194-4GB10-0AA0	Module carrier, wide, 1 m
1	6ES7154-2AA00-0AB0	IM 154-2 DP interface module with terminating module
3	3RK1922-2BA00	Bus module
1	3RK1304-5xS40-4AA0	DSe-ST motor starter[1]
1	3RK1304-5xS40-2AA0	DSe-HF motor starter[1]
1	3RK1304-5xS40-3AA0	RSe-HF motor starter[1]
3	3RK1902-0CK00	Cap for energy bus
3	3RK1911-2BEx0	Connector set for energy supply[1]
3	3RK1902-0Cx00	Connector set for motor connection[1]

1) x = according to model

Figure C-3: Design for hot swapping

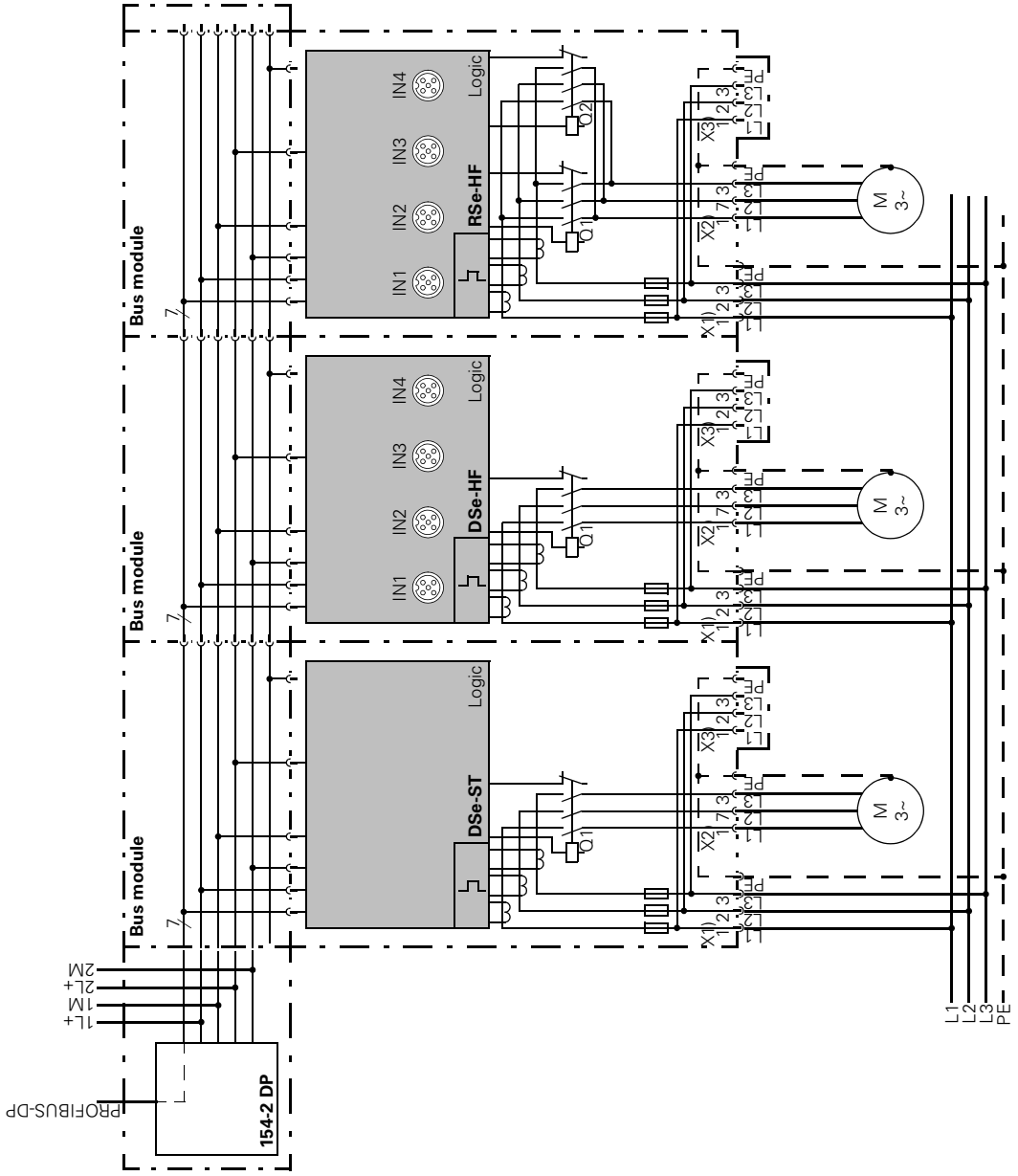


Figure C-3: (cont.) Design for hot swapping

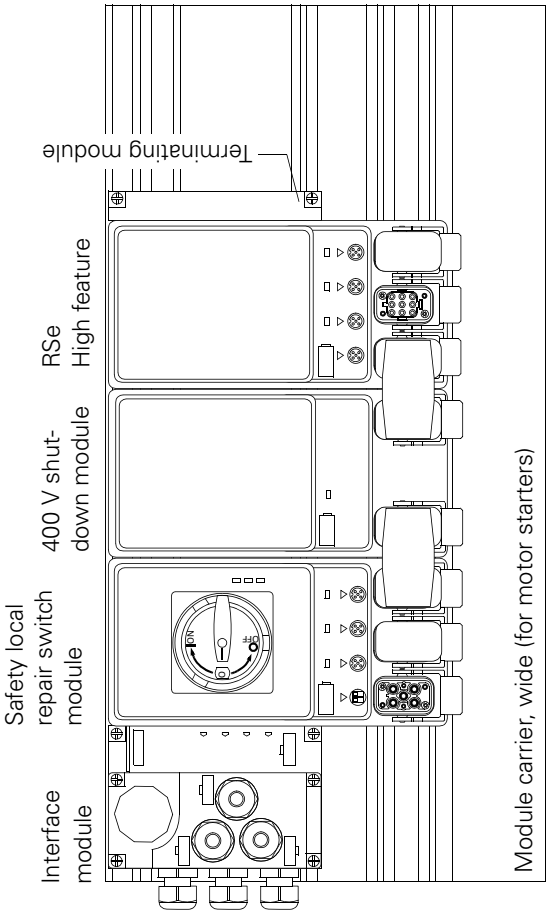
C.2 SAFETY applications

Safety note
With designs for safety applications in categories 2 to 4, a safety local repair switch module should be used in combination with a 400 V trip module.
An automatic re-start in connection with an emergency stop is not permitted.

C.2.1 1-channel emergency stop with monitored START

The example below shows a design with emergency stop with monitored START for category 2.

Caution
Please ensure that both coding switches are in the correct position in line with the safety local repair switch module for your application.



Number	Order number	Description
1	6ES7194-4GB10-0AA0	Module carrier, wide, 1 m
1	6ES7154-2AA00-0AB0	IM 154-2 DP interface module with terminating module
2	3RK1922-2BA00	Bus module
1	3RK1922-2BA01	Bus module for safety local repair switch module
1	3RK1304-0HS00-7AA0	Safety local repair switch module
1	3RK1304-0HS00-8AA0	400 V shutdown
1	3RK1304-5xS40-3AA0	RSe-HF motor starter[1]
2	3RK1922-2BQ00	Energy jumper plug
2	3RK1902-0CK00	Cap for energy bus
1	3RK1911-2BEx0	Connector set for energy supply[1]
1	3RK1902-0Cx00	Connector set for motor connection[1]
1	XXX	Emergency stop switch; 1-pole, NC contact
1	XXX	Switch for START; 1-pole, NO contact

1) x = according to model

Figure C-4: Design with emergency stop 1-channel with monitored START

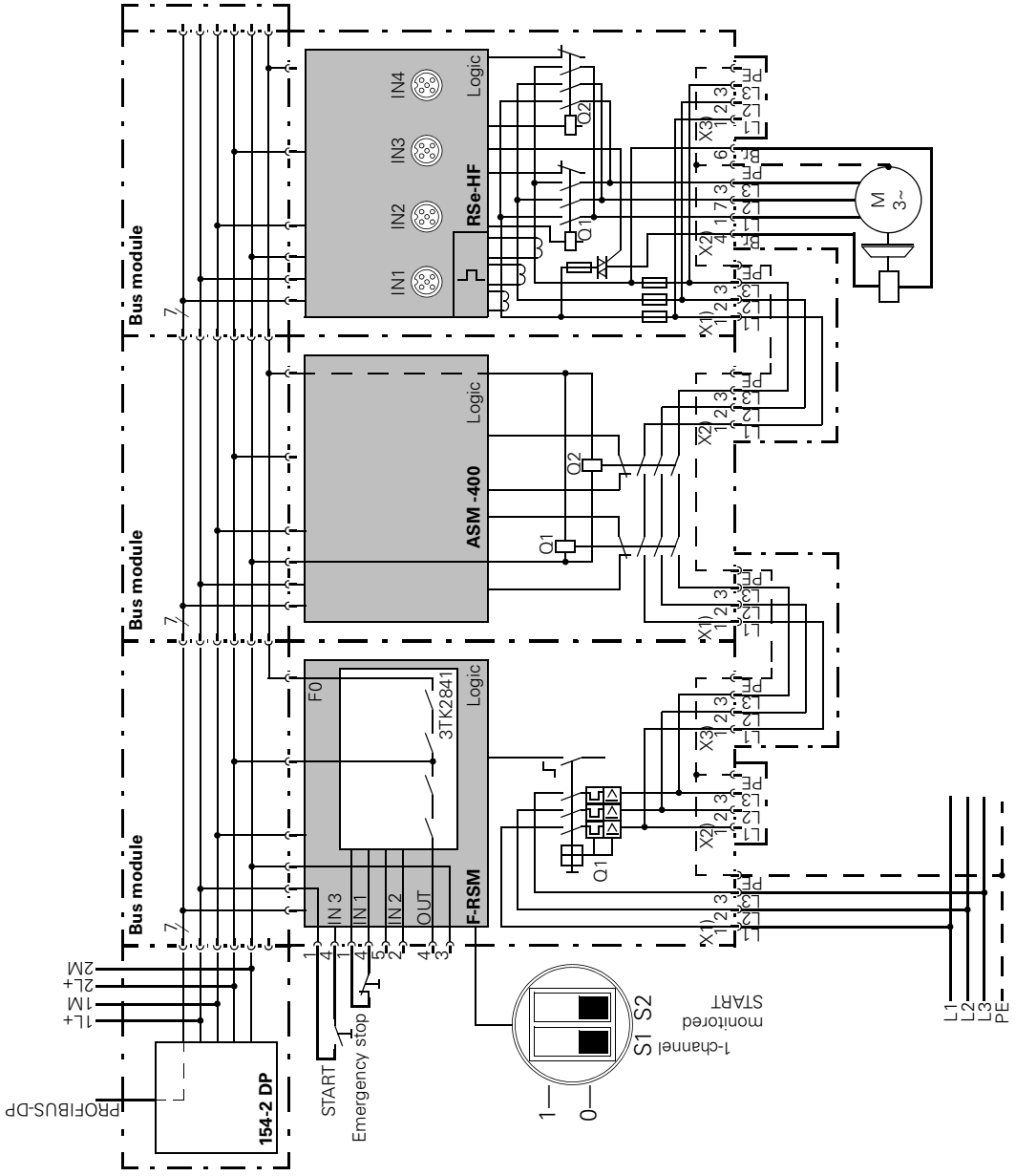
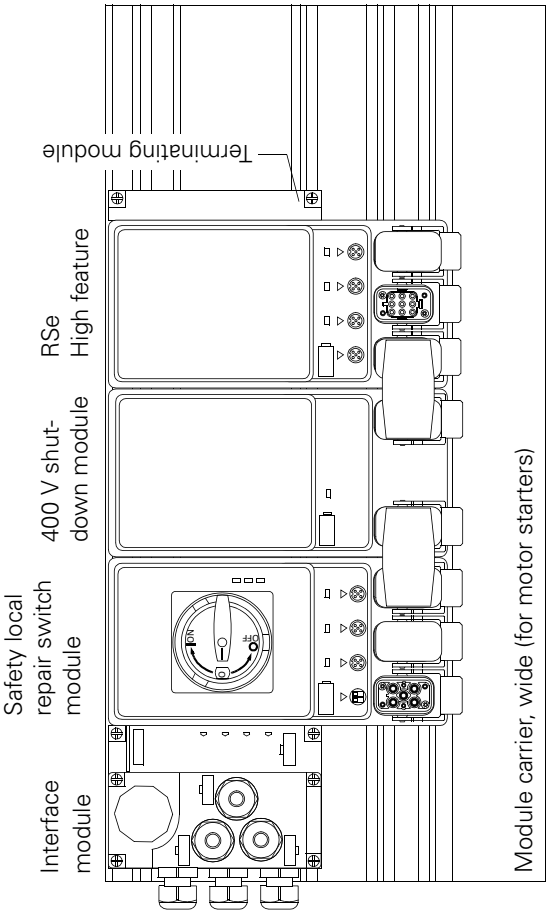


Figure C-4: (cont.) Design with emergency stop 1-channel with monitored START

C.2.2 2-channel emergency stop with monitored START

The example below shows a design with emergency stop with monitored START for category 4.

Caution
Please ensure that both coding switches are in the correct position in line with the safety local repair switch module for your application.



Number	Order number	Description
1	6ES7194-4GB10-0AA0	Module carrier, wide, 1 m
1	6ES7154-2AA00-0AB0	IM 154-2 DP interface module with terminating module
2	3RK1922-2BA00	Bus module
1	3RK1922-2BA01	Bus module for safety local repair switch module
1	3RK1304-0HS00-7AA0	Safety local repair switch module
1	3RK1304-0HS00-8AA0	400 V shutdown
1	3RK1304-5xS40-3AA0	RSe-HF motor starter[1)]
2	3RK1922-2BQ00	Energy jumper plug
2	3RK1902-0CK00	Cap for energy bus
1	3RK1911-2BEx0	Connector set for energy supply[1)]
1	3RK1902-0Cx00	Connector set for motor connection[1)]
1	XXX	Emergency stop / emergency stop switch; 2-pole, NC contact
1	XXX	Switch for START; 1-pole, NO contact

1) x = according to model

Figure C-5: Design with emergency stop 2-channel with monitored START

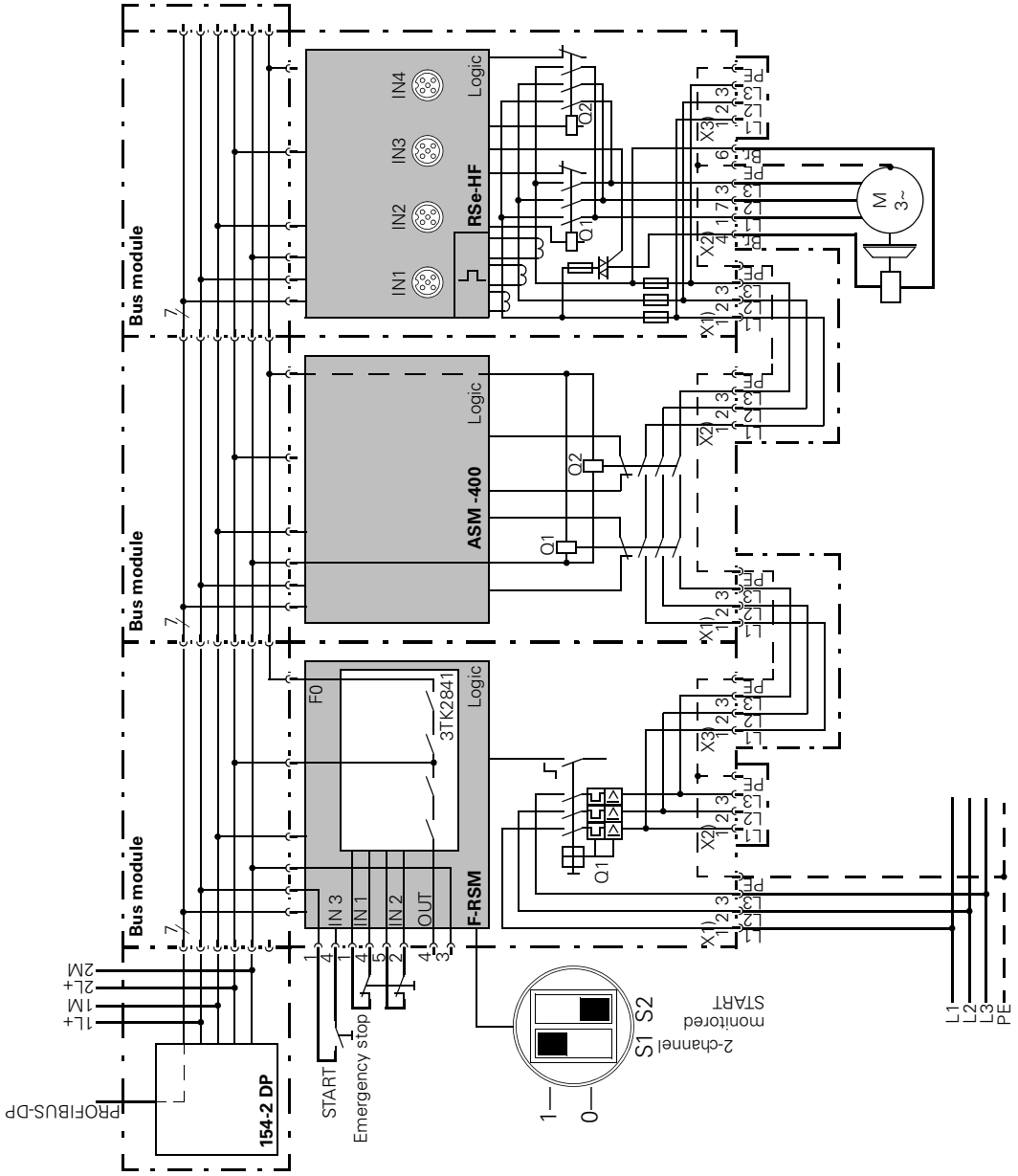
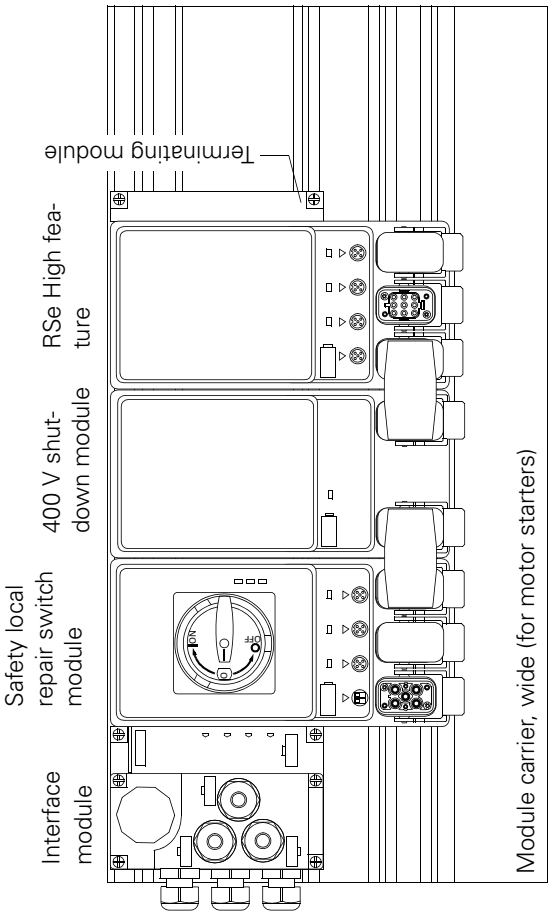


Figure C-5: (cont.) Design with emergency stop 2-channel with monitored START

C.2.3 Guard door monitoring 1-channel with automatic re-start

The example below shows a design with guard door monitoring with automatic re-start in category 2. As an option, a tumbler for guard doors can be connected to output OUT 1.

Caution
Please ensure that both coding switches are in the correct position in line with the safety local repair switch module for your application.



Number	Order number	Description
1	6ES7194-4GB10-0AA0	Module carrier, wide, 1 m
1	6ES7154-2AA00-0AB0	IM 154-2 DP interface module with terminating module
2	3RK1922-2BA00	Bus module
1	3RK1922-2BA01	Bus module for safety local repair switch module
1	3RK1304-0HS00-7AA0	Safety local repair switch module
1	3RK1304-0HS00-8AA0	400 V shutdown
1	3RK1304-5xS40-3AA0	RSe-HF motor starter [1]
2	3RK1922-2BQ00	Energy jumper plug
2	3RK1902-0CK00	Cap for energy bus
1	3RK1911-2BEx0	Connector set for power infeed [1]
1	3RK1902-0Cx00	Connector set for motor connection [1]
1	XXX	Personnel circuit-breaker for guard door monitoring; 1-pole, NC contact
1	XXX	Tumbler for guard door (optional)

1) x = according to model

Figure C-6: Design for guard door monitoring 1-channel and automatic re-start

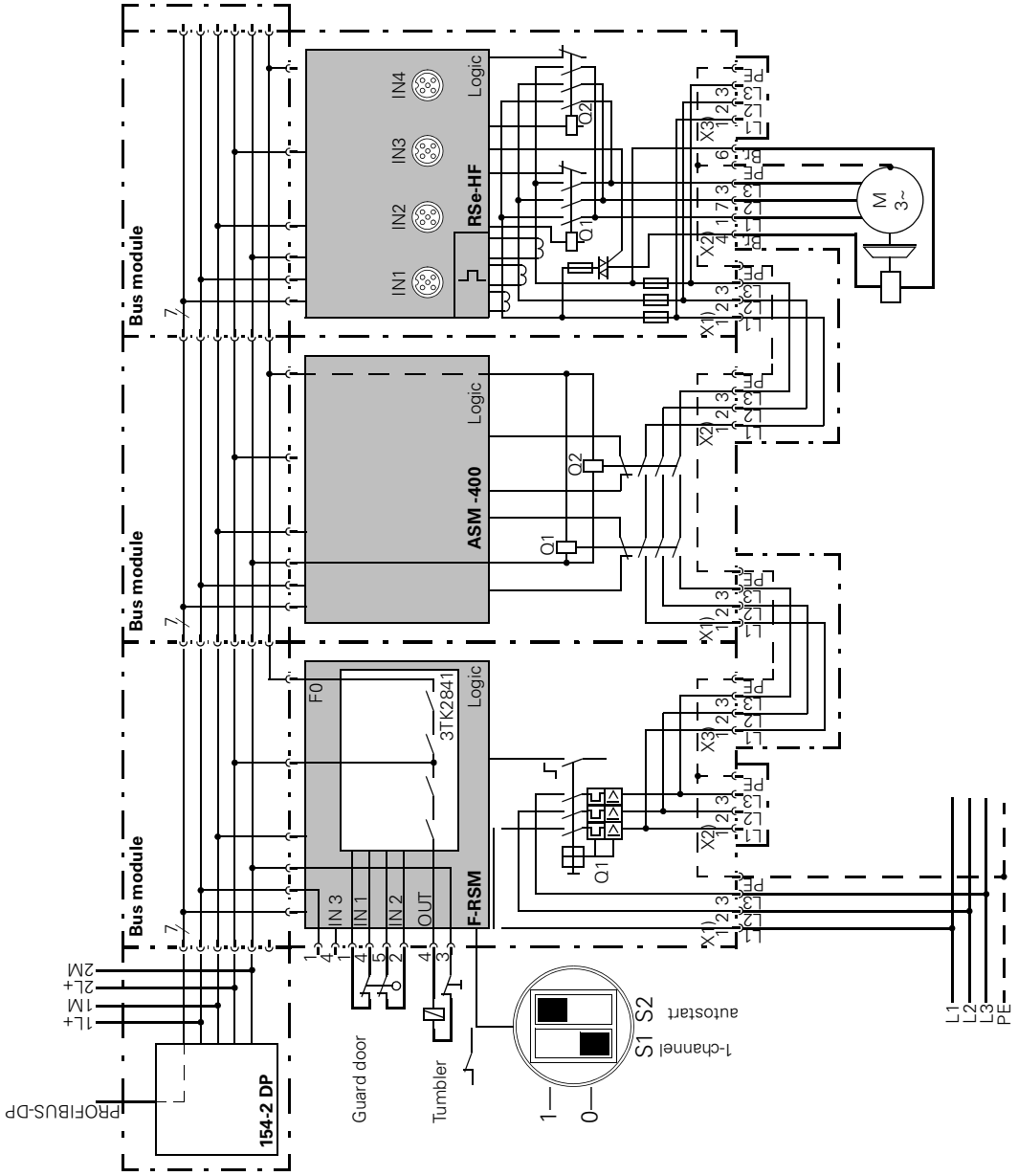


Figure C-6: (cont.) Design for guard door monitoring 1-channel and automatic re-start

Data formats and data records

D

D.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 6 bit current format, in 8 bit current format and in 9 bit current format:

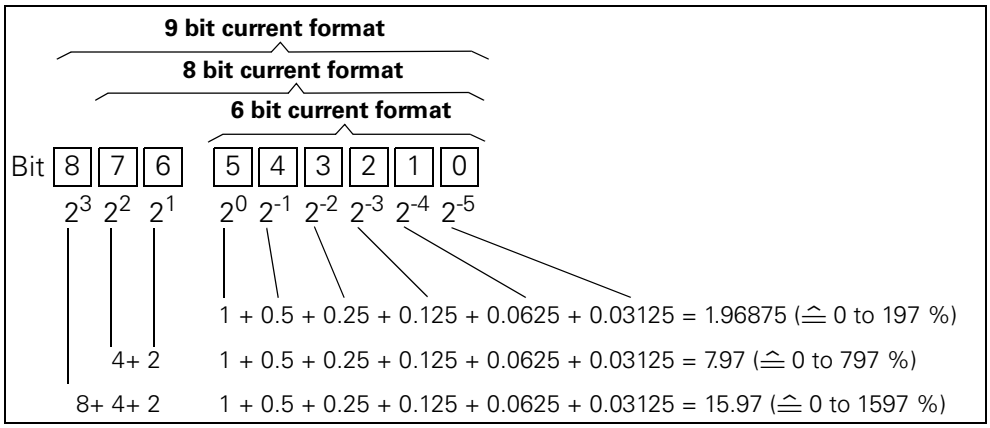


Figure D-1: Current formats

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.
    They indicate how long the motor was switched on.
  – The operating hours of the device (motor starter).
    They indicate how long the 24V-NS DC voltage supply 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 phase in percent [%] of the current set I_e.
  Data format: 1 byte, 8 bit current format
  Example: Current set I_e = 60 A
  Motor current displayed 110 %
  then corresponds to 60 A x 1.1 = 66 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]
  Data format: 2 byte, 9 bit current format
  Example: Current set I_e = 60 A
  Motor current displayed 455 % then corresponds to 60 A x 4.55 = 273 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 delete the measurement at any time.

The following data are available as slave pointers:

- Number of overload trips.
- Phase current $I_{L1\ max}$ to $I_{L3\ max}$. Maximum phase current in percent [%] of set current I_e and in amperes [A].
  Data format: Each 1 byte, 8 bit current format.
  The maximum phase current measured is saved per phase.

D.2 Fault codes

D.2.1 Fault codes with negative data record acknowledgement

Description

When a data record is rejected, a fault 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 fault codes conform to the PROFIBUS-DPV1 standard assuming they apply to the motor starter.

Evaluation via local device interface with ES motor starter

The fault codes are evaluated by the parameterization and diagnostics software ES motor starter **https://support.industry.siemens.com/cs/ww/en/ps/16713/td** and displayed in plain text. More information on this can be found in the ES motor starter online help system.

Evaluation via field bus

The fault codes sent in the field bus response telegram.

Fault codes

The following fault codes are generated by the motor starter:

Byte fault codes		Fault message	Cause
high	low		
00 H	00 H	No faults	—
		Communication interface	
80 H	A0 H	Negative acknowledgement with *'Read data record'*	• Data record only writeable
80 H	A1 H	Negative acknowledgement with *'Write data record'*	• Data record only readable
80 H	A2 H	Protocol fault	• 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	Invalid status	• PROFIenergy data record read without prior writing
		Access to technology	
80 H	B0 H	Unknown data record number (DS no.)	• 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	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
		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

Table D-1: Fault codes

D.3 Data records

Writing / reading of data records with STEP 7

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, the modules SFB 52 and 53 should be used. These also function with PROFIBUS.

Other 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"):

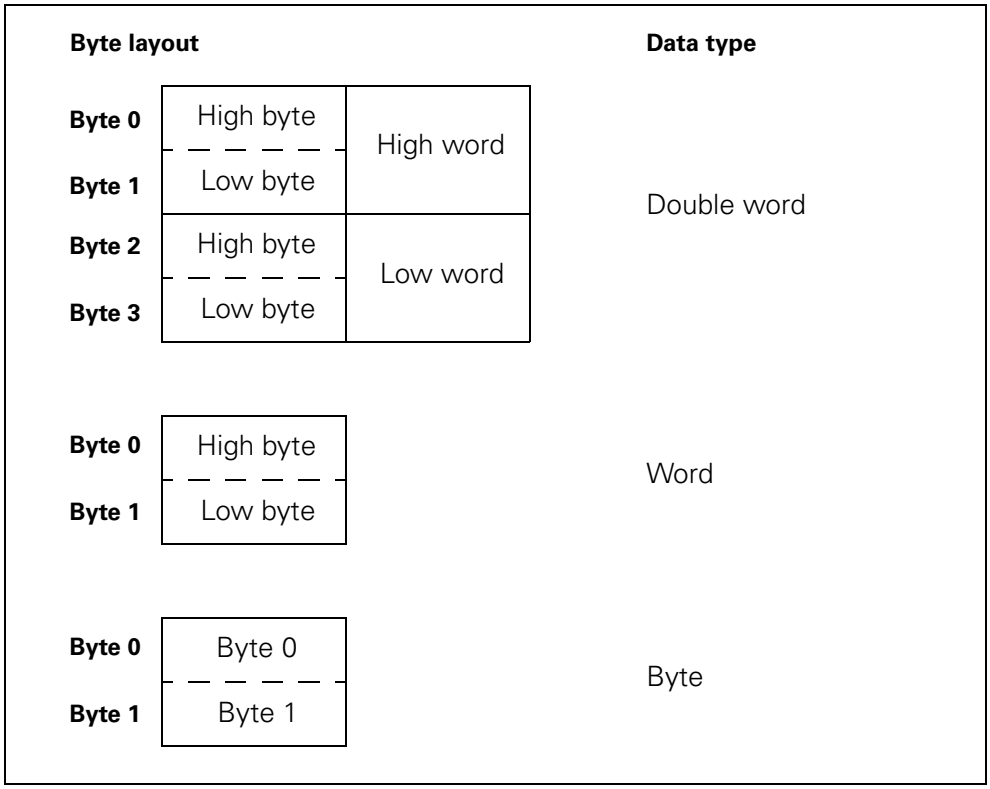


Figure D-2: Byte layouts in the 'big endian' format

D.4 DS68 process image for read/write outputs

Note
Note that data record 68 in automatic operating mode is overwritten by the cyclical process image

Byte	Meaning	
	Leader	
0	Coordination	0x21 writing via C1 channel (PLC) 0x31 writing via C2 channel (PC)
1	Reserved	
2	Reserved	
3	Reserved	
	Process image of the outputs	
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	

Table D-2: DS68 process image for read/write outputs

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	Reversing starters
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	Disable Quick Stop	all

1) only with devices with brake output

Table D-3: Meaning - Process image of the read / write outputs

D.5 DS69 process image for the read / write inputs

Byte	Meaning
Process image for the inputs	
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

Table D-4: DS69 process image for the read / write inputs

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 fault	all
0.3		DI 0.3	General warning	all
0.4		DI 0.4	Input 1	all
0.5		DI 0.5	Input 2	all
0.6		DI 0.6	Input 3	all
0.7		DI 0.7	Input 4	all
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
1.7		DI 1.7	Ramp operation	Soft starter

Table D-5: Meaning - Process image of the read / write outputs

D.5.1 DS72 – Log book – Device faults

Byte	Meaning	Value range	Increment	Note
0…3	Operating hours device	1…4294967295	1 s	oldest entry
4…5	Object number	0…32767	1	
…				
120…123	Operating hours device	1…4294967295	1 s	last, latest entry
124…125	Object number	0…32767	1	

Table D-6: DS72 – Log book – Device faults

This data record can take up to 21 inputs. When all positions have been written to, the oldest entry is overwritten.

Note
The most recent entry is entered at the end of the data record. The remaining entries are moved upwards one entry.

The following device faults can be entered:

Object no.	Device fault - Messages
451	Temperature sensor not ready for operation
452	Heat sink thermistor faulty
453	Interface for current detection faulty
456	EEPROM: Memory faulty
457	EEPROM: CRC fault "Fixed value parameter"
458	EEPROM: CRC fault "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

Table D-7: Messages in the log book – Device faults

D.5.2 DS73 – Log book – Read trips

Byte	Meaning	Value range	Increment	Note
0…3	Operating hours device	1…4294967295	1 s	oldest entry
4…5	Object number	0…32767	1	
…				
120…123	Operating hours device	1…4294967295	1 s	last, latest entry
124…125	Object number	0…32767	1	

Table D-8: DS73 – Log book – Read trips

This data record can take up to 21 inputs. When all positions have been written to, the oldest entry is overwritten.

Note
The most recent entry is entered at the end of the data record. The remaining entries are moved upwards one entry.

The following device faults can be entered:

Object no.	Trips - Messages	Note
309	Overload switching element	only with soft starters
317	Electronics power supply too low	—
318	Switching element power supply missing	—
319	No supply voltage	only with soft starters
324	Temperature sensor overload	—
325	Temperature sensor wire break	—
326	Temperature sensor short-circuit	—
327	Thermal motor model overload	—
334	I_e limit value exceeded	—
335	I_e limit value not reached	—
338	Zero current shutdown	—
339	Motor blocking shutdown	—
341	Asymmetry shutdown	—
348	Input tripping	—

Table D-9: Messages in the log book – Trips

Object no.	Trips - Messages	Note
354	Sensor supply overload	—
355	Process image fault	—
365	Invalid parameter value	—
381	Fault during self-test (= device fault)	precise cause also in log book – device fault
1406	Cold run shutdown	—

Table D-9: Messages in the log book – Trips (Contd.)

D.5.3 DS75 – Log book – Read events

Byte	Meaning	Value range	Increment	Note
0…3	Operating hours device	1…4294967295	1 s	oldest entry
4…5	Object number	**0…± 32767**	1	
..				
120…123	Operating hours device	1…4294967295	1 s	last, latest entry
124…125	Object number	**0…± 32767**	1	

***** + :Incoming event
– :Outgoing event

Table D-10: DS75 – Log book – Read events

This data record can take up to 21 inputs. When all positions have been written to, the oldest entry is overwritten.

Note
The most recent entry is entered at the end of the data record. The remaining entries are moved upwards one entry.

The following device faults can be entered:

Object no.	Events – Messages
	Advance warnings
1419	± Prewarning limit - time-based trigger reserve not reached [2]
1420	± Prewarning limit - motor heating exceeded [2]
1457	± Maintenance required [2]
	Warnings
318	± Switching element power supply missing
324	± Temperature sensor overload [1]
325	± Temperature sensor wire break [1]
326	± Temperature sensor short-circuit [1]
327	± Thermal motor model overload
334	± I_e limit value not reached
335	± I_e limit value exceeded
337	± Zero current detected
340	± Asymmetry detected
351	± Warning input
1458	± Maintenance request [2]
	Actions
310	± Emergency start active
357	Automatic operating mode
358	Manual bus operating mode
359	Local operating mode
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
1484	± Temperature sensor deactivated [2]
1520	± Energy-saving mode active

Table D-11: Messages in the log book – Events

1) only with soft starters
2) from electricity reading of the ET200pro motor starters:
- DSe/RSe 3RK1304-..S40…. with event status E06 or higher
- sDSSte/sDSte/sRSSte/sRSte 3RK1304-..S70…. with event status E07 or higher

±: Event is entered as an "incoming" (+) and "outgoing" (-) event, other messages are only entered as "incoming" messages.

D.5.4 DS81 – Read basic DS 131 setting

Data record 81 has the same layout and content as data record 131.
Data record 81 delivers the default values for all parameters of DS 131.

D.5.5 DS92 – Read device diagnostics

Greyed out signalling bits are not supported by ET 200pro motor starters.

Byte	Signalling bit	F-no.[1]	Meaning / **Acknowledgement**
	Switching / controlling:		
0^0	Ready (automatic)	—	Device can be operated via host (e.g. PLC) **Signalling bit is updated continuously**
0^1	Motor cw	—	Switching element 1 on **Signalling bit is updated continuously**
0^2	Motor ccw	—	Switching element 2 on **Signalling bit is updated continuously**
0^3	Overload switching element	(F5) F24	e.g. power semiconductor too hot and shutdown **Signalling bit is cleared if the shutdown cause has been eliminated and acknowledged using trip reset**
0^4	Switching element defective	F9	e.g. contactor welded shut or power semiconductor failed **Signalling bit can only be cleared by switching the power supply (24 V-NS DC) off and on again once the cause has been eliminated**
0^5	Emergency start active	—	**Signalling bit is cleared if emergency stop is deactivated**
0^6	Group fault	—	at least 1 fault that generates a F-no. is set. **Signalling bit is cleared when the shutdown cause is eliminated and has been acknowledged with trip reset, autoreset, OFF command**
0^7	General warning	—	there is at least 1 warning **Signalling bit is updated continuously**
1^0	Switching element power supply missing	F17, F24	**Signalling bit is cleared when the shutdown cause is eliminated** [4] **Signalling bit is cleared when the shutdown cause is eliminated and acknowledged with trip reset** [5]
1^1	No supply voltage	F17, F24	Signalling bit is cleared when the shutdown cause is eliminated and acknowledged with trip reset (occurs even if control voltage is missing on the incoming or outgoing side; applies to soft starters
1^2	Interlock active	—	With reversing starters **Signalling bit is updated continuously**

Table D-12: DS92 – Read device diagnostics

Byte	Signalling bit	F-no.[1)]	Meaning / **Acknowledgement**
1^3	Startup active	—	With soft starters **Signalling bit is updated continuously**
1^4	Run-down active	—	
1^5	Brake output active	—	Brake output is switched on by the user **Signalling bit is updated continuously**
1^6	Brake process is electrically active	—	Brake output is switched on by the motor starter **Signalling bit is updated continuously**
1^7	Creep feed active	—	**Signalling bit is updated continuously**
19^1	Start-ready for motor on	—	Device in ready-for-operation status, switch-on possible
19^2	Switching element shortcircuited	—	e.g. contactor welded shut
	Protective function: Motor / cable / short-circuit		
2^0	Temperature sensor overload	F 4	Overload detected **Signalling bit is updated continuously**
2^1	Temperature sensor wire break	F6	Thermistor circuit interrupted **Signalling bit is updated continuously**
2^2	Temperature sensor shortcircuit	F1	Short-circuit in thermistor circuit **Signalling bit is updated continuously**
2^3	Thermal motor model overload	F4	Overload detected **Signalling bit is updated continuously**
2^4	Overload shutdown	F24	Overload detected and shut-down **Signalling bit is cleared when the shutdown cause is eliminated and has been acknowledged with trip reset/autoreset**
2^5	Idle time active	—	**Signalling bit is updated continuously**
2^6	Cooldown time active	—	**Signalling bit is updated continuously**
2^7	Safety-oriented shutdown	F25	Shutdown carried out
3^0	Line protection overload	F4	Line between motor starter and motor overloaded Signalling bit is updated continuously
3^1	Line protection shutdown	F24	Line between motor starter and motor is overloaded and shutdown Signalling bit is cleared when the shutdown cause has been eliminated and acknowledged with trip reset
3^2	Circuit breaker tripped	F1, F24	Signalling bit is cleared when the shutdown cause has been eliminated and acknowledged with trip reset
3^3	Current limitation active	—	Motor current is limited to parameterized value. **Signalling bit is updated continuously**
3^4	Desired value = actual value	—	Desired speed regulating rheostat frequency = actual frequency. **Signalling bit is updated continuously**
3^5	Intermediate circuit voltage too high	—	Speed regulating rheostat **Signalling bit is updated continuously**
3^6	Regenerative motor run	—	Motor feeds current back into motor starter. **Signalling bit is updated continuously**

Table D-12: DS92 – Read device diagnostics (Contd.)

Byte	Signalling bit	F-no.[1)]	Meaning / **Acknowledgement**
3^7	Control input[2)]	—	Motor cw, motor ccw control commands via input actions **Signalling bit is updated continuously**
4^0	Asymmetry detected	—	Asymmetry present **Signalling bit is updated continuously**
4^1	Asymmetry shutdown	F24	Asymmetry present and shutdown **Signalling bit is cleared when the shutdown cause has been eliminated and acknowledged with trip reset**
4^2	I_e limit value exceeded[2)]	F7	Limit value exceeded **Signalling bit is updated continuously**
4^3	I_e limit value not reached[)]	F8	Limit value not reached **Signalling bit is updated continuously**
4^4	I_e limit value shutdown[2)]	F24	**Signalling bit is cleared when the shutdown cause has been eliminated and acknowledged with trip reset**
4^5	Residual current detected	—	Zero current detected **Signalling bit is updated continuously**
4^6	Zero current shutdown	F24	Zero current detected and shutdown
4^7	Motor blocking shutdown	F24	Shutdown, blocking current detected for longer than the permitted blocking time **Signalling bit is cleared when the shutdown cause has been eliminated and acknowledged with trip reset**
5^0	Input 12[)]	—	Status conditions of the free inputs (with NO contact): '1' = active, HIGH level present '0' = inactive, LOW level present (reversed for NC contact) **Signalling bit is updated continuously**
5^1	Input 22[)]	—	
5^2	Input 32[)]	—	
5^3	Input 42[)]	—	
5^4	Shutdown input[2)]	F26, F24	Shutdown present **Signalling bit is cleared when the shutdown cause has been eliminated and acknowledged with trip reset/autoreset**
5^5	Shutdown clockwise end position input[2)]	F26, F24	Shutdown present **Signalling bit is automatically cleared when the shutdown cause is eliminated. Counter-clockwise start possible.**
5^6	Warning input[2)]	—	Warning present **Signalling bit is updated continuously**
5^7	Shutdown counter-clockwise end position input[2)]	F26, F24	Shutdown present **Signalling bit is automatically cleared when the shutdown cause is eliminated. Clockwise start possible.**

Table D-12: DS92 – Read device diagnostics (Contd.)

Byte	Signalling bit	F-no.[1]	Meaning / **Acknowledgement**
6^0	Earth fault detected	—	Earth fault current present Signalling bit is updated continuously
6^1	Earth fault shutdown	F24	Earth fault current present and shutdown Signalling bit is cleared when the shutdown cause has been eliminated and acknowledged with trip reset
6^2	Quick-stop active[2]	F26, F24	Quick-stop is present and shutdown Signalling bit is cleared if the shutdown cause is eliminated and acknowledged with trip reset
6^3	Sensor supply overload[2]	F26, F24	Sensor supply overload present and shutdown **Signalling bit is cleared when the shutdown cause has been eliminated and acknowledged with trip reset**
6^4	Trip reset completed	—	**Signalling bit is cleared by updating or via trip reset in ready-for-operation status**
6^5	Trip reset not possible	—	Shutdown cause still present! **Signalling bit is cleared by updating (new trip reset) or via trip reset in ready-for-operation status**
6^6	Slave pointer deleted	—	**Signalling bit is always cleared when acknowledged with *'Trip Reset'*.**
6^7	Electronics power supply too low	—	**Signalling bit is automatically cleared when the shutdown cause is eliminated**
	Communication		
7^0	Bus fault	—	Response monitoring for DP interface expired **Signalling bit is updated continuously**
7^1	CPU/master STOP	—	PLC program is no longer being processed **Signalling bit is updated continuously**
7^2 22^0	Automatic operating mode redundant to bit 7.2	—	Automatic (PLC control) **Signalling bit is updated continuously**
7^3 22^1	Manual bus operating mode redundant to bit 7.3	—	Manual operation via field bus (B&B control) **Signalling bit is updated continuously**
22^2	Manual bus - PC controlling		
7^4 22^3	Manual local operating mode redundant to bit 7.4	—	Manual operation via local device interface (B&B control) **Signalling bit is updated continuously**
7^5	Reserved = 0		
7^6	Lost connection in manual operating mode	—	the associated communication connection was interrupted during manual operation **Signalling bit is updated continuously**
7^7	Process image fault	F26, F24	Process image of the outputs contains nonallowable bit combination **Signalling bit is automatically cleared when the shutdown cause has been eliminated**

Table D-12: DS92 – Read device diagnostics (Contd.)

Byte	Signalling bit	F-no.[1]	Meaning / **Acknowledgement**
22^4	Manual local input control[2]	—	Manual local operating mode active, + input control active
22^5	Manual local B&B control	—	Not supported
8^6	Memory submodule faulty	F26 (F24)	**Signalling bit is always cleared when acknowledged with trip reset.** **Results in a shutdown on startup**
8^7	Memory submodule not plugged in	—	**Signalling bit is updated continuously**
22^6	Manual local - PC controlling	—	Manual local operating mode active, + PC control active
	Parameters		
8^0	Parameterization active	—	**Signalling bit is updated continuously**
8^1	Invalid parameter value	F16 (F24)	**Signalling bit is always cleared when acknowledged with trip reset or valid parameters have been received.** **Results in a shutdown on startup**
8^2	Parameter change in ON status not permissible	—	Attempted parameter change with motor running or device function that caused the shutdown. **Signalling bit is always cleared when acknowledged with trip reset or valid parameters have been received**
8^3	Parameterization lock CPU / Master active	—	**Signalling bit is updated continuously** **Motor starter ignores parameters from the PLC**
8^4	No external startup parameter received	—	**Signalling bit is always cleared when changing from start to normal operating condition**
8^5	reserved = 0	—	
	Device function		
9^0	Self-test active	—	**Signalling bit is updated continuously**
9^1	Self-test OK	—	**Signalling bit is updated continuously**
9^2	Fault during self-test	F9	**Signalling bit can only be cleared by switching the supply voltage off / on (24 V-NS DC) when the cause of fault has been eliminated.**
9^3	Factory setting restored	—	**Signalling bit is always cleared when acknowledged with *'Trip Reset'.***
$9^{4...5}$	Memory module	—	00: not assigned (*status after power-ON)* 01: Programming active 10: Programming successful 11: Programming faulty F26, (F24 only on start-up) **Signalling bit is always cleared if acknowledged with trip reset.**

Table D-12: DS92 – Read device diagnostics (Contd.)

Byte	Signalling bit	F-no.[1]	Meaning / **Acknowledgement**
$9^{6...7}$	FW update	—	00: rejected / status after reset 01: Active 10: successful 11: faulty (F9) Signalling bit is always cleared when acknowledged with *'trip reset'*.
10	Faulty parameter number Object number (low byte)	—	in combination **8^1** and **8^2,** specifies the first unaccepted parameter **Signalling bit is always cleared when acknowledged with trip reset.**
11	Object number (high byte)	—	
14^0	Cold run active[3]	—	1 = Function active
14^1	Cold run shutdown[3]	—	a current flow was detected
	Advance warnings		
24^2	Prewarning limit – time-based trigger reserve not reached[2]	—	a group warning is generated
24^3	Prewarning limit – motor heating exceeded[2]	—	a group warning is generated
	Maintenance		
26^0	Maintenance required[2]	—	a group warning is generated
26^1	Maintenance requirement[2]	—	a group warning is generated
26^2	Maintenance alarm	—	Not supported
27^0	Maintenance timer limit_1 exceeded[2]	—	a group pre-warning is generated **Clear maintenance timer per command**
27^1	Maintenance timer limit_2 exceeded[2]	—	a group warning is generated **Clear maintenance timer per command**

1) PROFIBUS-DP fault numbers
2) not with standard motor starters
3) can only be activated via "command"
4) with standard motor starters
5) with high feature motor starters

Table D-12: DS92 – Read device diagnostics (Contd.)

D.5.6 DS93 – Write command

Structure of the command data record

Byte	Meaning	Note
	Command data record	
	Leader	
0	Coordination	0x21 write via C1 channel (PLC) 0x31 write via C2 channel (PC)
1…3	Reserved	
	Command	
4	No. of commands	Value range 1…5. Number of subsequent valid commands
5	Command 1	Cons. no. 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)

Table D-13: Structure of the command data record

Coding	Command	Meaning
	1-byte commands	
0	Reserved	no function
1	Trip reset	Reset and acknowledgement of fault messages
2	Emergency start ON	—
3	Emergency start OFF	—
4	Automatic operating mode	Transfer to automatic operating mode (control via DP master)
5	Manual operating mode - 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.
6	Factory setting	Restore factory setting of the parameters from DS 128
7	Clear slave pointer	The measurements for preventative diagnostics are cleared (= 0).
8	Program memory module	Not supported
9	Re-start	Trigger re-start (as after mains ON), e. g. after re-assignment of the station address.
10	Parameterization lock CPU / Master ON	No parameterization possible via parameterizing master, or its parameters will be ignored
11	Parameterization lock CPU / Master OFF	Parameterization possible via parameterizing master
12	Clear memory module	Not supported

Table D-14: DS93 – write command

Coding	Command	Meaning
13	Clear log book trips	Clear log book with recorded causes of fault.
14	Clear log book events	Clear log book with recorded warning messages and specific actions.
15	Cold run ON	Activate cold-run function
16	Cold run OFF	Deactivate cold-run function
17	Clear maintenance timer	The content of the maintenance timer statistics value is set to "0".
18	Establish current limits	Not supported
19	Transfer current limit values	Not supported
20 … 255	Reserved	—

Table D-14: DS93 – write command (Contd.)

D.5.7 DS94 – Read measurements

Byte	Meaning	Value range / [coding]	Increment	Note
	Measurements			
0	Phase current $I_{L1\ act(\%)}$	0…796.9 %	3.125%	8-bit current waveform.
1	Phase current $I_{L2\ act(\%)}$	0…796.9 %	3.125%	8-bit current waveform.
2	Phase current $I_{L3\ act(\%)}$	0…796.9 %	3.125%	8-bit current waveform.
4…5	Remaining cool-down time of the motor	0 … 1800 s	0.1 s	
$6^{0...6}$	Motor heating	0…200 % / [0…100]	2%	
6^{7}	Asymmetry	[0]: No asymm. [1]: Asymm. (≥ 40 %)		Tripping limit depends on asymmetry 0 = 100 % 1 = 75
7	Asymmetry value[1)]	0…100 % / [0…100]	1%	—
28…31	Phase current $I_{L1(eff)}$	±0 … 20 A	0.01 A	—
32…35	Phase current $I_{L2(eff)}$	±0 … 20 A	0.01 A	—
36…39	Phase current $I_{L3(eff)}$	±0 … 20 A	0.01 A	—
42	Heat sink temperature is evaluated with 1.5 - 12 A soft starters to protect the power module			
46…47	Time-based triggering of the thermal motor model	0…6500 s	0.1 s	$FFFF_H$: Time infinite

1) only with HF starters

Table D-15: DS94 – Read measurements

D.6 DS95 - Read statistics

Byte	Meaning	Value range / [coding]	Incre-ment	Relevant 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	Reversing starters only
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 hour 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 24V-NS DC supply voltage of the motor starter was switched on.

Table D-16: DS95 - Read statistics

D.6.1 DS96 – Slave pointer

Byte	Meaning	Value range / [coding]	Increment	Note
	Slave pointer			
14…15	Number of motor overload trips	0, 65535	1	—
12…13	Max. trip current $I_{A\ max(\%)}$	0…1000	3.125%	9-bit current waveform.
8	Phase current $I_{L1\ max(\%)}$	0…796.9 %	3.125%	8-bit current waveform.
9	Phase current $I_{L2\ max(\%)}$	0…796.9 %	3.125%	8-bit current waveform.
10	Phase current $I_{L3\ max(\%)}$	0…796.9 %	3.125%	8-bit current waveform.
4	Phase current $I_{L1\ min(\%)}$	0…796.9 %	3.125%	8-bit current waveform.
5	Phase current $I_{L2\ min(\%)}$	0…796.9 %	3.125%	8-bit current waveform.
6	Phase current $I_{L3\ min(\%)}$	0…796.9 %	3.125%	8-bit current waveform.
16…19	Max. trip current $I_{A\ max(eff)}$	±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	—
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	—
60	Maximum heat sink temperature	°C	1°C	Soft starters only

Table D-17: DS96 – Slave pointer

Byte	Meaning	Value range / [coding]	Increment	Note
64…67	Operating hours – motor current = 18…49.9 % x $I_{e\ max}$ [1)]	0…4294967295	1 s	
68…71	Operating hours – motor current = 50…89.9 % x $I_{e\ max}$ [1)]	0…4294967295	1 s	
72…75	Operating hours – motor current = 90…119.9 % x $I_{e\ max}$ [1)]	0…4294967295	1 s	
76…79	Operating hours – motor current = 120…1000 % x $I_{e\ max}$ [1)]	0…4294967295	1 s	

1) HF starters only

Table D-17: DS96 – Slave pointer (Contd.)

D.6.2 DS100 – Read device identification

Byte	Length	Value	Meaning
	Leader		
0…3	4	Reserved	
	Device identification (TF)		
4…11	8	…	Time stamp [1)]
12…31	20	Siemens AG	Manufacturer
32…55	24	—	MLFB number
56	1	0x01	Device range: load branch
57	1	0x01	Device sub-range: Motor starters
58	1	0x01 / 0x02 / 0x03 / 0x04	Device class: e.g. direct starters / reversing starters / direct soft starters / reversing soft starters
59	1	0x66	System: ET200pro
60	1	0x32 /0x5A	Standard starters / high feature starters
61	1	0x00	Reserved
62…77	16	—	Product code
78…81	4	E…	Hardware revision status (byte 0 to byte 3)
82…85	4	…	ID number
86…87	2	0x00	Reserved
88…95	8	…	Service number
96…99	4	0x00	Reserved

1) Time stamp: Time of the factory initialization with basic factory settings

Table D-18: DS100 – Read device identification

Object name		id_date							
Object length		8 bytes							
Bit **Byte**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**Note**
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	Reserved								

Table D-19: Time stamp

D.6.3 DS165 – Read / write comment

You can store any text with up to 121 characters (max. 128 bytes), e.g. for system documentation in the motor starter.

D.7 Device parameters

D.7.1 DS131 – Device parameters

When using the DP V1 functions, complete data records can be exchanged with the starters via the ET 200pro rear wall bus.
It is recommended to first export the data record 131 with the actual parameters from the motor starter, change the relevant parameters and then write them back to the motor starter.
Note that the coordination (byte 0) should be set to 0x21 before write data record.
The message interchange between the interface module and the special modules or motor starters is carried out in blocks of up to 16 bytes in length. The entirety (block) of a data record must be sent in each case.

For advanced parameterization of the ET 200pro starters, the following elements of the data record 131 (1st block / 62 bytes) are used:

GSD byte	DS 131 Byte	Parameters	Value range	Incre-ment	Factory setting	Relevant to
	0	Coordination	with startup parameterization: 0x20 writing via C1 channel (PLC) 0x30 writing via C2 channel (PC) with parameterization in operation: 0x21 writing via C1 channel (PLC) 0x31 writing via C2 channel (PC) with parameterization read: 0x00 reading via C1 channel (PLC) 0x00 reading via C2 channel (PC)			
	1…3	Reserved	[0]			
	4…7	Device functions_2 [1]	Content MLFB-specific			
	8…11	Device functions_1 [1]				
	12…13	Reserved				
$1^{0...7}$ and $2^{0...7}$	$14^{0...7}$ and $15^{0...7}$	Rated operating current I_e A	0.15…2 A	10 mA	0.15 / 2.0	all starters
		Rated operating current I_e A	1.5…12 A	10 mA	1.5 / 12	
	16^0	Load type	3-phase motor [0] 1-phase motor [1]		[0]	DSe, RSe (ST and HF)
	16^1	Non-resetting on voltage failure	yes [1] no [0]		[1]	all starters
	$16^{2...7}$	Reserved	—			
	$17^{0...7}$	Prewarning limit value - motor heating	0…95 %; deactivated [0]	5%	0%	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte

Table D-20: DS131 – Device parameters

GSD byte	DS 131 Byte	Parameters	Value range	Increment	Factory setting	Relevant to
$6^{4...5}$	$18^{0...1}$	Response to overload – thermal motormodel	Shutdown without re-start [0] Shutdown with restart [1]	—	[0]	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
	$18^{2...7}$	Reserved	—			
$6^{0...3}$	$19^{0...3}$	Tripping class	CLASS 5 [3] CLASS 10 [0] CLASS 15 [4] CLASS 20 [1]	—	[0]	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
			CLASS 10 [0]	—	[0]	DSe, RSe
	$19^{4...7}$	Reserved	—			
—	$20^{0...7}$	Recovery time	60 … 1800 s	30 s	90 s	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
—	$21^{0...7}$	Idle time	0…255 s deactivated [0]	1 s	[0]	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
—	22…23	Prewarning limit - time trip reserve	0…500 s deactivated [0]	0.1 s	0 s	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
$6^{6...7}$	$24^{0...1}$	Response on overload – temperature sensor	Shutdown without re-start [0] Shutdown with restart [1] Warning [2]	—	[0]	sDSSte/ sDSte, sRSSte/sRSte
—	$24^{2...3}$	Reserved	—			
$7^{0...2}$	$24^{4...6}$	Temperature sensor	deactivated [0] Thermoclick [1] PTC type A [2]	—	[0]	sDSSte/ sDSte, sRSSte/sRSte
—	24^{7}	Temperature sensor monitoring	no [0] yes [1]	—	[1]	sDSSte/ sDSte, sRSSte/sRSte
—	$25^{0...7}$	Lower current pre-warning limit value	not used			
—	26…27	Permissible line operating current	not used			
$8^{0...7}$	$28^{0...7}$	Lower current limit	18.75 %…100 %	3.125%	18.75%	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
$9^{0...7}$	$29^{0...7}$	Upper current limit	50 … 150	3.125%	112.5%	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte

Table D-20: DS131 – Device parameters (Contd.)

GSD byte	DS 131 Byte	Parameters	Value range	Increment	Factory setting	Relevant to
—	$30^{0...7}$	Blocking current	150 … 1000	50%	1000%	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
—	31	Upper current pre-warning limit value	not used			
—	$32^{0...3}$	Blocking time	1s 5 s	0.5 s	1 s	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
$7^{4...5}$	$32^{4...5}$	Response with power supply Switching element missing	Group fault [0] Group fault only with On command [1] Group warning [2]	—	[0]	all starters
7^{7}	32^{6}	Response to current limit violation	warning [0] shutdown [1]	—	[0]	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
7^{6}	32^{7}	Response to residual current detection	warning [0] shutdown [1]	—	[1]	all starters
—	$33^{0...1}$	Response with power switch off	not used			
—	$33^{2...3}$	Response with switching element overload	not used			
—	$33^{4...7}$	Asymmetry pre-warning limit value	not used			
—	$34^{0...2}$	Asymmetrical limit value	30 … 60	10%	30 %	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
—	$34^{3...5}$	Reserved	—			
7^{3}	34^{6}	Response with asymmetry	warning [0] shutdown [1]	—	[1]	all starters
—	34^{7}	Response with earth fault	not used			
—	$35^{0...7}$	Earth fault prewarning limit value	not used			
—	$36^{0...7}$	Interlock time	0s 60 s	1 s	0 s	RSe (HF), sRSSte/ sRSte
—	$37^{0...7}$	Input signal extension	0…200 ms	10 ms	0 ms	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte

Table D-20: DS131 – Device parameters (Contd.)

GSD byte	DS 131 Byte	Parameters	Value range	Incre-ment	Factory setting	Relevant to
—	$38^{0...2}$	Input signal delay	10 … 80 ms	10 ms	10 ms	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
—	38^{3}	Quick-Stop input level	not used			
3^{4}	38^{4}	Input 1 - level	NC contact [0] NO contact [1]	—	[1]	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
3^{5}	38^{5}	Input 2 - level				
3^{6}	38^{6}	Input 3 - level				
3^{7}	38^{7}	Input 4 - level				
$4^{0...3)}$	$39^{0...3}$	Input 1 - action	No action [0]	—	[0]	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
		NO contact / NC contact	Shutdown without re-start [1]			
		NO contact / NC contact	Shutdown with re-start [2]			
		NO contact / NC contact	Shutdown end position clockwise [3]			
		NO contact / NC contact	Shutdown end position counter-clockwise [4]			
		NO contact / NC contact	Group warning [5]			
		NO contact / NC contact	Manual operation local [6]			
		NO	Emergency start [7]			
		NO	Motor cw [8]			
		NO	Motor ccw (only with RS) [9]			
		NO contact / NC contact	Quick-Stop [11]			
		NO	Trip reset [12]			
		NO	Cold run [13]			

Table D-20: DS131 – Device parameters (Contd.)

GSD byte	DS 131 Byte	Parameters	Value range	Increment	Factory setting	Relevant to
$4^{4...7}$	$39^{4...7}$	Input 2 - action	No action [0]			
		NO contact / NC contact	Shutdown without re-start [1]			
		NO contact / NC contact	Shutdown with re-start [2]			
		NO contact / NC contact	Shutdown end position clockwise [3]			
		NO contact / NC contact	Shutdown end position counter-clockwise [4]			DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
		NO contact / NC contact	Group warning [5]	—	[0]	
		NO contact / NC contact	Manual operation local [6]			
		NO	Emergency start [7]			
		NO	Motor cw [8]			
		NO	Motor ccw (only with RS) [9]			
		NO contact / NC contact	Quick-Stop [11]			
		NO	Trip reset [12]			
		NO	Cold run [13]			

Table D-20: DS131 – Device parameters (Contd.)

GSD byte	DS 131 Byte	Parameters	Value range	Incre-ment	Factory setting	Relevant to
$5^{0...3}$	$40^{0...3}$	Input 3 - action	No action [0]			
		NO contact / NC contact	Shutdown without re-start [1]			
		NO contact / NC contact	Shutdown with re-start [2]			
		NO contact / NC contact	Shutdown end position clockwise [3]			
		NO contact / NC contact	Shutdown end position counter-clockwise [4]			DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
		NO contact / NC contact	Group warning [5]	—	[0]	
		NO contact / NC contact	Manual operation local [6]			
		NO	Emergency start [7]			
		NO	Motor cw [8]			
		NO	Motor ccw (only with RS) [9]			
		NO contact / NC contact	Quick-Stop [11]			
		NO	Trip reset [12]			
		NO	Cold run [13]			

Table D-20: DS131 – Device parameters (Contd.)

GSD byte	DS 131 Byte	Parameters	Value range	Increment	Factory setting	Relevant to
$5^{4...7}$	$40^{4...7}$	Input 4 - action	No action [0]	—	[0]	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
		NO contact / NC contact	Shutdown without re-start [1]			
		NO contact / NC contact	Shutdown with re-start [2]			
		NO contact / NC contact	Shutdown end position clockwise [3]			
		NO contact / NC contact	Shutdown end position counter-clockwise [4]			
		NO contact / NC contact	Group warning [5]			
		NO contact / NC contact	Manual operation local [6]			
		NO	Emergency start [7]			
		NO	Motor cw [8]			
		NO	Motor ccw (only with RS) [9]			
		NO contact / NC contact	Quick-Stop [11]			
		NO	Trip reset [12]			
		NO	Cold run [13]			
—	41^{0}	Input 1 – signal	non-retentive [0] retentive [1]		[0]	DSe, RSe sDSSte/ sDSte, sRSSte/sRSte
—	41^{1}	Input 2 – signal				
—	41^{2}	Input 3 – signal				
—	41^{3}	Input 4 – signal				
—	$41^{4...7}$	Reserved	—			
—	$42^{0...7}$	Enable delay of the brake when starting	not used			
—	$43^{0...7}$	Holding time of the brake when stopping	not used			
—	$44^{0...7}$	Braking time	not used			
—	$45^{0...7}$	Braking torque	not used			
—	$46^{0...7}$	Starting time	0 … 30 s	0.25 s	5 s	sDSSte/ sDSte, sRSSte/sRSte
—	$47^{0...7}$	Coasting down time	0 … 30 s	0.25 s	0 s	sDSSte/ sDSte, sRSSte/sRSte
—	$48^{0...7}$	Starting voltage	20% … 100%	5%	40%	sDSSte/ sDSte, sRSSte/sRSte

Table D-20: DS131 – Device parameters (Contd.)

GSD byte	DS 131 Byte	Parameters	Value range	Increment	Factory setting	Relevant to
—	$49^{0...7}$	Stop voltage	20% … 90%	5%	40%	sDSSte/ sDSte, sRSSte/sRSte
—	$50^{0...7}$	Current limiting value	125% … 600%	3.125%	600%	sDSSte/ sDSte, sRSSte/sRSte
—	$51^{0...3}$	Start type	direct [0] voltage ramp [1] current limitation [4] Voltage ramp and current limit. [5]	—	[0]	sDSSte/ sDSte, sRSSte/sRSte
—	$51^{4...7}$	Coast type	free coasting [0] voltage ramp [1]	—	[0]	sDSSte/ sDSte, sRSSte/sRSte
—	52	Replacement value (byte0)	see PAA	—	[0]	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
—	53	Replacement value (byte1)				
—	54…55	locked	not used			
—	$56^{0...2}$	locked	not used			
—	56^{3}	Status alarm	not used			
—	56^{4}	Update alarm	not used			
—	56^{5}	Process alarm	not used			
3^{0}	56^{6}	Group diagnostics	lock [0] enable [1]	—	[0]	all starters
3^{3}	56^{7}	Response to CPU / master STOP	replacement value [0] override [1]	—	[0]	all starters
—	$57^{0...1}$	Reserved	not used			
3^{1}	57^{2}	Group warning diagnostics	enable [0] lock [1]	—	[0]	DSe, RSe (HF); sDSSte/ sDSte, sRSSte/sRSte
3^{2}	57^{3}	wait for start-up parameter data	no [0] yes [1]	—	[0]	all starters
—	$57^{4...6}$	Secure shutdown group (F-reference)	not used			
—	57^{7}	Reserved	—			
—	58…59	Enable delay of the brake when starting	–2.5…2.5 s	10 ms	0 s	all ….-AA**3** starter
—	60…61	Holding time of the brake when stopping	0 … 25 s	10 ms	0 s	all ….-AA**3** starter

Table D-20: DS131 – Device parameters (Contd.)

1) on device functions_2 and device functions_1 on Page D-26

MLFB	Devicefunctions_2				Devicefunctions_1			
	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9	Byte 10	Byte 11
3RK1304-5KS40-4AA0	0x04	0x00	0x00	0x00	0x99	0x30	0x0C	0x4C
3RK1304-5LS40-4AA0	0x04	0x00	0x00	0x00	0x99	0x30	0x0C	0x4C
3RK1304-5KS40-4AA3	0x04	0x00	0x00	0x00	0x99	0x38	0x0C	0x4C
3RK1304-5LS40-4AA3	0x04	0x00	0x00	0x00	0x99	0x38	0x0C	0x4C
3RK1304-5KS40-2AA0	0x05	0x00	0x00	0x00	0xD9	0x30	0x0C	0x4C
3RK1304-5LS40-2AA0	0x05	0x00	0x00	0x00	0xD9	0x30	0x0C	0x4C
3RK1304-5KS40-2AA3	0x05	0x00	0x00	0x00	0xD9	0x38	0x0C	0x4C
3RK1304-5LS40-2AA3	0x05	0x00	0x00	0x00	0xD9	0x38	0x0C	0x4C
3RK1304-5KS40-5AA0	0x04	0x00	0x00	0x00	0x99	0x31	0x0C	0x4C
3RK1304-5LS40-5AA0	0x04	0x00	0x00	0x00	0x99	0x31	0x0C	0x4C
3RK1304-5KS40-5AA3	0x04	0x00	0x00	0x00	0x99	0x39	0x0C	0x4C
3RK1304-5LS40-5AA3	0x04	0x00	0x00	0x00	0x99	0x39	0x0C	0x4C
3RK1304-5KS40-3AA0	0x05	0x00	0x00	0x00	0xD9	0x31	0x0C	0x4C
3RK1304-5LS40-3AA0	0x05	0x00	0x00	0x00	0xD9	0x31	0x0C	0x4C
3RK1304-5KS40-3AA3	0x05	0x00	0x00	0x00	0xD9	0x39	0x0C	0x4C
3RK1304-5LS40-3AA3	0x05	0x00	0x00	0x00	0xD9	0x39	0x0C	0x4C
3RK1304-5KS70-2AA0	0x05	0x00	0x00	0x00	0xDB	0x52	0x0C	0x4C
3RK1304-5LS70-2AA0	0x05	0x00	0x00	0x00	0xDB	0x52	0x0C	0x5C
3RK1304-5KS70-2AA3	0x05	0x00	0x00	0x00	0xDB	0x5A	0x0C	0x4C
3RK1304-5LS70-2AA3	0x05	0x00	0x00	0x00	0xDB	0x5A	0x0C	0x5C
3RK1304-5KS70-3AA0	0x05	0x00	0x00	0x00	0xDB	0x53	0x0C	0x4C
3RK1304-5LS70-3AA0	0x05	0x00	0x00	0x00	0xDB	0x53	0x0C	0x5C
3RK1304-5KS70-3AA3	0x05	0x00	0x00	0x00	0xDB	0x5B	0x0C	0x4C
3RK1304-5LS70-3AA3	0x05	0x00	0x00	0x00	0xDB	0x5B	0x0C	0x5C

D.7.2 DS134 – Maintenance

Byte	Meaning	Value range / [coding]	Increment	Factory setting
0	Coordination	with startup parameterization: 0x20 writing via C1 channel (PLC) 0x30 writing via C2 channel (PC) with parameterization in operation: 0x21 writing via C1 channel (PLC) 0x31 writing via C2 channel (PC) with parameterization read: 0x00 reading via C1 channel (PLC) 0x00 reading via C2 channel (PC)		
1…7	Reserved	—	—	—
8…11	Maintenance timer- Warning limit value_1	0…4294967295 s	1 s	946080000 (30 years)
12…15	Maintenance timer- Warning limit value_2	0…4294967295 s	1 s	946080000 (30 years)
16…19	reserved = 0			
20…23	reserved = 0			
24	reserved = 0			
25	reserved = 0			
26	reserved = 0			
27	reserved = 0			

Table D-21: DS134 - Maintenance

D.8 I&M data

The following I&M (Identification & Maintenance Function) data are supported by all
ET200pro motor starters supported:

Number	Name	Note
I&M 0	Device identification	Stored by the manufacturer

D.8.1 DS231 - device identification I&M 0 read

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&M 0 - data block 0	
10 … 11	0x002A	MANUFACTURER_ID	42 = manufacturer 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	DSe 0x1011 RSe 0x1012 sDSSte 0x1013 sRSSte 0x1014	PROFILE_SPECIFIC_ TYPE	Addition to object "PRO-FILE_ID"
60 … 61	0x0101	IM_VERSION	I&M version status (01 01hex = version 1.1)
62 … 63	0x0000	IM_SUPPORTED	I&M 0

Table D-22: DS231 - Read device identification I&M 0

Glossary

1L+

(PWR) supply voltage for electronics.

2L+

(CON) supply voltage for contactor control.

Bypass

After the starting operation, the bypass connects the motor directly to the power supply and thus avoids the heat loss in the integrated thyristor modules.

Direct starters

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.

GSD

Device master data

GSDML

The GSDML language is defined by the GSDML schema. A GSDML schema contains validity rules permitting the syntax of a GSD file, for example. GSDML schema (in the form of schema files) ordered by manufacturers of IO devices of PROFIBUS International.

Load group

A group of motor starters supplied by **a single** power bus infeed. A load group can be located within a → potential group or parts of two potential groups.

MDD

The Master Device Description (MDD) represents a complete device description and is used for device integration into software tools (e.g. TIA Portal).

Motor starters; High feature

Motor starters; high feature has the following features:

- Device designations: DSe, RSe
- available with externally powered brake drive
- with 4 digital inputs
- Usable up to 5.5 kW
- Installation widths:110 mm

Motor starters; standard

Motor starters; standard has the following features:

- Device designations: DSe, RSe
- available with externally powered brake drive
- Usable up to 5.5 kW
- Installation widths:110 mm

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.

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.

Index