Manual Edition 07/2003

ecofast

SIEMENS

Motor Starters
High Feature

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ECOFAST

**Motor Starters
High Feature**

Manual

Order Number:
3RK1702-3BB18-1AA0

Edition 07/2003

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. These notices are highlighted in the manual by a warning triangle and are marked as follows according to the level of danger:

Danger

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

Warning

indicates that death, severe personal injury or substantial property damage **can** result if proper precautions are not taken.

Caution

indicates that minor personal injury or property damage can result if proper precautions are not taken.

Caution

indicates that property damage can result if proper precautions are not taken.

Attention

draws your attention to particularly important information on the product, handling the product, or to a particular part of the documentation.

Qualified personnel

Only **qualified personnel** should be allowed to install and work on this equipment. Qualified persons are defined as persons who are authorized to commission, to ground, and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

Correct usage

Note the following:

Warning

This device and its components may only be used for the applications described in the catalogue 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

SIMATIC®, SIMATIC HMI®, ECOFAST® and SIMATIC NET® are brands of SIEMENS AG.
Han-Brid®, Han Q8/0®, Han 10E® are brands of Harting.
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.

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Introduction to the Manual

Purpose

This manual is intended to be used for reference purposes. It shows you how to operate **"ECOFAST Motor Starters High Feature"** with field bus PROFIBUS-DP or AS-Interface. These motor starters **process data records,** such as parameters and diagnosis/statistical data.
"ECOFAST Motor Starters High Feature" are accompanied by **"ECOFAST Motor Starters"**, which **do not process data records.**

These motor starters are described in the "ECOFAST Motor Starter" manual.

Topics

The manual consists of chapters providing instructions for use and that can be used for reference. The following topics are covered:

- System description
- Short commissioning instructions
- Wiring
- Installation
- Commissioning and diagnosis
- Fault handling
- Device functions
- Data formats and data records
- Technical data
- Dimension drawings
- Software Switch ES Motor Starter
- Order numbers
- Glossary

Notes

Notes of special importance are enclosed by two straight lines.

Specifications

This manual only describes the ECOFAST Motor Starter High Feature.
The terms "ECOFAST Motor Starter High Feature",
"ECOFAST Motor Starter" and "Motor Starter" are interchangeable in this manual.
Commands and messages are written differently:
Example: Command: "Motor COUNTER CLOCKWISE"
Message: "Motor counter clockwise"

The term "Switch ES", which refers to the configuration software, is synonymous with "Switch ES Motor Starter".
The motor directions are defined as follows:

- Motor CLOCKWISE:The direction is determined by the line phase sequence.
- Motor COUNTER-CLOCKWISE:The direction is inverted with respect to the line phase sequence.

Setup with motor plugged in and motor nearby:

Han Drive motor connector

Han 10E motor terminal

Mounting plate

Motor plugged in:
Motor starter directly on
the motor

Motor nearby:
Motor starter and motor
connected with cable

Han Drive motor connector,
alternative: terminal block

Han 10E, alternative: free end for connection to
terminal block

Motor connection cable
prefabricated at both ends
alternative: prefabricated at one end and
other end free

Han 10E motor terminal

Fig. 0-1: Setup with motor plugged in and motor nearby

Manuals Motor Starters

Two manuals are available:

- ECOFAST Motor Starters
- ECOFAST Motor Starters High Feature (this manual)

This manual describes motor starters with PROFIBUS DP and AS-i. Both variants may
- be described in one section if they are **virtually identical** (e.g. system description). Any differences are indicated accordingly: PROFIBUS-DP or AS-Interface (AS-i)
- be described in two separate sections when **substantial differences** (commissioning and diagnosis) exist between them. You only need to read the section relating to the variant that you are using.

Attention

In addition to the manuals for the ECOFAST motor starter, you must observe the installation guidelines in the ECOFAST system manual.

Other system manuals

For more information on ECOFAST, see the following system manual:

- System ECOFAST

If you are working with IM 308C and COM PROFIBUS, you will also require the following system manual:

- "Decentralized Peripheral System ET 200"

If you are working with STEP 7, you will also require the following system manual:

- "System Software for S7 300/400 System and Standard Functions Reference Manual"

Correction page

At the end of this manual is a correction page. Please use this page to note down your suggestions for improvements, additional information, or corrections and send the page back to us. In this way, you will help us improve the next edition of this manual.

Motor Starters: Overview

1

1.1 What are ECOFAST Motor Starters?

ECOFAST Motor Starters are part of the ECOFAST system, which unifies the connection technology of all ECOFAST components.

ECOFAST Motor Starters are

- available as reversing starters and soft starters
- suitable for switching and protecting three-phase loads rated at 400 V AC up to 4 kW (mechanical switching) and up to 5.5 kW (soft starter)
- optionally equipped with a 400 V AC brake contact
- available with a PROFIBUS-DP or AS-Interface (AS-i) connection

1.2 Methods of Control

Inching Mode and Latching Mode

The primary method of control is inching mode. This function is executed for as long as the "signal" (e.g. "Motor CLOCKWISE and "Motor COUNTER-CLOCKWISE control commands, digital input signals, etc.) is present.
The secondary method of control is latching mode. When the "signal" (e.g. "Motor CLOCKWISE and "Motor COUNTER-CLOCKWISE control commands, digital input signals, etc.) is present, this function is executed until it is deactivated by another control command.
The following diagram shows the relationship between the switch-off and control functions:
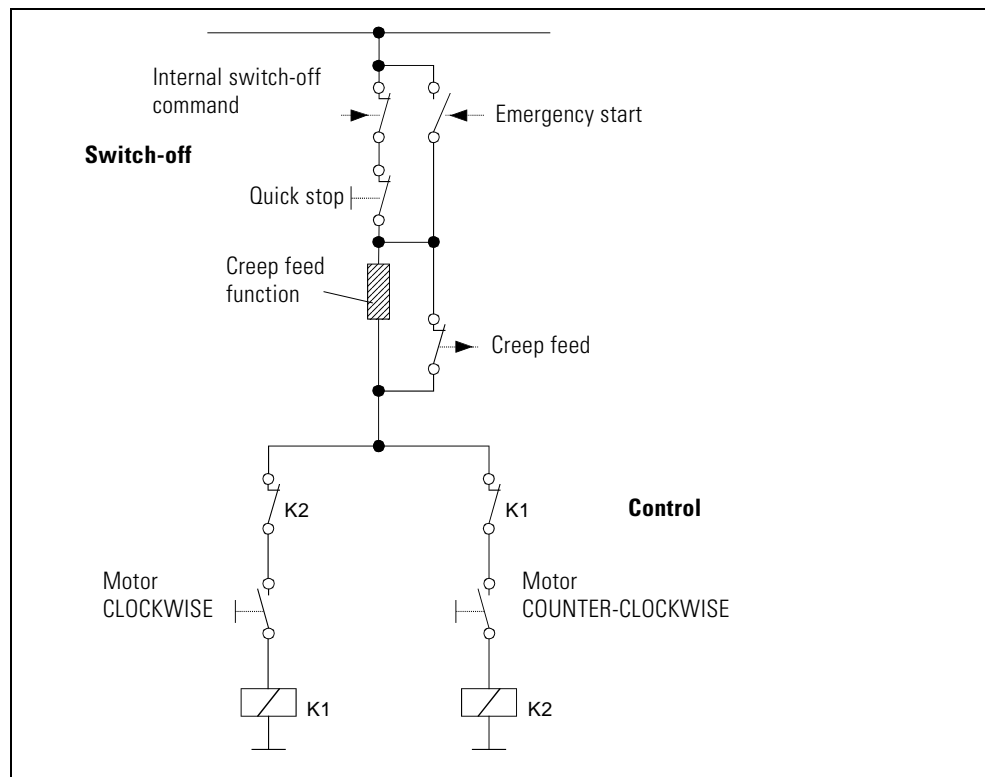
Fig. 1-1: Relationship between the device switch-off and control functions

1.3   Connections and LED Indicators

1.3.1   Connections

Motor Starters with PROFIBUS-DP

ECOFAST Motor Starters with PROFIBUS-DP have the following connections:
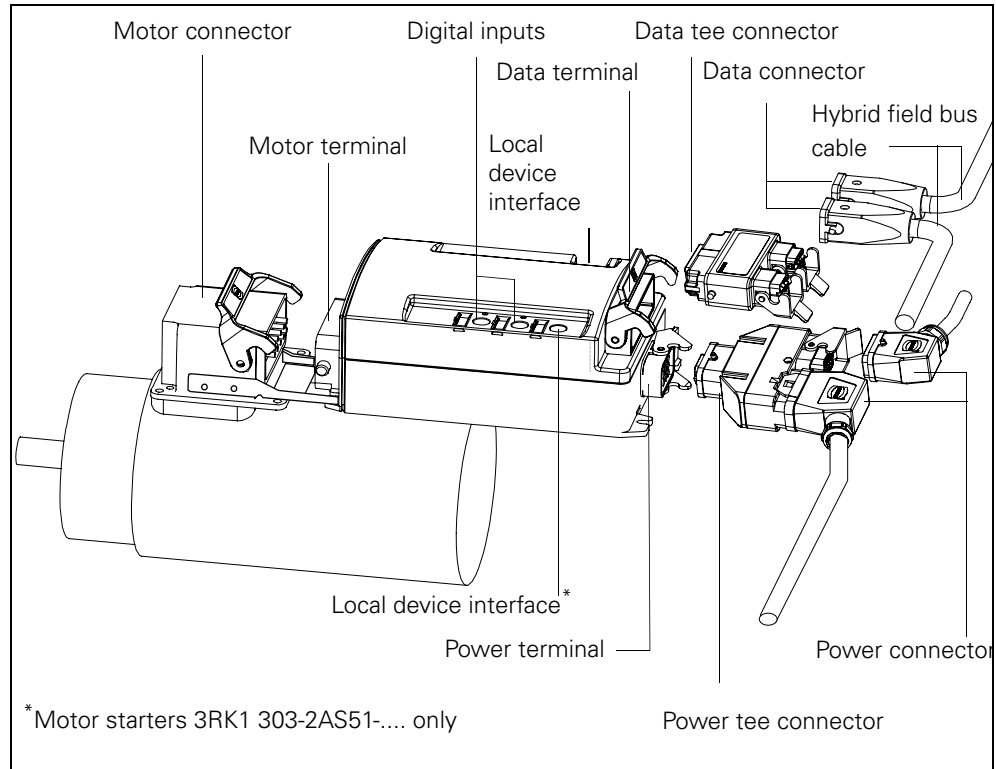
Fig. 1-2: Connections on a motor starter with PROFIBUS-DP

Motor Starters with AS-Interface

ECOFAST Motor Starters with AS-Interface have the following connections:
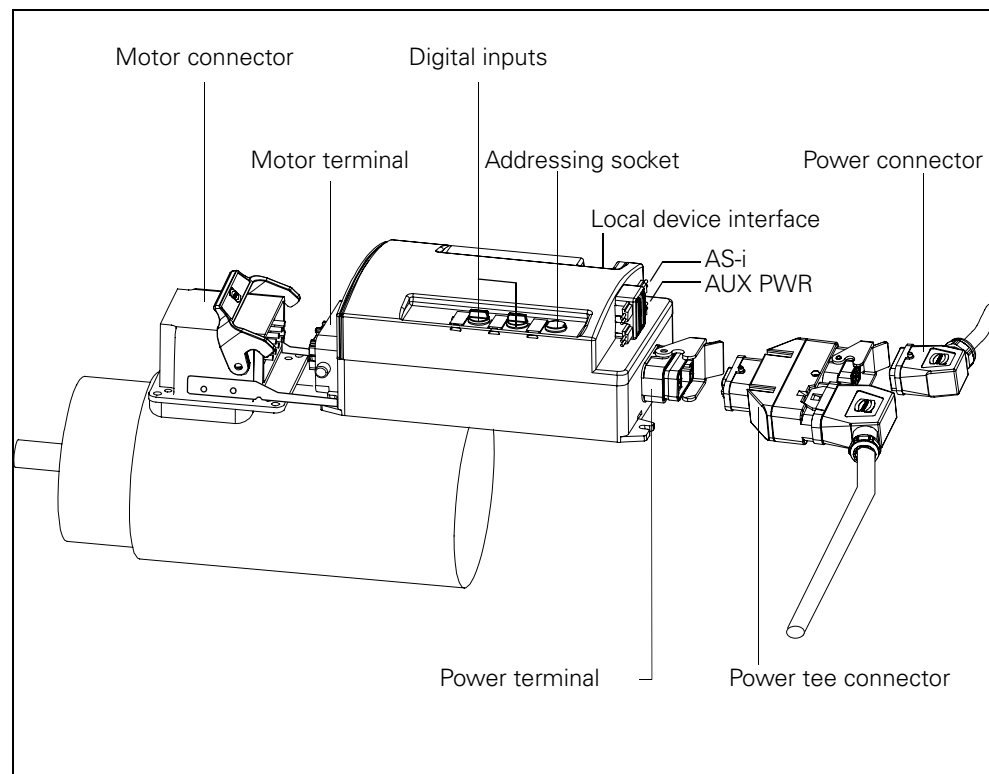
Fig. 1-3: Motor starter connections with AS-Interface

1.3.2   Field Bus Interfaces

Depending on the device version, ECOFAST Motor Starters have the following field bus interfaces:
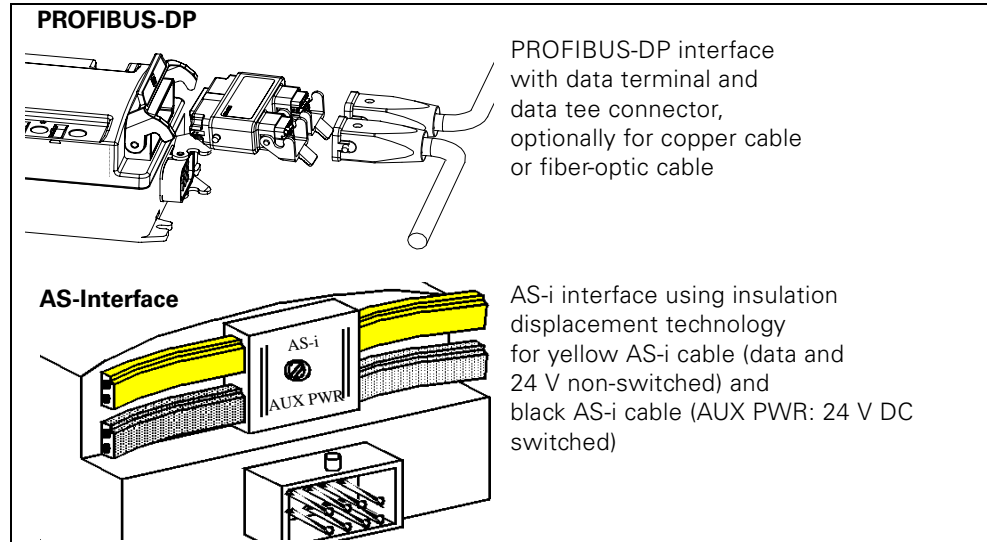
Fig. 1-4: Field bus interfaces

1.3.3   LED Indicators

ECOFAST Motor Starters have the following LED indicators:

PROFIBUS-DP	Description
SF	General fault
BF/RUN	Field bus status
DC24V-NS	24 V DC non-switched
DC24V-S	24 V DC switched
STATE	Switch status
DEVICE	Device status
IN 1/2	Digital input 1/2
IN 2*	Digital input 2

AS-Interface	Description
SF	General fault
AS-i	Field bus status
⌐	24 V DC 24 V DC non-switched (AS-i)
AUX PWR	24 V DC switched
STATE	Switch status
IN 1/2	Digital input 1/2
IN 2*	Digital input 2

*) IN 3/4 Digital Input 3/4
(Duo-reversing soft starters)

Fig. 1-5: LED indicators

1.4 Product Overview

1.4.1 General Notes

High Switching Rates

Attention

If you want to use the motor starter in applications with high switching rates, use motor starters with the "Electronic switching technology" device function.
For more information, see section "Switch Electronically - Reversing Soft Starter" on page B-9

Motor Starters Without Thermal Motor Model (3RK1 3.3-2AS51-....)

⚠ **Warning**

To protect the motor, a temperature sensor (thermistor type A, thermoclick) must be installed, otherwise the motor is unprotected.

1.4.2 Product Overview: Individual Motor Starters and Their Device Functions

PROFIBUS-DP

Order number \ Device function	Local device interface	Response to bus failure	Self-test	Emergency start	Inputs - actions	Asymmetry	Current limits	Thermal motor model	Temperature sensor	Line protection	Control function: revers. st.	Control function: soft starter	Control f.: Speed Controller	Mechanical braking	Electrical braking	Mechanical switch. technology	Electronic switch. technology
3RK1 303-2AS51-1AA0 *)		■							■		■					■	
3RK1 303-2AS51-1AA3 *)		■							■					■			
3RK1 303-5BS41-1AA0	■	■	■						■		■					■	
3RK1 303-5BS41-1AA3	■	■	■						■					■			
3RK1 303-5CS41-1AA0	■	■	■						■			■				■	
3RK1 303-5CS41-1AA3	■	■	■						■			■		■			
3RK1 303-6BS71-1AA0	■	■	■	■	■	■	■	■	■		■						■
3RK1 303-6BS71-1AA3	■	■	■	■	■	■	■	■	■		■			■	■		
3RK1 303-6DS71-1AA0	■	■	■	■	■	■	■	■	■			■					■
3RK1 303-6DS71-1AA3	■	■	■	■	■	■	■	■	■			■		■	■	■	
3RK1 303-6ES81-3AA3	■	■	■	■	■	■	■	■	■	■	■			■	■	■	■
3RK1 303-6FS82-3AA3	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■

> Shaded boxes: Device Function for this order number available
>
> Grey fields: ▒ Description in manual "ECOFAST Motor Starters High Feature"
> Order no. 3RK1702-3AB18-1AA0 (German)
> Order no. 3RK1702-3BB18-1AA0 (English)

Table 1-1: Product overview of motor starters with PROFIBUS-DP

*)

⚠ **Warning**
When you deactivate the "Temperature sensor" device function, the motor is unprotected!
For more information, see section 9.4 "Temperature Sensor" on page 9-9.

AS-Interface

Order number / Device function	Local device interface	Response to bus failure	Self-test	Emergency start	Inputs – actions	Asymmetry	Current limits	Thermal motor model	Temperature sensor	Line protection	Control function: revers. st.	Control function: soft starter	Control f.: speed controller	Mechanical braking	Electrical braking	Mechanical switch. technology	Electronic switch. technology
3RK1 323-2AS51-1AA0									□		□					□	
3RK1 323-2AS51-1AA3									□		□				□		
3RK1 323-5BS41-1AA0	■		■	■	■	■	■				■			■		■	
3RK1 323-5BS41-1AA3	■		■	■	■	■	■				■				■	■	
3RK1 323-5CS41-1AA0	■		■	■	■	■	■				■			■		■	
3RK1 323-5CS41-1AA3	■		■	■	■	■	■				■				■	■	
3RK1 323-6BS71-1AA0	■		■	■	■	■	■	■			■			■			■
3RK1 323-6BS71-1AA3	■		■	■	■	■	■	■			■				■		■
3RK1 323-6DS71-1AA0	■		■	■	■	■	■	■				■		■			■
3RK1 323-6DS71-1AA3	■		■	■	■	■	■	■				■			■		■
3RK1 323-6ES81-3AA3	■		■	■	■	■	■	■		■		■			■		■
3RK1 323-6FS82-3AA3	■		■	■	■	■	■	■					■		■		■

Grey fields:	■	Description in this manual "ECOFAST Motor Starters High Feature" Order no. 3RK1702-3AB18-1AA0 (German) Order no. 3RK1702-3BB18-1AA0 (English)
Light-grey fields:	□	Description in manual "ECOFAST Motor Starters" Order no. 3RK1702-2GB18-0AA0 (German/English)

Table 1-2: Product overview of motor starters with AS-Interface

Short Commissioning Instructions for PROFIBUS-DP

2

Introduction

The following example provides you with a simple step-by-step guide to commissioning a motor starter.

- Installation and wiring
- Configuration with STEP7 using the DMD file
- Integration in the user program
- Switch-on

In this example, you can choose whether or not you want to loop through the power.

You can either install the motor starter near the motor (with cable), or plug it in to the motor directly (with mounting plate) as shown in the example.

Prerequisites

- You have set up a supply module with an integrated S7 Station with CPU315-2 DP.
- STEP7 (V 5.1 or higher + Hotfix 2) has been fully installed on your PG.
- You are familiar with STEP7.
- The PG is connected to the DP Master.

Required components

The following table shows you the components you need in this example:

Item	Ordering data	Order number
1	Motor starter, setting range 0.3 A - 9 A (4 kW), PROFIBUS-DP, temperature sensor, mechanical switching, no brake	3RK1 303-2AS51-1AA0
2	Power & control module (infeed module) PROFIBUS S7-300 (master)	4FB2 111-2AE01-0AA0
2	Mounting plate with screws for motor starter	3RK1 911-3AA00
3	**Option for looping through power with the power tee connector:** Power cable Han Q8/0 pin/power tee connector 3 m, 5 x 4 mm^2	3RK1 911-0BB20
	Screw cap	3RK1 902-0CK00
	No looping through of power: Power cable Han Q8/0 pin/Han Q8/0 socket 3 m, 5 x 4 mm^2	3RK1 911-0BC20
4	Hybrid field bus cable for PROFIBUS-DP Cu, 3 m	6XV1 830-7BH30
5	Data tee connector PROFIBUS-DP Cu	3RK1 911-2AG00
6	Terminating connector for PROFIBUS-DP	3RK1 911-2AK00

Table 2-1: Required components

Diagram

The following diagram illustrates the example:
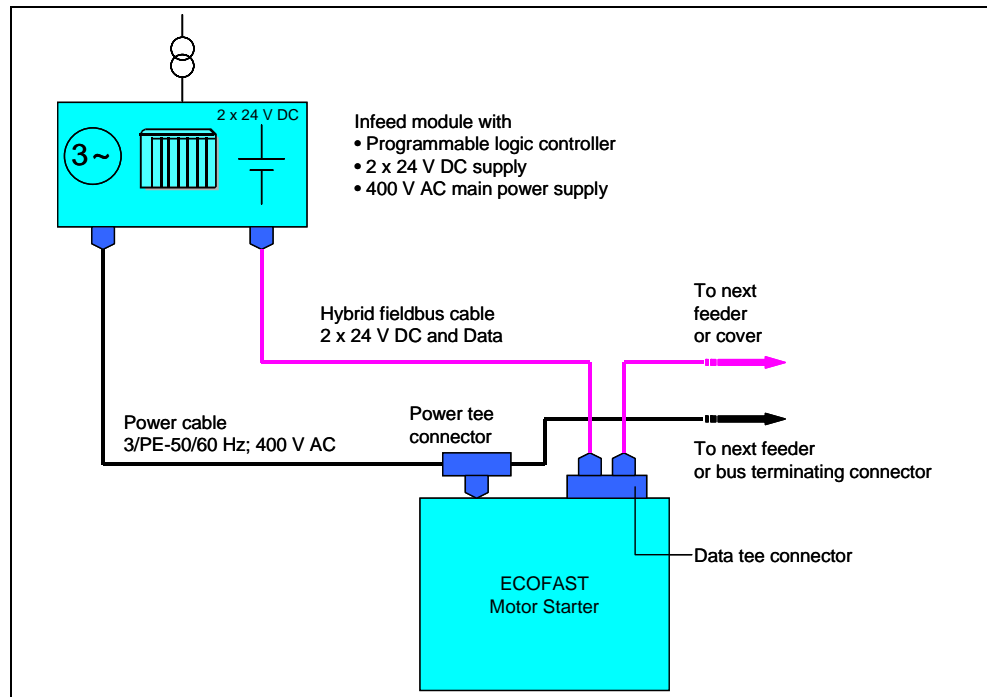
Fig. 2-1: Diagram for example

Set-up

The following diagram illustrates the set-up for the example:
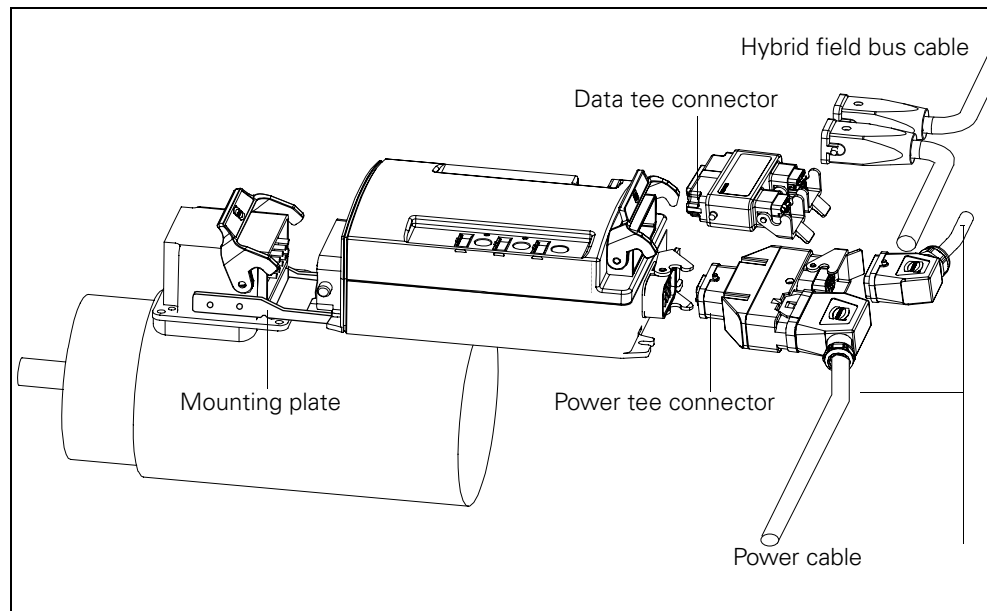
Fig. 2-2: Set-up for the example

Installation and Wiring

⚠️ **Warning**
HAZARDOUS VOLTAGE! CAN CAUSE ELECTRICAL SHOCK AND BURNS.
DISCONNECT POWER BEFORE PROCEEDING WITH ANY WORK ON THIS
EQUIPMENT!

Refer to the information in the operating instructions.
To install the motor starter, carry out the following steps:

Step	Description
1	Set the PROFIBUS-DP address either • with the identification connector (order no. 6ES7 194-1KB00-0XA0). For more information, see the operating instructions and chapter 4 "Installing Motor Starters with PROFIBUS-DP" on page 4-1. • or using the appropriate software, such as Switch ES (order no. 3RK1 803-2BF04-0FA0)
2	Screw the mounting plate onto the motor (motor connector).
3	Place the motor starter on the mounting plate. Push the motor starter into the motor connector. Secure the connection with the locking device.
4	**The power is to be looped through at a later stage:** Connect the power tee connector of the power cable to the power terminal on the motor starter. Secure the connection with the locking device. Seal the second terminal on the power tee connector with the screw cap. **The power is not to be looped through:** Connect the power cable to the power terminal on the motor starter. Secure the connection with the locking device.
5	Connect the Han Q8/0 pin power terminal to the supply module. Secure the connections with the locking device.
6	Connect the data tee connector to the data terminal on the motor starter. Secure the connection with the locking device.
7	Connect the hybrid field bus cable on the data tee connector and supply module. Secure the connections with the locking devices.
8	Connect the terminating connector to the last load feeder (non-assigned connection on the last data tee connector). Secure the connection with the locking device.

Table 2-2: Installing the motor starter

Commissioning

Step	Description
1	Switch on the supply voltage for the DP Master CPU 315-2 DP on the supply module.
2	Note the status LEDs of the DP Master CPU 315-2 DP in the supply module: DC 5 V : lights up SF DP : off BUSF : flashes

Table 2-3: Commissioning

Configuration with the device master data (DMD) in STEP7

Step	Description
1	Start the SIMATIC manager and create a new project with a DP Master (e.g. CPU 315-2 DP with DI16xDC24V and DO16xDC24V). Generate the OB1 and OB82 for the project.
2	Integrate the DMD file for the motor starter in the configuration tool of the DP Master you are using (in the CPU315-2 example, you can install either the German DMD file (SIEM80AF.GSG) or the English DMD file (SIEM80AF.GSE) in the STEP7 SIMATIC manager).
3	Generate the PROFIBUS subnetwork.
4	In the hardware configuration, connect the PROFIBUS subnetwork to the DP Master.
5	From the hardware catalog, add the motor starter on the PROFIBUS by choosing: **Other Field Devices** > **Switching Devices** > **Motor Starters** > **ECOFAST**.
6	Set PROFIBUS address 3 (or higher) for the motor starter.
7	From the "Select Target Configuration" menu, which opens automatically, select the required motor starter. The table configuration could appear as follows: | Slot	Module/ DP ID	Order number	Input address	Output address	Comment
------	------	------	------	------	------
1	192	3RK1 303-2AS51-1AA0	2[*]	2[*]		 Open the "DP Slave Properties" dialog by double-clicking it.
8	Click **Parameterize**. Set the parameters, e.g. • Rated normal current • Click **OK**. This completes the configuration.
9	Save the configuration.

Table 2-4: Configuration with the device master data (DMD)

Integration in the user program

Step	Description

1	Create the user program in the KOP/AWL/FUP editor in OB1.
	Example: Reading an input and setting an output:
	
	`OB1 : Title:`
	
	`Comment:`
	
	`Network 1: Title:`
	`Copy cyclicly the central DI (switches)to the`
	`decentralized motor starter (=PIQ)`
	`Output cyclicly the PII to the central outputs DO (LED)`
	
	`    L    I    0            //  PIQ: Read switches 0-7 (DI16xDC24V)`
	`    T    Q    2            //  and output to motor starter`
	`                           //  IB0.0   Motor CW`
	`                           //  IB0.1   Motor CCW`
	`                           //  IB0.2   0`
	`    L    I    2            //  Read PII from motor starter`
	`    T    Q    0            //  and output to DO16x24VDC`

2	Save the project in the SIMATIC manager.
3	Load the configuration to the DP Master.

Table 2-5: Integration in the user program

Switch-on

Step	Description
1	Switch on the supply voltage (supply module) for the motor starter.
2	Note the status LEDs on the DP Master CPU 315-2 DP: DC 5 V : lights up GF DP : off BUSF : off
3	Note the status LEDs on the motor starter: GF : off BF/RUN : lights up green DC24V-NS: lights up green DC24V-S : lights up green STATE : off DEVICE : lights up green IN.1 : off IN.2 : off

Table 2-6: Switch-on

ECOFAST Motor Starters High Feature

Wiring and Interfaces

<div style="text-align: right">

3

</div>

⚠️ **Warning**
Hazardous voltages! These may cause electric shock and burns.
Disconnect the system and device from the supply before starting work.

⚠️ **Danger**
Ensure that the wiring is carried out carefully and correctly. Otherwise motor starters may be destroyed. There is potentially **lethal danger!**

⚠️ **Caution**
Note that star jumpers are already wired in the motor starter.

3.1 Securing Plug in Connections that are not Safe Against Finger Touch When Using Duo-Reversing Soft Starters

Danger

Hazardous voltage caused by Duo-Reversing Softstarters!

Discharge time: 5 minutes

Protect plug connection after locking with enclosed cable fastener against unauthorized access!

The Capacitors of the Duo-Reversing Softstarter DC Link and EMC Filter remain charged for a period of 5 minutes after switching off of the power supply.

During this period, DO NOT disconnect the Duo-Reversing Softstarter power connector, as there is a danger of electric shock from contact with the connector pins.

The power connectors must therefore be interlocked to prevent inadvertent disconnection and contact with the connector pins.

If the Duo-Reversing Softstarter is used in systems incorporating multiple connectors, it must also be ensured that ALL connector positions are protected against inadvertent disconnection and contact and hold a label warning of transmission of dangerous voltages across the power cable network.

Securing the plug-in connections

Secure the plug-in connections as shown in the diagram below:
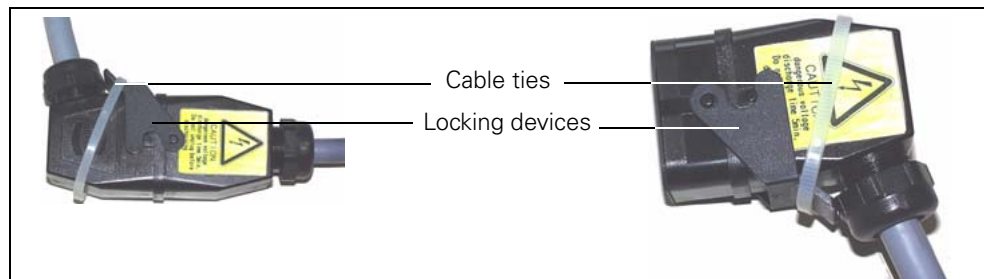
Fig. 3-1: Securing the plug-in connections against unauthorized access

Cable ties are enclosed with all prefabricated power cables and a warning label is affixed to the connectors.

Note on power cables prepared by the customer

Note

Please note that you must also secure the plug-in connections of customer-prepared power cables in an appropriate way!

Cable ties and warning labels are not included in the delivery package of individual power connectors!

3.2 Wiring Rules

⚠️ **Warning**
Hazardous voltages! These may cause electric shock and burns
Disconnect the system and device from the supply before starting work.

3.2.1 Selecting the power leads

The core cross-section of the power leads must be matched to the respective ambient conditions. The decisive factors for choosing the core cross-section are as follows:
- set current on the device
- method of installation
- ambient temperature
- type of material (PVC, rubber)

For PVC power leads installed in a cable duct, for example, the maximum current carrying capacity as a function of ambient temperature is as follows:

$\varnothing$ $\quad$ T_U	30 °C	40 °C	45 °C	50 °C	55 °C
1.5 mm^2	14 A	12.2 A	11.1 A	9.9 A	8.5 A
2.5 mm^2	19 A	16.5 A	15.0 A	13.5 A	11.6 A
4.0 mm^2	26 A	22.6 A	20.5 A	18.5 A	15.9 A

Observe the following rules when carrying out wiring:

Rules for flexible cables		Data	
Current carrying capacity of the plug connection as a function of the connectable core cross-sections and ambient temperature		$T_u =$ 55 °C	40 °C
	1.5 mm^2 2.5 mm^2 4.0 mm^2	12 A 20 A 30 A	15 A 25 A 35 A
Permissible outer diameter of the cable sealing insert	green red white	7.0 to 10.5 mm 9.0 to 13.0 mm 11.5 to 15.5 mm	
Length of insulation to strip from cores		8 mm	
Length of insulation to strip from cable sheath		20 mm	

Table 3-1: Rules for wiring

3.2.2 Unused Connections

Close off unused connections with screw caps; this is the only way of ensuring degree of protection IP65. Order number 3RK1902-0**CJ**00 (10 screw caps) or 3RK1902-0**CK**00 (1 screw cap)

3.3 Power Cables and Motor Connection Cables Prefabricated at One End

Description

Power cables and motor connection cables prefabricated at one end are available in different lengths (see appendix for order numbers). One end of the cable is fitted with a power plug connector with pins. The other end is free. Here, you can strip the cores and, for example, attach a plug connector or terminal block.

Numbers are printed on the cores for identification purposes.
The core number/pin assignments are specified in the following two sections.
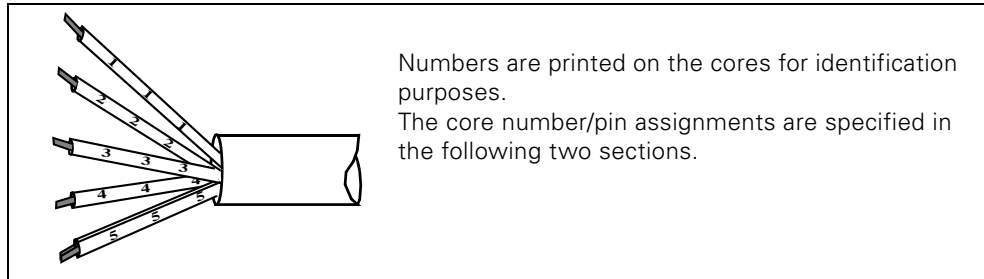
Fig. 3-2: Numbers printed on the cable cores

3.3.1 Power Cables Prefabricated at One End with Han Q8/0 Pin

Pin	Core no.	Assignment
1	1	Neutral N
2	3	Phase L2
3	—	—
4	5	24 V DC
5	6	0 V DC
6	4	Phase L3
7	—	—
8	2	Phase L1
⏚		PE (yellow/green)
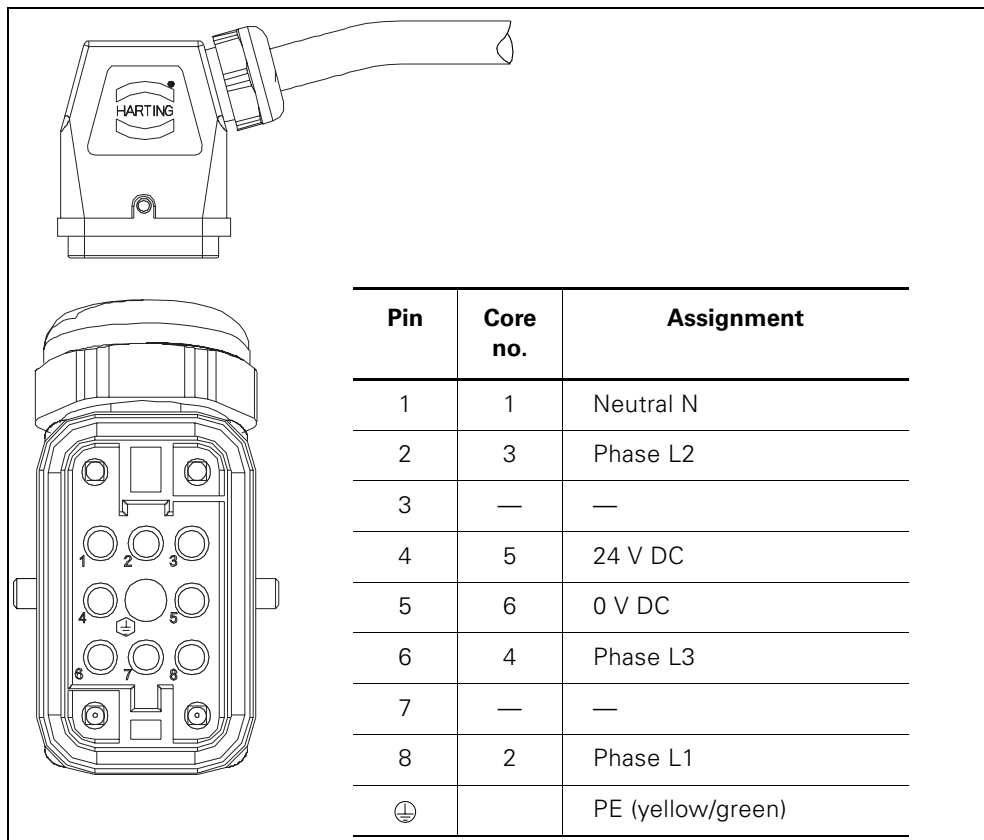
Fig. 3-3: Power cables prefabricated at one end with Han Q8/0 pin

3.3.2 Power Cables Prefabricated at One End with Han 10E Pin

Pin	Core no. (7-core)	Core no. (11-core)	Assignment
1	1	1	Phase L1
2	2	2	Phase L2
3	3	3	Phase L3
4	—	4	Brake (reference potential)
5	—	5	Brake
6	4	6	Winding terminal W2
7	5	7	Winding terminal U2
8	6	8	Winding terminal V2
9	—	9	Temperature sensor (terminal a)
10	—	10	Temperature sensor (terminal b)
⏚			PE (yellow/green)
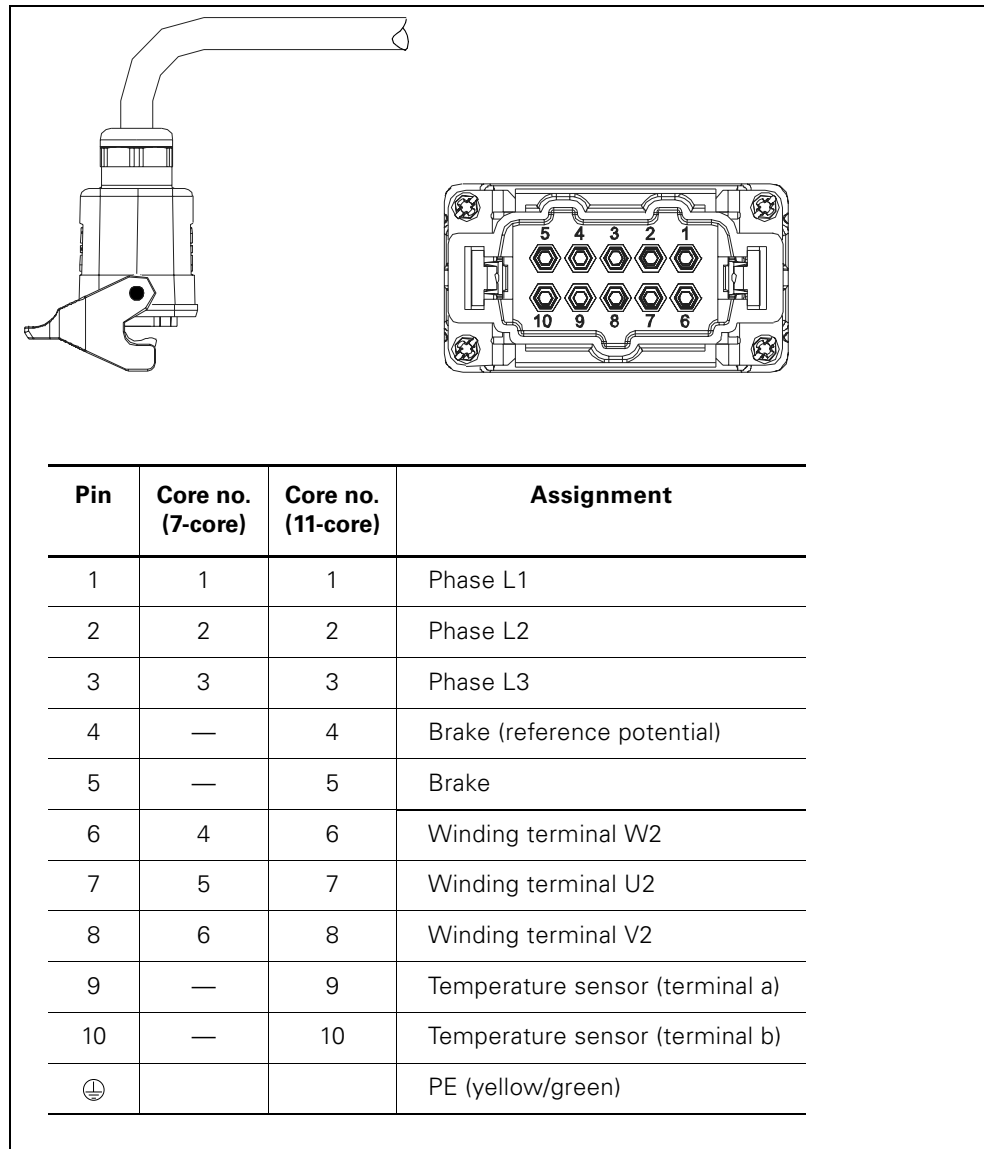
Fig. 3-4: Power cables prefabricated at one end with Han 10E pin

3.4 Motor Terminal (Han 10E)

Notes

Danger

Ensure that the wiring is carried out carefully and correctly. **The temperature sensor terminals must not be connected to 400 V AC.** Otherwise motor starters may be destroyed. There is potentially **lethal danger!**
For this reason, the motor line must be laid in such way that the cable cannot get jammed or squashed!

Caution

Safe separation between 400 V AC and 24 V DC is only guaranteed on a motor with safe separation of the temperature sensor circuit with respect to the stator winding.

Attention

With duo-reversing soft starters, shielded power cables must be used if the starter is to be located near the motor!

3.4.1 Pin assignment

Pin	Assignment
1	Winding terminal U1
2	Winding terminal V1
3	Winding terminal W1
4	Brake (reference potential)
5	Brake
6	Winding terminal W2
7	Winding terminal U2
8	Winding terminal V2
9	Temperature sensor (terminal a)
10	Temperature sensor (terminal b)
⊕	Earthing screw: PE
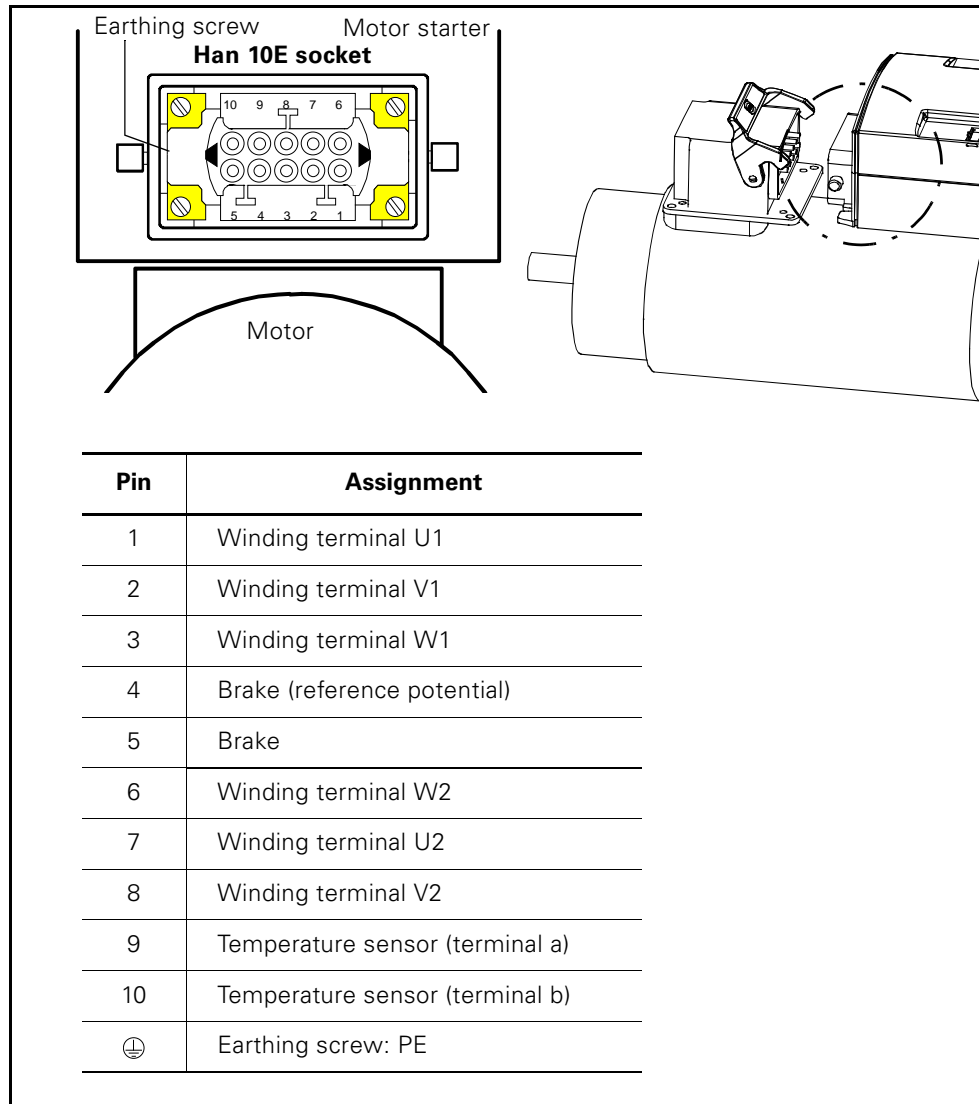
Fig. 3-5: Pin assignment for motor terminal

3.4.2 Prefabricating Motor Connection Cables

Accessories

When you are preparing motor connection cables, you need a crimping tool (soldering is possible as an alternative) and the accessories listed in the table.

Motor connection cables with Han 10E

For connecting the motor starter to the motor you need:	
A flexible Cu cable 7 x 1.5 mm^2/4 mm^2 (6 winding ends) 11 x 1.5 mm^2/4 mm^2 (6 winding ends + brake + temperature sensor)	
Han 10E pin in the coupler housing low PG 16 or Han 10E pin in the coupler housing high PG 21	3RK1 911-2BK00 3RK1 911-2BL00
If Han 10E available on motor: Han 10E socket in the socket housing low PG 16 or Han 10E socket in the socket housing high PG 21	 3RK1 911-2BM00 3RK1 911-2BN00

Table 3-2: Prefabricating connecting leads with Han 10E

⚠️ **Motor starter with brake contact/temperature sensor leads**

The leads for the main power for the motor, the two leads for the brake and the two leads for the temperature sensor are run to the motor starter via common cables and connectors. If cables are pinched or crushed there is a risk of voltage transfer.

To ensure safe separation between the 400 V AC main power and the 24 V DC for the temperature sensor circuit in accordance with IEC 60947-1, the insulation between the motor winding and the temperature sensor in the motor must satisfy the requirements for safe separation.

The 400 V power supply for the motor and the 24 V DC power supply for the brake are taken over common cables and plug connectors to the loads. If the cables are pinched, there is a risk of voltage transfer.
That is why loads with degree of protection "Extra-low voltage" must not be connected to the brake circuit.
As safeguard against "accidental voltage transfer", the supply voltage for the brake must be taken from a separate power supply unit with safe electrical isolation (PELV).
The brake must **not** be fed from the power supply unit for the 24 V auxiliary circuit (AUX PWR, black cable).

3.5   Power Terminal (Han Q8/0)

Notes

Caution

The supply voltage for the 24 V DC brake (optional) must be drawn from a power supply unit with safety separation (PELV) in order to safeguard against accidental voltage transfer in the event of a fault.
It is, therefore, not permissible to connect any loads with the "extra-low voltage" degree of protection to the braking circuit.

Caution

The brake must **not** be fed from the power supply unit of the 24 V DC switched supply (AUX PWR, black AS-i cable).

⚠ **Danger**

Dangerous residual voltage from the duo-reversing soft starter!
Discharge time: 5 minutes.
Use cable ties to lock the plug-in connections and secure against unauthorized access!
For more information, see section 3.1 "Securing Plug in Connections that are not Safe Against Finger Touch When Using Duo-Reversing Soft Starters" on page 3-3.

3.5.1 Pin assignment

Pin	Assignment
1	Neutral N
2	Phase L2
3	–
4	Brake 24 V DC (optional)
5	Brake 0 V DC (optional)
6	Phase L3
7	–
8	Phase L1
⏚	PE
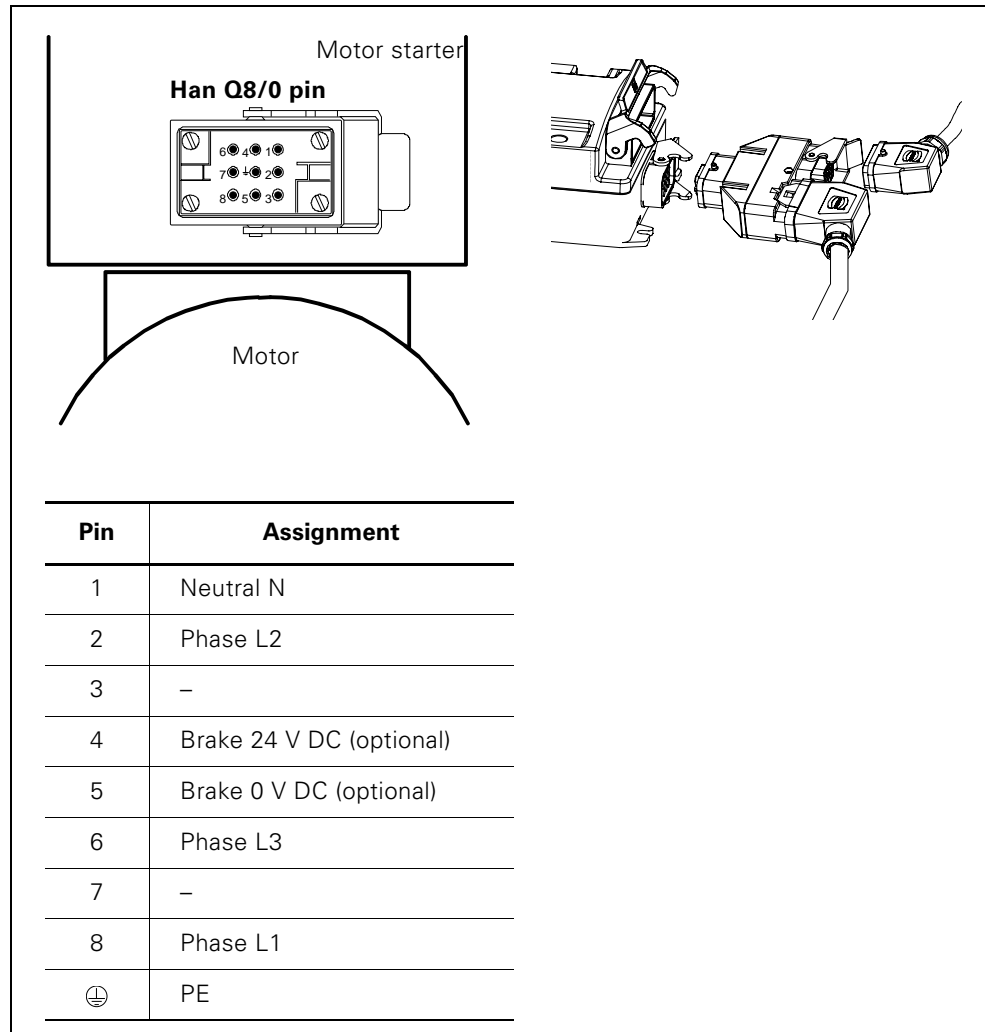
Fig. 3-6: Pin assignment for power terminal

3.5.2 Prefabricating Power Cables

Accessories

When you are preparing power cables, you need a crimping tool (soldering is possible as an alternative) and the accessories listed in the table.

Power cables with Han Q8

You need ...	
for connecting the main power on the motor starter/ power tee connector:	**for looping through the main power from the power tee connector:**
A flexible Cu cable 4 x 2.5 mm^2/4 mm^2 (3 conductors + PE) 6 x 2.5 mm^2/4 mm^2 (3 conductors + PE + brake)	
Power connector Han Q8/0 socket	Power connector Han Q8/0 pin
• 2.5 mm^2: 3RK1 902-0**CA**00 • 4.0 mm^2: 3RK1 902-0**CB**00	• 2.5 mm^2: 3RK1 902-0**CC**00 • 4.0 mm^2: 3RK1 902-0**CD**00

Table 3-3: Preparing connecting leads with Han Q8/0

Han Q8/0 power connectors

The power connectors belonging to a power tee connector and to the motor starter consist of the following components:
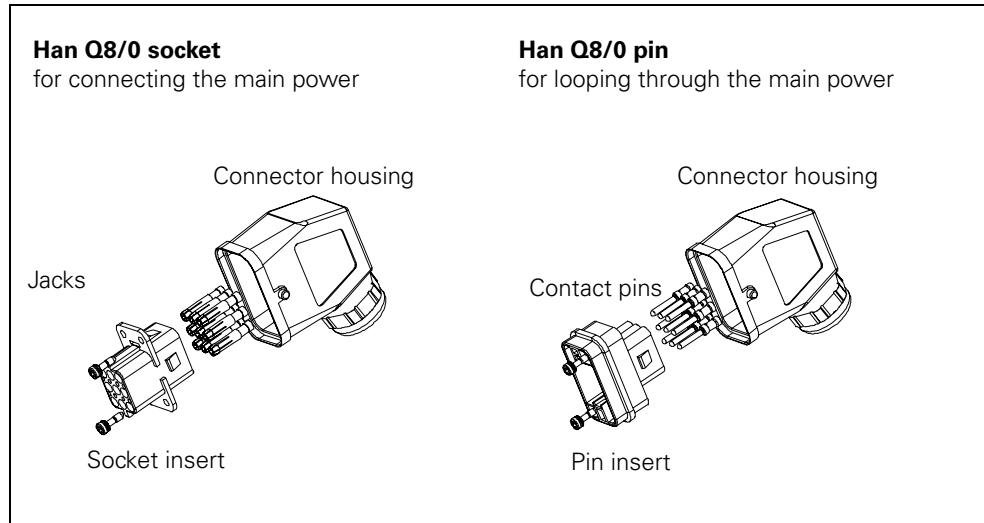
Fig. 3-7: Han Q8/0 power connector

Assembling and wiring power connectors

Assemble and wire the power connectors according to the following instructions:

Step	Procedure
1	Guide the cable through the heavy-gauge threaded joint, the matching enclosed sealing ring in each case and the connector housing.
2	Attach the jacks/contact pins to the strands
3	Push the jacks/contact pins into the socket insert/pin insert until they snap into place.
4	Pull the cable back and screw the insert in place in the connector housing with the enclosed screws.
5	Screw the heavy-gauge threaded joint tight.

Table 3-4: Assembling and wiring power connectors

3.6 Power Tee Connectors

Definition

Power tee connectors connect motor starters to the power bus. The power bus is not interrupted when the motor starter is unplugged.

Pin assignment

Pin	Assignment
1	Neutral N
2	Phase L2
3	–
4	Brake 24 V DC
5	Brake 0 V DC
6	Phase L3
7	–
8	Phase L1
9	PE
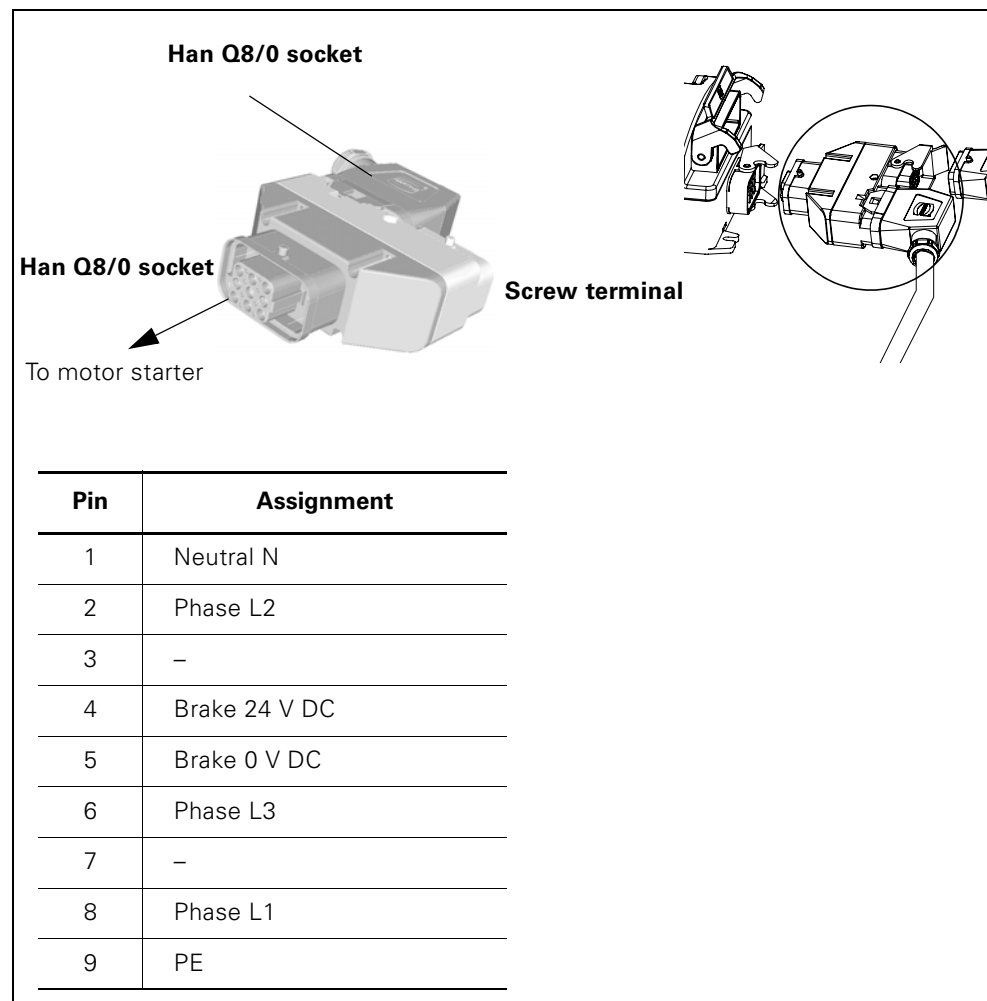
Fig. 3-8: Pin assignment for power tee connector

3.7 Digital Inputs

Definition

The motor starter has 2 or 4 digital inputs (Duo reversing soft starter), which you can connect directly to sensors (PNP) using 2-wire and 3-wire technology.
M12, 5-pole plug connectors are used for this.
M12, 5-pole jacks are fitted on the motor starter.

Pin assignment

The pin assignment is arranged in accordance with the standardized Y- and Y2 assignment and the examples for 2- and 3-wire circuits:
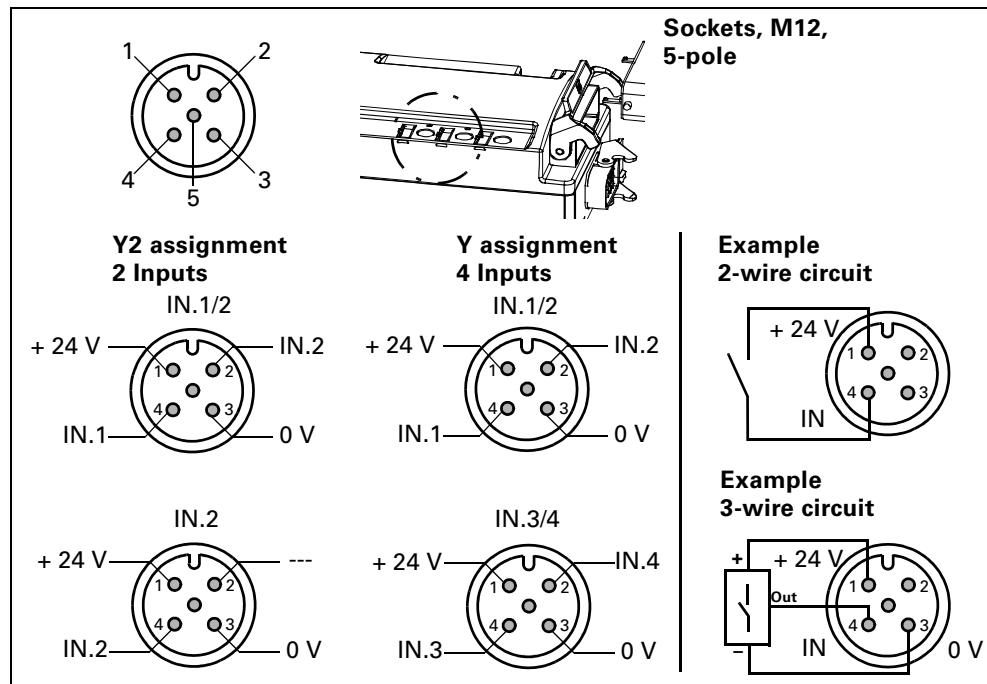
Fig. 3-9: Pin assignment digital inputs with circuit examples

Attention
The digital inputs are short-circuit-proof. The current is limited to a maximum of 200 mA. In the event of a short-circuit or overloading of the sensor supply, the switching element (motor) and brake output are deactivated and a general fault is issued. You must acknowledge this fault with trip reset.

Attention
Do not use an external power supply because otherwise there will be a risk of short-circuits.

3.8 AS Interface

3.8.1 Connection Techniques

The following AS-i cables are used:

- Yellow AS-i cable for AS-i communication and non-switched 24 V DC auxiliary power for supplying sensors and electronics
- Black AUX PWR AS-i cable for switched 24 V DC auxiliary power for supplying actuators (PELV - must be grounded!)

Schematic arrangement

The diagram below shows the position and coding of the AS-i cables on the motor starter:
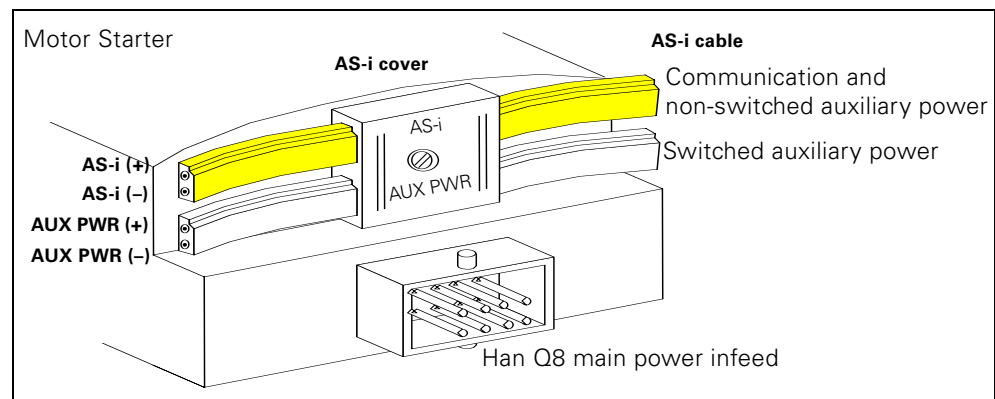
Fig. 3-10: AS interface

Contacting

The AS-i cables are contacted automatically using the insulation piercing method when the AS-i cover is screwed on.
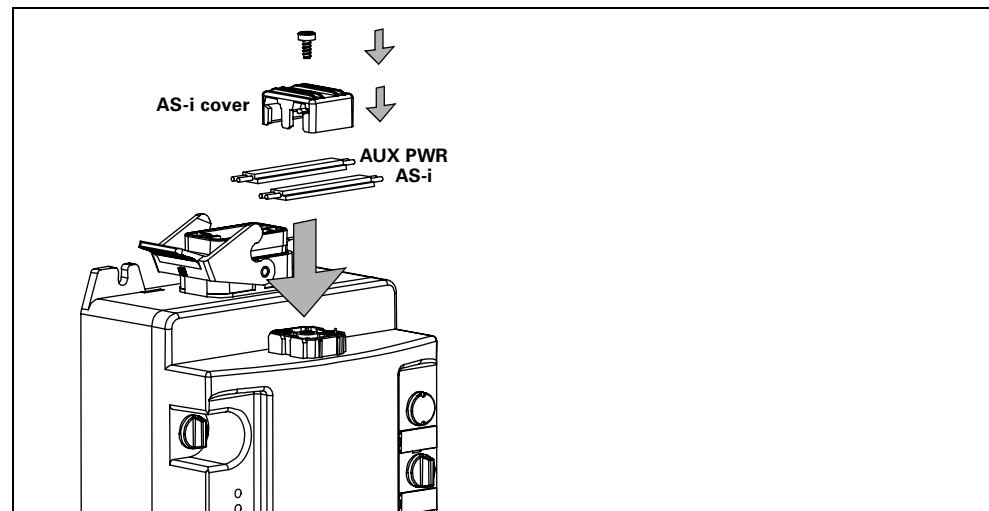
Fig. 3-11: Contacting the AS-i cables

3.8.2 Response in the Event of Power Failure

24 V DC voltage supply (AS-i) non-switched (yellow AS-i cable)

This voltage is constantly available. It is required for:
– supplying the electronics in the motor starter
– interrogating the auxiliary contacts

The voltage is not disconnected in the event of an emergency stop or safety shutdown.

Response to undervoltage (24 V DC < 18.5 V) and power failure:

• In the event of prolonged undervoltage or power failure > 20 ms, the switching elements and the brake output are disconnected.

• When the supply is restored, the disconnection command and the associated signal bits and error bits are acknowledged automatically.

24 V DC voltage supply (AUX PWR) switched (black AS-i cable)

This voltage is not constantly available. It is only required for:
– driving the switching elements, e.g. a contactor

The voltage can be disconnected in the event of an emergency stop or safety shutdown (category 1 according to EN 954-1), so that all switching elements are safely disconnected with the connected motors.

Response to undervoltage (24 V DC < 18.5 V) and power failure:

• In the event of prolonged undervoltage or power failure > 20 ms, the switching elements and the brake output are disconnected.

• When the supply is restored, the disconnection command and the associated signal bits and error bits are acknowledged automatically.

3.9   Addressing Socket for AS-Interface

Description

The addressing socket is used for addressing with a device such as the addressing and diagnostic unit. This is connected to the addressing socket with the connecting lead.
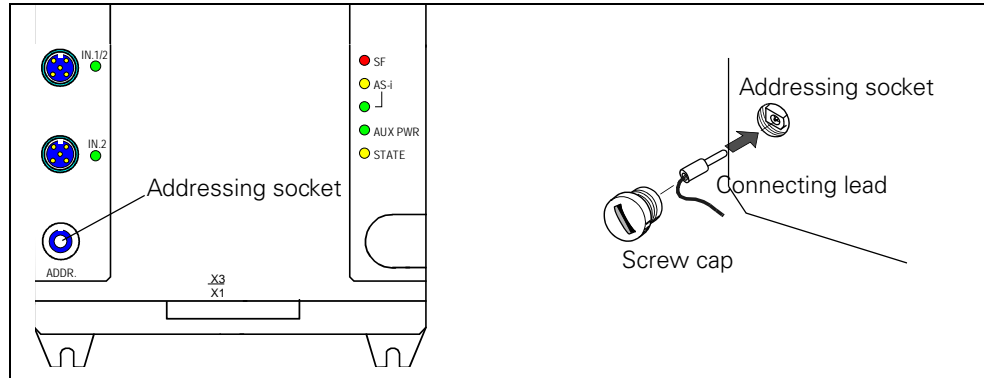
Fig. 3-12: Addressing socket

3.10 Data Tee Connector for PROFIBUS-DP

Definition

Data tee connectors connect the components of an automation system with

- PROFIBUS-DP
  Two data tee connectors are available in the ECOFAST system:
    - With a copper cable (PROFIBUS-DP Cu)
    - With an optical-fiber cable (PROFIBUS-DP optical-fiber cable)
- Non-switched supply voltage 24 V DC (DC24V-NS)
- Switched supply voltage 24 V DC (DC24V-S)

24 V DC voltage supply non-switched

This voltage is required for

- supplying the electronics in the motor starter
- interrogating the auxiliary contacts

This voltage is not switched off when the EMERGENCY OFF command is issued or as a result of a safety shutdown, thereby ensuring that the system can always communicate with the motor starter.

Response to undervoltage (24 V DC < 18.5 V):

- During a prolonged period of undervoltage (> 20 ms), the switching elements and the brake output are switched off.
  The signaling bit "Electronics supply voltage too low" and the error bits F24 and F17 are set.
- If the voltage is restored without a previous loss of power, the switch-off command and the accompanying signaling and error bits are acknowledged automatically.

Response to loss of power (24 V DC < 3 V):

- All the switching elements and the brake output are switched off. No message is generated to indicate the loss of power.
- When the voltage is restored, the switch-off command is acknowledged automatically.

24 V DC voltage supply switched

This voltage is required for

• controlling the switching elements (e.g. contactor)

This voltage can be switched off when the EMERGENCY OFF command is issued or as a result of a safety shutdown (switch-off category 1). All the switching elements can then be switched off safely with the connected motors.

Response to undervoltage (24 V DC < 18.5 V):

• During a prolonged period of undervoltage, (> 20 ms) the switching elements and the brake output are switched off. The signaling bit "No switching element supply voltage" and error bits F24 and F17 are set.

• If the voltage is restored without a previous loss of power, the switch-off command and the accompanying signaling and error bits are acknowledged automatically.

Response to loss of power (24 V DC < 3 V):

• All the switching elements and the brake output are switched off. The signaling bit "No switching element supply voltage" and error bits F24 and F17 are set.

• When the voltage is restored, the switch-off command and the accompanying signaling and error bits are acknowledged automatically.

Pin assignment

On the motor starter::
SUB-Dfemale connector, 25-pole

Data tee connector PROFIBUS-DP Cu

Pin Input

Socket Output

Pin	Assignment	Colour*)
1	+24 V DC non-switched	black 1
2	0 V DC non-switched	black 2
3	0 V DC switched	black 3
4	+24 V DC switched	black 4
A	Line A field bus	green
B	Line B field bus	red
⏚	Shield field bus	-

Data tee connector PROFIBUS-DP optical-fiber cable

Pin Input

Socket Output

Pin	Assignment	Colour*)
1	+24 V DC non-switched	black 1
2	0 V DC non-switched	black 2
3	0 V DC switched	black 3
4	+24 V DC switched	black 4
TD	optical-fiber cable field bus - sender	see fig. below
RD	optical-fiber cable field bus - receiver	see fig. below

*) Core colour of Hybrid field bus cable DESINA

Assignment optical-fiber cable field bus

Data connector (Pin)

optical-fiber cable field bus

Data connector (Socket)

Fig. 3-13: Pin assignment for the data tee connector/core assignment

3.11   Local Device Interface

Description

The "local device interface" connects optional accessories (e.g. the identification plug) with the motor starter. It is located on the bottom-right of the front (on motor starters 3RK1 303-2AS51-.... with PROFIBUS-DP on the bottom left).
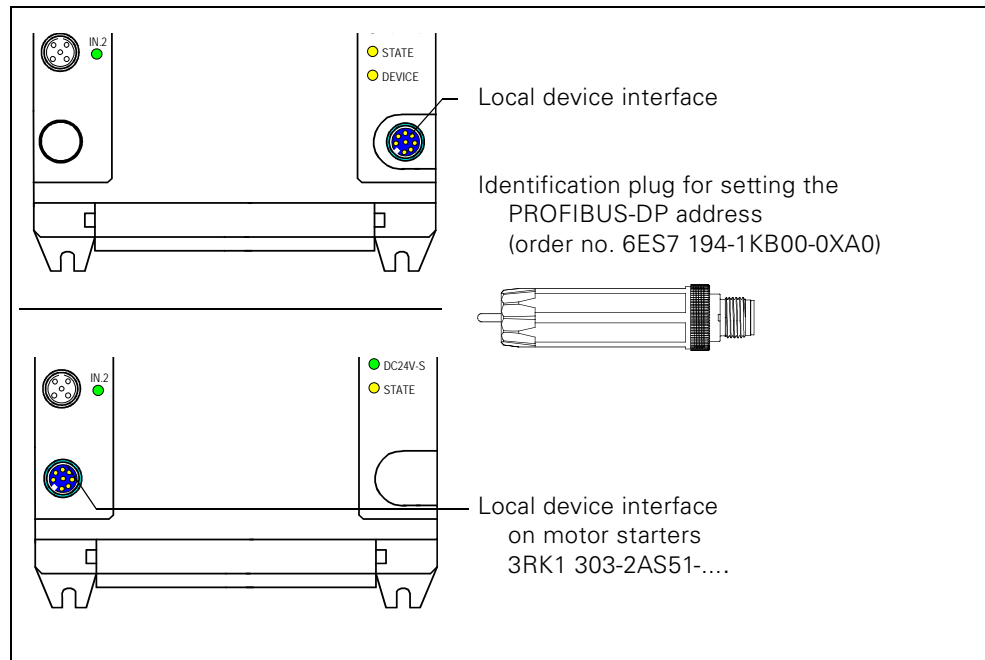
Fig. 3-14: Local device interface

For more information, see section .

Installing Motor Starters with PROFIBUS-DP

4

Introduction

You can either install the motor starter near the motor (motor nearby with cable), or plug it in to the motor directly (motor without cable and with mounting plate).

4.1 Setting the PROFIBUS-DP Address

The motor starter is shipped from the plant with the PROFIBUS-DP address 126. You can set the PROFIBUS-DP address as follows:

4.1.1 Setting the PROFIBUS-DP Address with the Identification Plug on the Local Device Interface

The identification plug is available as an accessory
(order number: 6ES7194-1KB00-0XA0)

1. Unscrew the identification plug from the motor starter (if necessary).

2. Unscrew the cap nut on the identification plug and pull the DIP switch out.

3. Use a screwdriver to set the required PROFIBUS-DP address (1 to 126) via the DIP switch.
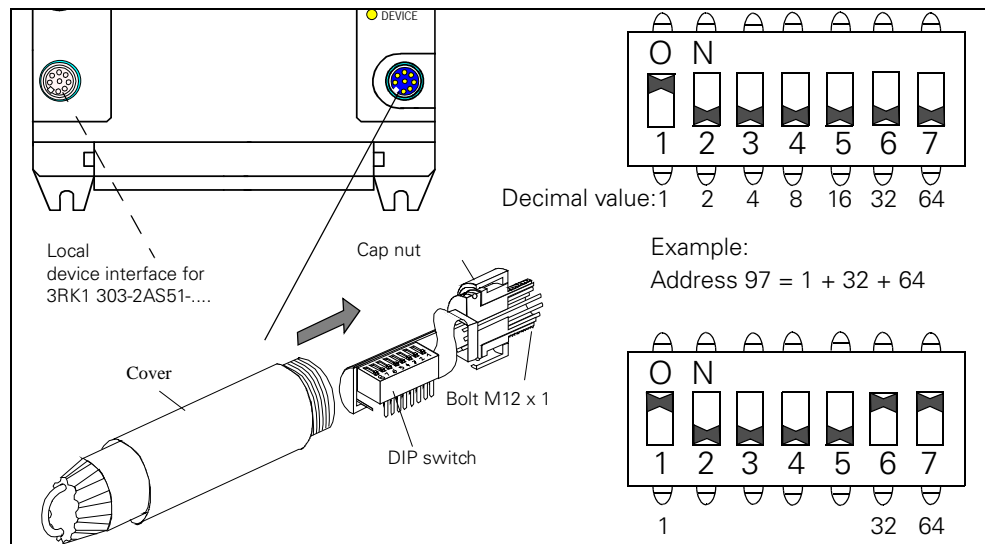
Fig. 4-1: Unscrew the identification plug and set the PROFIBUS-DP address.

4. Push the DIP switch back into the cover and tighten the cap nut.

5. Screw the identification plug onto the motor starter.

Attention

The motor starter only reads the PROFIBUS-DP address automatically and stores it permanently when the DC24V-NS is switched on or when the "Restart" command is issued. From now on, you only need the identification plug if you want to change the PROFIBUS-DP address.

When the identification plug is screwed on, the PROFIBUS-DP address cannot be overwritten by data records.

Invalid address: 127

Caution

If the identification plug with the invalid address 127 is screwed on after the DC24V-NS has been switched on, the motor starter restores the factory setting. For more information on the factory setting, see section 9.11 "Factory Setting" on page 9-26.

If the identification plug with the invalid address 127 is screwed on before the DC24V-NS is switched on, the motor starter signals "General fault" and "Invalid parameter value".

4.1.2 Setting the PROFIBUS-DP Address with Software

You can also set the PROFIBUS-DP address with the appropriate software, such as Switch ES (order no. 3ZS1310-0CC20-0YA0). For more information, see the appropriate documentation or online help.

4.2 Setup with motor plugged in

4.2.1 Required Components

The following table lists the required components:

Item	Ordering data	Order number
1	Motor starter	3RK13**..** Depending on the version
2	Mounting plate with screws for motor starter	3RK1911-3AA00
3	Power cable for looping through power Han Q8/0 pin/power tee connector (prefabricated or prepared by customer)	3RK1911-0.. depending on the length and cross-section
	Power cable, power not looped through Han Q8/0 (prefabricated at both ends or prepared by customer)	3RK1911-0.. depending on the length and cross-section
5	Data tee connector (PROFIBUS-DP Cu or optical-fiber cable)	3RK1911-2AG00 3RK1911-2AH00
6	Data line (PROFIBUS-DP Cu or optical-fiber cable) (prefabricated or prepared by customer)	3RK1911- Depending on the version
7	Terminating connector for PROFIBUS-DP	3RK1911-2AK00

Table 4-1: Required components for set up with motor plugged in

4.2.2 Installation

4-5

⚠️ **Warning**
Hazardous electrical voltages! These may cause electric shock and burns. Disconnect the system and device from the power supply before starting work.

Refer to the information in the operating instructions.
To install the motor starter, carry out the following steps:

Step	Description
1	Screw the mounting plate onto the motor (motor connector).
2	Place the motor starter on the mounting plate. Push the motor starter onto the motor connector. Secure the connection with the locking device.
3	Plug the power tee connector into the power terminal on the motor starter. Secure the connection with the locking device.
4	Connect the power cables on the power tee connector. Secure the connections with the locking devices.
5	Plug the data tee connector into the data terminal on the motor starter. Secure the connection with the locking device.
6	Plug the data lines into the data tee connector. Secure the connections with the locking devices.
7	Connect the terminating connector to the last load feeder (non-assigned connection on the last data tee connector). Secure the connection with the locking device.

Table 4-2: Installation with motor plugged in

4.3 Setup with motor nearby

4.3.1 Required Components

The following table lists the required components:

Item	Ordering data	Order number
1	Motor starter	3RK1 3**..** Depending on the version
2	4 fixing screws (dia. 5 mm), if necessary, nuts, spring washers, plain washers	
3	Power cables for connecting motor starter to the motor Han 10E (prefabricated or prepared by customer)	3RK1911-0.. depending on the length and cross-section Han 10E at one end/ both ends
4	Power cable for looping through power Han Q8/0 pin/power tee connector (prefabricated or prepared by customer)	3RK1911-0.. depending on the length and cross-section
	Power cable, power not looped through Han Q8/0 (prefabricated at both ends or prepared by customer)	3RK1911-0.. depending on the length and cross-section
5	Data tee connector (PROFIBUS-DP Cu or optical-fiber cable)	3RK1911-2AG00 3RK1911-2AH00
6	Data line (PROFIBUS-DP Cu or optical-fiber cable) (prefabricated or prepared by customer)	3RK1911- Depending on the version
7	Terminating connector (pin)	3RK 911-2AK00

Table 4-3: Setup with motor nearby

4.3.2 Installation

⚠️ **Warning**

Hazardous electrical voltages! These may cause electric shock and burns. Disconnect the system and device from the power supply before starting work.

Refer to the information in the operating instructions.
To install the motor starter, carry out the following steps:

Step	Description
1	Choose a flat surface for installation. The distance from the motor depends on the length of the power cable. You can choose any mounting position.
2	
3	Screw the motor starter onto the flat surface.
4	Connect the motor starter and the motor with the power cable. Secure the connections with the locking devices.
6	Plug the power tee connector into the power terminal on the motor starter. Secure the connection with the locking device.
7	Connect the power cables on the power tee connector. Secure the connections with the locking devices.
8	Plug the data tee connector into the data terminal on the motor starter. Secure the connection with the locking device.
9	Connect the data lines on the data tee connector. Secure the connections with the locking devices.
8	Connect the terminating connector to the last load feeder (non-assigned connection on the last data tee connector). Secure the connection with the locking device.

Table 4-4: Installation (motor nearby)

Installing Motor Starters with AS-Interface

5

Introduction

You can either set up the motor starter near the motor (with cable) or plug it into the motor directly (with mounting plate).

5.1 Setting the Address

AS-i slave profile

Motor starter Order No.	I/O configu- ration (hex)	ID Code (hex)	ID1 Code (hex)	ID2 Code (hex) of product status[1]	
				smaller 10	**from 10**
3RK1323-2AS51-1AA0	7	D	F	F	0
3RK1323-2AS51-1AA3	7	D	F	F	0
3RK1323-6*S8*-3AA3	7	E	F	F	0

[1] The product status is printed below the addressing socket

Table 5-1: AS-i slave profile

Requirements

To be able to set the address you need a device such as the addressing and diagnostic unit (Order No.: 3RK1904-2AB01).

The valid addresses are 1 to 31. Use each address only once.

Attention
Motor starters with product status smaller than 10 can be readdressed a maximum of 15 times. After the 15th time, the last valid address is retained.
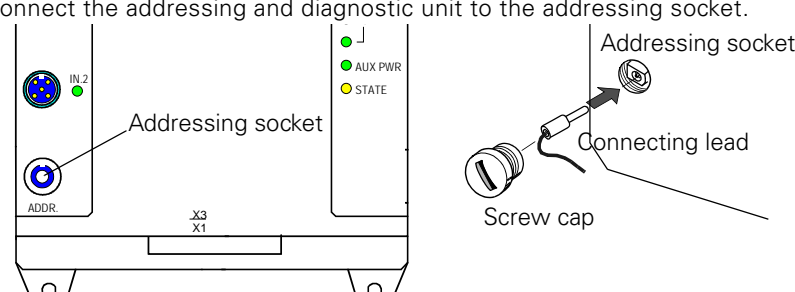
Step	Procedure
1	If you intend to address the motor starter via the addressing socket, switch off the AS-i supply voltage. This is necessary for reasons of system safety.
2	Unscrew the screw cap (Order No.: 3RK1901-1KA00) from the addressing socket.
3	Connect the addressing and diagnostic unit to the addressing socket.
4	Set the required address.
5	After carrying out addressing, screw the screw cap back into the socket in order to obtain degree of protection IP67.

Table 5-2: Setting the address via the addressing socket

5.2 Setup with motor plugged in

5.2.1 Required Components

The table below shows you the required components:

Item	Order data	Order number
1	Motor starter	3RK13.. depending on version
2	Mounting plate with screws for motor starter	3RK1911-3AA00
3	Power cable for looping through power Han Q8/0 pin/power tee connector prefabricated or prepared by customer	3RK1911-0.. depending on length and cross section
	Power cable, power not looped through Han Q8/0 (prefabricated at both ends or prepared by customer)	3RK1911-0.. depending on length and cross section
4	AS-i cable, trapezoidal-section yellow, rubber 2 x 1.5 mm^2 for field bus	3RX901.-0AA00 depending on length
5	AS-i cable, trapezoidal-section black, rubber 2 x 1.5 mm^2 for ext. 24 V auxiliary voltage AUX PWR	3RX902.-0AA00 depending on length
6	Cable end covers for sealing open cable ends (1 set = 10 covers)	3RK1901-1MN00

Table 5-3: Components required for setup with motor plugged in

5.2.2 Installation

⚠️ **Warning**
Hazardous voltages! These may cause electric shock and burns.
Disconnect the system and device from the supply before starting work.

Refer to the information in the operating instructions.
To install the motor starter, carry out the following steps:
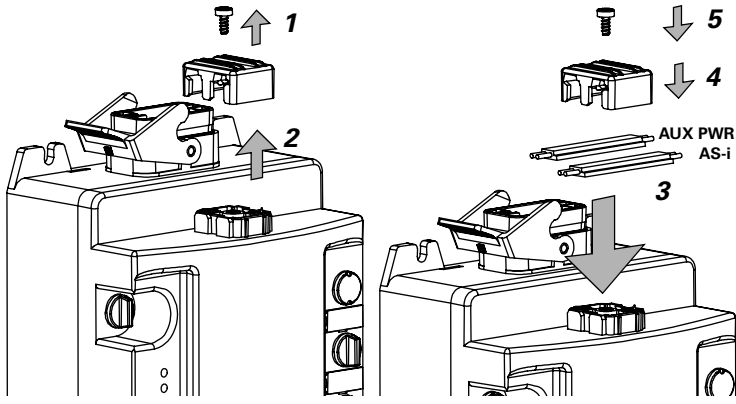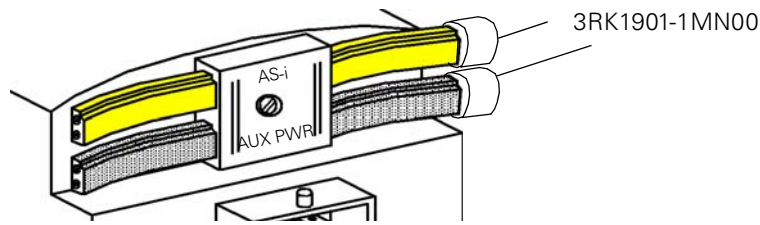
Step	Description
1	Screw the mounting plate to the motor (motor connector).
2	Place the motor starter on the mounting plate. Push the motor starter onto the motor connector. Secure the connection with the locking device.
3	Connect the AS-i cables as shown in the diagram below: **Important** If the motor starter is the last station on the AS interface line, you must terminate the ends of the AS-i cables with cable end covers (order no.: 3RK1 901-1MN00) in order to obtain degree of protection IP67. To allow this, leave the cable ends projecting by about 10 cm beyond the AS-i interface.
4	Plug the power tee connector into the power terminal on the motor starter. Secure the connection with the locking device.
5	Connect the power cables to the power tee connector. Secure the connections with the locking devices.

Table 5-4: Installation: motor plugged in

5.3 Setup with motor nearby

5.3.1 Required Components

The table below shows you the required components:

Item	Order data	Order number
1	Motor starter	3RK13.. depending on version
2	4 fixing screws (5 mm dia.), if necessary nuts, spring washers, plain washers	
3	Power cable for motor starter - motor connection Han 10E (prefabricated or prepared by customer)	3RK1911-0.. depending on length, cross section, Han 10E one end/ both ends
4	Power cable for looping through power Han Q8/0 pin/power tee connector (prefabricated or prepared by customer)	3RK 911-0.. depending on length and cross section
	Power cable, power not looped through Han Q8/0 (prefabricated at both ends or prepared by customer)	3RK1911-0.. depending on length and cross section
5	AS-i cable, trapezoidal-section yellow, rubber 2 x 1.5 mm^2 for field bus	3RX901.-0AA00 depending on length
6	AS-i cable, trapezoidal-section black, rubber 2 x 1.5 mm^2 for ext. 24 V auxiliary voltage AUX PWR	3RX902.-0AA00 depending on length
7	Cable end covers for sealing open cable ends (1 set = 10 covers)	3RK1901-1MN00

Table 5-5: Components required for Setup with motor nearby

5.3.2 Installation

![Warning triangle symbol]

Warning

Hazardous voltages! These may cause electric shock and burns.
Disconnect the system and device from the supply before starting work.

Refer to the information in the operating instructions.
To install the motor starter, carry out the following steps:
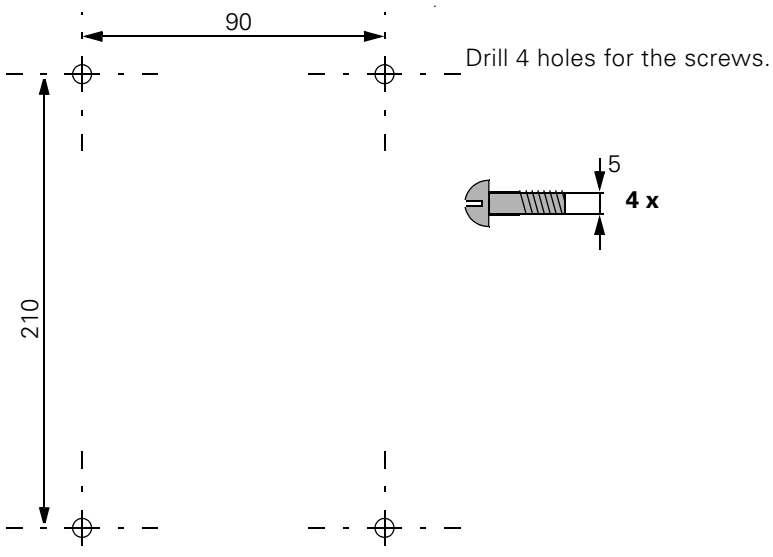
Step	Description
1	Choose a flat surface for installation. The distance from the motor depends on the length of the power cable. Any required mounting position can be chosen.
2	
3	Screw the motor starter onto the flat surface.

Table 5-6: Installation: motor nearby
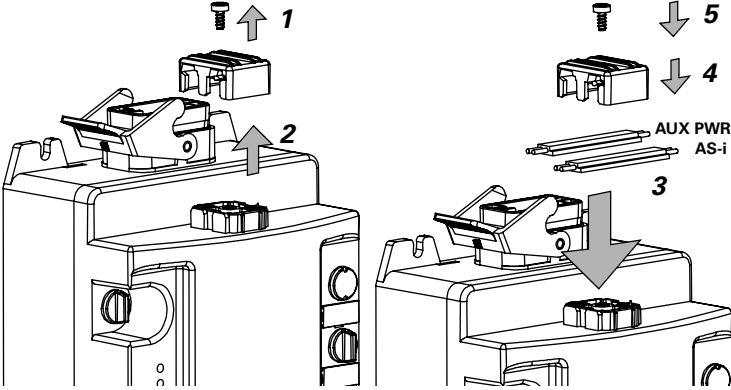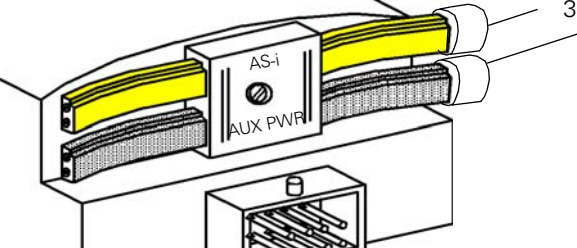
Step	Description
4	Connect the AS-i cables as shown in the diagram below:

Important:
If the motor starter is the last station on the AS interface line, you must terminate the ends of the AS-i cables with cable end covers
(order no.: 3RK1901-1MN00) in order to obtain degree of protection IP67. To allow this, leave the cable ends projecting by about 10 cm beyond the AS-interface.

3RK1901-1MN00

Step	Description
5	Connect the motor starter and motor with the power cable. Secure the connections with the locking devices.
6	Plug the power tee connector into the power terminal on the motor starter. Secure the connection with the locking device.
7	Connect the power cables to the power tee connector. Secure the connections with the locking devices.

Table 5-6: Installation: motor nearby (Cont.)

Commissioning and Diagnosis
with PROFIBUS-DP

6

6.1 Configuring Motor Starters

Introduction

This task involves both configuring and parameterizing motor starters.

- Configuration: systematic arrangement of the individual motor starters (structure).
- Parameterization: defining parameters with the configuration software. For more information on the parameters, see chapter 9 "Device Functions".

STEP7

- The "Diagnose hardware" function is supported by STEP7 V4.02 as of maintenance level K4.02.5.
- STEP7 does not support a read-back function (target system ➔ load to PG).
- The diagnosis cannot be read using the CPU 315-2 DP ("Diagnose hardware" function in STEP7) up to order no. 6ES7 315–2AF02.

6.1.1 Configuration with the DMD File

Definition of DMD

Device master data (DMD) contains DP slave descriptions in a standardized format. Using DMD makes it easier to configure the DP master and the DP slave.

Configuring with DMD

You configure the motor starter using the DMD file. The motor system is integrated in your system as a standard slave via the DMD file.
You can download the DMD file

- from the Internet at the following addresses:
  http://www.siemens.de/ecofast
  http://www.siemens.com/ecofast
  http://www.ad.siemens.de/csi_e/gsd

- using a modem by dialing: +49 (911) 737972

The following DMD files are available:

- SIEM80AF.GSG (German)
- SIEM80AF.GSE (English)

Attention
Your configuration tool must support DMD files - Rev. 3, such as STEP7 V5.1+ Service Pack 2 or higher.

Integrating the DMD file in the configuration software

The following table describes how you integrate the DMD file in SIMATIC S7 or SIMATIC S5 (COM PROFIBUS).

Step	STEP7 (V5.1 + SP2)	COM PROFIBUS (V5.0 or higher)
1	Start STEP7 and choose **Options > Install new > *.DMD file** in the hardware configuration.	Copy the DMD file from ECOFAST to the COM PROFIBUS directory: **...COMPB**\GSD** (default) Copy the bitmap file to the following directory: **...COMPB**\BITMAPS** **: Depending on the COM PROFIBUS version
2	In the following dialog, select the DMD file to be installed and confirm with OK. The field device is displayed in the hardware catalog in the PROFIBUS–DP directory. From the hardware catalog, add the motor starter on the PROFIBUS by choosing: **Additional field devices** > **Switching devices** > **Motor starters** > **ECOFAST**.	Start COM PROFIBUS and choose **File > Read device database file**. The motor starter is displayed in the hardware catalog in the slave configuration.
3	Configure the motor starter with STEP7 (see Integrated Help in STEP7).	Configure the motor starter with COM PROFIBUS (see Integrated Help in COM PROFIBUS).

Table 6-1: Integrating the DMD file in the configuration software

Parameter Dependencies in the DMD

Attention

If parameterization is carried out using the DMD, you can choose values that are interdependent and cannot be combined!
In data record 92, the corresponding parameter is reported as an "Invalid parameter value"!

The following table shows which parameters are interdependent and how they have to be set:

Dependent parameters	Setting
Rated operational current Ie Tripping class CLASS	With CLASS 20: Ie max = 7.3 A With CLASS 30: Ie max = 6.7 A
Input n - signal Input n - level Input n - action	Dependencies: section "Input n - Action" on page 9-18
Rated power Rated voltage	When U = 230 V AC: Pmax = 0.75 kW When U = 277 V AC: Pmax = 1.1 kW When U = 480 V AC: Pmin = 0.37 kW
Setpoint value fo Setpoint value f1 Setpoint value f2	$f2 \leq f1 \leq f0$

Setpoint value fo
Rated frequency
Rated speed
	When f = 50 Hz:
	  fo max = 70 Hz at > 1500 U/min.
	When f = 60 Hz:
	  fo max = 80 Hz at > 1800 U/min.

Table 6-2: Parameter dependencies in the DMD

6.1.2   Configuring with the Switch ES Motor Starter Software

You can also configure ECOFAST Motor Starter High Feature using the Switch ES Motor Starter software (order no. 3ZS1 310-0CC20-0YA0). Two options are available with PROFIBUS-DP:
• Stand-alone program on PC/PG with PROFIBUS-DP interface
• Integration with the Object Manager (OM) in STEP7

For detailed information on Switch ES, see
appendix D "Software Switch ES Motorstarter".

6.2 Process Data and Process Images

Definition of the process image

The process image is an integral part of the DP Master system memory. At the beginning of the cyclic program, the signal statuses of the inputs are transferred to the process input image. At the end of the cyclic program, the process output image is transferred to the DP Slave as a signal status.

Two different process images are available for motor starters with PROFIBUS-DP:
• Process image 1 with 1-byte outputs/1-byte inputs (8 O/8 I)
• Process image 2 with 2-byte outputs/2-byte inputs (16 O/16 I)

All motor starters accept process image 2 from the DP Master side. Some motor starters also accept process image 1 (see table below).

Overview

The following table provides an overview of the motor starters with the corresponding process image:

Process image 1: 1-byte outputs (8 O) 1-byte inputs (8 I)	Process image 2: 2-byte outputs (16 O) 2-byte inputs (16 I)
3RK1303-2AS51-1AA0	3RK1303-2AS51-1AA0
3RK1303-2AS51-1AA3	3RK1303-2AS51-1AA3
—	3RK1303-5BS41-1AA0
—	3RK1303-5CS41-1AA0
—	3RK1303-5BS41-1AA3
—	3RK1303-5CS41-1AA3
—	3RK1303-6BS71-1AA0
—	3RK1303-6BS71-1AA3
—	3RK1303-6DS71-1AA0
—	3RK1303-6DS71-1AA3
—	3RK1303-6ES81-3AA3
—	3RK1303-6FS82-3AA3

Table 6-3: Overview of the motor starters with the corresponding process image

Attention

For motor starters with 8O/8I, you have the option of setting process image 1 to save address space (depending on the tool or DP Master you are using).

Table

The following table contains process data and process images:

Process data		Process image 1: (8 O, DO 0.0 to DO 0.7) (8 I, DI 0.0 to DI 0.7)	Process image 2: (16 O, DO 0.0 to DO 1.7) (16 I, DI 0.0 to DI 1.7)
DO- 0.	0	Motor CLOCKWISE	Motor CLOCKWISE
	1	Motor COUNTER CLOCKWISE	Motor COUNTER CLOCKWISE
	2	Brake	Brake
	3	Trip reset	Trip reset
	4	Emergency start	Emergency start
	5	Self-test	Self-test
	6	Crawl speed (not supported)	Crawl speed
	7	Not assigned	Not assigned
DO- 1.	0	---	Not assigned
	1	---	Not assigned
	2	---	Not assigned
	3	---	Not assigned
	4	---	Reduction factor - bit 0
	5	---	Reduction factor - bit 1
	6	---	Reduction factor - bit 2
	7	---	Not assigned
DI- 0.	0	Ready (automatic)	Ready (automatic)
	1	Motor on	Motor on
	2	General fault	General fault
	3	General warning	General warning
	4	Input 1	Input 1
	5	Input 2	Input 2
	6	Input 3 (not supported)	Input 3
	7	Input 4 (not supported)	Input 4
DI-1.	0	---	Motor current $I_{act\ bit0}$
	1	---	Motor current $I_{act\ bit1}$
	2	---	Motor current $I_{act\ bit2}$
	3	---	Motor current $I_{act\ bit3}$
	4	---	Motor current $I_{act\ bit4}$
	5	---	Motor current $I_{act\ bit2}$
	6	---	Manual operation local mode
	7	---	Ramp operation

Table 6-4: Process data and process images

6.3 Commissioning and Start-Up

Software prerequisites

Configuration software	Version	Explanations
STEP7	Version 5.1 + SP2 (or higher)	You have integrated the DMD file of the motor starter in STEP7.
COM PROFIBUS	Version 5.0 (or higher)	You have integrated the DMD file of the motor starter in COM PROFIBUS.
Configuration software for the other DP Master used		You have integrated the DMD file of the motor starter in the appropriate configuration tool.

Table 6-5: Software prerequisites for commissioning

Commissioning prerequisites

Required activity	For more information, see...
1. Motor starter installed	chapter 4 "Installing Motor Starters with PROFIBUS-DP"
2. PROFIBUS DP address set on the motor starter	section 4.1 "Setting the PROFIBUS-DP Address" on page 4-2
4. Motor starter configured and parameterized	section 6.1 "Configuring Motor Starters" on page 6-2
5. Supply voltage for DP Master switched on	DP Master manual
6. DP Master switched to operating status RUN	DP Master manual

Table 6-6: Commissioning prerequisites

Commissioning the motor starter

Step	Required activity
1	Switch on the supply voltage for the motor starter
2	Switch on the supply voltage for the load (if necessary).

Table 6-7: Sequence of steps for commissioning the motor starter

Starting up the motor starter

```
                    ○
                    │
                    ▼
        ┌───────────────────────┐
       (  Switch on supply       )
       (  voltage for motor      )
        └───────────────────────┘
                    │
                    ▼
        ┌───────────────────────┐
        │ Motor starter sets     │
        │ outputs to             │
        │ "0" and adopts the     │
        │ set PROFIBUS-DP address │
        └───────────────────────┘
                    │
                    ▼
        ┌───────────────────────┐
        │ LEDs "DC24V-NS, DC24V-S"│
        │ light up, "BF" flashes  │
        │ red                     │
        └───────────────────────┘
                    │
                    ▼
        ┌───────────────────────┐
        │ Motor starter receives  │
        │ config. data from the   │
        │ DP Master               │
        └───────────────────────┘
                    │
                    ▼
              ◇ Does the config.
                data match the actual   ──No──┐
                configuration? ◇               │
                    │                          │
                   Yes                         │
                    ▼                          ▼
        ┌───────────────────────┐   ┌───────────────────────┐
        │ Green LED "BF" turns   │  (  Remedy: Compare the   )
        │ off;                   │  (  config. data with the )
        │ Inputs and outputs are │  (  configuration or vice )
        │ released;              │   └───────────────────────┘
        │ Data can be exchanged  │
        └───────────────────────┘
                    │
                    ▼
        ┌───────────────────────┐
       (  Ready for operation    )
        └───────────────────────┘
```

Fig. 6-1: Starting up the motor starter

6.4 Diagnosis by Means of the LED Indicators

LED		Description	
SF	red	General/peripheral fault (e.g. trip)	
	off	No fault	
BF/RUN	red	Bus fault	
	flash red	Parameterization error	
	flicker red	Factory setting restored (flickers red for 5 secs.)	
	toggle red/ green*	Parameterization error while starting S7	
	green	Device exchanging data	
	yellow	Device not initialized and bus fault (send device for repair)	
	flash yellow/ green	Device not initialized and parameterization error (send device for repair)	
	off	Device not exchanging data	
DC24V-NS	green	Non-switched supply voltage	OK
	off	Non-switched supply voltage	not OK
DC24V-S	green	Switched supply voltage	OK
	off	Switched supply voltage	not OK
STATE (Switch status)	green	Switching element ON by means of control/C&M	
	flash green	Ramp operation	
	flicker green	Switching element and brake output ON by means of input action	
	off	Switching element OFF	
	red	Switch status ≠ switching command	
	flash yellow	Manual operation: connection aborted	
	flicker yellow	Switching element and brake output OFF by means of input action	
DEVICE (Device status)	green	Device OK and "normal operation"	
	flash green	Device not initialized (send device for repair)	
	flash yellow	General warning (e.g. overload, asymmetry)	
	yellow	Internal trip	
	flash red	Self-test: current flowing or FW download	
	flicker red	Self-test: no current flow	
	flicker red for approx. 5 secs.	Factory setting restored	
	red	Device defective (send device for repair)	
	off	Non-switched supply voltage < 18 VDC	

Table 6-8: Diagnosis by means of LED indicators

Digital Inputs, Motor Starters with 2 Digital Inputs		
IN 1/2	green	Digital input 1: 24 V DC present
	off	Digital input 1: 24 VDC not present
IN 2	green	Digital input 2: 24 V DC present
	off	Digital input 2: 24 V DC not present
Digital Inputs, Motor Starters with 4 Digital Inputs		
IN 1/2	green	Digital input 1: 24 V DC present Digital input 2: 24 V DC not present
	orange	Digital input 1: 24 V DC not present Digital input 2: 24 V DC present
	yellow	Digital input 1: 24 V DC present Digital input 2: 24 V DC present
	off	Digital input 1: 24 V DC not present Digital input 2: 24 V DC not present
IN 3/4	green	Digital input 3: 24 V DC present Digital input 4: 24 V DC not present
	orange	Digital input 3: 24 V DC not present Digital input 4: 24 V DC present
	yellow	Digital input 3: 24 V DC present Digital input 4: 24 V DC present
	off	Digital input 3: 24 V DC not present Digital input 4: 24 V DC not present

Specifications	Fault: SF = general fault, BF = bus fault Frequency: flash: 0.5 Hz flicker: 8 to 10 Hz *toggle: 2 to 10 Hz

Table 6-8: Diagnosis by means of LED indicators (Cont.)

6.5 Diagnosis with STEP7

6.5.1 Reading the Diagnosis

Length of the diagnosis telegram

- The telegram can have a maximum length of 32 bytes.

Diagnosis read options

Automation system with DP Master	Module or register in STEP7	Application	See...
SIMATIC S7/M7	SFC 13 "DP NRM_DG"	Read slave diagnosis (store in the data area of the user program)	section 6.5.2 "Structure of the Slave Diagnosis" on page 6-12; SFC see online help in STEP7

Table 6-9: Reading the diagnosis with STEP 7

Example: reading the S7 diagnosis with SFC 13 "DP NRM_DG"

This example shows you how to read the slave diagnosis for a DP Slave in the STEP7 user program with SFC 13.

Assumptions

The following assumptions apply to the STEP7 user program:

- Diagnosis address: 1022 ($3FE_H$).
- The slave diagnosis is to be stored in DB82: as of address 0.0, length: 32 bytes.
- The slave diagnosis comprises 32 bytes.

STEP7 user program

```
AWL                              Explanation


CALL   SFC 13


REQ     :=TRUE                   Read request
LADDR   :=W#16#3FE               Diagnosis address
RET_VAL :=MW0                    RET_VAL from SFC 13
RECORD  :=P#DB82.DBX 0.0 BYTE 32 Mailbox for the diagnosis in DB82
BUSY    :=M2.0                   Read operation runs across several OB1 cycles
```

6.5.2 Structure of the Slave Diagnosis

Structure of the Slave Diagnosis
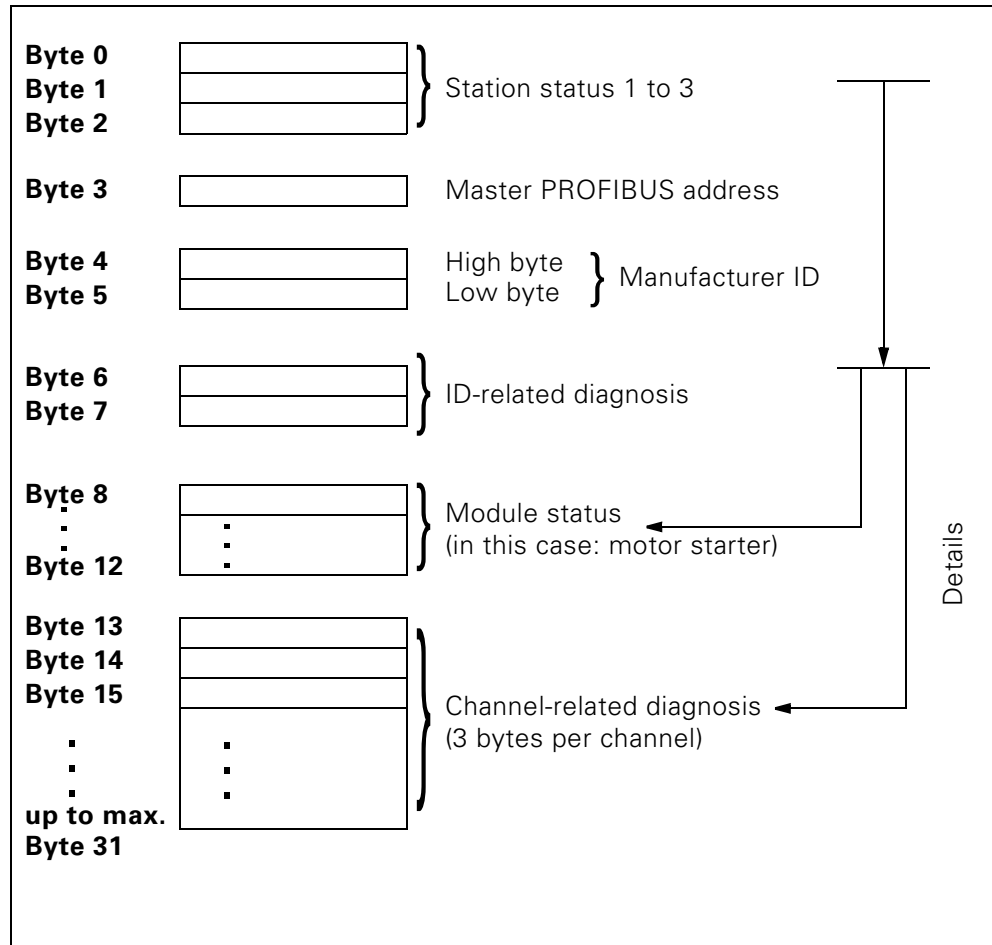
Fig. 6-2: Structure of the slave diagnosis

Attention
The length of the diagnosis telegram varies between 13 and 32 bytes. You can find out the length of the last diagnosis telegram to be received in
• STEP7 from the RET_VAL parameter in SFC 13.

6.5.3 Station Status 1 to 3

Definition

Station status 1 to 3 provides an overview of the status of a
DP Slave.

Station status 1

Bit	Meaning	Cause/Remedy
0	1: The DP Slave cannot be accessed by the DP Master.	• Is the correct PROFIBUS address set on the DP Slave? • Bus plug connected? • DP Slave voltage? • Is the RS 485 repeater set correctly? • Reset carried out on the DP Slave?
1	1: The DP Slave is not yet ready to exchange data.	• Wait while the DP Slave is being started up.
2	1: The configuration data sent from the DP Master to the DP Slave does not match the DP Slave structure.	• Have you entered the correct DP Slave station type or structure in the configuration software?
3	1: An external diagnosis exists (general diagnosis indicator)	• Evaluate the ID-related, module-status, and/or the channel-related-diagnosis. Bit 3 is reset once all the errors have been corrected. The bit is reset when a new diagnosis message is present in the bytes of the above diagnoses.
4	1: The DP Slave does not support the requested function (e.g. changing the PROFIBUS address using the software).	• Check the configuration.
5	1: The DP Master cannot interpret the response from the DP Slave.	• Check the bus structure.
6	1: The DP Slave type does not match the software configuration.	• Have you entered the correct station type in the configuration software?
7	1: The DP Slave has been parameterized by a different DP Master (not the DP Master that currently has access to the DP Slave).	• Bit is always 1 when you are currently accessing the DP Slave with the PG or a different DP Master, for example. The PROFIBUS address of the DP Master that parameterized the DP Slave is in the diagnosis byte "Master PROFIBUS address".

Table 6-10: Structure of station status 1 (byte 0)

Station status 2

Bit	Meaning
0	1: The DP Slave must be reparameterized.
1	1: A diagnosis message is present. The DP Slave will not work until the error has been corrected (static diagnosis message).
2	1: The bit is always "1" if the DP Slave has this PROFIBUS address.
3	1: Response watchdog is activated for this DP Slave.
4	1: The DP Slave has received the "FREEZE" control command[1].
5	1: The DP Slave has received the "SYNC" control command[1].
6	0: Bit is always "0".
7	1: The DP Slave is deactivated, that is, it has been disconnected from the current process.

[1] The bit is only updated when a further diagnosis message changes.

Table 6-11: Structure of station status 2 (byte 1)

Station status 3

Bit	Meaning
0 to 6	0: Bits are always "0".
7	1: • More diagnosis messages exist than the DP Slave can save. • The DP Master cannot enter all the diagnosis messages sent from the DP Slave in its diagnosis buffer (channel-related diagnosis).

Table 6-12: Structure of station status 3 (byte 2)

6.5.4 Master PROFIBUS Address

Definition

The PROFIBUS address of the DP Master

- that parameterized the DP Slave, and

- that has read/write access to the DP Slave

is stored in the diagnosis byte "Master PROFIBUS address". The Master PROFIBUS address is in byte 3 of the slave diagnosis.

6.5.5 Manufacturer ID

Definition

A code that describes the DP Slave type is stored in the manufacturer ID.

Manufacturer ID

Byte 4	Byte 5	Manufacturer ID for
80_H	AF_H	Motor starter

Table 6-13: Structure of the manufacturer ID

6.5.6 ID-Related Diagnosis

Definition

The ID-related diagnosis indicates whether or not motor starters are defective. The ID-related diagnosis starts as of byte 6 and comprises 2 bytes.

ID-related diagnosis

The ID-related diagnosis for motor starters is structured as follows:
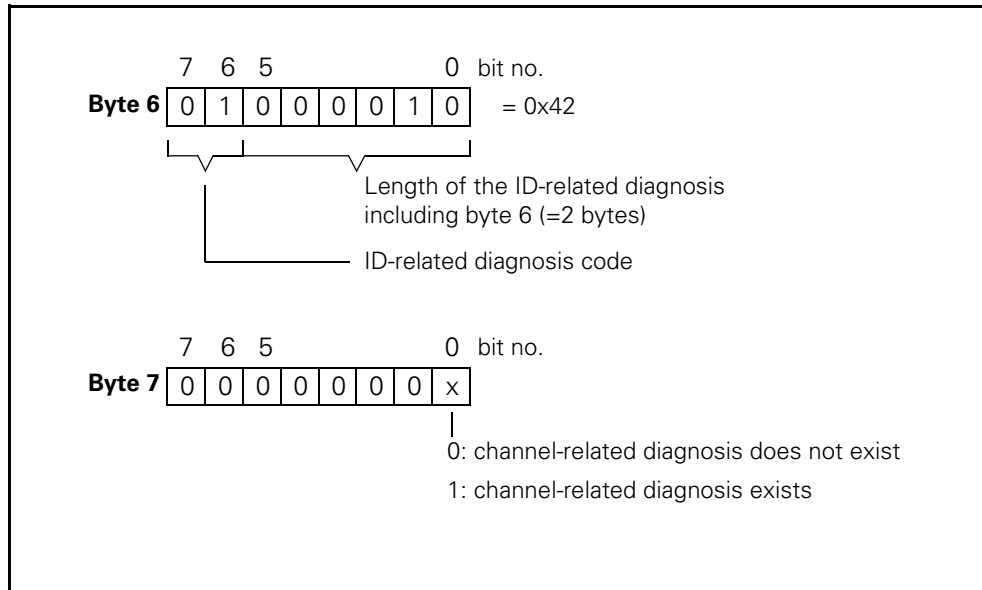
Fig. 6-3: Structure of the ID-related diagnosis

6.5.7 Module Status

Definition

The module status indicates the status of the configured modules (in this case: motor starter) and provides details of the ID-related diagnosis. The module status starts after the ID-related diagnosis and comprises 5 bytes.

Structure of the module status

The module status is structured as follows:
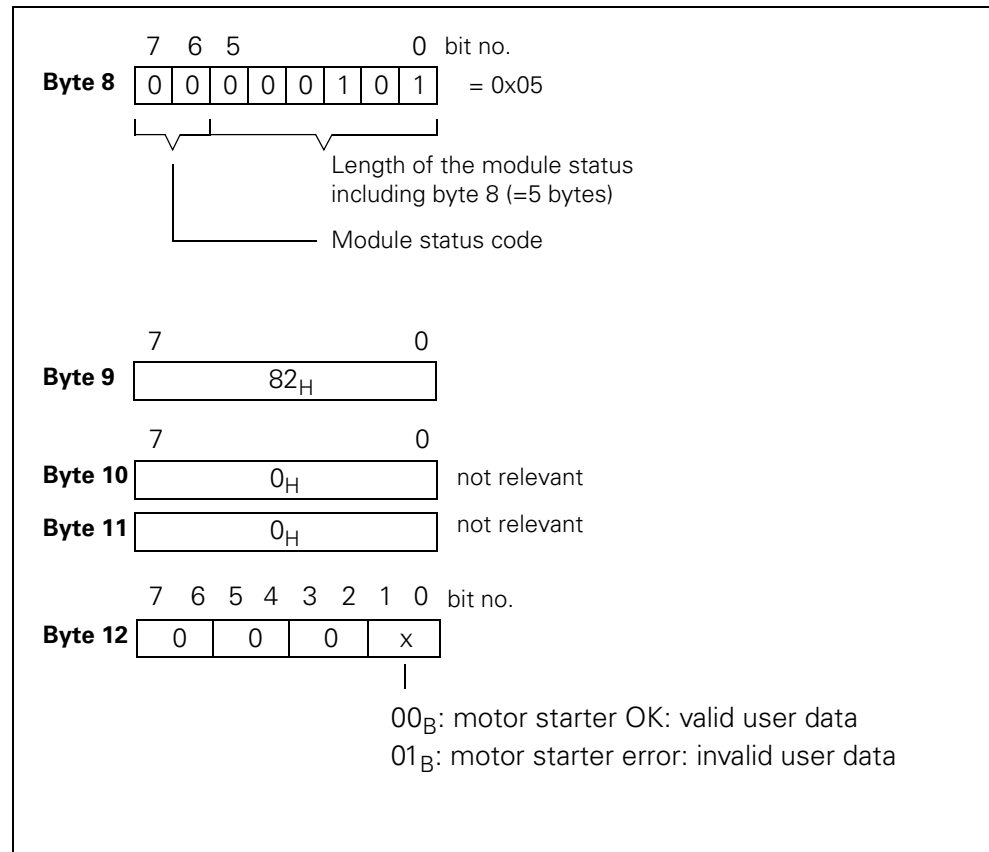
Fig. 6-4: Structure of the module status

6.5.8   Channel-Related Diagnosis

Definition

The channel-related diagnosis provides information on channel errors in modules (in this case: motor starter) and provides details of the ID-related diagnosis. The channel-related diagnosis starts after the module status. The maximum length is restricted by the maximum length of the entire slave diagnosis, which is 31 bytes. The channel-related diagnosis does not affect the module status.
A maximum of 9 channel-related diagnosis messages are possible (see also station status 3, bit 7).

Channel-related diagnosis

The channel-related diagnosis is structured as follows:
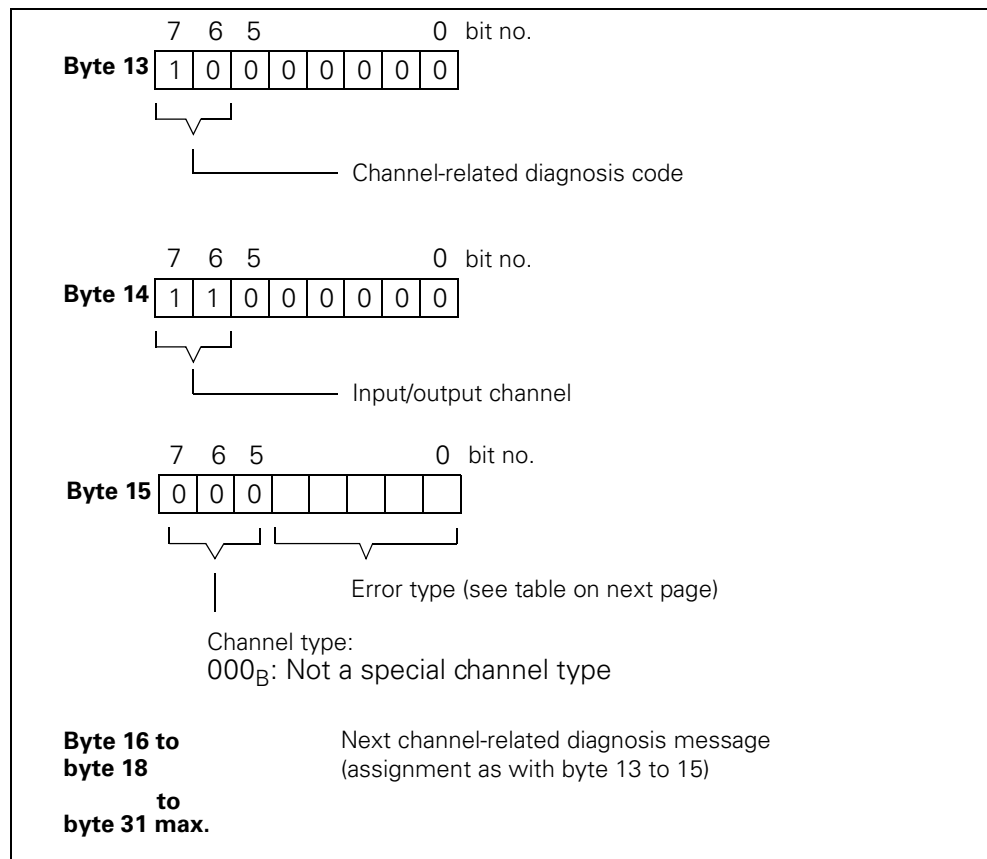
Fig. 6-5: Structure of the channel-related diagnosis

Attention

The channel-related diagnosis is always updated up to the current diagnosis message in the diagnosis telegram. Subsequent, older diagnosis messages are not deleted. Remedy: evaluate the valid current length of the diagnosis telegram:
• STEP7 from the RET_VAL parameter of SFC 13.

Error types

The diagnosis message is reported on channel 0.

F no.	Fault type	Meaning/Cause	Delete/acknowledge signaling bit
F1	00001: Short-circuit	• Circuit-breaker tripped • Temperature sensor short-circuit	The signaling bit is automatically deleted when the cause of the trip is removed and acknowledged with "trip reset".
F4	00100: Overload	• Temperature sensor overload • Thermal motor model overload • Line protection overload	The signaling bit is constantly updated.
F5	00101: Overtemperature	• Power semiconductor overload • Switching element overload	The signaling bit is automatically deleted when the cause of the trip is removed and acknowledged with "trip reset".
F6	00110: Cable break	• Temperature sensor wire break	
F7	00111: Upper limit value exceeded	• I_e upper limit value violation	The signaling bit is constantly updated.
F8	01000: Lower limit value exceeded	• I_e lower limit value violation	
F9	01001: Fault	• Internal fault/device fault • Fault during self-test • FW download fault • Switching element defective	When the cause of the error has been removed, the signaling bit can be deleted • by switching the supply voltage (DC24 V-NS) on/off. • using the "Restart" command (if possible)
F16	10000: Parameterization error	• Invalid parameter value	The signaling bit is always deleted when acknowledged with "trip reset".
F17	10001: No sensor or load voltage	• Electronics supply voltage too low (<18 V) • No switching element supply voltage • No mains voltage	The signaling bit is deleted when the cause of the trip is removed or acknowledged automatically.
F24	11000: Actuator trip	• Overload tripping • Residual current tripping • Asymmetry tripping • Earth fault tripping	The signaling bit is always deleted when acknowledged with "trip reset". Further acknowledgement in conjunction with a different error
F26	11010: External error	• Input trip • Input trip limit position • Sensor supply overload • Process image error • Memory module defective • Memory module programming error • Intermediate circuit voltage too high	The signaling bit is always deleted when acknowledged with "trip reset".

Table 6-14: Error types

Commissioning and Diagnosis with AS Interface

7

7.1 Process Data and Process Images

Definition of the process image

The process image is an integral part of the AS-i Master system memory. At the beginning of the cyclic program, the signal statuses of the inputs are transferred to the process input image. At the end of the cyclic program, the process output image is transferred to the slave as a signal status.

Table

The following table contains process data and process images:
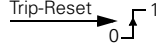
Process data	Process image: 4 outputs, DO 0.0 to DO 0.3 4 inputs, DI 0.0 to DI 0.3	Signal: [1]: HIGH [0]: LOW
Outputs	Control commands (PLC to the motor starter)	
DO- 0.0	Motor CLOCKWISE	[1]: ON [0]: OFF
1	Motor COUNTER CLOCKWISE	[1]: ON [0]: OFF
2	Brake	[1]: ON [0]: OFF
3	Trip-Reset/Crawl speed [*]	[0] –> [1]: ACTIVE $\xrightarrow{\text{Trip-Reset}}$ ⌐1 0⌐ [1]: ON (Crawl speed) [0]: OFF (Crawl speed
Inputs	Messages (motor starter to the PLC)	
DI- 0. 0	Ready (automatic)	[1]: YES [0]: NO
1	Motor on	[1]: YES [0]: NO
2	IN1 (input 1)	[1]: 24 V present [0]: OPEN
3	IN2 (input 2)	[1]: 24 V present [0]: OPEN

Table 7-1: Process data and process images for AS interface

[*]
Double assignment DO.3 with trip reset and creep feed.
Trip reset: Edge controlled with rising edge from [0] –> [1]
Creep feed: Level controlled [0] and [1]

7.2 Commissioning and Start-Up

Software prerequisites

Configuration software	Explanations
Configuration software for the AS-i Master used	(See manual for the AS-i Master)
Configuration software Switch ES Motor Starter	Order no.: 3ZS1310-0CC20-0YA0 For parameterizing, operator control and monitoring via the local device interface (see Chapter "Software Switch ES Motorstarter" .and online help for Switch ES)

Table 7-2: Software prerequisites for commissioning

Commissioning prerequisites

Required activity	For more information, see...
1. Motor starter installed	"Installation" chapter
2. Address set on the motor starter	"Installation" chapter
3. Supply voltage for the motor starter switched on	
4. Supply voltage for the load switched on (if necessary)	
5. Motor starter configured and parameterized	
6. Supply voltage for AS-i Master switched on	
7. AS-i Master set to operating status RUN	Manual for AS-i Master

Table 7-3: Commissioning prerequisites

Testing the wiring from the motor starter to the motor

Using the addressing and diagnostic unit (order no.: 3RK1 904-2AB00), you can test the wiring from the motor starter to the motor without the PLC via the addressing socket by setting the appropriate outputs:
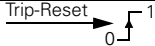
Outputs	Control commands (PLC to the motor starter)	
DO - **0**.0	Motor CLOCKWISE	[1]: ON [0]: OFF
1	Motor COUNTER CLOCKWISE	[1]: ON [0]: OFF
2	Brake	[1]: ON [0]: OFF
3	Trip-Reset/Crawl speed	[0] –> [1]: ACTIVE $\xrightarrow{\text{Trip-Reset}}$ $\underset{0}{\overset{1}{\rfloor}}$ [1]: ON (Crawl speed) [0]: OFF (Crawl speed

Table 7-4: Testing the wiring from the motor starter to the motor

For more information, see the operating instructions for the addressing and diagnostic unit.

Starting up the motor starter

```
                    ( )
                     │
                     ▼
         ╭─────────────────────────╮
         │  Switch on supply voltage │
         │     for motor starter     │
         ╰─────────────────────────╯
                     │
                     ▼
         ┌─────────────────────────┐
         │ Motor starter sets outputs│
         │ to "0" and adopts the     │
         │ address set.              │
         └─────────────────────────┘
                     │
                     ▼
         ┌─────────────────────────┐
         │ "AS-i" and "AUX PWR" LEDs │
         │ light up                  │
         └─────────────────────────┘
                     │
                     ▼
         ┌─────────────────────────┐
         │ Motor starter receives    │
         │ configuration data from   │
         │ the AS-i                  │
         └─────────────────────────┘
                     │
                     ▼
              ◇ Does the ◇
           configuration data match      No
              the actual structure?   ───────┐
                     │                         │
                    Yes                        │
                     ▼                         ▼
         ┌─────────────────────┐   ╭───────────────────────╮
         │ Inputs and outputs  │   │ Remedy: Compare the    │
         │ are released.       │   │ configuration data with│
         │ Data can be exchanged│  │ the structure or vice  │
         └─────────────────────┘   │ versa                  │
                     │             ╰───────────────────────╯
                     ▼
         ╭─────────────────────╮
         │  Ready for operation  │
         ╰─────────────────────╯
```

Fig. 7-1: Starting up the motor starter

7.3 Diagnosis

7.3.1 Diagnosis by Means of the LED Indicators

LED		Description
SF	red	General/peripheral fault (e.g. trip) **—> Motor switched off** General warning *) **—> Motor not switched off**
	off	No error
AS-i	red	No data exchange
	red/yellow flashing	Zero address
	green	Communication and supply not switched on OK
	off	No non-switched supply voltage
⌐	green	Non-switched supply voltage OK
	off	Non-switched supply voltage not OK
AUX PWR	green	Switched supply voltage OK
	off	Switched supply voltage not OK
STATE (switch status)	green	Switching element ON by means of control/operator control and monitoring
	flash green	Ramp operation
	flicker green	Switching element and brake output ON by means of input action
	off	Switching element OFF
	red	Switch status ≠ switching command
	flash yellow	Manual operation: connection broken
	flicker yellow	Switching element and brake output OFF by means of input action
DEVICE (Device status)	green	Device OK and "normal operation"
	flash green	Device not initialized (send device for repair)
	flash yellow	General warning (e.g. overload, asymmetry)
	yellow	Internal trip
	flash red	Self-test: current flowing or FW download
	flicker red	Self-test: no current flow
	flicker red for approx 5 secs.	Factory setting restored
	red	Device defective (send device for repair)
	off	Supply voltage not switched on < 18 VDC
DEVICE	green	Device OK and "normal operation"

*) Only Motor Starters without DEVICE LED (3RK1 303-2AS51-....)

Table 7-5: Diagnosis by means of the LED indicator

Digital Inputs, Motor Starters with 2 Digital Inputs		
IN 1/2	green	Digital input 1: 24 V DC present
	off	Digital input 1: 24 V DC not present
IN 2	green	Digital input 2: 24 V DC present
	off	Digital input 2: 24 V DC not present
Digital Inputs, Motor Starters with 4 Digital Inputs		
IN 1/2	green	Digital input 1: 24 V DC present Digital input 2: 24 V DC not present
	orange	Digital input 1: 24 V DC not present Digital input 2: 24 V DC present
	yellow	Digital input 1: 24 V DC present Digital input 2: 24 V DC present
	off	Digital input 1: 24 V DC not present Digital input 2: 24 V DC not present
IN 3/4	green	Digital input 3: 24 V DC present Digital input 4: 24 V DC not present
	orange	Digital input 3: 24 V DC not present Digital input 4: 24 V DC present
	yellow	Digital input 3: 24 V DC present Digital input 4: 24 V DC present
	off	Digital input 3: 24 V DC not present Digital input 4: 24 V DC not present

Table 7-5: Diagnosis by means of the LED indicator (Cont.)

7.3.2 Diagnosis with the Addressing and Diagnostic Unit

Diagnosis functions

The addressing and diagnostic unit (order no.: 3RK1 904-2AB01) has different diagnosis functions:
- Detecting incorrect polings or overload
- Measuring the AS-i supply voltage
- Detecting errors and providing a comment
- Displaying peripheral errors

For more information, see the operating instructions.

Fault Handling

8

8.1 Responding to Faults

Description

Responses to faults can be parameterized either as warnings or trips. Example: "Response to asymmetry", "Response to temperature sensor overload".
The following diagram illustrates how the motor starter responds (depending on how it has been parameterized):

	Fault	
	Reaction 1	Reaction 2
Response:	**Warning**	**Trip**
Signaling bit:	General warning set	General fault set
LED indicator:	DEVICE flashes yellow	DEVICE lights up yellow SF lights up red
Motor and brake:	Not deactivated	Deactivated

Fig. 8-1: Responding to faults

Attention
In the event of a fault ("Process image error") or device fault ("Switching element defective"), the response is always trip.
Responses to faults cannot be parameterized.

Other indications of faults

System faults can also be indicated as follows:
• When Switch ES is used, the appropriate
  fault message is displayed in plain text.
• On the field bus, the appropriate bit
  is set in the cyclic telegram and/or diagnosis channel.

8.1.1 Acknowledging Faults

Switch-on after device-internal trip

If the motor starter trips the switching elements automatically, it will not switch on again until
• the cause of the fault has been removed
• the fault has been acknowledged
• the "Emergency start" device function is activated, that is, the motor can be switched on and off with the control commands despite the general fault (does not apply to device faults)

Acknowledgement

You can acknowledge faults as follows:
• With "trip reset"
    – Bit DO-0.3 "trip reset" via field bus
    – "Trip reset" command
• Parameterized "Trip with restart" (autoreset)
• With a countercommand (e.g. "Motor off" (process image errors only))

Attention
Trip reset is edge triggered
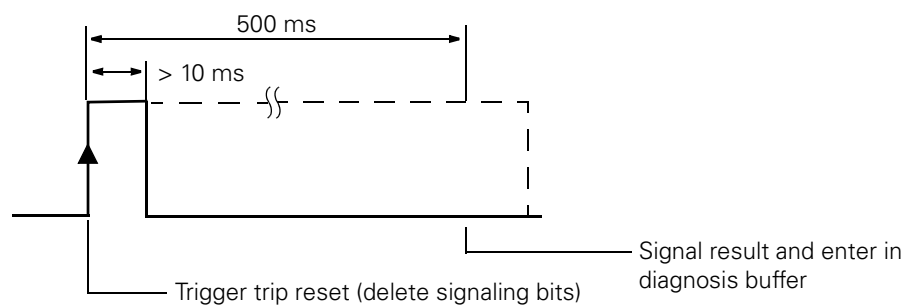
If trip reset is permanently present, the acknowledgement is triggered only once.

8.2   Potential Faults in Motor Starters with PROFIBUS-DP

Motor starter: 3RK1303-2AS51-1AA.

Potential faults	Action	Signaling bits	LED indicator	Acknow-ledged by	Comment
Bus fault	Switch substitute value	• Bus fault	BF: red	Auto*)	Check the communication connection to the field bus master.
	Retain last value	• CPU/Master STOP			Possible causes of faults: Bus connector removed? Bus line severed Field bus master defective
Control (PLC) is set to STOP	Switch substitute value	• CPU/Master STOP	BF: off	Auto*)	Switch control back to RUN.
	Retain last value				
Process image error	Trip	• General fault • Process image error	SF: red	OFF command	Deactivate the Motor CLOCKWISE/COUNTER-CLOCKWISE control command.
Undervoltage *DC24V-NS*	Trip	• General fault • Electronics supply voltage too low	SF: red	Auto*)	Check the power supply. $U_{DC24V-NS} < 18\ V$
Undervoltage *DC24V-S*	Trip	• General fault	SF: red	Auto*)	Check the power supply. $U_{DC24V-S} < 18\ V$
No main power supply	*Fault not recognized!*				If the motor cannot be switched on even though it is properly connected and power has been applied, the internal fuses are defective. –> Replace the device!
Sensor supply overload	Trip	• General fault	SF: red	Trip reset	Check the sensor supply. $I_{Sensor} > 200\ mA$
Temperature sensor overload	Warning/	• General warning • Temperature sensor overload	SF: off	Auto*)	Wait until the motor has cooled down.
	Trip	• General fault • Temperature sensor overload • Overload trip	SF: red	Autoreset/ trip reset	Wait until the motor has cooled down. Acknowledge after motor has cooled down. If acknowledgement is not possible, the motor is still too hot.
Temperature sensor short-circuit	Warning/	• General warning • Temperature sensor short-circuit	SF: off	Auto*)	Remove the short-circuit on the temperature sensor lead.
	Trip	• General fault • Temperature sensor short-circuit • Overload trip	SF: red	Autoreset/ trip reset	Remove the short-circuit on the temperature sensor lead. Acknowledge once the fault has been rectified.

Potential faults	Action	Signaling bits	LED indicator	Acknow-ledged by	Comment
Temperature sensor wire break	Warning/	• General warning • Temperature sensor wire break	SF: off	Auto[*]	Remove the wire break on the temperature sensor lead.
	Trip	• General fault • Temperature sensor wire break • Overload trip	SF: red	Autoreset/ trip reset	Remove the wire break on the temperature sensor lead. Acknowledge once the fault has been rectified.
Temperature sensor deactivated	None	None	SF: red	Auto[*]	Connect the motor to the temperature sensor. Remove the wire break or short-circuit on the temperature sensor lead. Allow the motor to cool down if overloaded.
Self-test fault (device fault)	Trip	• General fault • Self-test fault (device fault)	SF: red	Power OFF	Switch the device off and then back on.
Switching element defective	Trip	• General fault • Switching element defective	SF: red STATE: red	Power OFF	If a device fault is reported again, the device must be replaced.

*) Once the cause of the fault has been removed, the fault is acknowledged automatically regardless of the parameters set (not to be confused with autoreset).

Table 8-1: Faults and fault handling for 3RK1 303-5BS41-1AA.

Motor starter: 3RK1 303-5BS41-1AA./3RK1 303-5CS41-1AA.

Potential faults	Action	Signaling bits	LED indicator	Acknow-ledged by	Comment
Bus fault	Switch substitute value	• Bus fault	BF: red	Auto[*)]	Check the communication connection to the field bus master.
	Retain last value	• CPU/Master STOP			Possible causes of faults: • Bus connector removed? • Bus line severed • Field bus master defective
Control (PLC) is set to STOP	Switch substitute value	• CPU/Master STOP	BF: off	Auto[*)]	Switch control back to RUN.
	Retain last value				
Process image error	Trip	• General fault • Process image error	SF: red DEVICE: yellow	OFF command	Deactivate the Motor CLOCKWISE/COUNTER-CLOCKWISE control command.
Undervoltage *DC24V-NS*	Trip	• General fault • Electronics supply voltage too low	SF: red DEVICE: yellow	Auto[*)]	Check the power supply. $U_{DC24V-NS} > 18$ V
Undervoltage *DC24V-S*	Trip	• General fault • No switching element supply voltage	SF: red DEVICE: yellow	Auto[*)]	Check the power supply. $U_{DC24V-S} > 18$ V
No main power supply	Warning	• General warning • Residual current detected • Ie lower limit value violation	SF: red DEVICE: yellow flash	Auto[*)]	Switch on/check the main power supply.
	Trip	• General fault • Residual current detected • Residual current trip	SF: red DEVICE: yellow	Autoreset/ trip reset	Switch on/check the main power supply. Acknowledge once the fault has been rectified. If the fault message is still displayed even though power has been applied to the starter and the rated operational current has been set correctly, the internal fuses are defective. –>Replace the device.
Sensor supply overload	Trip	• General fault • Sensor supply overload	SF: red DEVICE: yellow	Trip reset	Check the sensor supply. $I_{Sensor} < 200$ mA

Table 8-2: Faults and fault handling for 3RK1303-5BS41-1AA./3RK1303-5CS41-1AA.

Potential faults	Action	Signaling bits	LED indicator	Acknow-ledged by	Comment
Thermal motor model overload	Warning	• General warning • Thermal motor model overload	SF: off DEVICE: yellow flash	Auto[*)]	Wait until the cooling time has elapsed (the motor has cooled down).
	Trip	• General fault • Thermal motor model overload • Overload trip • Cooling time active	SF: red DEVICE: yellow	Autoreset/ trip reset	Wait until the cooling time has elapsed (the motor has cooled down). Acknowledge after motor has cooled down. The current status of the cooling time is included in the measured values.
Self-test fault (device fault)	Trip	• General fault • Self-test fault (device fault)	SF: red DEVICE: red	Power OFF	Switch the device off and then back on.
Switching element defective	Trip	• General fault • Switching element defective	SF: red STATE: red DEVICE: red	Power OFF	If a device fault is reported again, the device must be replaced.

*) Once the cause of the fault has been removed, the fault is acknowledged automatically regardless of the parameters set (not to be confused with autoreset).

Table 8-2: Faults and fault handling for 3RK1303-5BS41-1AA./3RK1303-5CS41-1AA. (Cont.)

Motor starter: 3RK1303-6BS71-1AA./3RK1303-6DS71-1AA./3RK1303-6.S8-3AA3

Potential faults	Action	Signaling bits	LED indicator	Acknow-ledged by	Comment
Bus fault	Switch substitute value	• Bus fault	BF: red	Auto[*)]	Check the communication connection to the field bus master.
	Retain last value	• CPU/Master STOP			Possible causes of faults: • Bus connector removed? • Bus line severed • Field bus master defective
Control (PLC) is set to STOP	Switch substitute value	• CPU/Master STOP	BF: off	Auto[*)]	Switch control back to RUN.
	Retain last value				
Process image error	Trip	• General fault • Process image error	SF: red DEVICE: yellow	OFF command	Deactivate the Motor CLOCKWISE/COUNTER-CLOCKWISE control command.
Undervoltage *DC24V-NS*	Trip	• General fault • Electronics supply voltage too low	SF: red DEVICE: yellow	Auto[*)]	Check the power supply. $U_{DC24V\text{-}NS} > 18\ V$
Undervoltage *DC24V-S*	Trip	• General fault • No switching element supply voltage	SF: red DEVICE: yellow	Auto[*)]	Check the power supply. $U_{DC24V\text{-}S} > 18\ V$
No main power supply for OFF command	None	• No mains voltage	SF: off	Auto[*)]	Switch on/check the main power supply. If the fault message is still displayed even though power has been applied to the starter, the internal fuses are defective. –> Replace the device.
ON command	Trip	• General fault • No mains voltage	SF: red DEVICE: yellow	Trip reset	Switch on/check the main power supply. Acknowledge once the fault has been rectified. If the fault message is still displayed even though power has been applied to the starter, the internal fuses are defective. –> Replace the device.
Sensor supply overload	Trip	• General fault • Sensor supply overload	SF: red DEVICE: yellow	Trip reset	Check the sensor supply. $I_{Sensor} < 200\ mA$

Table 8-3: Faults and fault handling for 3RK1303-6BS71-1AA./3RK1303-6DS41-1AA./3RK1303-6.S8-3AA3

Potential faults	Action	Signaling bits	LED indicator	Acknow-ledged by	Comment
Temperature sensor overload	Warning	• General warning • Temperature sensor overload	SF: off DEVICE: yellow flash	Auto[*)]	Wait until the motor has cooled down.
	Trip	• General fault • Temperature sensor overload • Overload trip	SF: red DEVICE: yellow	Autoreset/ trip reset	Wait until the motor has cooled down. Acknowledge after motor has cooled down. If acknowledgement is not possible, the motor is still too hot.
Temperature sensor short-circuit	Warning	• General warning • Temperature sensor short-circuit	SF: off DEVICE: yellow flash	Auto[*)]	Remove the short-circuit on the temperature sensor lead.
	Trip	• General fault • Temperature sensor short-circuit • Overload trip	SF: red DEVICE: yellow	Autoreset/ trip reset	Remove the short-circuit on the temperature sensor lead. Acknowledge once the fault has been rectified.
Temperature sensor wire break	Warning	• General warning • Temperature sensor wire break	SF: off DEVICE: yellow flash	Auto[*)]	Remove the wire break on the temperature sensor lead.
	Trip	• General fault • Temperature sensor wire break • Overload trip	SF: red DEVICE: yellow	Autoreset/ trip reset	Remove the wire break on the temperature sensor lead. Acknowledge once the fault has been rectified.
Thermal motor model overload	Warning	• General warning • Thermal motor model overload	SF: off DEVICE: yellow flash	Auto[*)]	Wait until the cooling time has elapsed (the motor has cooled down).
	Trip	• General fault • Thermal motor model overload • Overload trip • Cooling time active	SF: red DEVICE: yellow	Autoreset/ trip reset	Wait until the cooling time has elapsed (the motor has cooled down). Acknowledge after motor has cooled down. The current status of the cooling time is included in the measured values. Acknowledgement only possible after cooling time has elapsed, that is, the signaling bit "Cooling time active" is no longer present.
Self-test fault (device fault)	Trip	• General fault • Self-test fault (device fault)	SF: red DEVICE: red	Power OFF	Switch the device off and then back on.
Switching element defective	Trip	• General fault • Switching element defective	SF: red STATE: red DEVICE: red	Power OFF	If a device fault is reported again, the device must be replaced.

Table 8-3: Faults and fault handling for
3RK1303-6BS71-1AA./3RK1303-6DS41-1AA./3RK1303-6.S8-3AA3 (Cont.)

Potential faults	Action	Signaling bits	LED indicator	Acknow-ledged by	Comment
Additional to 3RK1303-6.S8.-3AA3 (Duo Reversing Soft Starters)					
Intermediate circuit voltage too high	Trip	• General fault • Intermediate circuit voltage too high	SF: red DEVICE: yellow	Trip reset	Motor generating too much power during switch-off. Reduce the load or select a larger motor.
Short-circuit protection/ Line protection	Trip	• General fault • Line protection overload • Line protection trip	SF: red DEVICE: yellow	Trip reset	Remove the short-circuit on the motor supply lead. Acknowledge once the fault has been rectified.

*) Once the cause of the fault has been removed, the fault is acknowledged automatically regardless of the parameters set (not to be confused with autoreset).

Table 8-3: Faults and fault handling for
3RK1303-6BS71-1AA./3RK1303-6DS41-1AA./3RK1303-6.S8-3AA3 (Cont.)

8.3 Potential Faults in Motor Starters with AS Interface

Motor starter: 3RK1323-5BS41-1AA./3RK1323-5CS41-1AA.

Potential faults	Action	Signaling bits	LED indicator	Acknowledged by	Comment
Bus fault	Switch substitute value	• Bus fault	BF: red	Auto*)	Check the communication connection to the field bus master.
	Retain last value	• CPU/Master STOP			Possible causes of faults: • Bus connector removed? • Bus line severed • Field bus master defective
Control (PLC) is set to STOP	Switch substitute value	• CPU/Master STOP	BF: off	Auto*)	Switch control back to RUN.
	Retain last value				
Process image error	Trip	• General fault • Process image error	SF: red DEVICE: yellow	OFF command	Deactivate the Motor CLOCKWISE/COUNTER-CLOCKWISE control command.
Undervoltage *DC24V-NS or AS-i*	Trip	• General fault • Electronics supply voltage too low	SF: red DEVICE: yellow	Auto*)	Check the power supply. $U_{DC24V-NS} > 18\ V$
Undervoltage *DC24V-S or AUX PWR*	Trip	• General fault • No switch. element supply voltage	SF: red DEVICE: yellow	Auto*)	Check the power supply. $U_{DC24V-S} > 18\ V$
No main power supply	Warning	• General warning • Residual current detected • Ie lower limit value violation	SF: red DEVICE: yellow flash	Auto*)	Switch on/check the main power supply.
	Trip	• General fault • Residual current detected • Residual current trip	SF: red DEVICE: yellow	Autoreset/ trip reset	Switch on/check the main power supply. Acknowledge once the fault has been rectified. If the fault message is still displayed even though power has been applied to the starter and the rated operational current has been set correctly, the internal fuses are defective. –>Replace the device.
Sensor supply overload	Trip	• General fault • Sensor supply overload	SF: red DEVICE: yellow	Trip reset	Check the sensor supply. $I_{Sensor} < 200\ mA$

Table 8-4: Faults and fault handling for 3RK1323-5BS41-1AA./3RK1323-5CS41-1AA.

Potential faults	Action	Signaling bits	LED indicator	Acknowledged by	Comment
Thermal motor model overload	Warning	• General warning • Thermal motor model overload	SF: off DEVICE: yellow flash	Auto[*)]	Wait until the cooling time has elapsed (the motor has cooled down).
	Trip	• General fault • Thermal motor model overload • Overload trip • Cooling time active	SF: red DEVICE: yellow	Autoreset/ trip reset	Wait until the cooling time has elapsed (the motor has cooled down). Acknowledgement after cooling down. The current status of the cooling time is included in the measured values.
Self-test fault (device fault)	Trip	• General fault • Self-test fault (device fault)	SF: red DEVICE: red	Power OFF	Switch the device off and then back on.
Switching element defective	Trip	• General fault • Switching element defective	SF: red STATE: red DEVICE: red	Power OFF	If a device fault is reported again, the device must be replaced.

*) Once the cause of the fault has been removed, the fault is acknowledged automatically regardless of the parameters set (not to be confused with autoreset).

Table 8-4: Faults and fault handling for 3RK1323-5BS41-1AA./3RK1323-5CS41-1AA. (Cont.)

Motor starter: 3RK1323-6BS71-1AA./3RK1323-6DS71-1AA./3RK1323-6.S8-3AA3

Potential faults	Action	Signaling bits	LED indicator	Acknowledged by	Comment
Bus fault	Switch substitute value	• Bus fault	BF: red	Auto[*)]	Check the communication connection to the field bus master.
	Retain last value	• CPU/Master STOP			Possible causes of faults: • Bus connector removed? • Bus line severed • Field bus master defective
Control (PLC) is set to STOP	Switch substitute value	• CPU/Master STOP	BF: off	Auto[*)]	Switch control back to RUN.
	Retain last value				
Process image error	Trip	• General fault • Process image error	SF: red DEVICE: yellow	OFF command	Deactivate the Motor CLOCKWISE/COUNTER-CLOCKWISE control command.
Undervoltage *DC24V-NS or AS-i*	Trip	• General fault • Electronics supply voltage too low	SF: red DEVICE: yellow	Auto[*)]	Check the power supply. $U_{DC24V-NS} > 18\,V$
Undervoltage *DC24V-S or AUX PWR*	Trip	• General fault • No switching element supply voltage	SF: red DEVICE: yellow	Auto[*)]	Check the power supply. $U_{DC24V-S} > 18\,V$
No main power supply for OFF command	None	• No mains voltage	SF: off	Auto[*)]	Switch on/check the main power supply. If the fault message is still displayed even though power has been applied to the starter, the internal fuses are defective. –> Replace the device!
ON command	Trip	• General fault • No mains voltage	SF: red DEVICE: yellow	Trip reset	Switch on/check the main power supply. Acknowledge once the fault has been rectified. If the fault message is still displayed even though power has been applied to the starter, the internal fuses are defective. –> Replace the device.
Sensor supply overload	Trip	• General fault • Sensor supply overload	SF: red DEVICE: yellow	Trip reset	Check the sensor supply. $I_{Sensor} < 200mA$

Table 8-5: Faults and fault handling for
3RK1323-6BS71-1AA./3RK1323-6DS41-1AA./3RK1323-6.S8-3AA3

Potential faults	Action	Signaling bits	LED indicator	Acknowledged by	Comment
Temperature sensor overload	Warning	• General warning • Temperature sensor overload	SF: off DEVICE: yellow flash	Auto[*)]	Wait until the motor has cooled down.
	Trip	• General fault • Temperature sensor overload • Overload trip	SF: red DEVICE: yellow	Autoreset/ trip reset	Wait until the motor has cooled down. Acknowledge after motor has cooled down. If acknowledgement is not possible, the motor is still too hot.
Temperature sensor short-circuit	Warning	• General warning • Temperature sensor short-circuit	SF: off DEVICE: yellow flash	Auto[*)]	Remove the short-circuit on the temperature sensor lead.
	Trip	• General fault • Temperature sensor short-circuit • Overload trip	SF: red DEVICE: yellow	Autoreset/ trip reset	Remove the short-circuit on the temperature sensor lead! Acknowledge once the fault has been rectified.
Temperature sensor wire break	Warning/	• General warning • Temperature sensor wire break	SF: off DEVICE: yellow flash	Auto[*)]	Remove the wire break on the temperature sensor lead.
	Trip	• General fault • Temperature sensor wire break • Overload trip	SF: red DEVICE: yellow	Autoreset/ trip reset	Remove the wire break on the temperature sensor lead. Acknowledge once the fault has been rectified.
Thermal motor model overload	Warning	• General warning • Thermal motor model overload	SF: off DEVICE: yellow flash	Auto[*)]	Wait until the cooling time has elapsed (the motor has cooled down).
	Trip	• General fault • Thermal motor model overload • Overload trip • Cooling time active	SF: red DEVICE: yellow	Autoreset/ trip reset	Wait until the cooling time has elapsed (the motor has cooled down). Acknowledge after motor has cooled down. The current status of the cooling time is included in the measured values.
Self-test fault (device fault)	Trip	• General fault • Self-test fault (device fault)	SF: red DEVICE: red	Power OFF	Switch the device off and then back on.
Switching element defective	Trip	• General fault • Switching element defective	SF: red STATE: red DEVICE: red	Power OFF	If a device fault is reported again, the device must be replaced.

Table 8-5: Faults and fault handling for
3RK1323-6BS71-1AA./3RK1323-6DS41-1AA./3RK1323-6.S8-3AA3 (Cont.)

Potential faults	Action	Signaling bits	LED indicator	Acknowledged by	Comment
Additional to 3RK1 323-6.S8.-3AA3 (Duo Reversing Soft Starters)					
Intermediate circuit voltage too high	Trip	• General fault • Intermediate circuit voltage too high	SF: red DEVICE: yellow	Trip reset	Motor generating too much power during switch-off. Reduce the load or select a larger motor.
Short-circuit protection/ Line protection	Trip	• General fault • Line protection overload • Line protection trip	SF: red DEVICE: yellow	Trip reset	Remove the short-circuit on the motor supply lead. Acknowledge once the fault has been rectified.

*) Once the cause of the fault has been removed, the fault is acknowledged automatically regardless of the parameters set (not to be confused with autoreset).

Table 8-5: Faults and fault handling for 3RK1323-6BS71-1AA./3RK1323-6DS41-1AA./3RK1323-6.S8-3AA3 (Cont.)

Device Functions

9

9.1   Introduction

Device Function

This chapter describes the device functions. All the device functions have inputs (e.g. the device parameters) and outputs (e.g. signals). The following diagram illustrates the device functional principle:
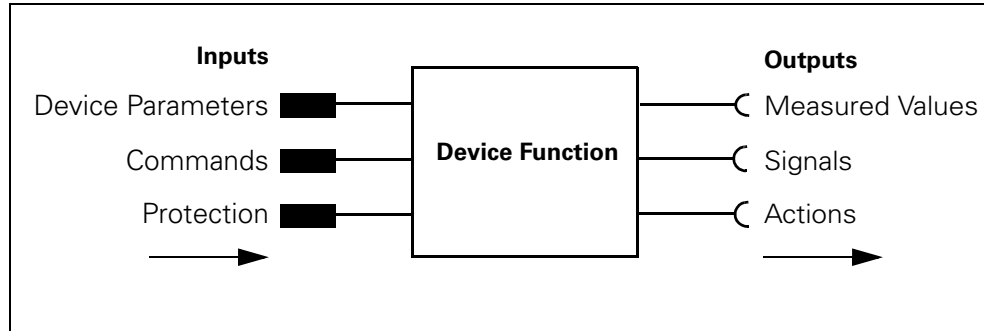
Fig. 9-1: Device functional principle

Self-Protection Mechanism

The motor starter protects itself against damage by means of the thermal motor model and temperature measurements for electronic switching elements. When the self-protection mechanism is activated:

• the brake output and the motor are switched off immediately
• the "Switching element overload" signal is generated

The device cannot be started with "Emergency start".

Currents

All the currents (e.g. blocking current, current limits) are current values measured as a percentage of the rated operational current.

9.2 Basic Parameters

Definition

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

• Rated operational current (current limits, asymmetry, thermal motor model)
• Load type (asymmetry, thermal motor model)
• Non-volatility (thermal motor model, temperature sensor)

Device parameters for Bascic Parameters - Description

Rated Operational Current

You use this parameter to specify the rated operational current that the feeder (switching devices and motor) can carry continuously. The setting range depends on the output class.

Attention
The rated operational current is the most important central parameter! The rated operational current must **always** be set to ensure that the motor is protected!

Special feature:
– The rated operational current in the motor starter is defaulted to the **maximum** value ex works. This means that the motor can be started without a field bus.
– For safety reasons, the rated operational current in the GSD and the Switch ES software is set to the **minimum** value. You must, therefore, parameterize this value during configuration, otherwise the motor starter would operate due to an overload the first time it is started.

Load Type

You use this parameter to specify whether you want the motor starter to protect a 1-phase or 3-phase load.

• With 1-phase load, asymmetry detection is deactivated!
    – The 1-phase load can be connected between any two phases for all motor starters that switch mechanically.
    – None of the motor starters that switch electronically (soft starter, duo-reversing soft starter) currently supports 1-phase consumers.
    The "Load type = 1-phase" parameter, however, is not rejected by the motor starter; it simply deactivates the asymmetry detection function.
• With 3-phase load, asymmetry detection is activated! The three phase currents are compared with each other.

Group Diagnosis

You use this parameter to enable or disable diagnosis via PROFIBUS-DP (error type)

Protection Against Voltage Failure

You use this parameter to retain the last overload signal
- Overload
- No Overload

in the event of a supply voltage failure

Basic Parameters - Settings

The following table shows the settings of the basic parameters:

Device parameters[*)]	Pre-setting	Setting Range
Rated operational current		Increment: 10 mA
Performance class 3 (0.09 kW to 1.1 kW)	3.0 A	0.3 A to 3.0 A
Performance class 2 (0.25 kW to 1.5 kW)	4.0 A	0.6 A to 4.0 A
Performance class 12 (1.1 kW to 3 kW)	8.0 A	2.4 A to 8.0 A
Performance class 4 (1.1 kW to 4.0 kW)	9.0 A	2.4 A to 9.0 A
Performance class 5 (0.09 kW to 4.0 kW)	9.0 A	0.3 A to 9.0 A
Performance class 6 (1.1 kW to 5.5 kW)	12. 0 A	2.4 A to 12.0 A
Load Type	3-phase	3-phase/1-phase
Protection Against Voltage Failure	Yes	Yes/No
[*)]Rated Power of the motor at 400 V AC		

Table 9-1: Basic parameters - settings

9.3   **Thermal Motor Model**

Definition

The winding temperature of the motor is calculated using the measured motor currents and the device parameters "Rated operational current" and "Tripping class". This indicates whether the motor is overloaded or functioning in the normal operating range.

Speed Controller Control Function: Corrective Measures

When the frequency and, therefore, the motor speed is changed, the speed of the motor fan impeller also changes.
This either increases or decreases the cooling capacity of the fan impeller and, in turn, the rated motor power.
This effect is taken into account in the thermal motor model.

        Device Parameters for Thermal Motor Model - Description

Response to Overload - Thermal Motor Model

You can parameterize the following responses to an overload:

- Trip without restart
- Trip with restart
- Warning

Attention
Restart means that if a starting command is pending, the motor starter switches on again automatically if the cause of the error has been corrected (Autoreset).

Tripping Class

The tripping class (Class) specifies the maximum tripping time within which a protection device must trip from the cold state with 7.2 times the set current (motor protection to IEC60947). The tripping characteristics indicate the tripping time depending on the tripping current.
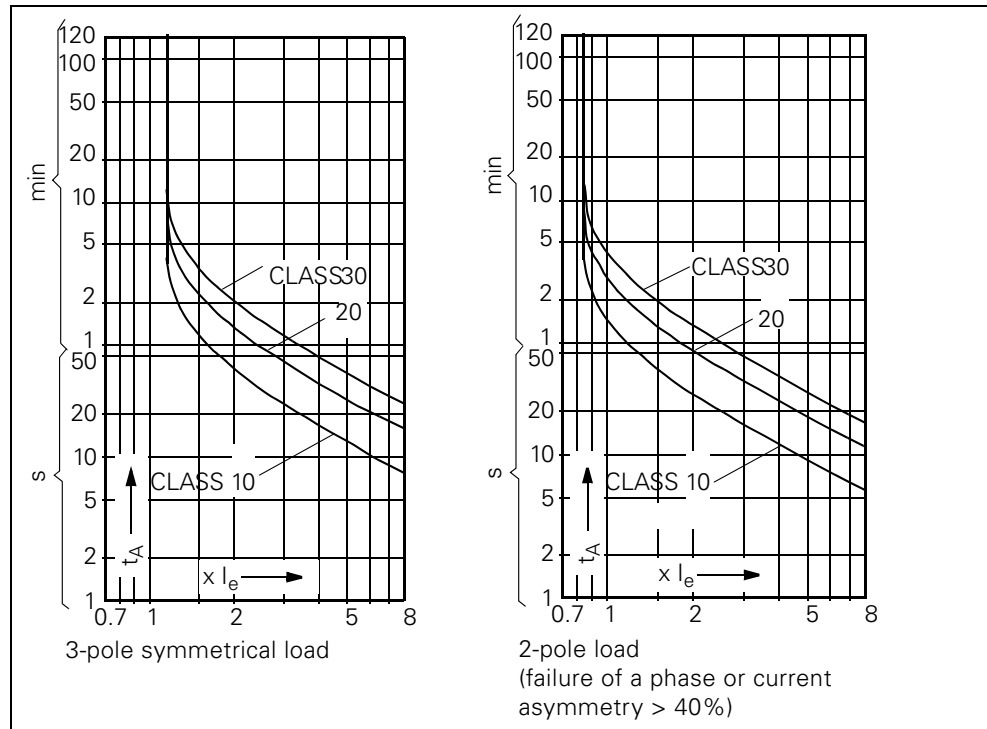
Fig. 9-2: Tripping classes

Attention

The tripping classes depend on rated operational current
CLASS 10: rated operational current 9 A/12 A max.
CLASS 20: rated operational current 7.3 A max.
CLASS 30: rated operational current 6.7 A max.

Recovery Time

The recovery time is the time specified for cooling, after which the system can be reset if overload tripping occurs. Voltage failures during this time extend the specified time accordingly. The cooling time after overload tripping is at least 1 minute. The recovery time is parameterizable and can be extended.

Recommended setting: 90 seconds

Idle Time

The idle time is the time specified for cooling when the motor is turned off by control functions at operating temperature (not due to overload). After this time, the thermal memory is

- deleted to 0% at motor heating < 50%
- reduced to 50% at motor heating ≥ 50%

This allows frequent starting (inching mode). The following diagram illustrates cooling with and without the idle time:
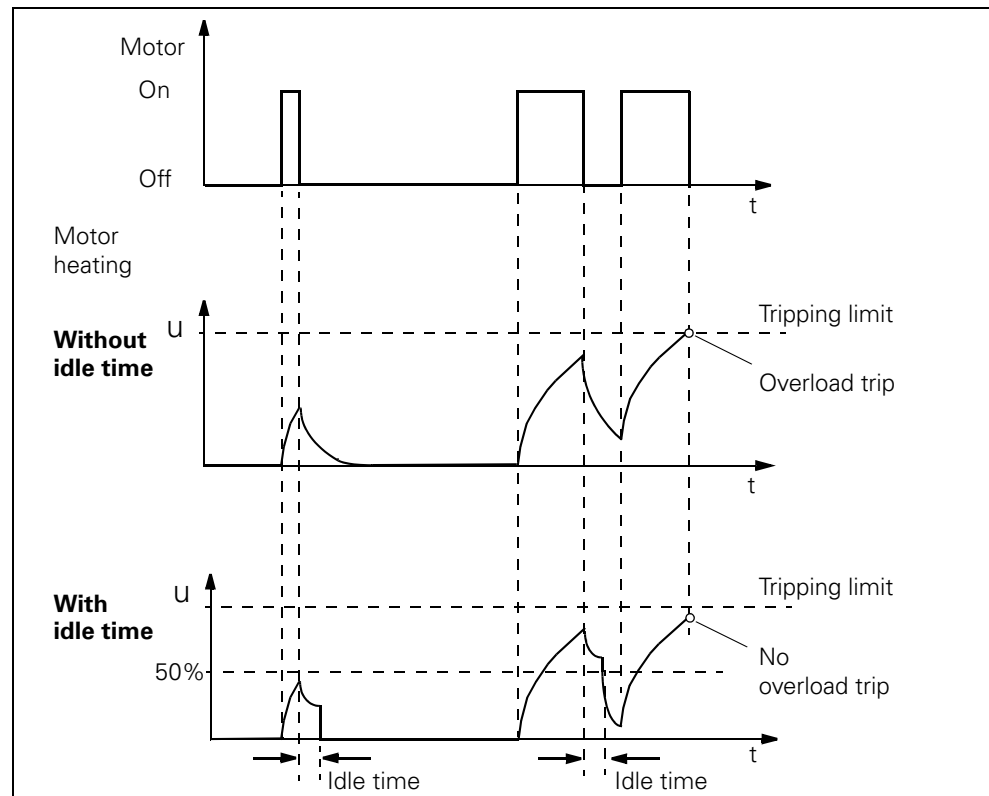
Fig. 9-3: Idle time

Thermal Motor Model - Settings

You find the settings of the basic parameters in the following table:

Device parameters	Pre-setting	Setting Range
Response to Overload - Thermal Motor Model	Trip without restart	Trip without restart/ Trip with restart/ Warning
Tripping Class	10	10, 20, 30
Recovery Time	90 seconds	1 min. to 30 minutes
Idle Time	0	0 to 255 seconds

Table 9-2: Device parameters for thermal motor model - settings

Signals and Actions, Measured Values, and Statistical Data

The device function "Thermal motor model" outputs the following signals, measured values, and statistical data:

Signals and Actions

Signal	Action
Thermal Motor Model - Overload	—
Overload Tripping	Tripping (overload present)
Idle Time active	—
Cooling Time active	—

Table 9-3: Thermal motor model - signals and actions

Measured Values and Statistical Data

Measured Values	Description
Remaining Cooling 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 %

Statistical Data	Description
Last Tripping Current	—
Motor Current I_{max}	—
Preventive Diagnosis	—
Number of Overload trips	—
Maximum Tripping 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 9-4: Thermal motor model - measured values and statistical data

9.4 Temperature Sensor

Definition

Temperature sensors are located in the stator winding of the motor. They are used to monitor the temperature of the motor windings. This indicates whether the motor is functioning normally or is overloaded.

Attention

ECOFAST motor starters can evaluate **one** temperature sensor circuit.

Device Parameters for Temperature Sensor - Description

Temperature Sensor

You can deactivate this parameter if the motor is not fitted with a temperature sensor.
You can activate this parameter if the motor is fitted with a temperature sensor in the motor.
Two types of temperature sensor are supported:
– Thermoclick: This is a switch that opens at a certain winding temperature.
– PTC - type A: This is a PTC thermistor with a defined characteristic according to VDE 0660 Part 302 and 303

Setting range:
• Deactivated

• Thermoclick (switch with fixed closing temperature)

• PTC type A (PTC thermistor with fixed resistance range)

Attention

When you parameterize "Deactivated", the following parameters are ignored
• Response to Temperature Sensor Overload
• Temperature Sensor Monitoring

When you parameterize "Thermoclick", the following parameters are ignored:
• Temperature sensor monitoring

Attention

The temperature sensor circuit is electrically connected to "24 V DC supply voltage not switched".

Response to Overload - Temperature Sensor

You use this device parameter to determine how the motor starter responds to a temperature sensor overload and when the temperature sensor monitor responds:

• Trip without restart

• Trip with restart

• Warning

Attention

Restart means that if a starting command is pending, the motor starter switches on again automatically if the cause of the error has been corrected (Autoreset).

Temperature Sensor Monitoring

You use this device parameter to determine whether the temperature sensor lead is to be monitored for interruptions and short-circuits.

Setting range: Yes/No

Device Parameters for Temperature Sensor-Settings

The following table shows the settings:

Device parameters	Pre-setting	Setting Range
Temperature Sensor	Deactivated	Deactivated/ Thermoclick/ PTC type A
Response to Overload - Temperature Sensor	Trip without restart	Trip without restart/ Trip with restart/ Warning
Temperature Sensor - Monitoring	Yes	Yes/No

Table 9-5: Device parameters for temperature sensor - settings

Signals and Actions

The "Temperature sensor" device function outputs the following signals and actions:

Signal	Action
Temperature Sensor Overload	—
Temperatursensor Wire Break	—
Temperatursensor Short-Circuit	—
Overload Tripping	Tripping (overload, wire break or short-circuit present)

Table 9-6: Temperature sensor - signals and actions

9.5 Line Protection

Task

Duo-reversing soft starters provide reliable line protection between the motor starter and motor. The current limitation function is also activated. This switches the motor starter power section off (e.g. due to a line short-circuit) as of 2.11 x the maximum setting current (2.11x Ie_{max}).

When line protection is activated, the following signaling bits are set in data record 92 - diagnosis:

- Line protection overload
- Line protection trip

Note

Attention
With duo-reversing soft starters, shielded motor supply leads must be used if the starter is to be located near the motor!

9.6 Current Limits

Definition

The motor current and current limits enable different system states to be determined:

System state	Current value	Protected by
System becomes sluggish (e.g. due to damaged bearings) System runs more smoothly (e.g. because there is no material left to process)	Current is greater or smaller than usual	Current limits
System is blocked	Very high current	Block protection
Motor running at no-load (e.g. due to system damage)	Very low current (< 18.75% of le)	Zero current detector

Device Parameters for Current Limits - Description

Lower/Upper Current Limit

You can enter an upper and/or a lower current limit.
Example:
- "Mixing mass too viscous"; in other words, the upper current limit is violated.
- "Idling because drive belt torn"; in other words, the lower current limit is violated.

Attention
The current limits are not activated until the class time elapses (for example, after 10 seconds for class 10) to permit the time for starting to be bridged.

If one of the current limits is violated, the motor starter responds with either a trip or a warning.

Setting range for the lower current limit:
18.75% to 100% of the rated operational current.

Setting range for the upper current limit:
50% to 150% of the rated operational current.

Response to Current Limit Violation

You use this device parameter to determine how the motor starter responds to a current limit violation:
- Warning
- Tripping

Blocking Current

If the blocking current is exceeded, the motor starter detects a block. From this point, blocking time monitoring, the duration of which is defined by the blocking time, is started independently of the class time.

Attention

If a block still exists after the blocking time has elapsed, the motor starter switches off.

Setting range: 50% to 1.000% of the rated operational current.

Blocking Time

The time during which a block can exist without the motor starter switching off. If a block still exists after the blocking time has elapsed, the motor starter switches off.
Setting range: 1 s to 5 s.

Block Protection Principle

The following diagram illustrates the block protection principle, that is, the relationship between the blocking current and blocking time:
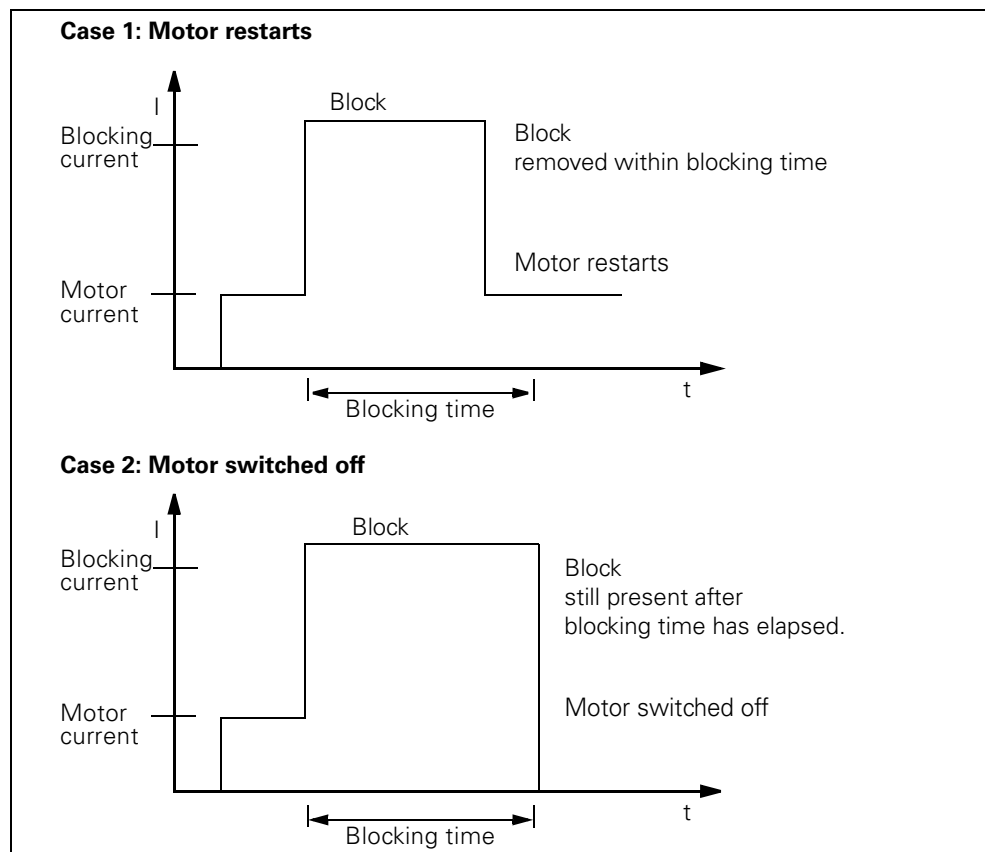
Fig. 9-4: Block protection principle

Response to Residual Current Detection

Residual current detection reacts when motor current gets lower than 18.75% of rated operational current in all 3 phases. You can parameterize the following responses:

• Warning

• Tripping

Attention
When the motor is switched on, the zero current detector is suppressed for approximately 1 second!

Device Parameters - Settings

The following table shows the settings:

Device parameters	Pre-setting	Setting Range
Response to Current Limit Violation	Warning	Warning/Trip
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 Detcection	Trip	Warning/Trip

Table 9-7: Device parameters current limits - settings

Signals and Actions

The "Current limits" device function outputs the following signals and actions:

Signal	– Action
I_s Upper Limit Value Violation	—
I_s Lower Limit Value Violation	—
I_s Limit Value Tripping	Tripping (limit value violation)
Residual Current Detected	—
Residual Current Tripping	Tripping (residual current detection)
Motor Block Tripping	Tripping (block protection)

Table 9-8: Current limits - signals and actions

9.7 Asymmetry

Definition

Three-phase induction motors respond to slight asymmetries in the system voltage with a higher asymmetric current consumption. As a result, the temperature in the stator and rotor winding increases.

Attention
When the motor is switched on, the asymmetry evaluation is suppressed for approximately 500 milliseconds.

Device Parameters for Asymmetry - Description

Asymmetry Limit

The asymmetry limit is a value in percent by which the motor current is allowed to vary in the individual phases.
Asymmetry occurs when the difference between the smallest and largest phase current is greater than the parameterized asymmetry limit.
The reference value for the evaluation is the maximum phase current in one of the three phases!

Setting range: 30% to 60% of the rated operating current

Response To Asymmetry

You use this device parameter to determine how the motor starter responds to asymmetry:
• Warning
• trip

Device Parameters for Asymmetry - Settings

The following table shows the device parameter settings:

Device parameters	Pre-setting	Setting Range
Response to Asymmetry	Trip	Warning/ Trip
Asymmetry Limit	30%	30% to 60% Increment: 10%

Table 9-9: Device parameters for asymmetry - settings

Signals, Actions and Measured Values

The "Asymmetry" device function outputs the following signals, actions and measured values:

Signals and Actions

Signal	Action
Asymmetry Detected	—
Asymmetry Tripping	Tripping (asymmetry exists)

Table 9-10: Asymmetry - signals and actions

Measured Values

Measured Values	Description
Asymmetry	Asymmetry 0 to 100% Increment: 1%

Table 9-11: Asymmetry - measured values

9.8   Inputs

Description

Using the inputs device function, the motor starter can carry out different actions, which you can parameterize. The signals at both digital inputs are evaluated for this purpose. You can connect the inputs directly to sensors (PNP) in 2 and 3-wire circuits.
The input actions of the individual digital inputs and their effect on the motor starter functions are independent of each other (=OR function).

Device Parameters for Inputs - Description

Input Delay

In the interests of interference immunity, you can set a debounce time for the inputs.
Setting range: 10 milliseconds to 80 milliseconds

Input n - Level

You use this device parameter to define the input logic.
Setting range: Normally closed contact/normally open contact

Attention

"Input n - Action: Emergency Start, Motor CLOCKWISE and Motor COUNTER CLOCKWISE"; input n level can only be parameterized as a make contact.

Attention

If Input n - Level is parameterized from break contact to make contact and the associated input n action to "Switch off without restart", the signaling bit "Input switch off" is set due to the input delay.

Attention

The input level of the digital inputs is always transferred to the controller (PLC) as a make contact, regardless of the "Input n - Level" parameter (process image of the inputs in data record 69 and diagnosis in data record 92).

Input n - Signal

You can use this device parameter to define whether the input level of the digital inputs is to be saved:

• latch (latching mode)
• unlatch (inching mode)

Input n - Action

Different actions can be triggered when an input signal is present. You can parameterize the following actions depending on "Input n - Level", "Input n - Signal", and "Operating Mode":

Attention
When "Input n - Signal = Latch" and "Input n - Action = Motor CW/CCW, at least one input must always be parameterized with input action "Switch off ..." or "Quick Stop".
If this rule is violated, the motor starter rejects the parameters and outputs an appropriate diagnosis message!

Input n - Action	- Level	- Signal	Opera-ting mode	Description
No action	NO/NC	unl/la	all	—
Tripping without restart	NO/NC	unl/–	all	• This causes the motor and brake to be switched off. • Acknowledgement is required after the cause of the trip has been eliminated (input state).
Tripping with restart (autoreset)	NO/NC	unl/–	all	• This causes the motor and brake to be switched off. • Automatic acknowledgement after the cause of the trip has been eliminated (input state).
Switch-off end position clockwise	NO/NC	unl/–	all	• The motor and brake output are switched off irrespective of the motor direction. • The brake output can be switched on again once the control commands "Brake" and "Motor CW/CCW" have been deleted.
Switch-off end position counter clockwise	NO/NC	unl/–	all	• Switch-off end position clockwise: The motor can only be switched on again with the countercommand "Motor CCW". • Switch-off end position counter clockwise: The motor can only be switched on again with the countercommand "Motor CW".
General warning	NO/NC	unl/la	all	• The "General warning" signal is set. • The motor starter and brake output are not switched off! ***la:*** *The input action responds to the active edge of the input signal. This also enables deactivation if the input signal is active.* *The action is deactivated with "trip reset".*
Manual operation local	NO/NC	unl/–	all	• Control only possible via "Input n - action: Motor CW and Motor CCW" (see below). • Control via field bus (automatic operating mode) not possible. • The automatic operating mode is only possible again once the Manual operation local mode has been canceled and "Input n action: Motor CW or Motor CCW" is not active.

Table 9-12: Description Input n - Action

Input n - Action	- Level	- Signal	Opera-ting mode	Description
Emergency start	NO/–	unl/–	all	• If a SWITCH-ON command is present, the motor is switched on despite an existing trip reason. • If a SWITCH-ON command for the brake output is present, this is switched on too. • Only permitted as a make contact.
Motor CW	NO/–	unl/la	Manual operation local	• The motor starter must be set to the "Manual operation local" mode for these actions • The device braking parameters are evaluated. • Motor CW: Switch the motor and brake output on and off. • Motor CCW: Switch the motor and brake output on and off. • Only permitted as a make contact. • **la:** *The input action is triggered as long as the active level of the input signal is present.* *The input trigger is deleted by the input action "quick-stop" or general fault.*
Motor CCW	NO/–	unl/la	Manual operation local	
Creep feed	NO/NC	unl/la	all	• Activates creep feed (the motor speed is reduced). The "Creep feed active" signal is set. • The input action is ORed with the "creep feed" bit in the PAA. ***la:*** *The input action responds to the active edge of the input signal. This also enables deactivation if the input signal is active.* *The input trigger is deleted by* *- Deleting the control commands/input actions "Motor CW" and "Motor CCW, or* *- Every time the edge for the "Creep feed" control command is changed* *- Retriggering by means of the active edge for the input signal.*
Quick stop	NO/NC	unl/la	All	• The motor and brake output are switched off without general faults. • Quick stop has priority over Motor CW and Motor CCW ***la:*** *The input action responds to the active edge of the input signal. This also enables deactivation if the input signal is active.* *The input trigger is deleted by* *- Deleting the control commands/input actions "Motor CW" and "Motor CCW.*
Trip reset	NO/–	un/–	All	• Trip reset is triggered once

Key: NO: Normally open contact   NC: Normally closed contact

               la: Latch   unl: Unlatch
                                                   Activation and deactivation of the input action depends on the status of the input signal (=inching mode)

Table 9-12: Description Input n - Action

Unlatch and Latch Principle (Inching Mode and Latching Mode)

The following diagram shows the principles of inching mode and latching mode:

Fig. 9-5: Principle of inching mode and latching mode

Device Parameters for Inputs - Settings

The following table shows the device parameter settings:

Device parameters	Pre-setting	Setting Range
Input Delay	10 ms	10 ms to 80 ms Increment: 10 ms
Input 1 - Level	NO	NC/NO
Input 2 - Level		
Input 3 - Level		
Input 4 - Level		
Input 1 - Action	No Action	No Action/ Tripping without restart/ Tripping with restart/ Switch-off end position clockwise/ Switch-off end position counter clockwise/ General Warning/ Manual operation local/ Emergency Start/ Motor CW/ Motor CCW Creep feed/ Quick-Stop/ Trip-Reset
Input 2 - Action		
Input 3 - Action		
Input 4 - Action		
Input 1 - Signal	Unlatch	Latch/ unlatch
Input 2 - Signal		
Input 3 - Signal		
Input 4 - Signal		

Table 9-13: Device parameters for inputs - settings

Signals and Actions

The "Inputs" device function outputs the following signals and actions:

Signal	Action
Input 1	—
Input 2	—
Input 3	—
Input 4	—
Input Tripping	Trip (must be acknowledged with "trip reset")
Input Tripping - End Position Counter Clockwise	Trip (must be acknowledged with countercommand)
Input Tripping - End Position Clockwise	Trip (must be acknowledged with countercommand)
Input Control	—
Input Warning	—
Sensor Supply Overload	Trip (must be acknowledged with "trip reset")

Table 9-14: Inputs - signals and actions

9.9   Self-Test

Description

Two different self-tests can be carried out:

- Self-test during start-up
  This is activated automatically when the device is switched on or initialized.
- Self-test during operation
  The user can activate this using bit DO-0.5 "Self-test" in the process output image.

Test Steps

The self-test comprises three steps. The steps are based on the duration of the signal for the test command:

Test step	Signal duration	Scope of test	Explanations
1	< 2 sec.	LED test	All LEDs are switched on for two seconds • Checks carried out by user, no signaling bit.
2	2 to 5 sec.	Hardware test	The motor starter hardware is tested; current measurement displayed via "DEVICE" LED: • Current flowing: flash red • Current not flowing: flicker red • Checks carried out by user, no signaling bit.
	> 5 sec.	No action	—

Table 9-15: Self-test - steps

Self-Test Error

If an error occurs, the "DEVICE" LED lights up red.
The error can only be acknowledged if the device is switched on again.
If the error is still present, the self-test will not be performed correctly during start-up. The motor starter must be replaced.

Signals

This device function outputs the following signals:

Signals
Self-Test Active
Self-Test OK
Self-Test Error

Table 9-16: Self-test - signals

Attention
Certain device components are constantly monitored internally by the motor starter. The results of this are output via the self-test signals. The "Self-test error" signal can also indicate an error during internal monitoring even if the self-test has not been activated.

9.10 Emergency Start

Description

The emergency start function enables you to restart the motor even when an internal switch-off command is present.

You **can** use the emergency restart function if

- the SWITCH-ON command for the motor is present. The motor is switched on even if the cause of the trip is still present.
- the SWITCH-ON command for the brake output is present. The brake output is switched on (the "Brake release delay on starting" parameter is taken into account).

You **cannot** use the emergency restart function if

- the SWITCH-OFF command is present
- a device error has occurred
  (signaling bit: "Self-test error", "Switching element defective")
- the self-protection mechanism of the motor starter has been activated
  (signaling bit: "Switching element overload")
- the switched/non-switched supply voltage DC24V-S/DC24V-NS is missing
  (signaling bit: "Switching element supply voltage missing",
                     "Electronics supply voltage" too low)
- block protection has been activated
  (signaling bit: "Motor block tripping")
- a process image error has occurred
  (signaling bit: "Process image error")

Emergency Start Control Options

- "Emergency start ON", "Emergency start OFF" commands
- "Input n - action" parameter –> "Emergency start"
- Bit DO-0.4 "Emergency start" in the process image.

Commands

The emergency start function can be controlled using the following commands:

Commands
Emergency Start ON
Emergency Start OFF

Table 9-17: Emergency start - commands

Signal

The emergency start function outputs the following signal:

Signal	Description
Emergency Start Active	This is present as long as the emergency start function is active, even if the motor and brake output are switched off.

Table 9-18: Emergency start - signals

9.11 Factory Setting

Description

The factory setting function enables you to restore the settings defined when the motor starter was delivered. In this way, you can reset the motor starter if it has been incorrectly parameterized.

Restoring the Factory Setting

You can restore the factory setting as follows:

• Use the "Factory setting" command.
You can only do this when the manual operating mode is set and the switching elements are switched off.

Attention
The field bus address and the baud rate are not reset.

• By attaching the identification plug with the invalid PROFIBUS-DP address 127 during operation.

Set the (invalid) PROFIBUS-DP address 127:
Set all the DIP switches to "ON"
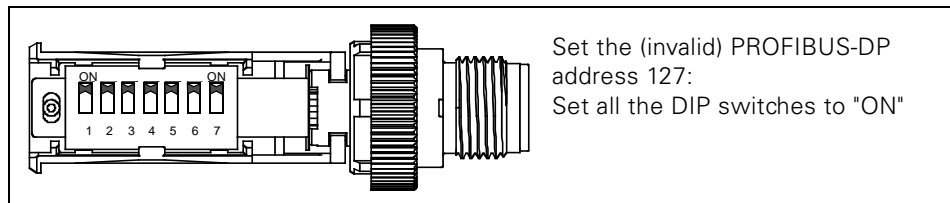
Fig. 9-6: Identification plug with the invalid PROFIBUS-DP address 127

This method also works for the High Feature motor starters with AS-Interface.

The factory setting can be restored in any operating mode.

Attention
The field bus address and the baud rate are also reset.
These changes only take effect after Power OFF/ON or the "Restart" command has been issued.

• Once the factory setting has been successfully restored, the motor starter is in the automatic operating mode.

Signals

This device function outputs the following signals:

Signals	Bedeutung
Factory Setting Restored[1]	All the parameter values are restored to their original factory settings.

[1] Signaling bits that can be reset using "Trip reset".

Table 9-19: Factory setting - signals

9.12 Control Function Reversing Starter

Definition

This control function enables the motor starter to control the motor direction. The internal logic prevents both contactors from pulling in simultaneously.
Time-delayed switching from one motor direction to the other is enabled by means of the lock-out time.

Device Parameters for Control Function: Reversing Starter - Description

Lock-Out Time

The lock-out time prevents the direction of rotation from being changed. The flywheel of a drive must come to a standstill within the lock-out time before the next switching command is executed.

Setting range: 0 seconds to 60 seconds.

Attention
For safety reasons, a lock-out time of 0 means 150 milliseconds.

Device Parameters for Control Function: Reversing Starter - Settings

The following table shows the device parameter settings:

Device parameters	Pre-setting	Setting range
Lock-Out Time	0	0 to 60 seconds Increment: 1 sec.

Table 9-20: Device parameters for control function reversing starter - settings

Signals

The "Reversing starter" control function outputs the following signals:

Signals
Motor CCW
Lock-Out Time Active

Table 9-21: Control function reversing starter - settings

9.13 Control Function: Soft Starter

Definition

Soft starters are based on the phase angle control principle.
You can specify soft starting and soft braking using a settable voltage ramp.

The following diagram illustrates this principle:
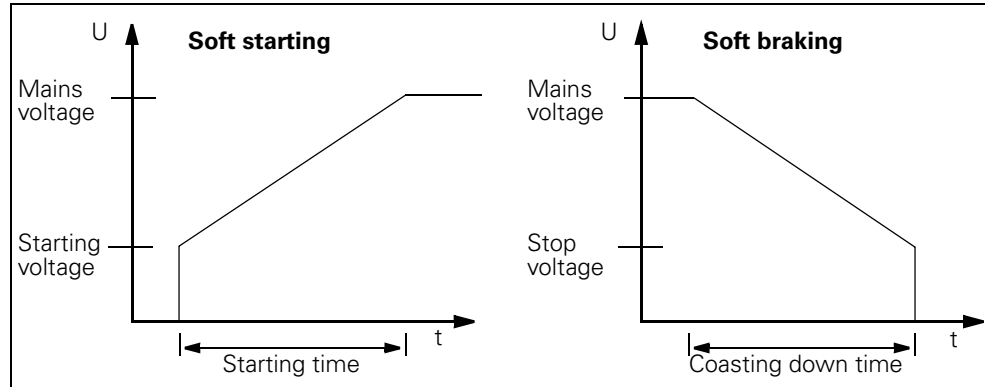
Fig. 9-7: Soft starting/soft braking principle

Deactivate the Soft Starter Control Function

If the starting and coasting-down times are set to zero, the motor does not switch on directly. The switch-on current is further restricted to the parameterized value, which ensures that the motor can start up smoothly! If the motor is to be switched on directly, the soft starter device function must be deactivated as follows:

- Switch ES: "Device configuration" dialog: deactivate the checkbox
- DMD: Deactivate the "GF: soft start control function" parameter

Attention
When the soft starter control function is deactivated, you must take into account the following derating:
Reduction of the rated operating current from 12 A to 9 A with class 10.

Interrupt Soft Braking (Regenerative Coasting)

Attention
Soft braking is only necessary if the motor does not support regenerative coasting (driving load). If soft braking has been parameterized, however, the motor starter interrupts soft braking and switches the motor off. Depending on the parameters that have been set, the brake output is switched off.

Soft Braking for Motor Starters with Mechanical Braking

In addition to soft braking, motor starters with mechanical braking with the parameter "Brake Hold Time On Stopping" offer the following control options:

• Brake hold time on stopping = 0:
During the coasting down time, motor voltage U is reduced to the stop voltage. The motor voltage and brake output are then switched off simultaneously. If soft braking is interrupted, the motor voltage and brake output are switched off simultaneously.

• Brake hold time on stopping > 0:
During the coasting down time, motor voltage U is reduced to the stop voltage and switched off. The hold time runs simultaneously to the coasting down time. Once the hold time has elapsed, the brake output is switched off independently of soft braking.

The following diagram illustrates this principle in a motor under load:
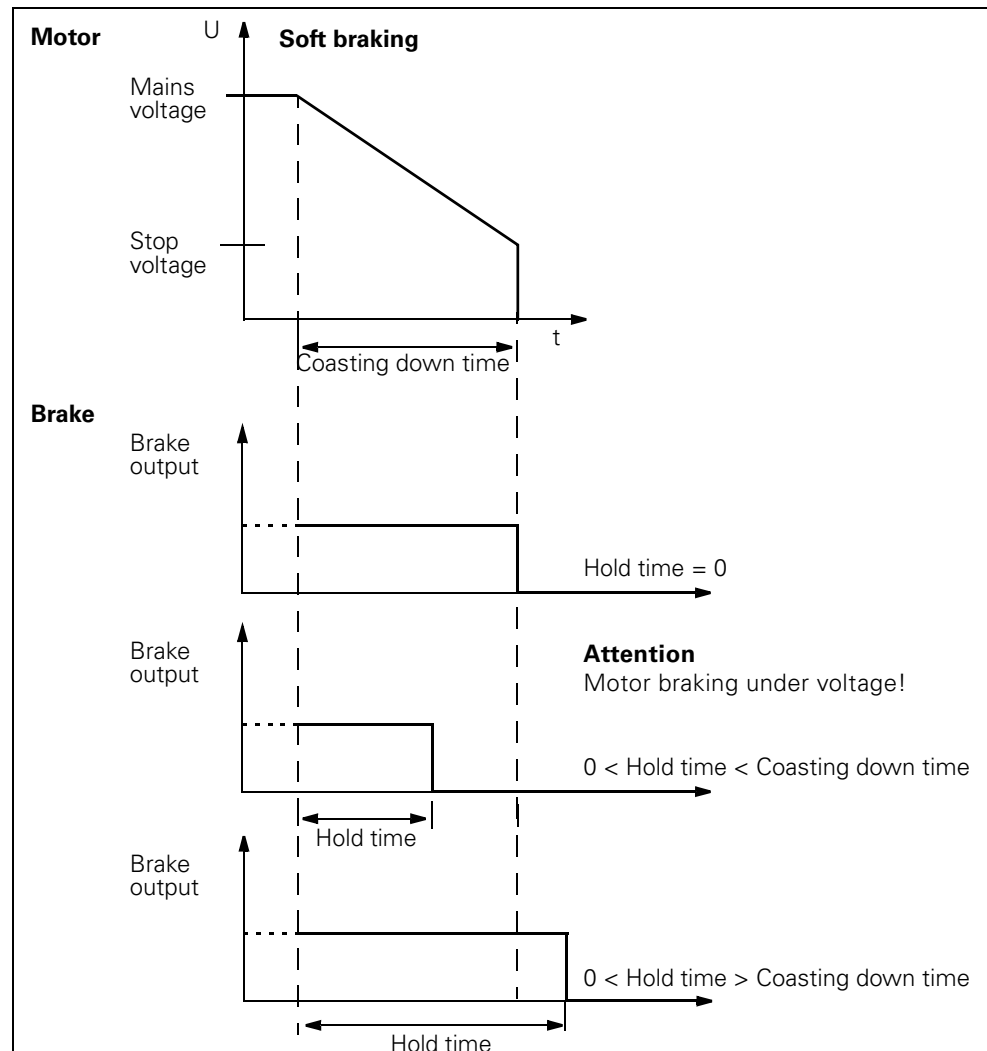
Fig. 9-8: The soft braking principle for motor starters with mechanical braking

For further information on the "Brake Hold Time On Stopping", see section "Brake Hold Time On Stopping" on page 9-44.

Device Parameters for Control Function: Soft Starter - Description

Starting Time

During the parameterizable soft starting time, the voltage at the motor terminals is increased linearly from the starting voltage to the full mains voltage. Zero means that the motor is switched on with a voltage ramp lasting 100 milliseconds.

Attention
The max. starting time of 30 seconds also enables heavy starting to CLASS 30 (24 seconds).

Setting range: 0 to 30 seconds.

Coasting Down Time

During the parameterizable coasting down time, the voltage at the motor terminals is linearly reduced from the mains voltage to the stop voltage. Zero means direct stopping without voltage ramp.

Setting range: 0 to 30 seconds

Starting Voltage

Initial value of the voltage ramp for starting.

Setting range: 20% to 100% of mains voltage.

Stop Voltage

Initial value of the voltage ramp for stopping.

Setting range: 20% to 90% of mains voltage.

Current Limiting Value

During starting, the motor current is limited to a maximum value.

Setting range: 50% to 600% of rated operational current.

Attention
With rated operational currents greater than or equal to 9 A, the current limiting value is reduced to 450%.

Device Parameters for Control Function: Soft Starter - Settings

The following table shows the device parameter settings:

Device parameters	Pre-setting	Setting range
Starting time	5 seconds	0 to 30 seconds Increment: 0.25 sec.
Starting time	0	0 to 30 seconds Increment: 0.25 sec.
Starting voltage	40%	20% to 100% Increment: 5 %
Stopping voltage	40%	20% to 90% Increment: 5%
Current Limiting Value	600%	125% to 600% Increment: 3.125%

Table 9-22: Device parameters control function soft starter - settings

Signals, Actions and Measured Values

The "Soft starter" control function outputs the following signals, actions and measured values:

Signals and Actions

Signals	Action
Starting Active	—
Coasting Down Active	—
No Mains Voltage	Trip
Current Limiting Active	—

Table 9-23: Control function soft starter - signals

Measured Values

Measured Values	Description
Output frequency	50 Hz/60 Hz

Table 9-24: Control functionSoft starter - measured values

9.14 Control Function: Speed Control

Task

Speed controllers (duo-reversing soft starters) are used in drive engineering to control the speed of motors.
With standard motors, they enable reversible motors and Dahlander motors with at least two speeds to be operated.

Calculating the Number of Motor Poles

You can connect 2, 4, and 6-pole three-phase induction motors. The control function for the speed controller automatically calculates the correct number of motor poles using the "Rated frequency" and "Rated speed" parameters.

Speeds

Speed controllers feature

- Soft starting and soft braking for each speed via frequency change.
- 16 speeds that are set in the process output image.
  The speeds are switched:
    - by the "creep feed" bit in the PAA or by the "creep feed" input action (creep feed = 0 = f1 active, creep feed = 1 = f2 active).
      Both of these signals are ORed.
    - by the "reduction factor" (3 bits in the PAA or data record 68). The reduction factor specifies by how much the starting setpoint is below the parameterized setpoint (f1,f2).

Note

Attention

The speed controller control function is based on frequency converter technology. When selecting the motor, ensure that it is suitable for operation with a frequency converter!

Reduction Factor

The diagram below shows how the reduction factor works:

Possible reduction factors:

Reduction factor	Bit 2	Bit 1	Bit 0
1.0	0	0	0
0.875	0	0	1
0.75	0	1	0
0.625	0	1	1
0.5	1	0	0
0.375	1	0	1
0.25	1	1	0
0.125	1	1	1
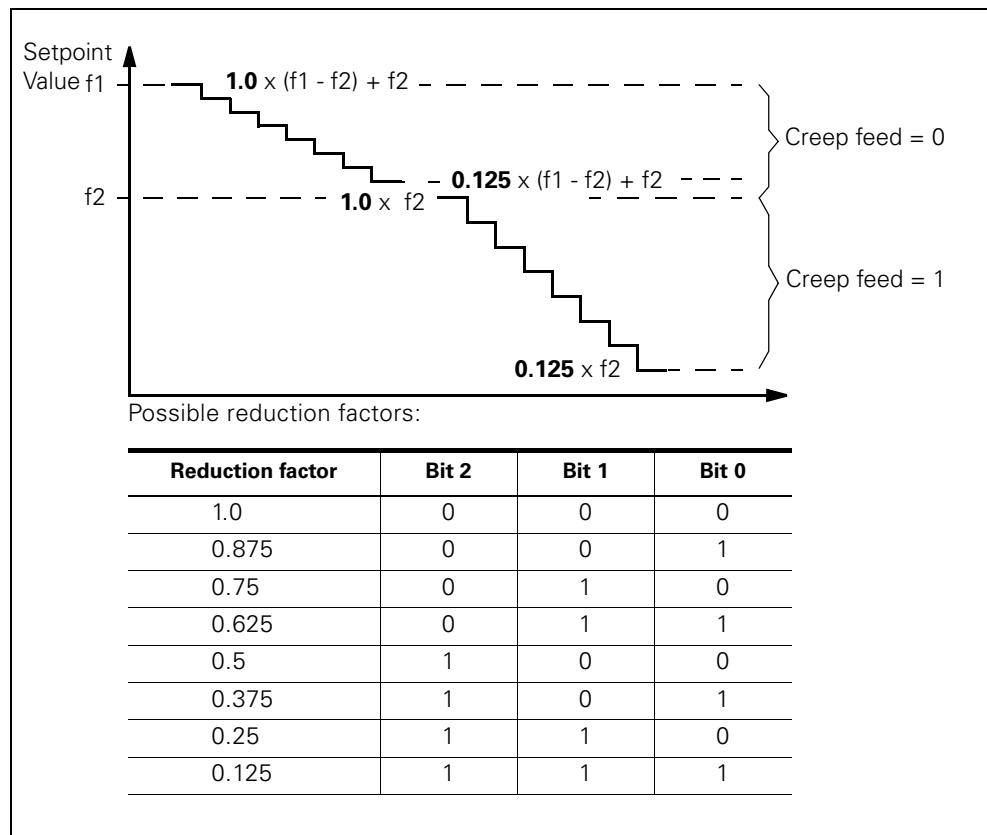
Fig. 9-9: Reduction factor

Example Speed Control

The following diagram illustrates the speed control principle:

Example:
- Start with Motor ON to "fast"
- After 5 seconds, switch from"fast" to "slow", switch using the "Creep Feed" Bit, reduction factor = 1

Parameters:
f1 = 50 Hz, starting time f1 = 10 s, stopping time f2 = 5 s, f2 = 25 Hz, starting time f2 and stopping time f1 not relevant to the example
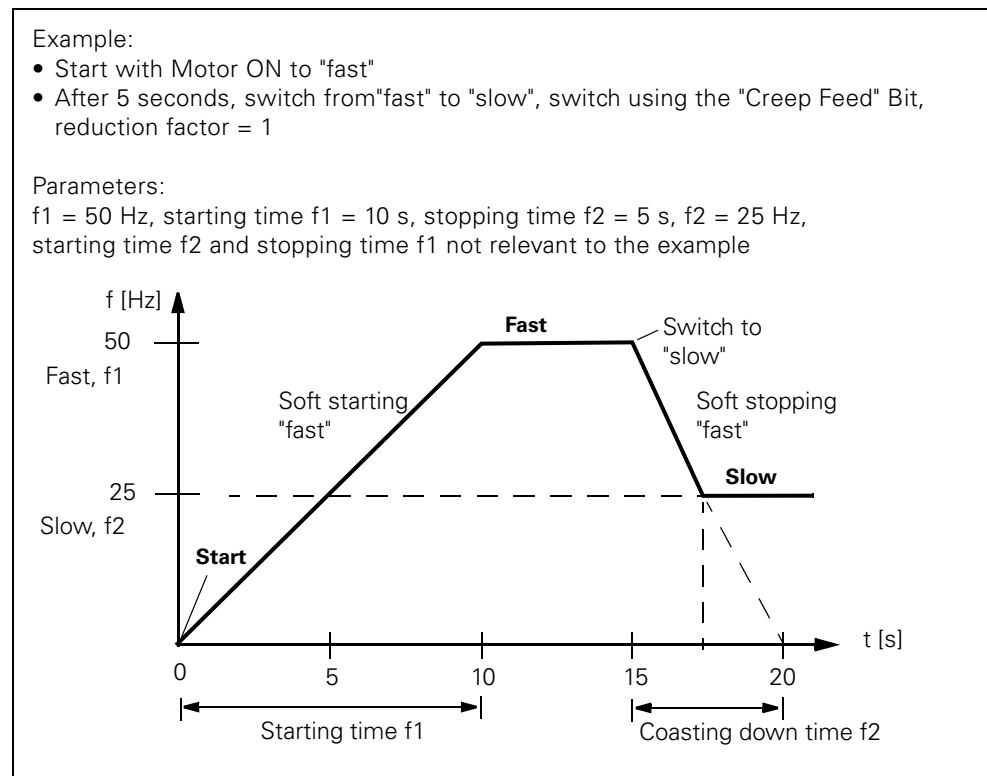
Fig. 9-10: Speed control principle

Device Parameters for Control Function: Speed Control - Description

Rated Power

The rated power specified on the motor rating plate.

Setting range: depends on the output class and rated voltage in accordance with the following table:

Rated Voltage	Performance class 2 (0.6 A to 4 A)	Performance class 12 (2.4 A to 8 A)
230 V AC	0.18 kW to 0.75 kW	0.75 kW to 1.5 kW
277 V AC	0.18 kW to 1.1 kW	0.75 kW to 1.5 kW
400 V AC	0.25 kW to 1.5kW	1.1 kW to 3.0 kW
480 V AC	0.37 kW to 1.5 kW	1.5 kW to 3.0 kW

Table 9-25: Rated voltage and performance class for speed control

Rated Voltage

The rated voltage specified on the motor rating plate.

Setting range: 230 V AC, 277 V AC, 400 V AC, 480 V AC

Rated Frequency

The rated frequency specified on the motor rating plate.

Setting range: 50 Hz, 60 Hz

Rated Speed

The rated speed specified on the motor rating plate.

Setting range: 500 U/min to 3600 U/min

The following table shows which parameters are interdependent and how they have to be set:

Depending Parameters	Setting

Setpoint Value fo
Rated Frequency
Rated Speed
	at f = 50 Hz:
	  fo max = 70 Hz at > 1500 U/min.
	at f = 60 Hz:
	  fo max = 80 Hz at > 1800 U/min.

Table 9-26: Parameter dependencies for the rated frequency and speed

Setpoint value fmax

Maximum frequency
The following applies:
f2 smaller than/equal to f1 smaller than/equal to fmax ($f2 \leq f1 \leq f_{max}$)

Setting range: 0.5 Hz to100 Hz

Attention
With 2-pole motors, f_{max} is restricted for safety reasons:
– to max. 70 Hz at a rated frequency of 50 Hz
– to max. 80 Hz at a rated frequency of 60 Hz

Setpoint value f1/f2

Setpoint values for speed 1 and speed 2
f1:   "Fast"
f2:   "Slow"
The following applies:
f2 smaller than/equal to f1 smaller than/equal to fmax ($f2 \leq f1 \leq fmax$)

Setting range: 0,5 Hz bis100 Hz

The following table shows which parameters are interdependent and how they have to be set:

Depending Parameters	Setting
Setpoint value fo Setpoint value f1 Setpoint value f2	$f2 \leq f1 \leq f0$

Table 9-27: Parameter dependencies of setpoint value

Starting time f1/f2

Time in which frequency f1/f2 is set during start-up.

Attention
The set time refers to a frequency change of 50 Hz.

Setting range: 0 to 25 seconds

Coasting Down time f1/f2

Time in which frequency f1/f2 is set during stopping.

Attention
The set time refers to a frequency change of 50 Hz.

Setting range: 0 to 25 seconds

Control Mode

U/f Characteristic Curve (Pre-setting)

A three-phase induction motor generates a constant torque when it receives a constant magnetic flux. This is achieved by means of a constant U/f ratio. This constant ratio can be ensured up to the rated frequency with the appropriate rated voltage. This is not possible when the speed is higher than the rated speed because the voltage cannot be increased any further. The torque (M ~ 1/f) is reduced as a result.

The following diagram illustrates this principle:
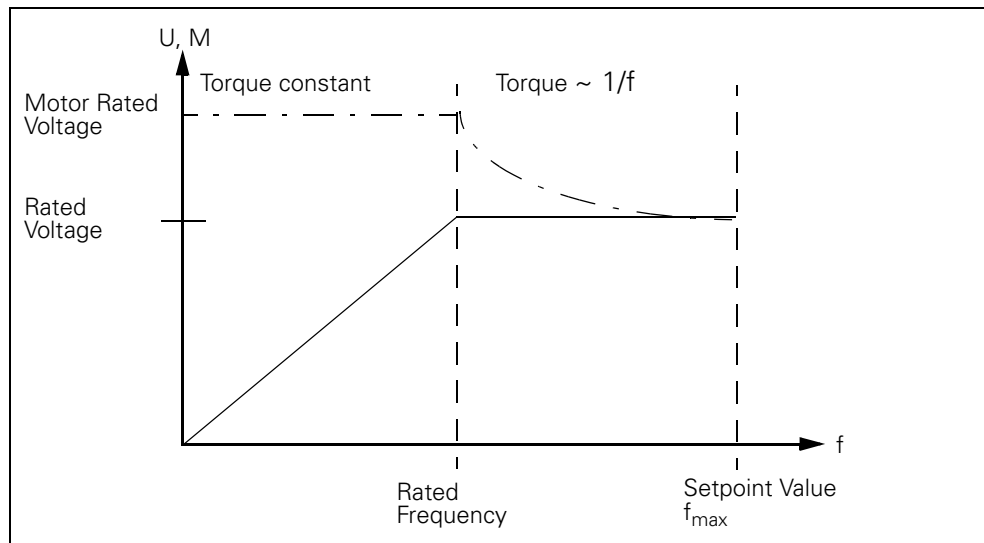
Fig. 9-11: Prinziple of U/f Characteristic curve

Attention

The U/f characteristic curve control is used when motor starters with different motors have to be operated.
The ECOFAST motor starters are designed for this. For this reason, you must retain the default "U/f characteristic curve".
You must also retain the default "U/f characteristic curve" when using 2-pole and 6-pole motors.

Flux Control

Flux control involves calculating the current **magnetic flux** in the motor with the measured motor currents.
This requires, however, a large amount of technical data for the motor.

Attention
Flux control is only necessary when the motor and motor starter form a single unit. It is only possible with 4-pole motors.

4-Quadrant Operation (pre-setting)

4-quadrant operation enables active induction motor braking during **regenerative coasting**, whereby the motor is driven by the machine.
A steady reduction of the output frequency ensures that the regenerative state is retained until standstill. The drive then brakes with a constant torque.

DC Breaking Operation

In this operating mode, a direct current is applied to the motor windings, which generates a braking torque in the motor.

Device Parameters for Control Function: Speed Control - Settings

The following table shows the device parameter settings:

Device parameters	Pre-setting	Setting Range
Rated Power performance class 2 Rated Power performance class 12	1.5 kW 3.0 kW	0.18 kW to 1.5 kW 0.75 kW to 3 kW
Rated Voltage	400 V	230 V, 277 V, 400 V, 480 V
Rated Frequency	50 Hz	50 Hz, 60 Hz
Rated Speed	1400 U/min	500 to 3600 U/min Increment: 1 U/min
Control Mode	U/f Characteristic curve + 4Q Operation	U/f Characteristic curve + 4Q Operation] U/f Characteristic curve + DC Break Flux Control + 4Q Operation Flux Control + DC Break
Setpoint value fmax	70 Hz	0 to 100 Hz *) Increment: 0.5 Hz
Setpoint value f1	50 Hz	0 to 100 Hz *) Increment: 0.5 Hz
Setpoint value f2	25 Hz	0 to 100 Hz *) Increment: 0.1 s
Starting Time f1	1 s	0 to 25 s Increment: 0.1 s
Starting Time f2	1 s	0 to 25 s Increment: 0.1 s
Coasting Down Time f1	1 s	0 to 25 s Increment: 0.1 s
Coasting Down Time f2	1 s	0 to 25 s Increment: 0.1 s

Table 9-28: Device parameters for control function speed control - settings

*) With 2-pole motors, the setting range is restricted for safety reasons
 – to max. 70 Hz at a rated frequency of 50 Hz
 – to max. 80 Hz at a rated frequency of 60 Hz

Signals, Actions and Measured Values

The "Speed control" device function outputs the following signals, actions and measured values:

Signals and Actions

Signal	Action
Lock-Out Time Active	—
Coasting Down Active	—
Starting Active	—
No Mains Voltage	Trip *)
Current Limiting Active	(activates at 1.6 * Iemax)
Setpoint Value = Actual Value	—
Generating Motor Run	—
Setpoint value = Actual Value	—
Intermediate Circuit Voltage too high	Trip

Table 9-29: Control function speed control - signal s and actions

*) "General fault" is only set if an ON command is present.

Measured Values

Measured Values	Description
Output frequency	0 to 100 Hz/0.5 Hz

Table 9-30: Control function speed control - measured values

9.15 Electrical Braking

Definition

Electrical braking (DC braking) involves a direct current being applied to the motor winding. 2 phases are short-circuited with an additional "braking contactor". A power semiconductor ensures that only a half-wave of the system voltage is supplied to the motor winding. This pulsating direct current induces a stationary magnetic field in the stator. The reaction with the rotating rotor produces a powerful braking torque.

Attention

The electrical braking method can only be used with electronic soft-switching motor starters.

We recommend you use an external "braking contactor" that short-circuits 2 phases to increase the braking effect. Since the braking contactor is controlled by the motor starter via the brake output, the control command "Brake" has no effect.

If a new switch-on command is issued during the braking operation, the operation is aborted and the motor restarted.

Example of Circuit

The following diagram shows an example of a circuit for electrical braking:
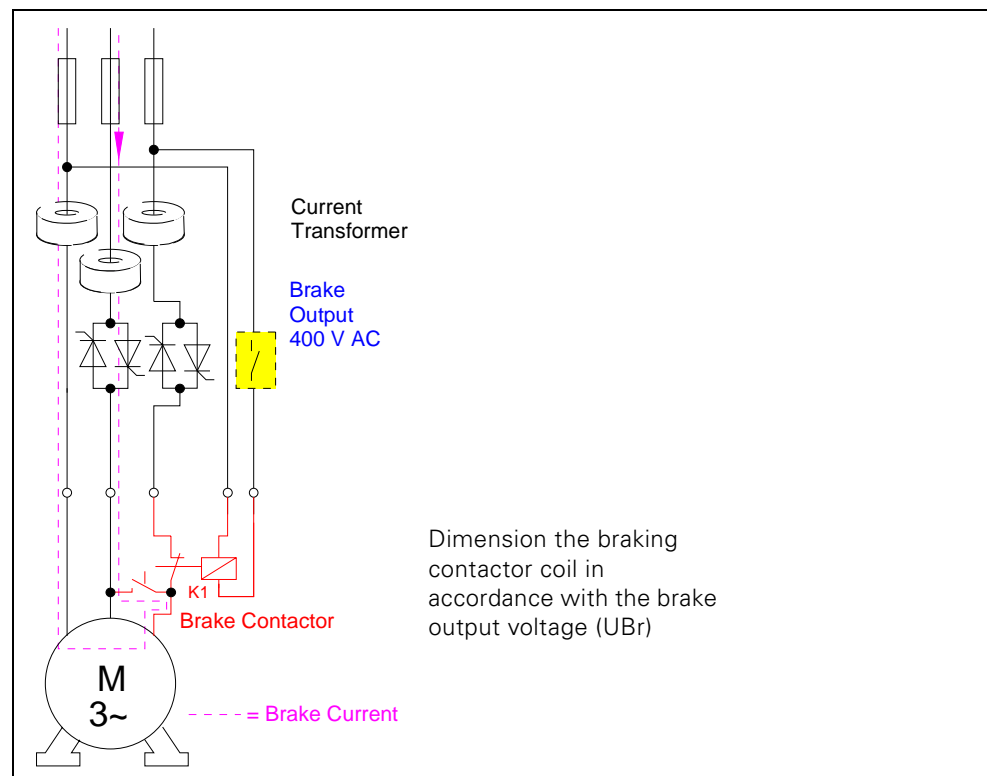
Fig. 9-12: Example of a circuit for electrical braking

Device Parameters for Electrical Braking - Description

Braking Time

Electrical braking is active during the braking time. Once the braking time has elapsed, the brake output and the motor are switched off

Attention
Important: braking time = 0 means DC brakes deactivated!
"Mechanical Braking" is reactivated provided that this device function is supported by the motor starter, that is, the brake output can be controlled again using the control command "Brake".

Braking time > 0 and soft braking time > 0 means that
electrical and mechanical braking have been deactivated and the soft braking function is activated.

Setting range: 0 to 30 seconds

Braking Torque

You can use the braking torque to influence the braking force.
Setting range: 20% to 100%.

Device Parameters for Electrical Braking - Settings

You find the settings of the device parameters in the following table:

Device parameters	Pre-setting	Setting Range
Braking Time	0	0 to 30 seconds Increment: 1 sec.
Braking Torque	40%	20% to 100% Increment: 5%

Table 9-31: Device parameters for electrical braking - settings

Signal

The electrical braking method to control the braking contactor outputs the following signal if the brake output has been switched on by the motor starter:

Signal
Electrical Braking Active

Table 9-32: Electrical braking - signal

9.16 Mechanical Braking

Definition

A mechanical disk or spring-loaded brake attached to the motor brakes the motor. The brake is controlled via the brake output.

Example of circuit

The following diagram shows an example of a circuit for mechanical braking:

Pin	Assignment
1	Winding terminal U1
2	Winding terminal V1
3	Winding terminal W1
4	Brake (reference potential)
5	Brake
6	Winding terminal W2
7	Winding terminal U2
8	Winding terminal V2
9	Temperature sensor (terminal a)
10	Temperature sensor (terminal b)
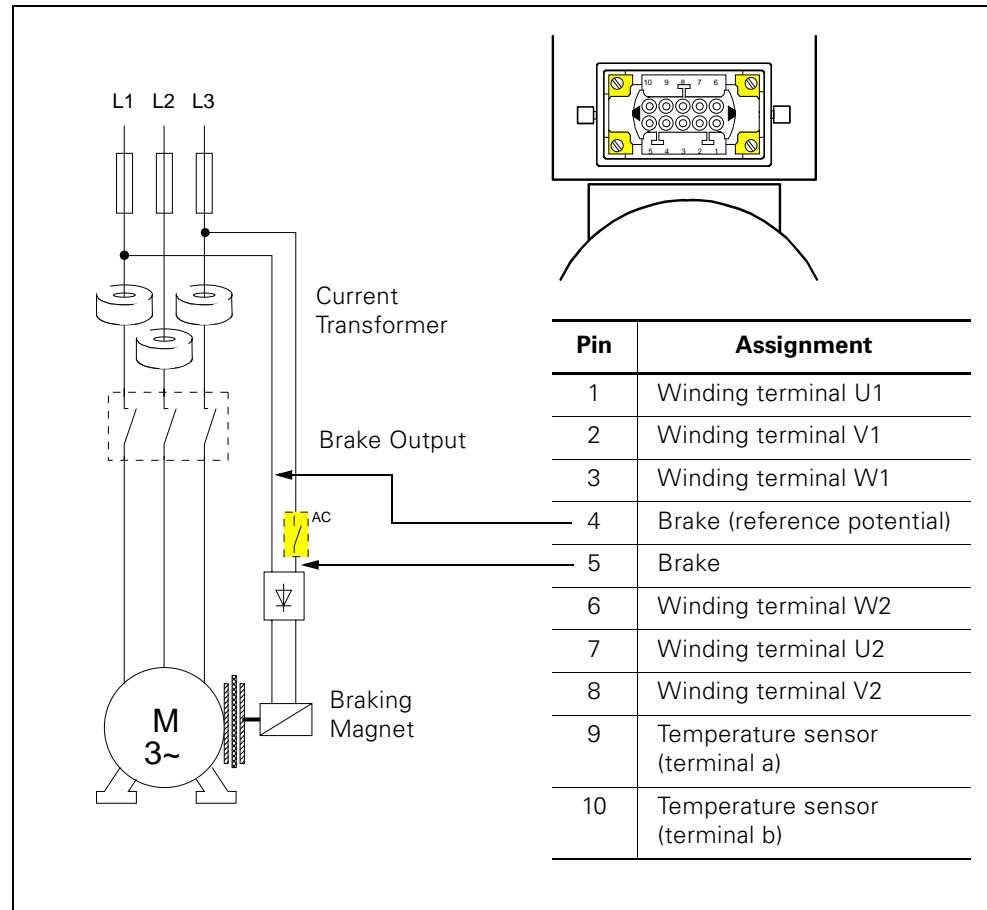
Fig. 9-13: Example of a circuit for mechanical braking

Device Parameters for Mechanical Braking - Description

Brake Release Delay On Starting

Attention
Only effective for a **simultaneous** SWITCH-ON command for the brake and motor.

Caution:

• Positive times: Delayed switch-on of the brake output with respect to the motor.
• Negative times: Delayed switch-on of the motor with respect to the brake output.

In reverse operation, the release delay does not begin until the lock-out time has elapsed

Setting range: -2.5 to +2.5 seconds

Brake Hold Time On Stopping

Attention
Only effective for a simultaneous SWITCH-OFF command for the brake and motor.

This device parameter causes a delayed switch-off of the brake output with respect to the motor. It is also active when the PLC fails.
In reverse operation, the hold time and lock-out time run simultaneously. The motor cannot be switched on in the opposite direction until the lock-out time has elapsed. The motor can be switched on in the same direction immediately, since the lock-out time is interrupted.
Setting range: 0 to 30 seconds

Priority Control

"Brake release delay on starting" has priority over "Brake hold time on stopping". An elapsing hold time is terminated when the release delay is restarted (via a SWITCH-ON command for the brake and motor).

Device Parameters for Mechanical Braking - Settings

The following table shows the device parameter settings:

Device parameters	Pre-setting	Setting Range
Brake Release Delay On Starting	0	-2.5 to 2.5 sec Increment: 0.1 sec.
Brake Hold Time On Stopping	0	0 to 30 seconds Increment: 1 second

Table 9-33: Device parameters for mechanical braking - settings

Signal

The mechanical braking method outputs the following signal when the brake output is switched on:

Signal
Mechanical Braking Active

Table 9-34: Mechanical braking - signal

9.17 Electronic/Mechanical Switching Technology

Electronic Switching Technology

The motor starter controls the motor with power semiconductors:

- 2-phase for reversing soft starters with thyristors
- 3-phase for duo-reversing soft starters with IGBTs

Mechanical Switching Technology

The motor starter controls the motor in a 3-phase system with contactors.

Signals and Actions

These device functions output the following signals:

Signal	Action
Switching element defective (e.g. contactor contact welded, power semiconductor failed)	Trip
Switching element overload (e.g. semiconductor too hot)	Trip

Table 9-35: Electronic/mechanical switching technology - signals and actions

9.18　Response to Bus Failure (PROFIBUS-DP)

Device Parameters for Response to Bus Failure - Description

Response to CPU/Master STOP

You use this device parameter to determine how the motor starter responds to CPU/master STOP:

• Retain the last value

• Switch substitute value

Attention

This device parameter is only relevant in "automatic operation".

Substitute value

If the bus fails, the motor starter is controlled by means of a suitable substitute process image of the outputs.
Example:

Substitute Value		
☑ Motor CW	☐ Reserved	
☐ Motor CCW	☐ Reserved	
☑ Brake	☐ Reserved	
☐ Trip-Reset	☐ Reserved	
☐ Emergency Start	☐ Reduction factor Bit 0	
☐ Self-Test	☐ Reduction factor Bit 1	
☐ Creep feed	☐ Reduction factor Bit 2	
☐ Reserved	☐ Reserved	

Attention

This parameter is only relevant if you have parameterized "Response to CPU/Master STOP": "Switch substitute value".

Device Parameters for Response to Bus Failure - Settings

The following table shows the device parameter settings:

Device parameters	Pre-setting	Setting range
Response to CPU/Master-STOP	Switch substitute value	Switch substitute value/Retain the last value
Substitute Value	0	6 x (0 or 1)

Table 9-36: Device parameters for response to bus failure - settings

9.19   Local Device Interface

Description

The "Local Device Interface" connects optional accessories, e.g. the identification connector with the motor starter. It is located on the bottom-right of the front (on motor starters 3RK1 303-2AS51-.... with PROFIBUS-DP on the bottom left).
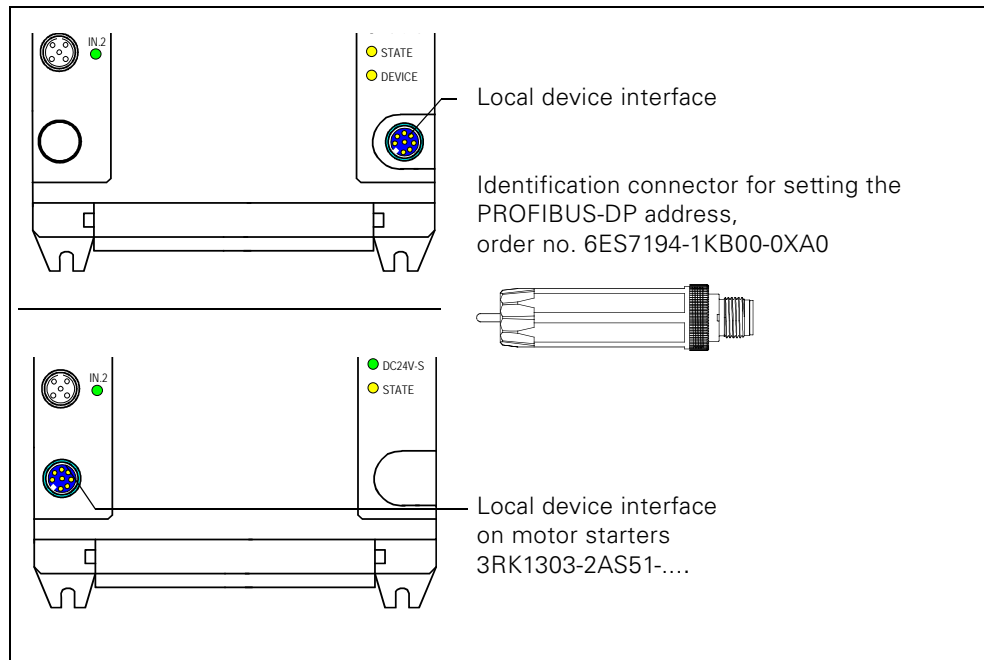
Fig. 9-14: Local device interface

Accessories

The following table lists the accessories for the local device interface:

Accessories	Description	Order No.
Identification connector	This is used to set the PROFIBUS-DP address (0 to 127) The address cannot be changed via other channels when the identification connector is plugged in.	6ES7194-1KB00-0XA0
Test connector set containing:	This enables you to test the motor without having to configure the motor starter beforehand.	3RK1911-2AM00
- Test connector	This is connected to the local device interface.When the test connector is identified, the motor starter switches to the Manual operation local mode. The digital inputs IN.1 and IN.2 are assigned the input actions "Motor CW" (IN.1) and "Motor CCW" (IN.2), that is, • IN.1: Motor CW and brake output ON/OFF • IN.2: Motor CCW and brake output ON/OFF The digital inputs IN.3 and IN.4 retain the parameterized input actions (apart from emergency start, motor CW, and motor CCW, which are deactivated).	
- Switch module	This is connected to digital input socket IN. 1/2 and IN. 3/4. With the "Motor CCW"/ "Motor CW" switches, the two digital inputs can be set and reset.	

not **for motor starters 3RK1303-2AS51-.... :**

PC cable with memory submodule	**PC cable:** For connecting the motor starters with a PC at the COM interface	3RK1911-0BN20
	Memory submodule: For saving the bus parameters, the device-specific parameters and device identification on external memory. This data is only copied from the memory module when the motor starter is restarted. The data can then be changed via other channels, even when the memory module is plugged in. Access is enabled using the following commands: • "Program memory module" Data in the memory module is overwritten with new data from the motor starter. • "Delete memory module" The motor starter ignores deleted memory modules. When it is restarted, no data is copied from the memory module.	

Table 9-37: Local device interface accessories

Commands (*not* for motor starters 3RK1303-2AS51-....)

This device function supports the following commands:

Commands
Program Memory Submodule
Reset Memory Submodule

Table 9-38: Local device interface - commands

Signals (*not* for motor starters 3RK1303-2AS51-....)

This device function outputs the following signals:

Signals	Meaning
Memory Submodule Not Connected[1)]	External memory module does not exist
Memory Submodule Defective[1]	External memory module defective
Memory Submodule Programming Active	Data is being transferred to external memory module
Memory Submodule Programming Successful[1]	Data successfully transferred to external memory module
Memory Submodule Programming Error[1]	Data transferred to external memory module with errors

[1] Signaling bits that can be reset using "Trip reset."

Table 9-39: Local device interface - signals

9.20 Communication

Description

Communication is a higher-level device function comprising several sub-functions:

- Operating mode monitoring
- Field bus connection
- Commands
- Data plausibility check
- Signal output

9.20.1 Operating Mode Monitoring

Data Channels

ECOFAST Motor Starters have three different data channels:
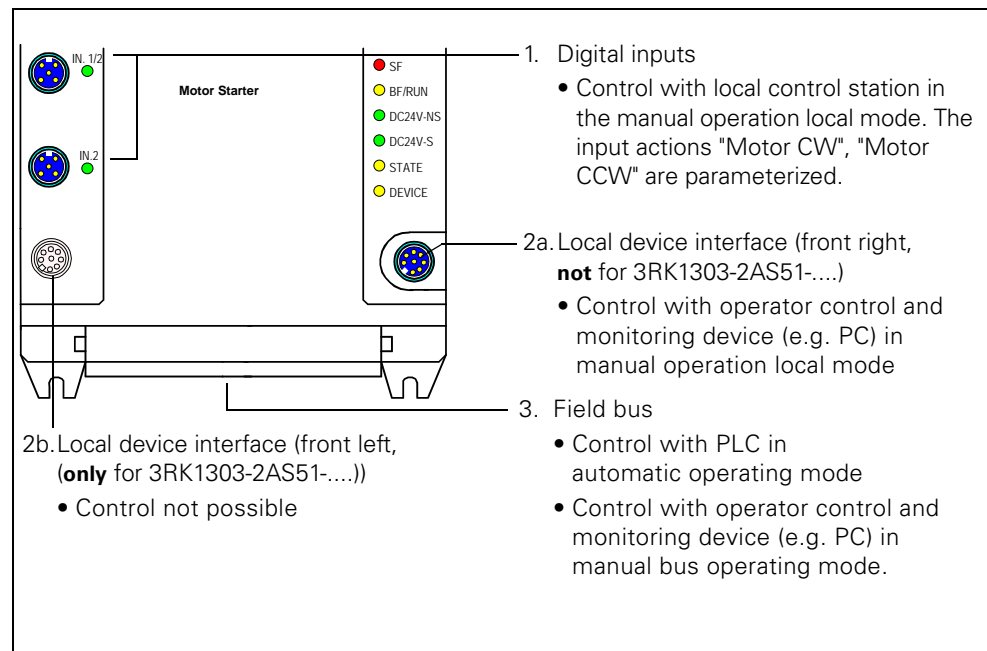
Fig. 9-15: Data channels

Control via the corresponding data channel depends on the operating mode.

Operating Modes

Three different operating modes are supported in ascending order of priority:

• Automatic **(lowest priority)**
The motor starter can only be controlled with the PLC via the field bus.

• Manual bus
The motor starter can only be controlled with the operator control and monitoring device (e.g. PC) via the field bus.

• Manual local operation
The motor starter can be controlled with

– local control station at the digital inputs.
(motor CW, motor CCW, e.g. with the switch module (from the test connector set) or with external switches.)
Prerequisite: The manual local operation mode must be set (see below).

– the operator control and monitoring device (e.g. PC) via the local device interface **(highest priority)**

Attention

A higher priority operating mode can **always** assume master control over a lower priority operating mode when the appropriate command is issued or with the "Manual operation" input action, but not vice versa.
A lower priority operating mode can only assume master control again when the higher priority operating mode returns master control when the "automatic operating mode" command is issued or the "Manual local operation" input action is deactivated, in both cases **when the motor is switched off**.

The following signaling bits in diagnosis data record DS92 can be used to clearly determine which control source currently has master control:
– Operation mode automatic
– Operation mode Manual bus
– Manual operation local mode
– Input Control
– Manual Operation Connection Abort

Automatic	Manual				Master control
	Manual bus	**Manual local operation**			
Op. mode Automatic	Op. mode Manual bus	Manual local operation	Input Control	Manual Op. Connection Abort	
0	0	1	0	0	PC via local 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	Operator Control (PLC)

Table 9-40: Master control

Connection Monitoring

The connection monitoring function is active in the manual bus and manual operation local operating modes. At least one write data record must be sent within five seconds, otherwise the motor starter switches off and the signal "Manual operation connection abort" is output.

If you do not want to send any commands or control commands, you can, for example, send an "empty" data record. Use the empty data record 93 - "Command" for this purpose. Only the coordination data is maintained accordingly and the commands are assigned "0".

Setting the Manual Local Operation Mode for a Local Control Station at the Digital Inputs

You can set the manual local operation mode as follows:

• With an operator control and monitoring device (e.g. PC) via the local device interface.
Parameterize the input n - actions "Motor CW" and "Motor CCW", and then disconnect the operator control and monitoring device to activate control via the digital inputs. The "Control input" signaling bit is set.

• With a test connector (from the test connector set) on the local device interface.
When the test connector is identified, the motor starter switches to the manual local operation mode. The digital inputs IN.1 and IN.2 are assigned the input actions "Motor CW" (IN.1) and "Motor CCW" (IN.2), regardless of how they have been parameterized.

• With a digital input to which you connect a switch for switching to the manual local operation mode.
You must then parameterize this digital input with the input n - action "Manual local operation mode".

Operating Modes and Different Control Tasks

The following table shows which operating modes support which control tasks:

Control Task	Control via	Automatic Operation	Manual OperationBus	Manual Local Operation
Control	PLC	▓		
	PC/PG		▓	
	Device Interface			▓
Parameterizing	PLC	1)		
	PC/PG		▓	
	Device Interface	▓		▓
Commands	PLC	▓		
	PC/PG	▓	▓	
	Device Interface	▓		▓
Diagnosis, measured values, read statistics	PLC	▓	▓	▓
	PC/PG	▓	▓	▓
	Device Interface	▓	▓	▓

	Grey fields:	▓	function supported

1) Apart from factory setting and restart

Table 9-41: Operating modes

9.20.2 Field Bus Connection

Field Bus Address

The addresses of all the devices connected to the field bus must be unique, that is, each address can only be assigned once for a device.

- PROFIBUS-DP address
  Setting range: 1 to 126.
  Setting options, e.g. with
    - the identification plug (order no.: 6ES7194-1KB00-0XA0)
    - Switch ES configuration software (order no.: 3ZS1310-0CC20-0YA0)
- AS-Interface address
  Setting range: 0 to 31.
  Setting options, e.g. with
    - addressing and diagnostic unit (order no.: 3RK1904-2AB01)
    - AS-i master

PROFIBUS-DP Baud Rate

The PROFIBUS-DP baud rate is identified automatically by the motor starter, for example.
Valid baud rates: 9.6 kBd, 19.2 kBd, 45.45 kBd, 93.75 kBd, 187.5 kBd, 500 kBd, 1500 kBd, 3000 kBd, 6000 kBd, 12000 kBd

AS-i Baud Rate

The AS-i baud rate is fixed at 167 kBd. It cannot be changed.

9.20.3 Commands

Commands and Their Meaning

Using the commands, you can instruct the motor starter to carry out certain actions.
Using the Switch ES configuration software, for example, you can send the following commands to the motor starter:

Command	Meaning
Trip reset	• Resets and acknowledges error messages • Resets signaling bits 1) if an error message is not present • No effect
Maximum Pointer Reset	Deletes the statistical data "preventative diagnosis".
Logbook - Delete Trips	Delete the logbook containing the causes of the errors.
Logbook - Delete Events	Delete the logbook containing the alarm messages and specific actions.
Factory Setting	The factory setting is restored for all parameters (excluding communication parameters). **Only possible in the manual operating mode!**
Program Memory Submodule	Transfers the device parameters and the communication parameters to the memory submodule.
Reset Memory Submodule	Deletes the parameters in the memory submodule.
Parameters Disabled CPU/Master ON	Motor starter ignores parameterization carried out by master (PLC).
Parameters Disabled CPU/Master OFF	Motor starter accepts parameterization carried out by master (PLC).
Emergency Start ON	Switches on the emergency start device function.
Emergency Start OFF	Switches off the emergency start device function.
Automatic Operation	Control via PLC; cyclic and acyclic bus channel (C1).
Manual Operation	• Control via PC; acyclic bus channel (C2) • Control via device interface
Restart	Motor starter restarts (same effect as Power OFF/ON). **Only possible in the manual operating mode!**

1) For the signaling bits, see the table on the next page.

Table 9-42: Commands and their meaning

Caution
Command is executed immediately!
You can only switch from the manual to the automatic operating mode when the motor and brake output are switched off.

9.20.4 Data Plausibility Check

Description

The motor starer checks that all the incoming parameters are valid and plausible. In the event of incorrect parameters

- during startup (after Power ON), the signals "General fault" and "Incorrect parameter value" are displayed.
- during operation, the signals "Incorrect parameter value" or "Parameters cannot be set in ON state".

9.20.5 Signal Output

The communication device function outputs the following signals:

Signals	Meaning
General signals	Commands
Ready (Automatic)	Device ready for operation via bus (e.g. PLC)
General Fault	At least 1 error present.
General Warning	At least 1 warning present.
Process image	The process output image contains an invalid bit combination (e.g. motor CLOCKWISE and motor COUNTER-CLOCKWISE set simultaneously).
Field Bus Connection	
Bus Fault	DP interface response watchdog timeout.
CPU/Master STOP	PLC program is no longer processed.
Acknowledgement	
Trip reset carried out	Trip reset accepted, i.e. fault acknowledged.
Trip reset not possible	Fault could not be acknowledged since cause of error still present.
Operating mode monitoring	
Automatic Operation	Automatic (controlled by PLC)
Manual Operation Bus	Manual Operation via field bus (controlled by operator control and monitoring device)
Manual Operation Local	Manual Operation via local device interface (controlled by operator control and monitoring device)
Manual Operation Connection Abort	Connection for communication interrupted for more than 5 seconds during Manual Operation mode.

Table 9-43: Communication - signals

Signals	Meaning
Parameterization	9-57
Parameter Assignment Active	Yes/No
Invalid Parameter Value[1]	Parameters not valid
Parameters Cannot Be Changed in ON State[1]	Attempted parameter change not permitted when motor is running.
Incorrect Parameter Number[1]	Specifies the first non-accepted parameter (parameter ID no.)
Parameter Block CPU/Master Active	Motor starter ignores PLC parameters but informs PLC that parameters are OK.
No External Start-Up Parameters Received	Signal indicating whether new parameters were received from the PLC after power ON or motor restart.
Statistic data	
Maximum pointers deleted[1]	The statistical data for preventative diagnosis has been deleted.

[1] Signaling bits that can be reset using "Trip reset".

Table 9-43: Communication - signals (Cont.)

9.21 Logbook

Description

The logbook contains a chronological list of trips, device faults, and events, which are assigned a time stamp and can be used to create a log. The log is stored internally so that the causes can be evaluated at a later stage.

Logbooks

Three types of logbook are available, which can be read as data records:

- Logbook - Trips: data record 73
  (section "Data record 73 - Logbook - Read Trips" on page A-9)

- Logbook - Events: data record 75
  (section "Data record 75 - Logbook - Read Events" on page A-11)

- Logbook - Device Faults: data record 72.
  The device faults are entered.

The current "Operating hours - device" value is entered as the time stamp. The ID numbers of the different messages are provided with the relevant data records.
The last 21 entries are stored in the logbooks. The entries can be read with the relevant data records.
The logbook is designed as a circular buffer. When 21 entries have been made, the next entry overwrites the oldest.

Logbook - Trips

> Logbook - Trips contains all the general faults. The ID numbers of the actual causes of faults are entered (e.g. "switching element overload").
> Note the following:
>
> • Logbook - Trips is deleted using the
>   "Delete Logbook - Trips" command.

Logbook - Events

> Logbook - Events contains all the alarms as well as certain actions.
> Note the following:
>
> • "Incoming" and "outgoing" events are entered.
>   "Incoming" means: The event is occurring.
>   "Outgoing" means: The event is being acknowledged.
>   The entries are distinguished from each other by means of a preceding character in the data record
>   (+: incoming, −: outgoing).
> • Logbook - Events is deleted with the "Delete Logbook - Events" command.

Logbook - Device Faults

> Logbook - Device Faults contains all the device faults that occur.
> Note the following:
>
> • Logbook - Device Faults cannot be deleted.

Data Formats and Data Records

A

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A.1 Data Formats

A.1.1 Properties

The motor starter determines a wide range of operational, diagnosis, and statistical data. Control data is transferred to the motor starter.

Control data

Data that is transferred to the motor, e.g. switching command motor COUNTER CLOCKWISE, trip reset, etc.
Data format: bit

Messages

Data that is transferred from the motor starter and indicates the current operating status, e.g. motor counter clockwise, etc.
Data format: bit

Diagnosis

Data that is transferred from the motor starter and indicates the current operating status, e.g. fault overload, etc.
Data format: bit

Current values

Current values are coded in different current formats:
6-bit, 8-bit, and 9-bit current format:
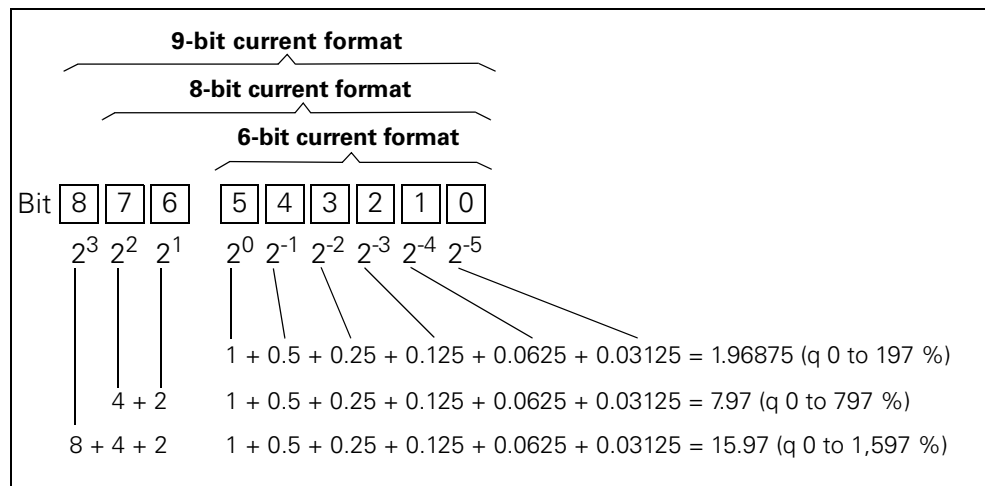
Fig. A-1: Current formats

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)

Statistical Data: Device Service Life

- Operating hours
  The motor starter records two operating hour values:
    – The operating hours of the motor.
      These indicate how long the motor was switched on.

    – The operating hours of the device (motor starter).
      These indicate how long the DC24V-NS power supply of the motor
      starter was switched on.

  Both operating hour values are recorded in data record 95 – Read statistics.
  They are entered alternately every 5 seconds in the "Operating hours" data
  field. The "Operating hour selection" bit indicates which of the two operating
  hour values has been transferred.
  [0]: Operating hours - motor
  [1]: Operating hours - device.
  The operating hours are recorded in the range 0 to 16,777,215 minutes
  in 1-minute steps.

- Number of overload trips
  The motor starter counts the number of overload trips in the
  range 0 to 65,535.

- Number of starts motor CW/CCW
  The motor starter counts the number of starts in the range 0 to 16,777,215.
  Example: When the current in the main circuit is activated by means of the
  "Motor ON" command, the value increases by 1.

- Motor current I_{max}.
  The motor starter measures the current in all 3 phases and displays the
  current of the phase under the greatest load as a percentage [%] of the
  setting current (I_e).
  Data format: 1 byte, 8-bit current format
  Example: Setting current I_e = 60 A
  The displayed motor current (110%), therefore,
  corresponds to 60 A x 1.1 = 66 A
  All three 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 that is flowing when the trip occurs in the phase under the greatest
  load as a percentage [%] of the setting current (Ie) and in amperes [A].
  Data format: 2 bytes, 9-bit current format
  Example: Setting current I_e = 60 A
  The displayed motor current (455%), therefore,
  corresponds to 60 A x 4.55 = 273 A.

Statistical Data: Maximum Pointers

Maximum pointers are used for preventative diagnosis purposes:
- The maximum measured value is stored in the device.
- The higher-level PLC can retrieve the measured value at any time.
- The higher-level PLC can delete the measured value at any time.

The following data is available as maximum pointers:
- Number of overload trips.
- Phase current $I_{L1\,max}$ to $I_{L3\,max}$. Maximum phase current as a percentage [%] of the setting current (I_e) and in amperes [A].
  Data format: 1 byte each, 8-bit current format.
  The maximum phase current is saved for each phase.

A.2 Identification numbers, Error Codes

A.2.1 Identification Number (ID No.)

The identification number (ID no.) is used for uniquely identifying all the information available in the motor starter (parameters, control commands, diagnostic data, commands, and so on). It is located in the left-hand column of the data record tables.

A.2.2 Error Codes for Negative Data Record Acknowledgement

Description

If a data record is rejected, an error code is sent with the negative acknowledgement via the device interface and the bus interface. This provides information on the reason for the negative acknowledgement. The error codes comply with the PROFIBUS-DPV1 standard (provided that they apply to the motor starter).

Evaluation via the local device interface with Switch ES

The error codes are evaluated by the parameterization and diagnosis software Switch ES (order no. 3ZS1 310-0CC20-0YA0) and displayed in plain text. For more information, see the online help for Switch ES.

Evaluation via PROFIBUS-DP

The error codes are displayed via PROFIBUS-DP layer 2. For more information, see the relevant manuals in the PROFIBUS-DP protocol description.

Error codes

The motor starter generates the following error codes:

Error code byte		Error message	Cause
high	**low**		
00$_H$	00$_H$	No error	
		Communication interface	
80$_H$	A0$_H$	Negative acknowledgement for "Read data record"	• Data record is write only
80$_H$	A0$_H$	Negative acknowledgement for "Write data record"	• Data record is read only
80$_H$	A2$_H$	Protocol error	• Layer 2 (field bus) • Device interface • Incorrect coordination
80$_H$	A9$_H$	This function is not supported!	• DPV1 service does not support the read/write data record function
		Access to technology	
80$_H$	B0$_H$	Unknown data record number (DR no.)	• DR no. in the motor starter unknown
80$_H$	B1$_H$	Incorrect data record length when writing	• DR length does not correspond to the specified DR length
80$_H$	B2$_H$	Incorrect slot number	• Slot not 1 or 4
80$_H$	B6$_H$	Communication partner has refused data transfer!	• Incorrect operating mode (automatic, manual bus, manual local operation) • Data record is read only • Parameter change not permissible in ON state
80$_H$	B8$_H$	Invalid parameter	• Incorrect parameter value
		Device resources	
80$_H$	C2$_H$	Temporary lack of resources in the device!	• No free receiver buffer • Data record is currently being updated • Data record function currently active on a different interface

Table A-1: Error codes

A.3 Data Records

Write/read data records with STEP7

You can access the data records of the motor starter from the user program.
- To write data records:
  S7 DPV1 Master: Call up SFB 53 "WR_REC" or SFC 58
  S7 Master: Call up SFC 58
- To read data records:
  S7 DPV1 Master: Call up SFB 52 "RD_REC" or SFC 59
  S7 Master: Call up SFC 59

Further information

For more information on the SFBs, see
- the "System software for S7-300/400, system and standard functions" reference manual
- in the STEP7 online help.

Byte layouts

When data longer than 1 byte is stored, the bytes are arranged as follows ("big endian"):

Byte arrangement			Data type
Byte 0	High byte	High word	Double word
Byte 1	Low byte		
Byte 2	High byte	Low word	
Byte 3	Low byte		
Byte 0	High byte		Word
Byte 1	Low byte		
Byte 0	Byte 0		Byte
Byte 1	Byte 1		
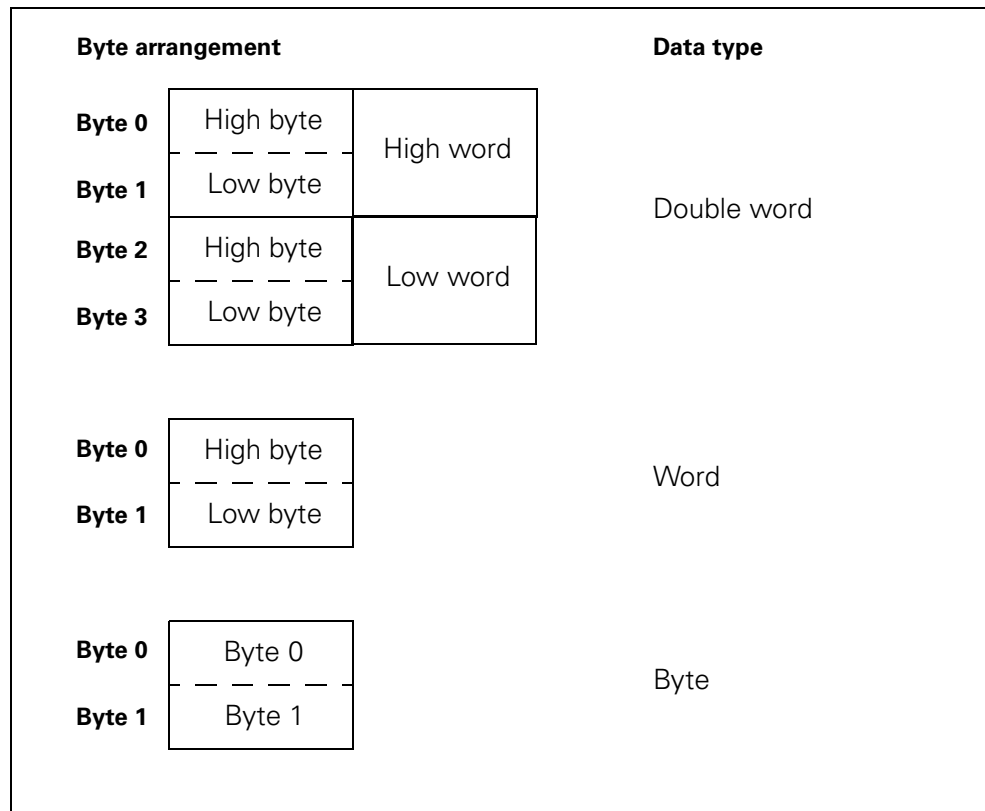
Fig. A-2: Byte arrangement in the "big endian" format

A.3.1   Data record 68 - Read/Write Process Output Image

Attention
Data record 68 in the automatic operating mode is overwritten by
the cyclic process image.

Byte	Meaning	
	Header	
0	Coordination	0x20 write via C1 channel (PLC) 0x30 write via C2 channel (PC) 0x40 write via device interface (PC)
1	reserved1	
2	reserved2	
3	reserved3	
	Process output image	
4	Process data DO-0.0 to DO-O.7 (table below)	
5	Process data DO-1.0 to DO-1.7 (table below)	
6	reserved = 0	
7	reserved = 0	

ID No.	Process data	Process image 1: (8 O, DO 0.0 to DO 0.7)	Process image 2: (16 O, DO 0.0 to DO 1.7)
1001	**DO**- **0.** 0	Motor CW	Motor CW
1002	1	Motor CCW	Motor CCW
1003	2	Brake	Brake
1004	3	Trip Reset	Trip Reset
1005	4	Emergency start	Emergency start
1006	5	Self-test	Self-test
1007	6	Creep feed	Creep feed
1008	7	Not assigned	Not assigned
1009	**DO**- **1.** 0	---	Not assigned
1010	1	---	Not assigned
1011	2	---	Not assigned
1012	3	---	Not assigned
1013	4	---	Reduction factor - Bit 0
1014	5	---	Reduction factor - Bit 1
1015	6	---	Reduction factor - Bit 2
1016	7	---	Not assigned

Table A-2: Data record 68 – Read/write process output image

In the "automatic operating mode", the PLC specifies the process output
image. In this case, when DR 68 is read on the local device interface, the
process output image is returned in the same form in which it was
transferred by the PLC.

A.3.2 Data record 69 - Read Process Input Image

Byte	Meaning
Process input image	
0	Process data DO-0.0 to DO-O.7 (table below)
1	Process data DO-1.0 to DO-1.7 (table below)
2	reserved = 0
3	reserved = 0
7	reserved = 0

ID No.	Process data		Process image1: (8 I, DI 0.0 to DI 0.7)	Process image2: (16 I, DI 0.0 to DI 1.7)
1101	**DI- 0.**	0	Ready (automatic)	Ready (automatic)
1102		1	Motor on	Motor on
1103		2	General fault	General fault
1104		3	General warning	General warning
1105		4	Input 1	Input 1
1106		5	Input 2	Input 2
1107		6	Input 3	Input 3
1108		7	Input 4	Input 4
1109	**DI-1.**	0	---	Motor current $I_{act\ bit0}$
1110		1	---	Motor current $I_{act\ bit1}$
1111		2	---	Motor current $I_{act\ bit2}$
1112		3	---	Motor current $I_{act\ bit3}$
1113		4	---	Motor current $I_{act\ bit4}$
1114		5	---	Motor current $I_{act\ bit5}$
1115		6	---	Manual operation local
1116		7	---	Ramp operation

Table A-3: Data record 69 - Read Process Input Image

A.3.3 Data record 73 - Logbook - Read Trips

A-9

Byte	Meaning	Range	Increment	Note
0 - 3	Operating hours - Device	1 ... 16777215	1 minute	Earliest entry
4 - 5	ID number Device Error	0... 32767 Signed 16	1	
..				
120 - 123	Operating hours - Device	1 ... 16777215	1 minute	Last, latest entry
124 - 125	ID number Tripping	0... 32767 Signed 16	1	

Table A-4: Data record 73 - Logbook - Read Trips

This data record can contain 21 entries. When all 21 places are full, the first entry is overwritten.

Attention
The latest entry is entered at the end of the data record. The remaining entries move up one position.

The following messages can be entered:

ID No.	Trip Messages	Note
305	Safety oriented tripping	
309	Switching element overload	
317	Electronics supply voltage too low	
318	No switching element supply voltage	
319	No mains voltage	
323	Intermediate circuit voltage too high	
324	Temperature sensor overload	
325	Temperature sensor wire break	
326	Temperature sensor short-circuit	
327	Thermal motor model overload	
331	Line protection overload	
333	Circuit breaker tipped	
334	I_e upper limit value violation	
335	I_e lower limit value violation	
338	Residual current trip	
339	Motor block tripping	
341	Asymmetry tripping	
343	Earth fault tripping	
348	Input tripping	
354	Sensor supply overload	
355	Process mapping error	
365	Invalid parameter value	
ID No. of the invalid parameter		
371	Memory submodule defective	For precise cause, see Logbook - Device Faults
374	Memory submodule programming error	
378	FW Download unsuccessful	
381	Self-test error (= device error)	For precise cause, see Logbook - Device Faults
1201	Block protection activated during start-up	
1202	Block protection activated during operation	

Table A-5: Messages in Logbook - Read Trips

A.3.4 Data record 75 - Logbook - Read Events

Byte	Meaning	Setting range	Increment	Note
0 - 3	Operating hours - Device	1 ... 16777215	1 minute	Earliest entry
4 - 5	ID number Device Error	0... ± 32767 Signed 16[*)] = two's complement	1	
..				
120 - 123	Operating hours - Device	1 ... 16777215	1 minute	Last, latest entry
124 - 125	ID number Tripping	0... ± 32767 Signed 16[*)] = two's complement	1	

*) + : Incoming event
  – : Outgoing event

Table A-6: Data Record 75 - Logbook - Read Events

This data record can contain 21 entries. When all 21 places are full, the first entry is overwritten.

Attention
The latest entry is entered at the end of the data record. The remaining entries move up one position.

The following messages can be entered:

ID No.	Error - Message	Note
	Warnings	
324	Temperature sensor overload	± (Incoming/outgoing event)
325	Temperature sensor wire break	± (Incoming/outgoing event)
326	Temperature sensor short-circuit	± (Incoming/outgoing event)
327	Thermal motor model overload	± (Incoming/outgoing event)
331	Line protection overload	± (Incoming/outgoing event)
334	I_e upper limit value violation	± (Incoming/outgoing event)
335	I_e lower limit value violation	± (Incoming/outgoing event)
337	Residual current detected	± (Incoming/outgoing event)
340	Asymmetry detected	± (Incoming/outgoing event)
342	Earth fault detected	± (Incoming/outgoing event)
351	Input warning	± (Incoming/outgoing event)
	Actions	
310	Emergency start active	± (Incoming/outgoing event)
357	Automatic operation	+ (Incoming event only)
358	Manual operation bus	+ (Incoming event only)
359	Manual operation local	+ (Incoming event only)
360	Manual operation connection abort	± (Incoming/outgoing event)
363	Maximum pointer reset	+ (Incoming event only)
365	Invalid parameter value	+ (Incoming event only)
ID no. of the invalid parameter		+ (Incoming event only)
366	Parameters cannot be changed in ON state	+ (Incoming event only)
ID no. of the invalid parameter		+ (Incoming event only)
368	Parameters disabled CPU/Master active	± (Incoming/outgoing event)
369	Factory settings restored	+ (Incoming event only)
371	Memory submodule defective	+ (Incoming event only)
373	Memory submodule programming successful	+ (Incoming event only)
374	Memory submodule programming error	+ (Incoming event only)
376	FW Download successful	+ (Incoming event only)
1302	Logbook - Trips deleted	+ (Incoming event only)
1303	Logbook - Events deleted	+ (Incoming event only)

Table A-7: Messages in Logbook - Read Events

A.3.5 Data Record 80 – Read Initial Setting DR128

The structure and content of data record 80 is identical to that of data record 128. Data record 80 supplies the default values for all the DR 128 parameters.

A.3.6 Data Record 81 - Read Initial Setting DS129

The structure and content of data record 81 is identical to that of data record 129. Data record 81 supplies the default values for all the DR 129 parameters.

A.3.7 Data Record 92 – Read Device Diagnosis

ID No.	Byte	Signaling bit	F no.*)	Meaning/**Acknowledgement**
		Switch/Controlling:		
301	0^0	Ready (automatic)	—	Device ready to operate via host (e.g. PLC) **The signaling bit is constantly updated.**
306	0^1	Motor CW	—	Switching element 1 on **The signaling bit is constantly updated.**
307	0^2	Motor CCW	—	Switching element 2 on **The signaling bit is constantly updated.**
309	0^3	Switching element overload	F5, F24	E.g. power semiconductor too hot resulting in trip. **Signal. bit is deleted when cause of trip is removed and acknowledged with trip reset.**
308	0^4	Switching element defective	F9	E.g. contactor welded or jammed, or power semiconductor failed. **The signaling bit can only be deleted by switching the supply voltage (DC24 V-NS) on/off once the cause of the error has been removed.**
310	0^5	Emergency start active	—	**The signaling bit is deleted when emergency start is deactivated.**
302	0^6	General fault	—	At least 1 fault that generates an F no. is set. **The signaling bit is deleted when cause of the trip is removed and acknowledged with trip reset, autoreset, or the OFF command.**
304	0^7	General warning		At least 1 warning is present. **The signaling bit is constantly updated.**
318	1^0	No switching element supply voltage	F17, F24	**The signaling bit is automatically deleted when the cause of the trip is removed.**
319	1^1	No mains voltage	F17, F24	The signaling bit is deleted when the cause of the trip is removed and acknowledged with trip reset.
320		Current limiting active	—	The motor current is restricted to the parameterized value. **The signaling bit is constantly updated.**
321		Setpoint value = Actual value	—	Setpoint frequency of speed controller = actual frequency. **The signaling bit is constantly updated.**

ID No.	Byte	Signaling bit	F no.*)	Meaning/**Acknowledgement**
322		Generating motor run	—	The motor supplies power back to the motor starter. **The signaling bit is constantly updated.**
323		Intermediate circuit voltage too high	—	Speed control **The signaling bit is constantly updated.**
311	1^2	Lock-out time active	—	Reversing starter **The signaling bit is constantly updated.**
312	1^3	Starting active	—	Soft starter **The signaling bit is constantly updated.**
313	1^4	Coasting down active	—	
315	1^5	Mechanical braking active	—	The brake output is switched on by the user. **The signaling bit is constantly updated.**
316	1^6	Electrical braking active	—	Brake output is switched on by the motor starter. **The signaling bit is constantly updated.**
314	1^7	Creep feed active	—	**The signaling bit is constantly updated.**
		Protection functions: motor/line/short-circuit		
324	2^0	Temperature sensor overload	F 4	Overload detected. **The signaling bit is constantly updated.**
325	2^1	Temperature sensor wire break	F6	Thermistor circuit interrupted. **The signaling bit is constantly updated.**
326	2^2	Temperature sensor short-circuit	F1	Short-circuit in the thermistor circuit. **The signaling bit is constantly updated.**
327	2^3	Thermal motor model overload	F4	Overload detected. **The signaling bit is constantly updated.**
328	2^4	Overload tripping	F24	Overload detected resulting in trip. **The signaling bit is deleted when the cause of the trip is removed and acknowledged with trip reset/autoreset.**
329	2^5	Idle time active	—	**The signaling bit is constantly updated.**
330	2^6	Cooling time active	—	**The signaling bit is constantly updated.**
305	2^7	Safety-oriented tripping	F25	Trip.
331	3^0	Line protection overload	F4	The line between the motor starter and the motor is overloaded. The signaling bit is constantly updated.
332	3^1	Line protection tripping	F24	The line between the motor starter and the motor is overloaded resulting in trip. The signaling bit is deleted when the cause of the trip is removed and acknowledged with trip reset.
333	3^2	Circuit breaker tripped	F1, F24	Signal. bit is deleted when cause of the trip is removed and acknowledged with trip reset.
	3^{4-6}	reserved = 0	—	
352	3^7	Input control	—	Control commands motor CW and motor CCW via the input actions. **Signaling bit is constantly updated.**
340	4^0	Asymmetry detected	—	Asymmetry exists. **The signaling bit is constantly updated.**

ID No.	Byte	Signaling bit	F no.*)	Meaning/**Acknowledgement**
341	4^1	Asymmetry tripping	F24	Asymmetry exists resulting in trip. **Signal. bit is deleted when cause of trip is removed and acknowledged with trip reset.**
334	4^2	I_e upper limit value violation	F7	Limit value violated. **The signaling bit is constantly updated.**
335	4^3	I_e lower limit value violation	F8	Limit value violated. **The signaling bit is constantly updated.**
336	4^4	I_e limit value tripping	F24	**Signal. bit is deleted when cause of trip is removed and acknowledged with trip reset.**
337	4^5	Residual current detected	—	Residual current detected. **The signaling bit is constantly updated.**
338	4^6	Residual current tripping	F24	Residual current identified resulting in trip.
339	4^7	Motor block tripping	F24	Trip. Blocking current longer than permitted blocking time. **The signaling bit is deleted when the cause of the trip is removed and acknowledged with trip reset.**
344	5^0	Input 1	—	States of the free inputs (for make contact): "1" = active, HIGH level present. "0" = inactive, LOW level present. (opposite for break contact) **The signaling bit is constantly updated.**
345	5^1	Input 2	—	
346	5^2	Input 3	—	
347	5^3	Input 4	—	
348	5^4	Input tripping	F26 F24	Trip present. **The signaling bit is deleted when the cause of the trip is removed and acknowledged with trip reset/autoreset.**
349	5^5	Input tripping limit position CW run	F26, F24	Trip present. **The signaling bit is automatically deleted when the cause of the trip is removed. Counter clockwise start possible.**
351	5^6	Input warning	—	Warning present. **The signaling bit is constantly updated.**
350	5^7	Input tripping limit position CCW run	F26, F24	Trip present. **The signaling bit is automatically deleted when the cause of the trip is removed. Clockwise start possible.**
342	6^0	Earth fault detected	—	Earth fault current present. The signaling bit is constantly updated.
343	6^1	Earth fault tripping	F24	Earth fault current present resulting in trip. The signaling bit is deleted when the cause of the trip is removed and acknowledged with trip reset.
353	6^2	Quick stop	F26, F24	Quick stop present resulting in trip. The signaling bit is deleted when the cause of the trip is removed and acknowledged with trip reset.
354	6^3	Sensor supply overload	F26, F24	Sensor supply overload present resulting in trip. **The signaling bit is deleted when the cause of the trip is removed and acknowledged with trip reset.**

ID No.	Byte	Signaling bit	F no.*)	Meaning/**Acknowledgement**
361	6^4	Trip reset successful	—	**The signaling bit is deleted by updating or by means of trip reset when in standby mode.**
362	6^5	Trip reset successful	—	Cause of the trip still present. **The signaling bit is deleted by updating (new trip reset) or by means of trip reset when in standby mode.**
363	6^6	Maximum pointer reset	—	**The signaling bit is always deleted when acknowledged with "trip reset".**
	6^7	Electronics supply voltage too low	—	**The signaling bit is automatically deleted when the cause of the trip is removed.**
		Communication		
303	7^0	Bus fault	—	DP interface response watchdog timeout. **The signaling bit is constantly updated.**
356	7^1	CPU/Master STOP	—	PLC program is no longer processed. **The signaling bit is constantly updated.**
357	7^2	Automatic operation	—	Automatic (controlled by PLC) **The signaling bit is constantly updated.**
358	7^3	Manual operation local	—	Manual operation via field bus (controlled by operator control and monitoring) **The signaling bit is constantly updated.**
359	7^4	Manual operation local	—	Manual operation via local device interface (controlled by operator control and monitoring) **The signaling bit is constantly updated.**
	7^5	reserved = 0	—	
360	7^6	Manual operation connection abort	—	The associated communication connection was aborted during manual operation. **The signaling bit is constantly updated.**
355	7^7	Process mapping error	F26 F24	The process output image contains an invalid bit combination. **The signaling bit is automatically deleted when the cause of the trip is removed.**
		Parameter		
364	8^0	Parameter assignment active	—	**The signaling bit is constantly updated.**
365	8^1	Invalid parameter value	F16 (F24)	**The signaling bit is always deleted when acknowledged with trip reset or when valid parameters have been received. Results in trip during start-up.**
366	8^2	Parameters cannot be changed in ON state	—	An attempt has been made to change parameters while the motor or associated device function is on. This results in a trip. **The signaling bit is always deleted when acknowledged with trip reset or when valid parameters have been received.**
368	8^3	Parameters disabled CPU/Master active	—	**The signaling bit is constantly updated. Motor starter ignores parameters from the PLC.**
	8^4	reserved = 0	—	
	8^5	reserved = 0	—	

ID No.	Byte	Signaling bit	F no.*)	Meaning/**Acknowledgement**
371	8^6	Memory submodule defective	F26 (F24)	**The signaling bit is always deleted when acknowledged with trip reset.** **Results in trip during start-up.**
370	8^7	Memory submodule not connected	—	**The signaling bit is constantly updated.**
		Device function		
379	9^0	Self-test active	__	**Signaling bit is constantly updated.**
380	9^1	Self-test OK	__	**Signaling bit is constantly updated.**
381	9^2	Self-test error	F9	**The signaling bit can only be deleted by switching the supply voltage (DC24 V-NS) on/off once the cause of the error has been removed.**
384		No external start-up parameters received		**The signaling bit is always deleted during the transition from start-up to the standard operating mode.**
369	9^3	Factory setting restored	__	**The signaling bit is always deleted when acknowledged with "trip reset".**
372 373 374	9^{4-5}	Memory submodule		00 : not assigned (status after PowerOn) 01 : programming active 10 : programming successful 11 : programming error (F26) (F24 during start-up only) **The signaling bit is always deleted when acknowledged with trip reset.**
377 375 376 378	9^{6-7}	FW download		00 : rejected/state after reset 01 : active 10 : successful 11 : unsuccessful (F9) The signaling bit is always deleted when acknowledged with "trip reset".
367	10	Parameter number error **)	—	In connection **8^1** and **8^2**, specifies the first parameter that is not accepted. **Signaling byte is always deleted when acknowledged with trip reset.**
	11	reserved = 0	—	

Table A-8: Data record 92 – Read device diagnosis

*)   PROFIBUS-DP error numbers
**)   Corresponds to the ID no.

Grayed-out signaling bits are not supported by ECOFAST Motor Starters.

A.3.8 Data Record 93 - Write Command

Structure of the command data record

Byte	Meaning	Note
	Command data record	
	Header	
0	Coordination	0x20 write via C1 channel (PLC) 0x30 write via C2 channel (PC) 0x40 write via device interface (PC)
1-3	reserved	
	Command	
4	Number of commands	Value range 1..5 Number of following valid commands.
5	Command 1	Sequence no. (see table below)
6	Command 2	Optional (sequence no. see table below)
7	Command 3	Optional (sequence no. see table below)
8	Command 4	Optional (sequence no. see table below)
9	Command 5	Optional (sequence no. see table below)

Table A-9: Structure of the command data record

ID No.	Code	Command	Meaning
		1-byte commands	
0	0	reserved	No function
703	1	Trip reset	Reset and acknowledge error messages
713	2	Emergency start ON	
714	3	Emergency start OFF	
709	4	Automatic operation	Switch to the automatic operating mode (controlled by DP Master)
710 711 712	5	Manual operation - bus - local	Switch to the manual operating mode. In this case, the motor starter switches to the manual bus or manual operation local operating mode, depending on the interface via which the command is received.
701	6	Factory settings	Restore factory settings for parameters from DR 128.
704	7	Maximum pointer reset	The measured values for preventative diagnosis are deleted (= 0).
705	13	Logbook - Delete Trips	Delete the logbook containing the causes of the errors.
706	14	Logbook - Delete Events	Delete the logbook containing the alarm messages and specific actions.
715	8	Memory submodule programming	The device parameters (DR 128) and communication parameters (DR 160) are transferred to the memory module.
702	9	Restart	Trigger restart (as after supply system ON), e.g. after station address has been reassigned.
707	10	Parameters disabled CPU/Master ON	Parameterization via parameterizing master not possible, or its parameters are ignored.
708	11	Parameters disabled CPU/Master OFF	Parameterization via parameterizing master possible.
716	12	Reset memory submodule	The parameters in the ext. memory module are deleted.
	..		
	127		

Table A-10: Data record 93 – Write command

A.3.9　　Data Record 94 - Read Measured Values

ID No.	Byte	Meaning	Range/ [Coding]	Incre- ment	Note
		Measured values			
504	0	Phase current $I_{L1\,act}$	0 to 797%	3.125%	8-bit current format
505	1	Phase current $I_{L2\,act}$	0 to 797%	3.125%	8-bit current format
506	2	Phase current $I_{L3\,act}$	0 to 797%	3.125%	8-bit current format
507	3	Earth fault current	0 to 2.5 A	10 mA	
508		Output frequency	0 to 100 Hz	0.5 Hz	
501	4-5	Remaining cooling time	0 to 30 mins	100 ms	
502	$6^{0\text{-}6}$	Motor heating	0 to 200%/[0...100]	2%	
	6^{7}	Asymmetry	[0]: No asymmetry [1]: Asymm. ($\geq$ 40%)		
503	7	Value asymmetry	0 ... 100%/[0...100]	1%	
		Maximum pointer			
653	8	Phase current $I_{L1\,max}$	0 to 797%	3.125%	8-bit current format
654	9	Phase current $I_{L2\,max}$	0 to 797%	3.125%	8-bit current format
655	10	Phase current $I_{L3\,max}$	0 to 797%	3.125%	8-bit current format
	11	reserved = 0			
652	12-13	Max. tripping current	0 to 1,000%	3.125%	9-bit current format
651	14-15	Number of overload trips	0 to 65535	1	
	16	reserved = 0			
	17	reserved = 0			
	18	reserved = 0			
	19	reserved = 0			

Table A-11: Data record 94 - Read measured values

A.3.10 Data Record 95 – Read Statistics

ID No.	Byte	Meaning	Range/ [Coding]	Increment	Note
		Statistics			
607	0	Motor current I_{max}	0 to 797%	3.125%	8-bit current format
	1^{0-6}	reserved = 0			
601	1^7	Operating hours - selection	[0]: Operating hours - motor [1]: Operating hours - device		Change every 5 seconds
606	2-3	Latest tripping current	0 to 1,000%	3.125%	9-bit current format
602	4-7	Operating hours	0 to 16777215	1 min	*) see below
603	8-11	Number of starts motor CW	0 to 16777215	1	
604	12-15	Number of starts motor CCW	0 to 16777215	1	
605	16-17	Number of overload trips	0 to 65535	1	
	18	reserved = 0			
	19	reserved = 0			

Table A-12: Data record 95 – Read statistics

*)

Operating hours: special feature

The motor starter records two operating hour values:
- The operating hours of the motor. These indicate how long the switching elements and, therefore, the motor were switched on.
- The operating hours of the device (motor starter). These indicate how long the DC24V-NS power supply of the motor starter was switched on.

Both operating hour values are recorded in data record 95 – Read statistics. They are entered alternately every 5 seconds in the "Operating hours" data field. The "Operating hour selection" bit indicates which of the two operating hour values has been transferred.
[0]: Operating hours - motor
[1]: Operating hours - device.
The operating hours are recorded in the range 0 to 16,777,215 minutes in 1-minute steps.

A.3.11   Data record 100 – Read device identification

ID No.	Byte	Length	Value	Meaning
			Header	
900	0	1	Coordination	0x20 write via C1 channel (PLC) 0x30 write via C2 channel (PC) 0x40 write via device interface (PC)
	1	1	reserved1	
	2	1	reserved2	
	3	1	reserved3	
			Device identification (TF)	
901	4-11	8	...	Time stamp[*)]
902	12..31	20	SIEMENS AG	Manufacturer
903	32..55	24		MRPD number (order number)
904	56	1	0x01	Device family: load feeder
905	57	1	0x01	Device sub-family: motor starter
906	58	1	0x01/0x02	Device class: e.g. direct starter/reversing starter
907	59	1	0x03	System: ECOFAST PROFIBUS DP
908	60	1	0x01	Functional group
909	61	1	0x00	reserved
910	62..77	16		Product short designation
911	78...81	1	′V...	Hardware version (byte 0 to byte 3)
912	82	1	0x00	Identification number (byte0) (ECOFAST)
	83	1	0x00	Identification number (byte1) (ECOFAST
	84	1	0x80	Identification number (byte2) (ECOFAST)
	85	1	0xAF	Identification number (byte3) (ECOFAST)
	86..87	2	0x00	reserved
915	88..95	8	...	Service number
	96	1	0x00	reserved
	97	1	0x00	reserved
	98	1	0x00	reserved
	99	1	0x00	reserved

Table A-13: Read device identification

*) Time stamp: time of initialization with factory settings.

Object name	id_date								
Object length	8 bytes								
Bits	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
Octet									
1	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	0 to 59,999 milliseconds
2	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	
3	res	res	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	0 to 59 minutes
4	SU	res	res	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	0 to 23 hours SU: 0: normal time, 1: summer time
	Weekday			Day of the month					1 to 7 ; 1=Monday, 7= Sunday
5	2^{2}	2^{1}	2^{0}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	1 to 31
6	res	res	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	1 to 12 months
7	res	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	0 to 99 years; 0 = 2000
8	res	res	res	res	res	res	res	res	reserved

A.3.12 Data Record 128 – Read/Write Device Parameters [1]

ID No.	Byte	Bit pos. in DMD	Device Parameters	Range/ [Coding]	Incre-ment	Pre-setting
	0	20	Coordination	0x20 write via C1 channel (PLC) 0x30 write via C2 channel (PC) 0x40 write via device interface (PC)		
	1	21	reserved 1			
	2	22	reserved 2			
	3	23	reserved 3			
	4-9	24-29	reserved = 0			
1	10	30	Device functions (byte0)	Bit 1: Thermal motor model 2: Temperature sensor 3: Line protection 4: Current limit values 5: Asymmetry 6: Earth fault 7: Inputs 8: Response to bus failure		
	11	31	Device functions (byte1)	9: Control function: reversing starter 10: Control function: soft starter 11: Electrical braking 12: Mechanical braking 13: Emergency start 14: Mechanical switching technology 15: Electronic switching technology 16: Short-circuit protection		
	12	32	Device functions (byte2)	17: Creep feed 18: Local device bus 19: FW download 20:Self-test 21:Control function Speed Control 22:Safety Technology 23...24: Not assigned		
	13	33	Device functions (byte3)	25...32: Not assigned		
2	14-15	34-35	Rated operational current	0.30 A ... 24 A [30-2400]	10 mA	

ID No.	Byte	Bit pos. in DMD	Device Parameters	Range/ [Coding]	Incre-ment	Pre-setting
3*)	16^0	36.0	Load type	3-phase [0] 1-phase [1]		3-phase
4	16^1	36.1	Protection against voltage failure	yes [1]/no[0]		yes
	16^{2-7}		reserved = 0			
	17^{0-7}		reserved = 0			
5	18^{0-1}	38.0	Response to overload - thermal motor model	Trip without restart [0] Trip with restart [1] Warning [2]	1	Trip without restart
	18^{2-7}	38.1	reserved = 0			
6	19^{0-2}	39.0	Tripping class	CLASS 10 [0] CLASS 20 [1] CLASS 30 [2]	1	10
	19^{3-7}	39.1	reserved = 0			
7	20	40	Recovery time	1 to 30 min [2-60]	30 s	90 s
8	21	41	Idle time	0 to 255 s [0-255]	1 s	0 = deactivated
	22-23	42-43	reserved = 0			
10	24^{0-1}	44.0	Response to overload - temperature sensor	Trip without restart [0] Trip with restart [1] Warning [2]	1	Trip without restart
	24^{2-3}	44.2	reserved = 0			
9	24^{4-6}	44.4	Temperature sensor	Deactivated [0] Thermoclick [1] PTC type A [2] Not assigned [3] ...[7]	1	Deactivated
12	24^7	44..7	Temperature sensor monitoring	Yes [1]/No [0]	1	Yes
	25^{0-7}	45	reserved = 0			
13	26-27	46	Permissional line operational current	1 A to 100 A [100-10000]	10 mA	100 A
15	28	48	Lower current limit	18.75% to 100% [6-32]	3.125%	18.75 %
16	29	49	Upper current limit	50% to 150% [16-48]	3.125%	112.5 %
17	30	50	Blocking current	150% to 1000% [3-20]	50%	800 %
	31	51	reserved = 0			
18	32^{0-3}	52.0	Blocking time	1 to 5 s [2-10]	0.5s	1 s
	32^{4-5}	52.4	reserved = 0			
14	32^6	52.6	Response to current limit violation	Warning [0] Tripping[1]	1	Warning
19	32^7	52.7	Response to residual current detection	Warning [0] Tripping[1]	1	Tripping
	33^{0-7}	53	reserved = 0			

ID No.	Byte	Bit pos. in DMD	Device Parameters	Range/ [Coding]	Incre-ment	Pre-setting
21	34^{0-2}	54.0	Asymmetry limit	30% to 60% [3-6]	10%	30%
	34^{3-5}	54.3	reserved = 0			
20	34^6	54.6	Response to asymmetry	Warning [0] Tripping [1]	1	Tripping
22	34^7	54.7	Response to earth failure	Warning [0] Tripping [1]	1	Warning
	35^{0-7}	55	reserved = 0			
37	36	56	Locking time	0 to 60 s [0-60]	1 s	0
	37	57	reserved= 0			
24	38^{0-2}	58.0	Input delay (debounce time)	10 to 80 ms [0-7]	10 ms	10 ms
23*)	38^3	58.3	Input quick-stop - Level	NC [0] NO [1]	1	NO
25*)	38^4	58.4	Input 1 - Level	NC [0] NO [1]	1	NO
27*)	38^5	58.5	Input 2 - Level			
29*)	38^6	58.6	Input 3 - Level			
31*)	38^7	58.7	Input 4 - Level			
26*)	39^{0-3}	59.0	Input 1 - Action	No Action [0] Tripping without restart [1] Tripping with restart [2] Switch-off end position clockwise [3] Switch-off end position counter clockwise [4] General warning [5] Manual operation local [6] Emergency start [7] Motor CW [8] Motor CCW [9] Creep feed [10] Quick-Stop [11] Trip-Reset [12] [13-15] not assigned	1	0
28*)	39^{4-7}	59.4	Input 2 - Action			
30*)	40^{0-3}	60.0	Input 3 - Action			
32*)	40^{4-7}	60.4	Input 4 - Action			
80*)	410	61.0	Input 1 -Signal	Unlatch [0] Latch [1]	1	Unlatch
81*)	411	61.1	Input 2 -Signal			
82*)	412	61.2	Input 3 -Signal			
83*)	413	61.3	Input 4 -Signal			
	41^{0-7}	61.4-.7	reserved = 0			0
48	42	62	Brake release delay on starting	-2.5 to +2.5 s [-25...+25] signed 8 = two's complement	100 ms	0
49	43	63	Brake holding time on stopping	0 to 30 s [0-30]	1s	0
46	44	64	Braking time	0 to 30 s [0-30]	1 s	0
	45	65	Braking torque	20 to 100% [4-20]	5%	40 %
38	46	66	Starting time	0 to 30 s [0-120]	0.25 s	5 s

ID No.	Byte	Bit pos. in DMD	Device Parameters	Range/ [Coding]	Incre-ment	Pre-setting
39	47	66	Coasting down time	0 to 30 s [0-120]	0.25 s	0
40	48	61	Starting voltage	20 to 100% [4-20]	5%	40%
41	49	62	Starting voltage	20 to 90% [4-18]	5%	40%
42	50	63	Current limiting value	125 to 600% [16-192]	3.125%	600%
	51		reserved = 0			
35	52	65.0	Substitute value (byte0)	8 x on/off	1	0
	53	66.0	Substitute value (byte1)	8 x on/off	1	0
	54-55		reserved = 0 (reserved for substitute value 32 bit)			
	56^{0-5}		reserved = 0			
36	56^6	69.6	General diagnostics	Block [0] Release [1]	1	Block
34	56^7	69.7	Response to CPU/Master STOP	Switch subst. value [0] Retain the last value[1]	1	Switch substitute value
	57^{0-7}		reserved = 0			
43	58	71	Creep speed factor	3 to 21 [3-21]	1	7
44	59	72	Creep torque	20 to 100% [4-20]	5%	60%
45	60	73	Creeping time	0 to 100 s [0-100]	1 s	0
	61		reserved = 0			

Table A-14: Data record 128 – Read/write device parameters [1]

*) Cannot be changed when the motor is running

A.3.13 Data Record 129 - Read/Write Device Parameters [2]

ID No.	Byte	Bit Pos. in DMD	Device Parameters	Range/ [Coding]	Incre- ment	Pre-setting
100	0	82	Coordination	0x20 write via C1 channel (PLC) 0x30 write via C2 channel (PC) 0x40 write via device interface (PC)		
	1	83	reserved1			
	2	84	reserved2			
	3	85	reserved3			
Control Function Speed Control						
101*)	40-5	86.0	Rated power	reserved [0] 0.06 kW [1] 0.09 kW [2] 0.12 kW [3] 0.18 kW [4] 0.25 kW [5] 0.37 kW [6] 0.55 kW [7] 0.75 kW [8] 1.1 kW [9] 1.5 kW [10] 1.2 kW [11] 3.0 kW [12] 4.0 kW [13] 5.5 kW [14] 7.5 kW [15] 9.2 kW [16] 11.0 kW [17] reserved [18 ... 63]		Maximum value of the relevant output class
105*)	46-7	86.6	Control Mode	U/f Characteristic curve+ 4Q Operation [0] U/f Characteristic curve+ DC Break [1] Flux Control + 4Q Operation [2] Flux Control + DC Break [3]		U/f Characteristic curve + 4Q Operation
102*)	50-3	87.0	Rated Voltage	reserved [0] 230 VAC [1] 277 VAC [2] 400 VAC [3] 480 VAC [4] reserved [5 ... 15]		400 VAC

ID No.	Byte	Bit Pos. in DMD	Device Parameters	Range/ [Coding]	Incre- ment	Pre-setting
103*)	54-7	87.4	Rated frequency	reserved [0] reserved [1] 50 Hz [2] 60 Hz [3] not assigned[4...15]	1	50 Hz
104*)	6-7	88-89	Rated speed	500 to 3600 U/min. [500-3600]	1 U/min	1400 U/min
106*)	8	90	Setpoint value f_{max}	0.5 to Hz [1 to 200]	0.5 Hz	70 Hz
107	9	91	Setpoint value f1	0.5 to 100 Hz [1 to 200]	0.5 Hz	50 Hz
109	10	92	Starting time f1	0 to 25 s [0-250]	0.1 s	1 s
110	11	93	Coasting down time f1	0 to 25 s [0-250]	0.1 s	1 s
108	12	94	Setpoint f2	0.5 to 100 Hz [1 to 200]	0.5 Hz	25 Hz
111	13	95	Starting time f2	0 to 25 s [0-250]	0.1 s	1 s
112	14	96	Coasting down time f2	0 to 25 s [0-250]	0.1 s	1 s
	15-63	97-145	reserved			

Table A-15: Data record 129 – Read/write device parameters [2]

*) Cannot be changed when the motor is running

A.3.14   Data Record 160 - Read/Write Communication Parameters

This data record is used to assign communication parameters and only applies to devices that have direct access to the field bus (e.g. PROFIBUS-DP).

ID No.	Byte	Length	Communication parameters	Range [Coding]	Incre-ment	Pre-setting
			Header			
200	0	1	Coordination	0x20 write via C1 channel (PLC) 0x30 write via C2 channel (PC) 0x40 write via device interface (PC)		
	1	1	reserved1			
	2-3	2	reserved2			
			Communication			
210	4	1	Field bus address	1 to 126	1	126
211	5	1	Baud rate	12000 kBd [0] 6000 kBd [1] 3000 kBd [2] 1500 kBd [3] 500 kBd [4] 187.5 kBd [5] 93.75 kBd [6] 45.45 kBd [7] 19.2 kBd [8] 9.6 kBd [9] Not assigned [10..14] Automatic baud rate identification [15]		
	6-9	4	reserved = 0			
	10-11	2	reserved = 0			

Table A-16: Data record 160 - Read/write communication parameters

Attention
When carrying out a read operation, ECOFAST Motor Starters indicate the current baud rate. For write operations, "Automatic baud rate identification [15]" must be entered as the baud rate.

A.3.15   Data Record 165 – Read/Write Comment

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

Technical Data

B

B.1 Motor Starters

B.1.1 General Technical Data

Installation location	On system	• Wall-mounted (motor plugged in) • Mounted directly on motor (motor nearby)
Installation position		Any
Degree of protection	IP65/67	Watertight acc. to IEC 529 (DIN 40050)
Safety class	1	IEC 536 (VDE 0106-1)
Cooling	Convection	No additional cooling required
Weight	1.4 kg 1.9 kg 2.6 kg	Reversing Starter Reversing Soft Starter Duo Reversing Soft Starter
Operating temperature	–20 °C to + 40 °C	Do not allow condensation to form! Max. 55 °C with reduction of I_e: • with 1.5%/K to Reversing Soft Starters and Duo Reversing Soft Starters • with 3%/K to Duo Reversing Soft Starters
Storage/transport temperature	–40 °C to + 80 °C	
Relative humidity	5% to 95%	Do not allow condensation to form!
Site altitude	1,000 m 2,000 m	Without restrictions With restrictions Reduction of Ie by 1% per 100 m to 2,000 m
Vibration strain	f = 5 to 26 Hz; d = 0.75 mm 10 cycles f = 26 to 150 Hz; a = 2 g	
Shock	a = 150 m/s^2 (15 g); 11 ms duration 3 shocks per +/- direction in all of the three perpendicular axes (=18)	
ESD	8 kV air discharge 6 kV contact discharge	IEC 1000-4-2 severity 3
Electromagnetic fields	10 V/m	IEC 1000-4-3 severity 3
BURST	2 kV/5 kHz supply voltage 1 kV/5 kHz data lines 2 kV/5 kHz process lines	IEC 1000-4-4 severity 3
Emitted interference	Limit value class A	EN 55011

Switching Frequency

If motors are switched too frequently, the thermal motor model is activated. The maximum permissible switching frequency depends on the following operating data:
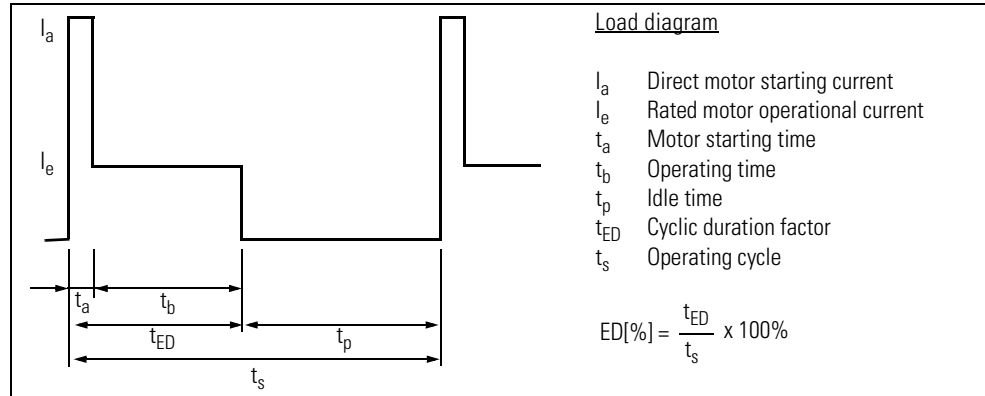
Fig. B-1: Load diagram for switching frequency

The following diagrams can be used to determine the maximum switching frequency.

Maximum switching frequency when $I_a = 4 \times I_e$ (with example)
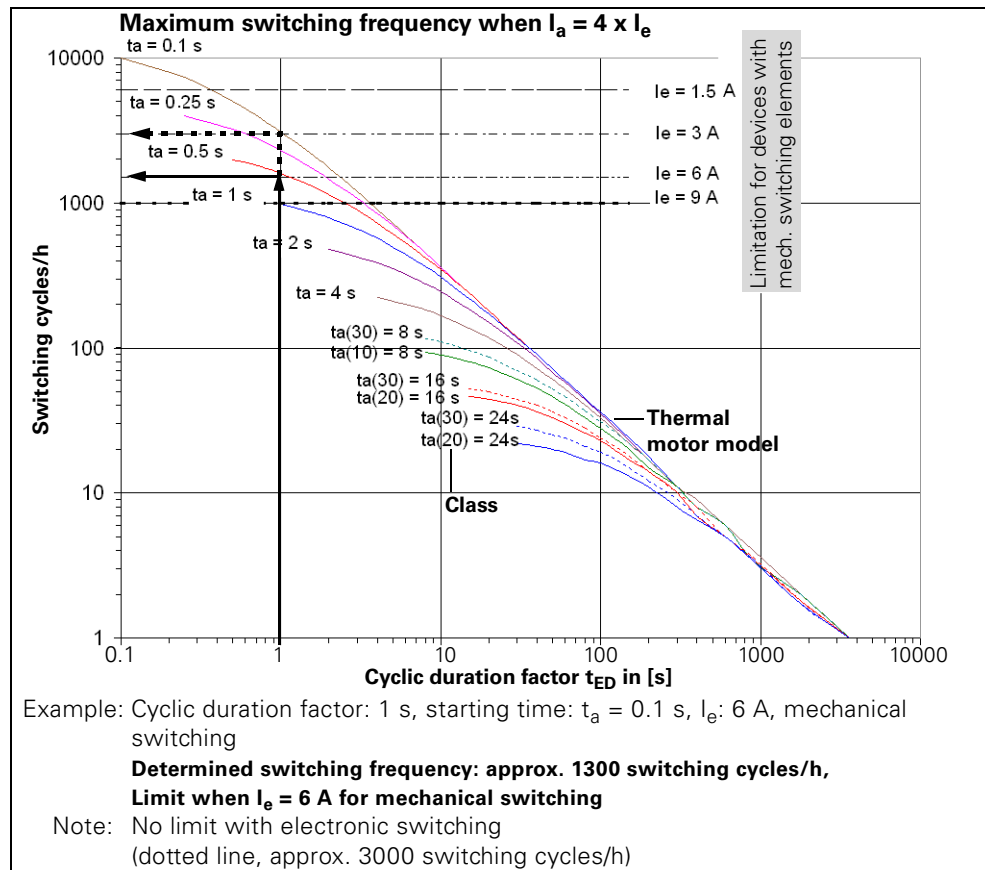
Fig. B-2: Maximum switching frequency when Ia = 4 x Ie (with example)

Maximum switching frequency when $I_a = 6 \times I_e$ and $I_a = 7.19 \times I_e$
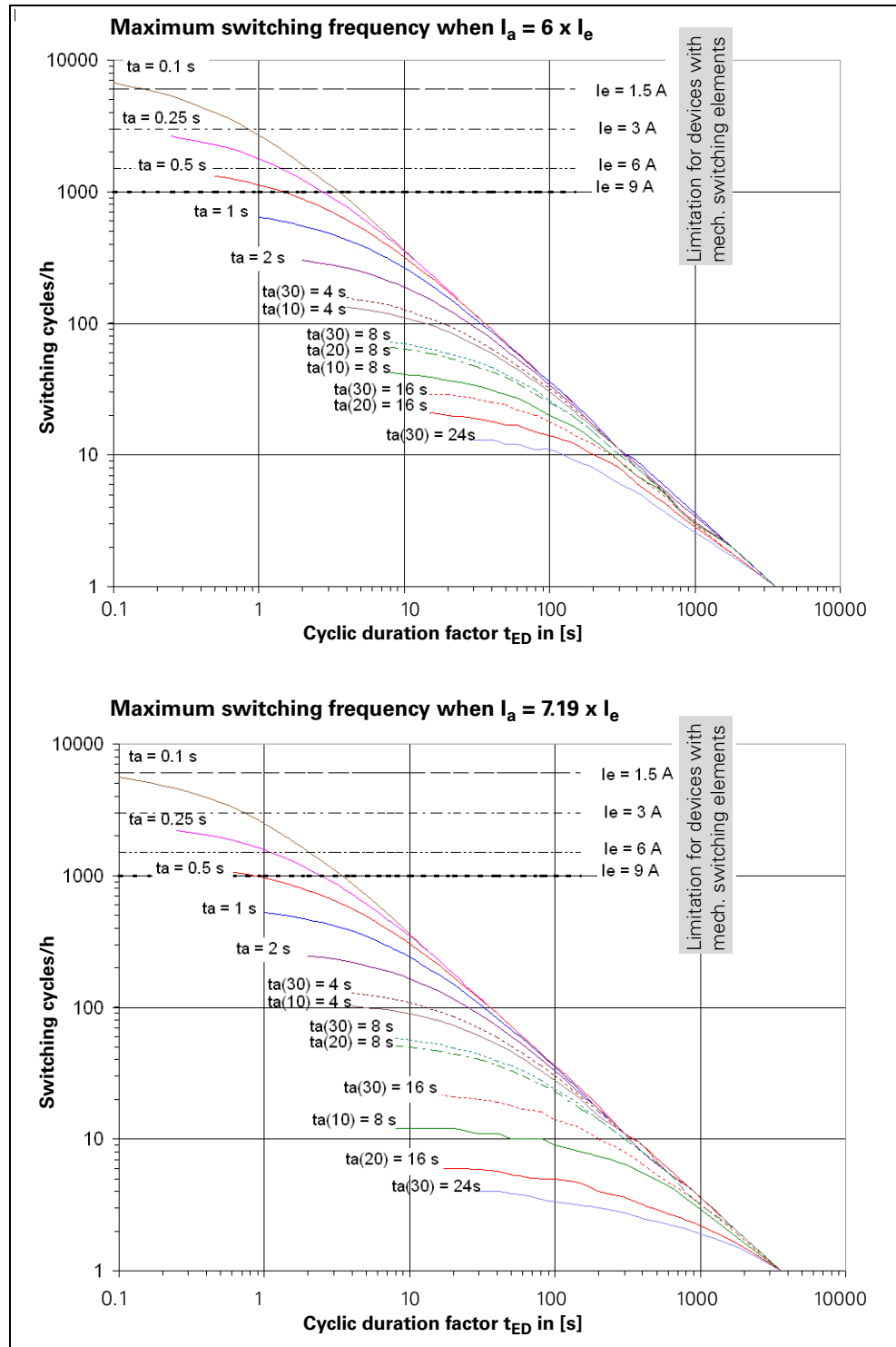
Fig. B-3: Maximum switching frequency when $I_a = 6 \times$ Ie and $I_a = 7.19 \times$ Ie

Maximum switching frequency when I_a = 1.5 x I_e (with example) (For duo-reversing soft starters only!)
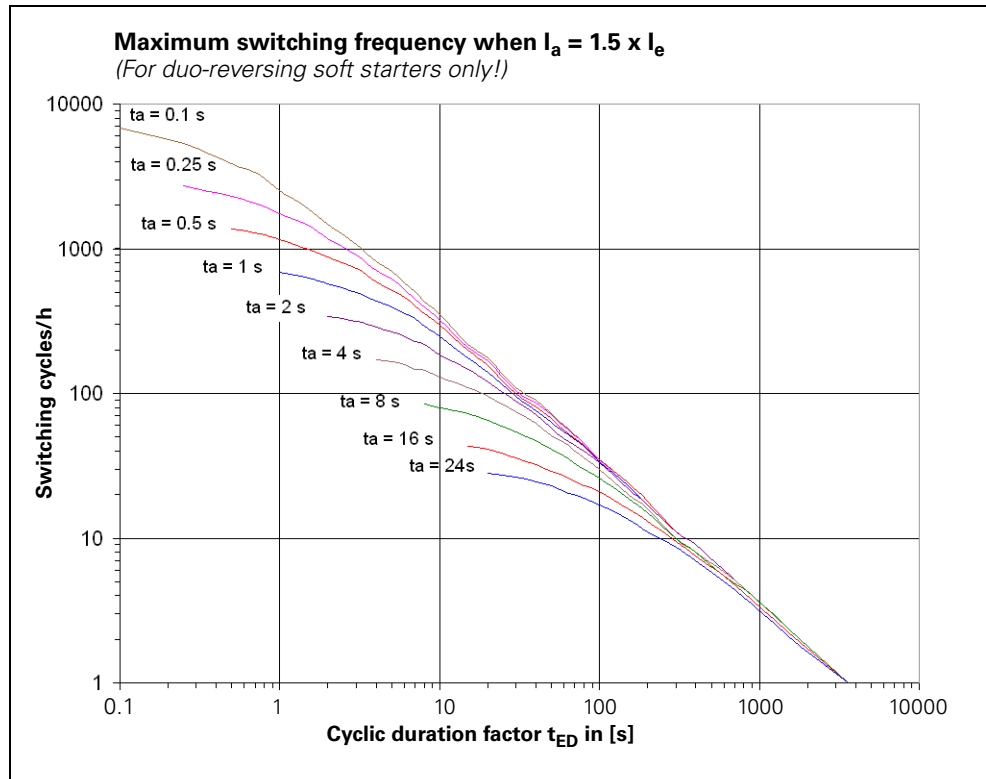
Fig. B-4: Maximum switching frequency when I_a = 1.5 x I_e for duo-reversing soft starters

B.1.2 Auxiliary Power

	Non-switched voltage (DC24V-NS)	Switched voltage (DC24V-S)
External auxiliary power PROFIBUS-DP	20.4 V DC to 28.8 V DC standard power supply to DIN 19240	
AS interface	23.0 V DC to 31.5 V DC (AS-i)	20.4 V DC to 28.8 V DC standard power supply to DIN 19240 (AUX PWR) (PELV - must be grounded)
Current consumption PROFIBUS-DP	Inputs not connected typically 80 mA	typ. 75 mA switching element (contactor) on typ. 15 mA switching element (contactor) off typ. 110 mA to Duo-Reversing Soft Starters
AS interface	Inputs not connected typically 60 mA	
Polarity reversal protection	Yes (device will not function, however)	
Short-circuit protection/ overload protection	Yes/ 0.5 A multifuse self-healing fuse Reset by power OFF	No
Undervoltage detection (USP)	< 17 V DC	< 17 V DC
Bridging of power failure	≥ 20 ms (device is not affected)	
Insulation voltage	500 V DC between the auxiliary voltages and PE	

B.1.3 Digital Inputs

Input voltage	20.4 V DC to 28.8 V DC
Current consumption	Typically 7 mA per input
Sensor supply	Max. 200 mA (from DC24V-NS). Sensor supply is short-circuit-proof.

B.1.4 Brake Output 400 V AC

Voltage range	200 V AC (-10%) to 460 V AC (+10%)	
Current carrying capacity	AC 15: 500 mA	
Short-circuit protection	Fusible link	am 1 A/500 V AC I_{Cu} = 1 kA

B.1.5　　　Main Power

Rated operating voltage	400 V AC	
CLASS	**10:** 8 s **20:** 16 s **30:** 24 s	Trip times at 7.2 x I_e
Rated insulation voltage	500 V AC	as per IEC 60947-1
Rated impulse withstand voltage	6 kV	as per IEC 60947-1
Safety separation	300 V AC	between auxiliary and main power
Frequency	50 Hz (-10%) to 60 Hz (+10%)	
ON duration	100%	
Utilization category	1	Device destroyed after short-circuit

Current Measurement

Measuring accuracy	± 7.5% of the parameterized rated normal current
Measuring range	10 x the parameterized rated normal current

Switch mechanically

Operating voltage	3 AC 200 V (-10%) to 460 V (+10%)	
Operating current	0.3 A to 9.0 A 0.3 A to 7.3 A 0.3 A to 6.7 A	Class 10 Class 20 Class 30
Switching capacity	AC 3: 9.0 A AC 4:6.5 A	
Switching load	3-phase	With SIMICONT contactor
Short circuit protection	Fusible link	am-16 A/500 VAC I_{Cu} = 120 kA
Lifetime of switching element	$0.4 * 10^6$ when le = 9.0 A $1.1 * 10^6$ when le = 4.5 A $2.5 * 10^6$ when le = 3.0 A $7.0 * 10^6$ when le = 1.5 A	Approx. no. of operating cycles per direction at 500 V AC
Waiting time	The time between the switch-off command and the next switch-on command	

Motor CCW

OFF

300 ms Motor CW

Switch Electronically - Reversing Soft Starter

Operating voltage	3 AC 200 V (-10%) to 460 V AC (+10%)	
Operating current	0.3 A to 3 A	Output class 3: Class 10, 20, 30
	2.4 A to 12 A	Output class 6: Class 10
	2.4 A to 7.3 A	Class 20
	2.4 A to 6.7 A	Class 30
Switching capacity	AC 53: 3 A	Output class 3:
	AC 4: 3 A	(0.3 A to 3 A)
Control function	AC 53: 12 A	Output class 6:
	AC 4: 12 A	(2.4 A to 12 A) (Max. 9 A when the soft starter control function is deactivated)
Control function	Direct starter, reversing starter	
Max. cool temperature	80 °C. This temperature is monitored. The device is switched off if the temperature is exceeded.	
Short circuit protection	Fusible link	am-16 A/500 V AC I_{Cu} = 120 kA
Switching load	2-phase	With thyristors
Lifetime of switching element for change of direction	8 x 10^6	Approx. no. of operating cycles for contactor at 500 V AC
Waiting time	The time between the switch-off command and the next switch-on command when the direction is changed:	

Motor CCW   OFF   Motor CW   **500 ms**

Switch Electronically - Duo-Reversing Soft Starter

Operating voltage	3 AC 380 V (-10%) to 460 V (+10%)	
Operating current	3.5 A	With 400 V AC system voltage
Apparent output power	2.8 kVA	
Output voltage	0 to U_{line}	
Output current	0.6 A to 4 A	Output class 2
	2.4 A to 8 A	Output class 12
Output frequency	2 to 100 Hz/0.1 Hz	
Pulse frequency	4, 8, **16** kHz	The device uses 16 kHz (low-noise) and, depending on the cooling temperature, switches step by step to lower switch frequencies.
Current limitation	Motoring: 1.6 x I_{emax} Regenerative: 1.6 x I_{emax}	
Brake resistance	Integral	Regenerative power is dissipated in the braking resistor
Max. cool temperature	80 °C. This temperature is monitored. The device is switched off if the temperature is exceeded.	
Short circuit protection	Fusible link	am-16 A/500 V AC I_{Cu} = 120 kA
Switching Load	3-phase	with IGBTs
Operating mode	DB (EN60149-1-1 and 1-3), S3 max., cycle duration 10 mins.	
Waiting time	The time between the switch-off command and the next switch-on command when the direction is changed:	

Motor CCW — OFF — **500 ms** — Motor CW

B.2   Data Tee Connectors

B.2.1   General technical Data

Installation location	On system	Mounted directly on motor (motor nearby)
Installation position		any
Degree of protection	IP65/67	Watertight acc. to IEC 529 (DIN 40050)
Cooling	Convection	no additional cooling required
Weight	105 g 100 g	Copper variant Optical-fiber cable variant
Operating temperature	–20 °C to +40 °C	Do not allow condensation to form! Max. 55 °C with reduction of $I_{DC24V-NS}$ and $I_{DC24V-S}$ each with 0.3 A per K
Storage/transport temperature	–40 °C to +80 °C	
Relative humidity	5 % to 95 %	Do not allow condensation to form!
Site altitude	2,000 m	Without restrictions
Vibration strain	f = 5 to 26 Hz; d = 0.75 mm f = 26 to 150 Hz; a = 2 g	10 cycles
Shock	a = 150 m/s^2 (15 g); 11 ms duration 3 shocks per +/- directions in all of the three perpendicular axes (=18)	
ESD	8 kV air discharge 6 kV contact discharge	IEC 1000-4-2 severity 3
Electromagnetic fields	10 V/m	IEC 1000-4-3 severity 3
BURST	2 kV/5 kHz supply voltage. 1 kV/5 kHz Data lines 2 kV/5 kHz Process lines	IEC 1000-4-4 severity 3
Emitted interference	Limit value class A	EN 55011

B.2.2 Electrical Data Auxiliary Power

	Non-switched voltage (DC24V-NS)	Switched voltage (DC24V-S)
Voltage range	20.4 V DC to 28.8 V DC standard power supply to DIN 19240	
Maximum current-carrying capacity from Han-Brid to Han-Brid	10 A	10 A
Polarity reversal protection	no	no
Short-circuit protection/ overload protection	no	no
Insulation voltage	500 V DC between the auxiliary voltages and PE	

B.2.3 Electrical Data Communication

	Copper variant	Optical-fiber cable variant
Baud rates supported	12,000 kBd 6.000 kBd 3.000 kBd 1,500 kBd 500 kBd 187.5 kBd 93.75 kBd 45.45 kBd 19.2 kBd 9.6 kBd	12,000 kBd (6,000 kBd) **not permitted** (3.000 kBd) **not permitted** 1,500 kBd 500 kBd 187.5 kBd 93.75 kBd 45.45 kBd 19.2 kBd 9.6 kBd
Cascade depth*)	—	9 at 12,000 kBd 32 at other baud rates
Maximum permissible fiber-optic cable length (POF) between 2 stations	—	50 m

*)
Maximum number of data tee connectors in the fiber-optic cable segment.
If the DP master for a fiber-optic cable system is located centrally with regard to topology, the maximum cascade depth is permissible at each fiber-optic cable segment connected to the DP master.

Dimension Drawings

C

C.1 Motor Starters

C.1.1 Reversing Starter PROFIBUS-DP with Plastic Bottom Part
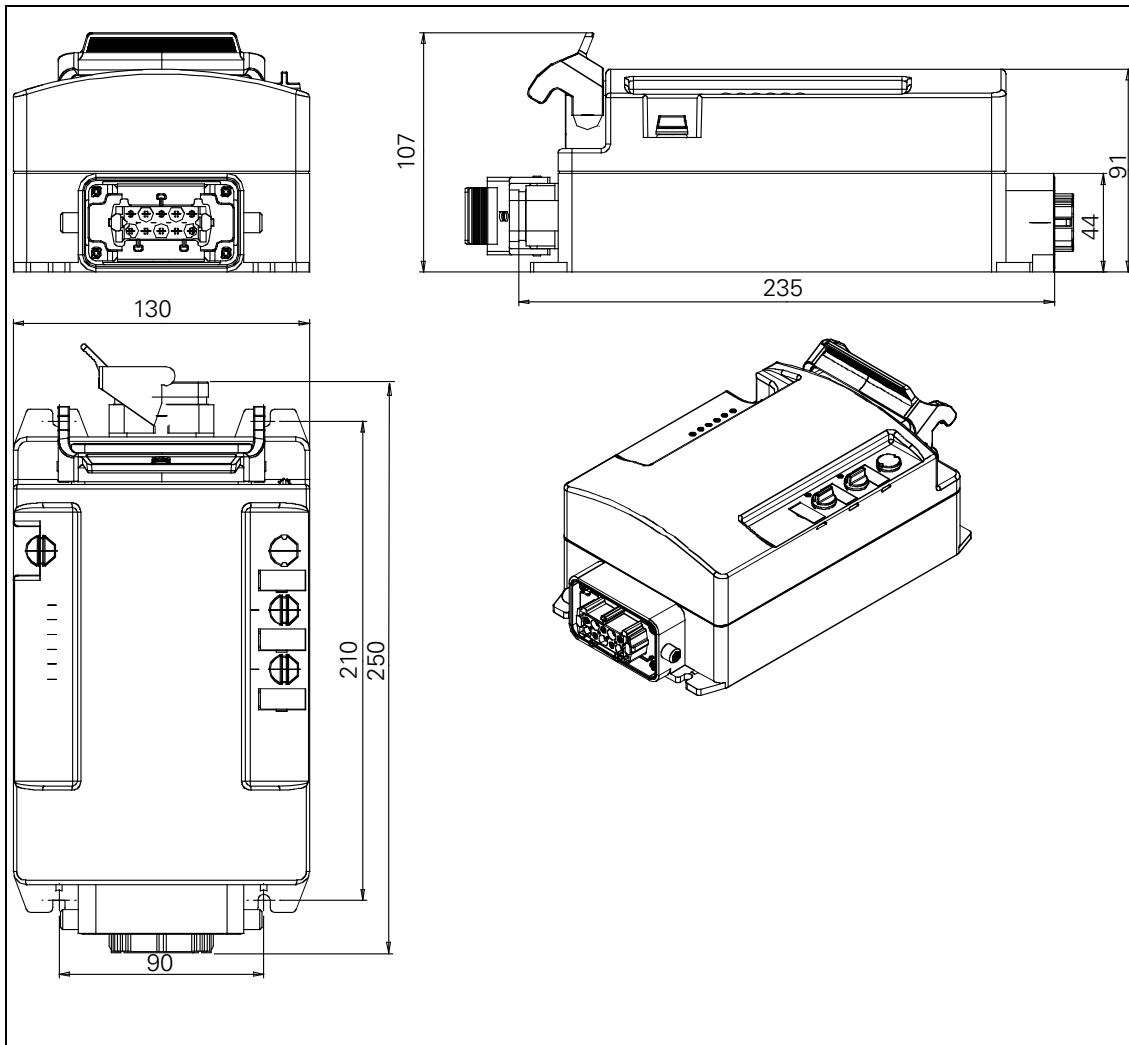
Fig. C-1: Dimension drawing of a reversing starter PROFIBUS-DP with plastic bottom part

C.1.2 Reversing Starter AS-Interface with Plastic Bottom Part
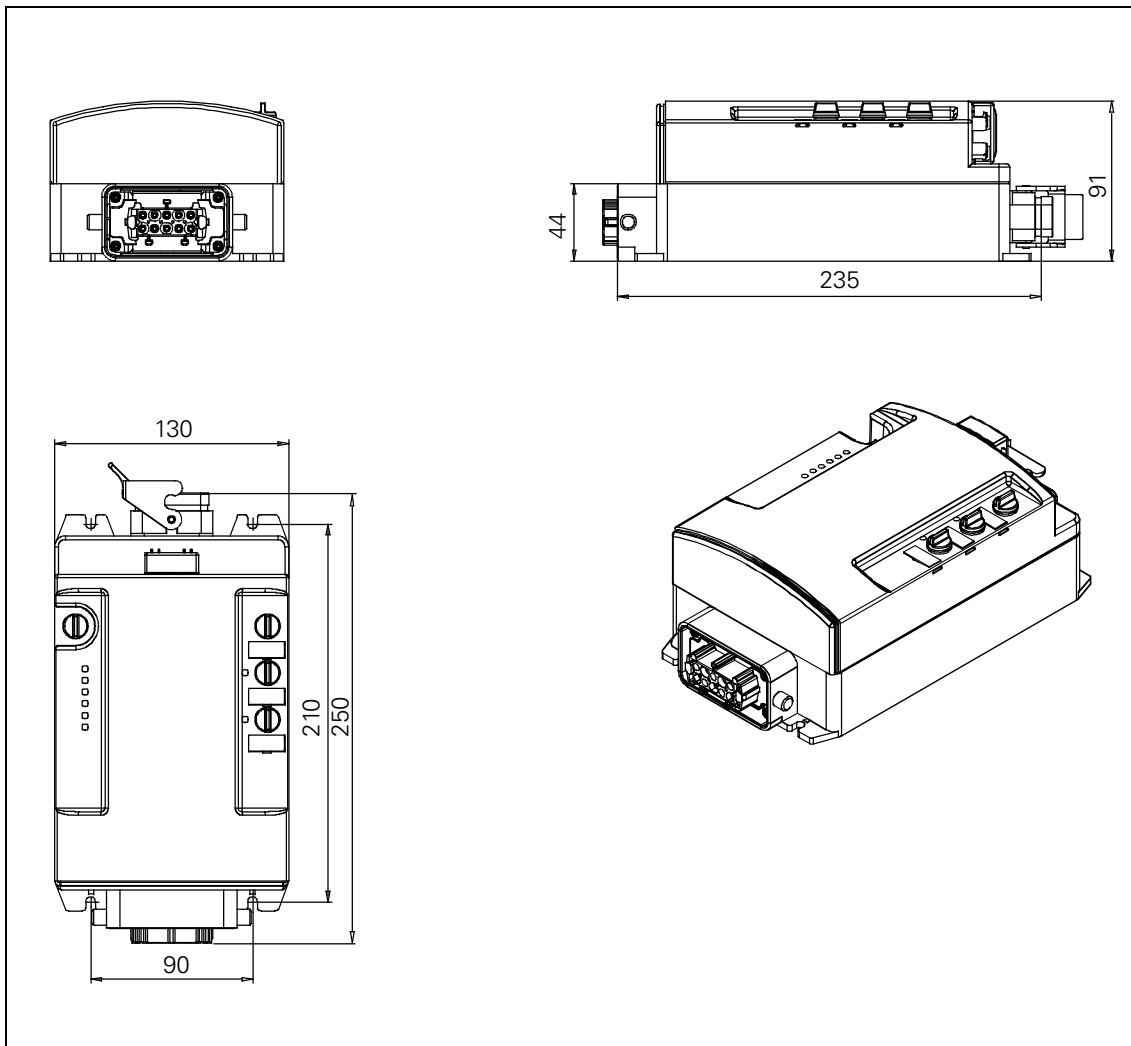
Fig. C-2: Dimension drawing of a reversing starter AS-Interface with plastic bottom part

C.1.3　Reversing Soft Starter with Metal Bottom Part

130

125 *

235

107

54

210

250

90

*) This measurement does not apply to motor starters with an AS interface.
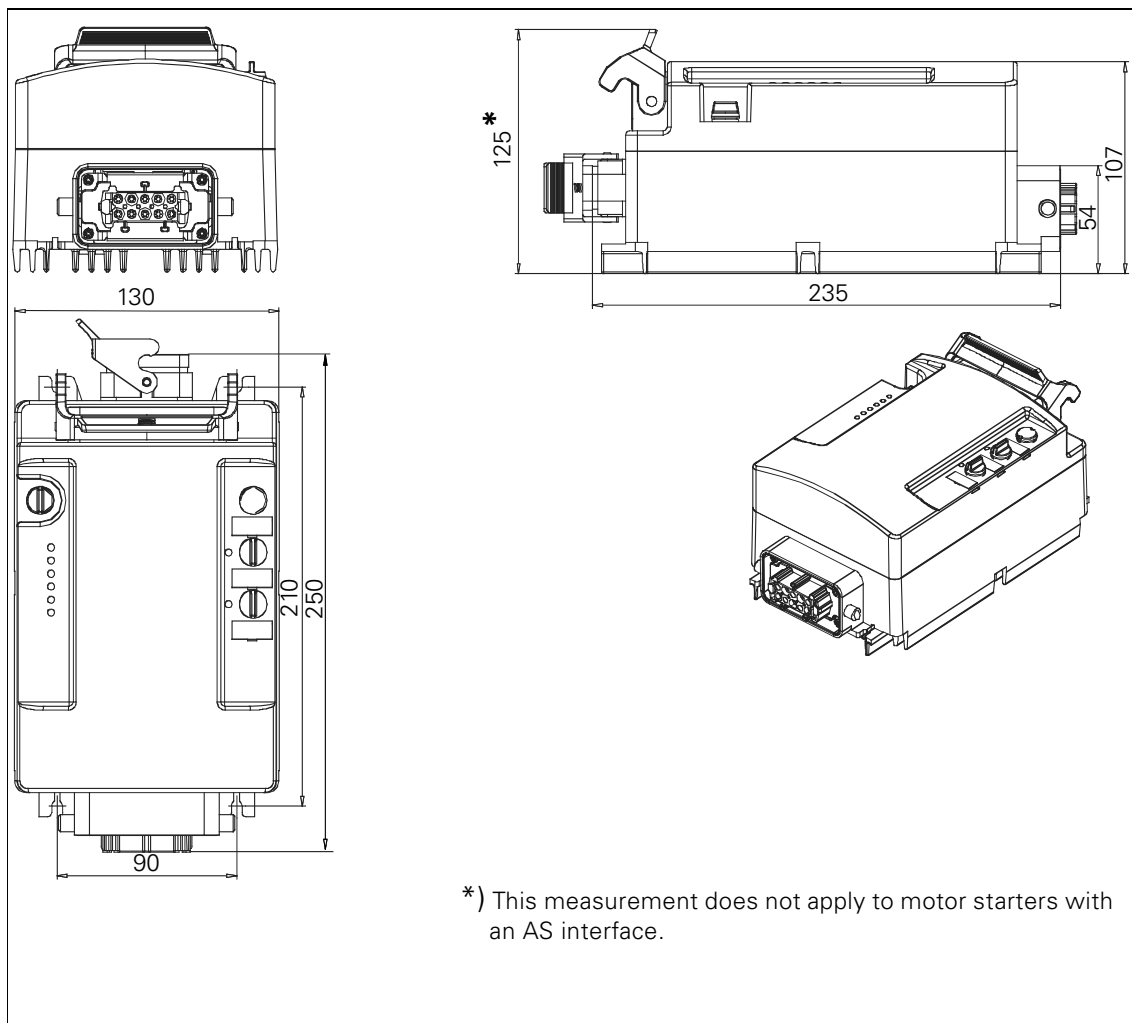
Fig. C-3: Dimension drawing of a reversing soft starter with metal bottom part

C.1.4 Duo Reversing Soft Starter with metal bottom part

*) This measurement does not apply to motor starters with an AS interface
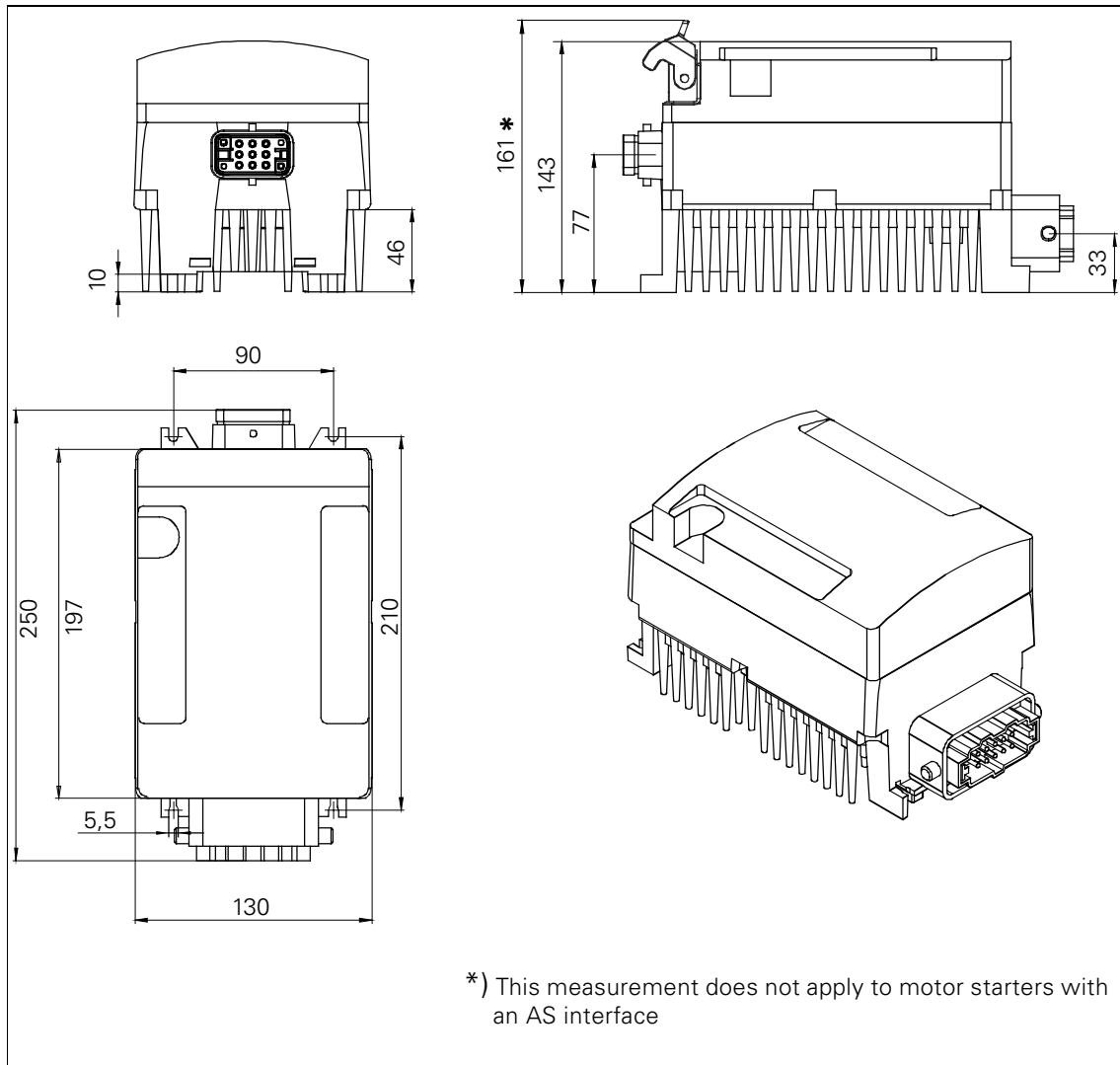
Fig. C-4: Dimension drawing of a duo reversing soft starter with metal bottom part

C.2 Data Tee Connector
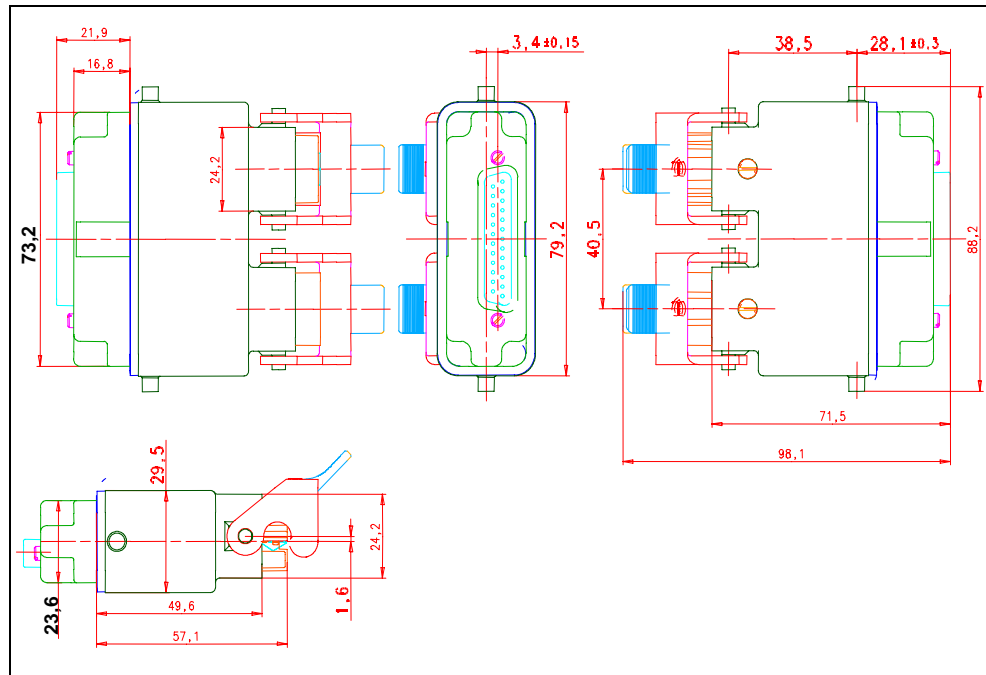
Fig. C-5: Dimension drawing of a data tee connector

Software Switch ES Motorstarter

D

D.1 Introduction

What is Switch ES?

Switch ES is the joint software platform for the different communication-capable switching devices.
The variant for Switch ES motor starters provides the following functions:

- User-friendly parameterization
- Operating and monitoring options
- Diagnosis
- Monitoring during operation
- Output of statistical data for preventative maintenance purposes (e.g. operating hours)

Communication

Switch ES communicates with ECOFAST High Feature motor starters via

- PROFIBUS-DP for motor starters with PROFIBUS-DP.
  Two options are available:
    - Stand-alone program on PC/PG with PROFIBUS-DP interface
    - Integration with the Object Manager (OM) in STEP7
- Local device interface with PC cable for serial interface RS232
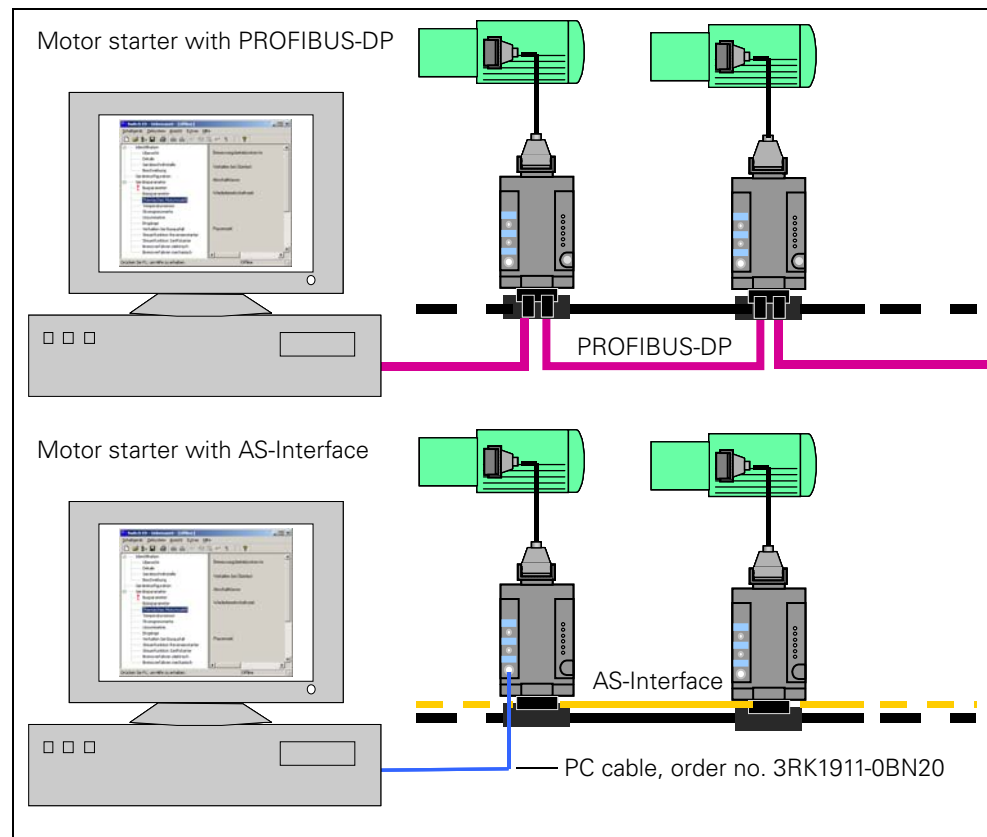
Fig. D-1: Switch ES communication with ECOFAST High Feature motor starters

Online with Switch ES

For online operation, the motor starter must be connected to the PC/PG. During online operation, two different access options are available:

- Access via the appropriate
  menu command (e.g. **Switching Device > Open Online).**
  Switch ES reads the data from the motor starter once. The parameters are processed in the main memory of the PC/PG. **With Target System > Load to Switching Device**, Switch ES writes the data back.

- Cyclic access (e.g. with
  Target System > Diagnosis).
  The diagnosis data is updated every second.

Offline with Switch ES

For offline operation, the motor starter does not have to be connected to the PC/PG. In this case, the menu commands relevant for online operation are grayed out (not active).
In offline mode, device parameters can be entered, processed, and stored in a file before commissioning.

Scope of Supply

Switch ES for motor starters is available on a CD-ROM (order no. 3ZS1 310-0CC20-0YA0).
The CD-ROM also contains:

- Internet Explorer for the HTML online help and printouts

- Acrobat Reader for displaying manuals and operating instructions in PDF format

- Motor starter manuals

- DMD file

- STEP7 Object Manager

D.2   Prerequisites

Before using Switch ES, the following prerequisites must be fulfilled:

Software Prerequisites

- Operating systems: Microsoft Windows 95/98, NT 4.x, 2000, or ME,
  XP Professional
- Internet Explorer V4.01 (or higher) for online help (available on the CD-ROM)
- Switch ES as a stand-alone program
    - for parameterization, monitoring, diagnosis, and testing
- STEP7 Object Manager for integrating the motor starter as an S7 slave
  in SIMATIC S7 for calling up Switch ES from STEP7.
  System prerequisites:
    - SIMATIC: S7, M7, C7, PCS7
    - STEP7: Version 5.1 SP3 or higher

Hardware Prerequisites

- For High Feature motor starters with PROFIBUS-DP
- PROFIBUS-DP interface for stand-alone operation on PC/PG
  CP5411 (ISA), CP5412 (ISA), CP5511 (PCMCIA), CP5611 (PCI)
- CP5613, CP5614, and MPI interface on PG7xx and its driver software (see
  interactive catalog CA01)
- For High Feature motor starters with AS-Interface
  (also for High Feature motor starters with PROFIBUS-DP)
- PC cable for serial communication via a local device interface
- CD-ROM drive

Notes/Required Knowledge

- Refer to the operating instructions/device manuals for the
  ECOFAST High Feature motor starters.
- You require a knowledge of Microsoft Windows®.
- Grayed out pushbuttons indicate that the function in question is not active or
  is not available.
- Knowledge of STEP7 (if you want to use STEP7 Object Manager).

Attention
This chapter describes the Switch ES functions.
For information on the device parameters, see Chapter 9 "Device Functions".
Basic Windows functions ("Print", "Save", and so on) are not described.

D.3   Installing and Starting the Program

Attention

Read the "readme.txt" file before installing Switch ES.

Installing the Software

The installation program starts automatically when you insert the CD. If you have deactivated this function on your computer, install Switch ES, OM Switch (integration in Step7), and/or the other components as follows:

Step	Description
1	Place the Switch ES CD in the CD-ROM drive.
2	Open the root directory in this drive.
3	Start the setup program by double-clicking the "setup.exe" file. The setup program guides you through the procedure for installing Switch ES, OM Switch, and the other components.

Table D-1: Installing the software

If the Switch ES Object Manager is to be installed, Switch ES must already be installed on your computer. When you install the Object Manager, the motor starter settings are included in the STEP7 hardware configuration on your computer. Once you have installed the Object Manager, the new meta files are generated when you start the SIMATIC Manager. The motor starters are now available in the
hardware catalog under "PROFIBUS-DP - Switching Devices - Motor Starters".

Attention

To install Switch ES and the Object Manager, administrator rights are required on computers with the Windows NT4.0, 2000, and XP Professional operating systems.

Starting and Configuring the Switch ES Program on the PC

Once the setup program is finished and you have restarted your computer (if necessary), start Switch ES as follows:

- Double-click the "Switch ES" icon on your desktop
- Choose **Start > SIRIUS NET > Switch ES**

Starting the Program and Configuration with STEP7 HWConfig (Integration via the Object Manager)

Proceed as follows:

Step	Description
1	Start the SIMATIC Manager and, from there, HWConfig.
2	Drag the required motor starter to the PROFIBUS-DP line.
3	Right-click the address line. The properties window is then displayed.
4	Click the "Parameters" tab page. The data is transferred from STEP7 to Switch ES.
5	Configure the motor starter in the device configuration.
6	Parameterize the motor starter.
7	If you want to configure and parameterize more motor starters, repeat steps 2 to 6.
8	End Switch ES by choosing **Switching Device > End and Return to Step7.** The set parameters are now stored in the STEP7 database and are transferred to the switches during start-up.

Table D-2: Configuration with STEP7 HWConfig

Attention

If you want to change parameters, you have to call up Switch ES again from HWConfig to ensure that the data stored is consistent.

D.4 Operator Interface

The following diagram shows the operator interface:
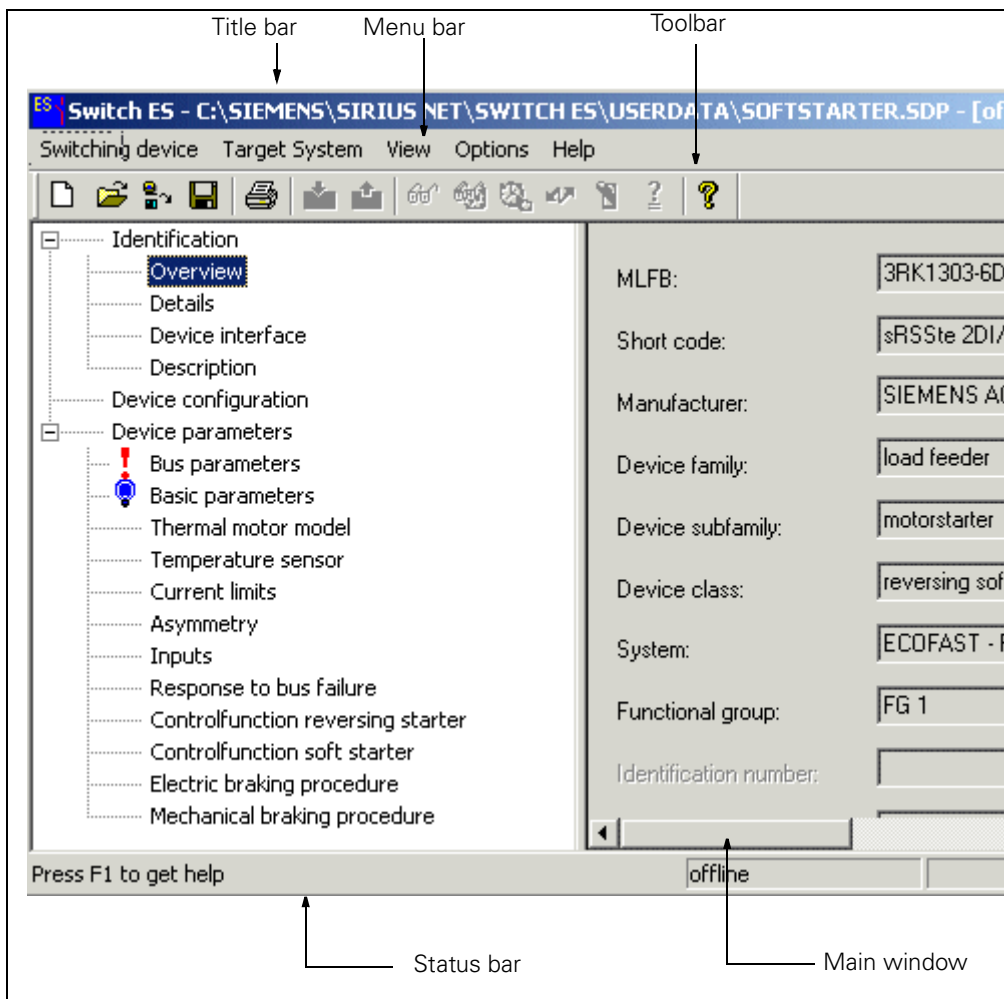
Fig. D-2: Operator interface for Switch ES motor starters

Title Bar

The title bar contains:
- The path of the SDP file (**S**witching **D**evice **P**arameters).
- The device status (online or offline). When the device is online, the title bar is light blue.
- The PROFIBUS-DP address when the device is online.

Menu Bar

The menu bar provides the following menus:
- Switching Device
- Target System
- View
- Options
- Help

Toolbar

The toolbar contains icons that you can click to access various menu options. If you leave your cursor over an icon for approx. 1 second, its function is displayed in plain text.

Main Window

The right-hand side of the main window contains all the optional parameters that you can set. The left-hand side of the main window, however, contains the parameters that you must set (e.g. highlighted with a red indicator **!**) under **Switching Device > New** or **Switching Device > Factory Setting**). As soon as you change or confirm these values, a blue indicator 💡 appears in the left-hand window.

Status Bar

The status bar contains:
- The note "Press F1 for help"
- The device status (online or offline)
  When Switch ES is in online mode, the word "Online" moves along the status bar.

D.5 Menu Bar

D.5.1 Switching Device

New...

Display the existing switching devices and choose one for processing.

Open...

Open files. All Switch ES files have the extension *.sdp
(switching device parameters).

Parameters from file... (Import)

Read and process parameters from a Switch ES file.

Attention

If you choose this menu command, the parameters in the main memory are overwritten with no further confirmation!

Online open...

Read data records from a switching device to the main memory (your PC and the switching device must be connected).

Save

Save the parameters in the standard format (*.sdp) on a storage medium.

Save as...

The menu command saves the current data under a new name.

Save copy... (Export)

Copy data from the main memory to a Switch ES file.

Close Device

If the parameters have been changed, they can be:
- Saved to a file if they were opened with
  Switching Device > New or **Switching Device > Open**.
- Saved to the switching device if they were opened with
  Switching Device > Open Online.

In both cases, a safety prompt asks you whether you want to save or load the switching device.

D.5.2 Target System

Load to Switching Device

Load the current parameters to the switching device.

Load to PC

Load the current parameters from the switching device to the PC.

Export to Switching Device

Load the current parameters via PROFIBUS-DP to a switching device, except for the PROFIBUS-DP address.
This menu command is used to duplicate device parameters in other switching devices.

Importing from Switching Device

Load the current parameters via PROFIBUS-DP from a switching device to the PC, except for the PROFIBUS-DP address.

Line View

The line view shows a diagram of the slaves connected to the PROFIBUS-DP line. This enables you to easily identify which devices can be opened and processed using Switch ES.

Diagnostics

Various diagnostics displays

- General view
  This dialog displays a picture of the ECOFAST Motor starter with the relevant LEDs, which indicate the status of the motor starter. The LED display is constantly updated.
- Switching/controlling
  e.g. control function reversing starter, emergency start
- Protection functions
  e.g. overload, thermal motor model
- Substation monitoring
  e.g. current limiting values, asymmety, inputs
- Communications
  e.g. bus fault, process image fault

Measured Values

e.g. current phase currents, motor heating

Statistical Data

Various statistical data
- Device service life
  e.g. operating hours, number of starts motor CW/CCW
- Maximum pointers
  e.g. number of overload trips, maximum tripping current

Commands

e.g. Trip-Reset, parameters disabled CPU/master ON/OFF

Control

Here you can see
- Process input images
- Current motor current of the most heavily loaded phase as a percentage [%] of the rated operational current (Ie) and in amperes [A].
- Process output images.

Target/Actual Comparison

The target/actual comparison enables you to compare the content of the current parameters in the computer with those in the device. For example, you can check whether:
- All the downloaded parameters have been copied.
- The parameters still correspond to the data documented during commissioning.
- The parameters correspond to the parameters of other motor starters.

D.5.3 View

Status Bar

You can display/hide the status bar at the bottom of the application screen.

Tool Bar

You can display/hide the tool bar at the top of the application screen.

D.5.4 Options

Settings

The menu command enables you to change various individual settings of this application:
- Language
- Storage location
- Startup picture

Set PC/PG Interface

Here you can set the PC/PG interface. This option is only relevant when you use the motor starter with PROFIBUS-DP.

Set RS 232 Interface

Here you can set the port of the RS 232 interface. This option is only relevant when you use the motor starter with AS-Interface.

D.5.5 Help

Help Topics

Help Topics for parameterizing switching devices.

Info

Here you find information about
- Switch ES Version
- Copyright
- Software Support

D.6 Creating a Switch ES File

Example

The following example shows you how to create a Switch ES file:
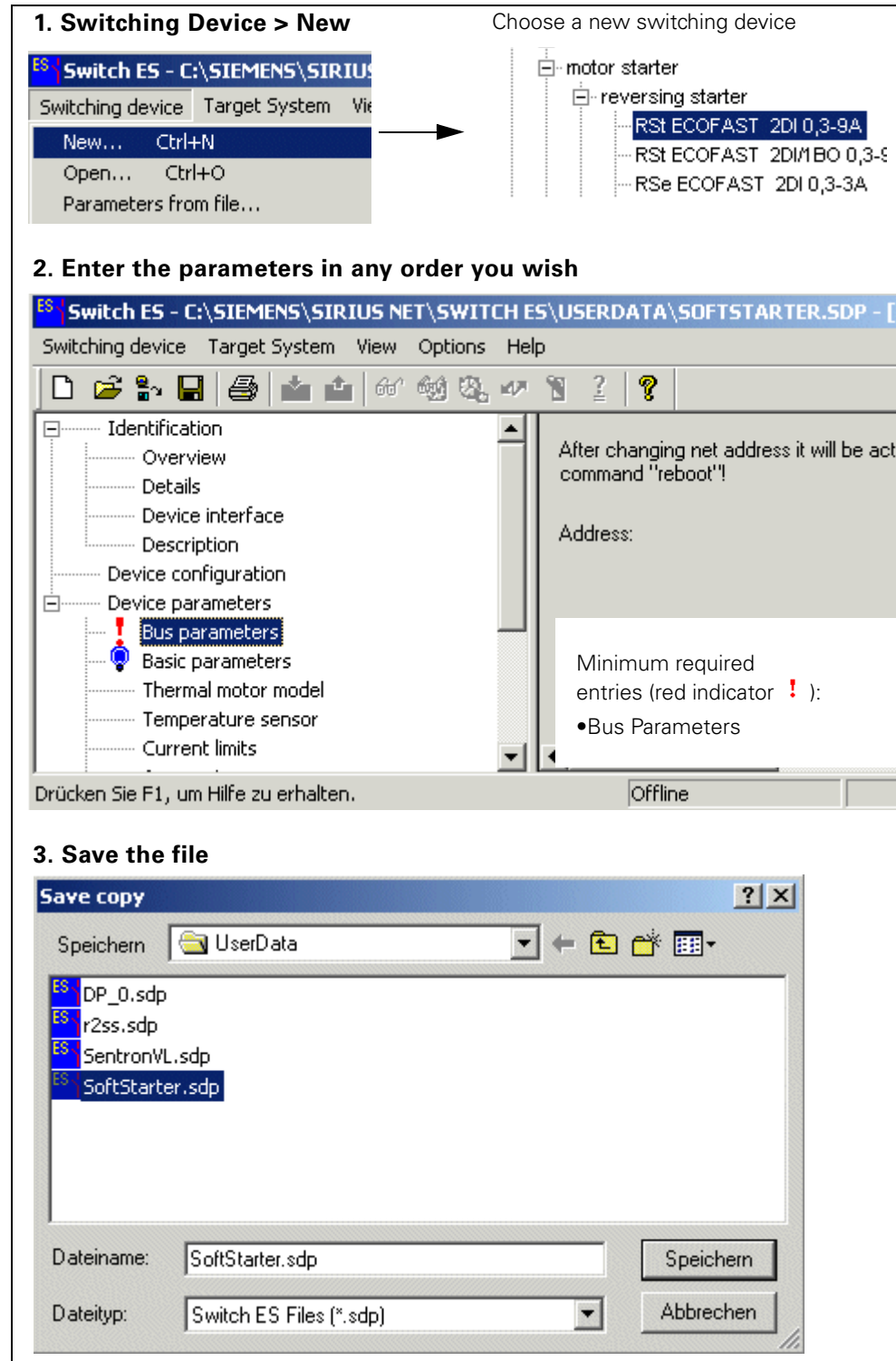
Fig. D-3: Example: Creating a Switch ES file

Order numbers

E

E.1 Motor Starters (Reversing starters)

Setting Range*	Motor Protection/ Switching Technology	Brake	Field Bus	Order No.
ECOFAST Motor Starters				
0.3 A - 9 A (4 kW)	Temperature Sensor/ Mechanical		AS-Interface	3RK1 3**2**3-2AS51- 1AA**0**
		400 V AC	AS-Interface	3RK1 3**2**3-2AS51- 1AA**3**
ECOFAST Motor Starters High Feature				
0.3 A - 9 A (4 kW)	Temperature Sensor/ Mechanical		PROFIBUS-DP	3RK1 3**0**3-2AS51- 1AA**0**
		400 V AC	PROFIBUS-DP	3RK1 3**0**3-2AS51- 1AA**3**
0.3 A - 3 A (1.1 kW)	Thermal Motor Model/ Mechanical		PROFIBUS-DP	3RK1 303-5**B**S41- 1AA**0**
2.4 A - 9 A (4 kW)			PROFIBUS-DP	3RK1 303-5**C**S41- 1AA**0**
0.3 A - 3 A (1.1 kW)		400 V AC	PROFIBUS-DP	3RK1 303-5**B**S41- 1AA**3**
2.4 A - 9 A (4 kW)		400 V AC	PROFIBUS-DP	3RK1 303-5**C**S41- 1AA**3**
0.3 A - 3 A (1.1 kW)	Thermal Motor Model/ Mechanical		AS-Interface	3RK1 323-5**B**S41- 1AA**0**
2.4 A - 9 A (4 kW)			AS-Interface	3RK1 323-5**C**S41- 1AA**0**
0.3 A - 3 A (1.1 kW)		400 V AC	AS-Interface	3RK1 323-5**B**S41- 1AA**3**
2.4 A - 9 A (4 kW)		400 V AC	AS-Interface	3RK1 323-5**C**S41- 1AA**3**
0.3 A - 3 A (1.1 kW)	Full Motor Protection/ Electronic Soft		PROFIBUS-DP	3RK1 303-6**B**S71- 1AA**0**
2.4 A - 12 A (5.5 kW)			PROFIBUS-DP	3RK1 303-6**D**S71- 1AA**0**
0.3 A - 3 A (1.1 kW)		400 V AC	PROFIBUS-DP	3RK1 303-6**B**S71- 1AA**3**
2.4 A - 12 A (5.5 kW)		400 V AC	PROFIBUS-DP	3RK1 303-6**D**S71- 1AA**3**
0,3 A - 3 A (1,1 kW)	Full Motor Protection/ Electronic Soft		AS-Interface	3RK1 323-6**B**S71- 1AA**0**
2,4 A - 12 A (5,5 kW)			AS-Interface	3RK1 323-6**D**S71- 1AA**0**
0.3 A - 3 A (1.1 kW)		400 V AC	AS-Interface	3RK1 323-6**B**S71- 1AA**3**
2.4 A - 12 A (5.5 kW)		400 V AC	AS-Interface	3RK1 323-6**D**S71- 1AA**3**
0,6 A - 4 A (1.5 kW)	Full Motor Protection/ Electronic Soft (Duo Reversing Soft Starters)	400 V AC	AS-Interface	3RK1 323-6**E**S81- 3AA**3**
0,6 A - 4 A (1.5 kW)		400 V AC	PROFIBUS-DP	3RK1 303-6**E**S81- 3AA**3**

Table E-1: Order numbers for Motor Starters

*) Power descriptions are valid for 400 V AC

E.2 Data Tee Connectors

Description	Order No.
Data + 24 V	
Data Tee Connector Cu	3RK1 911-2AG00
Data Tee Connector FO	3RK1 911-2AH00

Table E-2: Order numbers for Connectors

E.3 Accessories for Motor Starters

Description	Order No.
Mounting plate (for motor plugged in)	3RK1 911-3AA00
Identification Plug	6ES7 194-1KB00-0XA0
PC cable with memory submodule	3RK1 911-0BN20
Test connector set	3RK1 911-2AM00

Table E-3: Order numbers for accessories

E.4 Project engineering software and Documentation

Description	Order No.
Project engineering software	

Switch ES
 	
• Switch ES Motor Starter V 2.0
  – for parameterizing, visualizing, diagnosing and testing the ECOFAST motor starters via PROFIBUS-DP
  – with online help
  – German/English selectable
  – tested for execution under Windows 95/98/2000/NT System
  – System requirements:
  - PROFIBUS-DP interface: CP5411 (ISA), CP5412 (ISA), CP5511 (PCMCIA), CP5611 (PCI), Smart Cable for serial communication via a serial interface and Teleservice, CP5613 and CP5614 (new CP card) and MPI interface on PG7xx and its driver software (view interactive catalog CA01)
  - CD-ROM drive
 	
• STEP7 object manager
  – for integrating the ECOFAST starter as an S7 slave in SIMATIC S7
  – for calling Switch ES from STEP7
  – System requirements:SIMATIC: S7, M7, C7, PCS7
  - STEP7: Version 5.0 or higher
  - CD-ROM drive
	3ZS1 310-0CC20-0YA0

Upgrade Switch ES Motor Starter from Version 1.0 to 2.0	3ZS1 310-0CC20-0YA0
Documentation	
Manual for ECOFAST Motor Starters (German/English)	3RK1 702-2GB18-0AA0
Manual for ECOFAST Motor Starters High Feature (German)	3RK1 702-3AB18-1AA0
Manual for ECOFAST Motor Starters High Feature (English)	3RK1 702-3BB18-1AA0
Manual ECOFAST System (German)	3RK1 703-0AB18-0AA0
Manual ECOFAST System (English)	3RK1 703-0BB18-0AA0

Table E-4: Project engineering software and Documentation

Glossary

Asymmetry limit

A percentage value by which the motor current is allowed to vary in the individual phases. If an internally supplied brake is connected, you may need to adjust the asymmetry limit because the braking voltage is drawn from a phase asymmetrically.

Autoreset

The motor starter is reset automatically after the cause of the trip has been removed.

Baud rate

The baud rate is the rate of data transmission and indicates the number of bits transmitted per second (baud rate = bit rate).
Baud rates of 9.6 kilobaud to 12 megabaud are possible with PROFIBUS-DP.

Blocking current

If the blocking current is exceeded, the motor starter detects a block. From this point, blocking time monitoring, the duration of which is defined by the blocking time, is started independently of the class time.

Attention
If a block still exists after the blocking time has elapsed, the motor starter switches off.

Setting range: 150% to 1000% of the rated operational current.

Blocking Time

The time during which a block can exist without the motor starter switching off. If a block still exists after the blocking time has elapsed, the motor starter switches off.
Setting range: 1 s to 5 s.

Bus

Common transmission path via which all stations are connected. It has two defined ends.
With PROFIBUS, the bus is a two-wire line (copper wire) or an optical-fiber cable.

Bus connector

The bus connector is the physical connection between the station and the bus cable.

Bus segment

See "Segment"

Bus system

The bus system comprises all the stations that are physically connected via a bus cable.

Contact

A switch for switching a phase of a three-phase motor (if the "Soft Starter" control function is used, the phases of the three-phase motor must be switched or controlled separately).

Control Function: Reversing Starter

Motor starters use this control function to control the direction of rotation of motors. An internal logic component prevents both contactors from closing at the same time.
The time-delayed changeover from one direction of rotation to the other is implemented by the lockout time. This makes it possible to do without all contactor interlocking and pushbutton interlocking as well as the time-delay relay.

Control Function: Soft Starter

Soft starters are based on the phase angle control principle.
You can specify soft starting and soft braking using a settable voltage ramp.

Control Function: Speed Control

Speed controllers (duo-reversing soft starters) are used in drive engineering to control the speed of motors.
With standard motors, they enable reversible motors and Dahlander motors with at least two speeds to be operated.

Data tee connector

Data tee connectors connect the components of an automation system with
- PROFIBUS-DP
  Two data tee connectors are available in the ECOFAST system:
    – With a copper cable (PROFIBUS-DP Cu)
    – With an optical-fiber cable (PROFIBUS-DP optical-fiber cable)
- Supply voltage: 24 V DC non-switched (DC24V-NS)
- Supply voltage: 24 V DC switched (DC24V-S)

DESINA

Decentralized and **s**tandardized **in**stallation system for m**a**chine tools:
Developed by the Association of Machine Tool Manufacturers with the aim
of defining a standard for the design and installation of machine tool
components.

Direction

The motor directions are defined as follows:
- Motor CLOCKWISE: The direction is determined by the line phase sequence.
- Motor COUNTER-CLOCKWISE:The direction is inverted with respect to the line phase sequence.

Direct starter

The motor starter uses this function to switch a motor on or off.

DP Master

The DP Master is a master that functions in accordance with EN 50 170,
volume 2, PROFIBUS, and uses the DP protocol.

DP Slave

The DP Slave is a slave that is operated on the PROFIBUS bus with the
PROFIBUS-DP protocol and functions in accordance with EN 50 170
standard, volume 2, PROFIBUS.

ECOFAST

Energy and **Co**mmunication **F**ield Inst**a**llation Sy**st**em:
A system that decentralizes and modularizes installation to a large extent
and permits extensive diagnostics on the component level.

EEx e motors

EEx e motors are adapted to the DIN requirements regarding explosion
protection. This means that the motor must be encased in a flameproof
enclosure. In terms of mechanical design and dimensions, EEx e motors are
identical to normal, totally enclosed, fan-cooled, three-phase, squirrel cage
motors, but their rated output is usually lower.

Full motor protection

Electronic motor protection (current measurement) **and** thermoclick/thermistor protection, required for motors with critical rotors or for operation with a soft starter or a frequency converter, for example.

Power bus

Linear, primary power distribution bus.

Power tee connectors

Power tee connectors connect motor starters to the power bus. The power bus is not interrupted when the motor starter is unplugged.

DMD

Device master data (DMD) contains DP slave descriptions in a standardized format. The use of DMD makes configuring the master and the DP slave easier.

Host

A host is a system or unit that contains at least one DP Master. For example, the programmable controller with the CPU is the host, and the IM 308-C is the DP Master.

Idle time

The idle time is the time specified for cooling when the motor is switched off by control functions at operating temperature (not due to overloading). After this time, the thermal memory is reset and a cold start is possible. This allows frequent starting.

IM 308-C

The IM 308-C is a DP Master for the ET 200 distributed I/O system. The IM 308-C can be used together with COM PROFIBUS and plugged into the S5-115U, S5-135U and S5-155U programmable controllers.

IrDA

Inf**r**ared **D**ata **A**ssociation: standard for an infrared interface driver.

Load feeder

A load feeder is a branch from the main circuit to the load with "Switching" and "Protection" functions.
The "Protection" function comprises:
• Protection of the line from the load feeder to the load (line protection),

• Protection of the load against overloading (load protection).

Lock-Out Time

> The lock-out time prevents the direction of rotation from being changed. The flywheel of a drive must come to a standstill within the lock-out time before the next switching command is executed.

Master

> When they are in possession of the token, masters can send data to other stations and request data from these stations (= active station).

Master interface

> Module for a distributed configuration. The distributed inputs and outputs are "connected" to the programmable controller via the master interface C.

Master-slave method

> A bus access method whereby only one station at a time is the master and all other stations are slaves.

Master system

> All slaves that are assigned to a master with a reading and writing function form a master system together with the master.

Motor starter (MS)

> A motor starter is a load feeder whose rated values are designed for inductive loading. The motor starters comply with the "motor starters from Siemens/GS" profile.

PROFIBUS

> PROcess FIeld BUS, European process and field bus standard which is defined in the PROFIBUS standard (EN 50 170, Volume 2, PROFIBUS). It specifies functional, electrical and mechanical properties for a one-bit, serial field bus system.
> PROFIBUS is a bus system which networks PROFIBUS-compatible automation systems and field devices at the cell and field levels.
> PROFIBUS is available with the following protocols: DP (= Distributed Input/Output), FMS (= Field Bus Message Specification), PA (Process Automation) and TF (= Technological Functions).

PROFIBUS address

> Each station must be assigned a PROFIBUS address for the purpose of unique identification.
> The PC/PU or the ET 200 hand-held unit have the PROFIBUS address "0". The master and slaves have a PROFIBUS address within the range from 1 to 125.

Process image

An "image" of the states of all inputs (= PII) or all outputs (= PIO) at a particular instant in time. You can access the process image in the controller program.

PROFIBUS-DP

PROFIBUS bus system with the DP protocol. DP stands for distributed I/O system. The primary task of PROFIBUS-DP is fast cyclical exchange of data between the central DP Master and the peripheral devices.

General fault

If both messages for "Event Occurred" and "Internal Tripping" are set in the device diagnostic buffer (e.g. "Asymmetry" and "Asymmetry_Tripping"), the "General Fault" bit is set in the I/O area and a (bus-specific) diagnosis is generated if necessary.
The "General Warning" bit in the I/O area is not set.

General warning

A general warning is generated for all device diagnostic buffer entries that could result in internal tripping if the corresponding message (e.g. "Asymmetry") is set and the associated "Internal Tripping" message (e.g. "Asymmetry_Tripping") is not set. This warning is entered in the I/O area.
The "General Fault" bit in the I/O area is not set.

Segment

The bus line between two terminating resistors forms a segment.
A segment contains 0 to 32 stations. Segments can be coupled via RS 485 repeaters.

Slave

A slave can only exchange data with a master after being requested to do so by the master. Slaves include, for example, all DP Slaves, such as motor starters, frequency converters, etc.

Slave diagnosis

The slave diagnosis conforms to EN 50170, volume 2, PROFIBUS. Depending on the DP Master, it can be read with STEP5 or STEP7 for all DP Slaves that conform to the standard.

Station

A station is a device that can send, receive, or amplify data via the bus (e.g. a master, a slave, an RS 485 repeater, or an active star coupler).

Station number

See PROFIBUS address

Switching element

> A switching element is any "contact" required to switch a three-phase motor on or off (e.g. a contactor).

Terminating resistor

> Each bus line connecting the individual motor starters to each other must be terminated with a resistor at the start and end. This prevents line reflections.

Thermoclick

> Bimetal thermostatic switch

Thermal motor model

> The winding temperature of the motor is calculated according to a specific formula on the basis of the measured motor currents and the "Rated Operational Current" and "Tripping Class" input parameters.

Thermistor motor protection

> If the resistance limits are violated, the motor starter responds with either a trip or a warning.

Tripping characteristic

> The tripping characteristics show the tripping time as a function of tripping current. The tripping current is shown as a multiple of the set current Is. With motor starters, tripping characteristics are specified for symmetrical and asymmetrical loading of the motor from the cold and warm states.

Tripping classes

> The tripping class (CLASS) specifies the maximum tripping time within which a protection device must trip from the cold state with 7.2 times the set current. If CLASS 10 is set for motor starters, for example, this ensures that the (cold) motor is shut down after 10 seconds given 7.2 times the set current.

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ECOFAST Motor Starters High Feature manual

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