SIEMENS

SIRIUS

Soft Starters
3RW44

System Manual

Order No.: 3ZX1012-0RW44-1AB1

Issue 03/2007
GWA 4NEB 535 2195-02 DS 04

Safety instructions

This document contains instructions you are strongly advised to observe in order to guarantee your personal safety and to avoid damage to property. The instructions on your personal safety are marked by a warning triangle, notes on risk of property damage have no warning triangle. Depending on the degree of risk, the instructions are presented as follows.

Danger

means that death or serious physical injuries **will** follow if you do not take the appropriate precautionary measures.

Warning

means that death or serious physical injuries **may** follow if you do not take the appropriate precautionary measures.

Caution

with a warning triangle means that minor physical injuries may follow if you do not take the appropriate precautionary measures.

Caution

without a warning triangle means that damage to property may follow if you do not take the appropriate precautionary measures.

Notice

means that an undesired result or condition may occur if the corresponding instruction is not observed.

Where several degrees of risk are present at the same time, the instruction for the highest degree of risk is used. If an instruction with a warning triangle contains a warning against personal injury, the same instruction may also contain an additional warning against damage to property.

Qualified personnel

The associated device/system must only be configured and used in conjunction with this documentation. Devices/systems must be commissioned and operated by **qualified personnel** only. Qualified personnel according to the safety instructions of this documentation are persons authorized to commission, ground, and mark devices, systems and current circuits according to the relevant safety standards.

Notes on proper use

Please observe the following:

Warning

The device may only be used for applications specified in the catalog and the technical descriptions. Furthermore it may only be used in combination with third-party devices and components recommended or approved by Siemens. Faultless and safe operation is only ensured if the product is transported, stored, mounted and installed properly and if operation and maintenance is carried out conscientiously.

Trademarks

All names carrying the industrial property mark ® are registered trademarks of Siemens AG. The other designations in this publication may be trademarks whose use by third parties for their own purposes may infringe the rights of the owners.

Important notes

Objective of this manual

This manual contains basics and tips on the application of SIRIUS 3RW44 soft starters. The SIRIUS 3RW44 soft starter is an electronic motor control device for optimized starting and stopping of 3-phase asynchronous motors.
The manual describes all the SIRIUS 3RW44 soft starter functions.

Target group

The manual is aimed at all users who deal with
- commissioning
- service and maintenance
- planning and configuration of plants

Required basic knowledge

General knowledge in the field of general electrical engineering is required for understanding this manual.

Validity

This manual is valid for SIRIUS 3RW44 soft starters. It contains a description of the components that are valid at the time of publication of this manual. We reserve the right to include an updated product information leaflet with new components and new component versions.

Definitions

If the short form 3RW44 is used in the text, it refers to the SIRIUS 3RW44 soft starter.

Standards and approvals

The SIRIUS 3RW44 soft starter complies to the IEC/EN 60947-4-2 standard.

Disclaimer of liability

The manufacturer of the system or machine is responsible for ensuring the correct overall functioning. SIEMENS AG, its branch offices and associated companies (hereinafter referred to as "SIEMENS") cannot guarantee all properties of a system or machine not designed by SIEMENS.

SIEMENS can also not assume liability for recommendations given or implied by the following description. No new guarantee/warranty or liability claims in excess of the general terms and conditions of SIEMENS can be deduced from the following description.

Handling

To facilitate and speed up access to special information, the manual contains the following aids:

- A Table of Contents is listed at the beginning of the manual.
- The individual chapters contain subheadings to provide an overview of the contents of the section.
- At the end of the manual there is an extensive index to enable you to quickly access the required information.

Always up-to-date information

For questions on motor starters, your regional contact persons for communication-capable low-voltage switchgear will be pleased to assist you. You will find a list of contact persons and the latest version of the manual on the Internet at:

http://www.siemens.com/softstarter

Please address technical questions to:

Technical Assistance:	Telephone: +49 (0) 911-895-5900 (8°° - 17°° CET)Fax: +49 (0) 911-895-5907 E-mail: technical-assistance@siemens.com Internet: www.siemens.de/lowvoltage/technical-assistance
Technical Support:	Telephone:+49 (0) 180 50 50 222

Correction sheet

A correction sheet is included at the end of the manual. Please enter your suggestions for improvement, supplements and corrections and send the sheet back to us. This will help us to improve the next issue.

Introduction

<div style="text-align: right; font-size: 3em; font-weight: bold;">1</div>

1.1 Physical Basics of the 3-phase Asynchronous Motor and Mode of Operation of the Soft Starter

1.1.1 3-phase Asynchronous Motor

Applications of the 3-phase asynchronous motor
Thanks to their robust and simple design and low-maintenance operation, 3-phase asynchronous motors are used in large numbers in commercial applications, trade and industry.

Problem
If switched on directly, the typical current and torque behavior of the 3-phase asynchronous motor may negatively influence the feeding supply network and the load machine during start-up.

Starting current
3-phase asynchronous motors have a high direct starting current $I_{(starting)}$. Depending on the motor version, this current may be 3 times to 15 times the size of the rated operating current. A typical value is 7 to 8 times the size of the motor rated current.

Disadvantage
This results in the following disadvantage
- Higher load on the electrical supply network. This means that the supply network must be dimensioned for this higher output during motor start-up.
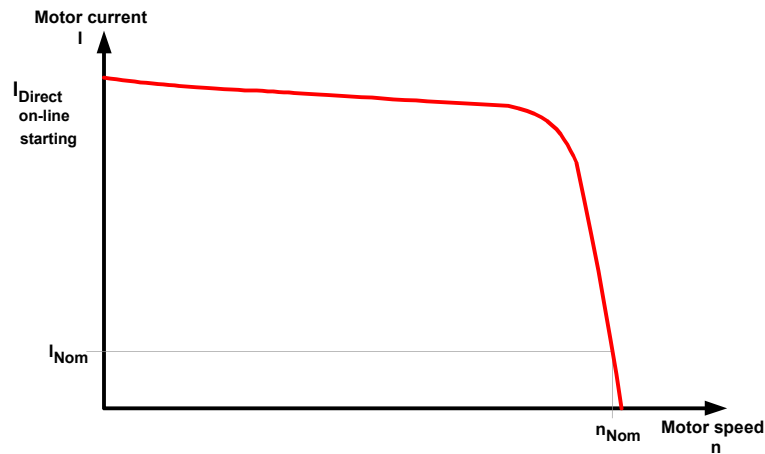
Figure 1-1: Typical starting current behavior of a 3-phase asynchronous motor

Start torque
The start torque and the stalling torque can usually be assumed to be between 2 and 4 times the rated torque. For the load machine, this means that the starting and acceleration forces in relation to rated operation result in increased mechanical load on the machine and the conveyed material.

Disadvantages
This results in the following disadvantages
- Higher load on mechanical parts of the machine
- Higher costs because of application wear and maintenance
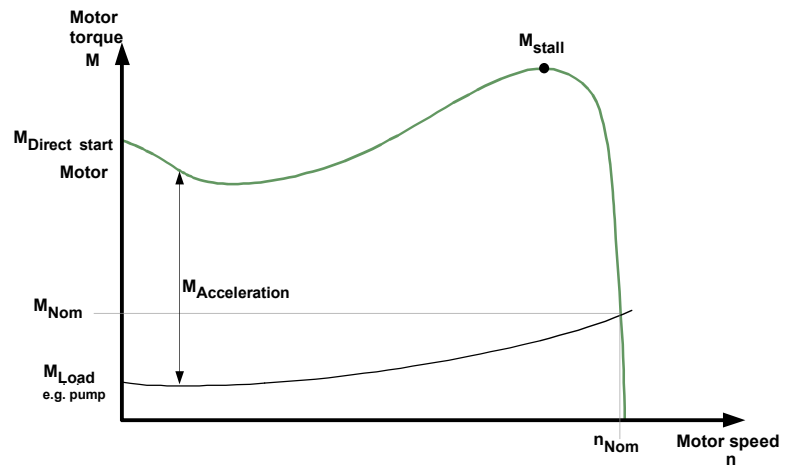
Figure 1-2: Typical starting torque behavior of a 3-phase asynchronous motor

Solution   The current and torque behavior during start-up can be optimally adapted to the requirement of the application using the SIRIUS 3RW44 electronic soft starter.

1.1.2 Operating Mode of the SIRIUS 3RW44 Electronic Soft Starter

The 3RW44 soft starter has two antiparallel thyristors in each of the phases. There is one thyristor for the positive and one thyristor for the negative half wave.

Using phase angle control and various control methods, the r.m.s. value of the motor voltage is increased from a definable start voltage or start torque to the motor rated voltage within a selectable starting time.

The motor current acts proportional to the voltage applied to the motor. Thus, the starting current is reduced by the factor of the voltage that is applied to the motor.

The torque behaves quadratically in relation to the voltage applied to the motor. The starting torque is thus reduced quadratically based on the voltage applied to the motor.

Example

SIEMENS motor 1LG4253AA (55 kW)

Rated data at 400 V:

P_e:	55 kW
I_e:	100 A
$I_{Direct\ on\text{-}line\ starting}$:	approx. 700 A
M_e:	355 Nm; Example: $M_e = 9.55 \times 55 \text{ kW} \times \dfrac{1000}{1480 \text{ min}^{-1}}$
n_e:	1480 min^{-1}
$M_{Direct\ on\text{-}line\ starting}$:	approx. 700 Nm
Set start voltage:	50 % (1/2 supply voltage)

=> I_{Start} 1/2 of the direct-start switch-on current (approx. 350 A)

=> M_{Start} 1/4 of the direct on-line start torque (approx. 175 Nm)

The following graphs illustrate the behavior of the starting current and torque of a 3-phase asynchronous motor in combination with a soft starter:
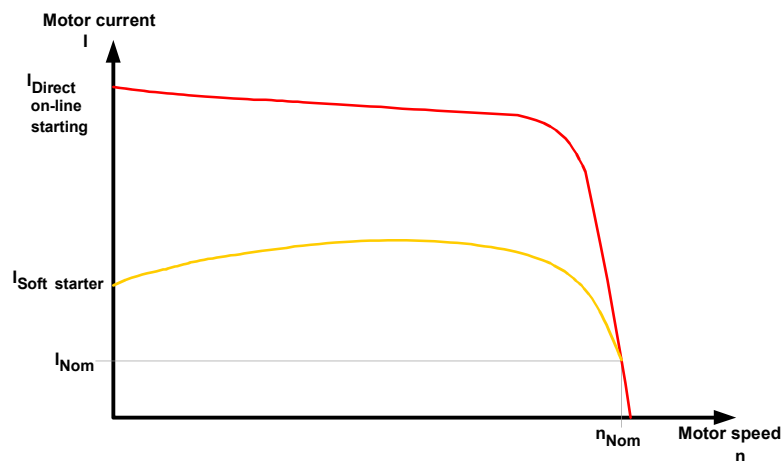
Figure 1-3: Reduced current behavior of the 3-phase asynchronous motor during start-up with the SIRIUS 3RW44 soft starter
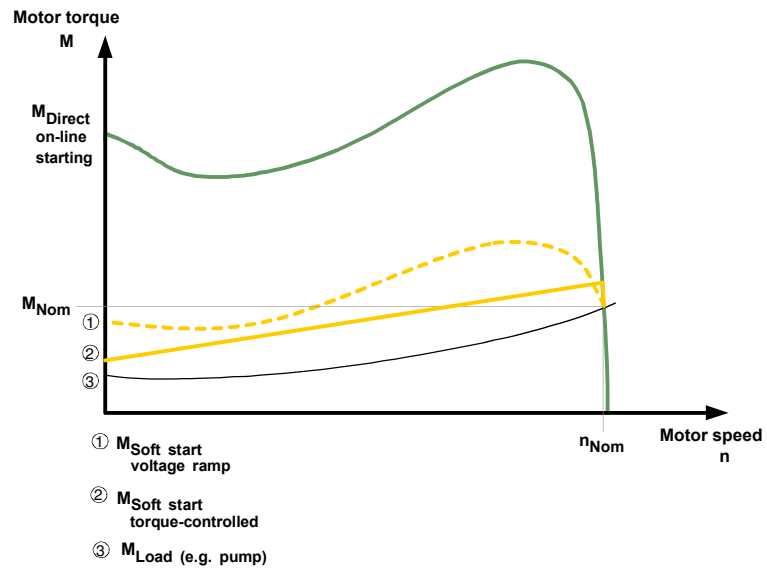
Figure 1-4: Reduced torque behavior of the 3-phase asynchronous motor during start-up with the SIRIUS soft starter 3RW44

Starting

This means that because the electronic soft starter controls the motor voltage during motor start-up, it simultaneously controls the ingoing starting current and the starting torque generated in the motor.

The same principle is also used during the stopping process. The effect is that the torque generated in the motor is slowly reduced, thus enabling soft stopping of the application.

During this process, the frequency remains constant and corresponds to the network frequency, contrary to the frequency-controlled starting and stopping of a frequency converter.

Upon completion of motor start-up, the thyristors are fully utilized, resulting in the complete network voltage being applied to the motor terminals. Since no motor voltage control is required during operation, the thyristors are bridged by integrated bypass contacts. This reduces the waste heat developing during continuous operation which is caused by power loss of the thyristor. Therefore, the area around the switching devices heats up less.

The following graph illustrates the mode of operation of the 3RW44 soft starter:
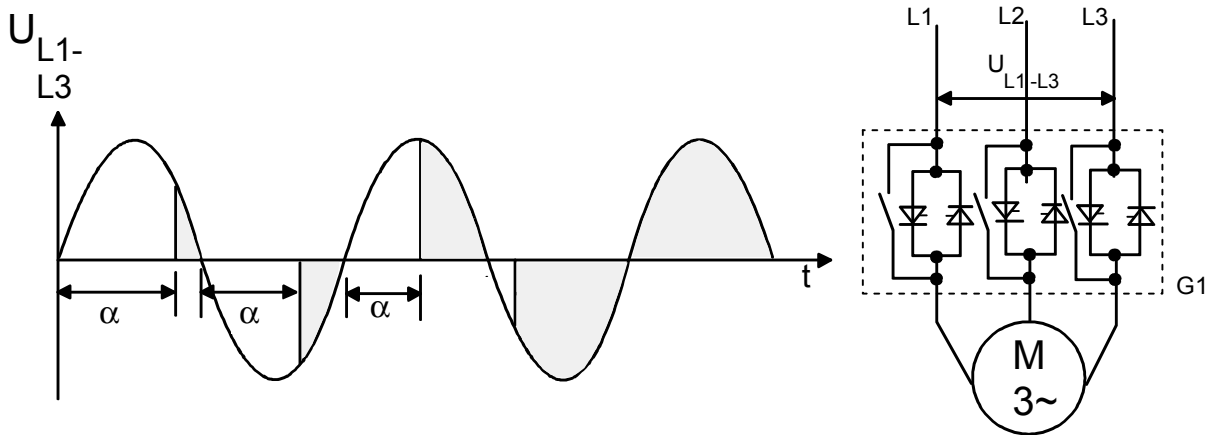
Figure 1-5:Phase angle control and schematic layout of a soft starter with internal bypass contacts

1.2   Application and Use

**Applications and
selection criteria**

3RW44 soft starters are an alternative for star-delta starters and frequency converters.
Their major benefits are smooth starting and stopping, uninterrupted changeover without current peaks that would stress the power supply, and their compact dimensions.
Numerous drives which previously could only be operated with frequency converters can be changed over to soft starter operation using the 3RW44 soft starter, as long as no speed control, no particularly high starting torque or no startup with close to nominal current is required.

Applications

Possible applications include:

- Conveyor belts
- Powered roller conveyors
- Compressors
- Ventilators, fans
- Pumps
- Hydraulic pumps
- Stirrers
- Centrifugal machines
- Milling machines
- Mills
- Crushers
- Disk saws/ribbon saws
- ...

Advantages

Conveyor belts and systems:
- Jerk-free starting
- Jerk-free braking

Centrifugal pumps, reciprocating pumps:
- Water hammering is avoided
- Increased service life of the tubing

Stirrers, mixers:
- Reduced starting current

Fans:
- Reduced stress on transmissions and V-belts

1.3 Marginal Conditions for Storage and Operation

Permissible ambient temperature for	
- Storage	-25 °C ... +80 °C
- Operation	0 °C ... +60 °C, from 40 °C with derating (refer to Chapter 10.3 "Technical Data")
Permissible relative air humidity	10 ... 95 %
Maximum permissible installation height	5,000 m, from 1,000 m with derating

> ⚠ **Caution**
> Please ensure that no liquid, dust or conductive parts enter the soft starter!

Configuration Instructions

2

2.1　Configuration

The electronic 3RW44 soft starters are designed for normal starting. A model with a higher output may be necessary for heavy starting or for a higher starting frequency.

A PTC thermistor in the motor is recommended for long starting times. This also applies to the soft stop, pump stop and DC braking stopping modes, since there is an additional current load in contrast to coasting down.

No capacitive elements (e.g. compensation systems) may be included in the motor branch between the soft starter and the motor. Active filters must not be operated in combination with soft starters.

All elements of the main circuit (such as fuses and switching devices) must be dimensioned for direct starting according to the local short-circuit conditions and should be ordered separately.

The harmonic load of the starting current must be taken into account when selecting circuit breakers (release selection).

2.1.1　RS 232 Serial PC Interface and Soft Starter ES Parameterization and Operating Software

The electronic 3RW44 soft starters are equipped with a PC interface to communicate with the Soft Starter ES smart software and an operating and monitoring module (display).

2.1.2　Win Soft Starter Selection and Simulation Program

This software allows all SIEMENS soft starters to be simulated and selected using various parameters such as network conditions, motor data, load data, special application requirements, etc.

The software is a powerful tool which makes time-consuming and complex manual calculations for determining the suitable soft starter a thing of the past. The CD-ROM can be ordered using the following order number:

Order No.: E20001-D1020-P302-V2-7400.

2.1.3　Training Course for SIRIUS Soft Starters (SD-SIRIUSO)

Siemens offers a two-day training course on electronic SIRIUS soft starters to keep both our customers and Siemens personnel up-to-date on configuration, commissioning and maintenance.

If you have any questions or would like to enroll, please contact:
Erlangen Training Center
A&D PT 4
Werner-von-Siemens-Str. 65
91052 Erlangen, Germany
Telephone: ++49 9131 729262
Fax: ++49 9131 728172
sibrain.industry@siemens.com
http://www.siemens.de/sitrain

2.2 Normal or Heavy Starting

To properly dimension a soft starter, it is important to know and take into account the starting time (normal or heavy starting) of the application. Long starting times mean a higher thermal load for the thyristors of the soft starter. The 3RW44 soft starters are designed for continuous operation under normal starting conditions (CLASS 10), an ambient temperature of 40 degrees Celsius and a fixed switching frequency. You can also find these values in Chapter 10.3.2 "Technical Data Power Unit". If deviations from these data occur, it may be necessary to overdimension the soft starter. Using the Win Soft Starter selection and simulation program from SIEMENS, you can enter your application data and requirements, and it will determine the optimum soft starter dimensions for your application (refer to Chapter 10.3.8 "Accessories" software).

Selection criteria

Note
The adequate size of the SIRIUS 3RW44 soft starters must be selected on the basis of the motor rated current
(Rated current$_{soft\ starter}$ ≥ motor rated current).

2.2.1 Application Examples for Normal Starting (CLASS 10)

Normal starting CLASS 10 (up to 20 s with 350 % $I_{n\ motor}$),
The soft starter's output can be the same as that of the implemented motor

Application		Conveyor belts	Powered roller conveyors	Compressors	Small ventilators	Pumps	Hydraulic pumps
Starting parameters							
• Voltage ramp and current limiting							
- Start voltage	%	70	60	50	30	30	30
- Starting time	s	10	10	10	10	10	10
- Current limit value		Deactivated	Deactivated	4 x I_M	4 x I_M	Deactivated	Deactivated
• Torque ramp							
- Start torque		60	50	40	20	10	10
- End torque		150	150	150	150	150	150
- Starting time		10	10	10	10	10	10
• Breakaway pulse		Deactivated (0 ms)	Deactivated (0 ms)	Deactivated (0 ms)	Deactivated (0 ms)	Deactivated (0 ms)	Deactivated (0 ms)
Stopping mode		Soft stopping	Soft stopping	Coasting down	Coasting down	Pump stop	Coasting down

2.2.2 Application Examples for Heavy Starting (CLASS 20)

Heavy starting CLASS 20 (up to 40 s with 350 % $I_{n\ motor}$),
The selected soft starter must have a power class that is 1 class higher than that of the implemented motor

Application		Stirrers	Centrifugal machines	Milling machines
Starting parameters				
• Voltage ramp and current limiting				
- Start voltage	%	30	30	30
- Starting time	s	30	30	30
- Current limit value		4 x I_M	4 x I_M	4 x I_M
• Torque ramp				
- Start torque		30	30	30
- End torque		150	150	150
- Starting time		30	30	30
• Breakaway pulse		Deactivated (0 ms)	Deactivated (0 ms)	Deactivated (0 ms)
Stopping mode		Coasting down	Coasting down	Coasting down or DC braking

2.2.3 Application Examples for Very Heavy Starting (CLASS 30)

Very heavy starting CLASS 30 (up to 60 s with 350 % $I_{n\,motor}$),
The selected soft starter must have a power class that is 2 classes higher than that of the implemented motor

Application			Large fans	Mills	Crushers	Disk saws/ribbon saws
Starting parameters						
• Voltage ramp and current limiting						
- Start voltage	%		30	50	50	30
- Starting time	s		60	60	60	60
- Current limit value			$4 \times I_M$	$4 \times I_M$	$4 \times I_M$	$4 \times I_M$
• Torque ramp						
- Start torque			20	50	50	20
- End torque			150	150	150	150
- Starting time			60	60	60	60
• Breakaway pulse			Deactivated (0 ms)	80 %; 300 ms	80 %; 300 ms	Deactivated (0 ms)
Stopping mode			Coasting down	Coasting down	Coasting down	Coasting down

Note

These tables provide example set values and device dimensionings. They serve as information only and are not binding. The set values are application-dependent and must be optimized during commissioning.
Soft starter dimensioning should, if necessary, be verified with the help of the Win-Soft Starter program or via the Technical Assistance in Chapter "Important notes".

2.3   On-time and Switching Frequency

In terms of motor rated current and normal/heavy starting, the 3RW44 soft starters are dimensioned for a maximum permissible switching frequency in combination with a relative on-time. Please also refer to Chapter 10.3.2 "Technical Data Power Unit". If these values are exceeded, you may have to select a larger soft starter.

On-time OT

The relative on-time OT in % corresponds to the relationship between the load duration and the switching-cycle period of loads that are frequently switched on and off.

The on-time OT can be calculated using the following formula:

$$OT = \frac{t_s + t_o}{t_s + t_o + t_i}$$

Explanation of the formula:

OT   On-time [%]
t_s Starting time [s]
t_o Operating time [s]
t_i Idle time [s]

The following graphic illustrates the procedure.
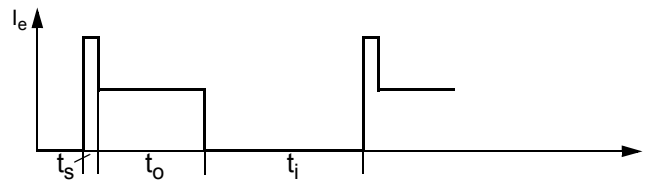
Figure 2-1:On-time OT

Switching frequency

To prevent thermal overloading of the devices, the maximum permissible switching frequency must be adhered to under all circumstances.

2.4   Installation Altitude and Ambient Temperature

The permissible installation altitude must not exceed 5,000 m above sea level (above 5,000 m on request).

If the installation altitude exceeds 1,000 m, the rated operating current must be reduced for thermal reasons.

If the installation altitude exceeds 2,000 m, the rated voltage must also be reduced because of the limited insulation strength. For installation altitudes between 2,000 m and 5,000 m above sea level, only rated voltages $\leq$ 460 V are allowed.

The following illustration shows the reduction in the rated device current in relation to the installation altitude:
The rated operating current I_e must be reduced when installed at 1,000 m above sea level or higher.
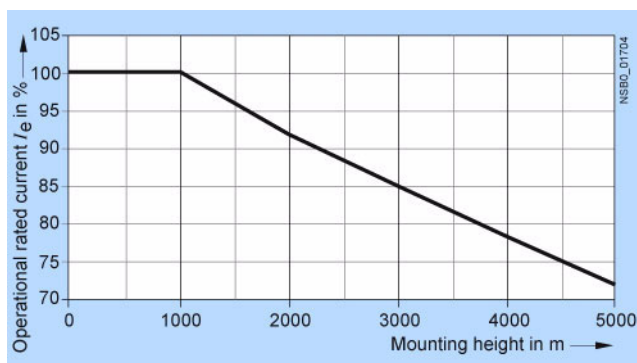
Figure 2-2: Current reduction in relation to the installation altitude

Ambient temperature   The 3RW44 soft starters are designed to be operated with a nominal current at an ambient temperature of 40 ° Celsius. If this temperature is exceeded, e.g. due to excessive heating up in the switchgear cabinet, other loads or due to a higher general ambient temperature, this will influence the performance of the soft starter and must be taken into account in the dimensioning process (refer to Chapter 10.3.2 "Technical Data Power Unit").

2.5 Factory Settings

Apply the factory settings (default settings)

• in the event of faulty parameterization
• if SIRIUS 3RW44 soft starters that have already been parameterized are to be further used in other systems.

Note

If this is not done, the present parameterization might cause drives to start running.

Soft starters already parameterized by the operator can be set back to the factory setting without requiring additional auxiliary tools.

To reset to the factory settings, refer to "Restoring the factory settings" on Page 5-40.

2.6 Order Number Classification for SIRIUS 3RW44 Soft Starters

Order number classification using the 3RW44 22-6BC44 as an example

3RW4	4	22	-	6	B	C	4	4
I	II	III		IV	V	VI	VII	VIII

*Gray fields cannot be configured

I	Designation of the basic unit: Semiconductor AC motor control device (soft starter)
II	Device version: 4 High End soft starter
III	Operating efficiency rating P_e (at U_e 400 V) Rated operating current I_e (for utilization category AC-53a) (at TU 40 °C)

		P_e	I_e			P_e	I_e
22	-	15 kW	29 A	45	-	160 kW	313 A
23	-	18.5 kW	36 A	46	-	200 kW	356 A
24	-	22 kW	47 A	47	-	250 kW	432 A
25	-	30 kW	57 A	53	-	315 kW	551 A
26	-	37 kW	77 A	54	-	355 kW	615 A
27	-	45 kW	93 A	55	-	400 kW	693 A
34	-	55 kW	113 A	56	-	450 kW	780 A
35	-	75 kW	134 A	57	-	500 kW	880 A
36	-	90 kW	162 A	58	-	560 kW	970 A
43	-	110 kW	203 A	65	-	630 kW	1076 A
44	-	132 kW	250 A	66	-	710 kW	1214 A

IV	Type of connection
	1 - Standard screw connection (main/auxiliary lead connection) (for devices ≤ 3RW44 27)
	2 - Main lead: Conductor-rail bond / auxiliary lead: Spring-type terminal (for devices > 3RW44 27)
	3 - Main lead: Screw connection / auxiliary lead: Spring-type terminal (for devices ≤ 3RW44 27)
	6 - Main lead: Conductor-rail bond / auxiliary lead: Terminal screw (for devices > 3RW44 27)
V	Special function: B - With bypass:
VI	Number of controlled phases: C - All 3 phases controlled
VII	Rated control supply voltage U_s: 3 - 115 V AC 4 - 230 V AC
VIII	Rated operating voltage U_e: 4 - 200 to 460 V 5 - 400 to 600 V 6 - 400 to 690 V

Installation, Connection and Branch Layout

3

3.1 Installing the Soft Starter

3.1.1 Unpacking

Caution
Do not lift the device by the lid when unpacking it, as this may damage the device.

3.1.2 Mounting Position

The unit should be mounted on vertical, level surfaces.
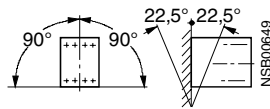
Figure 3-1:Mounting position

3.1.3 Standards

Degree of protection IP00

The 3RW44 soft starters comply with degree of protection IP00.
Taking into account the ambient conditions, the devices must be installed in IP54 switchgear cabinets (pollution degree 2).
Make sure that no liquids, dust or conductive parts can enter the soft starter.
Operation of the soft starter produces waste heat (heat loss) (refer to Chapter 10 "General Technical Data").

Caution
Ensure sufficient cooling where the unit is installed to prevent the switching device from overheating.

3.1.4 Mounting Dimensions and Clearances

For uninhibited cooling, ventilation and venting of the heat sink, it is essential that the minimum clearance from other devices is strictly observed.
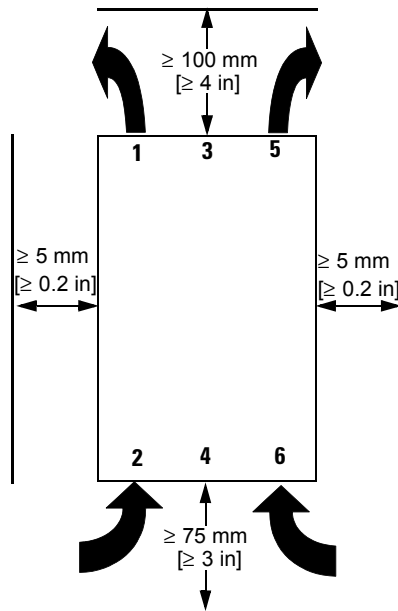
Figure 3-2:Clearance to other devices

Notice
Ensure that there is sufficient clearance so that air can freely circulate for cooling. The device is ventilated from bottom to top.

3.2   Branch Layout

> ⚠ **Warning**
> **Automatic restart.**
> May result in death, serious injury or damage to property.
> The automatic reset mode must not be used in applications where the
> unexpected restart of the motor may lead to personal injury or
> damage to property.
> The start command (e.g. by the PLC) must be reset before a reset
> command is issued, since an automatic restart is executed when a
> start command is pending after the reset command is issued. This
> especially applies to motor protection tripping. For safety reasons it is
> recommended to integrate the group error output (terminals 95 and
> 96) into the control.

3.2.1 General

A motor branch consists of at least a **disconnector**, a **switching element** and a
motor.
Protection functions should include line protection against short circuits and
overload protection for line and motor.

Disconnector   The disconnecting function with line protection against overload and short
circuits can be achieved by using, for example, a circuit-breaker or a fuse
disconnector.
(For fuse and circuit-breaker assignment, refer to Chapter 10.3.6 "Branch
Component Circuitry (Standard or Inline Circuit)" and Chapter 10.3.7 "Branch
Component Layout (Inside Delta Circuit)".

Switching element   The 3RW44 soft starter provides the switching element function and motor
protection.

> ⚠ **Danger**
> **Dangerous voltage.**
> **Danger to life or risk of serious injury.**
> If supply voltage is applied to the input terminals of the
> soft starter, there may be dangerous voltages at the soft starter output
> even without a start command! When working on the branch, it must
> be disconnected using a disconnector (open isolating gap, e.g with
> open switch disconnector)!

3.2.2 Soft Starters in Standard Circuits

The SIRIUS 3RW44 soft starter is connected in the motor branch between the disconnector or circuit breaker and the motor.
The 3RW44 soft starter automatically detects the connection type of the soft starter so this does not have to be explicitly set on the device. The detected connection type can be read on the starter under the menu item "Status display/Connection type". In this case, the
display reads "Star/delta". If the circuitry is faulty or the motor is not connected, the display shows "Unknown".
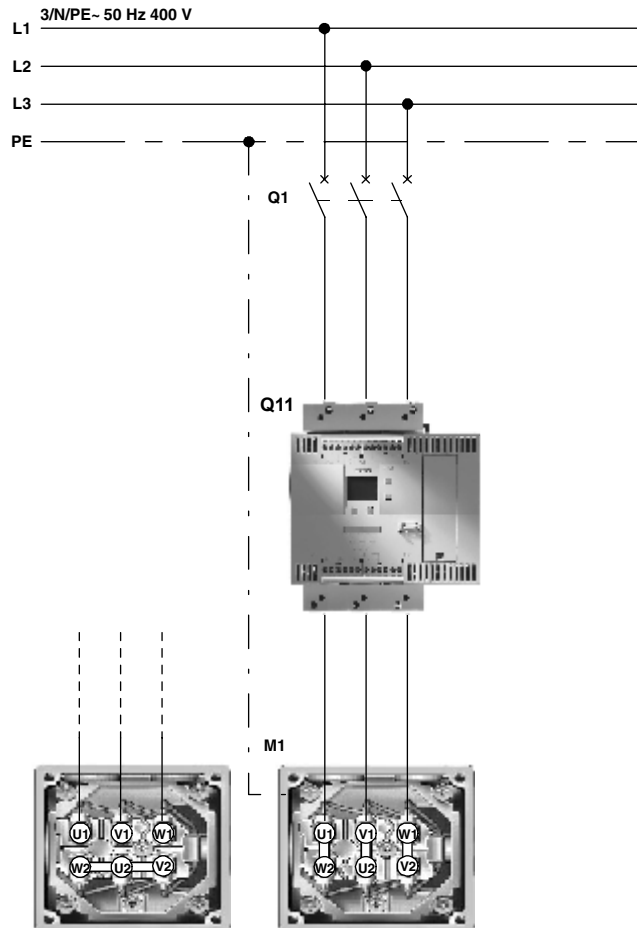
Figure 3-3: Block diagrams for 3RW44 soft starters in standard circuits

---

Notice
If a main or line contactor is used, this contactor must not be connected between the soft starter and the motor or in the return line between the motor and the soft starter. Otherwise the soft starter would not recognize the current circuit version (standard circuit or inside delta circuit) and would output the error message: "Missing load phase 1-3", thereby ensuring that the circuit is closed before the 3RW44 is activated.

3.2.3 Soft Starters in Inside Delta Circuits

Prerequisite

A motor whose windings can be connected in a delta circuit where a supply voltage prevails.

Example

Supply voltage:	400 V
Rated motor current:	40.5 A
Current via soft starter in an inside delta circuit	approx. 24 A
Selected soft starter in an inside delta circuit	3RW44 22
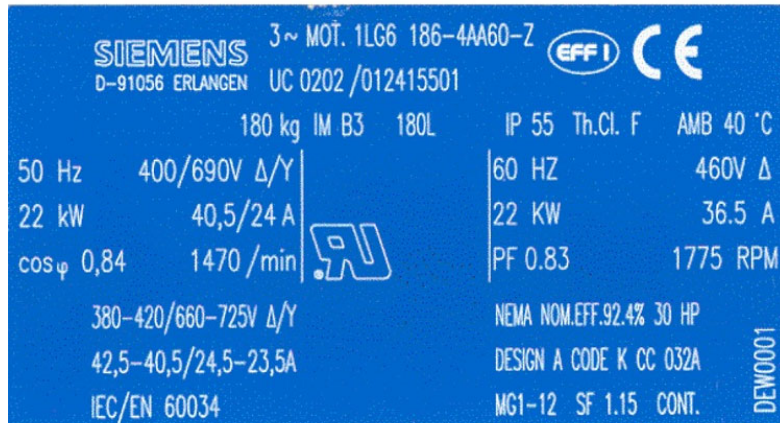
Figure 3-4:Name plate of a 22 kW motor

The SIRIUS 3RW44 soft starter can be dimensioned to match the current flowing in the motor section (58 % of the conductor current) by connecting it in the delta winding of the motor. This requires at least 6 motor lines.

The 3RW44 soft starter automatically detects how it is connected so the connection type does not have to be explicitly set on the device. The detected connection type can be read on the starter under the menu item "Status display/ Connection type". In this case the display reads "Inside delta circuit". If the circuitry is faulty or the motor is not connected, the display shows "Unknown".

Notice
The rated motor current given on the name plate should always be set in the quickstart menu or in the motor adjustment menu item. This setting is independent of the type of connection of the soft starter.
Value to be set in the above example for a supply voltage of 400 V, e.g. 40.5 A.

Notice

The DC braking and combined braking device functions are no longer available for inside delta circuits.

In order to ensure proper functioning of the soft starter, the electric connection of the main voltage (line and motor side) must be made according to the given circuit examples (refer to Section Chapter 9.1 "Connection Examples for Main and Control Circuits").
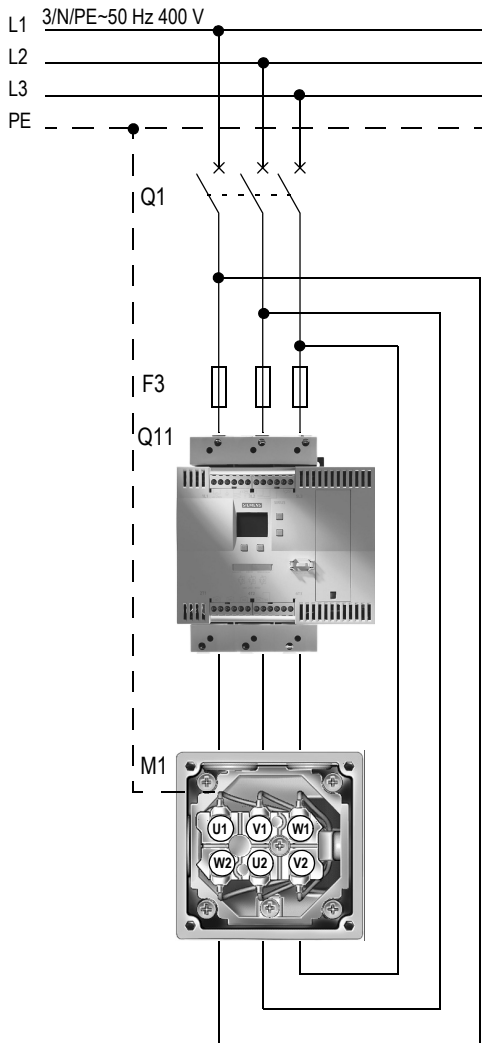
Motor rotation in phase direction   Motor rotation counterclockwise to phase direction
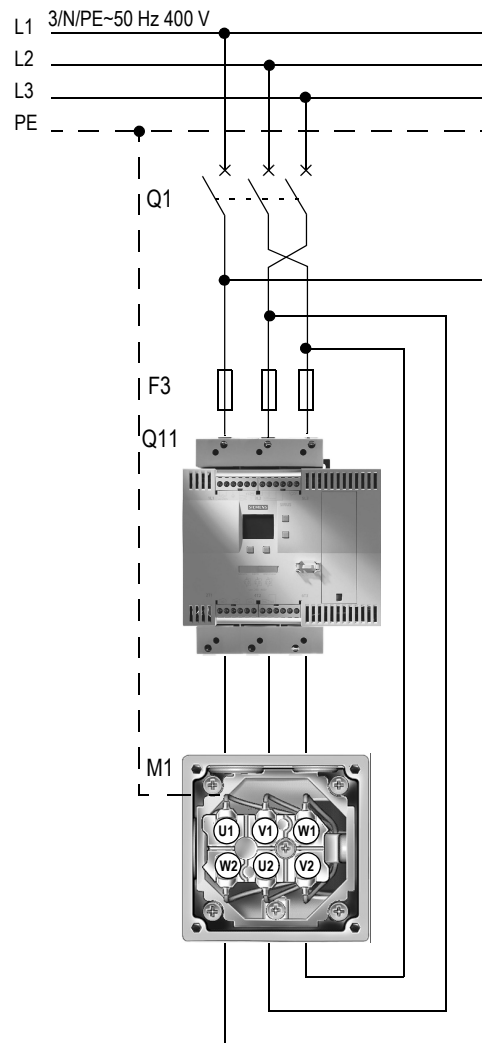
Figure 3-5: Block diagram of a 3RW44 soft starter in an inside delta circuit

Notice

If a main or line contactor is used, this contactor must not be connected between the soft starter and the motor or in the return line between the motor and the soft starter. Otherwise the soft starter would not recognize the current circuit version (standard circuit or inside delta circuit) and would output the error message: "Load phases 1-3 missing".

3.2.4 Soft starter with Contactor Disconnector (Main Contactor)

If galvanic decoupling is required, a motor contactor can be installed between the soft starter and the disconnector, or a fault output relay can be used. (Refer to Chapter 10.3 "Technical Data" for the contactor assignment)
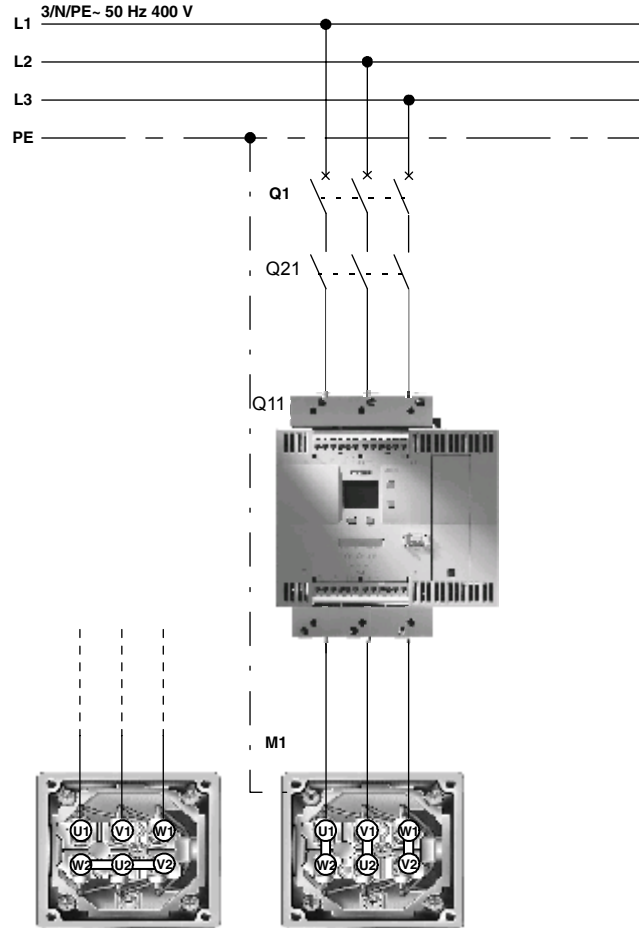
Figure 3-6:Block diagram of branch with optional main contactor / contactor disconnector

Notice
If a main or line contactor is used, this contactor must not be connected between the soft starter and the motor or in the return line between the motor and the soft starter. Otherwise the soft starter would not recognize the current circuit version (standard circuit or inside delta circuit) and would output the error message: "Load phases 1-3 missing".

3.3   Protection of the Soft Starter against Short Circuits

(Utilization class 2)

The soft starter has integrated thyristor protection against overloading. In the event of a short circuit, e.g. due to a defect in the windings of the motor or a short-circuit via the motor supply cables, this internal thyristor protection function is not sufficient. Special semiconductor fuses, e.g. SITOR fuses from SIEMENS, must be used for this purpose.
(Refer to Chapter 10.3 "Technical Data" for the fuse assignment)
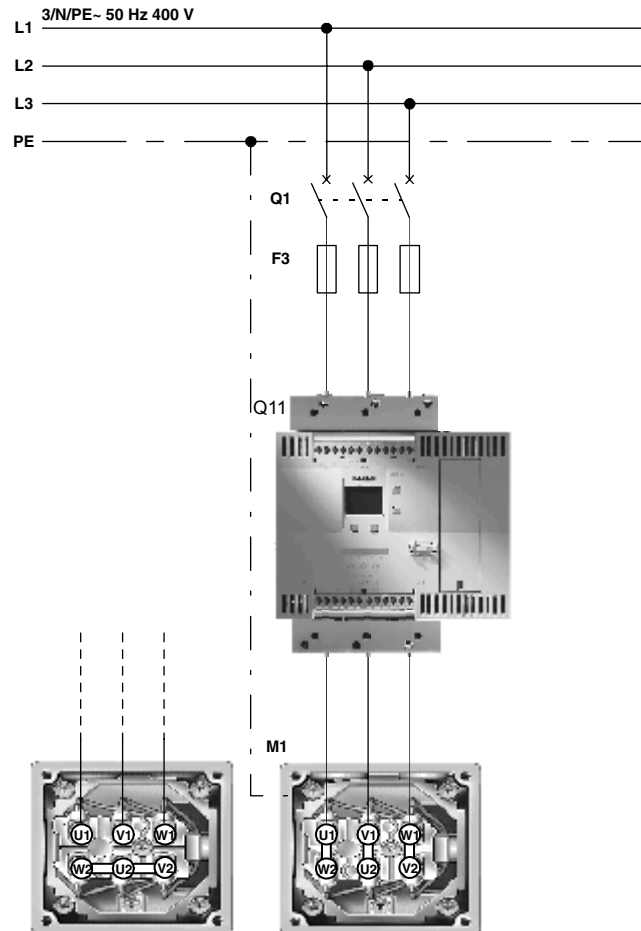
Figure 3-7:Block diagram of branch with semiconductor fuses

3.4 Capacitors for Power Factor Improvement

Caution
Do not connect any capacitors to the output terminals of the soft starter. If you do, the soft starter will be damaged.
Active filters, e.g. for reactive power compensation, must not be operated in parallel while the motor control device is operational.

If capacitors for reactive power compensation are used, they must be connected on the line side of the device. If a contactor disconnector or a main contactor is used in combination with the electronic soft starter, the capacitors must be disconnected from the soft starter when the contactor is open.

3.5 Electrical Connection

3.5.1 Control and Auxiliary Current Connection

The SIRIUS 3RW44 soft starter is supplied with two different connection types:
- Screw-type terminals
- Spring-loaded terminals

Two control voltage versions are available:
- 115 V AC
- 230 V AC

3.5.2 Main Current Connection

All soft starters are equipped with busbar connections for the main current connection.

Size 3RW44 2.

An additional box terminal for direct cable connection is supplied as standard with size 3RW44 2. devices.

Sizes 3RW44 3. and 3RW44 4.
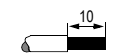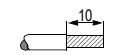
For size 3RW44 3. and 3RW44 4. devices it is possible to retrofit box terminals as optional accessories (refer to Chapter 10.3.8 "Accessories").
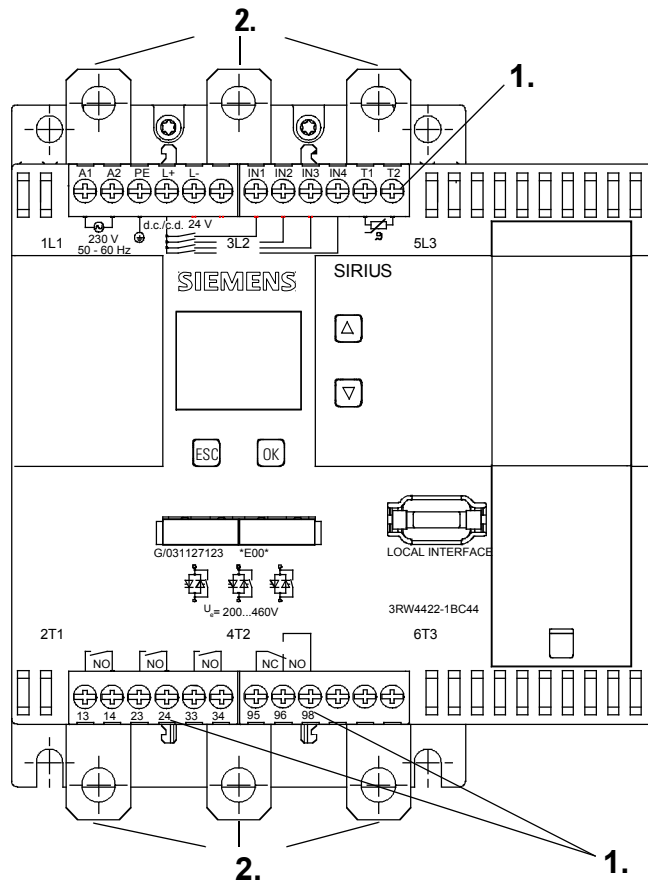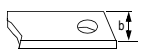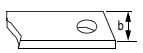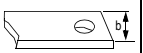
1.	A1, A2, PE, L+, L-, IN1, IN2, IN3, IN4, T1, T2, 13, 14, 23, 24, 33, 34, 95, 96, 98: Control/auxiliary circuit
2.	L1/L2/L3, T1/T2/T3: Main circuit

Figure 3-8: Connections

3.5.3 Conductor Cross-sections

A1, A2, PE, L+, L-, IN1, IN2, IN3, IN4, T1, T2, 13, 14, 23, 24, 33, 34, 95, 96, 98		
	3RW44..-1.... **3RW44..-6....**	**3RW44..-2....** **3RW44..-3....**
∅ 5 ... 6 mm / PZ2	0.8 ... 1.2 Nm 7 to 10.3 lb·in	—
10	1 x 0.5 ... 4.0 mm² 2 x 0.5 ... 2.5 mm²	2 x 0.25 ... 1.5 mm²
10	2 x 0.5 ... 1.5 mm² 1 x 0.5 ... 2.5 mm²	2 x 0.25 ... 1.5 mm²
10	—	2 x 0.25 ... 1.5 mm²
AWG	2 x 20 to 14	2 x 24 to 16

L1, L2, L3; T1, T2, T3						
3RW44 2.-....		**3RW44 3.-....**		**3RW44 4.-....**		**3RW44 5.-.... / 3RW44 6.-....**
min 22	4 ... 6 Nm 36 ... 53 lb·in	M8x25	10 ... 14 Nm 89 ... 124 lb·in	M10x30	14 ... 24 Nm 124 ... 210 lb·in	M12x40	20 ... 35 Nm 177 ... 310 lb·in
	2 x 10 ... 70 mm² 2 x AWG 7 ... 1/0		2 x 25 ... 120 mm² 2 x AWG 4 ... 250 kcmil		2 x 70 ... 240 mm² 2 x AWG 2/0 ... 500 kcmil		2 x 70 ... 240 mm² 2 x AWG 2/0 ... 500 kcmil
	2 x 10 ... 50 mm² 2 x AWG 7 ... 1/0		2 x 16 ... 95 mm² 2 x AWG 6 ... 3/0		2 x 50 ...240 mm² 2 x AWG 2/0 ... 500 kcmil		2 x 50 ...240 mm² 2 x AWG 2/0 ... 500 kcmil
	min. 3 x 9 x 0.8 max. 10 x 15.5 x 0.8	b	b ≤17 mm	b	b ≤ 25 mm	b	b ≤ 60 mm
17	2 x 2.5 ... 16 mm²	—	—	—	—	—	—
17	2 x 2.5 ... 35 mm² 1 x 2.5 ... 50 mm²	—	—	—	—	—	—
17	2 x 10 ... 50 mm² 1 x 10 ... 70 mm² 2 x AWG 10 ... 1/0 1 x AWG 10 ... 2/0	—	—	—	—	—	—

Display, Controls and Device Interfaces

4

4.1   Display and Controls

Graphic display   A graphic display on the front of the device provides information about the functions and statuses of the soft starter via plain text and symbols when control voltage is applied.

1. Displays the control unit that has current control priority, i.e. sends the control commands for the motor.

   Display with keys

   Serial interface

   Control inputs

   PLC via Profibus

   PC via bus

   ?   No control device

2. Displays the defined user level.

   Customer read only

   Customer write

3. Displays the current motor status.

   No motor

   Run up

   Motor running

   Stopping

   Motor ready to start
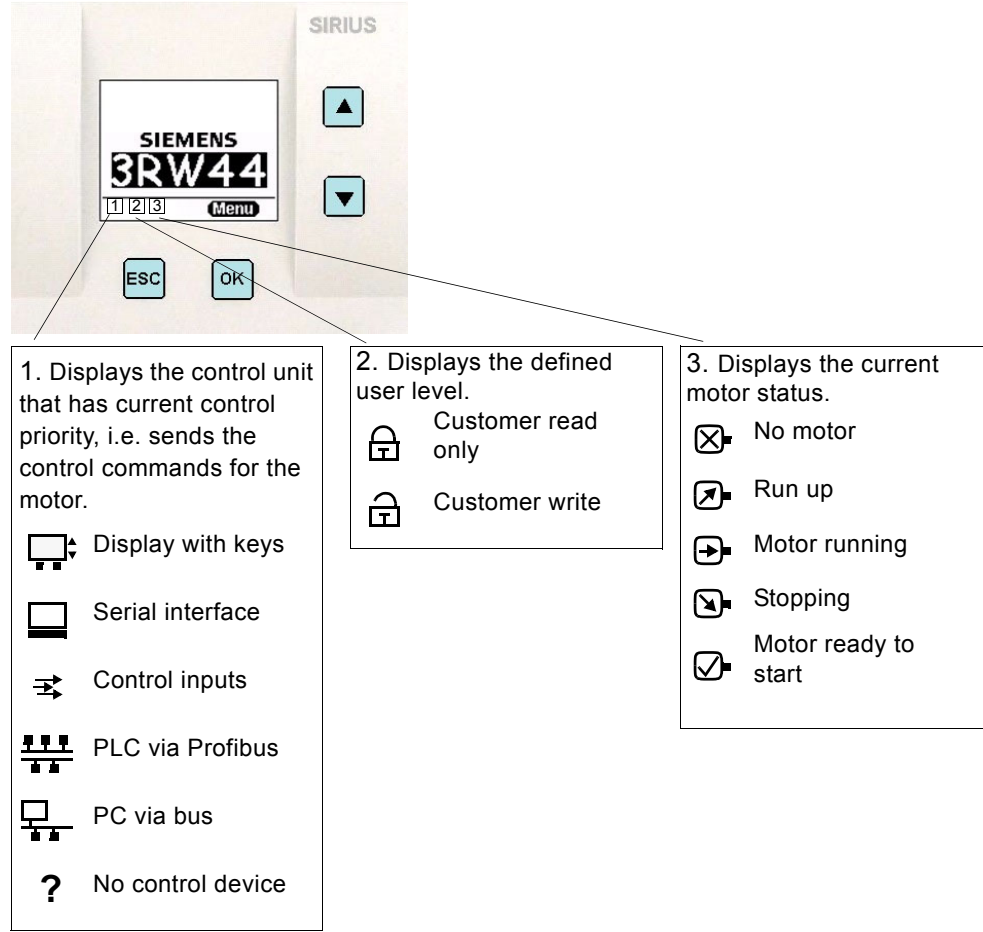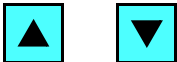
Figure 4-1:Key to symbols

Controls   There are four keys for operating and adjusting the soft starter:

OK   The current function, which is dependent on the menu item, is shown as text on the display above this key (e.g. select menu, change value or save settings).

▲ ▼   The up/down keys are used to navigate through the menu items or to change number values in the settings menu item.

ESC   The ESC key is used to quit the current menu item and to jump back to the higher-level menu item.

4.2 Device Interfaces

4.2.1 Local Device Interface

A local device interface on the front side of the starter is provided as standard. This interface can be used to connect either an optional external operating and display module, or the "Soft Starter ES smart" operating, monitoring and parameterizing software (refer to Chapter 10.3.8 "Accessories" , Software) using a PC and connecting cables.

4.2.2 Profibus Interface (Optional)

The SIRIUS 3RW44 soft starter can be equipped with an optional Profibus module (only available for products delivered after **04/06**). The soft starter can be connected, operated and parameterized via the Profibus interface. The "Soft Starter ES professional" operating, monitoring and parameterizing software (refer to Chapter 10.3.8 "Accessories" , Software) can also be connected to this interface using a PC and connecting cables.
Simultaneous operation of a 3RW44 with a Profibus interface is not possible in networks where one phase conductor is grounded.

4.3 External Display and Control Unit (Optional)

When de-energized, the external display and control unit can be connected to the local device interface via a special connecting cable.
After being switched on, the SIRIUS 3RW44 soft starter automatically recognizes that the external display and control unit has been connected. The 3RW44 display will be inverted and the display of the display and control unit will be showed in a normal way.
The control keys of the 3RW44 will be inactive so that normal handling is only possible via the external display and control unit.
→For ordering data, see Chapter 10.3.8.

Commissioning

5

5.1 Menu Structure, Navigation, Changing Parameters

The 3RW44 functions (parameterization, diagnosis and motor control) can be executed using the four control keys. The menu has various sublevels which are handled in different ways but are self-explanatory.

5.1.1 Menu Structure and Navigation
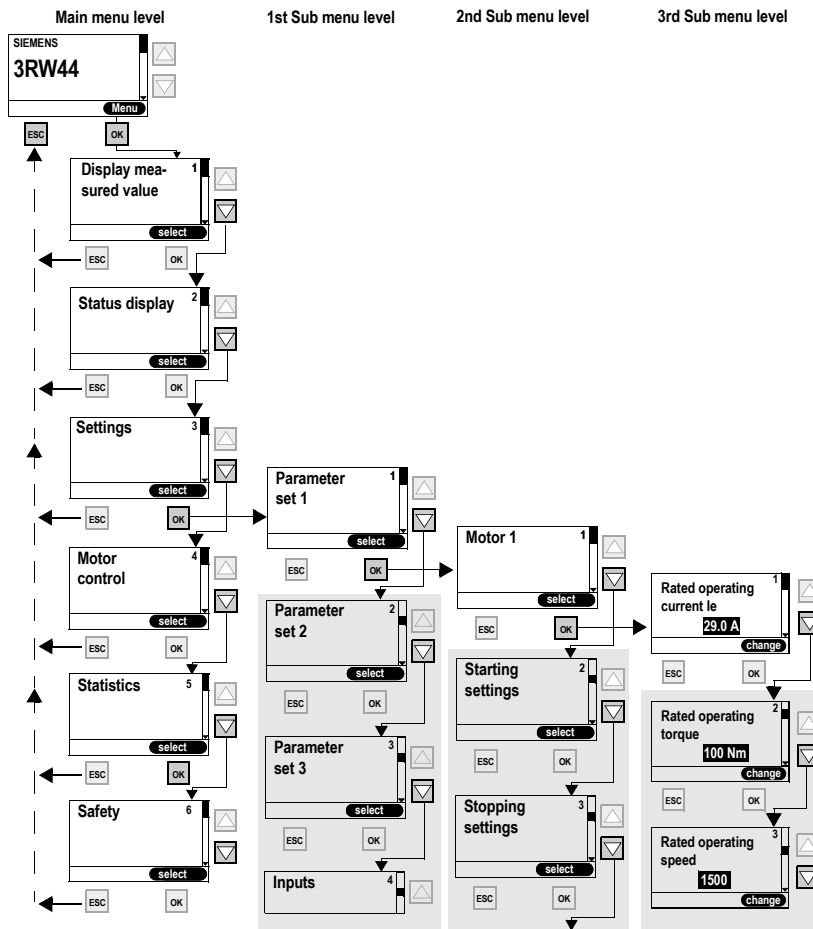
Figure 5-1:Menu structure

5.1.2 Changing Parameters: For Example Motor Data
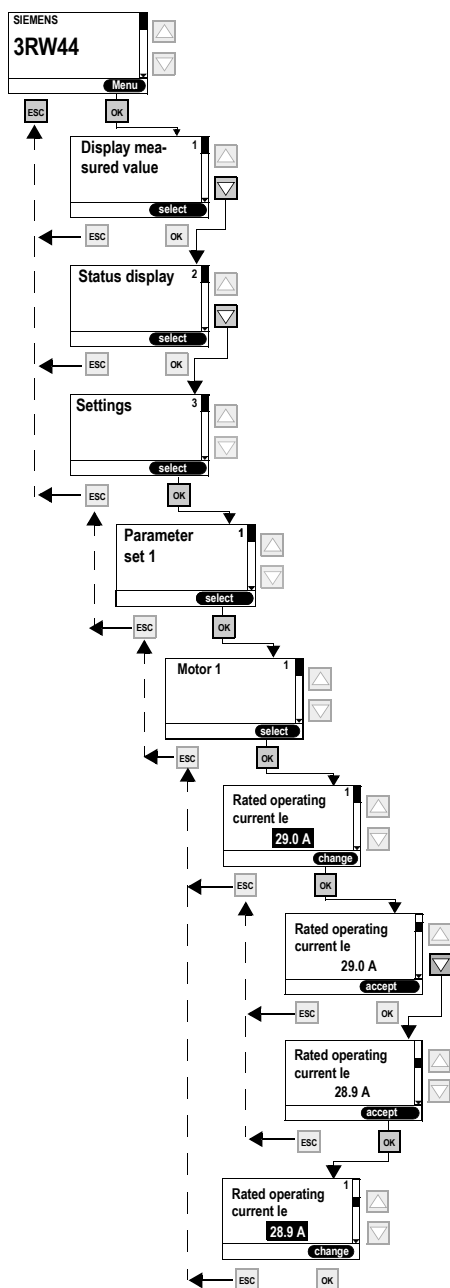
Figure 5-2: Changing values, e.g. adjusting motor data

5.2 Switching on for the First Time

Warning
Before switching the device on for the first time, verify that the main/control side is wired properly. Make sure that the supply and control voltage comply with the device-specific requirements (Chapter 10.3 "Technical Data").

5.2.1 Recommendation on Procedure for 3RW44 Commissioning

Suggested setting	Starting parameters				Stopping parameters		
	Starting mode: Voltage ramp and current limiting (U+current limiting)				Stopping mode	Parameter	
	Start voltage %	Starting time s	Current limit value	Breakaway pulse		Stopping time s	Stopping torque %
Application							
Conveyor belts	70	10	Deactivated	Deactivated (0 ms)	Torque control	10	10
Powered roller conveyors	60	10	Deactivated	Deactivated (0 ms)	Torque control	10	10
Compressors	50	10	4 x I_e	Deactivated (0 ms)	Coasting down	X	X
Small ventilators	30	10	4 x I_e	Deactivated (0 ms)	Coasting down	X	X
Pumps	30	10	4 x I_e	Deactivated (0 ms)	Pump stop	10	10
Hydraulic pumps	30	10	4 x I_e	Deactivated (0 ms)	Coasting down	X	X
Stirrers	30	30	4 x I_e	Deactivated (0 ms)	Coasting down	X	X
Centrifugal machines	30	30	4 x I_e	Deactivated (0 ms)	Coasting down	X	X
Milling machines	30	30	4 x I_e	Deactivated (0 ms)	Coasting down	X	X
Large fans	30	60	4 x I_e	Deactivated (0 ms)	Coasting down	X	X
Mills	50	60	4 x I_e	80 % / 300 ms	Coasting down	X	X
Crushers	50	60	4 x I_e	80 % / 300 ms	Coasting down	X	X
Disk saws/ribbon saws	30	60	4 x I_e	Deactivated (0 ms)	Coasting down	X	X

Notice
This table provides example set values. They serve as reference for informational purposes only and are non-binding. The set values depend on the particular application and must be optimized during commissioning.

Quick commissioning menu, when switching on for the first-time or after executing command "Factory settings"

Information on quick start menu
After supplying the control voltage for the first time, you will be automatically directed to the quick start menu. You must complete the entire quick start menu to commission the soft starter.
If you confirm the last item "Save settings?" with "yes" in the quick start menu, you can only return to this menu by resetting the device back to the basic factory settting. (See manual or operating instructions)
This overwrites all settings made up until that point.

Information on application selection:
Standard parameters are recommended on the basis of the set type of application.
If the required load is not listed, choose a fan in order to preselect the necessary start parameters.
In general:
The parameters are suggested settings.
The parameters may need to be optimized, as explained in the Section "Start command "Soft starter on".

Select language

Select application

Set the rated operating current of the motor

Set starting time

Set current limiting value

Save settings

Quick commissioning of the 3RW44 SIRIUS soft starter

Wiring control
- Control part and
- Performance part

Check and connect the voltages in the control and main circuits.

"Soft starter off"
Correct fault
(for possible faults see 3RW44 system manual, Chapter 7)

Fault message on display? — Yes

No

Initial parameterization or starter in basic factory settings?

No

Check set parameters in **Settings > Parameter set > Motor.**

Set starting and stopping parameters in **Settings > Parameter set > Starting or stopping settings** according to the Table "Suggested setting for commissioning" on the basis of the respective application.

Start command "Soft starter on"

"Soft starter off"
Correct fault
(for possible faults see 3RW44 system manual, Chapter 7)

Fault message in display — Yes

No

Does the motor immediately start softly?

No

Yes

Does the motor reach its nominal rotational speed quickly and within the desired time?

No

Yes

Switch off soft starter

---

1. "Soft starter off"
2. Increase starting time in menu item **Settings**, or
3. If current limiting has been set, possibly reduce current limiting value

The motor reaches its nominal rotational speed
- quicker than desired
- not softly
- if no current limiting has been set according to the specified ramp time

1. "Soft starter off"
2. Reduce starting time in menu item **Settings** or if current limiting has been set, increase the current limiting value.
3. If the torque control is active, check if the selected limiting torque is high enough (recommended ≥ 150 %)

The motor reaches its nominal rotational speed
- slower than desired,
- not at all (motor stuck)

1. "Soft starter off"
2. Increase the start voltage or start torque in menu item **Settings** or
3. if current limiting has been set, possibly increase the current limiting value

The motor
- hums and does not start immediately
- does not start at all (motor stuck)

1. "Soft starter off"
2. Decrease the start voltage or start torque in menu item **Settings**

The motor starts with a strong sudden increase in torque — No

Motor:

Motor:

Increase stopping time or decrease stopping torque

The motor comes to a stop abruptly, not softly. The water can be heard during the pumping operation.

Soft stopping Pump stop

Decrease stopping time

The motor keeps going for too long.

Increase DC braking torque or increase stopping time

The motor does not come to a standstill

DC braking

Reduce DC braking torque or reduce stopping time

The motor comes to a standstill but the braking current continues to flow. (Motor hums when at a standstill)

Increase dynamic braking torque

Yes

Does the motor continue to run during the braking process at a constant speed (no recognizable braking effect)?

No

Motor does not comes to a standstill or continues to run at a constant speed during the braking process.

Combined braking

Increase DC braking torque or increase stopping time

No

Reduce DC braking torque or reduce stopping time

The motor comes to a standstill but the braking current continues to flow. (Motor hums when at a standstill)

No

Which stopping mode is selected? — Coasting down

Pump stop, torque control, brakes

Motor comes to a standstill as desired

Yes

Save the changed parameters in the menu item: **Settings > Safety options > Save settings.**
End of commissioning

5.2.2 Quick Start Menu

Important

After applying the control supply voltage for the first time, you will automatically be in the quick start menu which you must go through once to commission the soft starter for the first time.

In the quick start menu you need to enter the information needed to preset the most important parameters of the soft starter for your application. Starting parameters for typical types of applications are stored in the device parameters. To achieve an optimum motor start, these parameters may need to be optimized on the basis of the connected load using the "Settings" menu item, as described in Chapter 5.4.3 "Specifying the Starting Mode".

If your particular load is not listed, select any load and optimize the defined parameters using the "Settings" menu item as described in Chapter 5.4.3 "Specifying the Starting Mode".

The factory setting values of the parameters and the predefined assignment of the control inputs and outputs are listed in Chapter 10.3 "Technical Data".

Important

If you confirm the last item "Save settings - execute?" with "Yes" in the quick start menu, you can only return to this menu by resetting the device back to the factory settings (refer to "Restoring the factory settings" on Page5-40.). This overwrites all settings made up until that point.

Quick start menu
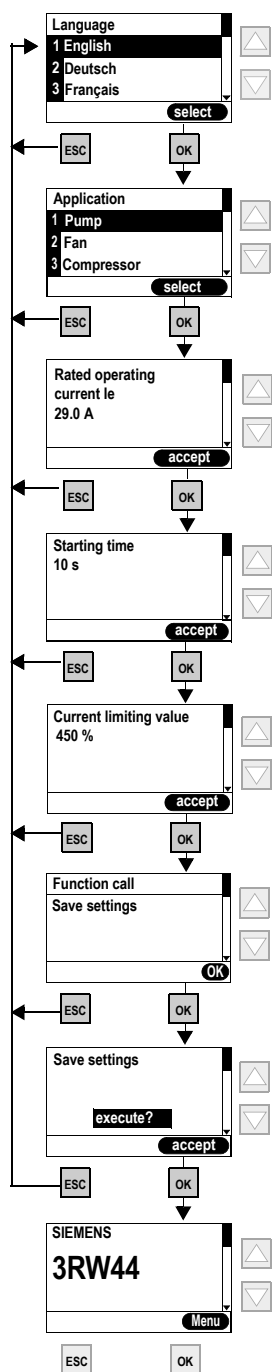
Figure 5-3:Quick start menu

5.3 User-specific Commissioning

If values are required that differ from the defined parameters in the quick start menu or in the factory settings of the 3RW44, please proceed as follows:

Under the "Settings" menu item select (refer to Chapter 5.3.1 "Main Menu Item "Settings""):

1. Select parameter set
2. Set motor data
3. Set starting mode and parameters
4. Set stopping mode and parameters
5. Set inputs and outputs
6. Check motor protection settings
7. Save settings

Notice
The setting is buffered in a Flash E-Prom memory as soon as you change a setting in the menu and execute it using the "OK" button. It is then active in the soft starter from this moment onwards. When the control supply voltage is switched off, this value will be canceled and the previous value restored. In order to permanently save the settings made in the soft starter, you must save the data as described in Chapter 5.3.1 "Main Menu Item "Settings"" and Chapter 5.4.14 "Saving Options".

5.3.1 Main Menu Item "Settings"
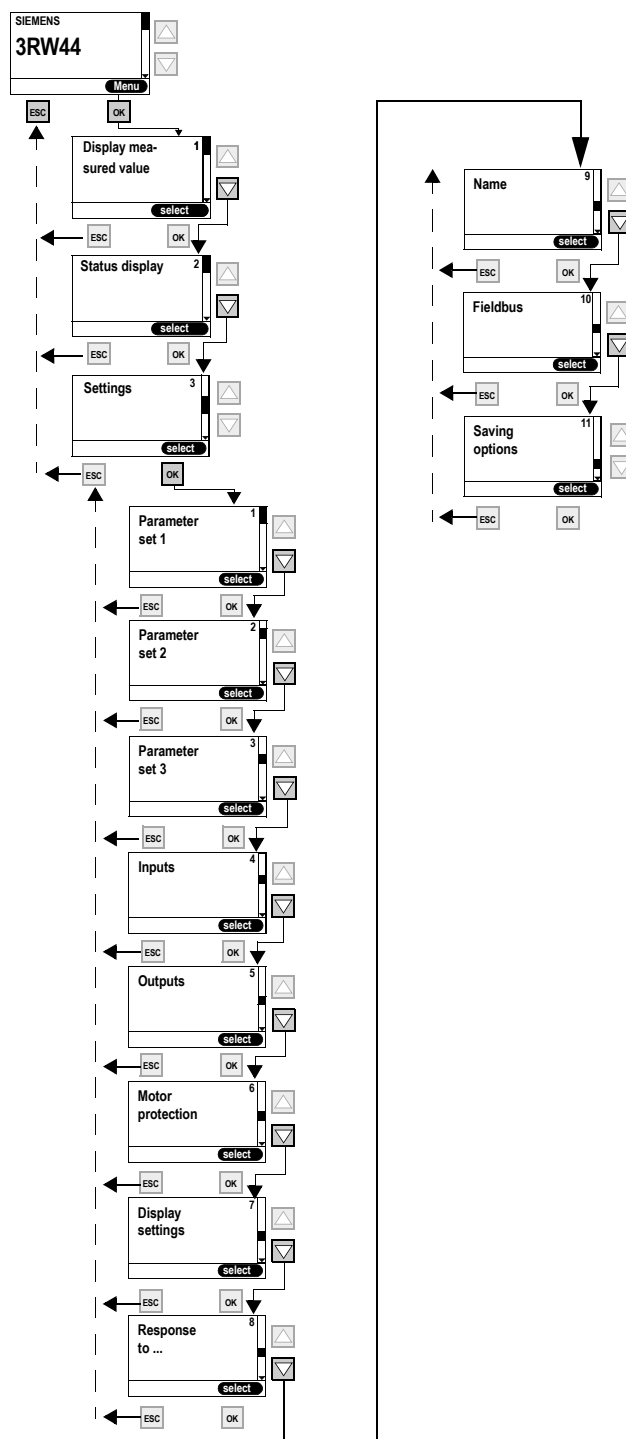
Figure 5-4: Main menu item "Settings"

5.4   Making Settings in the Selected Parameter Set

5.4.1 Selecting the Parameter Set
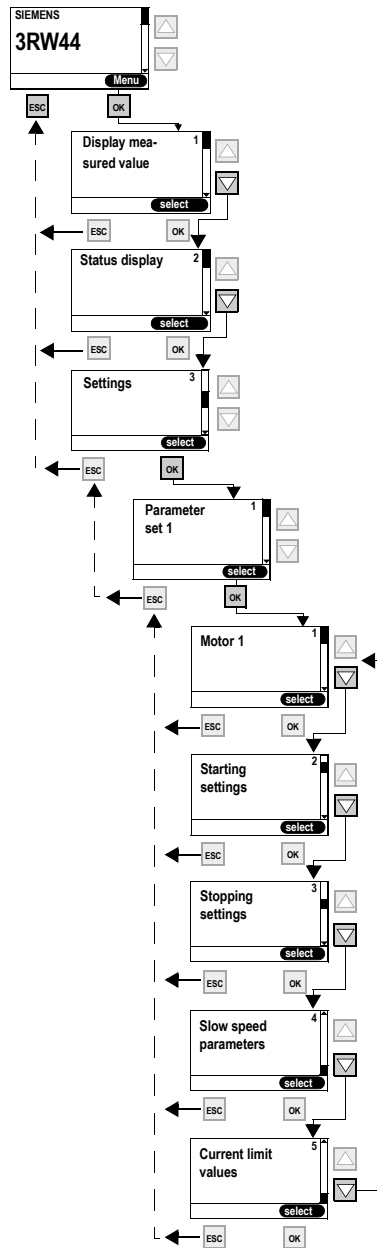
Figure 5-5: Selecting the parameter set

5.4.2 Entering the Motor Data
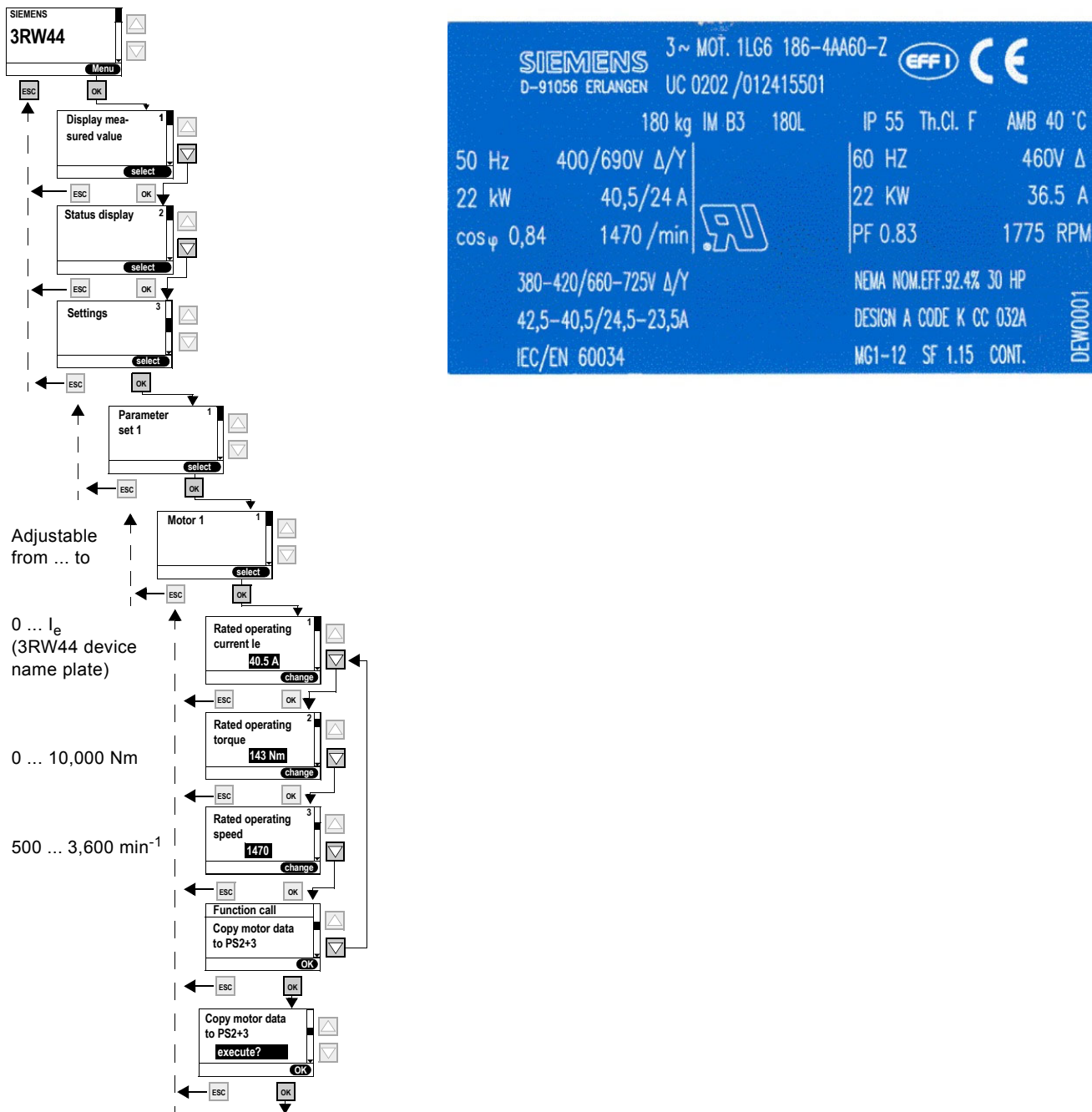
Figure 5-6: Entering the motor data and name plate

Rated operating current I_e	**Notice**
	Always set the rated operating current of the motor stated on the motor name plate for the prevailing supply voltage. This setting is independent of the connection method of the soft starter (soft starter in standard or inside delta circuit). Value to be set in the above example for a supply voltage of 400 V, e.g. 40.5 A.
	The motor current of the connected drive should be set to ensure proper functioning of the soft starter during starting and stopping as well as in regard to motor protection.

Rated torque   If the rated torque of the motor is not indicated on the name plate, it can be calculated using the following formula:

$$M = 9.55 \times P \times \frac{1000}{n}$$

Example

$$9.55 \times 22\,kW \times \frac{1000}{1470\,min^{-1}} = 143\,Nm$$

If no value is specified, the value of the factory setting is active (0 Nm).
When the start command is given and the motor is connected, the required value is automatically calculated once by the soft starter.

Notice
If a motor is connected to the soft starter (e.g. for testing purposes) whose rated data (current, speed, torque) differs from the values already entered, these rated data must be adapted to the new motor. If 0 Nm is entered as the rated torque, the value is automatically calculated once by the soft starter.

5.4.3 Specifying the Starting Mode
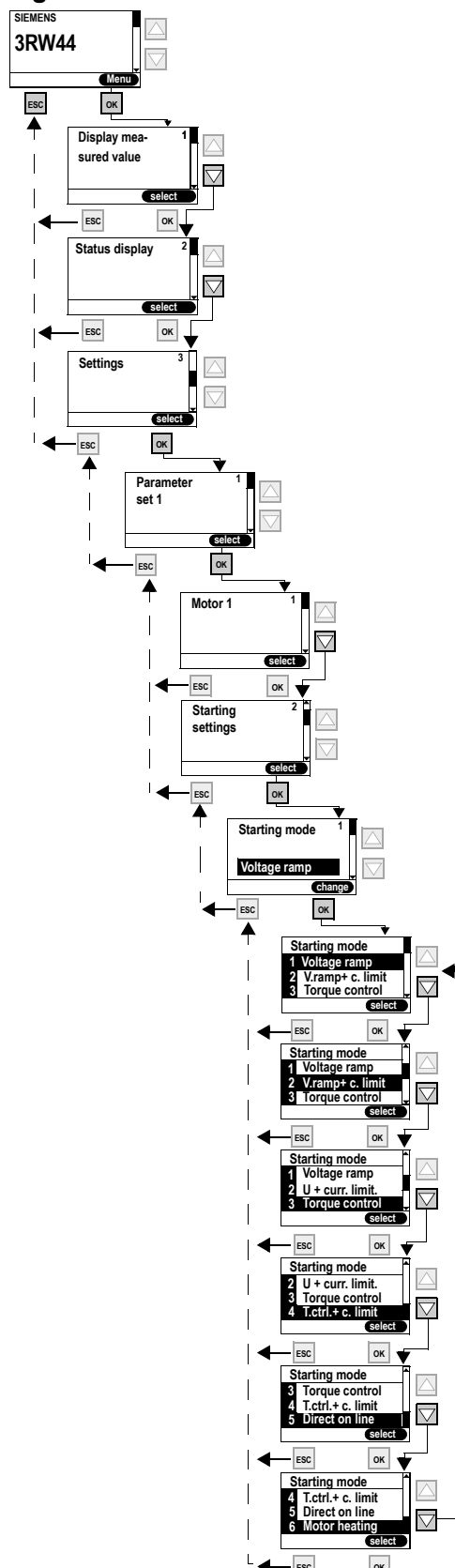
Figure 5-7: Specifying the starting mode

"Voltage ramp" starting mode
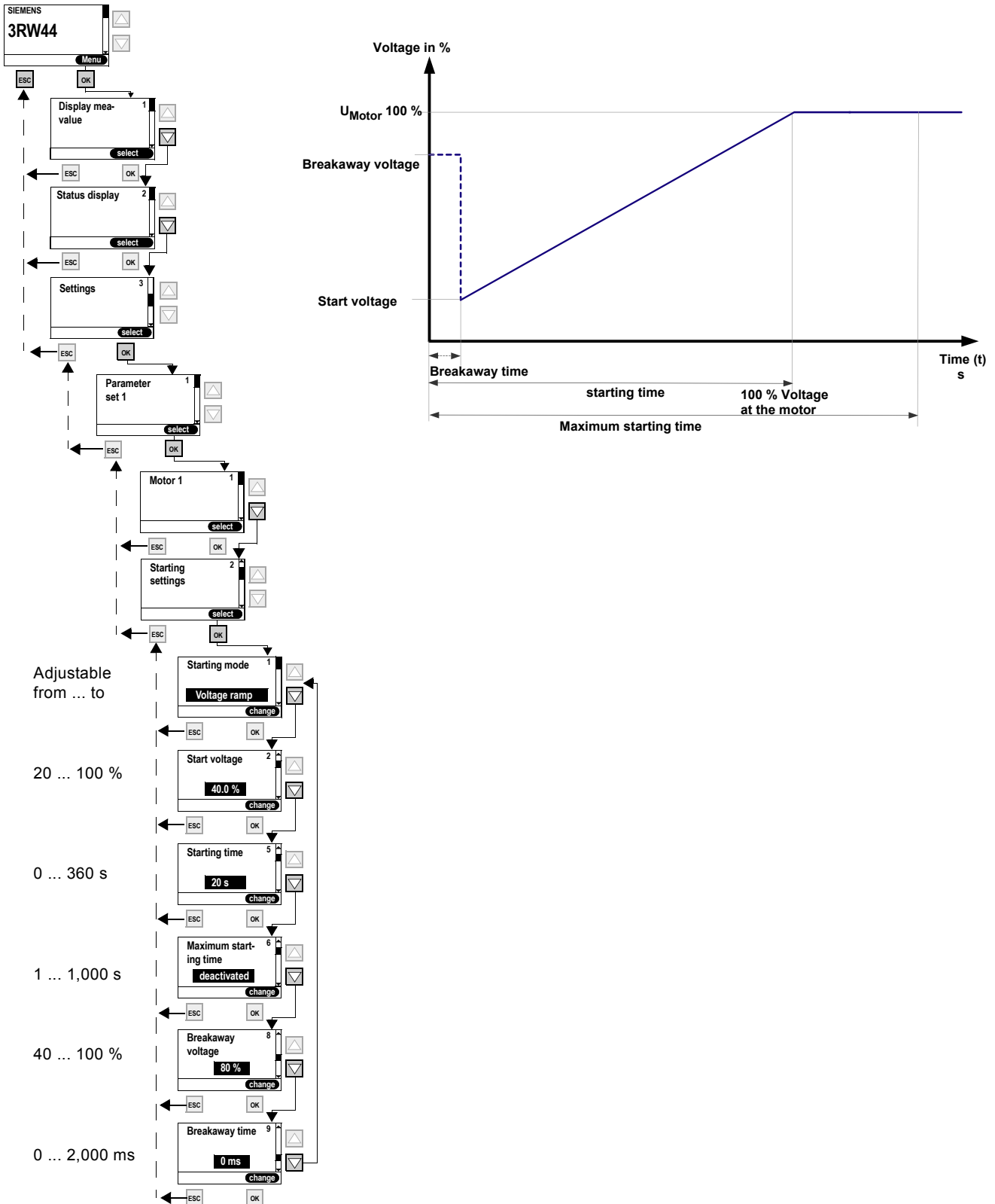
Figure 5-8:"Voltage ramp" starting mode

"Voltage ramp with current limiting"starting mode
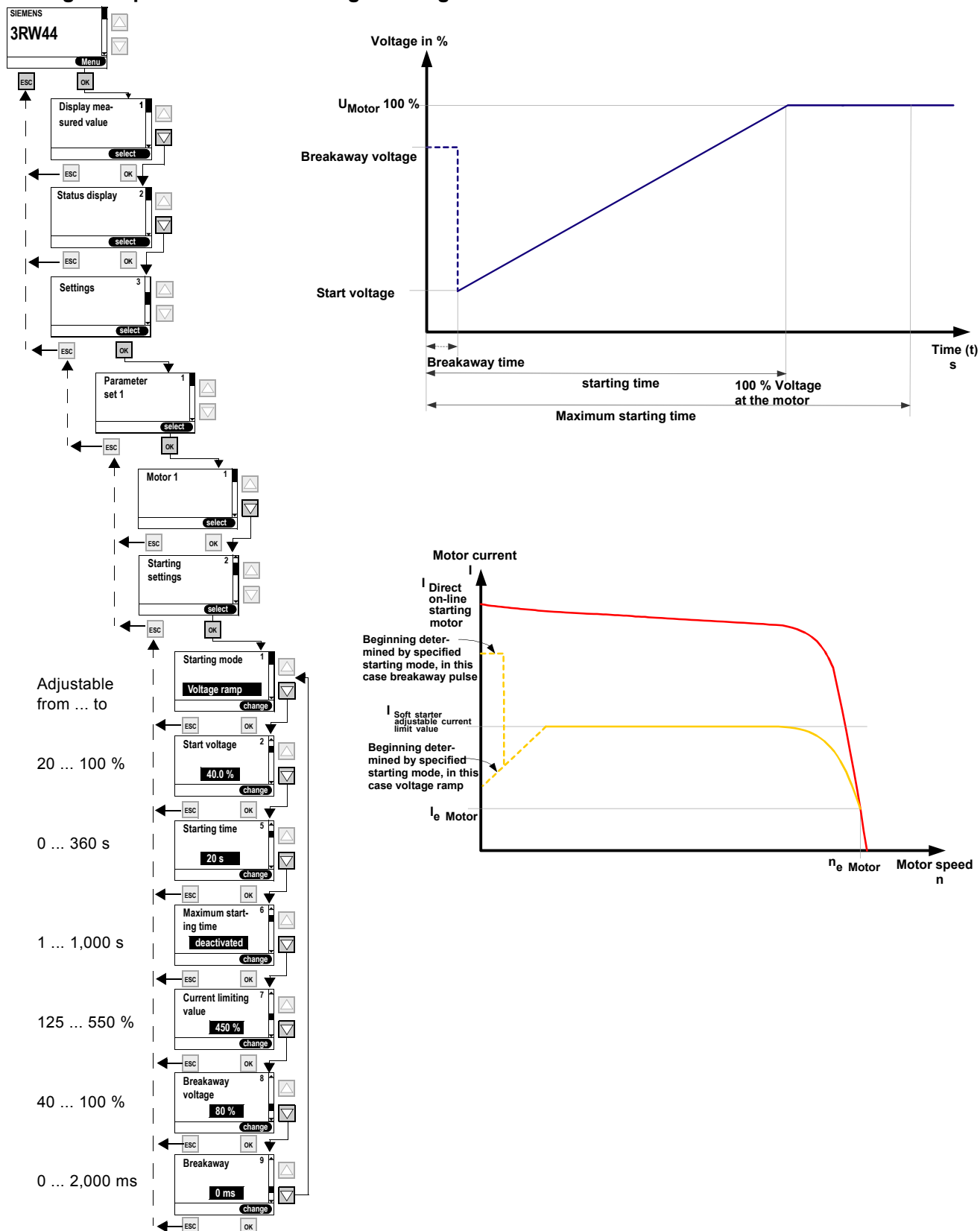
Figure 5-9:"Voltage ramp with current limiting" starting mode

"Torque control" starting mode

SIEMENS
3RW44
Menu

ESC   OK

Display measured value 1
select

ESC   OK

Status display 2
select

ESC   OK

Settings 3
select

ESC   OK

Parameter set 1 1
select

ESC   OK

Motor 1 1
select

ESC   OK

Starting settings 2
select

ESC   OK

Adjustable from ... to

Starting mode 1
Torque control
change

ESC   OK

10 ... 100 %

Start torque 3
50.0 %
change

ESC   OK

20 ... 200 % *

Limiting torque 4
150 %
change

ESC   OK

0 ... 360 s

Starting time 5
20 s
change

ESC   OK

1 ... 1,000 s

Maximum starting time 6
deactivated
change

ESC   OK

40 ... 100 %

Breakaway voltage 8
80 %
change

ESC   OK

0 ... 2,000 ms

Breakaway time 9
0 ms
change

ESC   OK

Motor torque (M) Nm

Breakaway voltage

Limiting torque

M_{Nom}

Start torque

Time (t) s

Breakaway time

Starting time

Maximum starting time

① $M_{Direct\ on\text{-}line\ starting}$
(maximum torque to be generated)

Limiting torque

* Notice
In order to start the motor, the parameter value should be set to about 150 %. It should be high enough to ensure that the motor does not get stuck during startup. This ensures that enough acceleration torque is generated throughout the entire motor run-up phase.

Figure 5-10:"Torque control" starting mode

SIRIUS 3RW44 System Manual

"Torque control with current limiting" starting mode
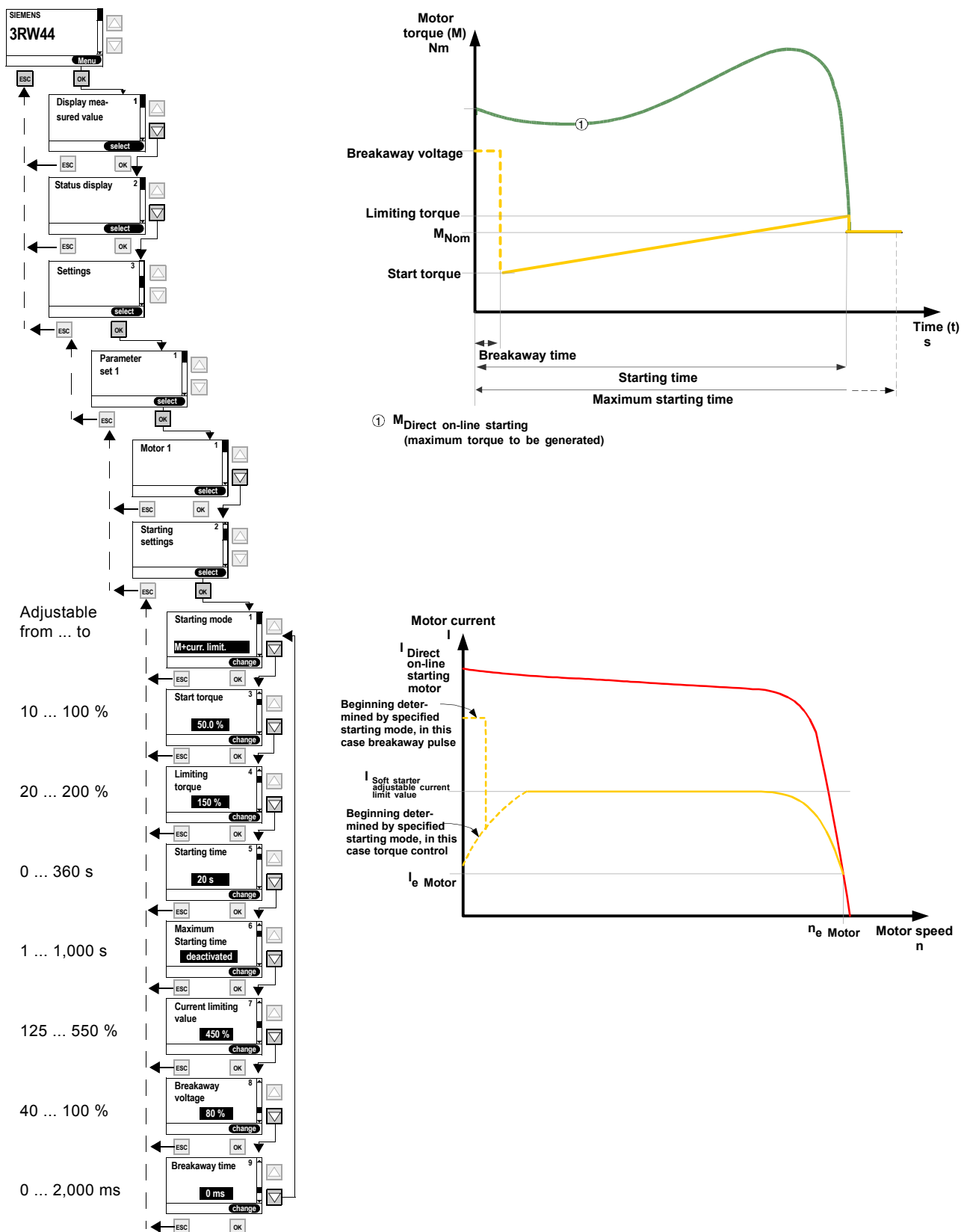
Figure 5-11:"Torque control with current limiting" starting mode

"Direct on-line starting" starting mode
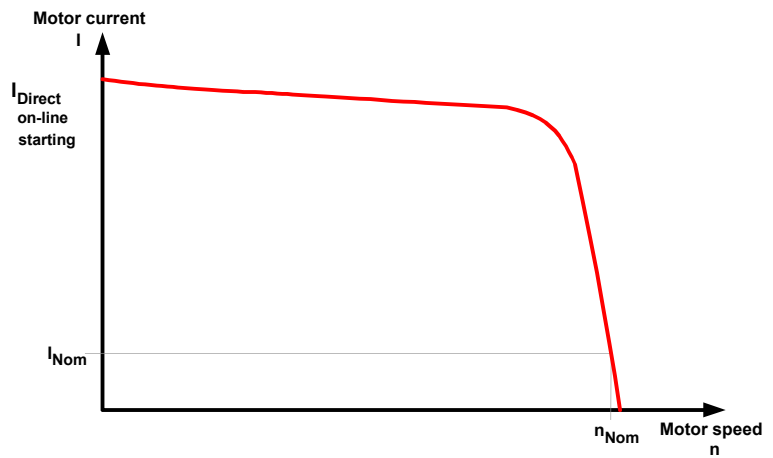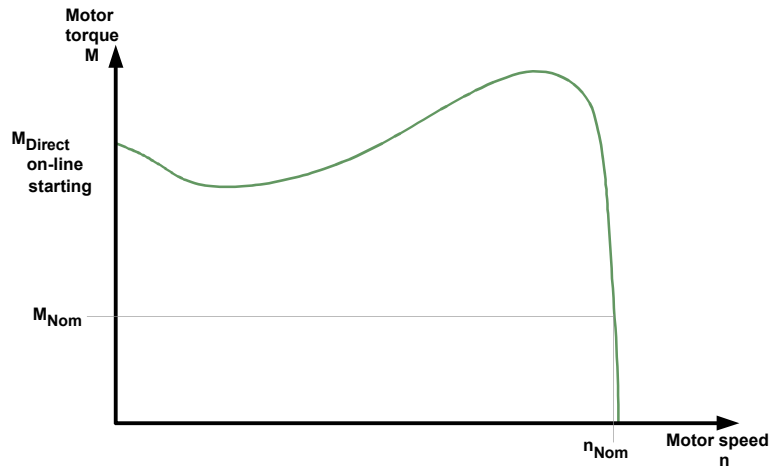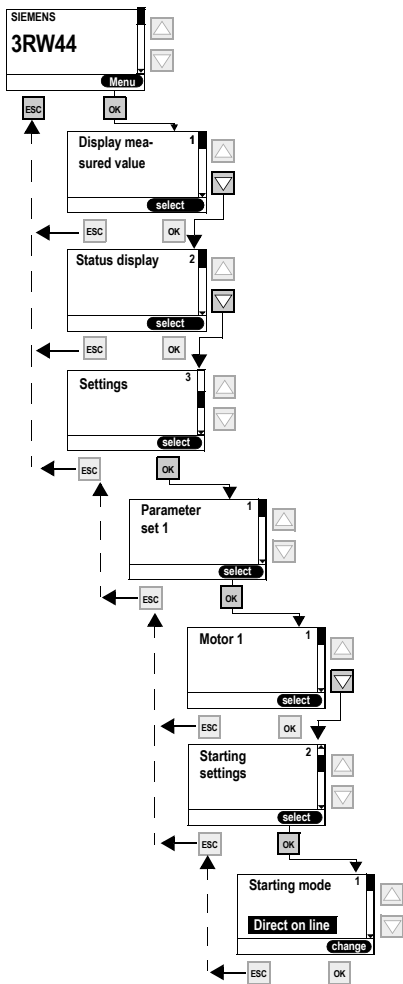
Figure 5-12:"Direct on-line starting" starting mode

"Motor heating" starting mode

Adjustable from ... to

10 ... 100 %
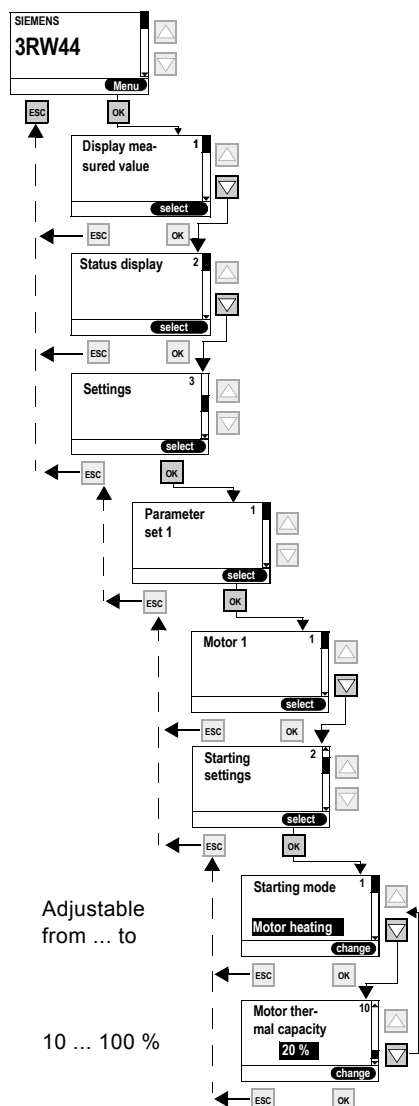
Motor thermal capacity

Caution
May lead to damage to property.
The "Motor heating" starting mode is not a continuous operating mode. The motor must be equipped with a temperature sensor (Thermoclick/PTC) to ensure motor protection. The motor model with integrated electronic motor overload protection is not suitable for this kind of operation.

Figure 5-13:"Motor heating" starting mode

5.4.4 Specifying the Stopping Mode
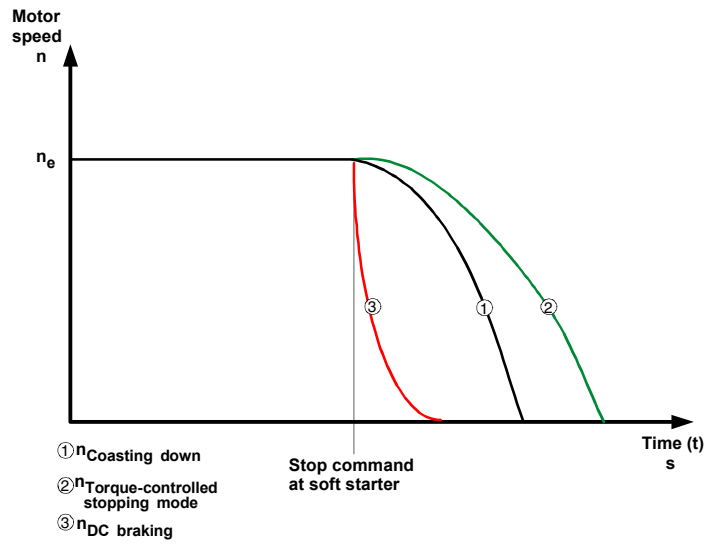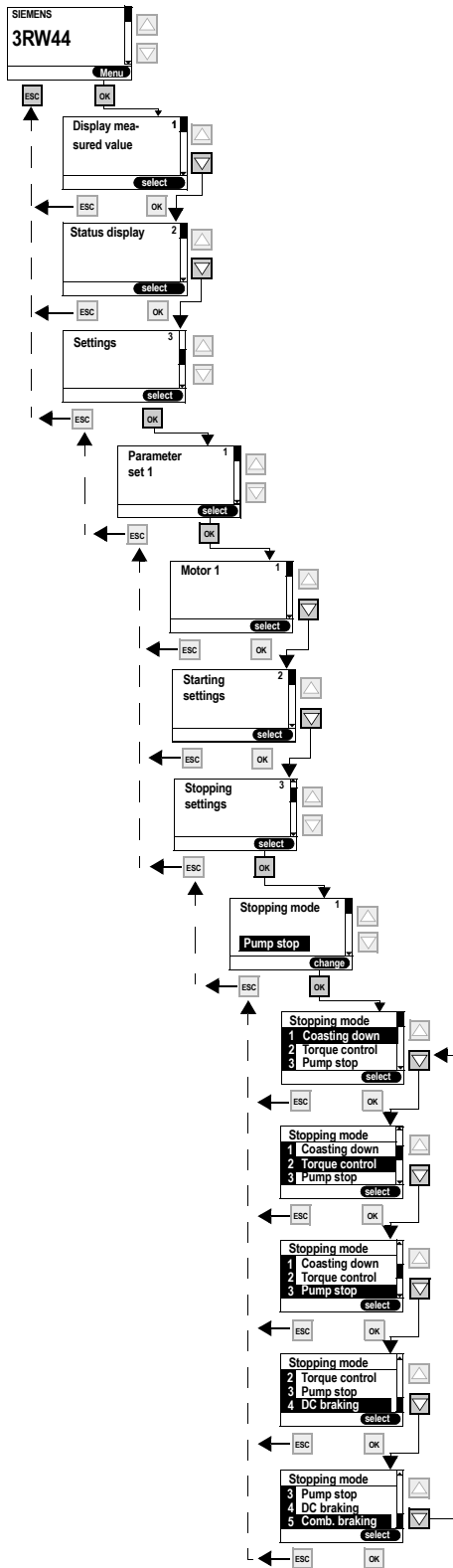
Figure 5-14: Specifying the stopping mode

"Coasting down" stopping mode
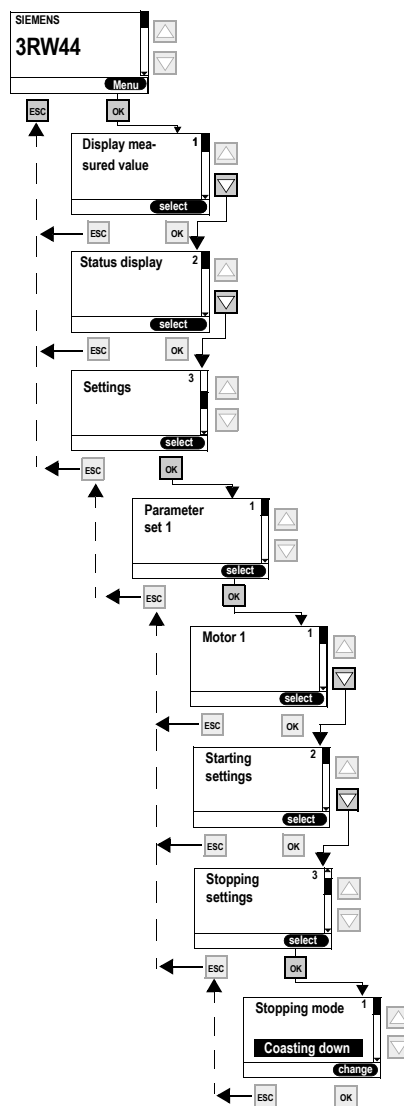
Figure 5-15:"Coasting down" stopping mode

"Torque control" stopping mode (soft stop)
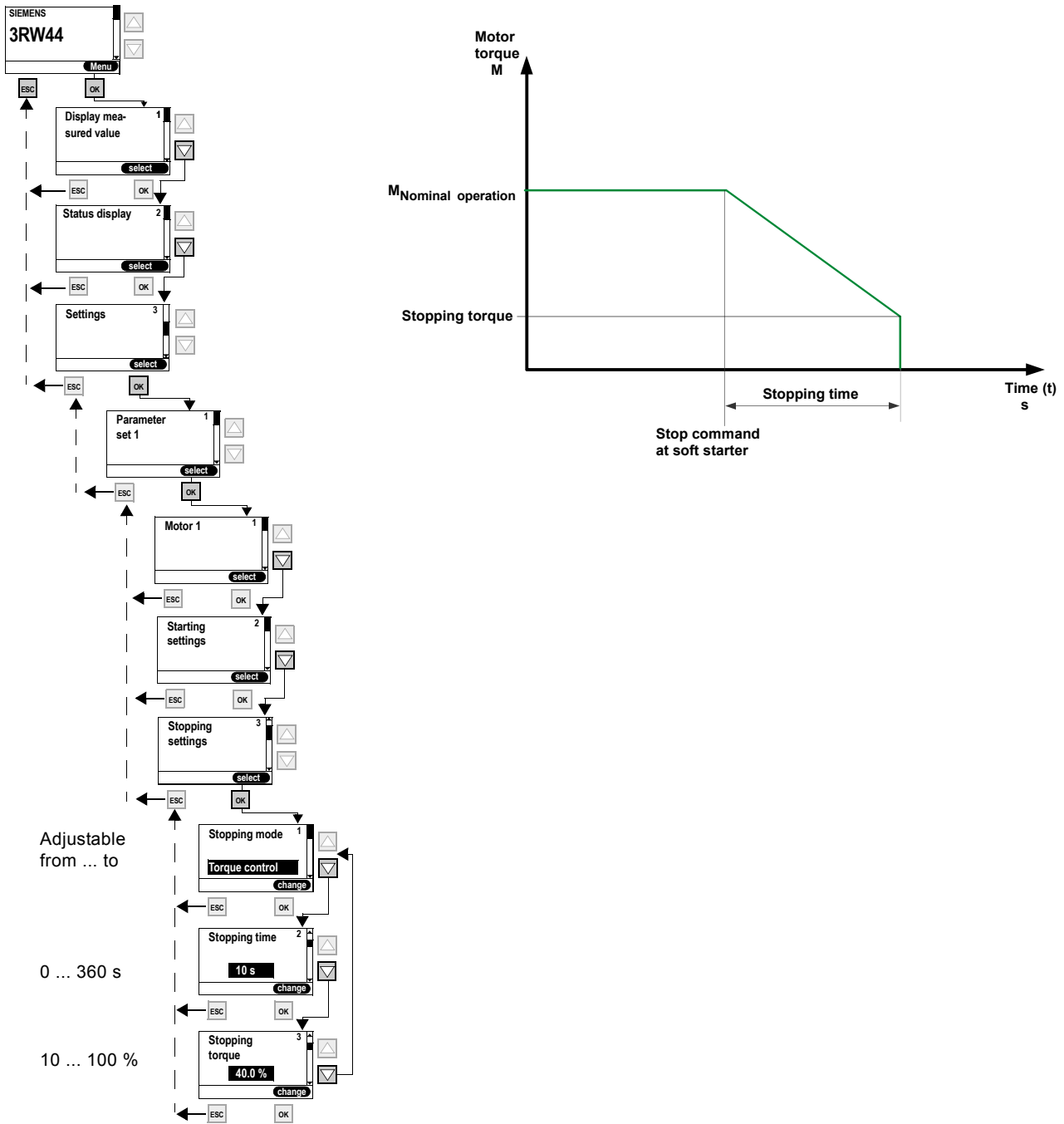
Figure 5-16:"Torque control" stopping mode

"Pump stop" stopping mode
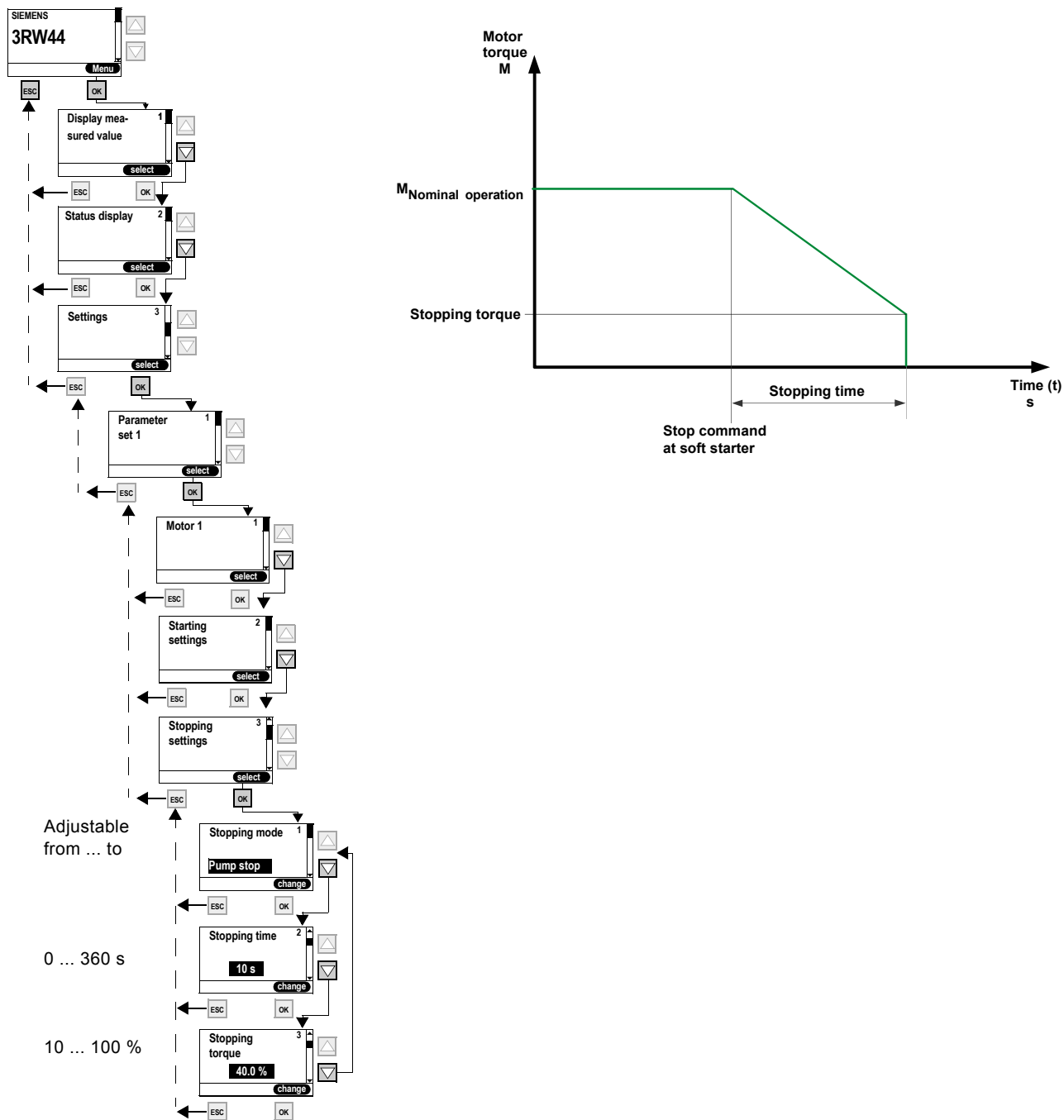
Figure 5-17:"Pump stop" stopping mode

"DC braking" stopping mode
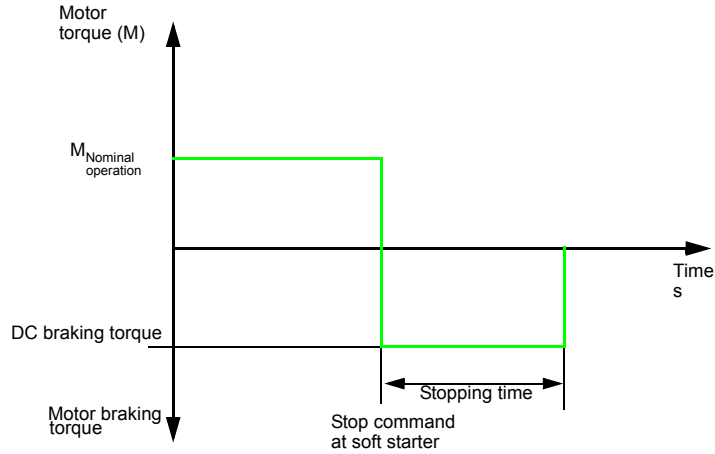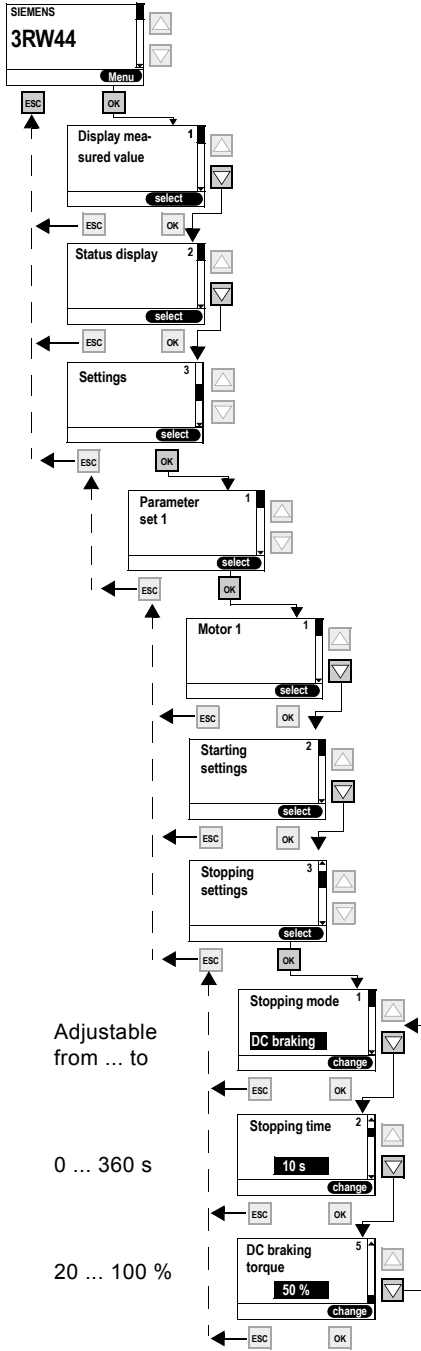
Notice
DC braking stopping function / combined braking is not possible in an inside delta circuit.

Figure 5-18: "DC braking" stopping mode

Note
If the "DC braking" function is selected, the "DC brake contactor" function must be assigned to one output of the soft starter. This output is used to control an external brake contactor.

"Combined braking" stopping mode

Motor torque M

M_{Nominal operation}

Stop command at soft starter

Stopping time

Time (t) s

DC braking torque

Dynamic braking torque

Motor braking torque

SIEMENS

3RW44

Menu

ESC OK

Display measured value 1

select

ESC OK

Status display 2

select

ESC OK

Settings 3

select

ESC OK

Parameter set 1 1

select

ESC OK

Motor 1 1

select

ESC OK

Starting settings 2

select

ESC OK

Stopping settings 3

select

ESC OK

Adjustable from ... to

Stopping mode 1

Comb. braking

change

ESC OK

0 ... 360 s

Stopping time 2

10 s

change

ESC OK

20 ... 100 %

Dynamic braking torque 4

50 %

change

ESC OK

20 ... 100 %

DC braking torque 5

50 %

change

ESC OK

Notice

DC braking stopping function / combined braking is not possible in an inside delta circuit.

Figure 5-19:"Combined braking" stopping mode

5.4.5 Setting Slow Speed Parameters

Figure 5-20:Setting slow speed parameters
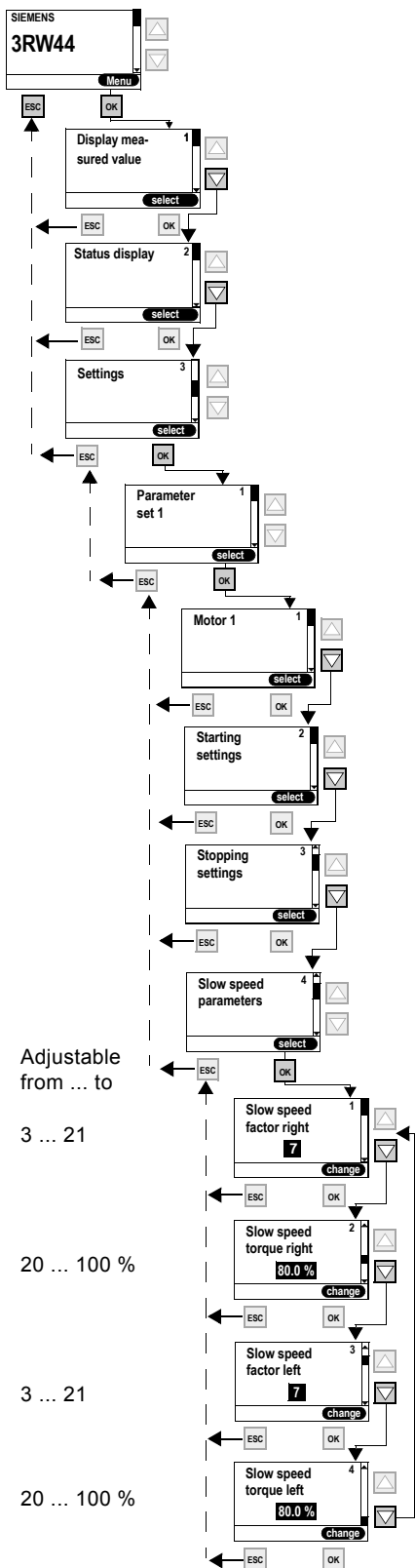
Slow speed parameters

Note
To control the motor with the specified slow speed parameters, "Slow speed" must be assigned to one control input, and "Motor right PS1/2/3" or "Motor left PS1/2/3" must be assigned to the other. Also refer to the circuit suggestion in 8.1.7.

Directions of rotation:
Right: rotation in line phase direction
Left: rotation counter-clockwise to the line phase direction

5.4.6 Specifying Current Limits
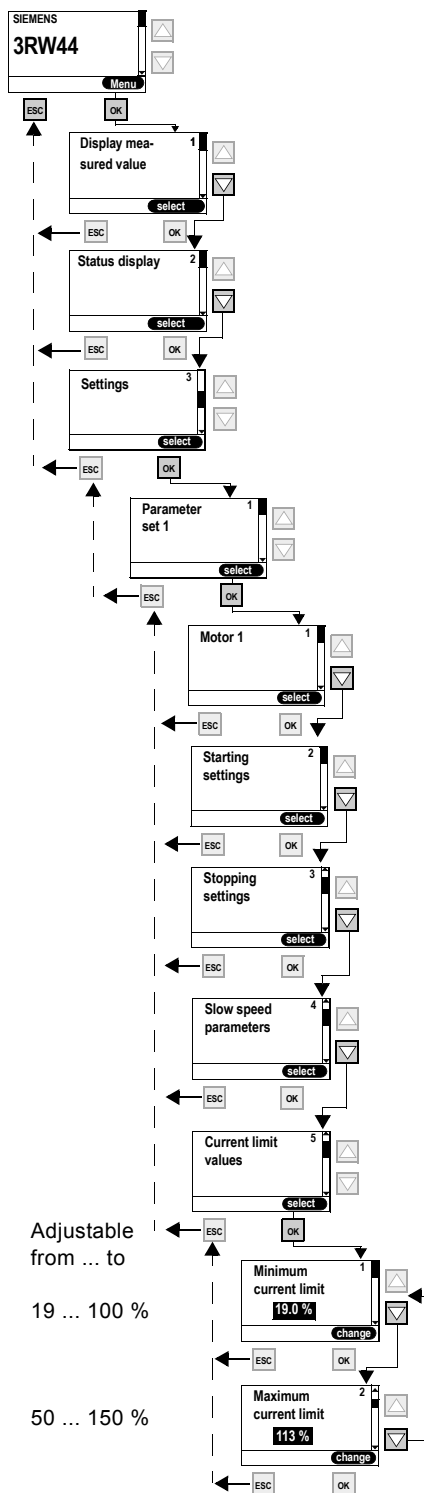
Figure 5-21: Specifying current limits

5.4.7 Parameterizing the Inputs

Note
An input action can only be altered if the respective input is inactive.

Parameterization options for control inputs 1 ... 4

No action [1]
Manual op. local [2]
Emergency start [3]
Slow speed [4]
Quick stop [5]
Trip Reset [6]
Motor right parameter set 1 [7]
Motor left parameter set 1 [8]
Motor right parameter set 2 [7]
Motor left parameter set 2 [8]
Motor right parameter set 3 [7]
Motor left parameter set 3 [8]

Notice
If one action is assigned to two different inputs, both of the inputs must be connected to carry out the selected function (e.g. to obtain logical "AND" linking for a start command, assign the "Motor right PS1" function to both input 1 and 2. A start command is only accepted if both inputs are active.).

Notice
If the soft starter is switched off via a motor protection or device protection tripping, the action cannot be acknowledged using the "Trip reset" function until the displayed cooling time has expired.

Explanation of the possible parameters:
[1] No action:
Input without function.
[2] Manual operation local:
When operated with Profibus, the soft starter control can be transmitted to the inputs by activating the input control. The control functions via Profibus are deactivated during this time.
[3] Emergency start:
Error: Current unbalance exceeded, thermal motor model overload, temperature sensor open, temperature sensor short, temperature sensor overload, maximum starting time exceeded, current limit exceeded/undershot, ground fault, impermissable le / class setting: In the case of these faults, the motor can be started via the emergency start function despite a pending group error input. An emergency start action will be assigned to one input, "Motor right > parameter set 1" e.g. assigned to another. The emergency start is active as long as the input is activated. It can also be activated during operation.
[4] Slow speed:
The motor starts with the values set under the "Slow speed parameters" menu item when the "Slow speed" input and the "Motor right/left parameter set 1/2/3" input are activated at the same time.
[5] Quick stop:
If the input is activated, an operational tripping with the currently set stopping function is carried out (no group error appears). The quick stop is carried out independently of the control priority.
[6] Trip reset:
Pending faults can be acknowledged after rectification.
[7] Motor right parameter set 1/2/3:
The motor starts (with rotation in line phase direction) and stops with the values stored in the respective parameter set.
[8] Motor left parameter set 1/2/3:
This function is active only when the Sslow speed" parameter is active at the same time. The motor starts with the values stored under the "Slow speed parameters" menu item (with rotation counter-clockwise to the line phase direction).

Figure 5-22:Parameterizing the inputs

5.4.8 Parameterizing the Outputs

SIEMENS
3RW44
Menu

ESC | OK

Display measured value 1
select

ESC | OK

Status display 2
select

ESC | OK

Settings 3
select

ESC | OK

Parameter set 1 1
select

ESC | OK

Parameter set 2 2
select

ESC | OK

Parameter set 3 3
select

ESC | OK

Inputs 4
select

ESC | OK

Outputs 5
select

ESC | OK

Output 1 - Action 1
On time motor
change

ESC | OK

Output 2 - Action 2
No action
change

ESC | OK

Output 3 - Action 3
No action
change

ESC | OK

Parameterization options
for relay outputs 1 ... 3

No action
PIO Output 1
PIO Output 2
Input 1
Input 2
Input 3
Input 4
Run up
Operation/bypass
Coasting down
On time motor
Comm. motor-on
DC brak. contact.
Group warning
Group error
Bus error
Device error
Power on
Ready to start

Figure 5-23:Parameterizing the outputs

Status diagram of the outputs
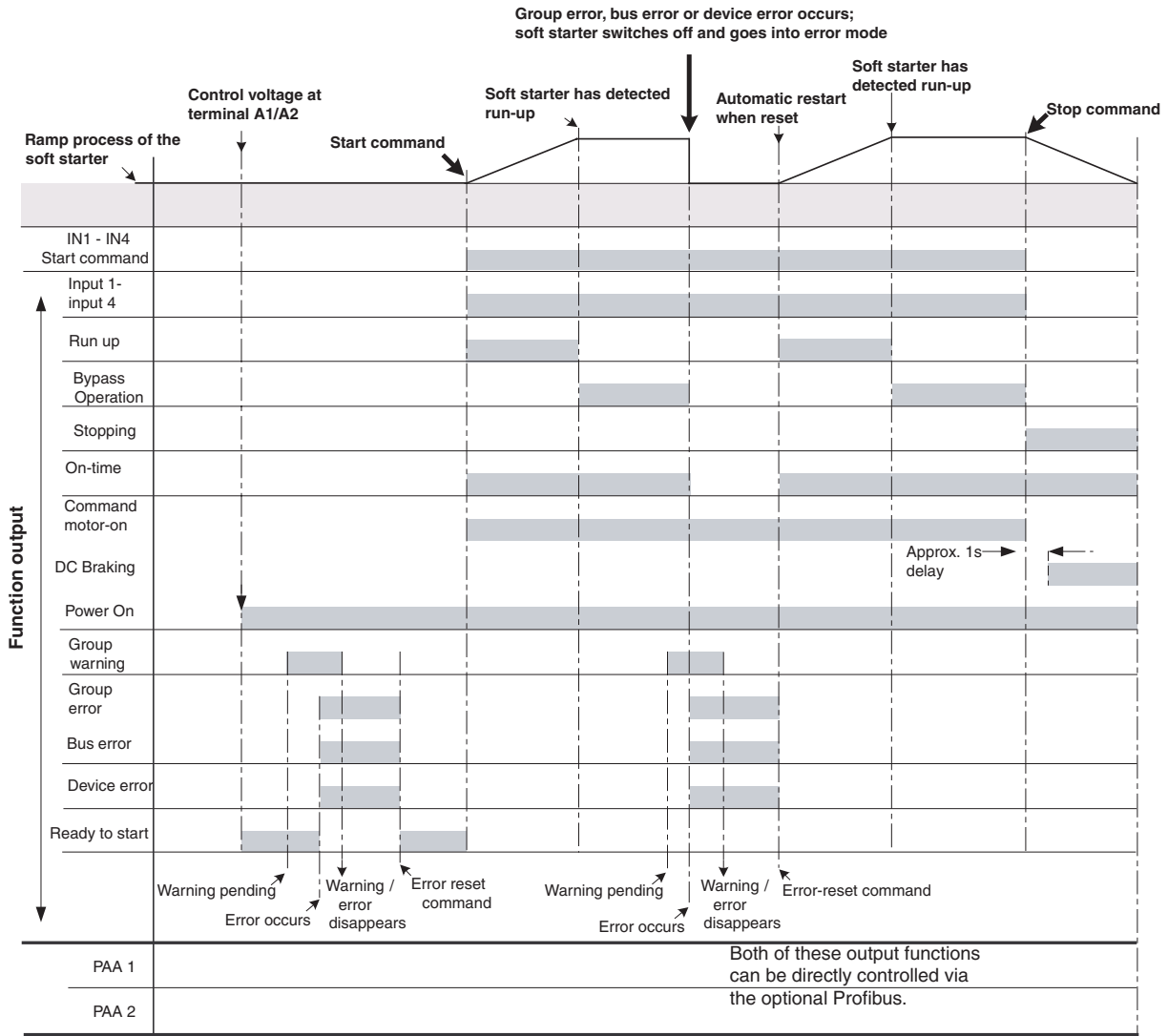
5.4.9 Selecting Motor Protection Settings
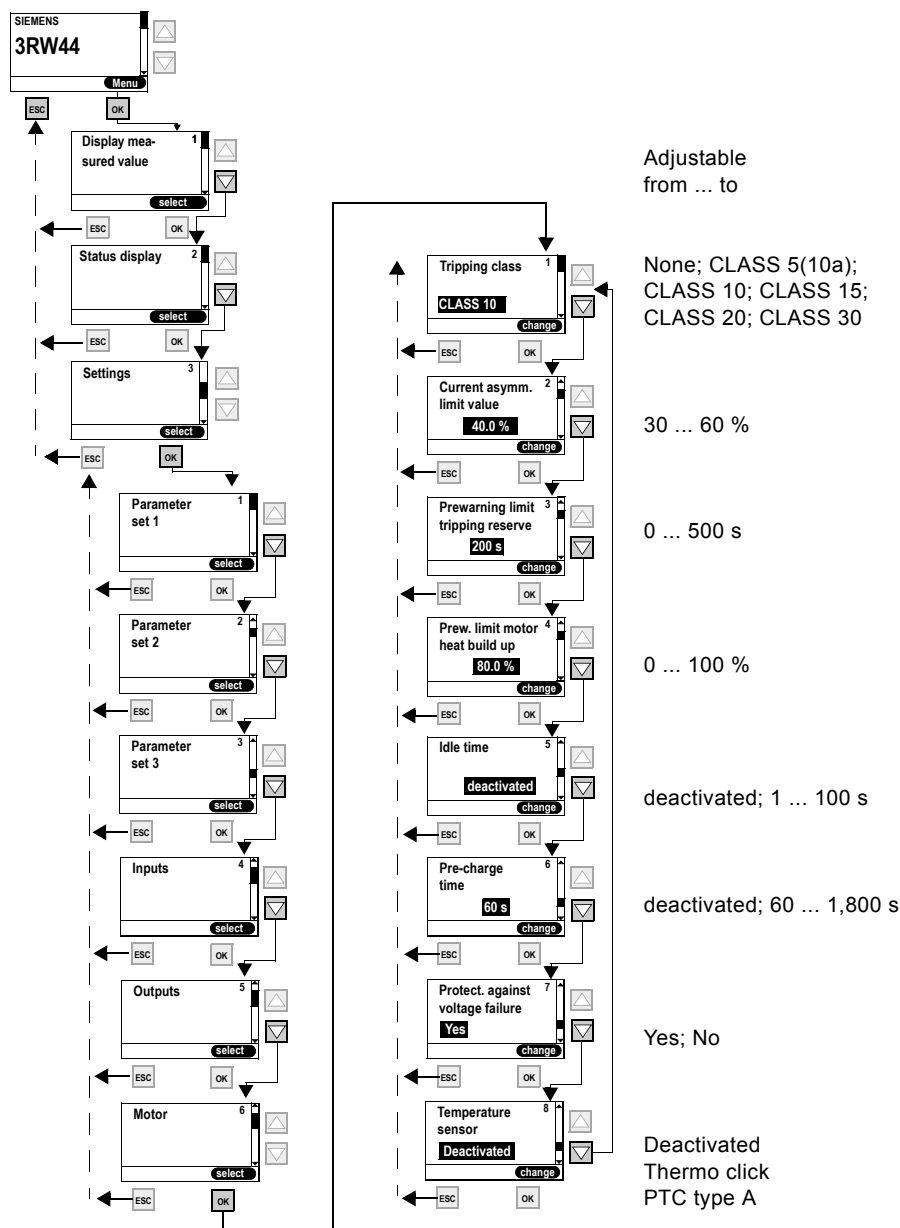
Figure 5-24:Selecting motor protection settings

Notice

In the case of heavy starting and set values of the tripping class $\geq$ CLASS 20, we recommend setting the "Prewarning limit tripping reserve" parameter value to 0 s (deactivated) and increasing the parameter "Prewarning motor temperature" to 95 % Otherwise, a warning message regarding motor protection will be issued when starting.

Notice

If CLASS settings other than 5(10a) or 10 are selected, it may be necessary to check and adjust the set values for the rated operating current I_e of the motor (Chapter 5.4.2 "Entering the Motor Data") in all 3 parameter sets, since otherwise the error message "Impermissible Ie/ CLASS settings" may be issued.

For the maximum permissible set value for the rated operating current I_e of the motor in regard to the CLASS settings please refer to Chapter 10.3.2 "Technical Data Power Unit".

Notice

Use of the 3RW44 to operate motors in hazardous areas:

The 3RW44 does not have an ATEX certificate. When an ATEX certified overload relay is used (e.g. 3RB2 from Siemens), which affects an additional device (e.g. contactor), the 3RW44 can be installed in series to this overload relay so that the ATEX requirements are met.

Important

The internal motor overload protection of the SIRIUS 3RW44 soft starter must be deactivated for this kind of installation! (Set value under the menu item Motor protection/ Tripping class: "None" and Motor protection/Temperature sensor: "Deactivated")

5.4.10 Selecting Display Settings
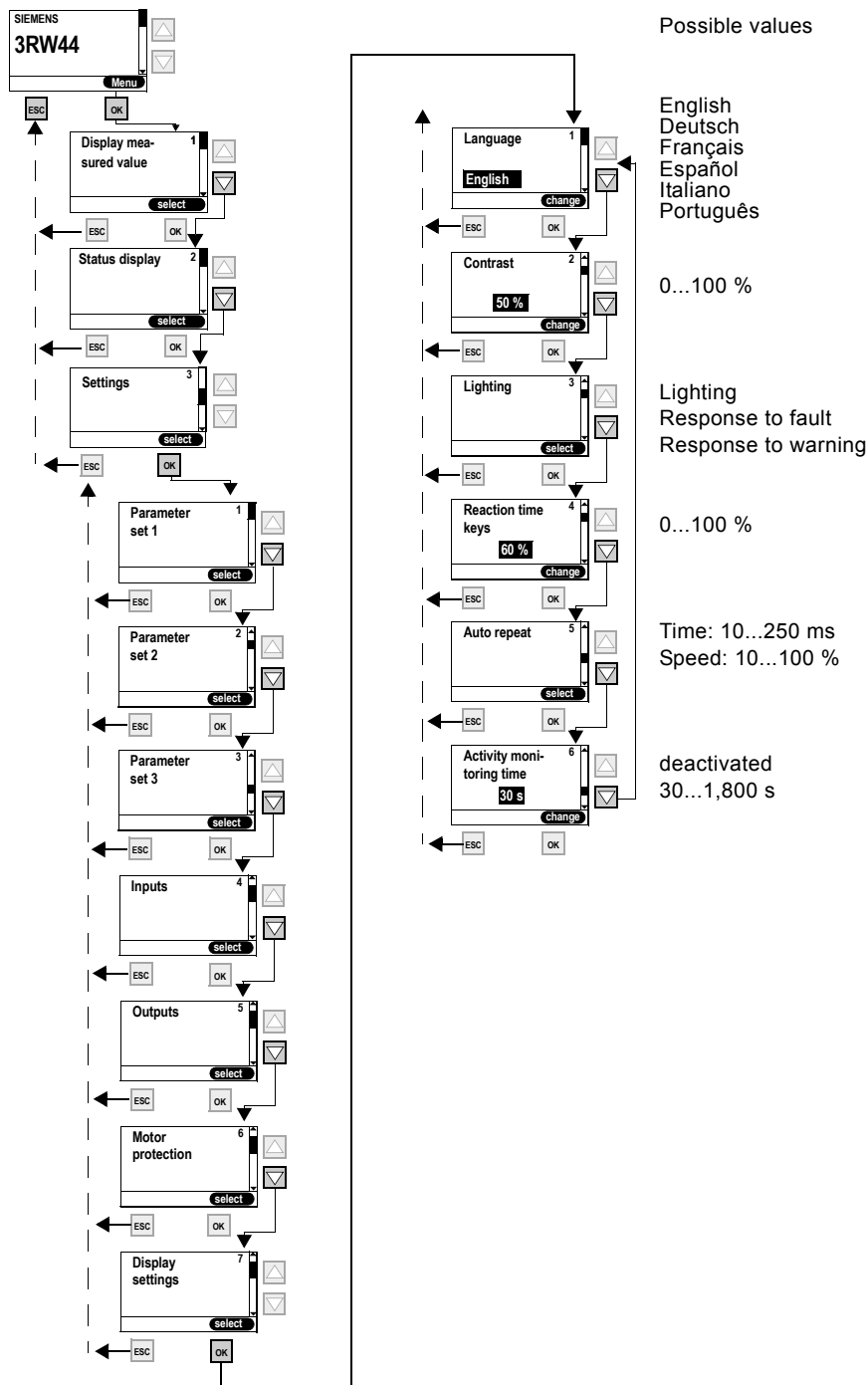
Figure 5-25: Selecting display settings

5.4.11 Specifying the Behavior of the Protective Functions
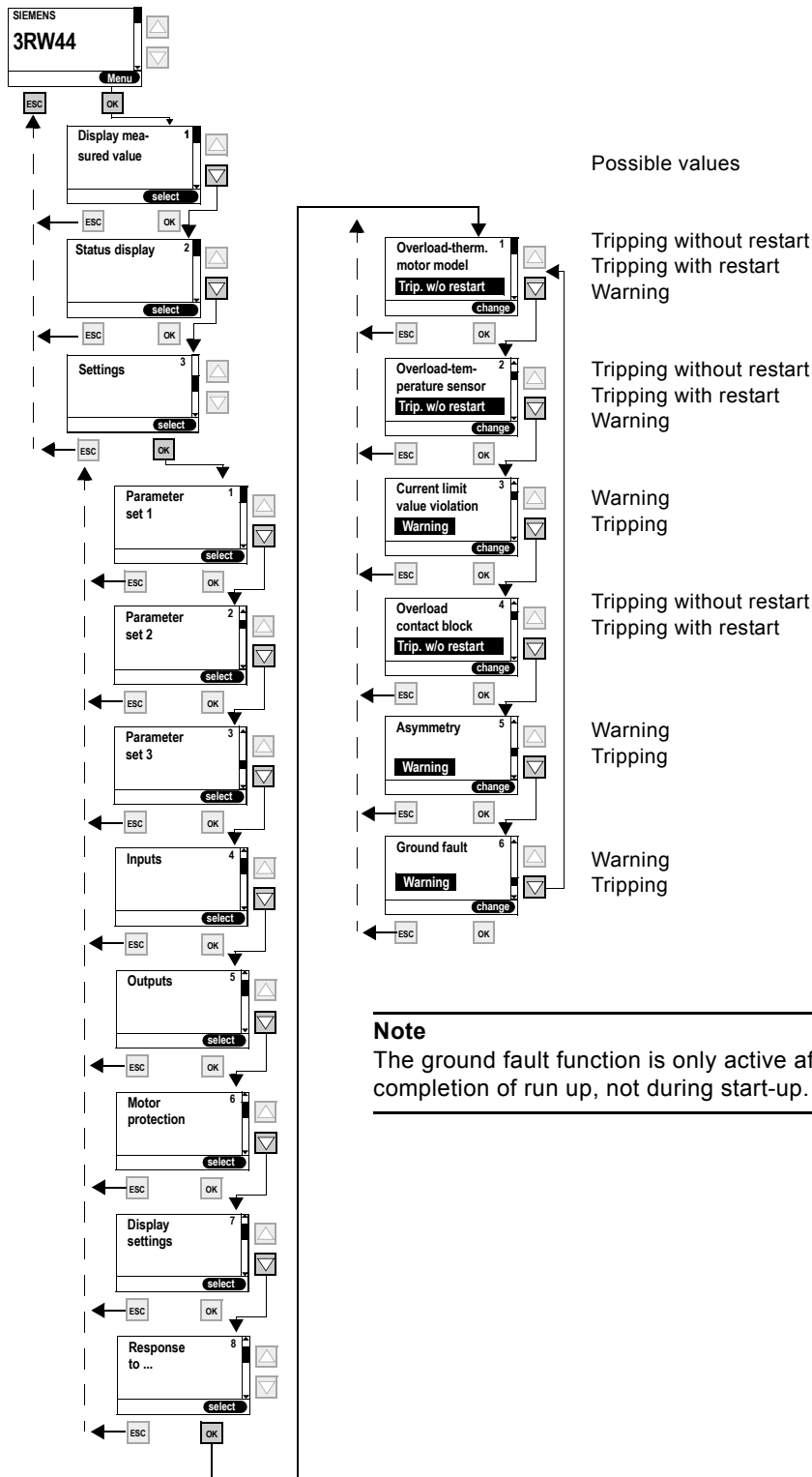
Figure 5-26: Specifying the behavior of the protective functions

5.4.12 Specifying the Names on the Device Display
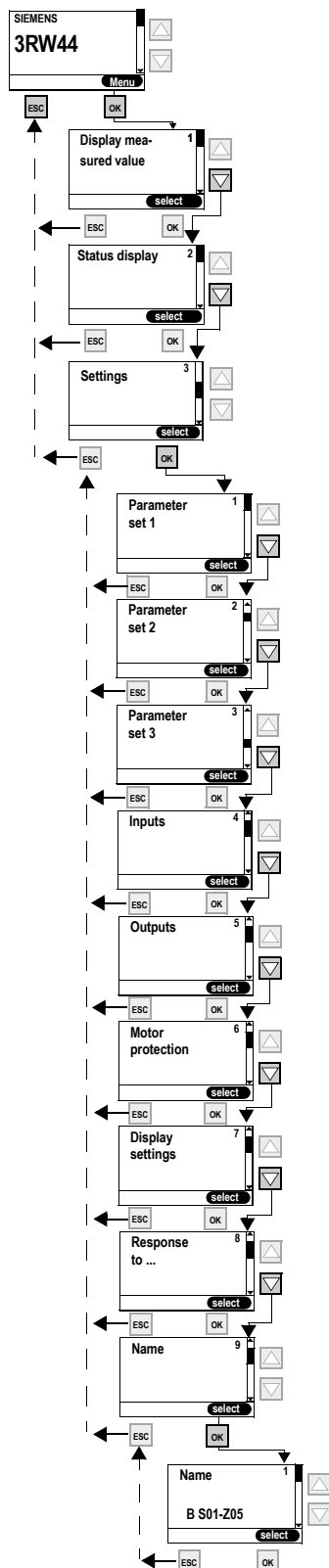
Figure 5-27: Specifying the names on the device display

5.4.13 Activating the Field Bus Interface (PROFIBUS DP)

For information on activating the field bus interface, please refer to Chapter 8.4 "Activating the PROFIBUS DP Communication Module (Field Bus Interface) and Setting the Station Address".
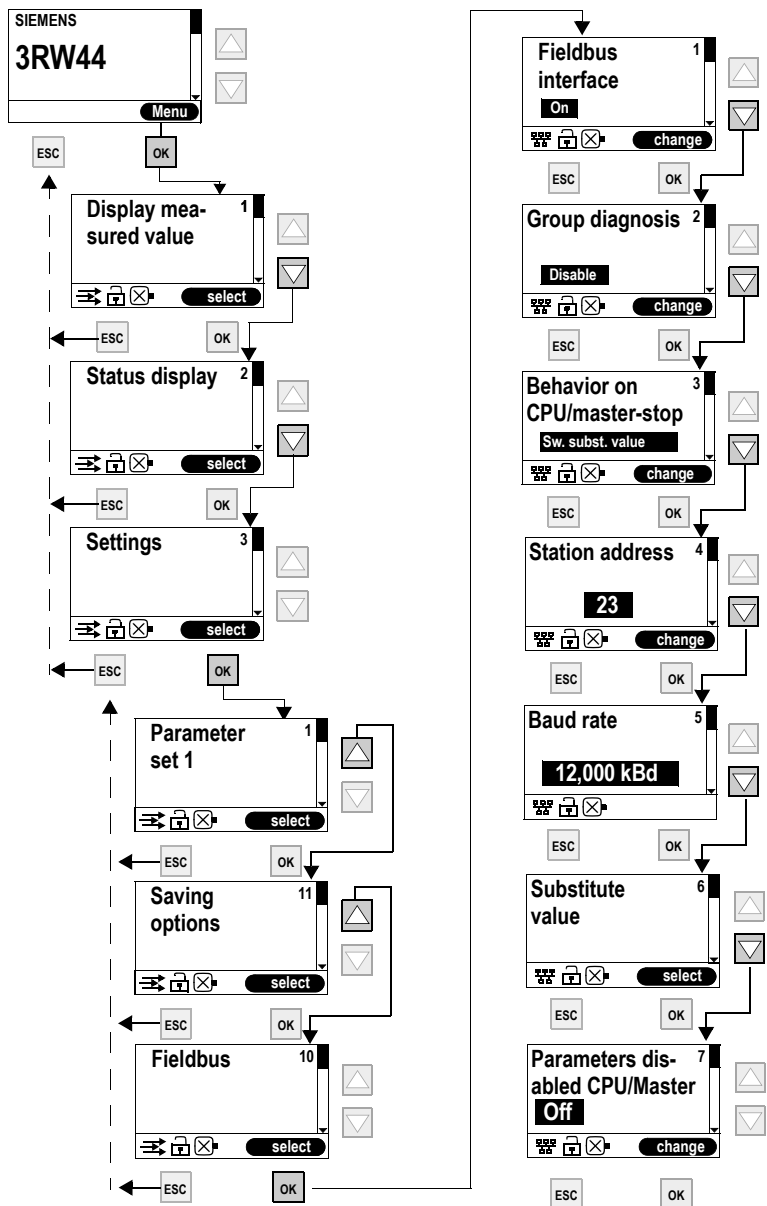
Notice
If the parameter "Parameters disabled CPU/Master" is set to "Off" (factory setting), the parameters set on the soft starter will be overwritten with the values stored in the GSD data or in the OM when the bus is started. If this is not desired, the parameter must be set to "On".

5.4.14 Saving Options

Specifying the saving options
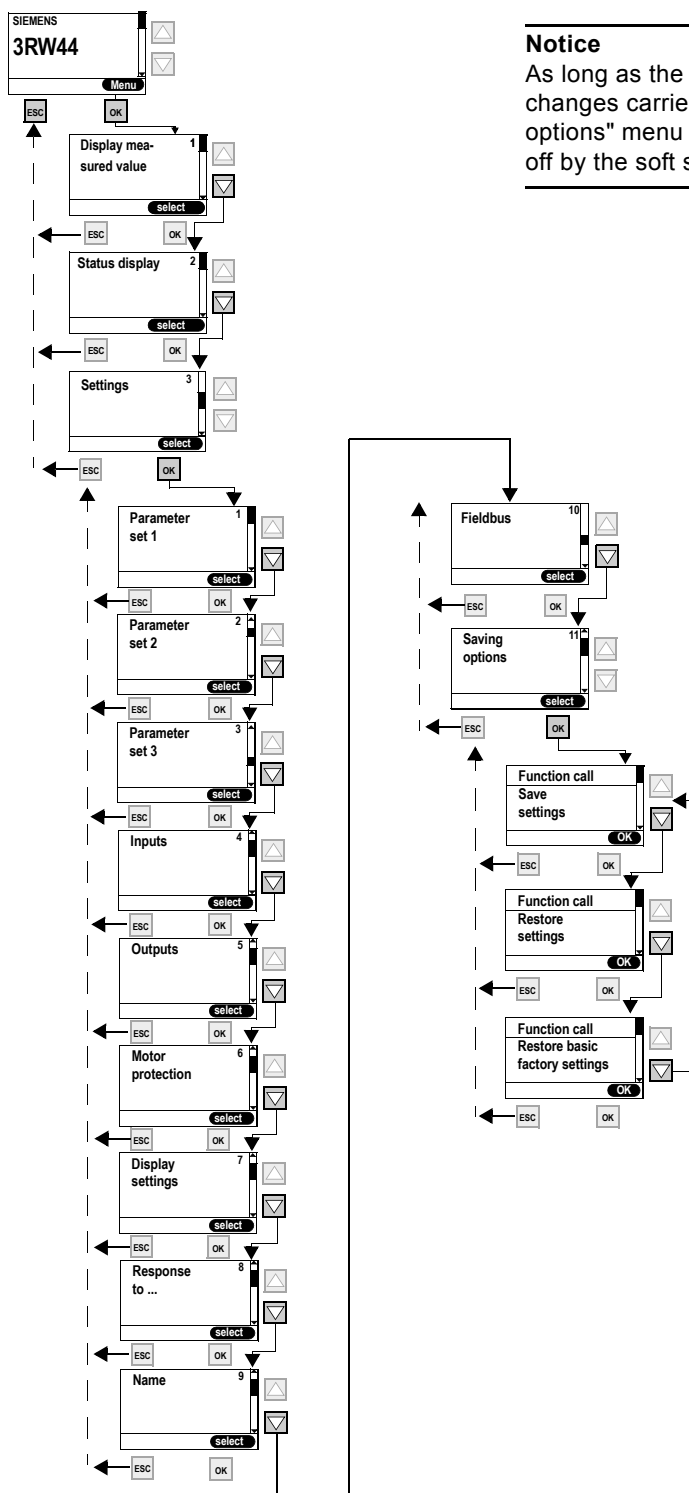
Notice

As long as the connected drive controls the soft starter, no parameter changes carried out at the same time can be saved using the "Saving options" menu item. This is only possible after the motor has been shut-off by the soft starter.

Figure 5-28: Specifying the saving options

Saving settings

Selected settings will be saved.
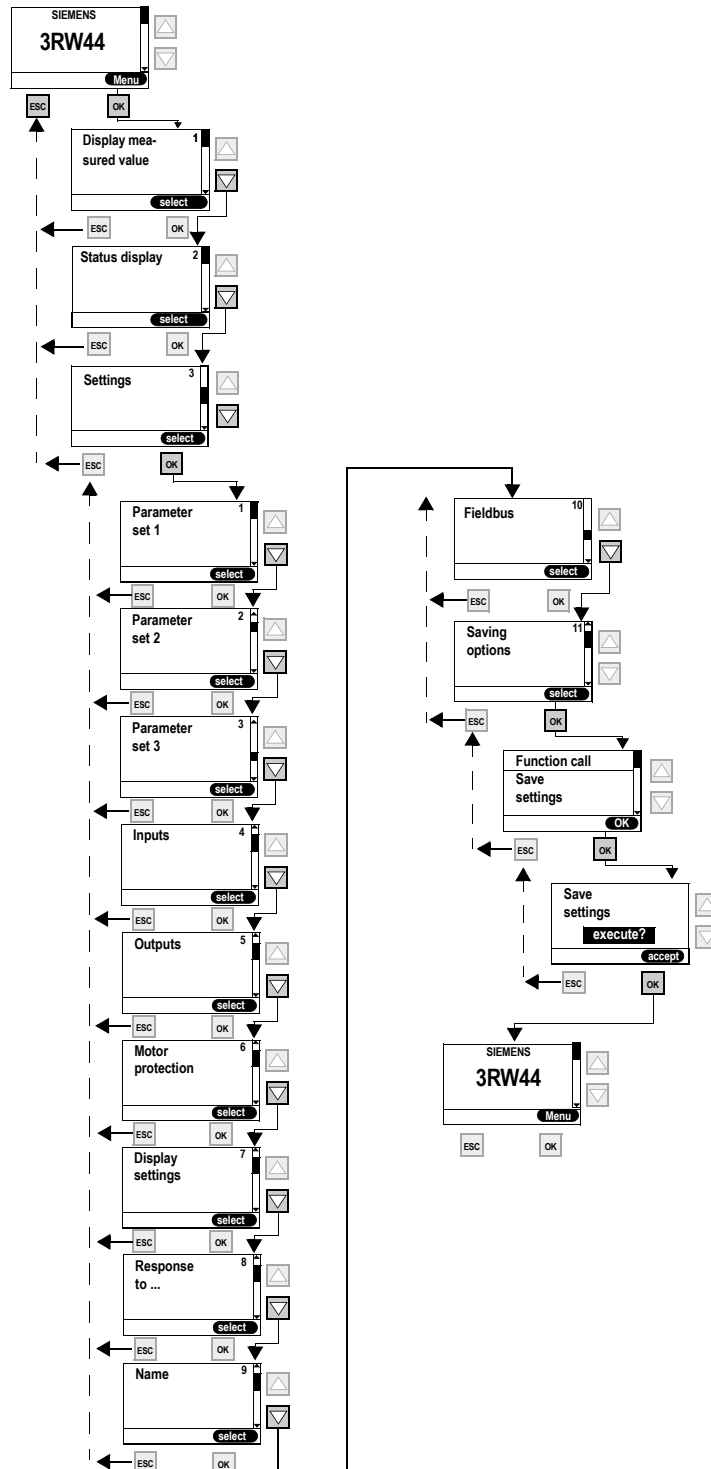
Figure 5-29: Saving settings

Restoring settings

Selected settings which have not been saved will be discarded and the previously saved settings will be restored.
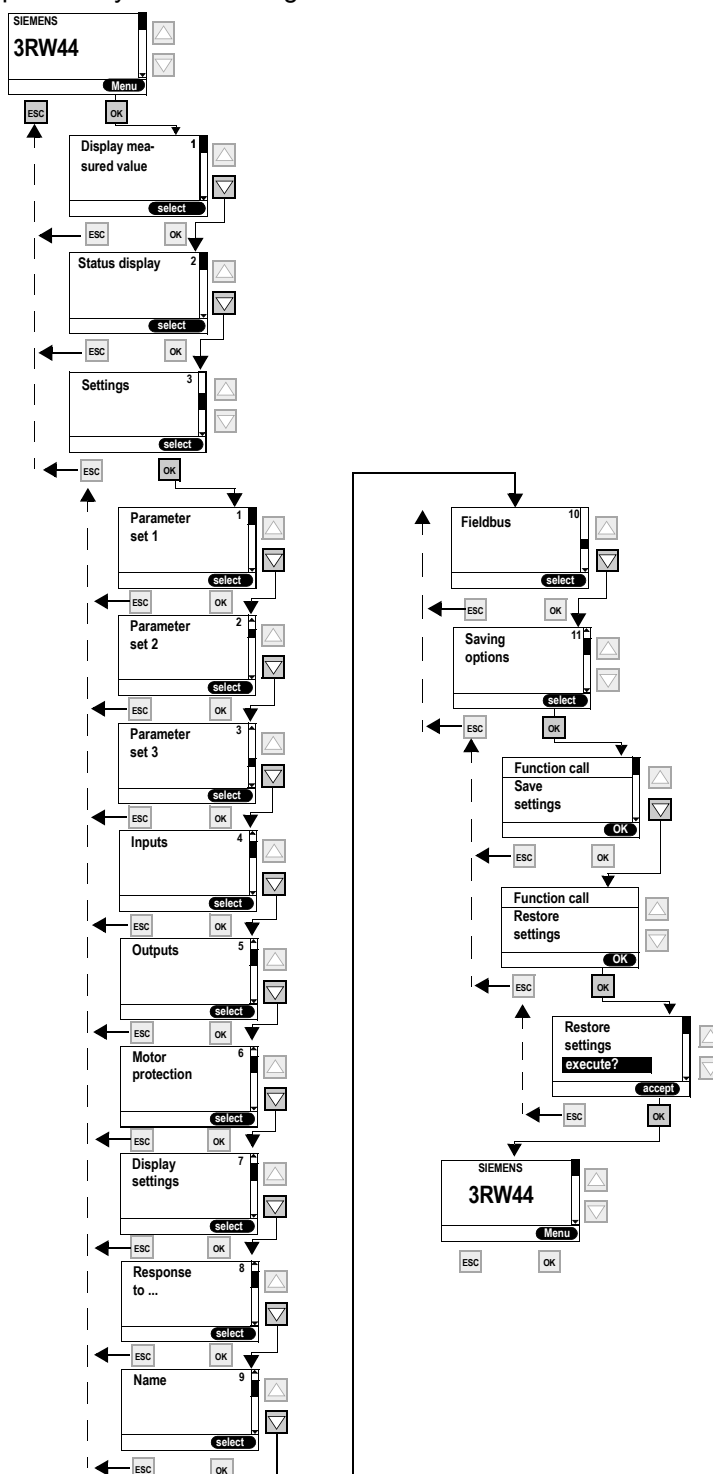
Figure 5-30: Restoring settings

Restoring the factory settings

All settings made or saved so far will be discarded and the device will be reset to the factory settings (master reset). The quick-start menu must be executed once again.
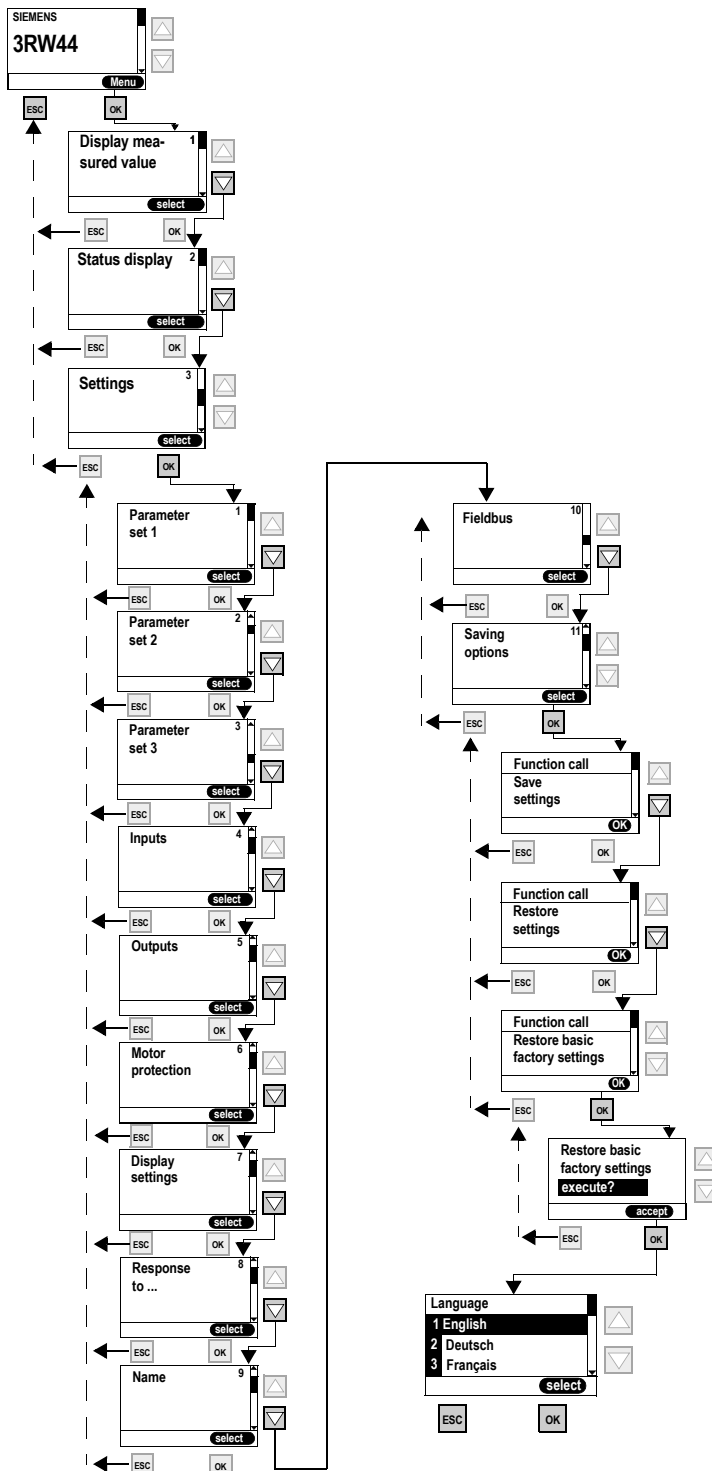
Figure 5-31: Restoring factory settings

5.5 Other Device Functions

5.5.1 Measurement-value Display

> **Note**
> When using the 3RW44 soft starter in an IT system with ground fault monitoring: 3RW44, product version ≤ *E06* and the PROFIBUS DP communication module may not be used in this network configuration. 3RW44 soft starters as of product version *E07* can be used in combination with the PROFIBUS DP communication module. However, the phase voltage values (UL-N) and phase-to-phase voltage values (UL-L) may be displayed incorrectly on the measurement-value display of the 3RW44.

> **Note**
> The "Phase currents" display always shows the currents in the supply cable. That is, if the soft starter is operated in the "Inside delta circuit" circuit type, the currents measured internally by the soft starter are extrapolated to the supply cable current (phase current) by a factor of 1.73 and displayed.
> Due to asymmetries, the phase currents in the inside delta circuit may deviate from the currents running through the supply cables.

Figure 5-32: Measurement-value display

5.5.2 Status Display
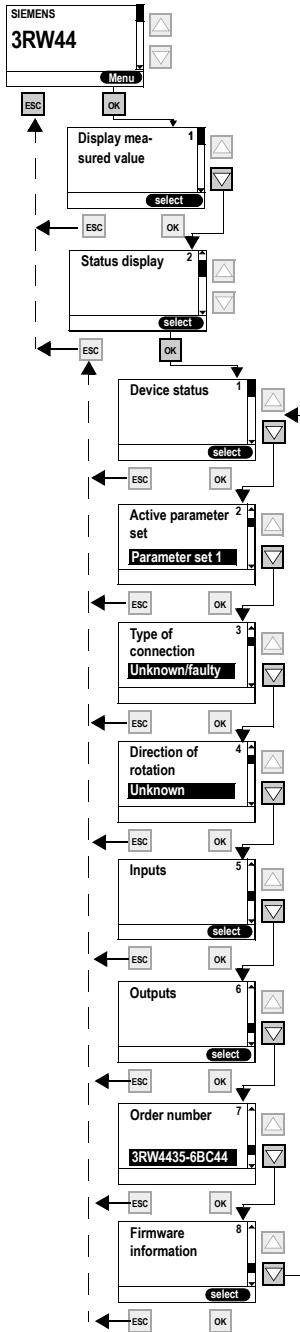
Explanation of the messages:

Unknown/faulty: No connected motor detected.
Star/delta: Soft starter connected in a standard circuit.
Inside delta: Soft starter connected in an inside delta circuit.

Unknown: No line phase direction of the main voltage detected at the terminals L1-L2-L3.
Right: Clockwise line phase direction of rotation of the main voltage detected at the terminals L1-L2-L3.
Left: Counter-clockwise line phase direction of rotation of the main voltage detected at the terminals L1-L2-L3.

Output 1 - 3: Function corresponds to parameterization
Output 4: Group error
Output 5: Internal bypass contactor connected
Output 6: Device fan activated

Figure 5-33: Status display

5.5.3 Motor Control (Assigning Control Priority)
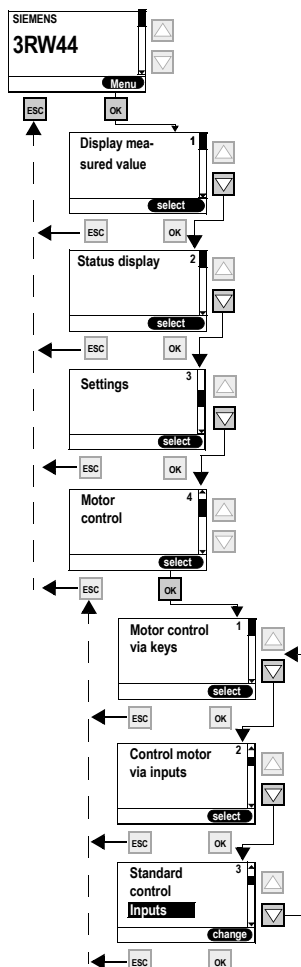
Notice
The "Standard control" menu item specifies which control device should be the master control device when the control supply voltage is applied.
When activating the PROFIBUS communication module, the setting is changed to "Automatic/none".

Control device priority
Only a higher-priority control device can assume and hand over the control priority (0 = lowest).

- 0:   Automatic operation (input control through PLC via PROFIBUS)
- 1:   PC via PROFIBUS (Soft Starter ES professional software required)
- 2:   Inputs
- 3:   Via display keys
- 4:   PC via serial interface (Soft Starter ES professional software required)

Possible values

Activate key control?
Deactivate key control?
Execute control functions

Activate "Control inputs"?
Deactivate "Control inputs"?

Automatic / none
Inputs
Keys

Figure 5-34: Motor control

5.5.4 Statistics

Figure 5-35: Statistics

Notice

The "Statistics" menu item is available for devices with firmware product version *E04* or higher. The firmware product version is listed on the front of the device below the petrol-colored labeling field. The log lists sub-item is only available in combination with "Soft Starter ES Smart" parameterizing and diagnostics software. This menu item will be available in the device display from 04/2006.

5.5.4.1 Log Lists

All device errors are recorded and stored

All group errors are recorded and stored

All warnings and certain actions are recorded and stored

Notice

The "Statistics" menu item is available for devices with firmware product version *E04* or higher. The firmware product version is listed on the front of the device below the petrol-colored labeling field. The log lists sub-item is only available in combination with "Soft Starter ES Smart" parameterizing and diagnostics software. This menu item will be available in the device display from 04/2006.

Notice

Log lists cannot be deleted while the motor running.

5.5.4.2 Maximum pointer

(all minimum and maximum measured values are stored and displayed)
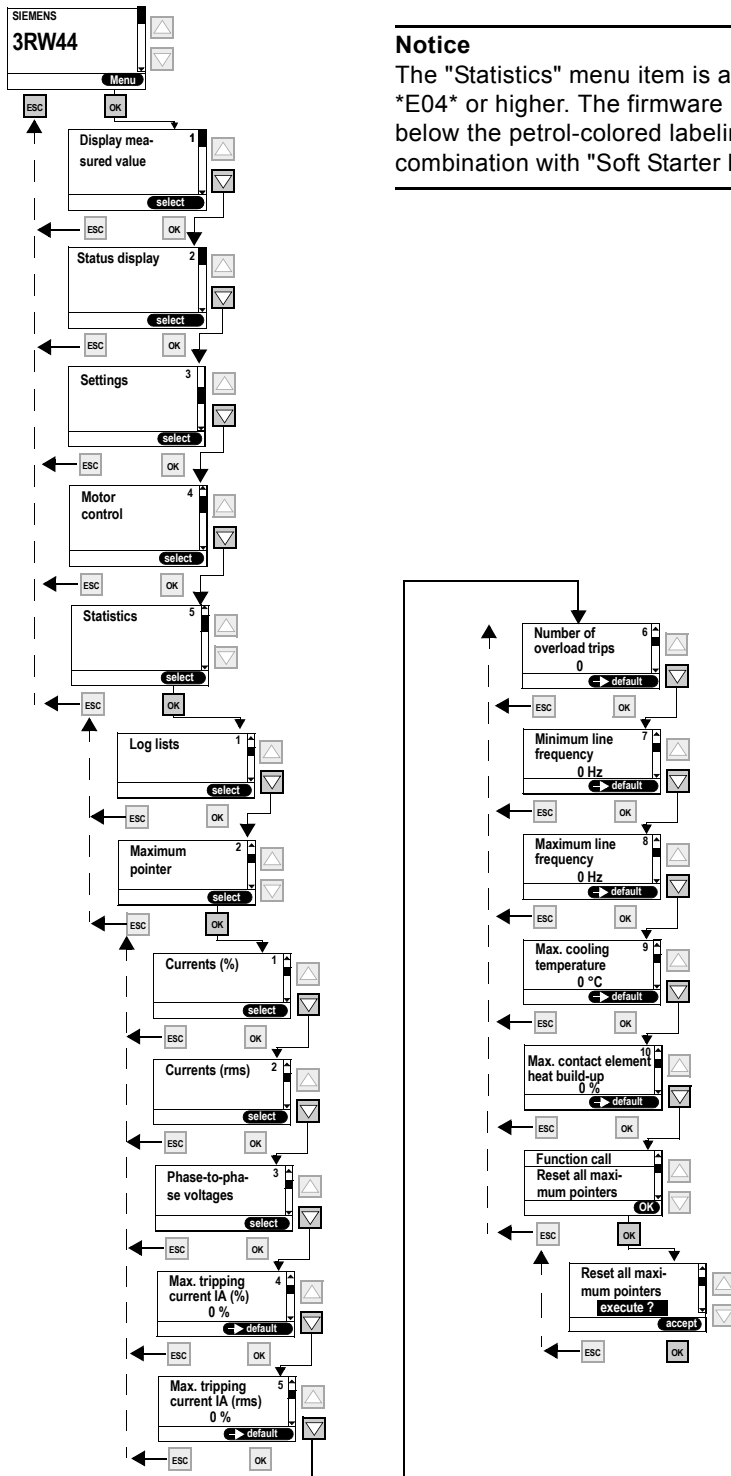
Notice

The "Statistics" menu item is available for devices with firmware product version *E04* or higher. The firmware product version is listed on the front of the device below the petrol-colored labeling field. The log lists sub-item is only available in combination with "Soft Starter ES Smart" parameterizing and diagnostics software.

Figure 5-36: Maximum Pointer

5.5.4.3 Statistics data

SIEMENS
3RW44
Menu
ESC   OK

Display mea- 1
sured value
select
ESC   OK

Status display 2
select
ESC   OK

Settings 3
select
ESC   OK

Motor 4
control
select
ESC   OK

Statistics 5
select
ESC   OK

Log lists 1
select
ESC   OK

Maximum 2
pointer
select
ESC   OK

Statistics 3
data
select
ESC   OK

Motor current 1
Imax (%)
0 %
→ default
ESC   OK

Motor current 2
Imax (rms)
0 A
→ default
ESC   OK

Last trigger 3
current IA (%)
0 %
→ default
ESC   OK

Last trigger 4
current IA (rms)
0 A
→ default
ESC   OK

Operating hours 5
device
0 : 28 : 02
→ default
ESC   OK

Notice
The "Statistics" menu item is available for devices with firmware product version *E04* or higher. The firmware product version is listed on the front of the device below the petrol-colored labeling field. The log lists sub-item is only available in combination with "Soft Starter ES Smart" parameterizing and diagnostics software.

Operating hours 6
motor
0 : 28 : 02
→ default
ESC   OK

No. of starts 7
motor right
0
→ default
ESC   OK

Note:
Number of starts motor left, only possible in combination with slow speed.

No. of starts 8
motor left
0
→ default
ESC   OK

Note:
Number of stops with el. brake: The value is increased by one when braking was chosen as stopping mode.

Number of 9
overload trips
0 %
→ default
ESC   OK

Note:
The value is increased by one when the output is activated.

Number of 10
braking stops
0
→ default
ESC   OK

No. of starts 11
output 1
0
→ default
ESC   OK

No. of starts 12
output 2
0
→ default
ESC   OK

No. of starts 13
output 3
0
→ default
ESC   OK

Number of starts 14
output 4
0
→ default
ESC   OK

Note:
The operating hour counter is activated as soon as control voltage is applied. Maxium value displayed: 99999:59:59 hours

Figure 5-37: Statistics data

5.5.5 Safety (Specifying the User Level, Parameterization Protection)
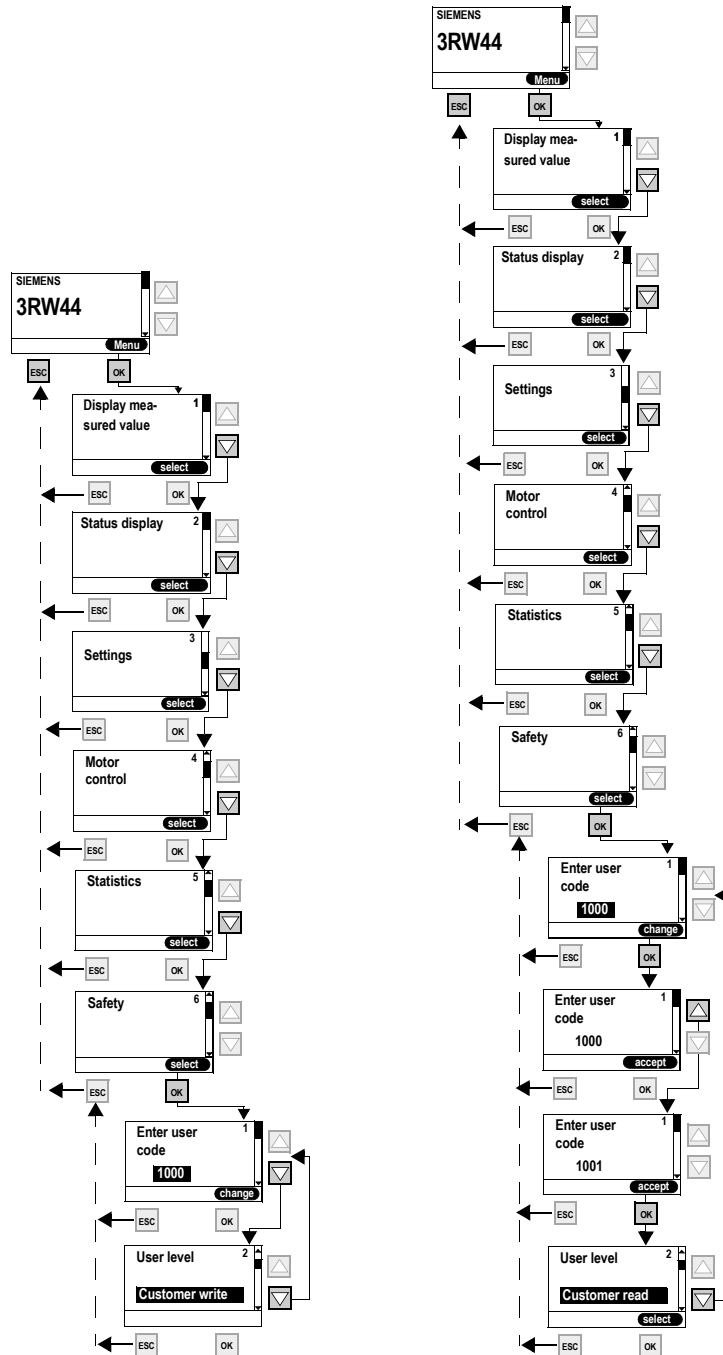
Figure 5-38: Safety

Device Functions

6

6.1 Various Parameter Sets

The soft starter provides three individually adjustable parameter sets. One starting mode and stopping mode can be directly specified per parameter set.

Applications
- Starting Dahlander motors (variable-speed drive).
- Starting an application with different load conditions (e.g. empty or full conveyor belt).
- Separate starting of up to three drives with different run-up behavior (e.g. compressor and pump).

6.2　Starting Modes

Different starting functions can be selected thanks to the large number of applications for which the SIRIUS 3RW44 soft starter can be used. The motor start can be set optimally according to application and deployment.

6.2.1　Voltage Ramp

The simplest type of soft start with the SIRIUS 3RW44 is achieved using a voltage ramp. The terminal voltage of the motor is increased from a parameterizable start voltage to line voltage within an adjustable starting time. This starting mode is preset in the quick start menu.

Start voltage

The level of the start voltage determines the switch-on torque of the motor. A smaller start voltage results in a smaller start torque and smaller starting current. The start voltage should be high enough so that the motor starts immediately and softly when the start command is sent to the soft starter.

Starting time

The length of the starting time determines the time in which the motor voltage is increased from the set start voltage to the line voltage. This influences the acceleration torque of the motor, which drives the load during the run-up procedure. A longer starting time results in a smaller acceleration torque over the motor run-up. This results in a longer and softer motor run-up. The length of the starting time should be selected such that the motor reaches its nominal speed within this time. If this time is too short, i.e. if the starting time ends before the motor has run up, an extremely high starting current will occur at that moment, reaching the value of the direct starting current at this speed. The soft starter can, in this case, switch itself off via the internal overload protection function and go into fault mode.

Maximum starting time

The "Maximum starting time" parameter is used to determine the time after which the drive should have fully run up. If the drive is not in nominal operation upon completion of the set time, the starting procedure is aborted and an error message is generated.

Internal run-up recognition

The soft starter features an internal run-up recognition. If a completed motor run-up is recognized by the device, the internal bypass contacts will close and the thyristors are bridged. If this run-up recognition is performed before the set run-up time is completed, the ramp is aborted and the motor voltage is immediately increased to 100 % of the line voltage before the internal bypass contacts are closed.
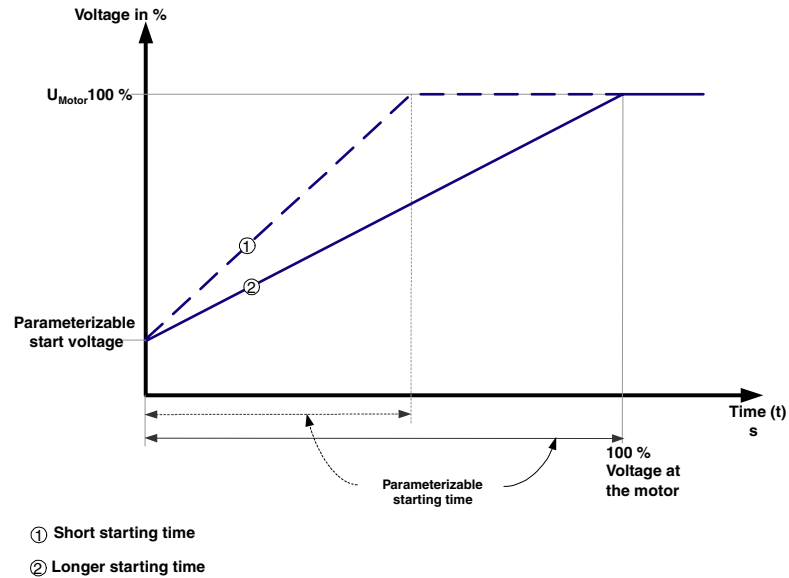
Figure 6-1: Function principle of voltage ramp
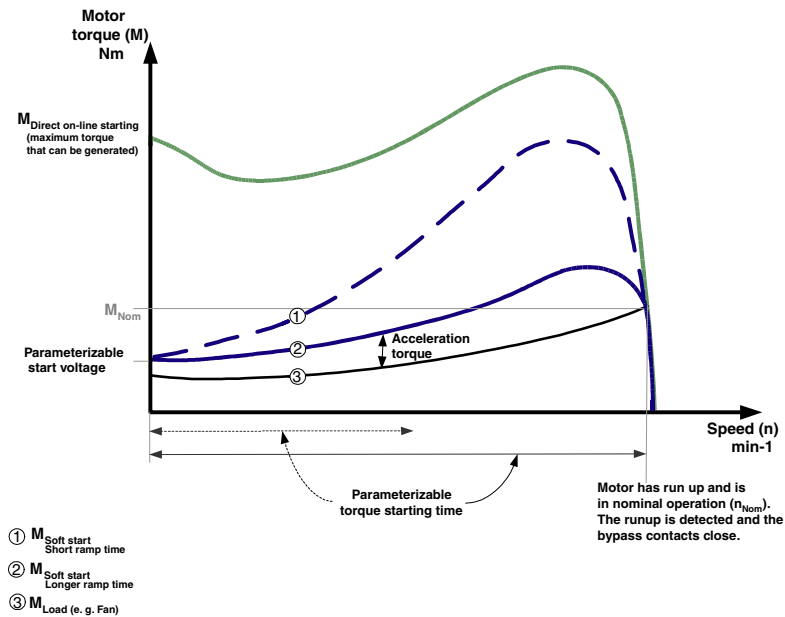
Figure 6-2: Function principle of voltage ramp/ torque curve

Typical applications for voltage ramps

The voltage ramp function principle is suitable for any type of application.
If test runs are carried out using motors that are smaller than those used in actual applications, we recommend using the "Voltage ramp" starting mode. For machines requiring a breakaway pulse (inverse load response, e.g. in mills or crushers), the breakaway pulse must be set as described in Chapter 6.2.3 "Breakaway Pulse in Combination with the Voltage Ramp or Torque Control Starting Mode". The "voltage ramp+current limiting (U+current limiting)" starting mode is recommended for heavy starting.

6.2.2 Torque Control

The motor speed and torque is calculated using the voltage and current r.m.s. values as well as the associated phase information between the line voltage and the motor current (= cos φ = sensorless control) and the motor voltage is controlled accordingly.

Torque control means that the torque generated in the motor is linearly increased from a parameterizable start torque up to a parameterizable end torque within an adjustable starting time.

The advantage over the voltage ramp is improved mechanical run-up behavior of the machine.

The soft starter controls the torque generated at the motor continuously and linearly according to the set parameters until the motor has completely run up. For optimum torque control during the stopping process, the motor data of the motor connected to the soft starter should be entered in the selected parameter. This can be specified using the "Setting" menu item.

Start torque

The height of the start torque determines the switch-on torque of the motor. A smaller start torque results in a smaller run-up torque and smaller starting current. The start torque should be high enough so that the motor starts immediately and softly when the start command is sent to the soft starter.

Limiting torque

The level of the limiting torque determines which maximum torque should be generated in the motor during running up. This value can thus also act as an adjustable torque limitation.

In order to obtain a successful run-up, the parameter value should be set to about 150 %. It should be at least high enough so that the motor does not get stuck during startup. This ensures that enough acceleration torque is generated throughout the entire motor run-up phase.

Starting time

The length of the starting time determines the time in which the start torque is increased to the end torque.

A longer starting time results in a smaller acceleration torque over the motor run-up. This results in a longer and softer motor run-up. The length of the starting time should be selected such that the motor accelerates softly until it reaches its nominal speed.

If the starting time ends before the motor has completely run up, the torque is limited to the set limiting torque until the soft starter recognizes the run-up process and closes the internal bypass contacts.

Maximum starting time

The "Maximum starting time" parameter is used to determine the time after which the drive should have fully run up. If the drive is not in nominal operation upon completion of the set time, the starting procedure is aborted and an error message is generated.

Internal run-up recognition

The soft starter features an internal run-up recognition. If a completed motor run-up is recognized within the defined starting time, the ramp will be aborted and the motor voltage will immediately be increased to 100 % of the line voltage. The internal bypass contacts will close and the thyristors are bridged.

Note
The torque generated in the motor and controlled by the soft starter can at no time be higher than the value of a similar direct start at the same speed.
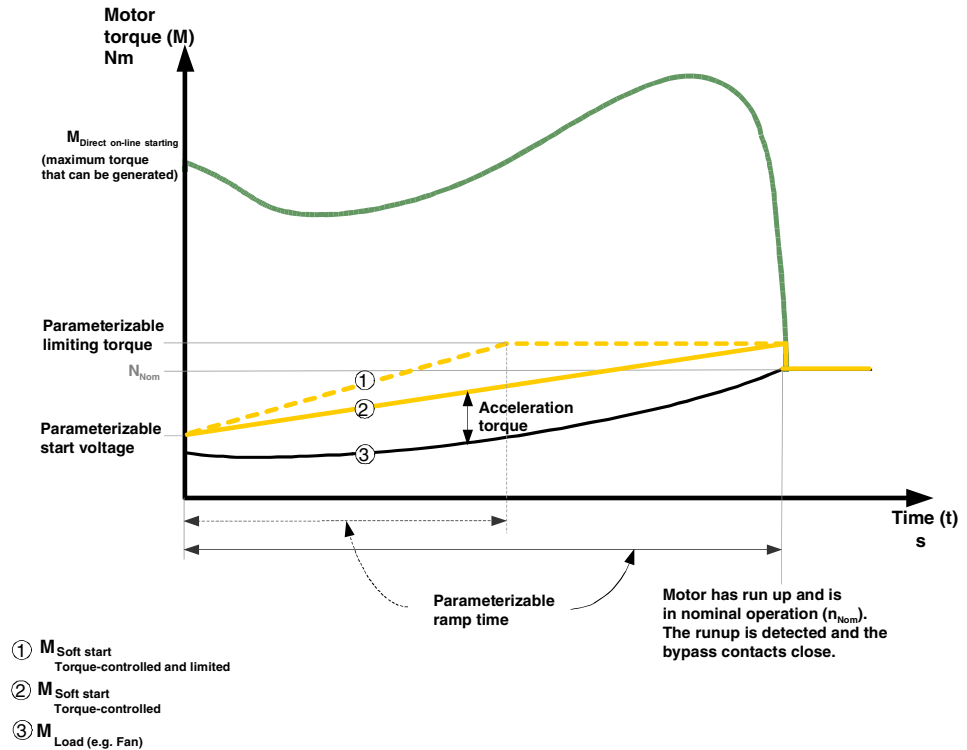
Figure 6-3: Function principle of torque control

Typical applications for torque control

Torque control is suitable for all applications, especially in cases where a homogeneous and smooth run-up is required. For machines requiring a breakaway pulse (inverse load response, e.g. in mills or crushers), the breakaway pulse must be set as described in Chapter 6.2.3 "Breakaway Pulse in Combination with the Voltage Ramp or Torque Control Starting Mode". The "Torque control+current limiting (M+current limiting)" starting mode is recommended for heavy starting (refer to Chapter 6.2.4 "Current Limiting in Combination with the Voltage Ramp or Torque Control Starting Mode").

6.2.3 Breakaway Pulse in Combination with the Voltage Ramp or Torque Control Starting Mode

This function is required for load machines with inverse torque behavior. Typical applications are mills, crushers or drives with plain bearings. In such cases it may be necessary to create a breakaway pulse at the beginning of the machine's start process. The breakaway pulse is set via the breakaway voltage and the breakaway time. Using the breakaway pulse, the high limiting friction of the load can be overcome and the machine can be set into motion.

The breakaway pulse can be used in combination with the voltage ramp, torque control or current limiting starting modes and is superimposed on these during the whole breakaway time.

Breakaway voltage

The breakaway voltage setting determines the breakaway torque to be generated. Its maximum value can be 100 % of the start torque generated on direct starting. The pulse should be high enough for the motor to start immediately when the soft starter receives the start command.

Breakaway time

The breakaway time specifies how long the breakaway voltage should be applied. Upon completion of the breakaway time, the soft starter finishes its run-up process with the selected starting mode, e.g. voltage ramp or torque control. The selected breakaway time should be at least long enough so that, after the configured time has elapsed, the motor does not remain stationary again but rather accelerates further in the selected starting mode.

If 0 ms is set as the breakaway time (default), the breakaway pulse function is deactivated.

① $M_{Direct\ on-line\ starting}$
   (maximum torque that can be generated)

② $M_{Soft\ start}$
   Breakaway pulse combined with
   torque regulation or voltage ramp

③ $M_{Load\ (e.\ g.\ Crusher)}$
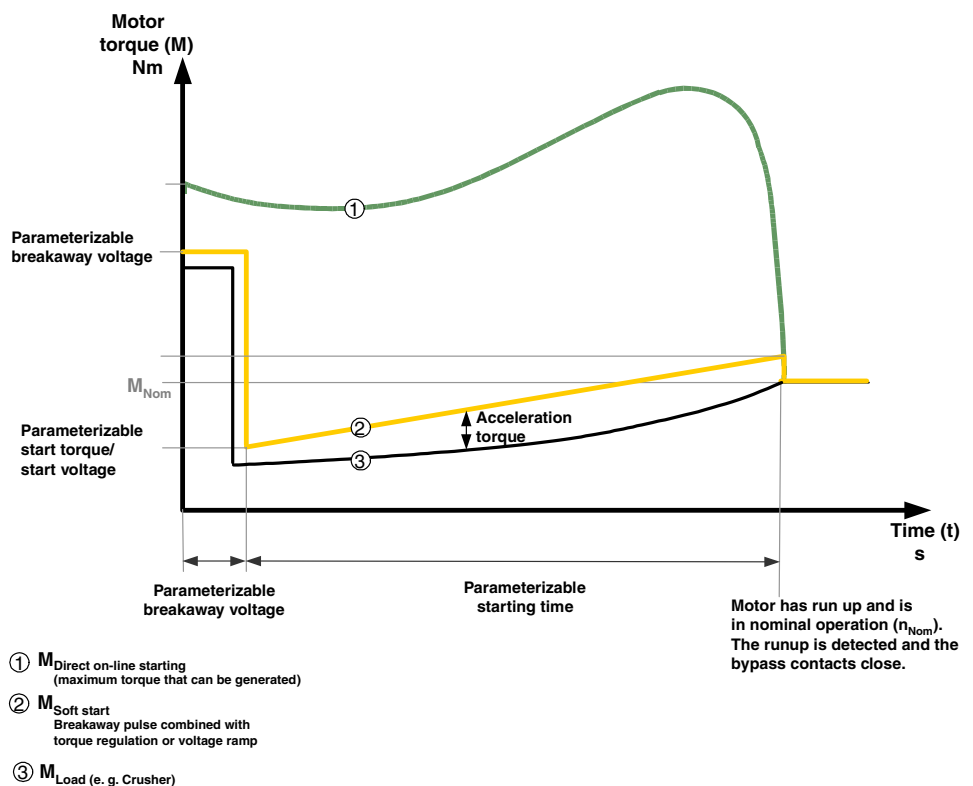
Figure 6-4: Function principle of breakaway pulse/torque control

Typical applications for breakaway pulses

Typical applications for breakaway pulses are load machines with inverse torque behavior, e.g. crushers and mills.

Note
A breakaway pulse that is too high may lead to the error message "Current measurement range exceeded".
Remedy: Use larger starter dimensions or a lower breakaway voltage.
Only set the breakaway pulse when it is really required (e.g. for mills for crushers).
A wrongly set breakaway pulse, e.g. for pumps, may lead to the error message "Incorrect start conditions".

6.2.4 Current Limiting in Combination with the Voltage Ramp or Torque Control Starting Mode

The starter continuously measures the phase current (motor current) using the integrated current transformer.

During motor run-up it is possible to set a current limit value on the soft starter. The current limiting can be activated if "Voltage ramp+currrent limiting" or "Torque control+current limiting" have been selected as starting mode and a value has been entered in the relevant parameter.

During the starting procedure, the phase current is limited to the set value until it falls below this value. A defined breakaway pulse is superimposed on the current limiting during the breakaway time.

Current limit value

As a factor of the motor rated current, the current limit value is set to the maximum current required during the starting procedure. If the set current limit value is reached, the motor voltage is lowered (or controlled) by the soft starter such that the current will not exceed the set current limit value. The configured current limit value must be selected high enough that enough torque can be created in the motor in order to bring the drive into the rated area of operation. A typical value is 3-4 times the value of the rated operating current (I_e) of the motor.

Run-up recognition

The soft starter features an internal run-up recognition. If a completed motor run-up is recognized, the motor voltage is immediately increased to 100 % of the line voltage. The internal bypass contacts will close and the thyristors are bridged.
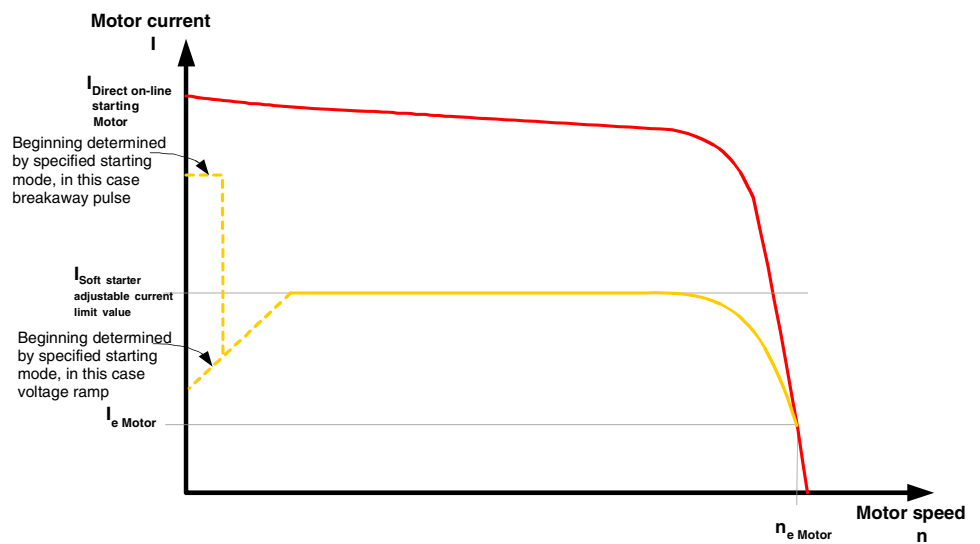
Figure 6-5: Current limiting with soft starter

Typical applications for current limiting

Used in applications with a large centrifugal mass (mass reactance) and hence long starting times, e.g. large fans, in order to lighten the load on the supply network.

6.2.5 Starting Mode: Direct On-line

If the "Direct on-line" starting mode is set, the motor voltage is immediately increased to line voltage when it receives the start command. This resembles the starting behavior with a contactor, i.e. the starting current and start torque are not limited.

Note
Due to the high starting current of the motor, the error "Current limit exceeded" may occur in direct on-line starting mode. It may be necessary to select a larger dimensioned soft starter.

Run-up recognition
The soft starter features an internal run-up recognition. If a completed motor run-up is recognized, the internal bypass contacts will close and the thyristors are bridged.

6.2.6 Starting Mode: Motor Heating

If IP54 motors are used outdoors, condensation occurs in the motor during cooler periods (e.g. overnight or in the winter). This may lead to leakage currents or short circuits when the devices are switched on.
A pulsating DC current is fed into the motor winding to warm it up.
If the "Motor heating" starting mode is selected, a heating capacity can be entered in the settings. This capacity should be chosen in such a way that the motor will not be damaged. The setting range for the heating capacity extends from 10 - 100 %. This corresponds to a motor current of approximately 5 - 30 % of the motor rated current.

Typical applications for motor heating
Used e.g. in outdoor drives to minimize condensation inside the motor.

Caution
May lead to damage to property.
The motor heating starting mode is not a continuous operating mode. The motor must be equipped with a temperature sensor (Thermoclick/PTC) to ensure motor protection. The motor model with integrated electronic motor overload protection is not suitable for this kind of operation.

6.3   Stopping Modes

Different stopping functions can be selected thanks to the large numbers of applications for which the SIRIUS 3RW44 soft starter can be used. The motor stop can be set optimally according to application and deployment.
If a start command is output while the motor is being stopped, this process is aborted and the motor is started up again using the specified starting mode.

Note
If guided stopping is selected as stopping mode (soft stop, pump stop or braking), it may be necessary to select a larger dimensioned branch (soft starter, wiring, branch protection elements and motor), since the current exceeds the motor rated current while the motor is being stopped.
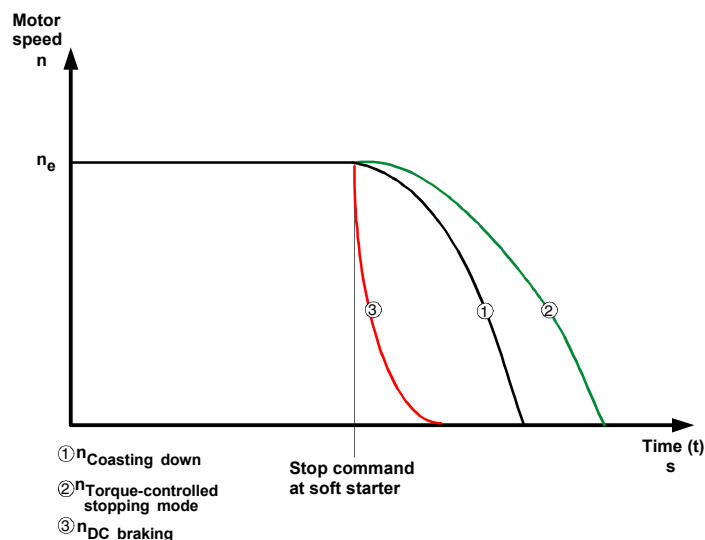
Figure 6-6:Stopping modes in general

6.3.1 Coasting Down

Coasting down means that when the on command to the soft starter is removed, the energy feed to the motor via the soft starter is interrupted. The motor will coast down freely, only driven by the mass reactance (centrifugal mass) of the rotor and the load. This is designated as a natural run-down. A larger centrifugal mass means a longer coasting-down.

Typical applications for coasting down

Coasting down is used for loads with no special requirements in terms of stopping behavior, e.g. large fans.

6.3.2 Torque Control and Pump Stop

In "Torque-controlled" and "Pump stop" mode, the coasting down process/ natural run-down of the load is extended. This function is set if abrupt stopping of the load is to be prevented. This is typical in applications with small mass reactances or high counter torques.

For optimum torque control during the stopping process, the motor data of the motor connected to the soft starter should be entered in the selected parameter set. This can be specified using the "Setting" menu item.

Stopping time and stopping torque

The "Stopping time" parameter of the soft starter can be used to specify for how long power should be fed into the motor after removal of the switch-on command. Within this stopping time, the torque generated in the motor is continuously and linearly reduced to the set stopping torque and the application is smoothly stopped.

Pump stop

In pump applications, so-called water hammers may occur if the drive is stopped abruptly without using pump stop. These water hammers are caused by the sudden break in the flow and the accompanying pressure deviations in the pump. They cause noise and a mechanical impact on the piping as well as on the flaps and valves inside the system.
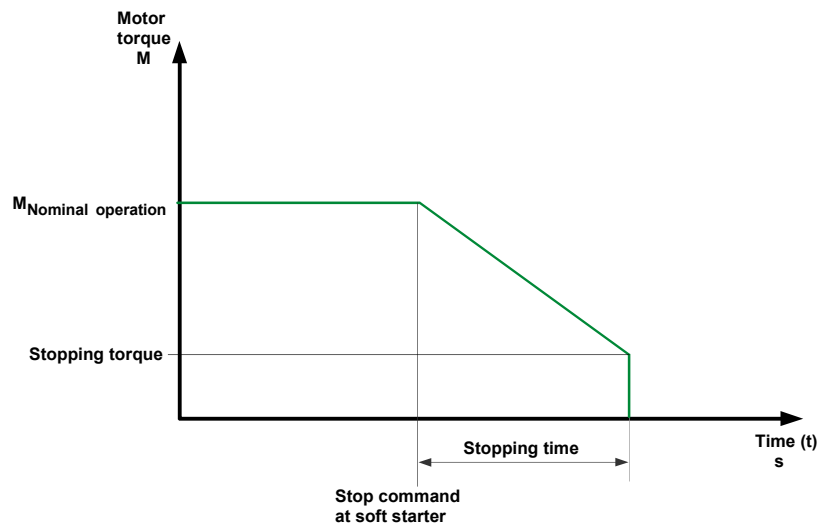
Figure 6-7:Soft stop / pump stop

Typical applications for soft stop / pump stop

Use soft stop / pump stop

• in pumps to prevent water hammers.

• in conveyor belts to prevent goods from toppling.

Caution
Risk of damage to property.
For optimum motor protection use a combination of electronic motor overload protection and evaluation of a temperature sensor integrated in the motor.

6.3.3 DC Braking / Combined Braking

In DC braking or combined braking, the coasting down / natural run-down of the load is shortened.

The soft starter imposes a (pulsating) DC current in phases L1 and L3 on the motor stator. This current creates a permanent magnetic field in the stator. Since the rotor is still rotating due to its mass reactance, currents are induced into the short rotor winding, creating a braking torque.

Notice
The DC braking / combined braking stopping function is not possible in an inside delta circuit.

Note
The pulsating DC current loads the network asymmetrically and the motor and the branch must be dimensioned accordingly for the higher current load during the stopping procedure. A larger dimensioned soft starter may be necessary.

Note
Two braking versions are available:
Combined braking:
Use the combined braking function if applications with small mass reactances (centrifugal masses) are to be stopped
($J_{Load} \leq J_{Motor}$). The real stopping time can vary during braking processes when the combined braking function is applied. Use the function DC braking if a consistently long braking time is to be achieved.
DC braking:
Use the DC braking function if applications with larger mass reactances (centrifugal masses) are to be stopped
($J_{Load} \leq 5 \times J_{Motor}$).
An external brake contactor is required for the DC braking function!

Caution
Risk of damage to property.
A combination of electronic motor overload protection and evaluation of a temperature sensor integrated into the motor is recommended for optimum motor protection.

Stopping mode: combined braking

If combined braking is selected, the dynamic braking torque, DC braking torque and stopping time parameters can be configured on the starter.

Dynamic braking torque

The dynamic braking torque determines the extent of the braking effect at the start of the braking process in order to reduce the rotational speed of the motor. The braking process is then continued using the DC braking torque function.

DC braking torque

The height of the DC braking torque determines the brake force of the motor. If the motor accelerates again during DC braking, the dynamic braking torque must be increased.

Stopping time
The stopping time determines how long braking torque is applied to the motor. The braking time should be long enough to bring the load to a complete standstill.
To achieve a sufficient brake effect until standstill, the centrifugal mass (J) of the load should not exceed that of the motor. The stopping time should be selected such that the motor comes to a standstill. The soft starter has no standstill recognition; if required, this must be accomplished using external measures.

Note
The real stopping time can vary during braking processes when the combined braking function is applied.
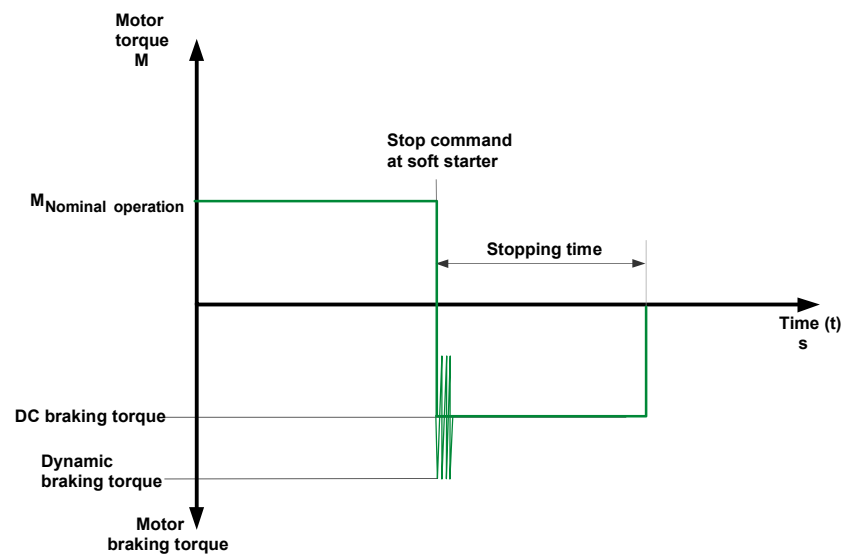
Figure 6-8: Combined braking

Stopping mode: DC braking
If the DC braking function is selected, the stopping time and DC braking torque parameters can be configured on the starter. With this braking type, one output of the soft starter must be switched over to DC braking to control an external brake contactor. Please refer to Chapter 9 for wiring suggestions.
The optimum parameters must be adjusted on the machine under appropriate load conditions.

DC braking torque
The DC braking torque determines the brake force of the motor.

Stopping time

The stopping time determines how long braking torque is applied to the motor. The braking time should be long enough to bring the load to a complete standstill.

To achieve a sufficient braking effect until standstill, the load's mass moment of inertia should not be higher than 5 times the motor's mass moment of inertia. ($J_{Load} \leq 5 \times J_{Motor}$).

The soft starter has no standstill recognition; if required, this must be accomplished using external measures.
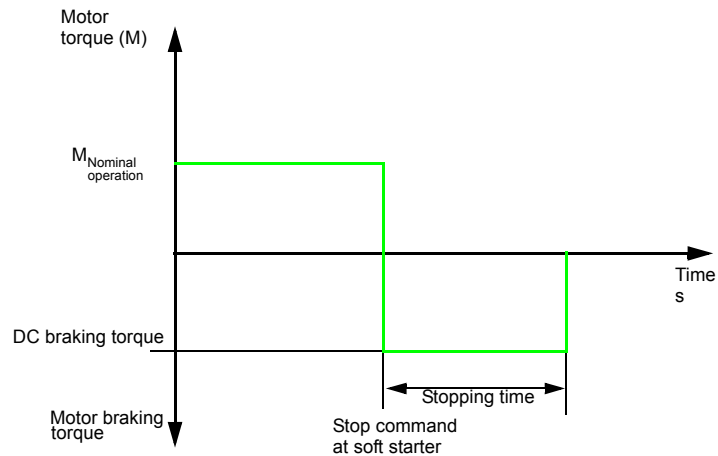
Figure 6-9:DC braking

Typical applications for DC braking

Use "DC braking" in lathes (e.g. for tool changeover) and disk saws.

6.4 Slow Speed Function

This function allows an asynchronous motor to be temporarily operated in both directions at a rotational speed that is lower than the rated rotational speed. The rated rotational speed n_{motor} of the motor is determined by its line frequency (f) and its number of pole pairs (p).

$$n_{Motor} = f \times \frac{60}{p}$$

A resulting slow speed frequency for the motor is defined by a specific thyristor control. However, this function requires that only a reduced torque can be generated in the motor. Due to possible overheating of the motor, this function is not suitable for continuous operation.

The slow speed factor and the slow torque can be entered individually for both directions of rotation.

Slow speed factor
By adjusting the slow speed factor, it is possible to control the motor with a rotational speed ($n_{Slow\ speed}$) that is lower than the rated rotational speed either in the same or opposite direction of rotation to that of the line.

$$n_{Slow\ speed} = \frac{n_{Rated}}{Slow\ speed\ factor}$$

Slow torque
The torque generated in the motor can be influenced using the slow torque. The maximum torque which can be created depends on the slow torque that is specified. 100 % slow torque can correspond to approx 30 % of the motor rated torque.
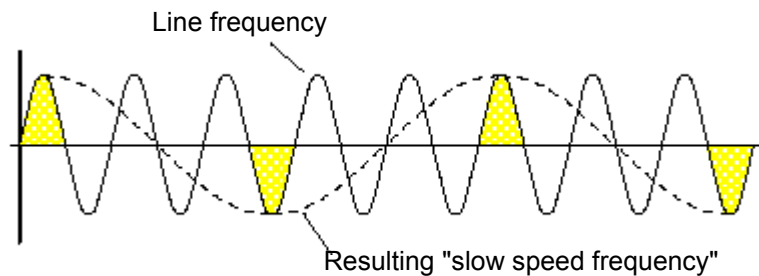
Figure 6-10:Slow speed function

Typical applications for slow speed function
This function is suitable for applications with a **low counter torque**, e.g. when machine tools are positioned.

Note
In addition to the set parameters, the motor-specific properties and the connected load also affect the rotational speed resulting from the slow speed function and the slow torque generated in the motor.

Note
To control the motor with the specified slow speed parameters, "Slow speed" must be assigned to one control input, and "Motor right PS1/2/3" or "Motor left PS1/2/3" must be assigned to the other. Also refer to the circuit proposal in Chapter 8.1.7.
Directions of rotation:
Right: rotation in line phase direction
Left: rotation counter-clockwise to the line phase direction

Notice
Due to the reduced motor speed and the accompanying reduced self-cooling of the motor this operating mode is not recommended for continuous operation.

Caution
Risk of damage to property.
For optimum motor protection use a combination of electronic motor overload protection and evaluation of a temperature sensor integrated into the motor.

6.5 Current Limits for Load Monitoring

It is possible to set maximum and minimum current limits; if these limits are exceeded or undershot, a message can be output.

Minimum current limit

The minimum current limit can, for example, be used to indicate a V-belt break and the corresponding no-load current of the motor or that the fan filter is clogged.

Maximum current limit

The maximum limit value can be used to determine increased power loss in the application, e.g. caused by storage damage.

6.6 Motor Protection Functions

The motor overload protection is based on the motor winding temperature. This temperature is used to determine whether the motor is overloaded or is operating within its normal rating.

The winding temperature can either be calculated using the integrated electronic motor overload function, or be measured using a connected motor thermistor.

Both versions must be combined (=activated) to obtain the so-called full motor protection. This combination is recommended for optimum motor protection.

Motor overload protection

The current flow during motor operation is measured using current measurement at the converters in the soft starter. The temperature rise of the winding is calculated on the basis of the configured rated operating current of the motor. Depending on the set tripping class (CLASS setting) and protection parameters, a warning or a trip is generated when the characteristic curve is reached.

Tripping class (electronic overload protection)	The tripping class (CLASS) indicates the maximum tripping time in which a protective device must trip at a value 7.2 times that of the rated operating current in cold condition (motor protection acc. to IEC 60947). The tripping characteristics indicate the tripping time in relation to the tripping current (refer to Chapter 10.4 "Tripping Characteristics"). Different CLASS characteristics are available for normal or heavy starting.

Note
The rated data of the soft starters are based on normal starting (CLASS 10). For heavy starting (> CLASS 10) it may be necessary
to select a larger dimensioned soft starter.

Current asymmetry limit value	Three-phase asynchronous motors respond to slight line voltage asymmetries with a higher asymmetrical current consumption. This increases the temperature in the stator and rotor winding.
	The asymmetric limit value is a percent value by which the motor current may deviate in the individual phases.
	The reference value for the evaluation is the maximum deviation from the average value of the three phases.
	Asymmetry is defined as a deviation of more than 40 % from the average value.
Prewarning limit tripping reserve	If the set prewarning time limit is reached, which is based on the calculated time until the motor is stopped by the motor protection function, a message can be output.
Prewarning limit motor heat build-up	A message can be generated if the configured thermal prewarning limit of the motor is reached. Tripping of the motor protection occurs at 100 %.
Idle time	The idle time is a setpoint time for the cooling behavior of the motor model after a normal shutdown, i.e. not after overload trips.
	After this period, the "Thermal motor model" of the motor starter is set to 50 % if the motor heat build-up is still at > 50 %, otherwise it is set to 0 %.
	This enables frequent start procedures (inching). Depending on the CLASS settings, these frequent start procedures lead to tripping where motor protection acc. to IEC 60947 is used.

The following graphic illustrates the cooling behavior with and without idle time:
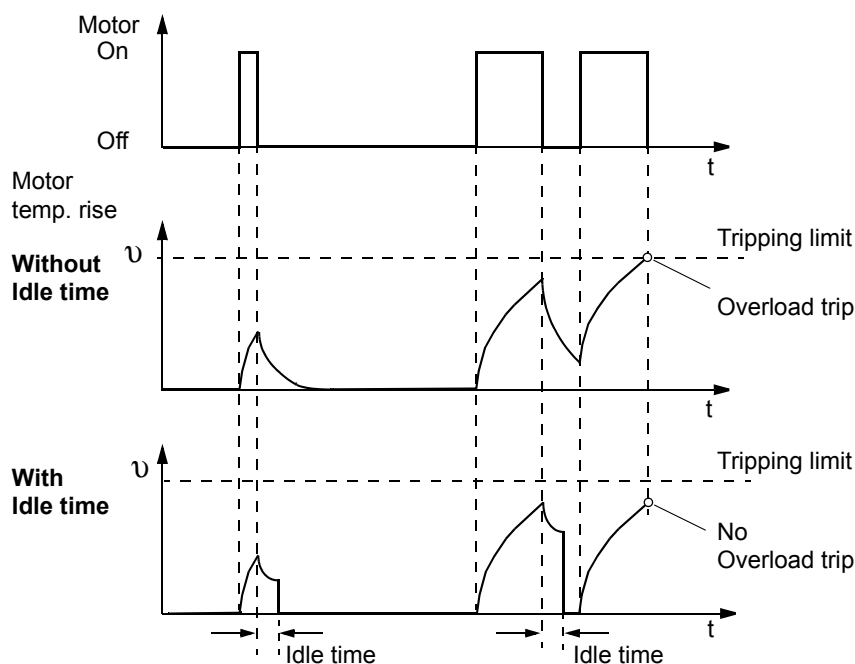
Figure 6-11:Idle time

The idle time can be set between 1 and 100 s.

Caution
Risk of damage to property.
If the idle time is changed (0 = deactivated), motor protection acc. to IEC 60947 (CLASS 10A, 10, 15, 20, 30) is no longer ensured. This means that there will be no system protection in such cases. We recommend protection action to be taken in parallel.

Caution
Risk of damage to property.
The motor must be designed for such inching operation, otherwise the overload may cause permanent damage.

Pre-charge time　　　When the thermal motor model is tripped, a pre-charge time is started to let the motor cool down and to prevent the motor from being restarted before the pre-charge time has elapsed.

Protection against voltage failure　　　If protection against voltage failure is active and the control supply voltage breaks down while a trip is pending, the current trip condition of the thermal motor model and the current pre-charge time are stored in the soft starter. When the control supply voltage returns, the trip condition of the thermal motor model before voltage failure will be restored.

Temperature sensor The temperature sensor motor protection function measures the motor's stator winding temperature directly using a measuring sensor in the motor, i.e. this requires a motor with a measuring sensor wound into the stator winding.
Two different types of measuring sensors are available for the evaluation.

- PTC thermistors type A ("type A sensors")
- Thermoclick

The wiring and the sensors are checked for wire breaks or short circuits.

Notice
If the soft starter is switched off via a motor protection or device protection tripping, the action cannot be acknowledged using the "Trip reset" function until the displayed cooling time has expired.

6.7 Inherent Protection

The soft starter has integrated device protection to prevent the thyristors from becoming thermally overloaded.
This is achieved via current measurement using converters in the three phases and by measuring the temperature with thermosensors at the thyristor heatsink.
If a fixed warning threshold is exceeded, a message is issued by the soft starter.
If the fixed tripping value is exceeded, the soft starter switches off automatically.

After a trip has occurred, a fixed 30-second pre-charge time must be kept before the starter can be restarted.

If protection against voltage failure is active and the control supply voltage breaks down while a trip is pending, the current trip condition of the thermal motor model and the current pre-charge time are stored in the soft starter. When the control supply voltage returns, the trip condition of the thermal inherent protection before voltage failure will be restored.

In order to protect the thyristors from being destroyed by short circuits (e.g. in the event of cable damage or a shorted coil in the motor), SITOR semiconductor fuses must be connected upstream. You can find the corresponding selection tables in Chapter 10.3.6 "Branch Component Circuitry (Standard or Inline Circuit)" and in Chapter 10.3.7 "Branch Component Layout (Inside Delta Circuit)".

Notice

If the soft starter is switched off via a motor protection or device protection tripping, the action cannot be acknowledged using the "Trip reset" function until the displayed cooling time has expired.

Diagnosis and Messages

7

7.1 Diagnosis, Messages

7.1.1 Status Messages

Message	Cause / Remedy
Checking voltage	Main voltage not yet applied.
Checking line	**Option 1:** Main voltage is applied but the motor has not yet been connected or has been incorrectly connected. **Option 2:** The motor is properly connected but there is no phase voltage.
Ready to start	Device is ready to start (main voltage is applied and the motor is properly connected). The motor will start as soon as a start command is received.
Start mode active	Motor is started in the set starting mode.
Running	Device is in bridging mode (bypass contactor). Starting completed.
Stopping mode active	Motor is stopped using the set stopping mode.
Cooling down period of the motor is active (for product version < *E06* devices)	After overload tripping of the thermal motor model, it is impossible to start the motor for a defined period of time (parameter: pre-charge time) to ensure that the motor can cool down.
Contact block cooling down period (for product version < *E06* devices)	After overload tripping of the inherent protection, it is impossible to start the motor for 30 s to allow the device to cool down.
Emergency start active	The Emergency start function is activated.
Quick stop active	The Quick stop function is activated.

7.1.2 Warnings and Group Errors

Message	Warning	Error without restart	Error with restart	Cause / Remedy
No main power		x		1. Start command output even though the main voltage has not yet been applied. **Remedy:** Switch on main power. 2. If this message is issued in bypass operation, it may have been mistakenly issued because one of the following messages was generated too often: "Prewarning motor temp.", "Prewarning time" or "Current limit exceeded/undershot" (can also be traced via the entries in Log list / Events). **Remedy:** See the description of the respective messages
Incorrect start conditions (for product version < *E04* devices) Phase angle control failure (for product version ≥ *E04* devices)		x		1. Error occurs without motor starting. Cause: - Motor has not been connected correctly. - Inside delta circuit incorrectly configured. - Ground fault present. **Remedy:** Check and rectify wiring (see inside delta circuit wiring suggestions). 2. Error occurs during starting. Cause: - Start voltage too high - Breakaway pulse set (incorrectly): instable motor start (Only set breakaway pulse if absolutely necessary. In the case of pumps, for example ,a breakaway pulse can often cause misfiring.) If there is an idle time of < 5 s since the last start, the 3RW44 starts with a higher start voltage. In combination with a set breakaway pulse, this can lead to "Incorrect start conditions". **Remedy:** Adjust parameters or increase idle time.

Message	Warning	Error without restart	Error with restart	Cause / Remedy
Loss of phase L1		x		**Option 1:** Phase L1 missing, drops or fails while motor is running. A trip occurs due to a voltage drop in the permissible rated operating voltage of >15 % >100 ms during starting, or >200 ms in bypass operation. **Remedy:** Connect L1 or rectify voltage drop. **Option 2:** The connected motor is too small and the error message is issued immediately after switching to bridging mode. **Remedy:** Adjust rated operating current for connected motor or set to minimum (if motor current is lower than 10 % of the configured I_e, the motor cannot be operated with this starter). **Option 3:** Starter used in IT system with ground fault monitoring: 3RW44, product version $\leq$ *E06* and the PROFIBUS DP communication module may not be used in this network configuration. **Remedy:** Replace starter with 3RW44, product version $\geq$ *E07*. This version can be used in combination with the PROFIBUS DP communication module. However, the phase voltage values (UL-N) and phase-to-phase voltage values (UL-L) may be displayed incorrectly on the measurement-value display of the 3RW44.
Loss of phase L2		x		**Option 1:** Phase L2 missing, drops or fails while motor is running. A trip occurs due to a voltage drop in the permissible rated operating voltage of >15 % >100 ms during starting, or >200 ms in bypass operation. **Remedy:** Connect L2 or rectify voltage drop. **Option 2:** The connected motor is too small and the error message is issued immediately after switching to bridging mode. **Remedy:** Adjust rated operating current for connected motor or set to minimum (if motor current is lower than 10 % of the configured I_e, the motor cannot be operated with this starter). **Option 3:** Starter used in IT system with ground fault monitoring: 3RW44, product version $\leq$ *E06* and the PROFIBUS DP communication module may not be used in this network configuration. **Remedy:** Replace starter with 3RW44, product version $\geq$ *E07*. This version can be used in combination with the PROFIBUS DP communication module. However, the phase voltage values (UL-N) and phase-to-phase voltage values (UL-L) may be displayed incorrectly on the measurement-value display of the 3RW44.
Loss of phase L3		x		**Option 1:** Phase L3 missing, drops or fails while motor is running. A trip occurs due to a voltage drop in the permissible rated operating voltage of >15 % >100 ms during starting, or >200 ms in bypass operation. **Remedy:** Connect L3 or rectify voltage drop. **Option 2:** The motor that is connected is too small and the error message is issued immediately after switching to bridging mode. **Remedy:** Adjust rated operating current for connected motor or set to minimum (if motor current is lower than 10 % of the configured I_e, the motor cannot be operated with this starter). **Option 3:** Starter used in IT system with ground fault monitoring: 3RW44, product version $\leq$ *E06* and the PROFIBUS DP communication module may not be used in this network configuration. **Remedy:** Replace starter with 3RW44, product version $\geq$ *E07*. This version can be used in combination with the PROFIBUS DP communication module. However, the phase voltage values (UL-N) and phase-to-phase voltage values (UL-L) may be displayed incorrectly on the measurement-value display of the 3RW44.
Missing load phase T1		x		Motor phase T1 is not connected. **Remedy:** Connect motor correctly.
Missing load phase T2		x		Motor phase T2 is not connected. **Remedy:** Connect motor correctly.
Missing load phase T3		x		Motor phase T3 is not connected. **Remedy:** Connect motor correctly.

Message	Warning	Error without restart	Error with restart	Cause / Remedy
Supply voltage below 75 %		x		Control supply voltage is below 75 % of the required nominal voltage for longer than 100 ms (voltage failure, voltage drop, wrong control supply voltage). **Remedy:** Check control supply voltage.
Supply voltage below 85 %		x		Control supply voltage is below 85 % of the required nominal voltage for longer than 2 s (voltage failure, voltage drop). **Remedy:** Check control supply voltage.
Supply voltage above 110 %		x		Control supply voltage is above 110 % of the required nominal voltage for longer than 2 s (voltage failure, voltage drop, wrong control supply voltage). **Remedy:** Check control supply voltage.
Current unbalance exceeded	x	x		Phase currents are asymmetric (asymmetric load). Message is output when the asymmetry is greater than the configured limit (parameter: Current asymmetry limit value). **Remedy:** Check load or change parameter value.
Therm. motor model overload	x	x	x	The thermal motor model has tripped. After an overload trip, there will be no restart until the pre-charge time has elapsed. **Remedy** in the case of unwanted tripping: - Check whether the motor rated operating current I_e is incorrectly adjusted or - Change CLASS setting or - Reduce switching frequency, or - Deactivate motor protection (CLASS OFF)
Prewarning motor temp.	x			Motor heat build-up is greater than the set value for the: Prewarning motor temp. The thermal motor model approaches an overload trip, dependent upon the set value. For heavy starting and set values of the tripping class $\geq$ CLASS 20, we recommend increasing the "Prewarning motor temp." parameter value to 95 %.
Prewarning time undershot	x			Time until overload tripping of the thermal motor model is shorter than the specified value for the "Prewarning limit tripping reserve" parameter. For heavy starting and set values of the tripping class $\geq$ CLASS 20, we recommend increasing the "Prewarning limit tripping reserve" parameter value to 0 s (deactivated).
System overvoltage (for product version < *E04* devices) System voltage too high (for product version $\geq$ *E04* devices)		x		Applied control supply voltage is not suitable for the device or longer voltage peaks occur. Tripping occurs due to the permitted rated control supply voltage being exceeded by >10 % >500 ms. **Remedy:** Apply correct voltage.
Current range overflow		x		1. A very high current has occurred (beyond the measuring range of the current transformers integrated in the soft starter). This may happen in the case of: direct starting, breakaway pulse or combined braking. **Remedy:** If the "Voltage ramp" starting mode is selected, extend the set ramp time or lower the breakaway voltage or braking torque. The soft starter may be too small for the motor. 2. If this message is issued during start-up, it may have been mistakenly issued because one of the following messages was generated too often: "Prewarning motor temp.", "Prewarning time" or "Current limit exceeded/undershot" (can also be traced via the entries in Log list / Events). **Remedy:** See the description of the respective messages.
Motor stalled - switched off (for product version < *E07* devices only)		x		A very high current suddenly occurs in bridging mode, e.g. when the motor stalls (I > 4 x I_{sMotor} higher than 100 ms). **Remedy:** Check motor.
Overcurrent		x		A current of more than 6 times the rated operating current has occurred for a long period of time. **Remedy:** Activate current limiting or check dimensioning (device/motor).
Power unit overheated		x	x	Overload trip of the thermal model for the power unit. **Remedy:** Wait until the device has cooled down, perhaps set a lower current limit or reduce the switching frequency (too many starts in succession). Check whether the motor is blocked or the ambient temperature is too high in the vicinity of the soft starter (for derating above 40 °C, refer to Chapter 10.3 "Technical Data").

Message	Warning	Error without restart	Error with restart	Cause / Remedy
Power unit overtemperature	x			The temperature of the thermal model for the power unit is higher than the permissible permanent operating temperature. **Remedy:** Check the motor operating current or check if the ambient temperature is too high in the vicinity of the soft starter (for derating above 40 °C, refer to Chapter 10.3 "Technical Data").
Temperature sensor short	x	x	x	Temperature sensor is short-circuited at terminals T1 / T2. **Remedy:** Check temperature sensor.
Temperature sensor open	x	x	x	Temperature sensor faulty at terminals T1 / T2, or one line is not connected or no sensor is connected at all. **Remedy:** Check temperature sensor or, if none is connected: deactivate temperature sensor.
Temperature sensor overload	x	x	x	Temperature sensor tripped at terminals T1 / T2, motor overheated. **Remedy:** Wait until the motor has cooled down and, if necessary, check motor.
Max. starting time exceeded		x		The set maximum starting time is shorter than the actual run-up time of the motor. **Remedy:** Extend "Max. starting time" parameter, increase current limit value or check load connected to the motor for mechanical faults.
Current limit exceeded/ undershot	x	x		Set current limit has been exceeded or undershot, e.g. due to a clogged fan filter or by the motor stalling. **Remedy:** Check the motor / load for the reason why the current limit value was exceeded/ undershot or adjust the limit value according to the existing load conditions.
Ground fault	x	x		One phase is connected to ground (only possible in bypass operation). **Remedy:** Check connections and wiring.
Manual operation connection abort	x			Connection to the PC has been interrupted (if PC-controlled) or (if motor is key-controlled) no key has been pressed for a long period of time (see settings > Display > Activity monitoring time in Chapter 5.4.10. Control will be handed over to the inputs if these have requested control priority. **Remedy:** Reconnect the PC or increase activity monitoring time and press a key at regular intervals.
Impermissible Ie / CLASS settings		x		The set rated operating current I_s of the motor (Chapter 5.4.2 "Entering the Motor Data") exceeds in at least one of the three parameter sets the corresponding, maximum permissible set current, based upon the selected CLASS settings (Chapter 5.4.9 "Selecting Motor Protection Settings"). In product version ≥ *E07* devices, the corresponding parameter set (PS) in which the incorrect value is to be found will be displayed. For maximum permissible adjustable values please refer to Chapter 10.3 "Technical Data". If the soft starter is connected in an inside delta circuit, the motor feeder may have been incorrectly wired (Chapter 9.1.5 "3RW44 in an Inside elta Circuit") so that the "Status display / Connection method" menu item (Chapter 5.5.2 "Status Display") shows "Unknown / fault". **Remedy:** Check the set rated operating current of the motor in all 3 parameter sets, reduce the CLASS setting or use larger soft starter dimensions. If used for inside delta circuits, check the wiring of the motor feeder to ensure that it corresponds to the specified circuit diagrams. If the motor is not activated this is only a status message. However, the message turns into an error without restart once a start command is issued.
No external start parameters received (for product version ≥ *E06* devices)		x		Only when operated with PROFIBUS DP. Incorrect or non-permissible parameter values have been sent by the PLC. **Remedy:** The incorrect parameter can be read out and corrected to a permissible value via the Soft Starter ES software.
PIO error (for product version ≥ *E06* devices)			x	PIO error (process image of the outputs faulty) is displayed: • If Motor right and Motor left are simultaneously selected (Cause 1) or • were selected via PLC parameter set 4 (Cause 2). **Remedy:** • Automatic deletion once Motor right and Motor left are deactivated again (Cause 1), or • a valid parameter set (PS 1-3) is set (in the case of Cause 2).

Message	Warning	Error without restart	Error with restart	Cause / Remedy
Bypass element protective tripping (for product version ≥ *E07* devices)		x		A very high current occurs in bridging mode. Tripping depends upon the time and strength of the current. The error can only be reset after 30 s (cooling). **Remedy:** Check the motor and the soft starter dimensioning.

7.1.3 Device Errors

Message	Cause / Remedy
Contact block damaged (for product version ≥*E04* devices)	At least one bypass element is welded and/or at least one thyristor has shorted. This message is generated when the control supply voltage is applied and the current flow is being measured, but no start command has been issued. **Remedy:** Contact your SIEMENS contact partner or Technical Assistance (see Chapter "Important notes")
Switching element 1 failed	Thyristor in phase L1 has shorted. (This message is displayed when the start command is issued.) **Remedy:** Contact your SIEMENS contact partner or Technical Assistance.
Switching element 2 failed	Thyristor in phase L2 has shorted. (This message is displayed when the start command is issued.) **Remedy:** Contact your SIEMENS contact partner or Technical Assistance.
Switching element 3 failed	Thyristor in phase L3 has shorted. (This message is displayed when the start command is issued.) **Remedy:** Contact your SIEMENS contact partner or Technical Assistance.
Flash memory error	The device memory is faulty. **Remedy:** Contact your SIEMENS contact partner or Technical Assistance.
Device not identified	Device has not yet been identified. It must be given identification data. **Remedy:** Contact your SIEMENS contact partner or Technical Assistance.
Versions not matching	The version does not match the firmware. **Remedy:** Contact your SIEMENS contact partner or Technical Assistance.
Bypass part fault	The bypass contactor is welded or defective. **Remedy:** Contact your SIEMENS contact partner or Technical Assistance.
Heatsink thermistor open	**Option 1:** The temperature sensor at the heatsink of the starter is not connected or is defective. **Option 2:** 3RW4465 or 3RW4466 may have a defective fan on the front of the starter. **Remedy:** For 3RW4465 and 3RW4466 only: Try to rectify the fault after a cooling down period of approx. 30 to 60 minutes by switching the control supply voltage on and off again. If successful, check whether the fan on the front of the soft starter runs when a start command is issued. If not, it may be necessary to replace the fan. (The fan on the front of the starter and the fan on the bottom of the device must both be running in trouble-free operation). For all 3RW44 starters: If switching the control supply voltage on and off did not cause the error message to reset, contact your SIEMENS contact partner or Technical Assistance.
Heatsink thermistor short	The temperature sensor at the heatsink of the starter is defective. **Remedy:** Contact your SIEMENS contact partner or Technical Assistance.

Note
Some error messages may be incorrect (e.g. Loss of phase L1, although L2 is missing).

Note
When using the 3RW44 soft starter in an IT system with ground fault monitoring: 3RW44, product version ≤*E06* and the PROFIBUS DP communication module may not be used in this network configuration. 3RW44 soft starters as of product version *E07* can be used in combination with the PROFIBUS DP communication module. However, phase voltage values (UL-N) and phase-to-phase voltage values (UL-L) may be displayed incorrectly on the measurement-value display of the 3RW44.

PROFIBUS DP Communication Module

8

8.1 Introduction

This chapter describes the PROFIBUS DP communication module for the 3RW44 soft starter.

Using the PROFIBUS DP communication module, the 3RW44 soft starter can be linked to the Profibus branch with all its functionality.

Prerequisites

- You have configured an infeed module with integrated S7 station e.g. with CPU315-2 DP.
- STEP 7 (V 5.1 and higher + Hotfix 2) is completely installed on your PC/PD.
- You are proficient in STEP 7.
- The PD is connected to the DP master.

Notice

The PROFIBUS DP communication module only works with 3RW44 devices, product version "E06" or higher, implemented for devices as of production date 060501.

Production location/ Year /Month/ Day Productversion
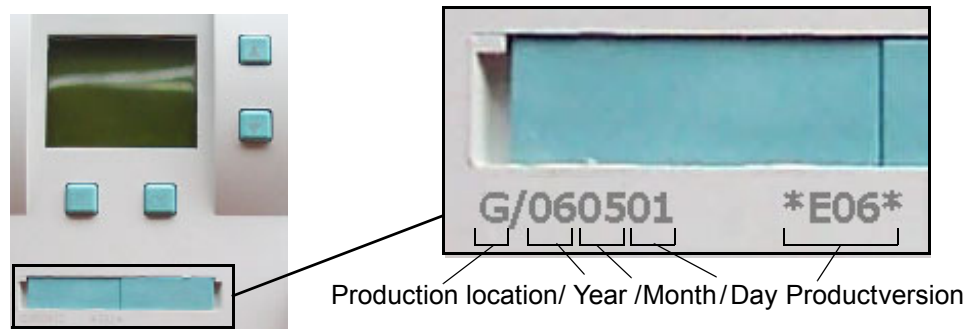
Notice

IT systems with ground fault monitoring:

3RW44, product version $\leq$ *E06* and the PROFIBUS DP communication module may not be used in this network configuration. 3RW44 soft starters as of product version *E07* can be used in combination with the PROFIBUS DP communication module. However, phase voltage values (UL-N) and phase-to-phase voltage values (UL-L) may be displayed incorrectly on the measurement-value display of the 3RW44.

Notice

Use of the 3RW44 with PROFIBUS for redundant controls and Y link:

The 3RW44 acts like a DPV0 Slave in the Y link. Parameterization can only be carried out via the GSD file. Only cyclic data is transmitted, no data sets or alarms.

Further PROFIBUS DP documentation

Operating instructions "PROFIBUS DP Communication Module for 3RW44 Soft Starters", order number: 3ZX1012-0RW44-0KA0.

8.1.1 Definitions

S7 slave

An S7 slave is a slave fully integrated into STEP 7. It is embedded via OM Soft Starter ES Professional. It supports the S7 model (diagnosis alarms).

Writing data

Writing data means that data is transmitted to the soft starter.

Reading data

Reading data means that data is transmitted from the soft starter.

GSD

The device master file (GSD) contains DP slave descriptions in a uniform format. Use of the GSD simplifies the configuration of the DP master and the DP slave.

8.2 Data Transmission

8.2.1 Data Transmission Options

The following figure illustrates the data transmission options:
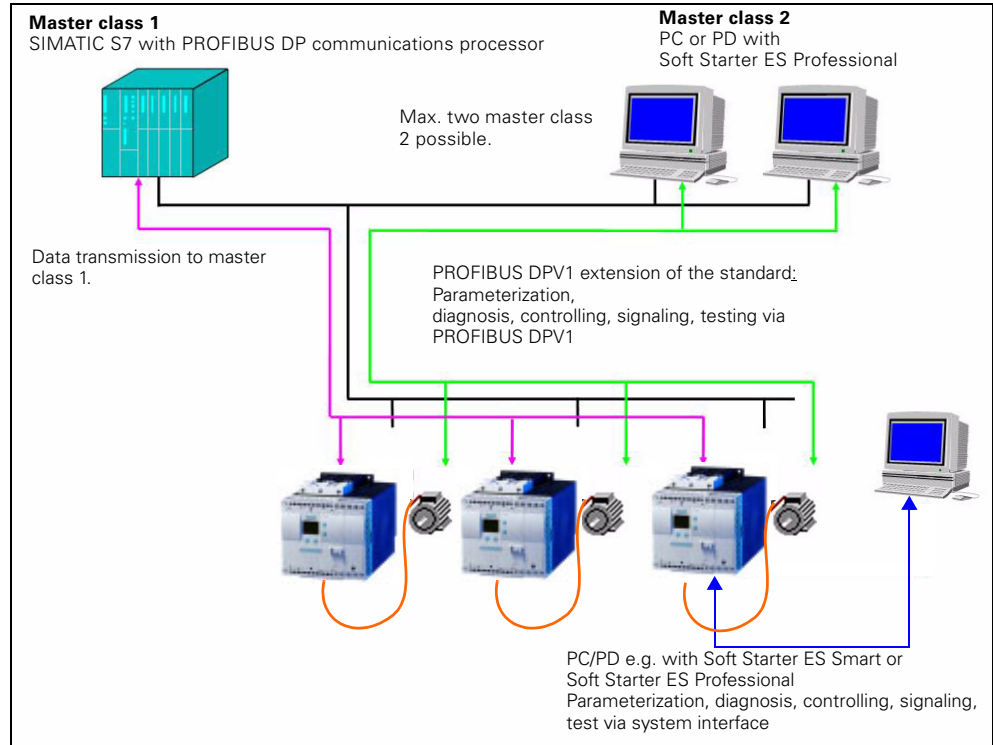
Figure 8-12:Data transmission options

8.2.2 Communication Principle

The following figure illustrates the communication principle. Different data is transmitted depending on the operating modes of the master and slave:
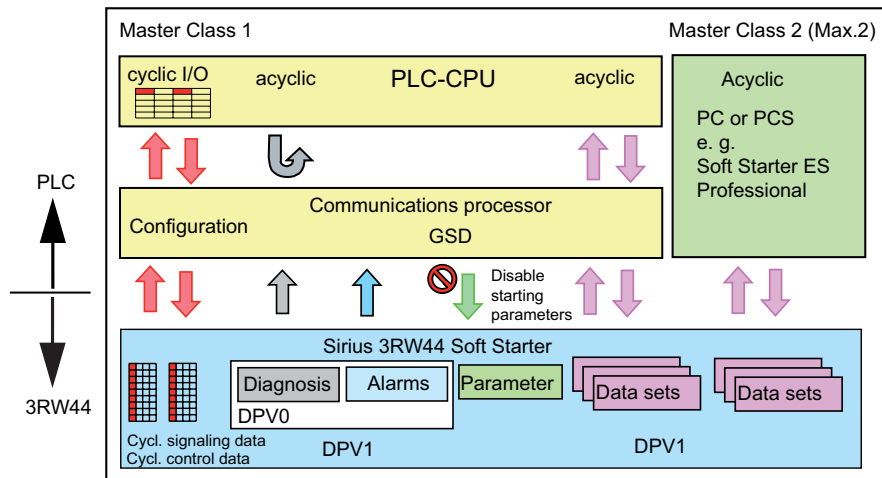
Figure 8-13:Communication principle

SIRIUS 3RW44 System Manual
GWA 4NEB 535 2195-02 DS 04

8.3 Installation of the PROFIBUS DP Communication Module

> ⚠ **Warning**
> Dangerous electrical voltage! Can cause electric shock and burning.
> Before starting work, de-energize the system or device.

Observe the information in the operating instructions "PROFIBUS DP communication module for 3RW44 Soft Starters", order number 3ZX1012-0RW44-0KA0.

8.3.1 Insertion of the PROFIBUS DP Communication Module (Field Bus Interface)
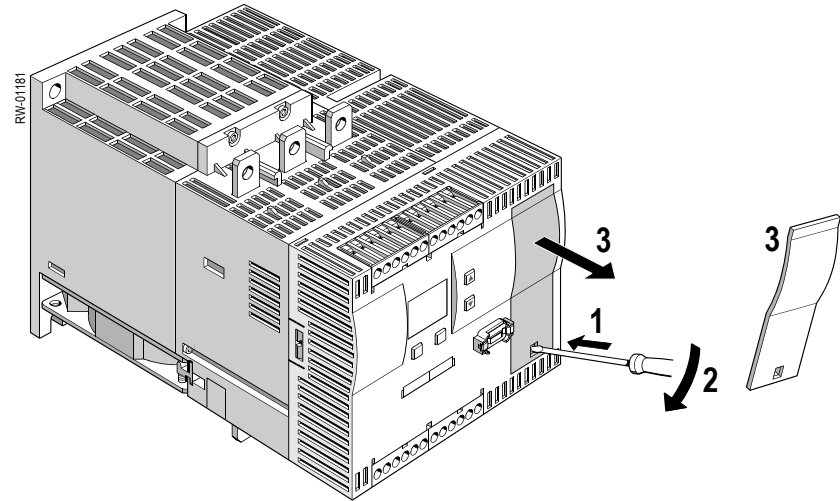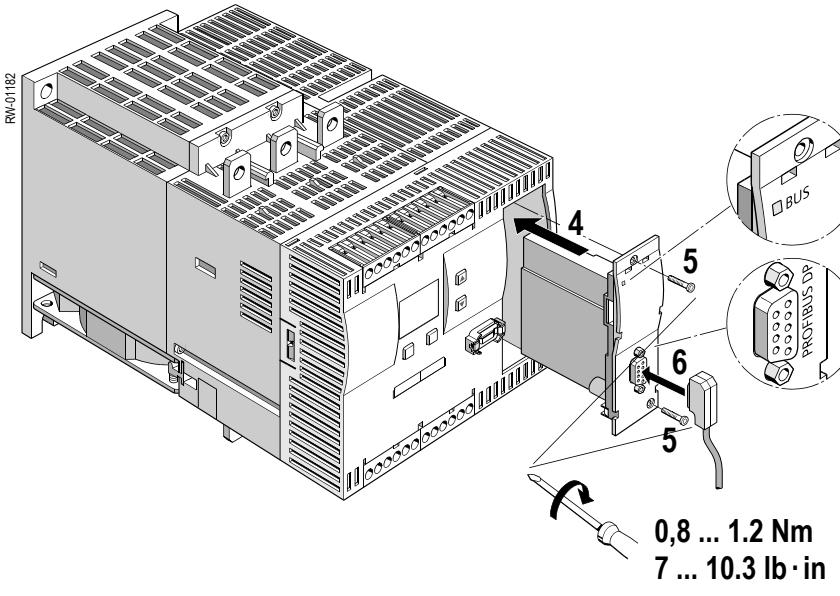
> **Caution**
> **Risk of damage to property.**
> Before inserting the PROFIBUS DP communication module, de-energize the 3RW44 soft starter.

> **Notice**
> The PROFIBUS DP communication module only works with 3RW44 devices, product version "E06" or higher, implemented for devices as of production date 060501.

G/060501   *E06*

Production location / Year / Month / Day   Product version
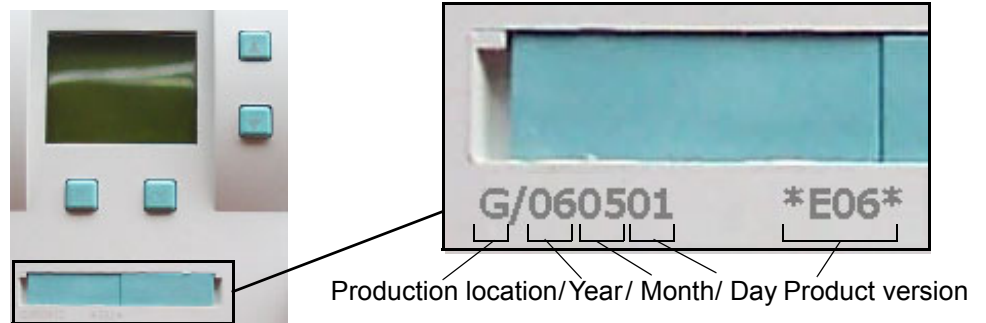
Proceed as follows:

Step	Description
	Insert a small screwdriver into the opening in the cover of the 3RW44 soft starter **(1)**. Lightly press the screwdriver downwards **(2)** and remove the cover **(3)**.
	Insert the PROFIBUS DP communication module into the device **(4)**.
	Screw in the PROFIBUS DP communication module with the screws included in the scope of supply **(5)**.
	Plug the PROFIBUS connecting cable into the socket of the communication module **(6)**. Screw the PROFIBUS connecting cable in tightly.
	Switch on the supply voltage. The "BUS" LED blinks yellow. This means that the communication module has been inserted correctly, but has not yet been activated.

8.4 Activating the PROFIBUS DP Communication Module (Field Bus Interface) and Setting the Station Address

8.4.1 Introduction

Activate the PROFIBUS DP communication module (device function "Field bus") and set the station address either via the display or via the device interface using the "Soft Starter ES Professional" or the "Soft Starter ES smart + SP1" software.

Notice

After activating the communication module, the control priority automatically switches from the inputs to the
PROFIBUS DP communication module.
If an input is active with the "Manual operation local" function, the control priority does not change (refer to Chapter 5.4.7 "Parameterizing the Inputs" on Page 5-28).

The station address of the soft starters is pre-set to 126 as factory default.

8.4.2 Activating the PROFIBUS DP Communication Module via the Display, Setting the Station Address and Saving the Settings

1. When putting the soft starter into operation for the first time, you have to go through the quick start menu (refer to Chapter 5.2). Also refer to the operating instructions "3RW44 Soft Starters" (order number: 3ZX1012-0RW44-0AA0).

2. Press the respectively marked key on the device.
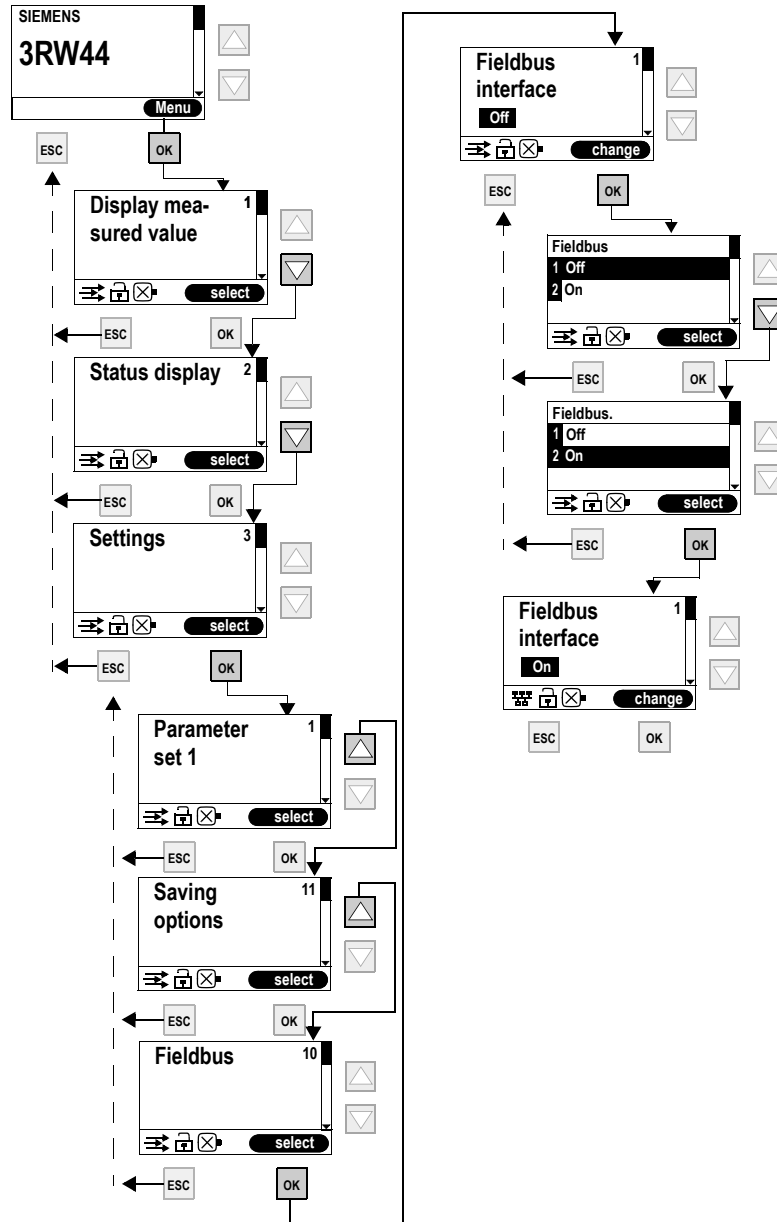
3. The "BUS" LED blinks red.

4. When the PROFIBUS icon appears on the display, the PROFIBUS DP communication module has been activated successfully.

The next step is to set the desired station address of the 3RW44 as PROFIBUS slave.

In this example, the station address is set to "23".
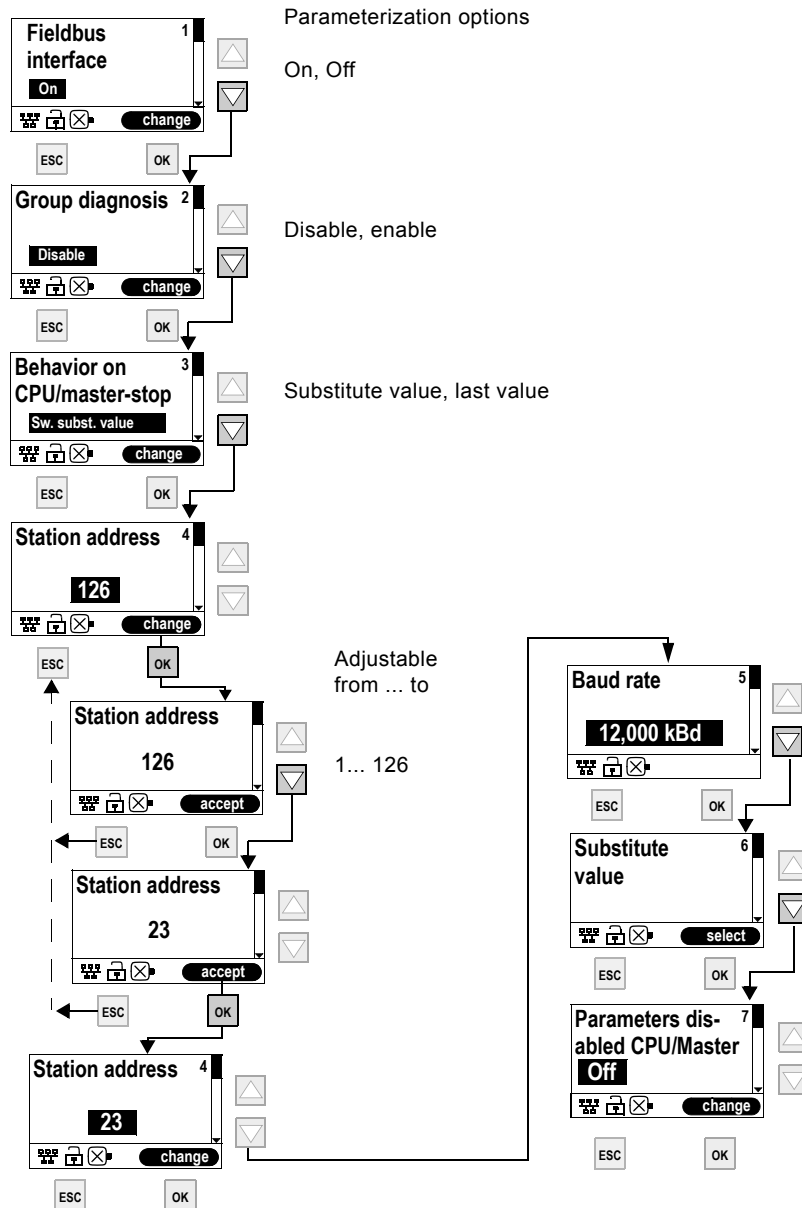
Notice

If the parameter "Parameters disabled CPU/Master" is set to "Off" (factory setting), the parameters set on the soft starter will be overwritten with the values stored in the GSD data or in the OM when the bus is started. If this is not desired, the parameter must be set to "On".

5. In order to permanently save the settings, proceed as follows:
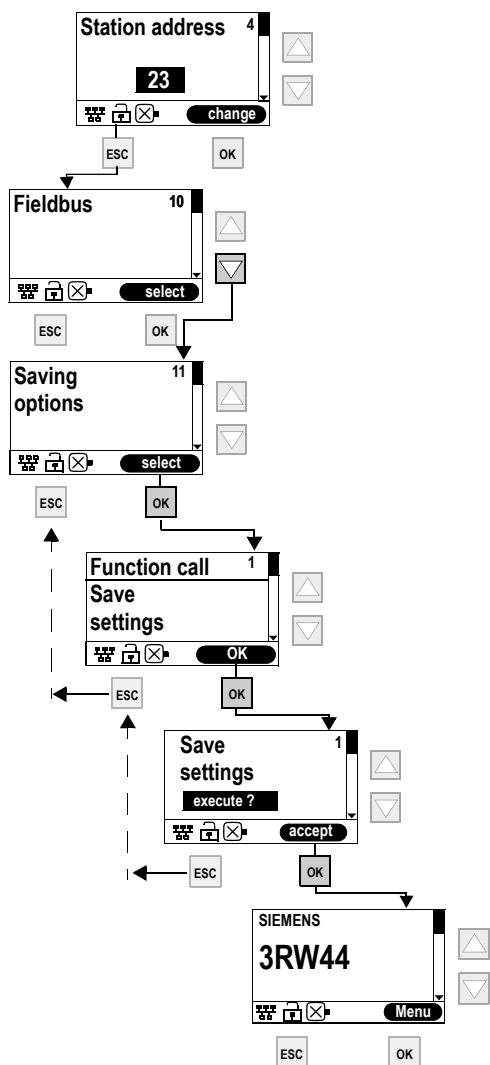
Notice

If the parameter "Parameters disabled CPU/Master" is set to "Off" (factory setting) in the menu "Field bus", the parameters set on the soft starter will be overwritten with the stored values in the GSD data or in the OM on starting the bus. If this is not desired, the parameter must be set to "On".

8.4.3 Activating the PROFIBUS DP Communication Module (Field Bus Interface) and Setting the Station Address via the Device Interface using the "Soft Starter ES Professional" or the "Soft Starter ES Smart + SP1" Software

Carry out the following steps to activate the communication module:

1. Use an interface cable to connect the 3RW44 soft starter to a PC on which the "Soft Starter ES Professional" or the "Soft Starter ES Smart + Service Pack 1" software is installed.
2. Start the "Soft Starter ES Professional" or "Soft Starter ES Smart + Service Pack 1" software.
3. Select "Switching device > Open online" in the menu.
4. In the "Open online" dialog box, select the "Local device interface" option and the desired COM port under "Interface".
5. Click "OK".
6. Select "Device configuration" on the left-hand side of the window.
7. Activate the "Field bus interface" control box on the right-hand side of the window.
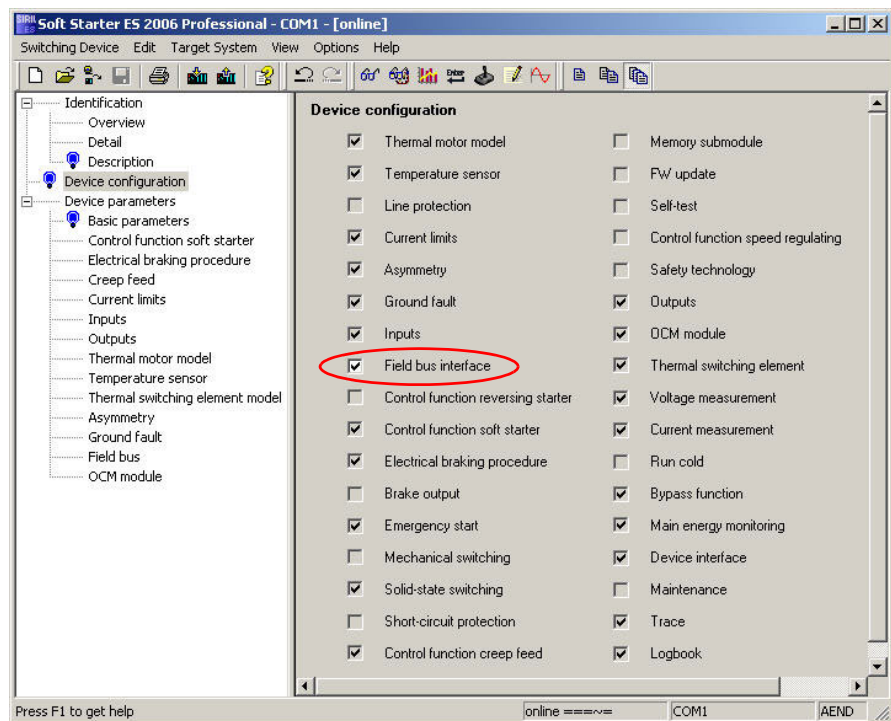
8. Select "Device parameters > Field bus" on the left-hand side of the window.

9. Select your station address from the dropdown list box on the right-hand side of the window.
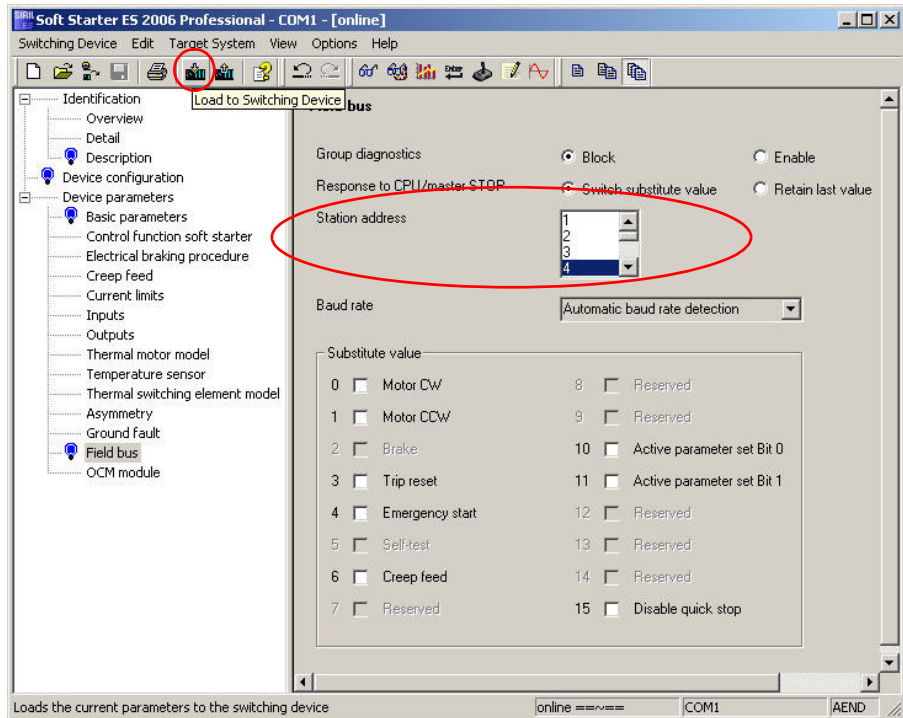
10. Select the "Load to Switching Device" icon in the tool bar.
11. Confirm the station address change with "OK".
12. Confirm the activation of the PROFIBUS DP communication module with "OK". The PROFIBUS DP communication module has been activated.
13. When the "BUS" LED on the communication module blinks red and the

   PROFIBUS icon ⌗ appears on the display, the communication module has been activated successfully.

Notice
The soft starter only reads the station address automatically and permanently saves it when the supply voltage of the soft starter is switched on (refer to Chapter 8.6.5 "Flow Diagram PROFIBUS DP - Starting the Soft Starter" on Page 8-22) or following a "Restart" command.

8.5 Soft Starter Configuration

8.5.1 Introduction

This consists of configuring and parameterizing soft starters.
- Configuring: Systematic arrangement of the individual soft starters (structure).
- Parameterizing: Setting of the parameters using the configuration software. Further information regarding parameters can be found in Chapter 8.10 "Data Formats and Data Sets" on Page 8-35.

STEP 7

- The "Diagnose hardware" function is available with STEP 7 V5.1 as of correction version K5.1.2.0.
- Reloading of the configuration is not supported in STEP 7 (Target system →Load to PD).
- It is only possible to read the diagnosis via the CPU 315-2 DP (using the "Diagnose hardware" function in STEP 7) as of from order number 6ES7315–2AF02.

8.5.2 Configuration with the GSD File

Definition of the GSD

The device master file (GSD) contains DP slave descriptions in a uniform format. Use of the GSD simplifies the configuration of the DP master and the DP slave.

Configuration with the GSD File

Soft starters are configured using the GSD file. Via the GSD file, the soft starter is embedded into your system as a standard slave.
You can download the GSD file

- from the Internet at
  http://www.siemens.de/sanftstarter
  http://www.siemens.com/softstarter
  http://support.automation.siemens.com/WW/view/en/23219700
  (Select "Low-Voltage Controls" from the product tree. Select the "Downloads" tab and the folder "PROFIBUS GSD files: Switchgears".)

The following GSD files are available:
- SIEM80DE.GSG (German)
- SIEM80DE.GSE (English)
- SIEM80DE.GSF (French)
- SIEM80DE.GSI (Italian)
- SIEM80DE.GSS (Spanish)

Notice
Your configuration tool must support GSD files - Rev.3, e.g. STEP 7 V5.1+Service Pack 2 and higher.

8.5.3 Configuration using the Soft Starter ES Professional Software

Sirius 3RW44 soft starters can also be configured using the
Soft Starter ES Professional software, order number 3ZS1313-2CC10-0YA0.
There are two possibilities when using PROFIBUS DP:

- Stand-alone program on a PC/PD with PROFIBUS DP interface
- Integration with the object manager (OM) in STEP 7
  Detailed information regarding Soft Starter ES can be found in the program's online help.

8.6 PROFIBUS DP Commissioning using the GSD File in STEP 7 (Example)

8.6.1 Introduction

The following example shows you how to commission the PROFIBUS DP communication module.

- Installation and activation of the PROFIBUS DP communication module (field bus interface)
- Configuration with STEP 7 using the GSD file
- Integration into the User Program
- Switching on

Necessary components

- 3RW44 soft starter
- 3RW49 00-0KC00 communication module

General prerequisites

- You have configured an infeed module with integrated S7 station e.g. with CPU315-2 DP.
- You are proficient in STEP 7.
- The PD is connected to the DP master.

Software prerequisites

Configuration software used	Version	Explanations
STEP 7	From version V5.1+SP2	You have integrated the GSD file of the soft starter into STEP 7.
Configuration software for the different DP master used		You have integrated the GSD file of the soft starter into the respective configuration tool.

Table 8-1: Software prerequisites for commissioning

Prerequisites for commissioning

Required actions	For further information, refer to ...
1. The soft starter is installed	Chapter 3 "Installation, Connection and Branch Layout"
2. The PROFIBUS DP communication module is installed	Chapter 8.3 "Installation of the PROFIBUS DP Communication Module" on Page 8-7.
3. The station address is set on the soft starter	Chapter 8.4.3 "Activating the PROFIBUS DP Communication Module (Field Bus Interface) and Setting the Station Address via the Device Interface using the "Soft Starter ES Professional" or the "Soft Starter ES Smart + SP1" Software" on Page 8-13.
4. The soft starter has been configured (configured and parameterized)	Chapter 8.5 "Soft Starter Configuration" on Page 8-15
5. The supply voltage of the DP master is switched on	DP master manual
6. The DP master is switched to the operating state RUN	DP master manual

Table 8-2: Prerequisites for commissioning

8.6.2   Configuration using the Device Master File (GSD) in STEP 7

Step	Description
1	Activate the PROFIBUS DP communication module as described in Chapter 8.4.
2	Set the desired station address as described in Chapter 8.4.
3	Switch on the supply voltage for the DP master CPU 315-2 DP at the infeed module.
4	Observe the status LEDs of the DP master CPU 315-2 DP on the infeed module: 5 V DC: Lights up SF DP: Off BUSF: Blinking
5	Start the SIMATIC Manager and create a new project with a DP master (e.g. CPU315-2 DP with DI 16 x 24 V DC and DO 16 x 24 V DC). Generate OB1 and OB82 for the project.
6	In HW config call up the menu command Extras > Install new GSD file and integrate the GSD file of the soft starter into the configuration tool of the DP master used. For the CPU315-2 used in the example you can install • the German GSD file SIEM80DE.GSG • the English GSD file SIEM80DE.GSE • the French GSD file SIEM80DE.GSF • the Spanish GSD file SIEM80DE.GSS • the Italian GSD file SIEM80DE.GSI in the STEP 7 SIMATIC Manager.
7	Generate the PROFIBUS DP subnet.
8	Add the soft starter to the PROFIBUS from the hardware catalog under PROFIBUS DP > Additional field devices > Switching devices > Motor starters > Direct on line soft starters > Sirius 3RW44.
9	Set the station address for the soft starter to 3 (or higher).
10	Drag the module from the selection list of the dropdown menu to slot 1 of the Sirius 3RW44: <table><tr><td>Slot</td><td>Module/ DP ID</td><td>Order number</td><td>I addr.</td><td>O addr.</td><td>Comment</td></tr><tr><td>1</td><td>192</td><td>3RW4422-*BC**</td><td>2...3*)</td><td>2...3*)</td><td></td></tr></table> *) Depending on the structure Open the "DP slave characteristics" dialog with a double click.
11	Click on "Parameterization". Set the parameters **), e.g. **:** Rated operating current **:** Click "OK". The configuration is completed.
12	Save the configuration.

Table 8-3: Commissioning

**) Notice
During parameterization with the GSD file it is possible to select values that are dependent on each other, but which are not permissible in combination. The respective parameter is reported as "Incorrect parameter value" in data set 92.

The following table shows which parameters are dependent on each other and how these have to be set:

Parameter		Settings
Rated operating current I_e	Depends on	Tripping class CLASS (refer to Chapter 10.3.2 "Technical Data Power Unit" on Page 10-8).
Maximum current limit	Greater than	Minimum current limit Chapter 5.4.6 "Specifying Current Limits" on Page 5-27.
Maximum starting time	Greater than	Starting time Chapter 5.4.3 "Specifying the Starting Mode" on Page 5-13.
Limiting torque	Greater than	Start torque Chapter 5.4.3 "Specifying the Starting Mode" on Page 5-13, torque control and torque control with current limiting.

Table 8-4: Interdependent parameter settings

8.6.3 Integration into the User Program

Step	Description

1	Create the user program in the LAD/STL/CSF editor in OB1.
	Example: Reading an input and controlling an output:
	
	OB1 : Title:
	
	Comment:
	
	Network 1: Title:
	Cyclically copy the central DIs (switches) to the decentralized motor starter (=PAA).
	Cyclically output the PAE of the motor starter to the central DOs (LED).
	
	L EB 0 // PAA: read in switches 0-7 (DI 16 x 24 V DC)
	T AB 2 // y emitir al arrancador de motor
	
	// EB0.0 Motor - RIGHT
	// EB0.1 Motor - LEFT
	// EB0.2 0
	L EB 2 // Read in the motor starter PAE
	T AB 0 // and output to D016xDC24V

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

Table 8-5: Integration into the user program

8.6.4 Switching On

Step	Description
1	Switch on the voltage supply for the soft starter.
2	Observe the status LEDs on the DP master CPU315-2 DP: 5 V DC: Lights up SF DP: Off BUSF: Off
3	Observe the status LEDs on the PROFIBUS module: LED BUS: Lights up green

Table 8-6: Switching on

8.6.5 Flow Diagram PROFIBUS DP - Starting the Soft Starter
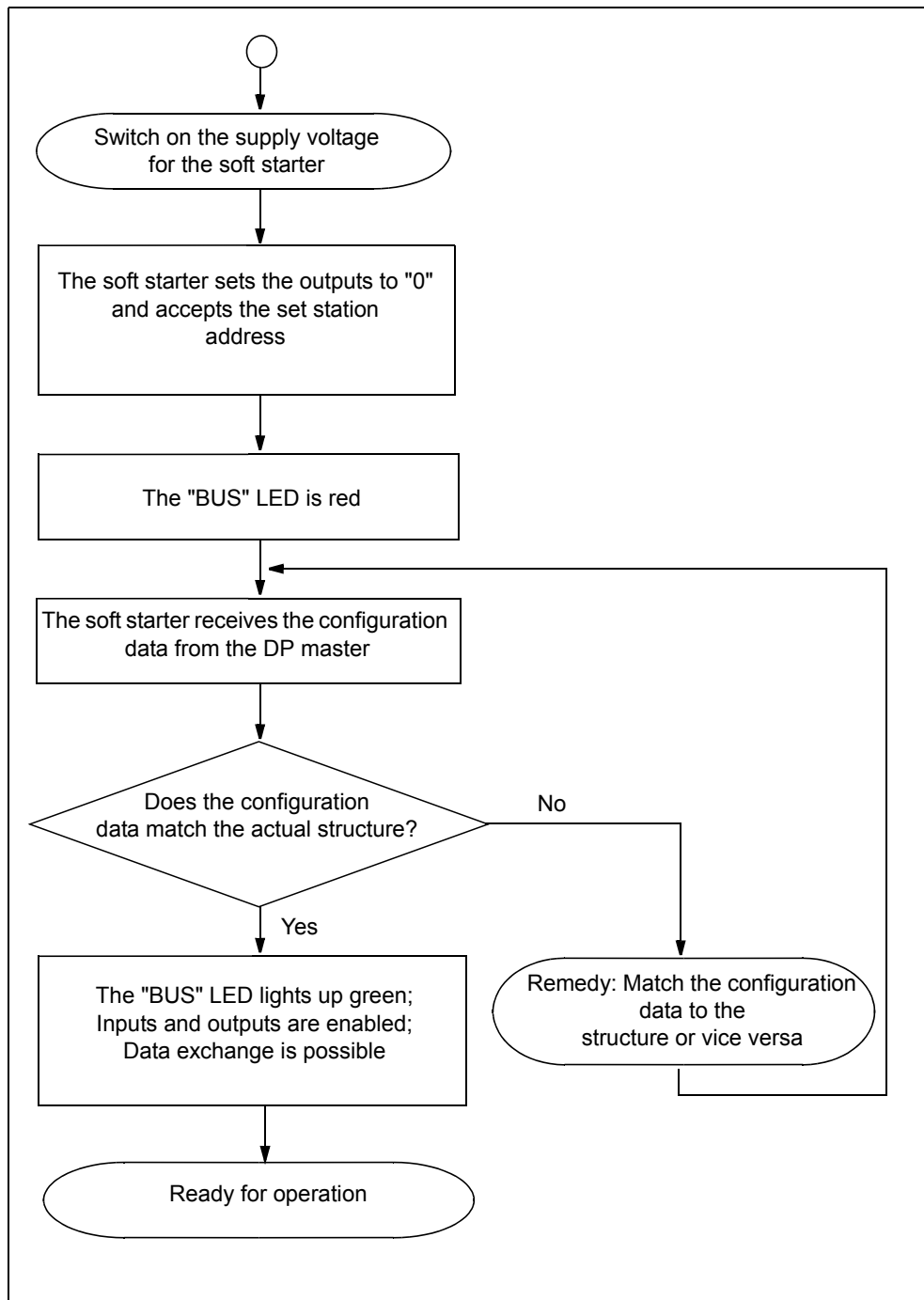
Figure 8-14:PROFIBUS DP - starting the soft starter

8.7 Process Data and Process Images

Definition of the process image

The process image is part of the system memory of the DP master. At the beginning of the cyclical program the signal stati of the inputs are transmitted to the process image of the inputs. At the end of the cyclical program, the process image of the outputs is transmitted to the DP slave as a signal status.

Soft starters with PROFIBUS DP have the following process image:

• Process image with 2 byte outputs / 2 byte inputs (16 O / 16 I)

Table

The following table contains process data and process images:

Process data		Process image: (16 O, DO 0.0 to DO 1.7) (16 I, DI 0.0 to DI 1.7)
Outputs		
DO- 0.	0	Motor right
	1	Motor left
	2	Available
	3	Trip reset
	4	Emergency start
	5	Available
	6	Slow speed
	7	Available
DO- 1.	0	Output 1
	1	Output 2
	2	Parameter set Bit 0
	3	Parameter set Bit 1
	4	Available
	5	Available
	6	Available
	7	Disable quick stop
Inputs		
DI- 0.	0	Ready (automatic)
	1	Motor on
	2	Group error
	3	Group warning
	4	Input 1
	5	Input 2
	6	Input 3
	7	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 $I_{act-bit5}$
	6	Manual operation local operating mode
	7	Ramp operation

Table 8-7: Process data and process images

8.8 Diagnosis via LED Display

	LED	Description
BUS	Red	Bus error
	Red blinking	Parameter error
	Red flickering	Factory settings restored (red flickering for 5 s)
	Red-green toggling[*]	Parameter error while starting S7
	Green	Device exchanging data!
	Yellow	Device not initialized and bus error! (Send in device!)
	Yellow-green blinking	Device not initialized and parameterization error! (Send in device!)
	Off	Device not exchanging data!
Specifications		
Error:	BE =	Bus error
Frequency specifications:	Blinking:	0.5 Hz
	Flickering:	8 to 10 Hz
	*) Toggling:	2 to 10 Hz

Table 8-8: Diagnosis via LED display

8.9 Diagnosis with STEP 7

8.9.1 Reading the Diagnosis

Length of the diagnosis telegram

The maximum length of the telegram is 32 byte.

8.9.2 Options for Reading the Diagnosis

Automation system with DP master	Module or register in STEP 7	Application	Refer to ...
SIMATIC S7/M7	SFC 13 "DP NRM_DG"	Reading the slave diagnosis (store in data area of the user program)	Chapter 8.9.3 "Structure of the Slave Diagnosis" on Page 8-27, For SFC, refer to the online help in STEP 7

Table 8-9: Reading the diagnosis with *STEP 7*

Reading the S7 diagnosis with SFC 13 "DP NRM_DG" (example)

This is an example of how to read the slave diagnosis for a DP slave in the STEP 7 user program using SFC 13.

Assumptions

The following assumptions are true for this STEP 7 user program:

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

STEP 7 user program

```
STL                                  Explanation


CALL   SFC 13


REQ      :=TRUE                      Read request

LADDR    :=W#16#3FE                  Diagnostic address

RET_VAL  :=MW0                       RET_VAL of SFC 13

RECORD   :=P#DB82.DBX 0.0 BYTE 32    Data compartment for diagnosis in DB82

BUSY     :=M2.0                      Read  operation  runs  over  several  OB1

                                     cycles
```

SIRIUS 3RW44 System Manual

8.9.3 Structure of the Slave Diagnosis
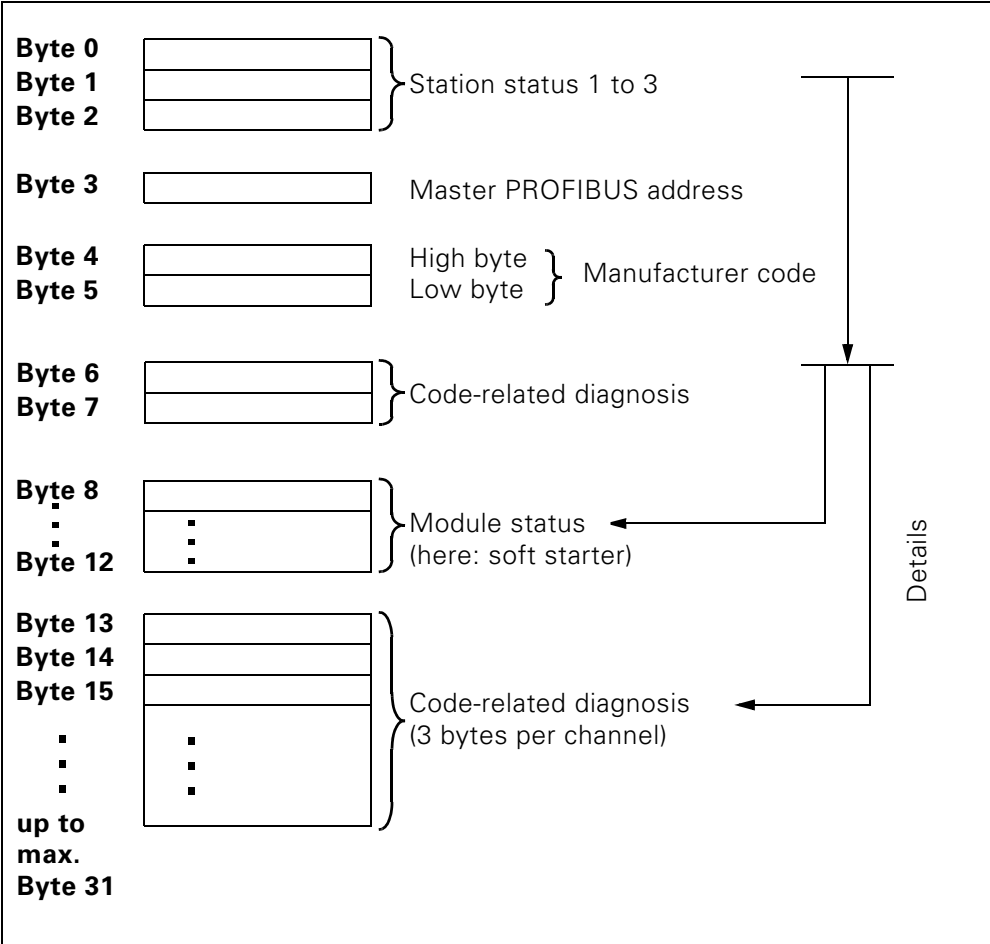
Figure 8-15: Structure of the slave diagnosis

Notice
The length of the diagnosis telegram varies between 13 and 32 bytes. The length of the diagnosis telegram last received can be seen in STEP 7 from the RET_VAL parameter of SFC 13.

8.9.4 Station Status 1 to 3

Definition

Station status 1 to 3 gives an overview of the status of a
DP slave.

Station status 1

Bit		Meaning	Cause/Remedy
0	1:	The DP slave cannot be addressed by the DP master.	• Has the station address been set correctly at the DP slave? • Is the bus connector connected? • Is voltage applied at the DP slave? • Is the RS 485 repeater set correctly? • Has a Reset been carried out at the DP slave?
1	1:	The DP slave is not yet ready for data exchange.	• Wait, since the DP slave is just starting up.
2	1:	The configuration data sent to the DP slave by the DP master does not match the structure of the DP slave.	• Has the correct station type and the correct structure for the DP slave been entered into the configuration software?
3	1:	There is an external diagnosis. (Group diagnosis display)	• Analyze the code-related diagnosis, the module status and / or the channel related diagnosis. As soon as all errors have been remedied, bit 3 is reset. The bit is set again when a new diagnosis message is available in the bytes of the above mentioned diagnoses.
4	1:	The requested function is not supported by the DP slave (e.g. changing of the station address via software).	• Check the configuration.
5	1:	The DP master cannot interpret the answer from the DP slave.	• Check the bus design.
6	1:	The DP slave type does not match the software configuration.	• Has the correct station type been entered into the configuration software?
7	1:	The DP slave was parameterized by a different DP master (not by the DP master accessing the DP slave at the moment).	• Bit is always 1 when you are e.g. accessing the DP slave with the PD or another DP master. The station address of the DP master which carried out the parameterization of the DP slave can be found in the "Master PROFIBUS Address" diagnostic byte.

Table 8-10: Station status 1 structure (byte 0)

Station status 2

Bit		Meaning
0	1:	The DP slave must be newly parameterized.
1	1:	There is a diagnosis message. The DP slave does not function until the error has been remedied (static diagnosis message).
2	1:	The bit is always set to "1" when a DP slave with this station address exists.
3	1:	The watchdog function is activated for this DP slave.
4	1:	The DP slave has received the "FREEZE" command[1].
5	1:	The DP slave has received the "SYNC" command[1].
6	0:	Bit is always "0".
7	1:	The DP slave has been deactivated, i.e. it is not part of the current processing.

1) The bit is not updated until another diagnosis message changes.

Table 8-11: Station status 2 structure (byte 1)

Station status 3

Bit		Meaning
0 to 6	0:	Bits are always "0".
7	1:	• There are more diagnosis messages than the DP slave can store. • The DP master cannot write all diagnosis messages sent by the slave in its diagnosis buffer (channel-related diagnosis).

Table 8-12: Station status 3 structure (byte 2)

8.9.5 Master PROFIBUS Address

Definition

The master PROFIBUS address diagnostic byte stores the station address of the DP master:
- which has carried out the parameterization of the DP slave and
- has read and write access to the DP slave.

The master PROFIBUS address is in byte 3 of the slave diagnosis.

8.9.6 Manufacturer Code

Definition

The manufacturer code contains a code describing the type of DP slave.

Manufacturer code

Byte 4	Byte 5	Manufacturer code for
80_H	DE_H	soft starters

Table 8-13: Structure of the manufacturer code

8.9.7 Code-Related Diagnosis

Definition

The code-related diagnosis indicates whether there are any faulty soft starters. The code-related diagnosis begins with byte 6 and comprises 2 bytes.

Code-related diagnosis

The structure of the code-related diagnosis for soft starters is as follows:
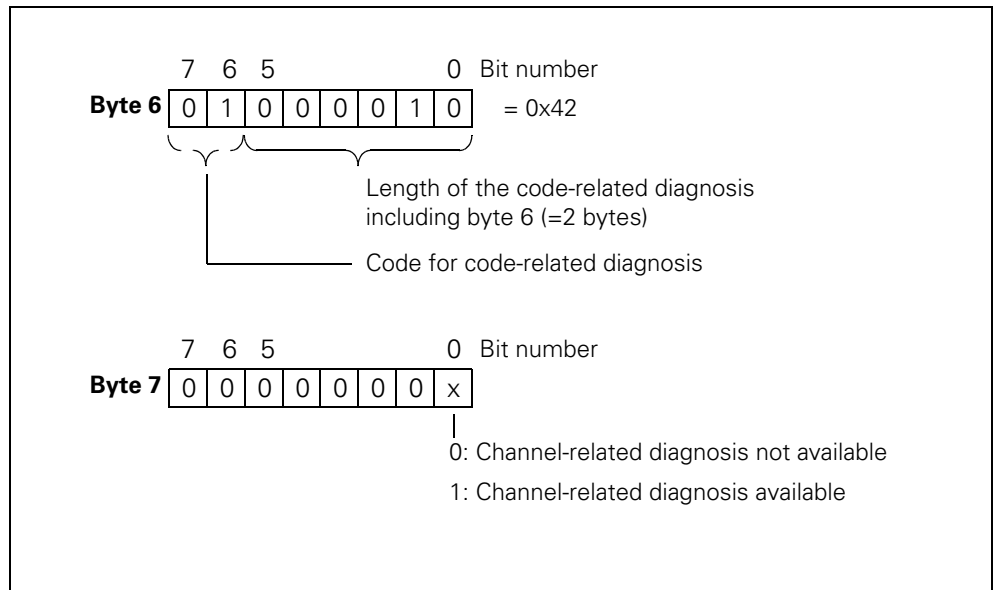
Figure 8-16:Structure of the code-related diagnosis

8.9.8   Module Status

Definition

The module status reflects the status of the configured module (here: soft starter) and represents a specification of the code-related diagnosis. The module status starts after the code-related diagnosis and comprises 5 bytes.

Module status structure

The structure of the module status is as follows:
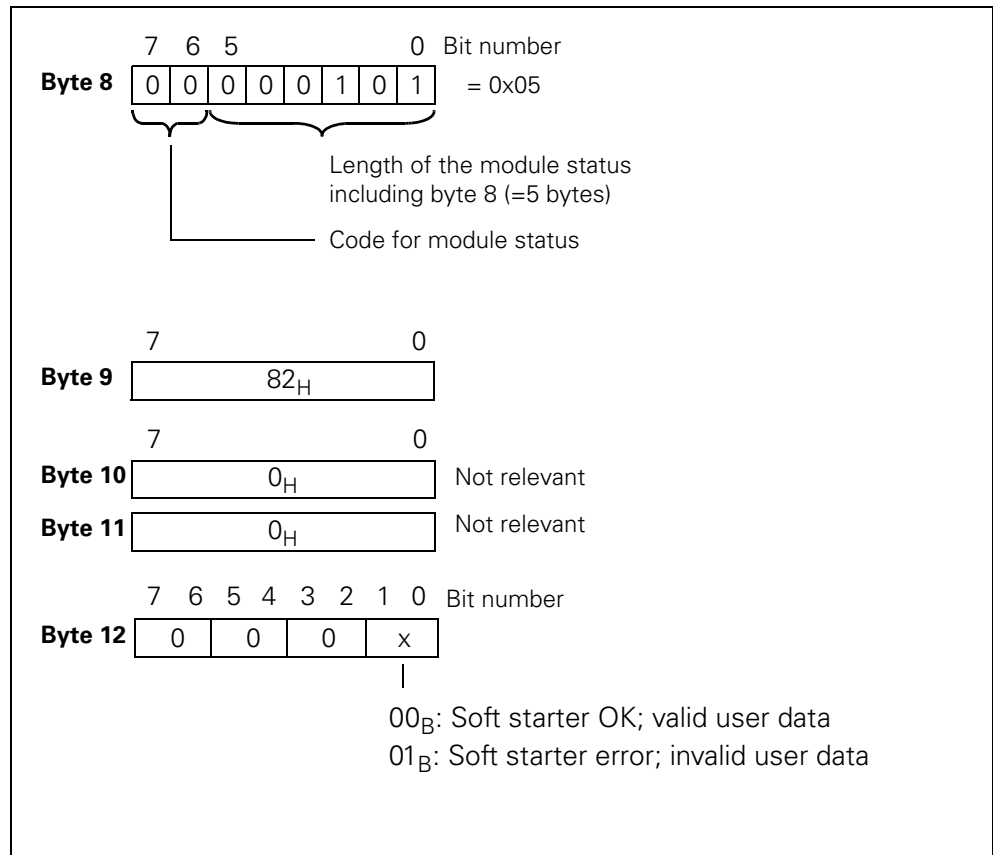
Figure 8-17: Structure of the module status

8.9.9 Channel-Related Diagnosis

Definition

The channel-related diagnosis informs about channel errors of the modules (here: soft starter) and represents a specification of the code-related diagnosis. The channel-related diagnosis starts after the module status. The maximum length is restricted to the maximum overall length of the slave diagnosis, i.e. 31 bytes. The channel-related diagnosis does not affect the module status.
The number of channel-related diagnosis messages is restricted to 9 (also refer to station status 3, bit 7).

Channel-related diagnosis

The structure of the channel-related diagnosis is as follows:
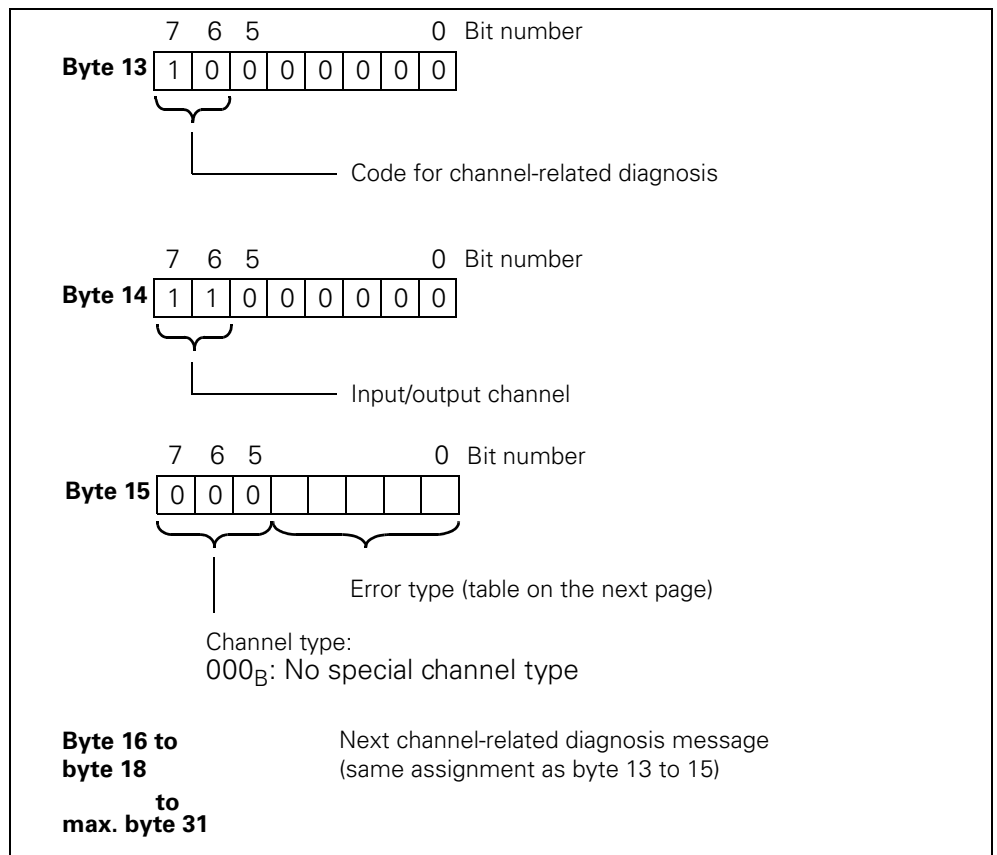
Figure 8-18: Structure of the channel-related diagnosis

Notice

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: Analyze the valid current length of the diagnosis telegram:
• STEP 7 from the RET_VAL parameter of SFC 13.

Error types

The diagnosis message is reported on channel 0.

E No.	Error type	Meaning/Cause	Delete signal bit/Acknowledgement
E1	00001: Short circuit	• Short circuit in the temperature sensor	The signal bit is deleted automatically when the cause for the switch-off has been remedied and acknowledged via "Trip reset".
E4	00100: Overload	• Overload of the temperature sensor • Overload of the thermal motor model	The signal bit is updated continuously.
E5	00101: Overtemperature	• Overload of the contact block	The signal bit is deleted automatically when the cause for the switch-off has been remedied and acknowledged via "Trip reset".
E6	00110: Line breakage	• Wire breakage in the temperature sensor	The signal bit is updated continuously
E7	00111: Maximum limit value exceeded	• Current limit exceeded	
E8	01000: Minimum limit value undershot	• Current limit undershot	
E9	01001: Error	• Internal error/device error • Contact block damaged	The signal bit can be deleted when the cause of the error has been remedied by • Switching the supply voltage on/off • Issuing the "Restart" command if possible
E16	10000: Parameter error	• Incorrect parameter value	The signal bit is always deleted after acknowledgement with "Trip reset".
E17	10001: No supply or load voltage	• Electronics supply voltage too low • No supply voltage at the contact block • No main power	The signal bit is deleted when the cause for the switch-off has been remedied or acknowledged automatically.
E24	11000: Actuator switch-off	• Switch-off due to overload • Switch-off due to zero current • Switch-off due to asymmetry • Switch-off due to earth fault	The signal bit is always deleted after acknowledgement with "Trip reset". Additional acknowledgement in combination with other errors.
E26	11010: External error	• Overload of the sensor supply • Process image error	The signal bit is always deleted after acknowledgement with "Trip reset".

Table 8-14: Error types

8.10 Data Formats and Data Sets

8.10.1 Characteristics

The soft starter acquires a multitude of operating, diagnostics and statistics data.

Control data

Data transmitted to the soft starter, e.g. Motor left switching command, Trip reset, etc.
Data format: Bit

Messages

Data transmitted by the soft starter indicating the current operating status, e.g. Motor left, etc.
Data format: Bit

Diagnosis

Data transmitted by the soft starter indicating the current operating status, e.g. Overload fault mode, etc.
Data format: Bit

Current values

Current values are coded in different formats, in
- 6-bit current format,
- 8-bit current format and
- 9-bit current format:
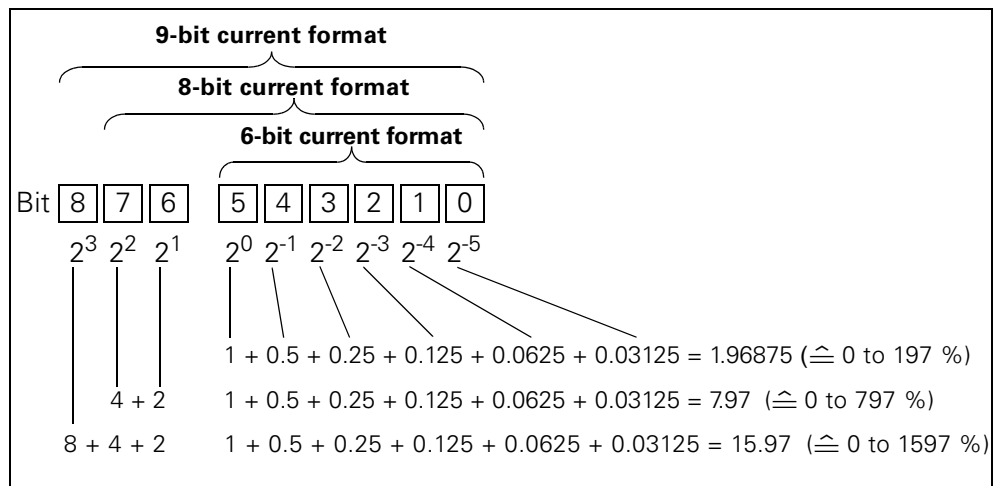
Figure 8-19:Current formats

Current values are
- Motor current I_{max} (6-bit current format)
- Phase currents I_{L1max}, I_{L2max}, I_{L3max} (8-bit current format)
- Last trigger current (9-bit current format)
- Maximum tripping current (9-bit current format)

Statistics data for device service life

- Operating hours
  The soft starter records 2 operating hour values:
  - The motor operating hours.
    These indicate how long the motor has been switched on.
  - The device operating hours (soft starter).
    These indicate how long the 115 V AC or the 230 V AC supply voltage of the soft starter has been switched on.
    Both operating voltage values are recorded in data set 95 - "Read statistics". They are recorded in the "Operating hours" data field once every second.
    The operating hours are recorded in the range of 0 to 2^{32} seconds in 1-second increments.
- Number of overload trips
  The soft starter counts the number of overload trips in the 0 to 65 535 range.
- Number of starts motor right / left
  The soft starter counts the number of starts in the 0 to 2^{32} range.
  Example: The value is incremented by 1 when current is flowing in the main circuit following a "Motor ON" command.
- Number of starts outputs 1 to 4
- Motor current I_{max}.
  The soft starter measures the current in all 3 phases and indicates the current of the phase with the highest load as a percentage [%] of the set current I_e.
  Data format: 1 byte, 8-bit current format
  Example: Set current I_e = 60 A
  Indicated motor current 110 %
  corresponds to 60 A x 1.1 = 66 A
  All 3-phase currents are available in data set 94
- Last trigger current
  The soft starter measures the current in all 3 phases and indicates the current flowing through the phase with the highest load at the time of the tripping as a percentage [%] of the set current I_e and in amperes [A]
  Data format: 2 byte, 9-bit current format
  Example: Set current I_e = 60 A
  indicated motor current 455 % corresponds to 60 A x 4.55 = 273 A

Statistics data of the maximum pointer

Maximum pointers are used for preventive diagnosis:

– The maximum measured value is stored in the device.
– The higher-level PLC can collect 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_{L1max} to I_{L3max} and I_{L1min} to I_{L3min}. The maximum and minimum phase current are indicated as a percentage [%] of the set current I_e and in amperes [A].
  Data format: 1 byte, 8-bit current format each
  The measured maximum and minimum phase current in bridging mode is stored per phase.
- Minimum and maximum phase-to-phase voltages U_{Lx} - U_{Ly} as r.m.s values in 0.1 V. Minimum and maximum line frequency in 0.5 Hz resolution.

8.11 Identification Number (ID No.), Error Codes

8.11.1 Identification Number (ID No.)

The identification number (ID No.) is used for the unique identification of all information available in the soft starter (parameters, control commands, diagnosis, commands, etc.). It can be found in the left column of the data set table.

8.11.2 Error Codes for Negative Data Set Acknowledgement

Description

When a data set is declined, an error code is send together with the negative acknowledgement via the device interface as well as via the bus interface. The error code provides information on the reason for the negative acknowledgement.
The error codes comply with the PROFIBUS DPV1 standard in so far as they apply to soft starters.

Analysis via the local device interface using Soft starter ES

The error codes are analyzed by the "Soft Starter ES" parameterizing and diagnostics software and output as plain text. For further information on this topic, please refer to the "Soft Starter ES" online help.

Analysis via PROFIBUS DP

The error codes are output via PROFIBUS DP layer 2. For further information on this topic, please refer to the section describing the PROFIBUS DP protocol in the respective manuals.

Error codes

The following error codes are generated by the soft starter:

Error codes byte		Error message	Cause
High	**Low**		
00 H	00 H	No error	
		Communication interface	
80 H	A0 H	Negative acknowledgement "Read data set"	• Data set can only be written
80 H	A1 H	Negative acknowledgement "Write data set"	• Data set can only be read
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 reading/writing of the data set
		Technology access	
80 H	B0 H	Unknown data set number	• Data set number not known in the soft starter
80 H	B1 H	Incorrect data set length when writing	• Data set length differs from data set length specified
80 H	B2 H	Incorrect slot number	• Slot number not 1 or 4
80 H	B6 H	Communication partner declined data acceptance!	• Incorrect operating mode (automatic, manual bus, manual operation local) • Data set can only be read • Parameter changes not permissible when ON
80 H	B8 H	Invalid parameter	• Incorrect parameter value
		Device resources	
80 H	C2 H	Temporary lack of resources in the device!	• No available receive buffer • The data set is currently being updated • The data set order is currently active at another interface

Table 8-15: Error codes

8.12   Data Sets

Writing/reading data sets with STEP 7

You can access the soft starter data sets via the user program.

- Writing data sets:
  S7-DPV1 master: By calling up SFB 53 "WR_REC" or SFC 58
  S7 master: By calling up SFC 58
- Reading data sets:
  S7-DPV1 master: By calling up SFB 52 "RD_REC" or SFC 59
  S7 master: By calling up SFC 59

Further information

For further information regarding SFBs, please refer to

- the reference manual
  "System software for S7-300/400, System and Standard Functions"
- the STEP 7 online help

Byte arrangements

When data is stored which is longer than one byte, 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		

Table 8-16: Byte arrangement in "big endian" format

8.12.1 Data Set 68 - Reading/Writing the Process Image of the Outputs

Note

Please keep in mind that data set 68 is overwritten by the cyclical process image in automatic operating mode!

Byte	Meaning
	Preamble
0	Writing coordination 0x20 via channel C1 (PLC) Writing 0x30 via channel C2 (PC) Writing 0x40 via device interface (PC)
1 - 3	Reserved = 0
	Process image of the outputs
4	Process data DO-0.0 to DO-0.7, 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: (16 A (outputs), DO 0.0 to DO 1.7)
1001	DO- 0.	0	Motor right
1002		1	Motor left
1003		2	Available
1004		3	Trip reset
1005		4	Emergency start
1006		5	Available
1007		6	Slow speed
1008		7	Available
1009	DO- 1.	0	Output 1
1010		1	Output 2
1011		2	Parameter set Bit 0
1012		3	Parameter set Bit 1
1013		4	Available
1014		5	Available
1015		6	Available
1016		7	Disable quick stop

Table 8-17: Data set 68 - reading/writing the process image of the outputs

In the "Automatic operating mode", the PLC sets the process image of the outputs. In this case, reading of data set 68 at the local device interface supplies the process image of the outputs as transmitted by the PLC.

8.12.2 Data Set 69 - Reading the Process Image of the Inputs

Byte	Meaning
	Process image of the inputs
0	Process data DI-0.0 to DI-0.7, table below
1	Process data DI-1.0 to DI-1.7, table below
2	Reserved = 0
3	Reserved = 0

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

Table 8-18: Data set 69 - reading the process image of the inputs

8.12.3 Data Set 72 - Log List - Reading Device Errors

Byte	Meaning	Value range	Increment	Comment
0 - 3	Operating hours - device	$1 \ldots 2^{32}$ s	1 second	Oldest entry
4 - 5	ID number of the device error	$0 \ldots \pm 32767$	1	
6 - 9	Operating hours - device	$1 \ldots 2^{32}$ s	1 second	Second oldest entry
10 - 11	ID number of the device error	$0 \ldots \pm 32767$	1	
etc.				
120 - 123	Operating hours - device	$1 \ldots 2^{32}$ s	1 second	Last, newest entry
124 - 125	ID number of the tripping	$0 \ldots \pm 32767$	1	

Table 8-19: Data Set 72 - Log List - Reading Device Errors

This data set can record 21 entries. When all spaces are filled, the first entry is overwritten.

Note
The latest entry is entered at the end of the data set. The remaining entries are moved up by one entry.

The following messages can be entered:

ID No.:	Device error - Messages
452	Heatsink - thermistor defective
1466	Switching element 1 failed
1467	Switching element 2 failed
1468	Switching element 3 failed
1417	Bypass part fault

8.12.4 Data Set 73 Log List - Reading the Trippings

Byte	Meaning	Value range	Increment	Comment
0 - 3	Operating hours - device	$1 \ldots 2^{32}$ s	1 second	Oldest entry
4 - 5	ID number of the device error	$0 \ldots \pm 32767$	1	
6 - 9	Operating hours - device	$1 \ldots 2^{32}$ s	1 second	Second oldest entry
10 - 11	ID number of the device error	$0 \ldots \pm 32767$	1	
etc.				
120 - 123	Operating hours - device	$1 \ldots 2^{32}$ s	1 second	Last, newest entry
124 - 125	ID number of the tripping	$0 \ldots \pm 32767$	1	

Table 8-20: Data set 73 - log list - reading the trippings

This data set can record 21 entries. When all spaces are filled, the first entry is overwritten.

Note
The latest entry is entered at the end of the data set. The remaining entries are moved up by one entry.

The following messages can be entered:

ID No.:	Trippings - Messages
309	Contact block overload
317	Electronics supply voltage too low
319	No main power
324	Temperature sensor overload
325	Temperature sensor open
326	Temperature sensor short
327	Therm. motor model overload
334	Current limit exceeded
335	Current limit undershot
339	Motor stalled - switched off
341	Asymmetry switch-off
343	Ground fault switch-off
355	Process image error
365	Incorrect parameter value
ID number of the faulty parameter	
1407	Electronics supply voltage too high
1408	No load
1409	Loss of phase L1
1410	Loss of phase L2
1411	Loss of phase L3
1421	Impermissible I_e / CLASS settings
1479	Phase angle control failure
1481	System voltage too high
1482	Current range overflow

Table 8-21: Log list messages - reading the trippings

8.12.5 Data Set 75 Log List - Reading Events

Byte	Meaning	Value range	Increment	Comment
0 - 3	Operating hours - device	$1 \dots 2^{32}$ s	1 second	Oldest entry
4 - 5	ID number of the device error	$0 \dots \pm 32\,767$ *)	1	
6 - 9	Operating hours - device	$1 \dots 2^{32}$ s	1 second	Second oldest entry
10 - 11	ID number of the device error	$0 \dots \pm 32\,767$ *)	1	
etc.				
120 - 123	Operating hours - device	$1 \dots 2^{32}$ s	1 second	Last, newest entry
124 - 125	ID number of the tripping	$0 \dots \pm 32\,767$ *)	1	

*) + Coming event

   – going event

Table 8-22: Data set 75 log list - reading events

This data set can record 21 entries. When all spaces are filled, the first entry is overwritten.

Note
The latest entry is entered at the end of the data set. The remaining entries are moved up by one entry.

The following messages can be entered:

ID No.:	Events - Messages	Comment
	Warnings	
324	Temperature sensor overload	± (coming/going event)
325	Temperature sensor open	± (coming/going event)
326	Temperature sensor short	± (coming/going event)
327	Therm. motor model overload	± (coming/going event)
334	Current limit exceeded	± (coming/going event)
335	Current limit undershot	± (coming/going event)
340	Asymmetry recognized	± (coming/going event)
342	Ground fault	± (coming/going event)
	Actions	
310	Emergency start is active	± (coming/going event)
357	Automatic operating mode	+ (coming event only)
358	Manual bus operating mode	+ (coming event only)
359	Manual operation local operating mode	+ (coming event only)
360	Connection break in manual operating mode	± (coming/going event)
363	Maximum pointer deleted	+ (coming event only)
365	Incorrect parameter value	+ (coming event only)
ID number of the faulty parameter		+ (coming event only)
366	Parameter changes not permissible when ON	+ (coming event only)
ID number of the faulty parameter		+ (coming event only)
368	Parameterization disable CPU/master active	± (coming/going event)
369	Factory settings restored	+ (coming event only)
1302	Log list - trippings deleted	+ (coming event only)
1303	Log list - events deleted	+ (coming event only)

Table 8-23: Log list messages - reading events

8.12.6 Data Set 81 - Reading the Basic Settings of Data Set 131

Data set 81 matches data set 131 in structure and content. Data set 81 supplies the default values for all parameters of data set 131.

8.12.7 Data Set 82 - Reading the Basic Settings of Data Set 132

Data set 82 matches data set 132 in structure and content. Data set 82 supplies the default values for all parameters of data set 132.

8.12.8 Data Set 83 - Reading the Basic Settings of Data Set 133

Data set 83 matches data set 133 in structure and content. Data set 83 supplies the default values for all parameters of data set 133.

8.12.9 Data Set 92 - Reading the Device Diagnosis

ID No.:	Byte^{Bit}	Signal bit	E No.*)	Meaning/Acknowledgment
		Switching/controlling:		
301	0^0	Ready (automatic)	—	Device ready for operation via host (e.g. PLC), The signal bit is updated continuously.
306	0^1	Motor right	—	Contact block 1 switched on. The signal bit is updated continuously.
307	0^2	Motor left	—	Contact block 2 switched on. The signal bit is updated continuously.
309	0^3	Contact block overload	E5, E24	For example, power semiconductor too hot, causing the motor to switch off. The signal bit is deleted when the cause for the switch-off has been remedied and acknowledged via "Trip reset".
308	0^4	Contact block damaged	E9	For example, contactor welded/blocked or power semiconductor has become short-circuited. The signal bit can only be deleted by switching the supply voltage on / off when the cause of error is remedied.
310	0^5	Emergency start is active	—	The signal bit is deleted when the emergency start is deactivated.
302	0^6	Group error	—	At least one error is set which generates an error number. The signal bit is deleted when the cause for the switch-off has been remedied and acknowledged via "Trip reset", autoreset or OFF command.
304	0^7	Group warning	—	At least one warning is pending. The signal bit is updated continuously.
	1^0	Reserved = 0	—	
319	1^1	No main power	E17, E24	The signal bit is deleted when the cause for the switch-off has been remedied and acknowledged via "Trip reset".
	1^2	Reserved = 0	—	
312	1^3	Start mode active	—	The signal bit is updated continuously.
313	1^4	Stopping mode active	—	
	1^5	Reserved = 0	—	
316	1^6	Electrical braking procedure is active	—	The braking output is switched on by the soft starter. The signal bit is updated continuously.
314	1^7	Slow speed active	—	The signal bit is updated continuously.
		Protective function: Motor/line/short-circuit		
324	2^0	Temperature sensor overload	E4	Overload recognized, the signal bit is updated continuously.
325	2^1	Temperature sensor open	E6	The thermistor circuit has been interrupted. The signal bit is updated continuously.
326	2^2	Temperature sensor short	E1	Short circuit in the thermistor circuit. The signal bit is updated continuously.

ID No.:	Byte^Bit	Signal bit	E No.^*)	Meaning/Acknowledgment
327	2^3	Therm. motor model overload	E4	Overload recognized, the signal bit is updated continuously.
328	2^4	Overload switch-off	E24	The motor is switched off due to a recognized overload. The signal bit is deleted when the cause for the switch-off has been remedied and acknowledged via "Trip reset" / "Autoreset".
329	2^5	Idle time active	—	The signal bit is updated continuously.
330	2^6	Cool-down time active	—	The signal bit is updated continuously.
	2^7	Reserved = 0	—	
	3^{0-6}	Reserved = 0	—	
352	3^7	Control input	—	The device receives control commands via the inputs. The signal bit is updated continuously.
340	4^0	Asymmetry recognized	—	There is asymmetry. The signal bit is updated continuously.
341	4^1	Asymmetry switch-off	E24	The motor is switched off due to asymmetry. The signal bit is deleted when the cause for the switch-off has been remedied and acknowledged via "Trip reset".
334	4^2	Current limit exceeded	E7	Limit value exceeded. The signal bit is updated continuously.
335	4^3	Current limit undershot	E8	Limit value undershot. The signal bit is updated continuously.
336	4^4	Current limit switch-off	E24	The signal bit is deleted when the cause for the switch-off has been remedied and acknowledged via "Trip reset".
	4^5	Reserved = 0	—	
	4^6	Reserved = 0	—	
339	4^7	Motor stalled - switched off	E24	Switch-off, blocking current detected longer than permissible blocking time. The signal bit is deleted when the cause for the switch-off has been remedied and acknowledged via "Trip reset".
344	5^0	Input 1	—	Input stati: "1" = active, HIGH level applied "0" = inactive, LOW level applied The signal bit is updated continuously.
345	5^1	Input 2	—	
346	5^2	Input 3	—	
347	5^3	Input 4	—	
	5^{4-7}	Reserved = 0	—	
342	6^0	Ground fault	—	There is a ground fault. The signal bit is updated continuously.
343	6^1	Ground fault switch-off	E24	The motor is switched off due to a ground fault. The signal bit is deleted when the cause for the switch-off has been remedied and acknowledged via "Trip reset".

ID No.:	Byte^{Bit}	Signal bit	E No.$^{*)}$	Meaning/Acknowledgment
353	6^2	Quick stop active	E26, E24	The motor is switched off due to a quick stop. The signal bit is deleted when the cause for the switch-off has been remedied and acknowledged via "Trip reset".
	6^3	Reserved = 0		
361	6^4	Trip reset carried out	—	The signal bit is deleted through update or "Trip reset" in ready state.
362	6^5	Trip reset not possible	—	Cause for the switch-off is still present. The signal bit is deleted through update (new "Trip reset") or through "Trip reset" in ready state.
363	6^6	Maximum pointer deleted	—	The signal bit is always deleted after acknowledgement with "Trip reset".
317	6^7	Electronics supply voltage too low	—	The signal bit is deleted automatically when the cause for the switch-off is remedied.
		Communication		
303	7^0	Bus error	—	Watchdog function of the DP interface has been executed. The signal bit is updated continuously.
356	7^1	CPU/master STOP	—	PLC program no longer processed. The signal bit is updated continuously.
357	7^2	Automatic operating mode	—	Automatic (PLC controlled). The signal bit is updated continuously.
358	7^3	Manual bus operating mode	—	Manual mode via field bus (O&M controlled). The signal bit is updated continuously.
359	7^4	Manual operation local operating mode	—	Manual mode via local device interface, (O&M controlled), the signal bit is updated continuously.
	7^5	Reserved = 0	—	
360	7^6	Connection break in manual operation local operating mode	—	The associated communication connection was interrupted during manual operation. The signal bit is updated continuously.
355	7^7	Process image error	E26 E24	Process image of the outputs contains impermissible bit combinations. The signal bit is automatically deleted when the cause for the switch-off is remedied.
		Parameter		
364	8^0	Parameterization active	—	The signal bit is updated continuously.
365	8^1	Incorrect parameter value	E16	The signal bit is always deleted following an acknowledgement with "Trip reset" or after valid parameters have been received.
			E24	Causes a switch-off during start-up.
366	8^2	Parameter changes not permissible when ON	—	Parameter change attempted while motor running or during the affected device function, causing a switch-off. The signal bit is always deleted following an acknowledgement with "Trip reset" or after valid parameters have been received.
368	8^3	Parameterization disable CPU/ master active	—	The signal bit is updated continuously. The soft starter ignores the parameters from the PLC.

ID No.:	Byte^{Bit}	Signal bit	E No.$^{*)}$	Meaning/Acknowledgment
	8^{4-7}	Reserved = 0	—	
		Device function		
	9^{0-2}	Reserved = 0	—	
369	9^{3}	Factory settings restored	—	The signal bit is always deleted after acknowledgement with "Trip reset".
	9^{4-7}	Reserved = 0	—	
367	10	Faulty parameter number (low byte)	—	In connection with byte 8^{1} and 8^{2}, states the ID number of the first parameter not accepted. The signal byte is always deleted after acknowledgement with "Trip reset".
	11	Faulty parameter number (high byte)	—	
	12^{0-1}	Reserved = 0	—	
1421	12^{2}	Impermissible Ie/CLASS settings	—	
	12^{3-7}	Reserved = 0	—	
1449	13^{0}	Parameter set 1 active	—	
1450	13^{1}	Parameter set 2 active	—	
1451	13^{2}	Parameter set 3 active	—	
	13^{3}	Reserved = 0	—	
1453	13^{4}	Impermissible change of the parameter set	—	
	13^{5-7}	Reserved = 0	—	
	14^{0-1}	Reserved = 0	—	
1404	14^{2}	Motor heating active	—	
1402	14^{3}	DC braking active	—	
1403	14^{4}	Dynamic DC braking active	—	
1471	14^{5}	Motor connection method star/delta	—	
1472	14^{6}	Motor connection method inside delta	—	
1473	14^{7}	Motor connection method unknown	—	
1408	15^{0}	No load	—	
	15^{1}	Reserved = 0	—	
1409	15^{2}	Loss of phase L1	—	
1410	15^{3}	Loss of phase L2	—	
1411	15^{4}	Loss of phase L3	—	
1412	15^{5}	Line phase direction right	—	
1413	15^{6}	Line phase direction left	—	
	15^{7}	Reserved = 0	—	
	16	Reserved = 0	—	
1435	17^{0}	Output 1 active	—	
1436	17^{1}	Output 2 active	—	
1437	17^{2}	Output 3 active	—	

ID No.:	Byte^Bit	Signal bit	E No.*)	Meaning/Acknowledgment
1438	17^3	Output 4 active	—	
	$17^{4\text{-}7}$	Reserved = 0	—	
	18	Reserved = 0	—	
		Switching/controlling		
1407	19^0	Electronics supply voltage too high	—	
1470	19^1	Ready for motor on	—	
1414	19^2	Contact block short-circuited	—	
1417	19^3	Bypass part fault	—	
1418	19^4	Reserved = 0	—	
1466	19^5	Switching element 1 failed	—	
1467	19^6	Switching element 2 failed	—	
1468	19^7	Switching element 3 failed	—	
		Protective function		
1422	20^0	Thermal motor model deactivated	—	
	$20^{1\text{-}2}$	Reserved = 0	—	
1479	20^3	Phase angle control failure	—	
	$20^{4\text{-}7}$	Reserved = 0	—	
1415	21^0	Cool-down time contact block active	—	
1416	21^1	Contact element too hot for starting	—	
1482	21^2	Current range overflow	—	
	$21^{3\text{-}7}$	Reserved = 0	—	
		Communication		
357	22^0	Automatic operating mode (redundant to bit 7.2)	—	
358	22^1	Manual bus operating mode (redundant to bit 7.3)	—	
1443	22^2	Manual bus - PC controlled	—	
359	22^3	Manual operation local operating mode (redundant to bit 7.4)	—	
1444	22^4	Manual operation local - input controlled	—	
1445	22^5	Manual operation local - O&M controlled	—	
1446	22^6	Manual operation local - PC controlled	—	
	22^7	Reserved = 0	—	
	23	Reserved = 0	—	

ID No.:	Byte^{Bit}	Signal bit	E No.$^{*)}$	Meaning/Acknowledgment
		Prewarnings		
	24^{0-1}	Reserved = 0	—	
1419	24^2	Prewarning limit - prewarning time undershot	—	
1420	24^3	Prewarning limit - motor heat build-up exceeded	—	
	24^{4-7}	Reserved = 0	—	
	25	Reserved = 0	—	
	26	Reserved = 0	—	
	27	Reserved = 0	—	
	28	Reserved = 0	—	
	29	Reserved = 0	—	

Table 8-24: Data set 92 - reading the device diagnosis

*) Error number PROFIBUS DP

8.12.10 Data Set 93 - Writing a Command

Structure of the command data set

Byte	Meaning	Comment
	Preamble	
0	Coordination	Writing 0x20 via channel C1 (PLC) Writing 0x30 via channel C2 (PC) Writing 0x40 via device interface (PC)
1 - 3	Reserved	
	Command	
4	Number of commands	Value range 1 ... 5 Number of subsequent valid commands
5	Command 1	For the consecutive number refer to the table below
6	Command 2	Optional (for coding refer to the table below)
7	Command 3	Optional (for coding refer to the table below)
8	Command 4	Optional (for coding refer to the table below)
9	Command 5	Optional (for coding refer to the table below)

Table 8-25: Structure of the command data set

ID No.:	Coding	Command	Meaning
		1-byte commands	
0	0	Reserved	No function
703	1	Trip reset	Reset and acknowledgement of error messages
713	2	Emergency start ON	Switch on emergency start
714	3	Emergency start OFF	Switch off emergency start
709	4	Automatic operating mode	Transition to automatic operating mode (DP master controlled)
710 711 712	5	Operating mode manual - bus - operation local	Transition to manual operating mode. The soft starter switches to manual bus or manual operation local operating mode, independent of which interface received the command.
701	6	Factory settings	Restore factory settings of the parameters.
704	7	Delete maximum pointer	The measured values for the preventive diagnosis are deleted (=0).
705	13	Log list - delete trippings	Delete log list with recorded causes of errors.
706	14	Log list - delete events	Delete log list with recorded warning messages and certain actions.
702	9	Restart	Trigger restarting (same as after line ON), e.g. after reassigning the station address.
707	10	Parameterization disable CPU/master ON	No parameterization possible via the parameterizing master or this master's parameters are ignored.
708	11	Parameterization disable CPU/master OFF	Parameterization possible via the parameterizing master.

Table 8-26: Data set 93 - writing a command

8.12.11 Data set 94 - Reading the Measured Values

ID No.:	Byte^{Bit}	Meaning	Value range / [coding]	Incre-ment	Comment
		Measured values			
504	0	Phase current I_{L1} (%)	0 ... 797 % / [0 ... 255]	3.125 %	8-bit current format
505	1	Phase current I_{L2} (%)	0 ... 797 % / [0 ... 255]	3.125 %	8-bit current format
506	2	Phase current I_{L3} (%)	0 ... 797 % / [0 ... 255]	3.125 %	8-bit current format
507	3	Reserved = 0			
501	4 - 5	Remaining cool-down time of the motor	0 ... 1800 s / [0 ... 18000]	0.1 s	
502	6^{0-6}	Motor heat build-up	0 ... 200 % / [0 ... 100]	2 %	
	6^7	Asymmetry ≥ 40 %	No asymmetry [0] Asymmetry (≥ 40 %) [1]		
503	7	Asymmetry	0 ... 100 % / [0 ...100]	1 %	
	8	Reserved = 0			
	9	Reserved = 0			
	10	Reserved = 0			
	11	Reserved = 0			
	12 - 13	Reserved = 0			
	14	Reserved = 0			
508	16	Output frequency	0 ... 100 Hz / [0 ... 200]	0.5 Hz	
	17	Reserved = 0			
	18	Reserved = 0			
	19	Reserved = 0			
509	20	Line frequency	0 ... 100 Hz / [0 ... 200]	0.5 Hz	
	21	Reserved = 0			
510	22 - 23	Phase-to-phase voltage U_{L1-L2} (eff)	0 ... 1500 V / [0 ... 15000]	0.1 V	
511	24 - 25	Phase-to-phase voltage U_{L2-L3} (eff)	0 ... 1500 V / [0 ... 15000]	0.1 V	
512	26 - 27	Phase-to-phase voltage U_{L3-L1} (eff)	0 ... 1500 V / [0 ... 15000]	0.1 V	
513	28 - 31	Phase current I_{L1} (eff)	0 ... 20000 A / [0 ... 2000000]	0.01 A	
514	32 - 35	Phase current I_{L2} (eff)	0 ... 20000 A / [0 ... 2000000]	0.01 A	
515	36 - 39	Phase current I_{L3} (eff)	0 ... 20000 A / [0 ... 2000000]	0.01 A	
516	40 - 41	Electronics supply voltage	0 ... 1500 V / [0 ... 15000]	0.1 V	
517	42	Heatsink temperature	-40 ... 127 °C/ [-40 ... 127]	1 °C	
518	43	contact block temperature	0 ... 250 °C/ [0 ... 250]	1 °C	
519	44 - 45	Remaining cool-down time of the contact block	0 ... 1800 s / [0 ... 18000]	0.1 s	
520	46 - 47	Remaining time for tripping of the thermal motor model	0 ... 10000 s / [0 ... 10000]	1 s	
521	48 - 51	Output power	0 ... 2147483 W / [0 ... 21474830]	0.1 W	
522	52 - 63	Reserved = 0			

Table 8-27: Data set 94 - Reading the Measured Values

8.12.12 Data Set 95 - Reading the Statistics Data

ID No.:	Byte^{Bit}	Meaning	Value range / [coding]	Increment	Comment
		Statistics			
609	0	Motor current I_{max}	0 ... 797 % / [0 ... 255]	3.125 %	8-bit current format
	1	Reserved = 0			
608	2	Last trigger current IA (%)	0 ... 1000 % / [0 ... 320]	3.125 %	
	4	Operating hours - device	0 ... 2^{32}-1 s / [0 ... 2^{32}-1]	1 s	
603	8 - 11	Number of starts motor right	0 ... 2^{32}-1 / [0 ... 2^{32}-1]	1	
604	12 - 15	Number of starts motor left	0 ... 2^{32}-1 / [0 ... 2^{32}-1]	1	
605	16 - 17	Number of overload trips	0 ... 65535 / [0 ... 65535]	1	
	18	Reserved = 0			
	19	Reserved = 0			
607	20	Motor current $I_{max\,(eff)}$	0 ... 20000 A / [0 ... 2000000]	0.01 A	
606	24	Last trigger current IA (eff)	0 ... 20000 A / [0 ... 2000000]	0.01 A	
602	28	Operating hours - motor	0 ... 2^{32}-1 s / [0 ... 2^{32}-1]	1 s	
611	32	Operating hours - motor current 18 ... 49.9 % x $I_{e(max)}$	0 ... 2^{32}-1 s / [0 ... 2^{32}-1]	1 s	
612	36	Operating hours - motor current 50 ... 89.9 % x $I_{e(max)}$	0 ... 2^{32}-1 s / [0 ... 2^{32}-1]	1 s	
613	40	Operating hours - motor current 90 ... 119.9 % x $I_{e(max)}$	0 ... 2^{32}-1 s / [0 ... 2^{32}-1]	1 s	
614	44	Operating hours - motor current 120 ... 1000 % x $I_{e(max)}$	0 ... 2^{32}-1 s / [0 ... 2^{32}-1]	1 s	
615	48	Reserved = 0			
616	50	Number of contact block overload trips	0 ... 2^{32}-1 / [0 ... 2^{32}-1]	1	
617	52	Reserved = 0			
618	54	Reserved = 0			
619	56	Reserved = 0			
620	60	Number of braking stops	0 ... 2^{32}-1 / [0 ... 2^{32}-1]	1	
621	64	Number of starts - output 1	0 ... 2^{32}-1 / [0 ... 2^{32}-1]	1	
622	68	Number of starts - output 2	0 ... 2^{32}-1 / [0 ... 2^{32}-1]	1	
623	72	Number of starts - output 3	0 ... 2^{32}-1 / [0 ... 2^{32}-1]	1	
624	76	Number of starts - output 4	0 ... 2^{32}-1 / [0 ... 2^{32}-1]	1	
	80	Reserved = 0			
	84	Reserved = 0			
	88	Reserved = 0			
	89	Reserved = 0			

Table 8-28: Data set 95 - reading the statistics data

8.12.13 Data Set 96 - Reading the Maximum Pointer

ID No.:	Byte^{Bit}	Meaning	Value range / [coding]	Incre-ment	Comment
		Maximum pointer			
656	4	Phase current $I_{L1 min}$ (%)	0 ... 797 % / [0 ... 255]	3.125 %	In bypass operation
657	5	Phase current $I_{L2 min}$ (%)	0 ... 797 % / [0 ... 255]	3.125 %	In bypass operation
658	6	Phase current $I_{L3 min}$ (%)	0 ... 797 % / [0 ... 255]	3.125 %	In bypass operation
	7	Reserved = 0			
653	8	Phase current $I_{L1 max}$ (%)	0 ... 797 % / [0 ... 255]	3.125 %	In bypass operation
654	9	Phase current $I_{L2 max}$ (%)	0 ... 797 % / [0 ... 255]	3.125 %	In bypass operation
655	10	Phase current $I_{L3 max}$ (%)	0 ... 797 % / [0 ... 255]	3.125 %	In bypass operation
	11	Reserved = 0			
652	12	Maximum tripping current $I_{A max}$ (%)	0 ... 1000 % / [0 ... 320]	3.125 %	Current during switch-off due to error
651	14	Number of motor overload trips	0 ... 65535 / [0 ... 65535]	1	Motor protection, temperature sensor, stalling
659	16	Maximum tripping current $I_{A max}$ (eff)	0 ... 20000 A / [0 ... 2000000]	0.01 A	Current during switch-off due to error
660	20	Phase current $I_{L1 min}$ (eff)	0 ... 20000 A / [0 ... 2000000]	0.01 A	In bypass operation
661	24	Phase current $I_{L2 min}$ (eff)	0 ... 20000 A / [0 ... 2000000]	0.01 A	In bypass operation
662	28	Phase current $I_{L3 min}$ (eff)	0 ... 20000 A / [0 ... 2000000]	0.01 A	In bypass operation
663	32	Phase current $I_{L1 max}$ (eff)	0 ... 20000 A / [0 ... 2000000]	0.01 A	In bypass operation
664	36	Phase current $I_{L2 max}$ (eff)	0 ... 20000 A / [0 ... 2000000]	0.01 A	In bypass operation
665	40	Phase current $I_{L3 max}$ (eff)	0 ... 20000 A / [0 ... 2000000]	0.01 A	In bypass operation
666	44	Phase-to-phase voltage $U_{L1 - L2min}$ (eff)	0 ... 1500 V / [0 ... 15000]	0.1 V	
667	46	Phase-to-phase voltage $U_{L2 - L3min}$ (eff)	0 ... 1 500 V / [0 ... 15 000]	0.1 V	
668	48	Phase-to-phase voltage $U_{L3 - L1min}$ (eff)	0 ... 1500 V / [0 ... 15000]	0.1 V	Reset to 0 after loss of phase or switch-off of the main voltage.
669	50	Phase-to-phase voltage $U_{L1 - L2max}$ (eff)	0 ... 1500 V / [0 ... 15000]	0.1 V	
670	52	Phase-to-phase voltage $U_{L2 - L3max}$ (eff)	0 ... 1500 V / [0 ... 15000]	0.1 V	
671	54	Phase-to-phase voltage $U_{L3 - L1max}$ (eff)	0 ... 1500 V / [0 ... 15000]	0.1 V	
672	56	Electronics supply voltage $U_{NS min}$ (eff)	0 ... 1500 V / [0 ... 15000]	0.1 V	Reset to zero during "Power on".

ID No.:	Byte^{Bit}	Meaning	Value range / [coding]	Incre-ment	Comment
		Maximum pointer			
673	58	Electronics supply voltage $U_{NS\,max}$ (eff)	0 ... 1500 V / [0 ... 15000]	0.1 V	
674	60	Maximum heatsink temperature	1 ... -40 °C / [-40 ... 127]	1 °C	
675	61	Maximum contact block temperature	0 ... 250 % / [0 ... 250]	1 %	
676	62	Minimum line frequency	0 ... 100 Hz / [0 ... 200]	0.5 Hz	During network or loss of phase = 0
677	63	Maximum line frequency	0 ... 100 Hz / [0 ... 200]	0.5 Hz	
678	64	Operating hours - motor current = 18 ... 49.9 % x I_e	0 ... 2^{32}-1 s / [0 ... 2^{32}-1]	1 s	
679	68	Operating hours - motor current = 50 ... 89.9 % x I_e	0 ... 2^{32}-1 s / [0 ... 2^{32}-1]	1 s	
680	72	Operating hours - motor current = 90 ... 119.9 % x I_e	0 ... 2^{32}-1 s / [0 ... 2^{32}-1]	1 s	
681	76	Operating hours - motor current = 120 ... 1000 % x I_e	0 ... 2^{32}-1 s / [0 ... 2^{32}-1]	1 s	
682	80	Operating hours - device	0 ... 2^{32}-1 s / [0 ... 2^{32}-1]	1 s	
	84	Reserved = 0			
	85	Reserved = 0			

Table 8-29: Data set 96 - reading the maximum pointer

8.12.14 Data Set 100 - Reading the Device Identification

ID No.:	Byte^{Bit}	Value	Comment
	Preamble		
	0	Coordination	Writing 0x20 via channel C1 (PLC) Writing 0x30 via channel C2 (PC) Writing 0x40 via device interface (PC)
	1 - 3	Reserved = 0	
	Device identification (TF)		
901	4 - 11	...	Time stamp *)
902	12 - 31	SIEMENS AG	Manufacturer
903	32 - 55		Order number
904	56	0x01	Device family: load feeder
905	57	0x01	Device sub-family: soft starters
906	58	0x01	Device class: e.g. direct on line starter
907	59	0x03	System: SIRIUS 3RW44
908	60	0x46	Function group
909	61	0x00	Reserved = 0
910	62 - 77		Short product description
911	78 - 81	e.g. E001	HW version (byte 0 to byte 3)
912	82	0x00	ID number (byte0) (3RW44)
	83	0x00	ID number (byte1) (3RW44)
	84	0x80	ID number (byte2) (3RW44)
	85	0xDE	ID number (byte3) (3RW44)
	86 - 87	0x00	Reserved = 0
915	88 - 95	...	Service number
	96	0x00	Reserved = 0
	97	0x00	Reserved = 0
	98	0x00	Reserved = 0
	99	0x00	Reserved = 0

Table 8-30: Data set 100 - reading the device identification

*) Time stamp: Time of the initialization with the factory settings in the factory

Object name	id_date								
Object length	8 byte								
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: Daylight saving time
5	2^2	2^1	2^0						1 to 7 ; 1 = Monday, 7 = Sunday
				2^4	2^3	2^2	2^1	2^0	1 to 31 day
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

Table 8-31: Coding for time stamp

8.12.15 Data Sets 131, 141, 151 - Technology Parameters 2: Reading/Writing Set 1, 2, 3

Byte^{Bit}	Value	Comment
Preamble		
0	Coordination	Writing 0x20 via channel C1 (PLC) Writing 0x30 via channel C2 (PC) Writing 0x40 via device interface (PC)
1 - 3	Reserved = 0	

ID No.	Byte^{Bit}	Meaning	Only for data set 131	Value range [coding]	Factor
120	4 - 7	Device function_2	x		
1	8 - 11	Device function_1	x		
130	12	Rated operating current I_e		0 ... 2000 A [0 ... 200000]	0.01 A
3	16^0	Load type	x	3-phase [0]	
4	16^1	Protection against voltage failure	x	• No [0] • Yes [1]	
	16^{2-7}	Reserved = 0			
136	17	Prewarning motor temperature	x	0 ... 95 % [0 ... 19]	5 %
5	18^{0-2}	Response to overload - thermal motor model	x	• Tripping without restart [0] • Tripping with restart [1] • Warning [2]	
	18^{3-7}	Reserved = 0			
6	19^{0-4}	Tripping class	x	• CLASS 5 (10a) [3] • CLASS 10 [0] • CLASS 15 [4] • CLASS 20 [1] • CLASS 30 [2] • CLASS OFF [15]	
	19^{5-7}	Reserved = 0			
7	20	Pre-charge time	x	60 ... 1800 s [2 ... 60]	30 s
8	21	Idle time	x	0 ... 255 s [0 ... 255]	1 s
137	22-23	Prewarning limit - tripping reserve	x	0 ... 500 s [0 ... 500]	1 s
10	24^{0-1}	Response to overload - temperature sensor	x	• Tripping without restart [0] • Tripping with restart [1] • Warning [2]	
	24^{2-3}	Reserved = 0			
9	24^{4-6}	Temperature sensor	x	• Deactivated [0] • Thermoclick [1] • PTC - type A [2]	

ID No.	Byte^{Bit}	Meaning	Only for data set 131	Value range [coding]	Factor
12	24^7	Temperature sensor monitoring	x	• No [0] • Yes [1]	
	25 -26	Reserved = 0			
15	28	Minimum current limit		18.75 ... 100 % [6 ... 32]	3.125 %
16	29	Maximum current limit		50 ... 150 % [16 ... 48]	3.125 %
	30 - 31	Reserved = 0			
	32$^{0-5}$	Reserved = 0			
14	32^6	Response to current limit value violation	x	• Warning [0] • Tripping [1]	
	32^7	Reserved = 0			
	33$^{0-1}$	Reserved = 0			
140	33^2	Response to overload - contact block	x	• Tripping without restart [0] • Tripping with restart [1]	
	33$^{4-7}$	Reserved = 0			
21	34$^{0-2}$	Asymmetric limit value	x	30 ... 60 % [3 ... 6]	10 %
	34$^{3-5}$	Reserved = 0			
20	34^6	Response to asymmetry	x	• Warning [0] • Tripping [1]	
22	34^7	Response to ground fault	x	• Warning [0] • Tripping [1]	
	35 - 44	Reserved = 0			
47	45	Braking torque		20 ... 100 % [4 ... 20]	5 %
	46 - 47	Reserved = 0			
40	48	Start voltage		20 ... 100 % [4 ... 20]	5 %
	49	Reserved = 0			
42	50	Current limit value		• 3RW44 2, 3, 4: 125 ... 550 % [40 ... 176] • 3RW44 5: 125 ... 500 % [40 ... 160] • 3RW44 6: 125 ... 450 % [40 ... 144]	3.125 %
167	51$^{0-3}$	Starting mode		• Direct on line [0] • Voltage ramp [1] • Torque control [2] • Motor heating [3] • Voltage ramp + current limiting [5] • Torque control + current limiting [6]	

ID No.	Byte[Bit]	Meaning	Only for data set 131	Value range [coding]	Factor
168	51[4-7]	Stopping mode		• Coasting down [0] • Voltage ramp [1] • Torque control [2] • Pump stop [3] • DC braking [4] • Combined braking [5]	
35	52 - 53	Substitute value	x		
	54 - 55	Reserved = 0			
	56[0-5]	Reserved = 0			
36	56[6]	Group diagnosis	x	• Disable [0] • Enable [1]	
34	56[7]	Response to CPU/master STOP	x	• Switch substitute value [0] • Retain last value [1]	
	57 - 75	Reserved = 0			
26	76	Input 1 - Action	x	• No action (default) [0] • Group warning [5] • Manual operation local operating mode [6] • Emergency start [7] • Slow speed [10] • Quick stop [11] • Trip reset [12] • Motor right with PS1 [16] • Motor left with PS1 [17] • Motor right with PS2 [18] • Motor left with PS2 [19] • Motor right with PS3 [20] • Motor left with PS3 [21]	
28	77	Input 2 - Action (refer to Input 1 - Action)	x		
30	78	Input 3 - Action (refer to Input 1 - Action)	x		
32	79	Input 4 - Action (refer to Input 1 - Action)	x		
	80 - 95	Reserved = 0			

SIRIUS 3RW44 System Manual

ID No.	Byte[Bit]	Meaning	Only for data set 131	Value range [coding]	Factor
163	96	Output 1 - Action	x	• No action (default) [0] • Control source PAA-DO 1.0 output 1 [1] • Control source PAA-DO 1.1 output 2 [2] • Control source input 1 [6] • Control source input 2 [7] • Control source input 3 [8] • Control source input 4 [9] • Run up [10] • Operation / bridging [11] • Stopping [12] • On time motor [13] • Control command MOTOR ON [14] • Fan [15] • DC braking contactor [16] • Device - ON [18] • Group warning [31] • Group error [32] • Bus error [33] • Device error [34] • Ready for motor on [38]	
164	97	Output 2 - Action (refer to Output 1 - Action)	x		
165	98	Output 3 - Action (refer to Output 1 - Action)	x		
166	99	Output 4 - Action			
	100 - 111	Reserved = 0			
116	112	Breakaway time		0 ... 2 s [0 ... 200]	0.01 s
117	113	Breakaway voltage		40 ... 100 % [8 ... 20]	5 %
169	114 - 115	Maximum starting time		0 ... 1000 s [0 ... 10 000]	0.1 s
170	116 - 117	Starting time		0 ... 360 s [0 ... 3600]	0.1 s
171	118 - 119	Stopping time		0 ... 360 s [0 ... 3600]	0.1 s
172	120	Start torque		10 ... 100 % [2 ... 20]	5 %
118	121	Limiting torque		20 ... 200 % [4 ... 40]	5 %
173	122	Stopping torque		10 ... 100 % [2 ... 20]	5 %
	123	Reserved = 0			
	124	Reserved = 0			
119	125	Motor thermal capacity		1 ... 100 % [1 ... 100]	1 %
	126 - 129	Reserved = 0			
178	130	Dynamic braking torque		20 ... 100 % [4 ... 20]	5 %
43	131	Slow speed factor - clockwise rotation		3 ... 21 [3 ... 21]	1
198	132	Slow speed factor - counter-clockwise rotation		3 ... 21 [3 ... 21]	1

ID No.	Byte^Bit	Meaning	Only for data set 131	Value range [coding]	Factor
44	133	Slow torque - clockwise rotation		20 ... 100 % [4 ... 20]	5 %
199	134	Slow torque - counter-clockwise rotation		20 ... 100 % [4 ... 20]	5 %
	135 - 137	Reserved = 0			

Table 8-32: Data sets 131, 141, 151 - technology parameters 2: reading/writing set 1, 2, 3

Relations

- Maximum current limit > minimum current limit
- DC braking can only be selected when the "DC braking" function is assigned to an output.
- Max. starting time ≥ starting time
- Limiting torque > start torque

8.12.16 Data Sets 132, 142, 152 - Technology Parameters 3: Reading/Writing Set 1, 2, 3

Byte^Bit	Value	Comment
	Preamble	
0	Coordination	Writing 0x20 via channel C1 (PLC) Writing 0x30 via channel C2 (PC) Writing 0x40 via device interface (PC)
1 - 3	Reserved = 0	

ID No.:	Byte^Bit	Meaning	Value range [coding]	Factor
	4 - 9	Reserved = 0		
104	10 - 11	Rated rotational speed	500 ... 3 600 rpm / min [500 ... 3 600]	1 rpm
	12 - 18	Reserved = 0		
113	19 - 20	Rated torque	0 ... 65 535 Nm [0 ... 65 535]	1 Nm
	21 - 63	Reserved = 0		

Table 8-33: Data sets 132, 142, 152 - technology parameters 3: reading/writing set 1, 2, 3

8.12.17 Data Set 133 - Technology Parameters 4: O&M Module

Byte^{Bit}	Value	Comment
Preamble		
0	Coordination	Writing 0x20 via channel C1 (PLC) Writing 0x30 via channel C2 (PC) Writing 0x40 via device interface (PC)
1 - 3	Reserved = 0	

ID No.:	Byte^{Bit}	Meaning	Value range [coding]	Factor
	4	Reserved = 0		
179	8$^{0-3}$	Language	• English [0] • German [1] • French [2] • Spanish [3] • Italian [4] • Portuguese [5]	
181	8$^{4-7}$	Lighting brightness	• Normal [0] • Off with time delay [4] • Off [5]	
180	9	Contrast display	0 ... 100 % [0 ... 20]	5 %
182	10$^{0-3}$	Lighting response to fault	• Unchanged [0] • On [1] • Blinking [2] • Flickering [3]	
183	10$^{4-7}$	Lighting response to warning	• Unchanged [0] • On [1] • Blinking [2] • Flickering [3]	
	11	Reserved = 0		
184	12	Reaction time keys	10 ... 100 % [2 ... 20]	5 %
185	13	Auto repeat speed	10 ... 100 % [2 ... 20]	5 %
186	14	Auto repeat time	10 ... 250 ms [2 ... 50]	5 ms
187	15	O&M keys - activity monitoring time	0 ... 1800 s [0 ... 60]	30 s
	16 - 19	Reserved = 0		

Table 8-34: Data set 133 - technology parameters 4: O&M module

8.12.18 Data Set 160 - Reading/Writing Communication Parameters

This data set is only meant for devices with direct access to the field bus (e.g. PROFIBUS DP) for the allocation of communication parameters.

ID No.:	Byte[Bit]	Communication parameters	Value range [coding]	Increment	Default setting
		Preamble			
200	0	Coordination	Writing 0x20 via channel C1 (PLC) Writing 0x30 via channel C2 (PC) Writing 0x40 via device interface (PC)		
	1	Reserved1			
	2-3	Reserved2			
		Communication			
210	4	Station address	1 ...126	1	126
211	5	Baud rate	12 000 kBd [0] 6 000 kBd [1] 3 000 kBd [2] 1 500 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] Available [10..14] Automatic baud rate detection [15]		
	6 - 11	Reserved = 0			

Table 8-35: Data set 160 - reading/writing communication parameters

Note
3RW44 soft starters signal the current baud rate while reading. When writing, the baud rate must be set to "Automatic baud rate detection [15]"!

8.12.19 Data Set 165 - Reading/Writing Comments

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

Byte[Bit]	Communication parameters	Value range [coding]
Preamble		
0	Coordination	Writing 0x20 via channel C1 (PLC) Writing 0x30 via channel C2 (PC) Writing 0x40 via device interface (PC)
1	Reserved1	
2-3	Reserved2	
Comment		
4 - 124	Comment data	

Table 8-36: Data set 165 - reading/writing comments

Circuit Examples

9

9.1 Connection Examples for Main and Control Circuits

9.1.1 3RW44 in a Standard Circuit with Control via Keys

Main circuit

Option 1a:
Standard circuit with circuit breaker and SITOR fuse
(pure solid-state protection)
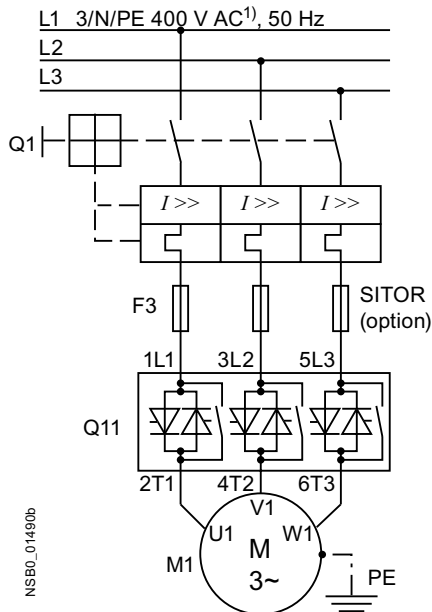
Control circuit
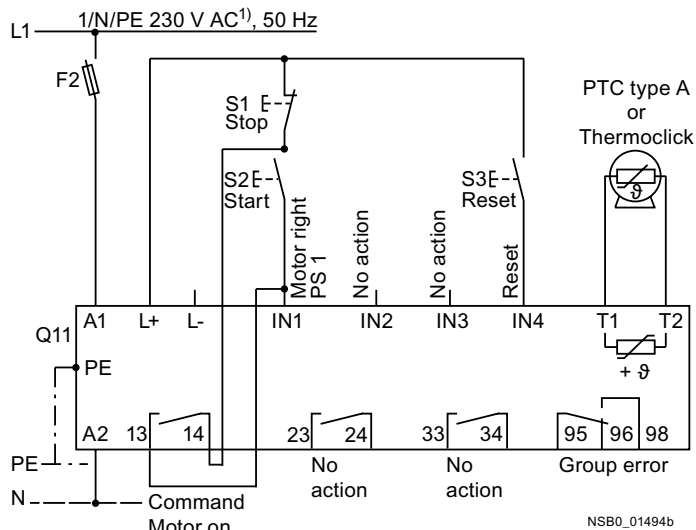
Alternative branch layout in standard circuit

Main circuit

Option 1b:
Standard circuit with all-range fuse
(line and solid-state protection)
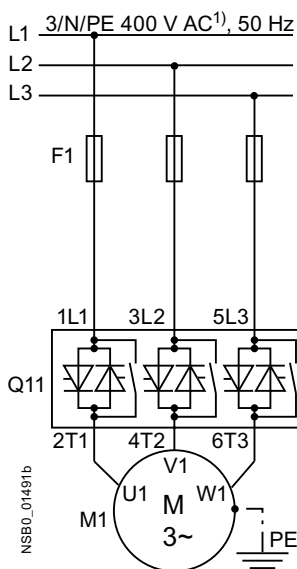
Option 1c:
Standard circuit with line and SITOR fuse (pure
solid-state protection)
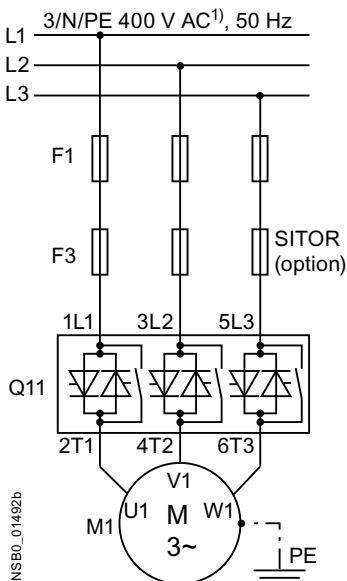
1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

9.1.2 3RW44 in Standard Circuit with Line Contactor and Control via PLC

Main circuit
Standard circuit with optional main contactor
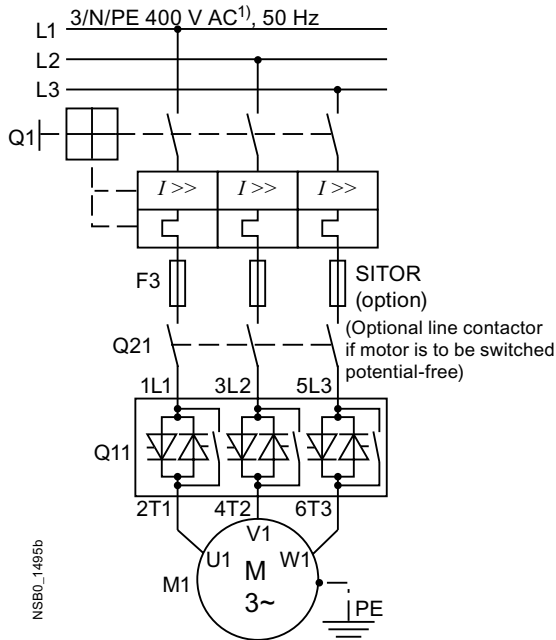
Control circuit
Activation of an optional main contactor and activation via PLC
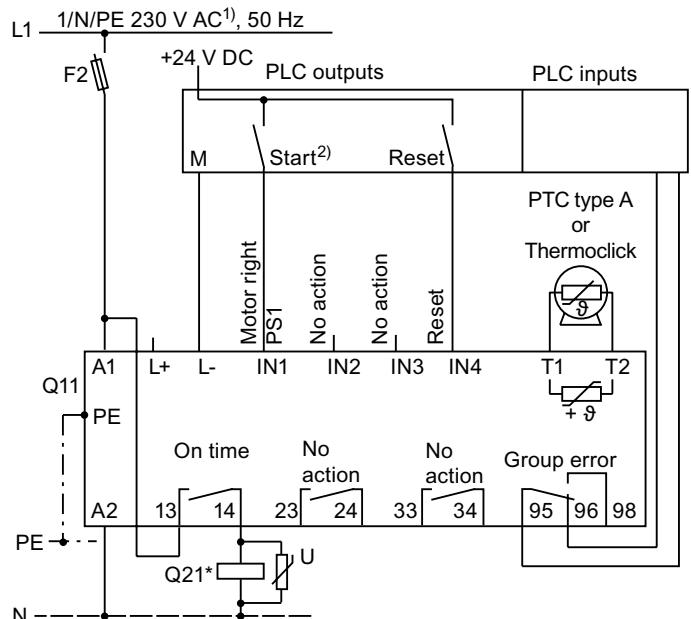
1) For permissible values for main and control voltage, refer to Technical Data, Pages 10-8 to 10-12.

2) Caution: risk of restart!
The start command (e.g. via PLC) must be reset if a general fault occurs as an automatic restart is executed when a start command is pending after the reset command is issued. This applies to motor protection tripping in particular.
For safety reasons, we recommend integrating the general fault output (terminals 95 and 96) into the control.

9.1.3 3RW44 in a Standard Circuit and DC Braking[3] Stopping Function for Device Types 3RW44 22 to 3RW44 25

Main circuit

Control circuit

L1   3/N/PE 400 V AC[1], 50 Hz
L2
L3

Q1

$I \gg$ $I \gg$ $I \gg$

F3   SITOR (option)

1L1   3L2   5L3

Q11

2T1   4T2   6T3

Q91   Q91
2   2

V1
M1   U1   M   W1
3~   PE

NSB0_01501

E4   1/N/PE 230 V AC[1], 50 Hz

F2

+24 V DC

PLC outputs   PLC inputs

M   Start[2]   Reset

Q91

Motor right   PS1

No action   No action   Reset

PTC type A or Thermoclick

Q11   A1   L+   L-   IN1   IN2   IN3   IN4   T1   T2

PE

On time   DC brake contactor[3]   No action   Group error

A2   13   14   23   24   33   34   95   96   98

PE

Q91   U

N

NSB0_01502b

1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

2) Caution: risk of restart!
The start command (e.g. by the PLC) must be reset before a reset command is issued, as an automatic restart is executed when a start command is pending after the reset command is issued. This applies to motor protection tripping in particular. For safety reasons, we recommend integrating the general fault output (terminals 95 and 96) into the control.

3) If the "Combined braking" stopping function is selected, no braking contactor is required.
   If the "DC braking" function is selected, a braking contactor must be additionally used.
   For types, refer to the "Branch Component Circuitry (Standard Circuit)" table on Page 10-17.
   The "DC braking" function is recommended for applications with larger centrifugal masses ($J_{Load} > J_{Motor}$).
   Output 2 must be set to "DC braking contactor".

9.1.4 3RW44 in a Standard Circuit and DC Braking[3] Stopping Function for Device Types 3RW44 26 to 3RW44 66

Main circuit

Control circuit

1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

---

2) Caution: risk of restart!
The start command (e.g. by the PLC) must be reset before a reset command is issued, as an automatic restart is executed when a start command is pending after the reset command is issued. This applies to motor protection tripping in particular. For safety reasons, we recommend integrating the general fault output (terminals 95 and 96) into the control.

---

3) If the "Combined braking" stopping function is selected, no braking contactor is required.
If the "DC braking" function is selected, a braking contactor must be additionally used. For types, refer to the "Branch Component Circuitry (Standard Circuit)" table on Page 10-17.
The "DC braking" function is recommended for applications with larger centrifugal masses ($J_{Load} > J_{Motor}$). Output 2 must be set to "DC braking contactor".

4) K4 auxiliary relay, e.g.:
LZX:RT4A4T30 (230 V AC rated control supply voltage),
LZX:RT4A4S15 (115 V AC rated control supply voltage).

9.1.5 3RW44 in an Inside elta Circuit
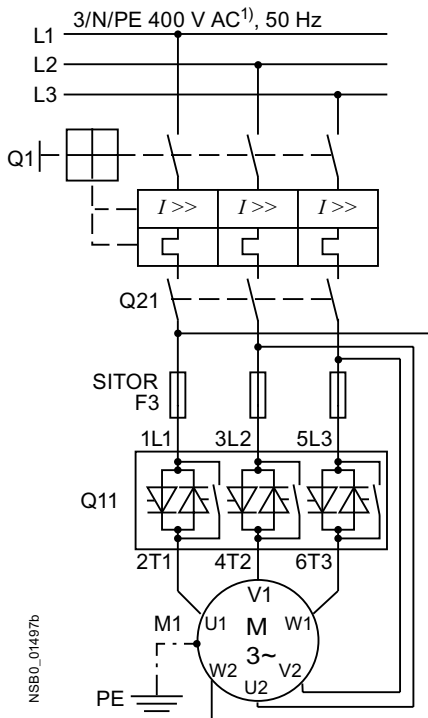
Main circuit Option 1a: **Control circuit** Option 1: Activation via PLC
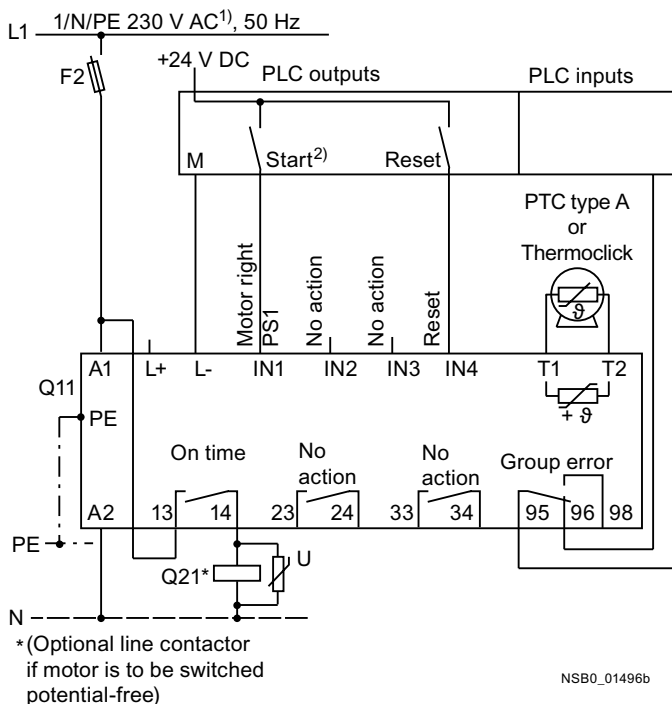
Reversed direction of rotation in an inside delta circuit

Main circuit Option 1b:
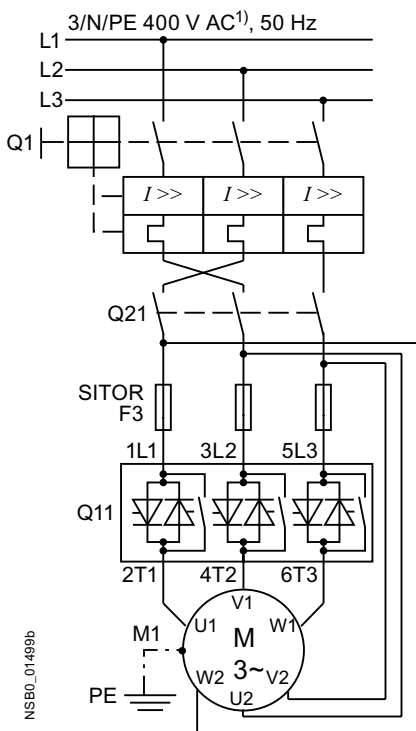
Notice
Observe the wiring suggestions for the inside delta circuit on the main circuit page. Faulty connection may cause breakdowns.

1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

2) Caution: risk of restart!
The start command (e.g. by the PLC) must be reset before a reset command is issued, as an automatic restart is executed when a start command is pending after the reset command is issued. This particularly applies to motor protection tripping.
For safety reasons, we recommend integrating the general fault output (terminals 95 and 96) into the control.

9.1.6 3RW44 in a Standard Circuit and Control as per Contactor
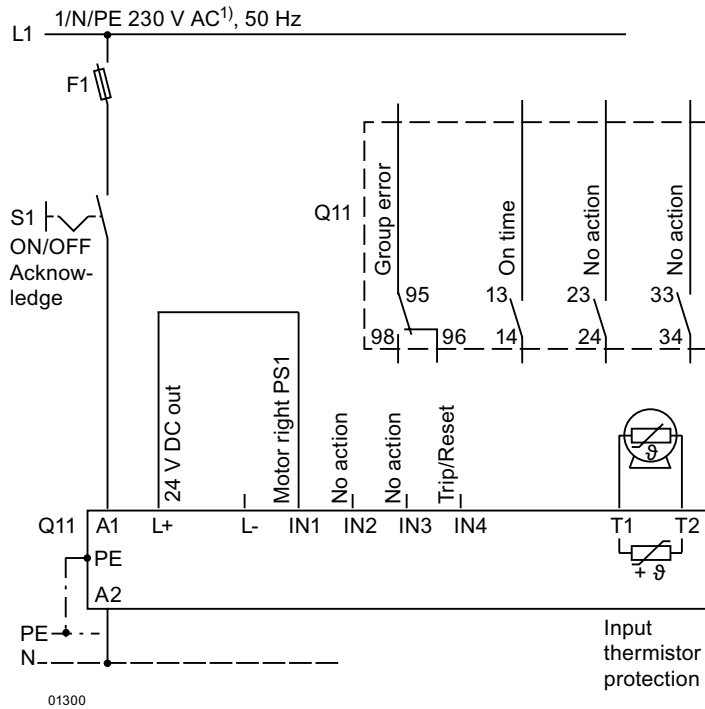
Control circuit   **Main circuit**
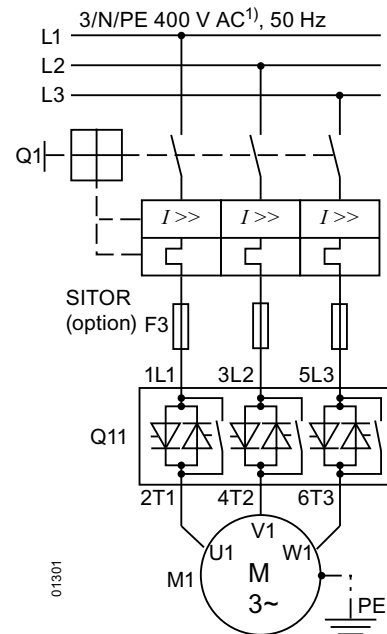
Note

With this circuit type, the motor start may be delayed by up to 5 s after the start command is issued due to the internal run times of the soft starter. Coasting down is the only possible stopping mode.

Notice

After switching off the control supply voltage and before restarting, the device must be allowed to cool down for at least 30 s, as this influences the effectiveness of the inherent protection of the soft starter.

This type of circuit is not recommended for higher switching frequencies as the integrated fan cannot idle after the soft starter has been switched off, thus reducing the switching frequency specified in the technical data.
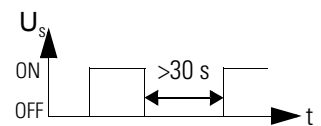
1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

9.1.7 3RW44 in a Standard Circuit with Soft Start/Stop and Additional Slow Speed Function in both Directions of Rotation with one Parameter Set
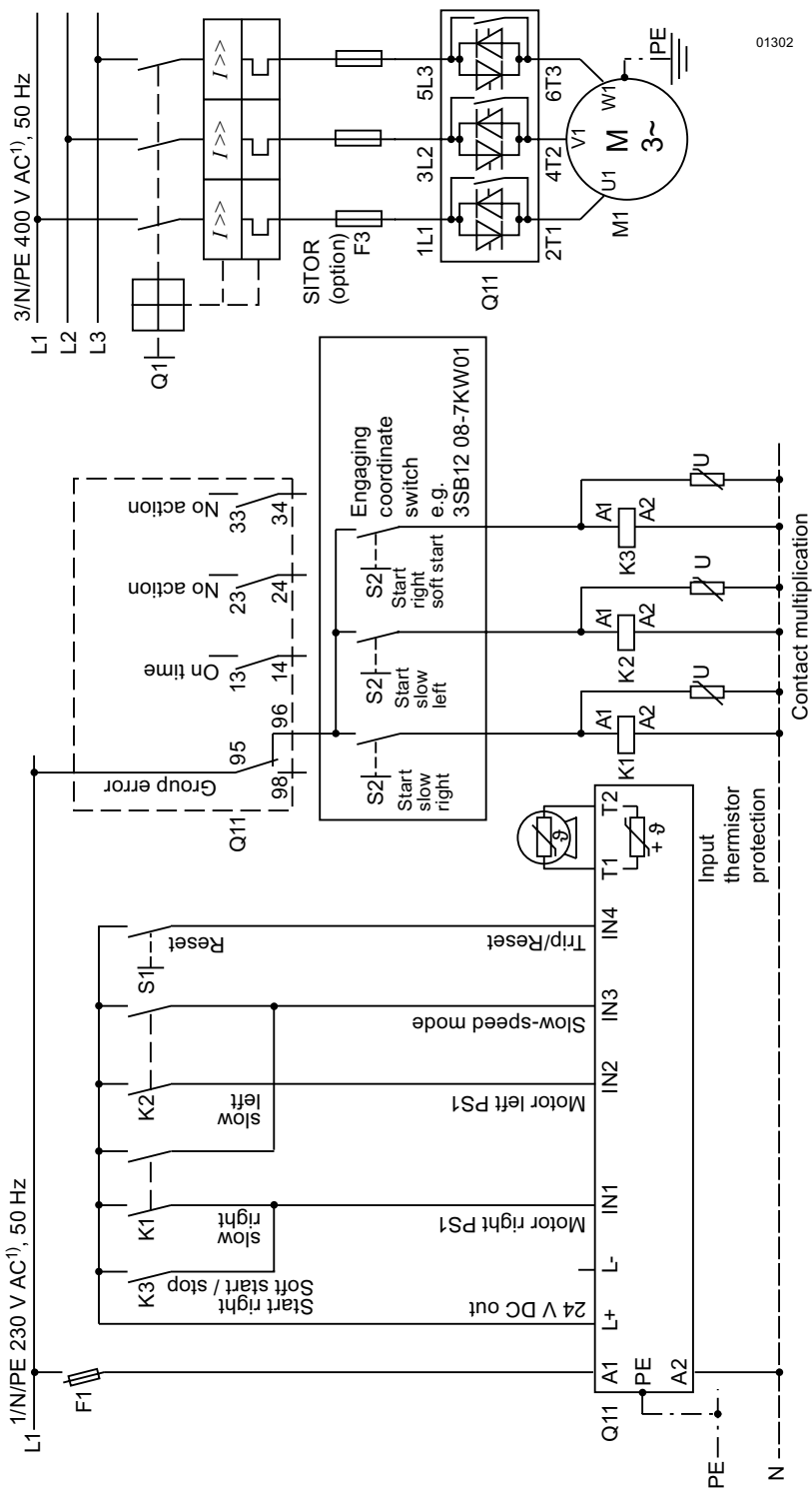
Note: parameterization
Set the control input functions to:
IN1: Motor right PS1
IN2: Motor left PS1
IN3: Slow speed mode
IN4: Trip/Reset (factory default)
The slow speed parameters in Parameter Set 1 must be set. Motor right means rotation in line phase direction, motor left means rotation against the line phase direction.

Notice
The slow speed function is not suitable for continuous operation. The motor can overheat at slow speed during continuous operation.

Caution: risk of restart:
The start command must be reset before a reset command is issued, as an automatic restart is executed when a start command is pending after the reset command is issued. This applies to motor protection tripping in particular.
K1, K2, K3 = relays for contact multiplication, e.g. for 230 V AC operation: 3RS 1800-1BP00

1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

SIRIUS 3RW44 System Manual

9.1.8 Activation via PROFIBUS with Switching to Manual Operation Local (e. g. at the Control Cabinet)
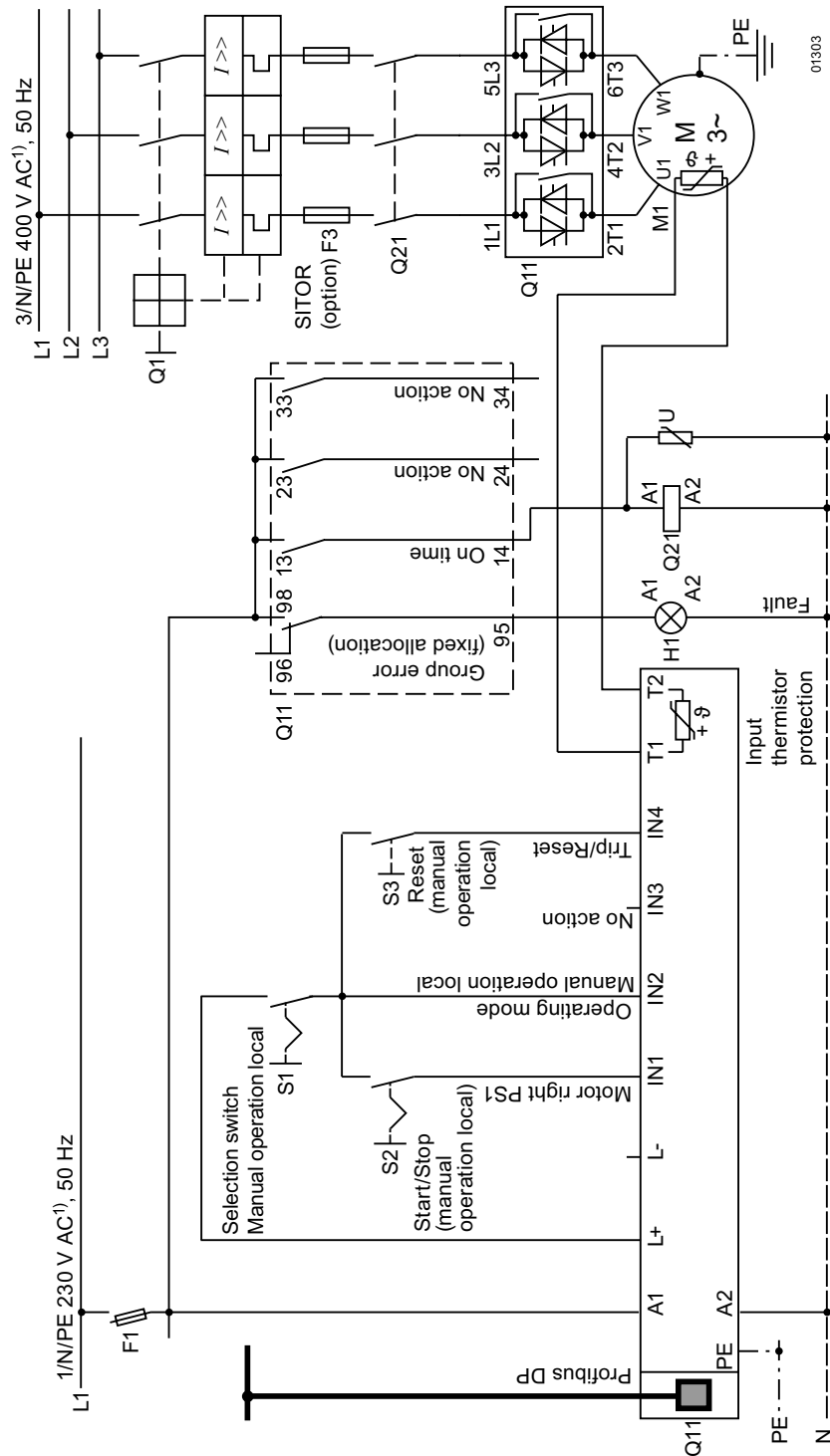
1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

9.1.9 3RW44 in a Standard Circuit and Reversing Operation via Main Contactors with one Parameter Set without Soft Stop
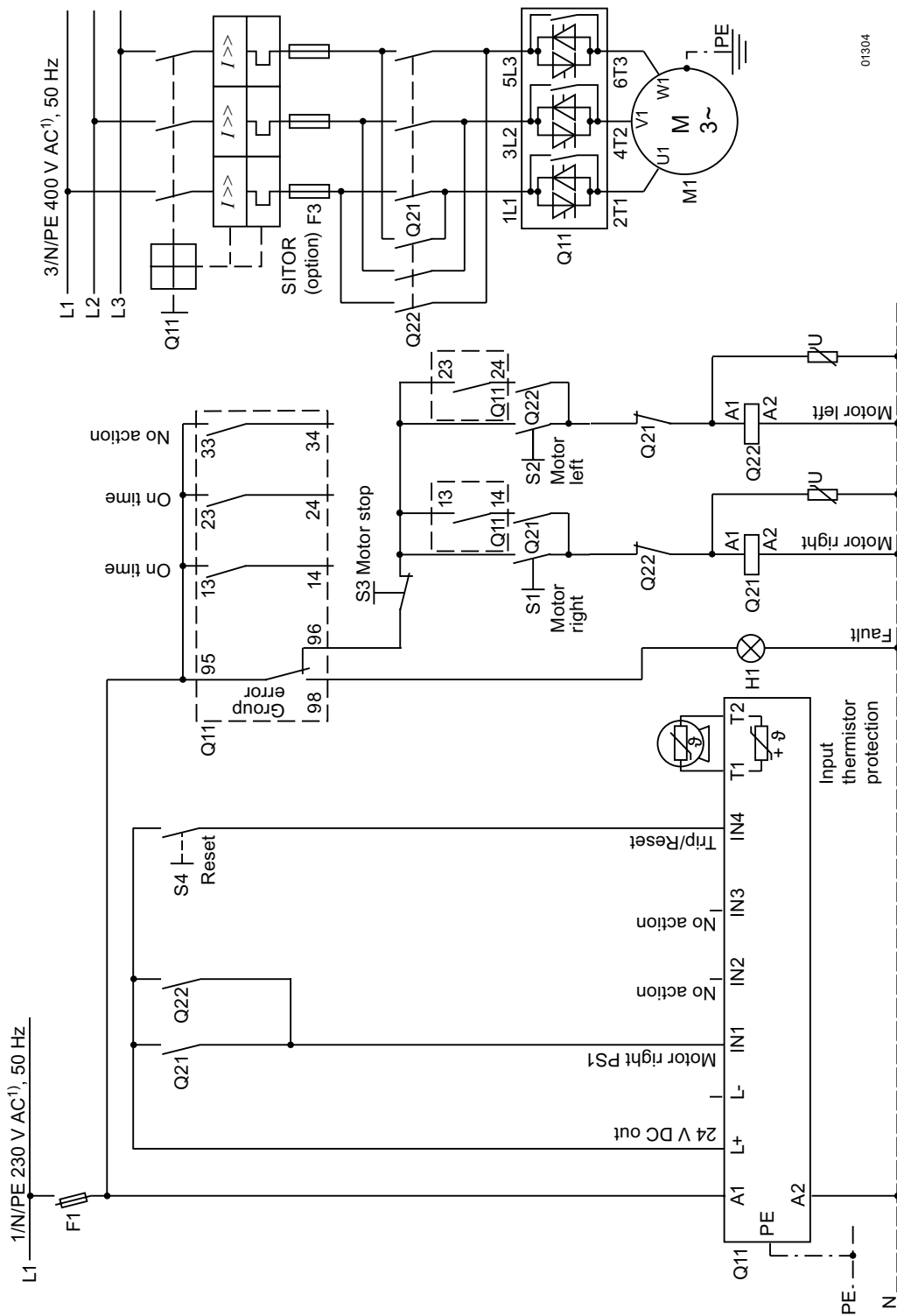
1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

9.1.10 Reversing Operation with Soft Stop
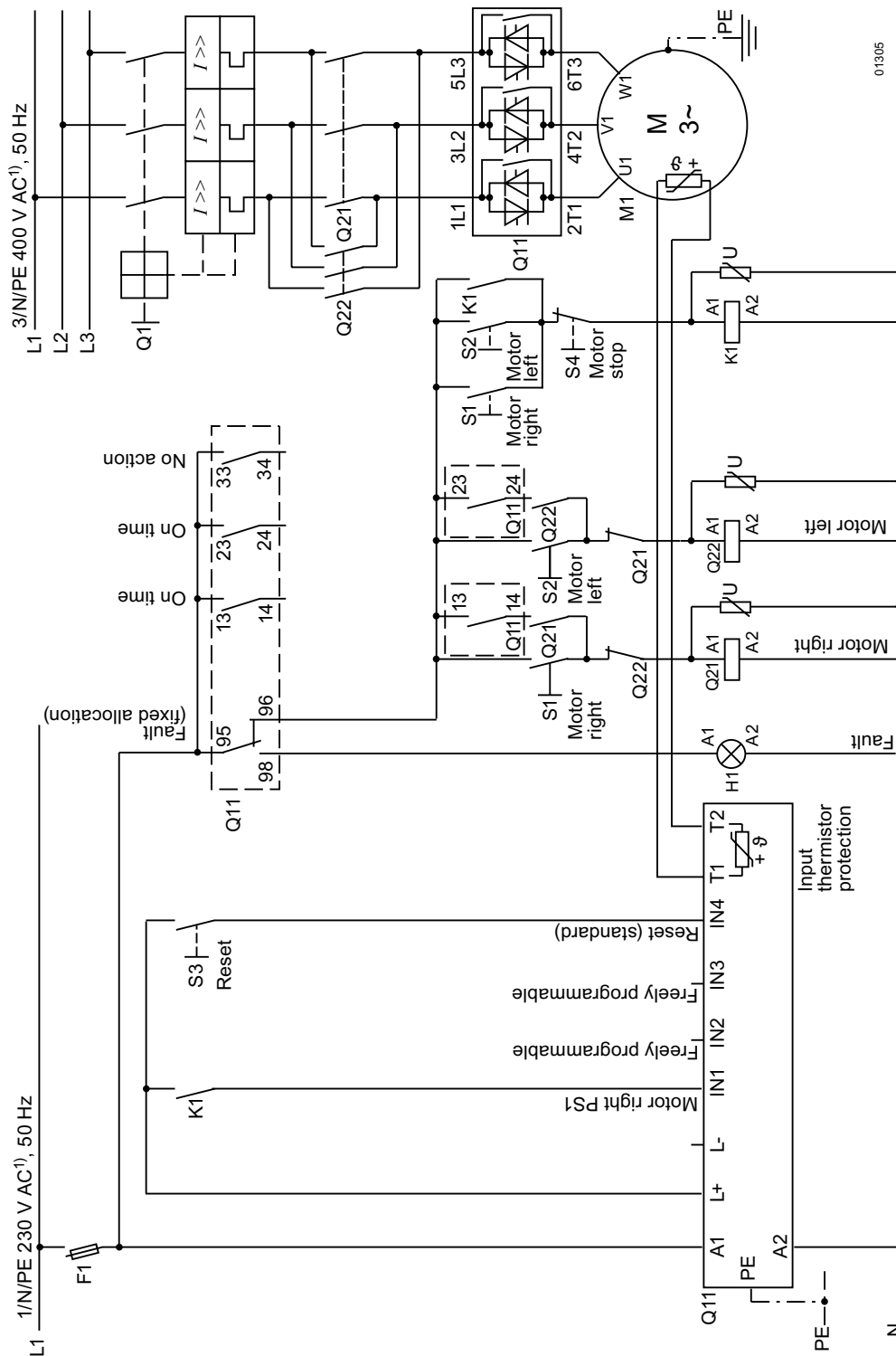
1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

9.1.11 Soft Starter for Pole-Changing Motor with Separate Windings and 2 Paramerter Sets
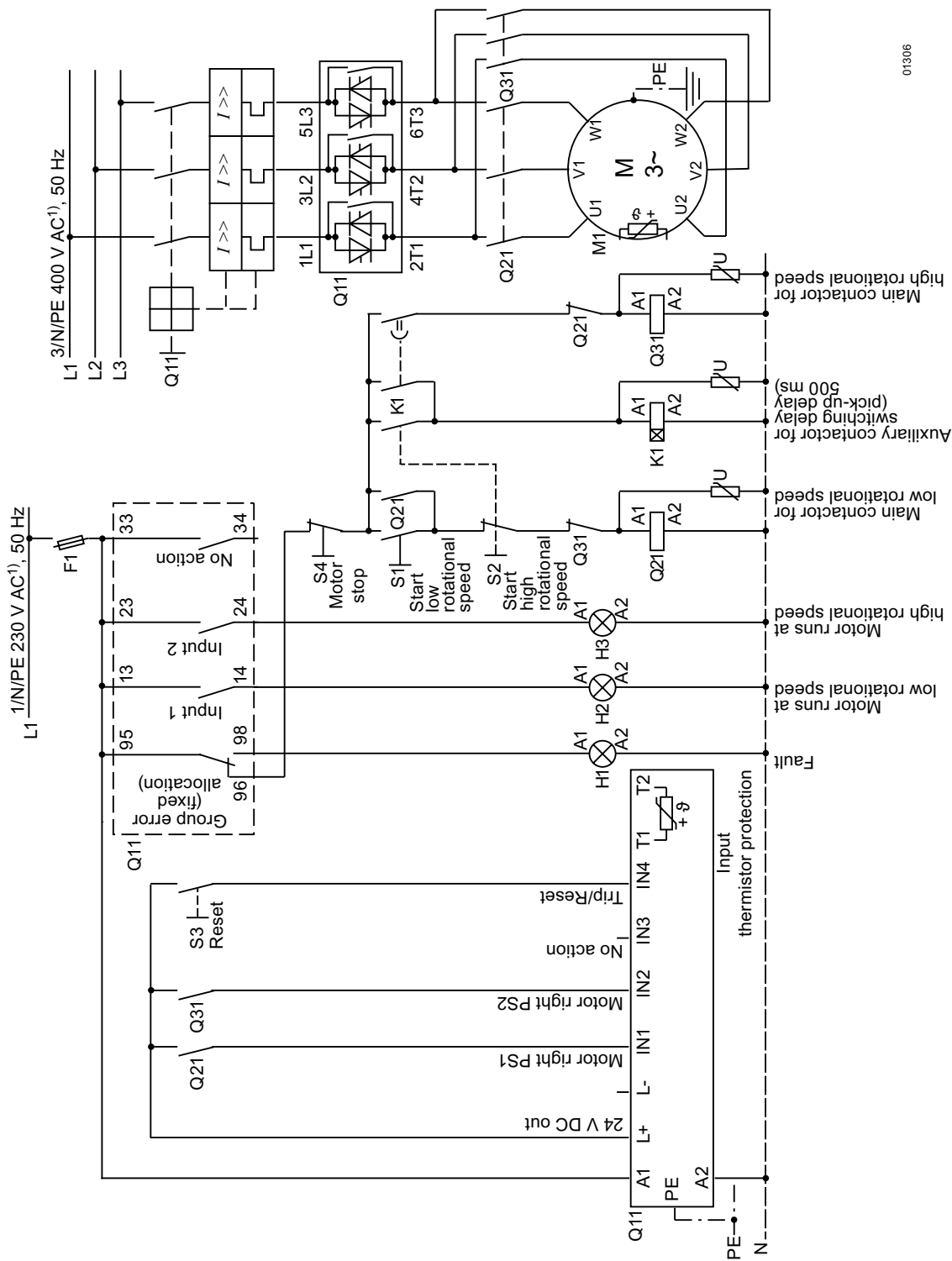
Notice
The "Coasting down" stopping mode must be set on the 3RW44.

1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

9.1.12 Soft Starters for Dahlander Motors with 2 Parameter Sets

1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

9.1.13 Parallel Starting of 3 Motors

Control circuit
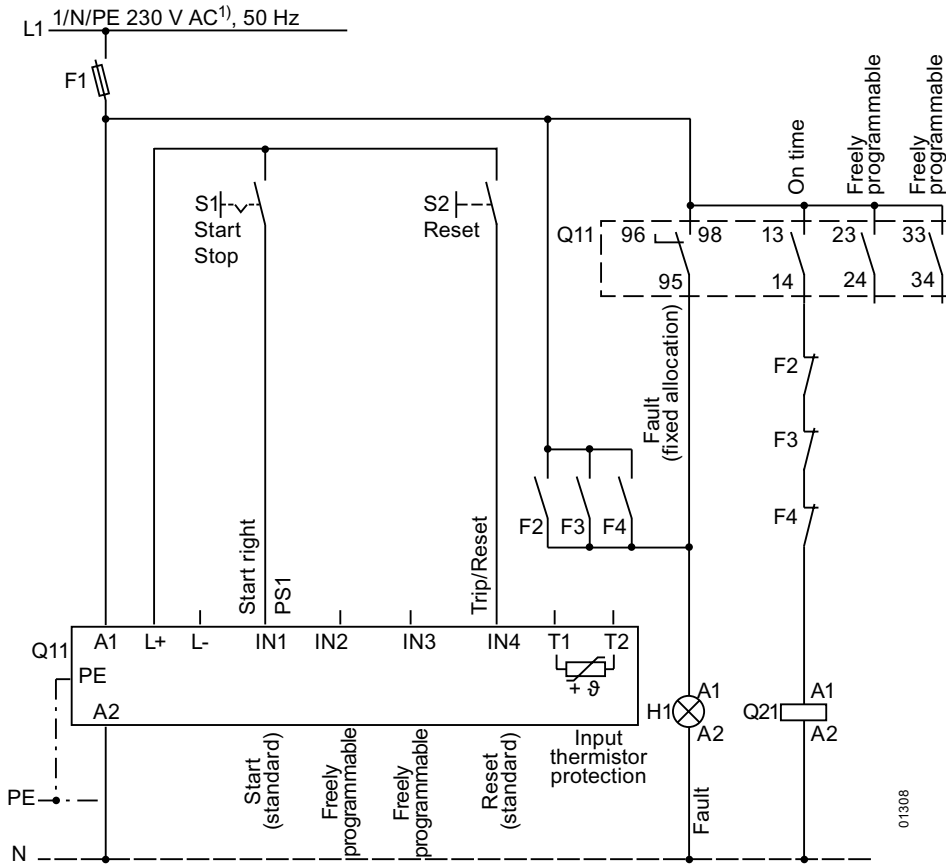
1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

Notice

The rated output of the 3RW44 to be configured must be at least as high as the total motor rated output.
The loads should have similar mass moments of inertia and torque characteristic curves.

Parallel Starting of 3 Motors

Main circuit
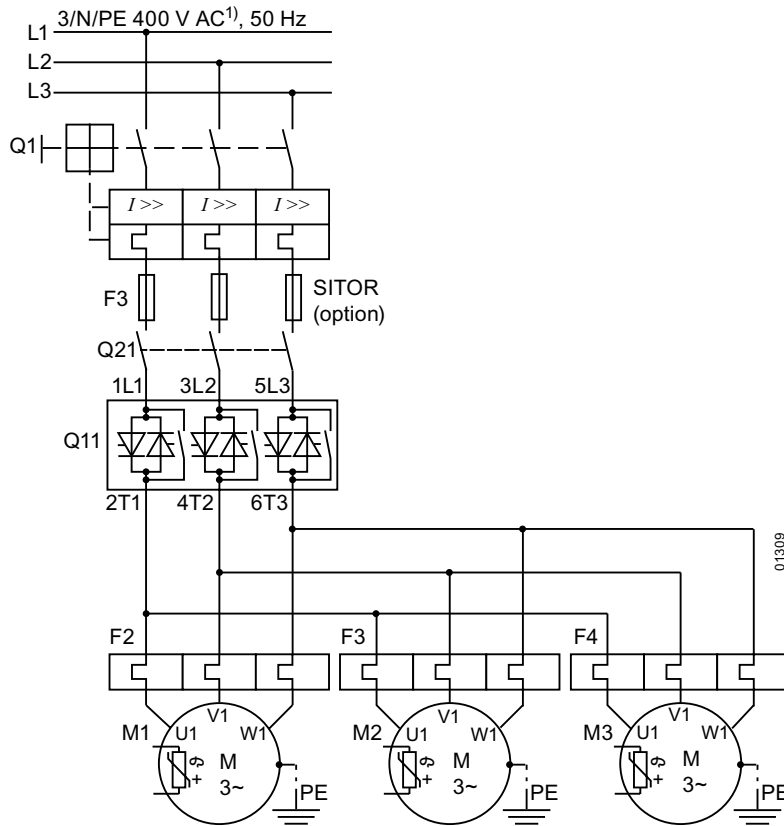
3/N/PE 400 V AC[1], 50 Hz

01309

1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

Notice

The rated output of the 3RW44 to be configured must be at least as high as the total motor rated output.
The loads should have similar mass moments of inertia and torque characteristic curves.

9.1.14 Soft Starter for Serial Starting with 3 Parameter Sets

Notice
The "Coasting down" stopping mode must be set on the 3RW44.

Note
In the case of high switching frequency, the 3RW44 should be dimensioned at least one capacity level higher.
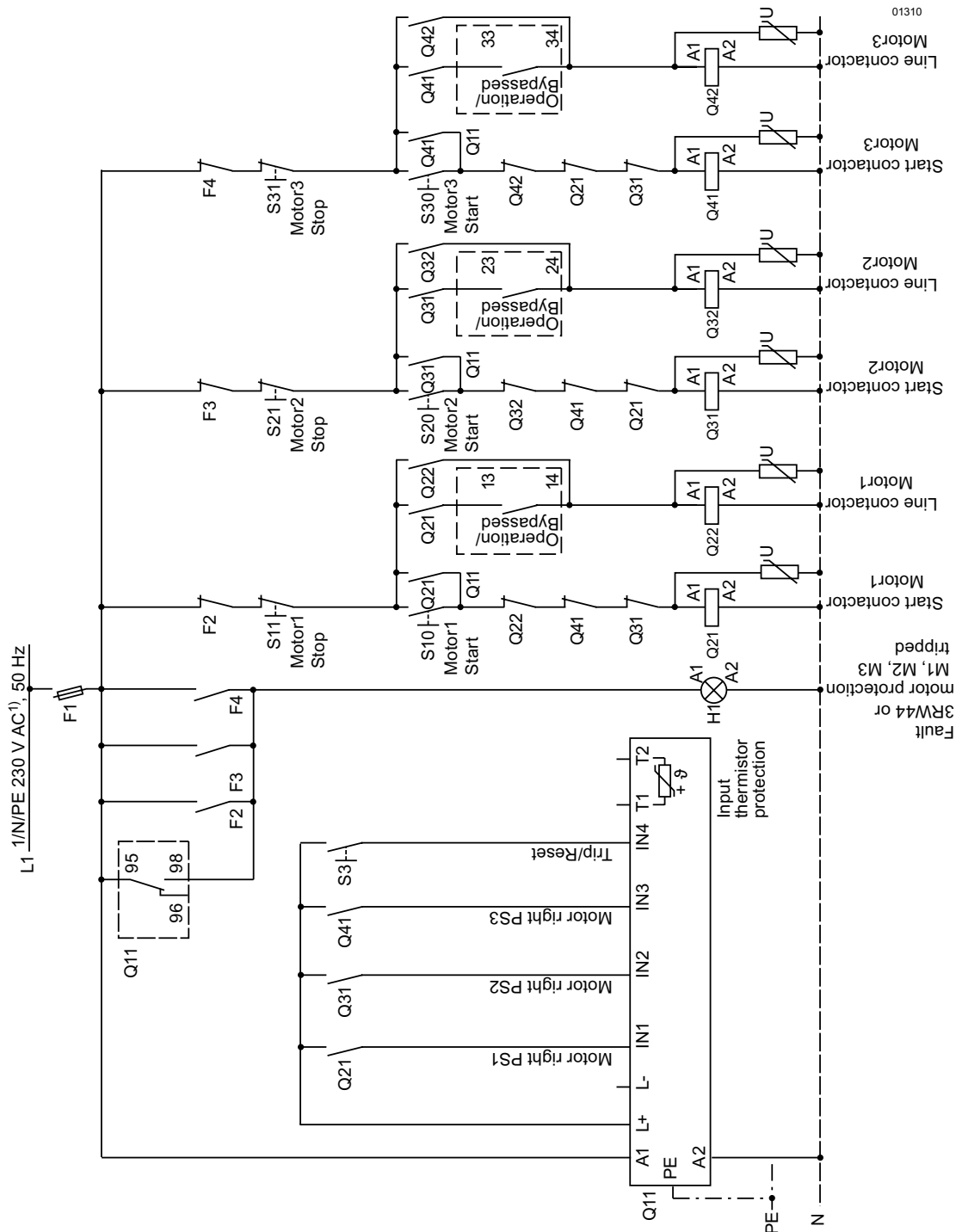
1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

Soft Starter for Serial Starting with 3 Parameter Sets (Deactivate Soft Stop and 3RW44 Motor Protection)
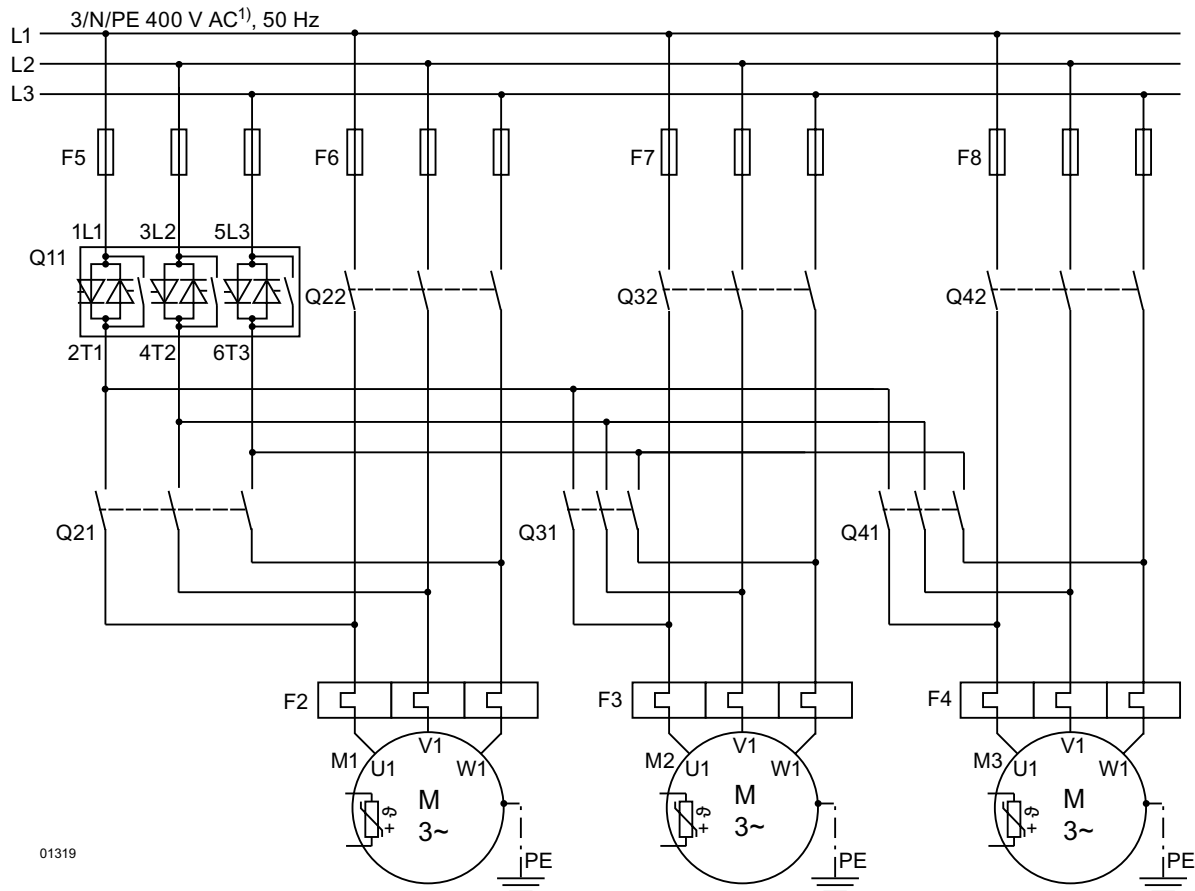
1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

Note

In the case of high switching frequency, the 3RW44 should be dimensioned at least one capacity level higher than the highest connected motor output.

Notice

The "Coasting down" stopping mode must be set on the 3RW44.

9.1.15 Soft Starter for Activation of a Motor with Magnetic Fixing Brake
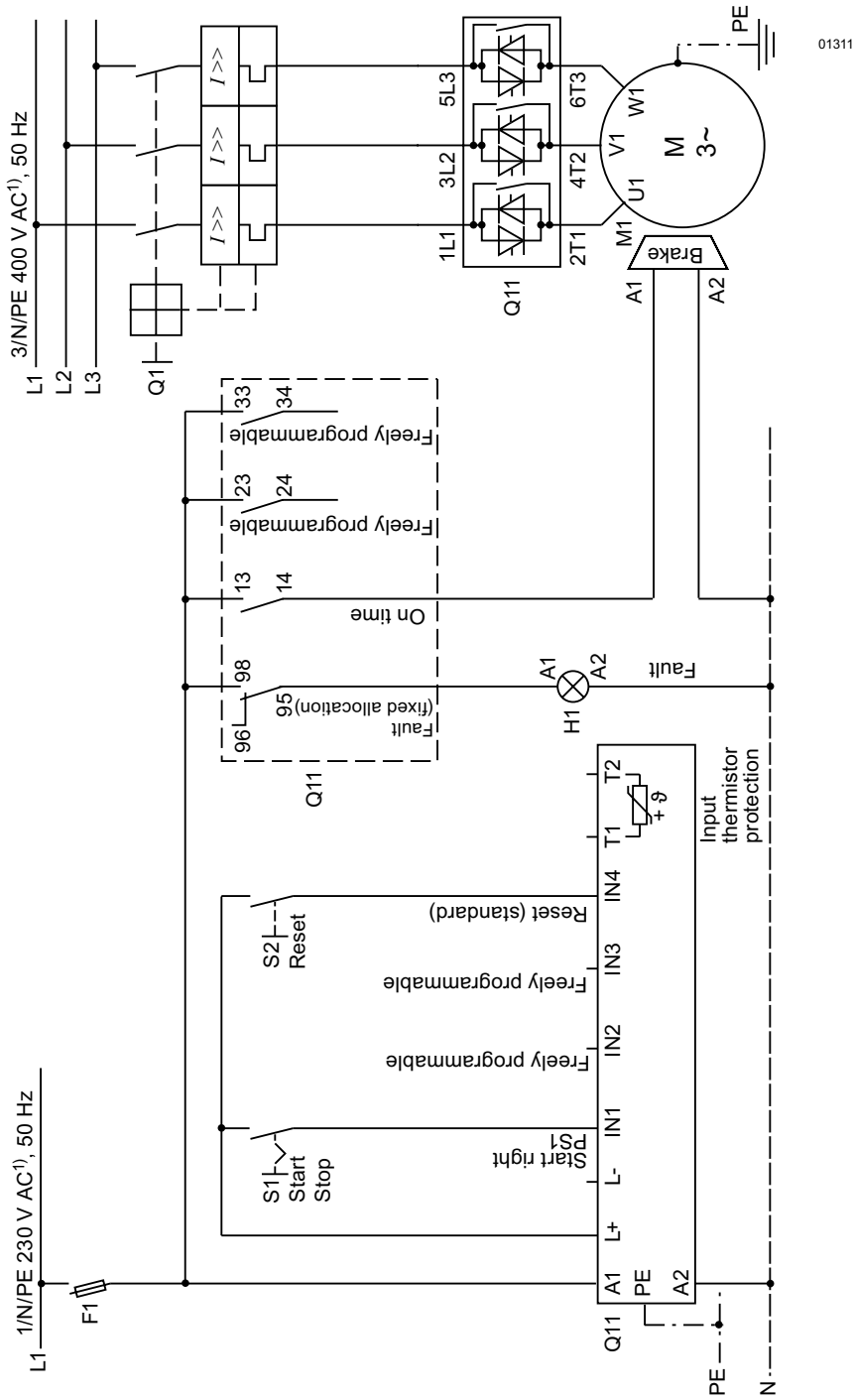
1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

9.1.16 Emergency Stop Monitoring according to EN 954-1 Category 4 with Safety Relay 3TK2823 and 3RW44

1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

Emergency Stop Monitoring according to EN 954-1 Category 4 with Safety Relay 3TK2823 and 3RW44

Main circuit
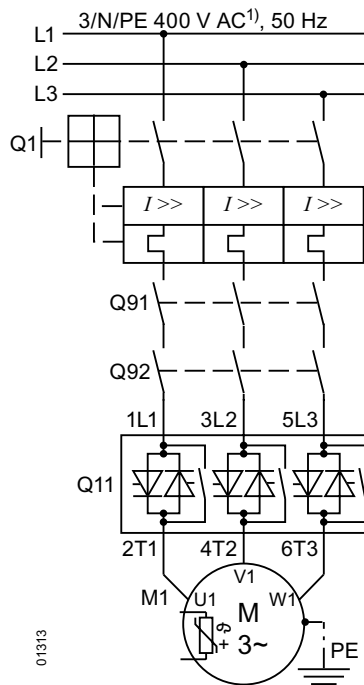
1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

Notice

If a stopping function has been set (exception: "Coasting down"), a fault message may be issued by the soft starter when the Emergency Off circuit is activated (e.g."Loss of phase L1/L2/L3" or "No main power").

9.1.17 Soft Starter with Direct Switching (DOL) as Emergency Start
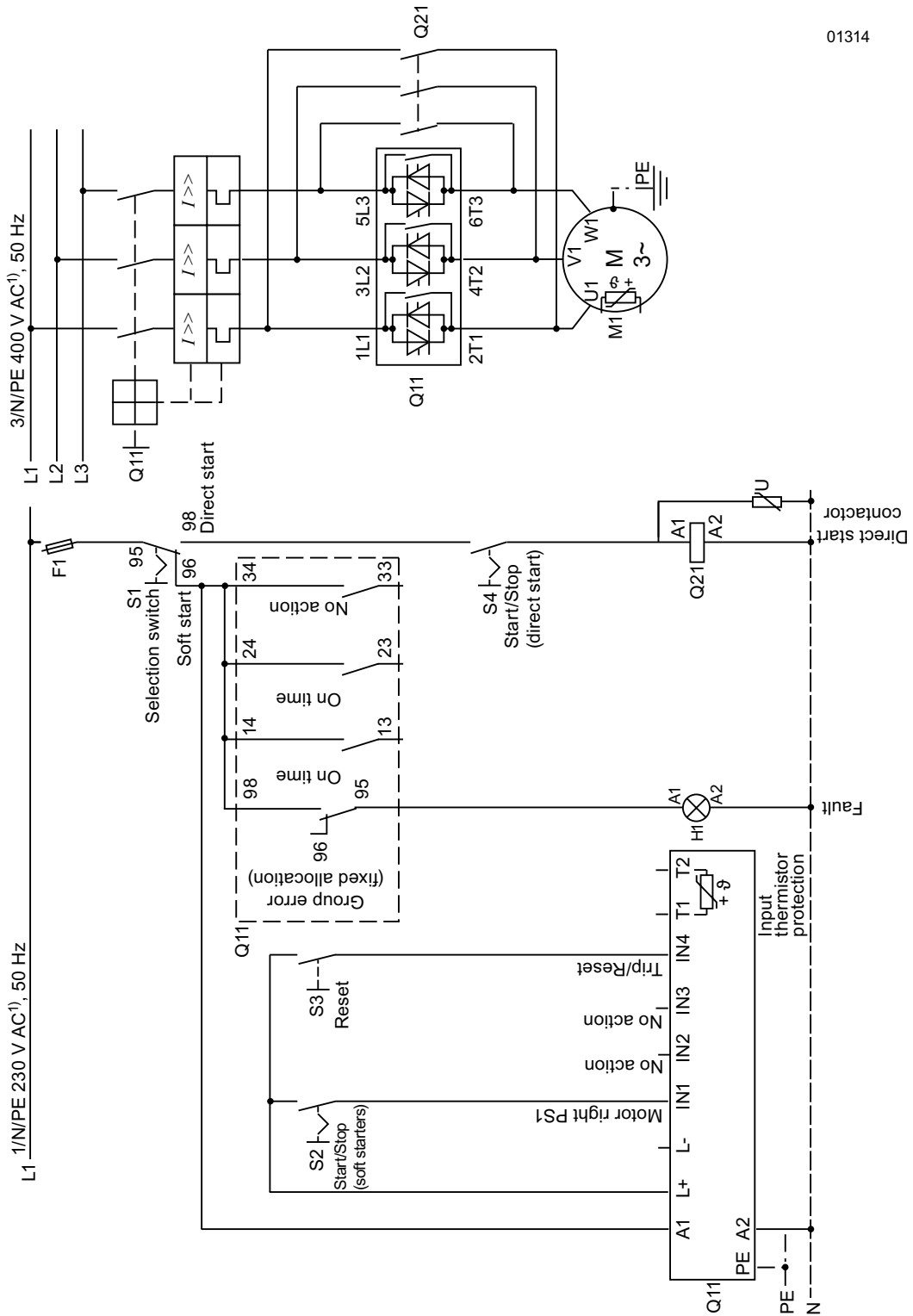
01314

1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

9.1.18 Soft Starter with Star-Delta Starter as Emergency Start (3RW44 in Standard Circuit)
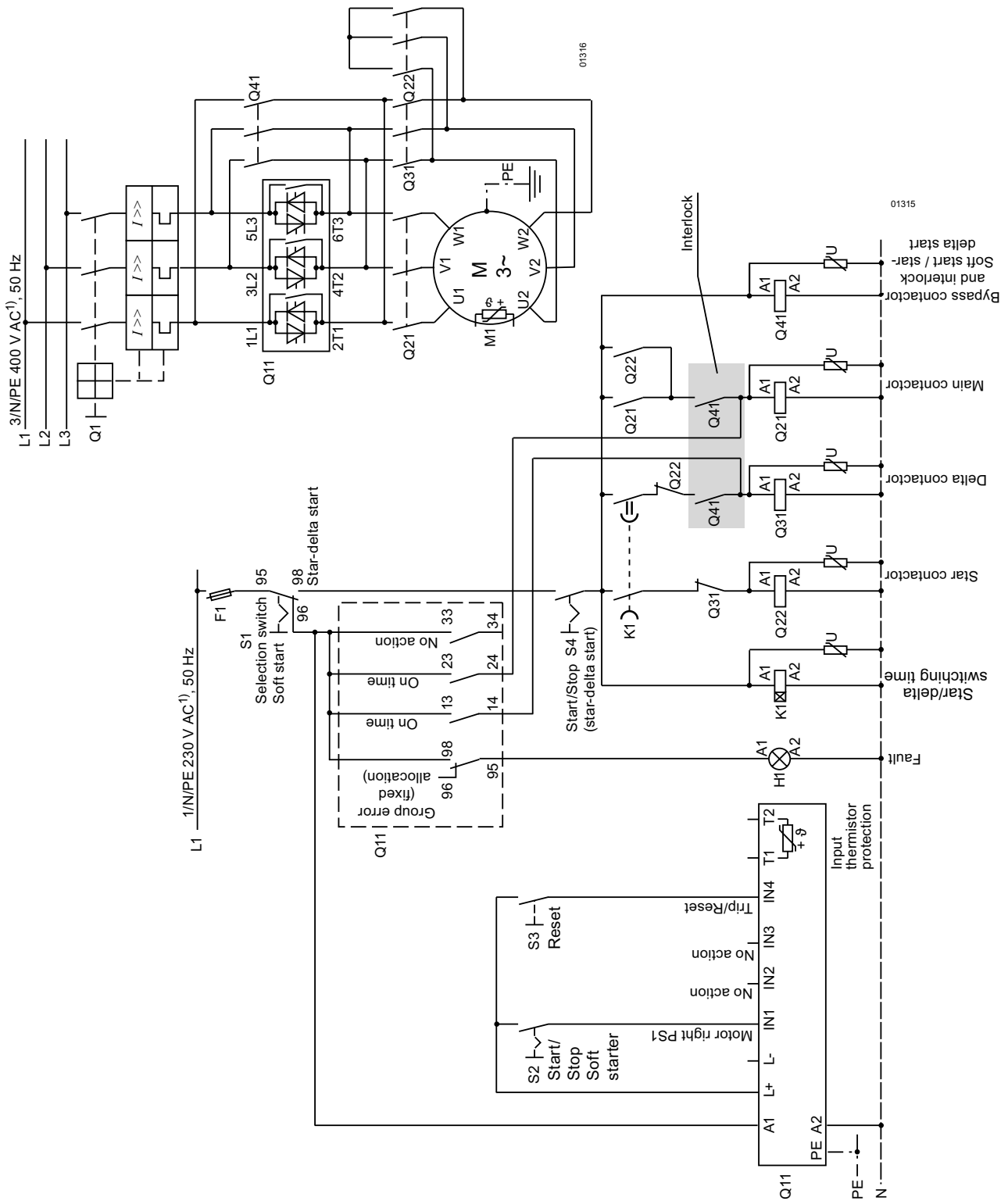
1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

9.1.19 Soft Starter and Frequency Converter on a Motor
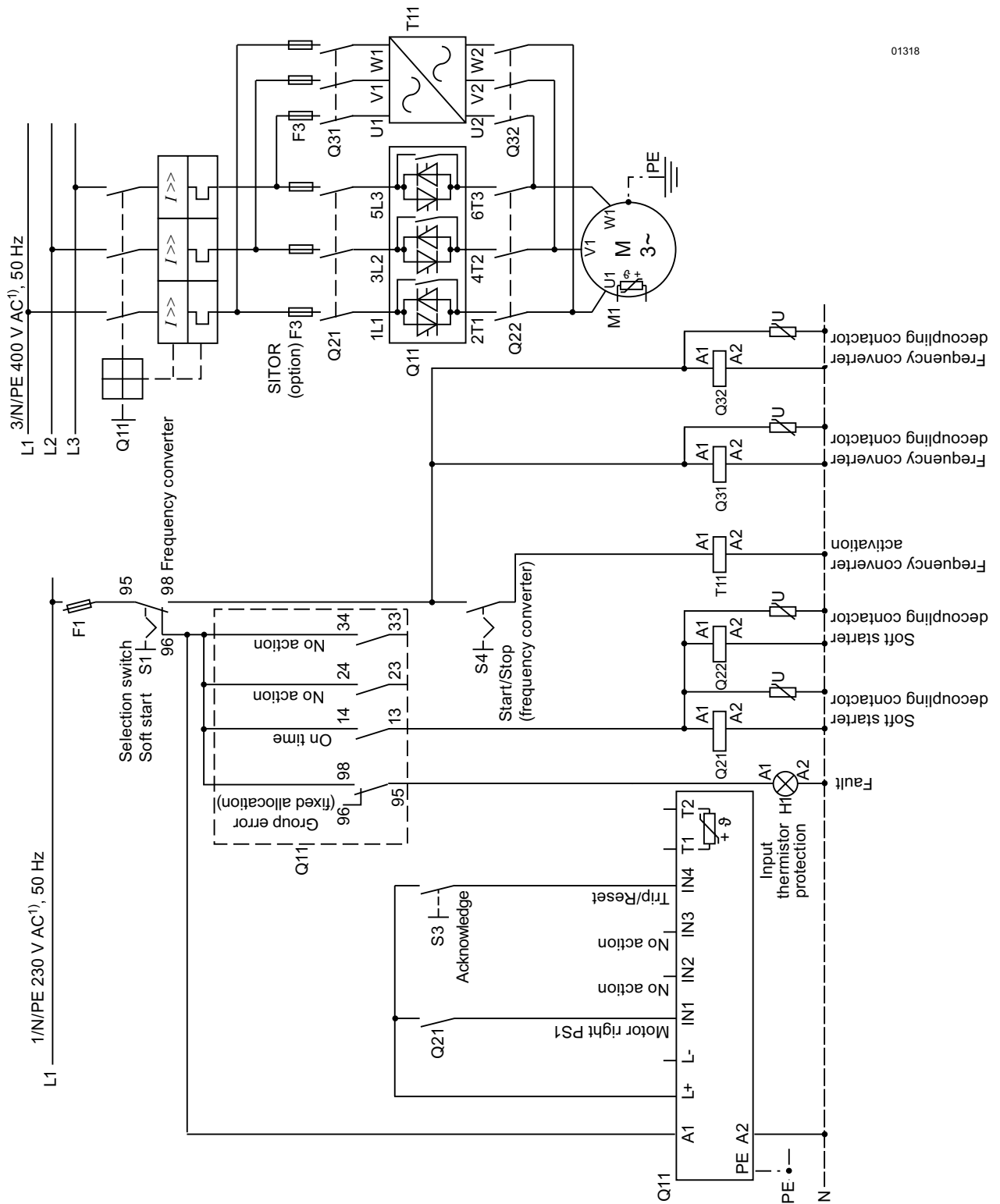
1) For permissible main and control voltage values, refer to Technical Data, Pages 10-8 to 10-12.

General Technical Data

10

10.1 Menu Structure

Display measured value	Status display	Settings
ESC ▼ OK	ESC ▼ OK	ESC ▼ OK

	Factory Settings	Customer Settings
Phase voltages		
UL1N		
UL2N		
UL3N		
Phase-to-phase voltages		
UL1-L2		
UL2-L3		
UL3-L1		
Blocking voltages		
ULT1		
ULT2		
ULT3		
Phase currents		
IL1		
IL2		
IL3		
Power		
Line frequency		
Supply voltage		
Heatsink temperature		
Motor heat build-up		
Remaining time for tripping		
Switch off standard display		

	Factory Settings	Customer Settings
Device status		
Active parameter set		
Parameter set 1		
Parameter set 2		
Parameter set 3		
Type of connection		
Unknown/faulty		
Star/delta		
Inside delta		
Direction of rotation		
Unknown		
Clockwise		
Counter-clockwise		
Inputs		
Status - Inputs		
Input 1 - Action		
No action		
Manual operation local		
Emergency start		
Slow speed		
Quick stop		
Trip reset		
Motor right PS1		
Motor left PS1 **		
Motor right PS2		
Motor left PS2 **		
Motor right PS3		
Motor left PS3 **		
Input 2 - Action [...]		
Input 3 - Action [...]		
Input 4 - Action [...]		
Outputs		
Status - Outputs		
Output 1 - Action		
No action		
PIO output 1		
PIO output 2		
Input 1		
Input 2		
Input 3		
Input 4		
Run up		
Bypass operation		
Coasting down		
On time motor		
Command motor-on		
DC braking contactor		
Group warning		
Group error		
Bus error		
Device error		
Power on		
Ready to start		
Output 2 - Action [...]		
Output 3 - Action [...]		
Output 4 - Action [...]		
Order number		
Firmware information		
Version		
Date		

	Factory Settings	Customer Settings
Parameter set 1		
Motor 1		
Rated operating current Ie	Depends on order number	
Rated operating torque	0	
Rated operating speed	1500	
Copy motor data to PS2 + 3		
Starting settings		
Starting mode		
Voltage ramp		
Voltage ramp + current limiting	x	
Torque control		
Torque control + current limiting		
Direct on line		
Motor heating		
Start voltage	30 %	
Start torque	10 %	
Limiting torque	150 %	
Starting time	10 s	
Maximum starting time	0/deactivated	
Current limiting value	400 %	
Breakaway voltage	40 %	
Breakaway time	0 ms	
Motor thermal capacity	20 %	
Stopping settings		
Stopping mode		
Coasting down	x	
Torque control		
Pump stop		
DC braking		
Combined braking		
Stopping time	10 s	
Stopping torque	10 %	
Dynamic braking torque	50 %	
DC braking torque	50 %	
Slow speed parameters		
Slow speed factor right	7	
Slow speed torque right	50 %	
Slow speed factor left	7	
Slow speed torque left	50 %	
Current limit values		
Minimum current limit	18.75 %	
Maximum current limit	112.50 %	
Parameter set 2 [...]		
Parameter set 3 [...]		
Inputs		
Input 1 - Action		
No action		
Manual operation local		
Emergency start		
Slow speed		
Quick stop		
Trip Reset		
Motor right PS1	x	
Motor left PS1 **		
Motor right PS2		
Motor left PS2 **		
Motor right PS3		
Motor left PS3 **		
Input 2 - Action [...]		
Input 3 - Action [...]	No Action	
Input 4 - Action [...]	Trip Reset	

	Factory Settings	Customer Settings
Outputs		
Output 1 - Action		
No action		
PIO output 1		
PIO output 2		
Input 1		
Input 2		
Input 3		
Input 4		
Run up		
Operation / bypass		
Coasting down		
On time motor	x	
Command motor-on		
DC braking contactor		
Group warning		
Group error		
Bus error		
Device error		
Power on		
Ready to start		
Output 2 - Action [...]	No Action	
Output 3 - Action [...]	No Action	
Motor protection		
Tripping class		
None		
CLASS 5 (10a)		
CLASS 10	x	
CLASS 15		
CLASS 20		
CLASS 30		
Current asymmetry limit value	40 %	
Prewarning limit tripping reserve	0 s	
Prewarning limit motor heat build-up	80 %	
Idle time	0 s	
Pre-charge time	60 s	
Protection against voltage failure		
No		
Yes	x	
Temperature sensor		
Deactivated	x	
Thermo click		
PTC-type A		
Display settings		
Language		
English	x	
Deutsch		
Français		
Español		
Italiano		
Português		
Contrast	50 %	
Lighting		
Brightness		
Lighting on	x	
Off with time delay		
Lighting off		
Response to fault		
Unchanged		
On		
Blinking		
Flickering	x	

** Possible only in connection with creep speed

	Factory Settings	Customer Settings
Response to warning		
Unchanged		
On		
Blinking	x	
Flickering		
Reaction time keys	60 %	
Auto repeat		
Time	80 ms	
Speed	80 %	
Activity monitoring time	30 s	
Response to ...		
Overload - therm. motor model		
Tripping without restart	x	
Tripping with restart		
Warning		
Overload - temperature sensor		
Tripping without restart	x	
Tripping with restart		
Warning		
Current limit value violation		
Warning	x	
Tripping		
Overload - contact block		
Tripping without restart	x	
Tripping with restart		
Asymmetry		
Warning		
Tripping	x	
Ground fault		
Warning	x	
Tripping		
Name		
Name		
Fieldbus		
Fieldbus interface		
Off	x	
On		
Group diagnosis		
Disable	x	
Enable		
Behavior on CPU/master-stop		
Switch substitute value	x	
Hold last value		
Station address	126	
Baud rate		
Substitute value		
Motor right		
Motor left		
Slow speed		
Emergency start		
Output 1		
Output 2		
Parameter set 1		
Parameter set 2		
Parameter set 3		
Lock quickstop		
Parameters disabled CPU/Master		
Off	x	
On		
Saving options		
Save settings		
Restore settings		
Restore basic factory settings		

Motor control [ESC] ▼ [OK]

Motor control via keys
Activate / deactivate key control
Select parameter set
  Parameter set 1
  Parameter set 2
  Parameter set 3
Execute control function
  Motor right
  Motor left **
  Slow speed
  Emergency start
  Output 1
  Output 2
Control motor via inputs
Activate / deactivate control via inputs
Standard control
Automatic / None
Inputs
Keys

Statistics [ESC] ▼ [OK]

Log lists
Device errors
Trips
Events
Maximum pointer
Currents (%)
  Phase current L1 min
  Phase current L2 min
  Phase current L3 min
  Phase current L1 max
  Phase current L2 max
  Phase current L3 max
Currents (rms)
  Phase current L1 min
  Phase current L2 min
  Phase current L3 min
  Phase current L1 max
  Phase current L2 max
  Phase current L3 max
Phase-to-phase voltages
  UL1 - L2 min (rms)
  UL2 - L3 min (rms)
  UL3 - L1 min (rms)
  UL1 - L2 max (rms)
  UL2 - L3 max (rms)
  UL3 - L1 max (rms)
Maximum tripping current IA (%)
Maximum tripping current IA (rms)
Number of overload trips
Minimum line frequency
Maximum line frequency
Max. cooling temperature
Max. contact block temperature
Reset all maximum pointers
Statistics data
Motor current Imax (%)
Motor current Imax (rms)
Last trigger current IA (%)
Last trigger current IA (rms)
Operating hours - device
Operating hours - motor
No. of starts motor right
No. of starts motor left
Number of overload trips
Number of braking stops
No. of starts output 1
No. of starts output 2
No. of starts output 3
No. of starts output 4

Safety [ESC] ▼ [OK]

	Factory Settings	Customer Settings
Enter user code	1000	
User level		
Customer read (> 1000)		
Customer write (1000)		

** Possible only in connection with creep speed

10.2   Transport and Storage Conditions

Transport and storage conditions

The soft starters comply with the requirements of DIN IEC 721-3-1/HD478.3.1 P1 for transport and storage conditions. The following data applies to modules that are transported and stored in their original packing.

Type of condition	Permissible range
Temperature	From -25 $^\circ$C to +80 $^\circ$C
Atmospheric pressure	From 700 to 1060 hPa
Relative humidity	From 10 to 95 %

10.3 Technical Data
10.3.1 Selection and Ordering Data

Rated operating voltage U_e	Rated operating current I_e	Standard circuit				Rated operating current I_e	Standard circuit				Order No.
		Ambient temperature 40 °C					Ambient temperature 50 °C				
		Rated output of three-phase motors for rated operating voltage U_e					Rated output of three-phase motors for rated operating voltage U_e				
V	A	230 V / kW	400 V / kW	500 V / kW	690 V / kW	A	200 V / HP	230 V / HP	460 V / HP	575 V / HP	
200 ... 460	29	5.5	15	—	—	26	7.5	7.5	15	—	3RW44 22-☐BC☐4
	36	7.5	18.5	—	—	32	10	10	20	—	3RW44 23-☐BC☐4
	47	11	22	—	—	42	10	15	25	—	3RW44 24-☐BC☐4
	57	15	30	—	—	51	15	15	30	—	3RW44 25-☐BC☐4
	77	18.5	37	—	—	68	20	20	50	—	3RW44 26-☐BC☐4
	93	22	45	—	—	82	25	25	60	—	3RW44 27-☐BC☐4
400 ...600	29	—	15	18.5	—	26	—	—	15	20	3RW44 22-☐BC☐5
	36	—	18.5	22	—	32	—	—	20	25	3RW44 23-☐BC☐5
	47	—	22	30	—	42	—	—	25	30	3RW44 24-☐BC☐5
	57	—	30	37	—	51	—	—	30	40	3RW44 25-☐BC☐5
	77	—	37	45	—	68	—	—	50	50	3RW44 26-☐BC☐5
	93	—	45	55	—	82	—	—	60	75	3RW44 27-☐BC☐5
400 ... 690	29	—	15	18.5	30	26	—	—	15	20	3RW44 22-☐BC☐6
	36	—	18.5	22	37	32	—	—	20	25	3RW44 23-☐BC☐6
	47	—	22	30	45	42	—	—	25	30	3RW44 24-☐BC☐6
	57	—	30	37	55	51	—	—	30	40	3RW44 25-☐BC☐6
	77	—	37	45	75	68	—	—	50	50	3RW44 26-☐BC☐6
	93	—	45	55	90	82	—	—	60	75	3RW44 27-☐BC☐6

| Order No. extension for connection method | | | | | | | | Screw-type terminals | | ↑ 1 ↑ |
| | | | | | | | | Spring-loaded terminals | | 3 |

		Standard circuit					Standard circuit				
200 ... 460	113	30	55	—	—	100	30	30	75	—	3RW44 34-☐BC☐4
	134	37	75	—	—	117	30	40	75	—	3RW44 35-☐BC☐4
	162	45	90	—	—	145	40	50	100	—	3RW44 36-☐BC☐4
	203	55	110	—	—	180	50	60	125	—	3RW44 43-☐BC☐4
	250	75	132	—	—	215	60	75	150	—	3RW44 44-☐BC☐4
	313	90	160	—	—	280	75	100	200	—	3RW44 45-☐BC☐4
	356	110	200	—	—	315	100	125	250	—	3RW44 46-☐BC☐4
	432	132	250	—	—	385	125	150	300	—	3RW44 47-☐BC☐4
	551	160	315	—	—	494	150	200	400	—	3RW44 53-☐BC☐4
	615	200	355	—	—	551	150	200	450	—	3RW44 54-☐BC☐4
	693	200	400	—	—	615	200	250	500	—	3RW44 55-☐BC☐4
	780	250	450	—	—	693	200	250	600	—	3RW44 56-☐BC☐4
	880	250	500	—	—	780	250	300	700	—	3RW44 57-☐BC☐4
	970	315	560	—	—	850	300	350	750	—	3RW44 58-☐BC☐4
	1076	355	630	—	—	885	350	400	850	—	3RW44 65-☐BC☐4
	1214	400	710	—	—	1051	400	450	950	—	3RW44 66-☐BC☐4
400 ... 600	113	—	55	75	—	100	—	—	75	75	3RW44 34-☐BC☐5
	134	—	75	90	—	117	—	—	75	100	3RW44 35-☐BC☐5
	162	—	90	110	—	145	—	—	100	125	3RW44 36-☐BC☐5
	203	—	110	132	—	180	—	—	125	150	3RW44 43-☐BC☐5
	250	—	132	160	—	215	—	—	150	200	3RW44 44-☐BC☐5
	313	—	160	200	—	280	—	—	200	250	3RW44 45-☐BC☐5
	356	—	200	250	—	315	—	—	250	300	3RW44 46-☐BC☐5
	432	—	250	315	—	385	—	—	300	400	3RW44 47-☐BC☐5
	551	—	315	355	—	494	—	—	400	500	3RW44 53-☐BC☐5
	615	—	355	400	—	551	—	—	450	600	3RW44 54-☐BC☐5
	693	—	400	500	—	615	—	—	500	700	3RW44 55-☐BC☐5
	780	—	450	560	—	693	—	—	600	750	3RW44 56-☐BC☐5
	880	—	500	630	—	780	—	—	700	850	3RW44 57-☐BC☐5
	970	—	560	710	—	850	—	—	750	950	3RW44 58-☐BC☐5
	1076	—	630	800	—	885	—	—	850	1100	3RW44 65-☐BC☐5
	1214	—	710	900	—	1051	—	—	950	1200	3RW44 66-☐BC☐5

Order No. extension for connection method								Screw-type terminals		↑ 2 ↑
								Spring-loaded terminals		6
Order No. extension for rated control supply voltage U_s								AC 115 V		3
								AC 230 V		4

Rated operating voltage U_e	Standard circuit				Standard circuit					Order No.
	Ambient temperature 40 °C				Ambient temperature 50 °C					
	Rated operating current I_e	Rated output of three-phase motors for rated operating voltage U_e			Rated operating current I_e	Rated output of three-phase motors for rated operating voltage U_e				
400 ... 690	113	—	55	75	110	100	—	—	75	75	**3RW44 34-□BC□6**
	134	—	75	90	132	117	—	—	75	100	**3RW44 35-□BC□6**
	162	—	90	110	160	145	—	—	100	125	**3RW44 36-□BC□6**
	203	—	110	132	200	180	—	—	125	150	**3RW44 43-□BC□6**
	250	—	132	160	250	215	—	—	150	200	**3RW44 44-□BC□6**
	313	—	160	200	315	280	—	—	200	250	**3RW44 45-□BC□6**
	356	—	200	250	355	315	—	—	250	300	**3RW44 46-□BC□6**
	432	—	250	315	400	385	—	—	300	400	**3RW44 47-□BC□6**
	551	—	315	355	560	494	—	—	400	500	**3RW44 53-□BC□6**
	615	—	355	400	630	551	—	—	450	600	**3RW44 54-□BC□6**
	693	—	400	500	710	615	—	—	500	700	**3RW44 55-□BC□6**
	780	—	450	560	800	693	—	—	600	750	**3RW44 56-□BC□6**
	880	—	500	630	900	780	—	—	700	850	**3RW44 57-□BC□6**
	970	—	560	710	1000	850	—	—	750	950	**3RW44 58-□BC□6**
	1076	—	630	800	1100	885	—	—	850	1100	**3RW44 65-□BC□6**
	1214	—	710	900	1200	1051	—	—	950	1200	**3RW44 66-□BC□6**

Order No. extension for connection method

Spring-loaded terminals   2
Screw-type terminals   6

Order No. extension for rated control supply voltage U_S

115 V AC   3
230 V AC   4

Rated operating voltage U_e	Inside delta circuit				Inside delta circuit					Order No.
	Ambient temperature 40 °C				Ambient temperature 50 °C					
	Rated operating current I_e	Rated output of three-phase motors for rated operating voltage U_e			Rated operating current I_e	Rated output of three-phase motors for rated operating voltage U_e				
V	A	230 V / kW	400 V / kW	500 V / kW	A	200 V / HP	230 V / HP	460 V / HP	575 V / HP	
200 ... 460	50	15	22	—	45	10	15	30	—	3RW44 22-☐BC☐4
	62	18.5	30	—	55	15	20	40	—	3RW44 23-☐BC☐4
	81	22	45	—	73	20	25	50	—	3RW44 24-☐BC☐4
	99	30	55	—	88	25	30	60	—	3RW44 25-☐BC☐4
	133	37	75	—	118	30	40	75	—	3RW44 26-☐BC☐4
	161	45	90	—	142	40	50	100	—	3RW44 27-☐BC☐4
400 ... 600	50	—	22	30	45	—	—	30	40	3RW44 22-☐BC☐5
	62	—	30	37	55	—	—	40	50	3RW44 23-☐BC☐5
	81	—	45	45	73	—	—	50	60	3RW44 24-☐BC☐5
	99	—	55	55	88	—	—	60	75	3RW44 25-☐BC☐5
	133	—	75	90	118	—	—	75	100	3RW44 26-☐BC☐5
	161	—	90	110	142	—	—	100	125	3RW44 27-☐BC☐5

Order No. extension for connection method — Screw-type terminals ↑1 / Spring-loaded terminals ↑3

Rated operating voltage U_e	A	230 V / kW	400 V / kW	500 V / kW	A	200 V / HP	230 V / HP	460 V / HP	575 V / HP	Order No.
200 ... 460	196	55	110	—	173	50	60	125	—	3RW44 34-☐BC☐4
	232	75	132	—	203	60	75	150	—	3RW44 35-☐BC☐4
	281	90	160	—	251	75	100	200	—	3RW44 36-☐BC☐4
	352	110	200	—	312	100	125	250	—	3RW44 43-☐BC☐4
	433	132	250	—	372	125	150	300	—	3RW44 44-☐BC☐4
	542	160	315	—	485	150	200	400	—	3RW44 45-☐BC☐4
	617	200	355	—	546	150	200	450	—	3RW44 46-☐BC☐4
	748	250	400	—	667	200	250	600	—	3RW44 47-☐BC☐4
	954	315	560	—	856	300	350	750	—	3RW44 53-☐BC☐4
	1065	355	630	—	954	350	400	850	—	3RW44 54-☐BC☐4
	1200	400	710	—	1065	350	450	950	—	3RW44 55-☐BC☐4
	1351	450	800	—	1200	450	500	1050	—	3RW44 56-☐BC☐4
	1524	500	900	—	1351	450	600	1200	—	3RW44 57-☐BC☐4
	1680	560	1000	—	1472	550	650	1300	—	3RW44 58-☐BC☐4
	1864	630	1100	—	1533	650	750	1500	—	3RW44 65-☐BC☐4
	2103	710	1200	—	1820	700	850	1700	—	3RW44 66-☐BC☐4
400 ... 600	196	—	110	132	173	—	—	125	150	3RW44 34-☐BC☐5
	232	—	132	160	203	—	—	150	200	3RW44 35-☐BC☐5
	281	—	160	200	251	—	—	200	250	3RW44 36-☐BC☐5
	352	—	200	250	312	—	—	250	300	3RW44 43-☐BC☐5
	433	—	250	315	372	—	—	300	350	3RW44 44-☐BC☐5
	542	—	315	355	485	—	—	400	500	3RW44 45-☐BC☐5
	617	—	355	450	546	—	—	450	600	3RW44 46-☐BC☐5
	748	—	400	500	667	—	—	600	750	3RW44 47-☐BC☐5
	954	—	560	630	856	—	—	750	950	3RW44 53-☐BC☐5
	1065	—	630	710	954	—	—	850	1050	3RW44 54-☐BC☐5
	1200	—	710	800	1065	—	—	950	1200	3RW44 55-☐BC☐5
	1351	—	800	900	1200	—	—	1050	1350	3RW44 56-☐BC☐5
	1524	—	900	1000	1351	—	—	1200	1500	3RW44 57-☐BC☐5
	1680	—	1000	1200	1472	—	—	1300	1650	3RW44 58-☐BC☐5
	1864	—	1100	1350	1533	—	—	1500	1900	3RW44 65-☐BC☐5
	2103	—	1200	1500	1820	—	—	1700	2100	3RW44 66-☐BC☐5

Order No. extension for connection method — Spring-loaded terminals ↑2 / Screw-type terminals ↑6

Order No. extension for rated control supply voltage U_S — 115 V AC ↑3 / 230 V AC ↑4

10.3.2 Technical Data Power Unit

Type		3RW44 ..-.BC.4	3RW44 ..-.BC.5	3RW44 ..-.BC.6
Power electronics				
Rated operational voltage for inline circuit	V	AC 200 ... 460	AC 400 ... 600	AC 400 ... 690
Tolerance	%	-15 / +10	-15 / +10	-15 / +10
Rated operational voltage for inside-delta circuit	V	AC 200 ... 460	AC 400 ... 600	AC 400 ... 600
Tolerance	%	-15 / +10	-15 / +10	-15 / +10
Rated frequency	Hz	50 ... 60		
Tolerance	%	±10		
Continuous operation at 40 °C (% of I_e)	%	115		
Minimum load (% of set motor current I_M)	%	20		
Maximum conductor length between soft starter and motor	m	200		
Permissible installation height	m	5000 (derating from 1000, see characteristics); higher on request		
Permissible mounting position				
Permissible ambient temperature				
Operation	°C	0 ... +60; (derating from +40)		
Storage	°C	-25 ... +80		
Degree of protection		IP00		

Type		3RW44 22	3RW44 23	3RW44 24	3RW44 25	3RW44 26	3RW44 27
Power electronics							
Rated operational current I_e		29	36	47	57	77	93
Load rating with rated operational current I_e							
• Acc. to IEC and UL/CSA for individual mounting, AC-53a							
- at 40 °C	A	29	36	47	57	77	93
- at 50 °C	A	26	32	42	51	68	82
- at 60 °C	A	23	29	37	45	59	72
Smallest adjustable rated motor current I_M for the motor overload protection	A	5	7	9	11	15	18
Power loss							
• In operation after completed ramp-up with uninterrupted rated operational current (40 °C) approx.	W	8	10	32	36	45	55
• During starting with current limit set to 350 % I_M (40 °C)	W	400	470	600	725	940	1160
Permissible rated motor current and starts per hour							
• **Normal starting (Class 5)**							
- Rated motor current I_M[1], starting time 5 s	A	29	36	47	57	77	93
- Starts per hour[2]	1/h	41	34	41	41	41	41
- Rated motor current I_M[1)3)], starting time 10 s	A	29	36	47	57	77	93
- Starts per hour[2]	1/h	20	15	20	20	20	20
• **Normal starting (Class 10)**							
- Rated motor current I_M[1], starting time 10 s	A	29	36	47	57	77	93
- Starts per hour[2]	1/h	20	15	20	20	20	20
- Rated motor current I_M[1)3)], starting time 20 s	A	29	36	47	57	77	93
- Starts per hour[2]	1/h	10	6	10	10	8	8
• **Normal starting (Class 15)**							
- Rated motor current I_M[1], starting time 15 s	A	29	36	47	57	77	93
- Starts per hour[2]	1/h	13	9	13	13	13	13
- Rated motor current I_M[1)3)], starting time 30 s	A	29	36	47	57	77	93
- Starts per hour[2]	1/h	6	4	6	6	6	6
• **For heavy starting (Class 20)**							
- Rated motor current I_M[1], starting time 20 s	A	29	36	47	57	73	88
- Starts per hour[2]	1/h	10	6	10	10	10	10
- Rated motor current I_M[1)3)], starting time 40 s	A	29	36	47	57	73	88
- Starts per hour[2]	1/h	4	2	4	5	1.8	0.8
• **For very heavy starting (Class 30)**							
- Rated motor current I_M[1], starting time 30 s	A	29	36	44	57	65	77
- Starts per hour[2]	1/h	6	4	6	6	6	6
- Rated motor current I_M[1)3)], starting time 60 s	A	29	36	44	57	65	77
- Starts per hour[2]	1/h	1.8	0.8	3.3	1.5	2	1

1) Current limit on soft starter set to 350 % I_M.

2) For intermittent duty S4 with ON period OT = 70 %, T_u = 40 °C, stand-alone installation vertical. The quoted operating frequencies do not apply for automatic mode.

3) Maximum adjustable rated motor current I_M, dependent on CLASS setting.

SIRIUS 3RW44 System Manual
GWA 4NEB 535 2195-02 DS 04

Type		3RW44 34	3RW44 35	3RW44 36
Power electronics				
Rated operational current I_e		113	134	162
Load rating with rated operational current I_e • Acc. to IEC and UL/CSA for individual mounting, AC-53a				
- at 40 °C	A	113	134	162
- at 50 °C	A	100	117	145
- at 60 °C	A	88	100	125
Smallest adjustable rated motor current I_M for the motor overload protection	A	22	26	32
Power loss • In operation after completed ramp-up with uninterrupted rated operational current (40 °C) approx.	W	64	76	95
• During starting with current limit set to 350 % I_M (40 °C)	W	1350	1700	2460
Permissible rated motor current and starts per hour				
• Normal starting (Class 5)				
- Rated motor current I_M[1], starting time 5 s	A	113	134	162
- Starts per hour[2]	1/h	41	39	41
- Rated motor current I_M[1][3], starting time 10 s	A	113	134	162
- Starts per hour[2]	1/h	20	15	20
• Normal starting (Class 10)				
- Rated motor current I_M[1], starting time 10 s	A	113	134	162
- Starts per hour[2]	1/h	20	15	20
- Rated motor current I_M[1][3], starting time 20 s	A	113	134	162
- Starts per hour[2]	1/h	9	6	7
• Normal starting (Class 15)				
- Rated motor current I_M[1], starting time 15 s	A	113	134	162
- Starts per hour[2]	1/h	13	9	12
- Rated motor current I_M[1][3], starting time 30 s	A	113	134	162
- Starts per hour[2]	1/h	6	6	1
• For heavy starting (Class 20)				
- Rated motor current I_M[1], starting time 20 s	A	106	125	147
- Starts per hour[2]	1/h	9	9	10
- Rated motor current I_M[1][3], starting time 40 s	A	106	125	147
- Starts per hour[2]	1/h	1.5	2	1
• For very heavy starting (Class 30)				
- Rated motor current I_M[1], starting time 30 s	A	91	110	120
- Starts per hour[2]	1/h	6	6	6
- Rated motor current I_M[1][3], starting time 60 s	A	91	110	120
- Starts per hour[2]	1/h	2	2	2

1) Current limit on soft starter set to 350 % I_M.

2) For intermittent duty S4 with ON period OT = 70 %, T_u = 40 °C, stand-alone installation vertical. The quoted operating frequencies do not apply for automatic mode.

3) Maximum adjustable rated motor current I_M, dependent on CLASS setting.

Type		3RW44 43	3RW44 44	3RW44 45	3RW44 46	3RW44 47
Power electronics						
Rated operational current I_e		203	250	313	356	432
Load rating with rated operational current I_e • Acc. to IEC and UL/CSA for individual mounting, AC-53a						
- at 40 °C	A	203	250	313	356	432
- at 50 °C	A	180	215	280	315	385
- at 60 °C	A	156	185	250	280	335
Smallest adjustable rated motor current I_M for the motor overload protection	A	40	50	62	71	86
Power loss						
• In operation after completed ramp-up with uninterrupted rated operational current (40 °C) approx.	W	89	110	145	174	232
• During starting with current limit set to 350 % I_M (40 °C)	W	3350	4000	4470	5350	5860
Permissible rated motor current and starts per hour						
• Normal starting (Class 5)						
- Rated motor current I_M[1], starting time 5 s	A	203	250	313	356	432
- Starts per hour[2]	1/h	41	41	41	41	39
- Rated motor current I_M[1][3], starting time 10 s	A	203	250	313	356	432
- Starts per hour[2]	1/h	20	20	19	17	16
• Normal starting (Class 10)						
- Rated motor current I_M[1], starting time 10 s	A	203	250	313	356	432
- Starts per hour[2]	1/h	20	20	19	17	16
- Rated motor current I_M[1][3], starting time 20 s	A	203	250	313	356	432
- Starts per hour[2]	1/h	9	10	6	4	5
• Normal starting (Class 15)						
- Rated motor current I_M[1], starting time 15 s	A	203	240	313	325	402
- Starts per hour[2]	1/h	13	13	10	13	11
- Rated motor current I_M[1][3], starting time 30 s	A	203	240	313	325	402
- Starts per hour[2]	1/h	3	6	1	2	1
• For heavy starting (Class 20)						
- Rated motor current I_M[1], starting time 20 s	A	195	215	275	285	356
- Starts per hour[2]	1/h	10	10	10	10	10
- Rated motor current I_M[1][3], starting time 40 s	A	195	215	275	285	356
- Starts per hour[2]	1/h	1	5	1	3	1
• For very heavy starting (Class 30)						
- Rated motor current I_M[1], starting time 30 s	A	162	180	220	240	285
- Starts per hour[2]	1/h	6	6	6	6	6
- Rated motor current I_M[1][3], starting time 60 s	A	162	180	220	240	285
- Starts per hour[2]	1/h	3	3	3	2	1

1) Current limit on soft starter set to 350 % I_M.

2) For intermittent duty S4 with ON period OT = 70 %, T_u = 40 °C, stand-alone installation vertical. The quoted operating frequencies do not apply for automatic mode.

3) Maximum adjustable rated motor current I_M, dependent on CLASS setting.

Type		3RW44 53	3RW44 54	3RW44 55	3RW44 56	3RW44 57	3RW44 58	3RW44 65	3RW44 66
Power electronics									
Rated operational current I_e		551	615	693	780	880	970	1076	1214
Load rating with rated operational current I_e									
• Acc. to IEC and UL/CSA for individual mounting, AC-53a									
- at 40 °C	A	551	615	693	780	880	970	1076	1214
- at 50 °C	A	494	551	615	693	780	850	970	1076
- at 60 °C	A	438	489	551	615	693	760	880	970
Smallest adjustable rated motor current I_M for the motor overload protection	A	110	123	138	156	176	194	215	242
Power loss									
• In operation after completed ramp-up with uninterrupted rated operational current (40 °C) approx.	W	159	186	220	214	250	270	512	630
• During starting with current limit set to 350 % I_M (40 °C)	W	7020	8100	9500	11100	13100	15000	15000	17500
Permissible rated motor current and starts per hour									
• **Normal starting (Class 5)**									
- Rated motor current I_M[1], starting time 5 s	A	551	615	693	780	880	970	1076	1214
- Starts per hour[2]	1/h	41	41	37	33	22	17	30	20
- Rated motor current I_M[1][3], starting time 10 s	A	551	615	693	780	880	970	1076	1214
- Starts per hour[2]	1/h	20	20	16	13	8	5	10	6
• **Normal starting (Class 10)**									
- Rated motor current I_M[1], starting time 10 s	A	551	615	693	780	880	970	1076	1214
- Starts per hour[2]	1/h	20	20	16	13	8	5	11	6
- Rated motor current I_M[1][3], starting time 20 s	A	551	615	693	780	880	970	1076	1214
- Starts per hour[2]	1/h	10	9	6	4	0.3	0.3	3	0.5
• **Normal starting (Class 15)**									
- Rated motor current I_M[1], starting time 15 s	A	551	615	666	723	780	821	1020	1090
- Starts per hour[2]	1/h	13	13	11	9	8	8	7	5
- Rated motor current I_M[1][3], starting time 30 s	A	551	615	666	723	780	821	1020	1090
- Starts per hour[2]	1/h	6	4	3	1	0.4	0.5	1	1
• **For heavy starting (Class 20)**									
- Rated motor current I_M[1], starting time 20 s	A	551	591	633	670	710	740	970	1030
- Starts per hour[2]	1/h	10	10	7	8	8	9	7	5
- Rated motor current I_M[1][3], starting time 40 s	A	551	591	633	670	710	740	970	1030
- Starts per hour[2]	1/h	4	2	1	1	0.4	1	1	1
• **For very heavy starting (Class 30)**									
- Rated motor current I_M[1], starting time 30 s	A	500	525	551	575	600	630	880	920
- Starts per hour[2]	1/h	6	6	6	6	6	6	6	6
- Rated motor current I_M[1][3], starting time 60 s	A	500	525	551	575	600	630	880	920
- Starts per hour[2]	1/h	2	1	1	1	1.5	1	1	1

1) Current limit on soft starter set to 350 % I_M.

2) For intermittent duty S4 with ON period OT = 70 %, T_u = 40 °C, stand-alone installation vertical. The quoted operating frequencies do not apply for automatic mode.

3) Maximum adjustable rated motor current I_M, dependent on CLASS setting.

10.3.3 Technical Data Control Unit

Type	Terminal		3RW44 ..-.BC3.	3RW44 ..-.BC4.
Control electronics				
Rated values				
Rated control supply voltage	A1 / A2 / PE	V	AC 115	AC 230
• Tolerance		%	-15 / +10	-15 / +10
Rated control supply current STANDBY		mA	30	20
Rated control supply current ON				
• 3RW44 2.		mA	300	170
• 3RW44 3.		mA	500	250
• 3RW44 4.		mA	750	400
• 3RW44 5.		mA	450	200
• 3RW44 6.		mA	650	300
Maximum current (pickup bypass)				
• 3RW44 2.		mA	1000	500
• 3RW44 3.		mA	2500	1250
• 3RW44 4.		mA	6000	3000
• 3RW44 5.		mA	4500	2500
• 3RW44 6.		mA	4500	2500
Rated frequency		Hz	50 ... 60	50 ... 60
• Tolerance		%	±10	±10

Type	Terminal		3RW44 ..	Factory presetting
Control electronics				
Control inputs				
Input 1	IN1			Start motor right parameter set 1
Input 2	IN2			No action
Input 3	IN3			No action
Input 4	IN4			Trip reset
Supply	L+ / L-			
• Rated operational current		mA	Approx. 10 per input to DIN 19240	
• Rated operational voltage	L+		Internal voltage: 24 V DC from internal supply through terminal L+ to IN1 ... IN4. Maximum load at L+ approx. 55 mA	
	L-		External voltage: DC external voltage (to DIN19240) through terminals L- and IN1 ... IN4 (min. 12 V DC, max. 30 V DC)	
Thermistor motor protection input				
Input	T1/T2		PTC type A or Thermoclick	Deactivated
Relay outputs (floating auxiliary contacts)				
Output 1	13/14			ON period
Output 2	23/24			No action
Output 3	33/34			No action
Output 4	95/96/98			Group fault
Switching capacity of the relay outputs				
230 V / AC-15		A	3 at 240 V	
24 V / DC-13		A	1 at 24 V	
Protection against overvoltages			Protection by means of Varistor through relay contact	
Short-circuit protection			4 A gL/gG operational class; 6 A quick (fuse is not included in scope of supply)	
Protective functions				
Motor protection functions				
Trips in the event of			Thermal overloading of the motor	
Trip class to IEC 60947-4-1		CLASS	5 / 10 / 15 / 20 / 30	10
Phase failure sensitivity		%	>40	
Overload warning			yes	
Reset and recovery			Manual/Automatic	Manual
Reset option after tripping			Manual/Automatic	Manual
Recovery time		min.	1 ... 30	1
Device protection functions				
Trips in the event of			Thermal overloading of the thyristors	
Reset option after tripping			Manual/Automatic	Manual
Recovery time		min.	0.5	

Type		3RW44 ..	Factory presetting
Control times and parameters			
Control times			
Closing delay (with connected control voltage)	ms	<50	
Closing delay (automatic mode)	ms	<4000	
Recovery time (closing command in active ramp-down)	ms	<100	
Mains failure bridging time			
Control supply voltage	ms	100	
Mains failure response time			
Load current circuit	ms	100	
Reclosing lockout after overload trip			
Motor protection trip	min.	1 ... 30	1
Device protection trip	s	30	
Setting options for starting			
Voltage ramp for starting voltage	%	20 ... 100	30
Torque control for starting torque	%	10 ... 100	10
Torque control for limit torque	%	20 ... 200	150
Starting time	s	0 ... 360	20
Maximum starting time	s	1 ... 1000	Deactivated
Current limit value	%	125 ... 550 [1]	450
Breakaway voltage	%	40 ... 100	80
Breakaway time	s	0 ... 2	Deactivated
Motor heat output	%	1 ... 100	20
Creep mode Left/Right running			
Speed factor as function of rated speed ($n = n_{rated}$/factor)		3 ... 21	7
Creep torque [2]	%	20 ... 100	50
Setting options for ramp-down			
Torque control for stopping torque	%	10 ... 100	10
Ramp-down time	s	0 ... 360	10
Dynamic braking torque	%	20 ... 100	50
DC braking torque	%	20 ... 100	50
Operating indications		Test voltage Test mains phases Ready to start Start active Motor running Ramp-down active Emergency start active	
Warnings/error signals		Mains voltage missing Leading-edge phase error Phase failure • L1 • L2 • L3 Missing load phase • T1 • T2 • T3 Failure • Contact element 1 (thyristor) • Contact element 2 (thyristor) • Contact element 3 (thyristor) Flash memory faulty Supply voltage • Below 75 % • Below 85 % • Below 110 % Current unbalance exceeded Thermal motor model overload Prewarning limit exceeded • Motor heating • Time-related trip reserve Bypass elements defective Mains voltage too high Device not named Wrong naming version Current range exceeded Bypass element protective tripping Current limit exceeded Motor blocking – shutdown Current limit exceeded Power section • Overheated • Overtemperature	

[1] max. current limit value: 3RW44 22 - 3RW44 47: 550 %
3RW44 53 - 3RW44 57: 500 %
3RW44 58 - 3RW44 66: 450 %

[2] Reference quantity depends on motor used, but is in any case lower than the rated motor torque

Type	3RW44 ..	Factory presetting
Control times and parameters		
Warnings/error signals (contd.)	Temperature sensor • Overload • Open-circuit • Short-circuit Ground fault • Detected • Shutdown Connection abort in manual mode Max. number of starts exceeded I_e limit value overshoot/undershoot Cooling time • Motor active • Switch block active Heat sink sensor • Open-circuit • Short-circuit Quick-stop function Switch block faulty I_e/class setting not permissible No external start parameters received PIO error	
Control inputs Input 1 Input 2 Input 3 Input 4 Parameterizing options for control inputs 1 ... 4	No action Local manual mode Emergency start Creep speed Quick-stop Trip reset Motor right parameter set 1 Motor left parameter set 1[1] Motor right parameter set 2 Motor left parameter set 2[1] Motor right parameter set 3 Motor left parameter set 3[1]	Motor right parameter set 1 No action No action Trip reset
Relay outputs Output 1 Output 2 Output 3 Output 4 Parameterizing options for relay outputs 1 ... 3	No action PAA output 1 PAA output 2 Input 1 Input 2 Input 3 Input 4 Ramp-up Operation/Bypass Ramp-down ON period Command motor on Fan DC braking contactor Group warning Group fault Bus fault Device error Power on Ready to star	ON period No action No action Group fault
Motor temperature sensors	Deactivated Thermoclick PTC type A	Deactivated

[1] Parameter motor left possible only in conjunction with creep mode.

10.3.4 Conductor Cross-sections

Type			3RW44 2.	3RW44 3.	3RW44 4.	3RW44 5.
Conductor cross-sections						
Screw terminals with box terminal	Main conductors:			3RT19 55-4G (55 kW)	3RT19 66-4G	—
Front clamping point connected NSB00479	• Finely stranded with end sleeve	mm²	2.5 ... 35	16 ... 70	70 ... 240	—
	• Finely stranded without end sleeve	mm²	4 ... 50	16 ... 70	70 ... 240	—
	• Solid	mm²	2.5 ... 16	—	—	—
	• Stranded	mm²	4 ... 70	16 ... 70	95 ... 300	—
	• Ribbon cable conductors (number x width x thickness)	mm	6 x 9 x 0.8	min. 3 x 9 x 0.8, max. 6 x 15.5 x 0.8	min. 6 x 9 x 0.8 max. 20 x 24 x 0.5	—
	• AWG conductors, solid or stranded	AWG	10 ... 2/0	6 ... 2/0	3/0 ... 600 kcmil	—
Rear clamping point connected NSB00480	• Finely stranded with end sleeve	mm²	2.5 ... 50	16 ... 70	120 ... 185	—
	• Finely stranded without end sleeve	mm²	10 ... 50	16 ... 70	120 ... 185	—
	• Solid	mm²	2.5 ... 16	—	—	—
	• Stranded	mm²	10 ... 70	16 ... 70	120 ... 240	—
	• Ribbon cable conductors (number x width x thickness)	mm	6 x 9 x 0.8	min. 3 x 9 x 0.8, max. 6 x 15.5 x 0.8	min. 6 x 9 x 0.8 max. 20 x 24 x 0.5	—
	• AWG conductors, solid or stranded	AWG	10 ... 2/0	6 ... 2/0	250 ... 500 kcmil	—
Both clamping points connected NSB00481	• Finely stranded with end sleeve	mm²	2 x (2.5 ... 35)	max. 1 x 50, 1 x 70	min. 2 x 50; max. 2 x 185	—
	• Finely stranded without end sleeve	mm²	2 x (4 ... 35)	max. 1 x 50, 1 x 70	min. 2 x 50; max. 2 x 185	—
	• Solid	mm²	2 x (2.5 ... 16)	—	—	—
	• Stranded	mm²	2 x (4 ... 50)	max. 2 x 70	max. 2 x 70; max. 2 x 240	—
	• Ribbon cable conductors (number x width x thickness)	mm	2 x (6 x 9 x 0.8)	max. 2 x (6 x 15.5 x 0.8)	max. 2 x (20 x 24 x 0.5)	—
	• AWG conductors, solid or stranded	AWG	2 x (10 ... 1/0)	max. 2 x 1/0	min. 2 x 2/0; max. 2 x 500 kcmil	—
	• Terminal screws		M6 (Inbus, SW4)	M10 (Inbus, SW4)	M12 (Inbus, SW5)	—
	- Pickup torque	Nm	4 ... 6	10 ... 12	20 ... 22	—
		lb.in	36 ... 53	90 ... 110	180 ... 195	—
Screw terminals with box terminal	Main conductors:		—	3RT19 56-4G	—	—
Front or rear clamping point connected NSB00479 NSB00480	• Finely stranded with end sleeve	mm²	—	16 ... 120	—	—
	• Finely stranded without end sleeve	mm²	—	16 ... 120	—	—
	• Stranded	mm²	—	16 ... 120	—	—
	• Ribbon cable conductors (number x width x thickness)	mm	—	min. 3 x 9 x 0.8 max. 6 x 15.5 x 0.8	—	—
	• AWG conductors, solid or stranded	AWG	—	6 ... 250 kcmil	—	—
Both clamping points connected NSB00481	• Finely stranded with end sleeve	mm²	—	max. 1 x 95, 1 x 120	—	—
	• Finely stranded without end sleeve	mm²	—	max. 1 x 95, 1 x 120	—	—
	• Stranded	mm²	—	max. 2 x 120	—	—
	• Ribbon cable conductors (number x width x thickness)	mm	—	max. 2 x (10 x 15.5 x 0.8)	—	—
	• AWG conductors, solid or stranded	AWG	—	max. 2 x 3/0	—	—
Screw terminals	Main conductors:					
	Without box terminal/rail connection					
	• Finely stranded with cable lug	mm²	—	16 ... 95[1]	50 ... 240[2]	50 ... 240[2]
	• Stranded with cable lug	mm²	—	25 ... 120[1]	70 ... 240[2]	70 ... 240[2]
	• AWG conductors, solid or stranded	AWG	—	4 ... 250 kcmil	2/0 ... 500 kcmil	2/0 ... 500 kcmil
	• Connecting bar (max. width)	mm	—	17	25	60
	• Terminal screws		—	M8 x 25 (SW13)	M10 x 30 (SW17)	M12 x 40
	- Pickup torque	Nm	—	10 ... 14	14 ... 24	20 ... 35
		lb.in	—	89 ... 124	124 ... 210	177 ... 310

1) When connecting cable lugs to DIN 46235 use 3RT19 56-4EA1 terminal cover for conductor cross-sections from 95 mm² to ensure phase spacing.

2) When connecting cable lugs to DIN 46234, the 3RT19 66-4EA1 terminal cover must be used for conductor cross-sections of 240 mm² and more as well as DIN 46235 for conductor cross-sections of 185 mm² and more to keep the phase clearance.

Soft Starters	Type		3RW44 ..
Conductor cross-sections			
Auxiliary conductors (1 or 2 conductors can be connected)**:**			
	Screw terminals		
	• Solid	mm^2	2 x 0.5 ... 2.5
	• Finely stranded with end sleeve	mm^2	2 x 0.5 ... 1.5
	• AWG cables		
	- Solid or stranded	AWG	2 x 20 ... 14
	- Finely stranded with end sleeve	AWG	2 x 20 ... 16
	• Terminal screws		
	- Pickup torque	Nm	0.8 ... 1.2
		lb.in	7 ... 10.3
	Spring-loaded terminal		
	• Solid	mm^2	2 x 0.25 ... 1.5
	• Finely stranded with end sleeve	mm^2	2 x 0.25 ... 1.5
	• AWG conductors, solid or stranded	AWG	2 x 24 ... 16

10.3.5 Electromagnetic Compatibility

	Standard	Parameters
Electromagnetic compatibility acc. to EN 60947-4-2		
EMC interference immunity		
Electrostatic discharge (ESD)	EN 61000-4-2	±4 kV contact discharge, ±8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Frequency range: 80 ... 1000 MHz with 80 % at1 kHz Degree of severity 3, 10 V/m
Conducted RF interference	EN 61000-4-6	Frequency range: 150 kHz ... 80 MHz with 80 % at1 kHz Interference 10 V
RF voltages and RF currents on conductors • Burst • Surge	EN 61000-4-4 EN 61000-4-5	±2 kV/5 kHz ±1 kV line to line ±2 kV line to ground
EMC interference emission		
EMC interference field strength	EN 55011	Limit value of Class A at 30 ... 1000 MHz
Radio interference voltage	EN 55011	Limit value of Class A at 0.15 ... 30 MHz
Is an RI suppression filter necessary?		
Degree of noise suppression A (industrial applications)	no	

10.3.6 Branch Component Circuitry (Standard or Inline Circuit)

Inline circuit fuseless version
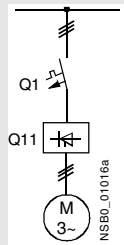
Soft starters		Motor starter protectors/circuit-breakers[1]	
	Rated current	440 V +10 %	Rated current
Q11		Q1	
Type	A	Type	A
Type of coordination 1[2]): 3RW44 22 ... 3RW44 27: I_q = 32 kA; 3RW44 34 and 3RW44 35: I_q = 16 kA; 3RW44 36 ... 3RW44 57: I_q = 65 kA			
3RW44 22	29	3RV10 42-4HA10	50
3RW44 23	36	3RV10 42-4JA10	63
3RW44 24	47	3RV10 42-4KA10	75
3RW44 25	57	3RV10 42-4LA10	90
3RW44 26	77	3RV10 42-4MA10	100
3RW44 27	93	3RV10 42-4MA10	100
3RW44 34	113	3VL17 16-2DD36	160
3RW44 35	134	3VL17 16-2DD36	160
3RW44 36	162	3VL37 25-2DC36	250
3RW44 43	203	3VL47 31-3DC36	315
3RW44 44	250	3VL47 31-3DC36	315
3RW44 45	313	3VL47 40-3DC36	400
3RW44 46	356	3VL47 40-3DC36	400
3RW44 47	432	3VL57 50-3DC36	500
3RW44 53	551	3VL67 80-3AB36	800
3RW44 54	615	3VL67 80-3AB36	800
3RW44 55	693	3VL67 80-3AB36	800
3RW44 56	780	3VL77 10-3AB36	1000
3RW44 57	880	3VL77 10-3AB36	1000
3RW44 58	970	3VL77 12-3AB36	1200
3RW44 65	1076	3VL77 12-3AB36	1200
3RW44 66	1214	3VL77 12-3AB36	1200

1) The rated motor current must be considered when selecting the devices.

2) The types of coordination are explained in more detail in the Technical information LV 1 T under – Fuseless Load Feeders.

Inline circuit fused version (line protection only)
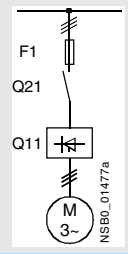
Soft starters		Line protections, maximal			Line contactors up to 400 V	Braking contactors[1][2]	
	Rated current	690 V +5 % F1	Rated current	Size	(optional) Q21	(for typical circuit see page 9-2) Q91	Q92
Q11 Type	A	Type	A		Type	Type	Type
Type of coordination 1[3]: I_q = 65 kA							
3RW44 22	29	3NA3 820-6	50	00	3RT10 34	3RT15 26	—
3RW44 23	36	3NA3 822-6	63	00	3RT10 35	3RT15 26	—
3RW44 24	47	3NA3 824-6	80	00	3RT10 36	3RT15 35	—
3RW44 25	57	3NA3 830-6	100	00	3RT10 44	3RT15 35	—
3RW44 26	77	3NA3 132-6	125	1	3RT10 45	3RT10 24	3RT10 35
3RW44 27	93	3NA3 136-6	160	1	3RT10 46	3RT10 25	3RT10 36
3RW44 34	113	3NA3 244-6	250	2	3RT10 54	3RT10 34	3RT10 44
3RW44 35	134	3NA3 244-6	250	2	3RT10 55	3RT10 36	3RT10 45
3RW44 36	162	3NA3 365-6	500	3	3RT10 56	3RT10 44	3RT10 45
3RW44 43	203	2 x 3NA3 354-6	2 x 355	3	3RT10 64	3RT10 44	3RT10 54
3RW44 44	250	2 x 3NA3 354-6	2 x 355	3	3RT10 65	3RT10 44	3RT10 55
3RW44 45	313	2 x 3NA3 365-6	2 x 500	3	3RT10 75	3RT10 54	3RT10 56
3RW44 46	356	2 x 3NA3 365-6	2 x 500	3	3RT10 75	3RT10 54	3RT10 56
3RW44 47	432	2 x 3NA3 365-6	2 x 500	3	3RT10 76	3RT10 55	3RT10 64
3RW44 53	551	2 x 3NA3 365-6	2 x 500	3	3TF68 44-0CM7	3RT10 64	3RT10 66
3RW44 54	615	2 x 3NA3 365-6	2 x 500	3	3TF68 44-0CM7	3RT10 64	3RT10 75
3RW44 55	693	2 x 3NA3 365-6	2 x 500	3	3TF69 44-0CM7	3RT10 65	3RT10 75
3RW44 56	780	2 x 3NA3 365-6	2 x 500	3	3TF69 44-0CM7	3RT10 65	3RT10 75
3RW44 57	880	2 x 3NA3 365-6	2 x 500	3	2 x 3TF69 44-0CM7	3RT10 75	3RT10 76
3RW44 58	970	3 x 3NA3 365-6	3 x 500	3	—	3RT10 75	3RT10 76
3RW44 65	1076	3 x 3NA3 365-6	3 x 500	3	—	3RT10 75	3TF68
3RW44 66	1214	3 x 3NA3 365-6	3 x 500	3	—	3RT10 76	3TF68

1) If the ramp-down function "Combined braking" is selected, no braking contactor is required.
   If the ramp-down function "DC braking" is selected, a braking contactor must also be used (see table for type).
   For applications with large centrifugal masses (J_{Load} > J_{Motor}) we recommend the function "DC braking".

2) Additional auxiliary relay K4:
   LZX:RT4A4T30 (soft starter with rated control supply voltage 230 V AC), LZX:RT4A4S15 (soft starter with rated control supply voltage 115 V AC).

3) The types of coordination are explained in more detail in the Technical information LV 1 T under – Fuseless Load Feeders.

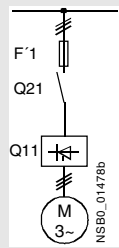**Inline circuit fused version with 3NE1 SITOR all-range fuse** (semiconductor and line protection)

Soft starters		All-range fuses				Line contactors up to 400 V	Braking contactors[1][2]	
	Rated current		Rated current	Voltage	Size	(optional)	(for typical circuit see page 9-5)	
Q11 Type	A	F'1 Type	A	V		Q21 Type	Q91 Type	Q92 Type
Type of coordination 2[3]: I_q = 65 kA								
3RW44 22	29	3NE1 020-2	80	690 +5 %	00	3RT10 34	3RT15 26	—
3RW44 23	36	3NE1 020-2	80	690 +5 %	00	3RT10 35	3RT15 26	—
3RW44 24	47	3NE1 021-2	100	690 +5 %	00	3RT10 36	3RT15 35	—
3RW44 25	57	3NE1 022-2	125	690 +5 %	00	3RT10 44	3RT15 35	—
3RW44 26	77	3NE1 022-2	125	690 +5 %	00	3RT10 45	3RT10 24	3RT10 35
3RW44 27	93	3NE1 024-2	160	690 +5 %	1	3RT10 46	3RT10 25	3RT10 36
3RW44 34	113	3NE1 225-2	200	690 +5 %	1	3RT10 54	3RT10 34	3RT10 44
3RW44 35	134	3NE1 227-2	250	690 +5 %	1	3RT10 55	3RT10 36	3RT10 45
3RW44 36	162	3NE1 227-2	250	690 +5 %	1	3RT10 56	3RT10 44	3RT10 45
3RW44 43	203	3NE1 230-2	315	600 +10 %	1	3RT10 64	3RT10 44	3RT10 54
3RW44 44	250	3NE1 331-2	350	460 +10 %	2	3RT10 65	3RT10 44	3RT10 55
3RW44 45	313	3NE1 333-2	450	690 +5 %	2	3RT10 75	3RT10 54	3RT10 56
3RW44 46	356	3NE1 334-2	500	690 +5 %	2	3RT10 75	3RT10 54	3RT10 56
3RW44 47	432	3NE1 435-2	560	690 +5 %	3	3RT10 76	3RT10 55	3RT10 64
3RW44 53	551	2 x 3NE1 334-2	500	690 +10 %	2	3TF68 44-0CM7	3RT10 64	3RT10 66
3RW44 54	615	2 x 3NE1 334-2	500	690 +10 %	2	3TF68 44-0CM7	3RT10 64	3RT10 75
3RW44 55	693	2 x 3NE1 334-2	500	690 +10 %	2	3TF69 44-0CM7	3RT10 65	3RT10 75
3RW44 56	780	2 x 3NE1 435-2	560	690 +10 %	3	3TF69 44-0CM7	3RT10 65	3RT10 75
3RW44 57	880	2 x 3NE1 435-2	560	690 +10 %	3	2 x 3TF69 44-0CM7	3RT10 75	3RT10 76
3RW44 58	970	2 x 3NE1 435-2	560	690 +10 %	3	—	3RT10 75	3RT10 76
3RW44 65	1076	3 x 3NE1 334-2	500	690 +10 %	2	—	3RT10 75	3TF68
3RW44 66	1214	3 x 3NE1 335-2	560	690 +10 %	3	—	3RT10 76	3TF68

1) If the ramp-down function "Combined braking" is selected, no braking contactor is required.
   If the ramp-down function "DC braking" is selected, a braking contactor must also be used (see table for type).
   For applications with large centrifugal masses ($J_{Load} > J_{Motor}$) we recommend the function "DC braking.

2) Additional auxiliary relay K4: LZX:RT4A4T30 (3RW44 soft starter with rated control supply voltage 230 V AC), LZX:RT4A4S15 (3RW44 soft starter with rated control supply voltage 115 V AC).

3) The types of coordination are explained in more detail in the Technical information LV 1 T under – Fuseless Load Feeders.
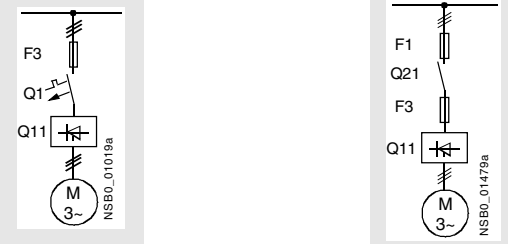
Inline circuit fused version with 3NE or 3NC SITOR semiconductor fuse
(semiconductor protection by fuse, lead and overload protection by circuit-breaker)

Soft starters		Semiconductor fuses, minimum			Semiconductor fuses, maximum			Semiconductor fuses (cylinder)		
Q11 Type	Rated current A	F3 Type	Rated current A	Size	F3 Type	Rated current A	Size	F3 Type	Rated current A	Size
Type of coordination 2[1]: I_q = 65 kA										
3RW44 22	29	3NE4 120	80	0	3NE4 121	100	0	3NC2 280	80	22 x 58
3RW44 23	36	3NE4 121	100	0	3NE4 122	125	0	3NC2 200	100	22 x 58
3RW44 24	47	3NE4 121	100	0	3NE4 122	125	0	3NC2 200	100	22 x 58
3RW44 25	57	3NE4 122	125	0	3NE4 124	160	0			
3RW44 26	77	3NE4 124	160	0	3NE4 124	160	0			
3RW44 27	93	3NE3 224	160	1	3NE3 333	450	2			
3RW44 34	113	3NE3 225	200	1	3NE3 335	560	2			
3RW44 35	134	3NE3 225	200	1	3NE3 335	560	2			
3RW44 36	162	3NE3 227	250	1	3NE3 333	450	2			
3RW44 43	203	3NE3 230-0B	315	1	3NE3 333	450	2			
3RW44 44	250	3NE3 230-0B	315	1	3NE3 333	450	2			
3RW44 45	313	3NE3 233	450	1	3NE3 336	630	2			
3RW44 46	356	3NE3 333	450	2	3NE3 336	630	2			
3RW44 47	432	3NE3 335	560	2	3NE3 338-8	800	2			
3RW44 53	551	2 x 3NE3 335	560	2	3 x 3NE3 334-0B	500	2			
3RW44 54	615	2 x 3NE3 335	560	2	3 x 3NE3 334-0B	500	2			
3RW44 55	693	2 x 3NE3 335	560	2	3 x 3NE3 334-0B	500	2			
3RW44 56	780	2 x 3NE3 336	630	2	2 x 3NE3 340-8	900	2			
3RW44 57	880	2 x 3NE3 336	630	2	2 x 3NE3 340-8	900	2			
3RW44 58	970	2 x 3NE3 336	630	2	2 x 3NE3 340-8	900	2			
3RW44 65	1076	2 x 3NE3 340-8	900	2	3 x 3NE3 338-8	800	2			
3RW44 66	1214	2 x 3NE3 340-8	900	2	3 x 3NE3 338-8	800	2			

1) The types of coordination are explained in more detail in the Technical information LV 1 T under – Fuseless Load Feeders.

Soft starters		Line contactors up to 400 V	Braking contactors[11)2)]		Circuit-breakers		Max. line protection		
	Rated current	(optional)	(for typical circuit see page 9-2)		440 V +10 %	Rated current	690 V +5 %	Rated current	Size
Q11 Type	A	Q21 Type	Q91 Type	Q92 Type	Q1 Type	A	F1 Type	A	
Type of coordination 2[3)]: I_q = 65 kA									
3RW44 22	29	3RT10 34	3RT15 26	—	3RV10 41-4HA10	50	3NA3 820-6	50	00
3RW44 23	36	3RT10 35	3RT15 26	—	3RV10 41-4JA10	63	3NA3 822-6	63	00
3RW44 24	47	3RT10 36	3RT15 35	—	3RV10 41-4KA10	75	3NA3 824-6	80	00
3RW44 25	57	3RT10 44	3RT15 35	—	3RV10 41-4LA10	90	3NA3 830-6	100	00
3RW44 26	77	3RT10 45	3RT10 24	3RT10 35	3RV10 41-4MA10	100	3NA3 132-6	125	1
3RW44 27	93	3RT10 46	3RT10 25	3RT10 36	3RV10 41-4MA10	100	3NA3 136-6	160	1
3RW44 34	113	3RT10 54	3RT10 34	3RT10 44	3VL17 16-1DD36	160	3NA3 244-6	250	2
3RW44 35	134	3RT10 55	3RT10 36	3RT10 45	3VL17 16-1DD36	160	3NA3 244-6	250	2
3RW44 36	162	3RT10 56	3RT10 44	3RT10 45	3VL37 25-1DC36	250	3NA3 365-6	500	3
3RW44 43	203	3RT10 64	3RT10 44	3RT10 54	3VL47 31-1DC36	315	2 x 3NA3 354-6	2 x 355	3
3RW44 44	250	3RT10 65	3RT10 44	3RT10 55	3VL47 31-1DC36	315	2 x 3NA3 354-6	2 x 355	3
3RW44 45	313	3RT10 75	3RT10 54	3RT10 56	3VL47 40-1DC36	400	2 x 3NA3 365-6	2 x 500	3
3RW44 46	356	3RT10 75	3RT10 54	3RT10 56	3VL47 40-1DC36	400	2 x 3NA3 365-6	2 x 500	3
3RW44 47	432	3RT10 76	3RT10 55	3RT10 64	3VL57 50-1DC36	500	2 x 3NA3 365-6	2 x 500	3
3RW44 53	551	3TF68 44-0CM7	3RT10 64	3RT10 66	3VL67 80-1AB36	800	2 x 3NA3 365-6	2 x 500	3
3RW44 54	615	3TF68 44-0CM7	3RT10 64	3RT10 75	3VL67 80-1AB36	800	2 x 3NA3 365-6	2 x 500	3
3RW44 55	693	3TF69 44-0CM7	3RT10 65	3RT10 75	3VL67 80-1AB36	800	2 x 3NA3 365-6	2 x 500	3
3RW44 56	780	3TF69 44-0CM7	3RT10 65	3RT10 75	3VL77 10-1AB36	1000	2 x 3NA3 365-6	2 x 500	3
3RW44 57	880	2 x 3TF69 44-0CM7	3RT10 75	3RT10 76	3VL77 10-1AB36	1000	2 x 3NA3 365-6	2 x 500	3
3RW44 58	970	—	3RT10 75	3RT10 76	3VL77 12-1AB36	1200	3 x 3NA3 365-6	3 x 500	3
3RW44 65	1076	—	3RT10 75	3TF68	3VL77 12-1AB36	1200	3 x 3NA3 365-6	3 x 500	3
3RW44 66	1214	—	3RT10 76	3TF68	3VL77 12-1AB36	1200	3 x 3NA3 365-6	3 x 500	3

1) If the ramp-down function "Combined braking" is selected, no braking contactor is required.
f the ramp-down function "DC braking" is selected, a braking contactor must also be used (see table for type).
For applications with large centrifugal masses (J_{Load} > J_{Motor}) we recommend the function "DC braking.

2) Additional auxiliary relay K4:
LZX:RT4A4T30 (3RW44 soft starter with rated control supply voltage 230 V AC), LZX:RT4A4S15 (3RW44 soft starter with rated control supply voltage 115 V AC)).

3) The types of coordination are explained in more detail in the Technical information LV 1 T under – Fuseless Load Feeders.

10.3.7 Branch Component Layout (Inside Delta Circuit)

Inside-delta circuit fused version with 3NE or 3NC SITOR fuses
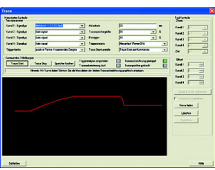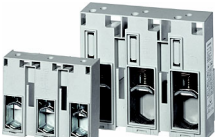(semiconductor protection by fuse, lead and overload protection by circuit-breaker)

Soft starters		Semiconductor fuses, minimum			Semiconductor fuses, maximum			Semiconductor fuses (cylinder)		
	Rated current		Rated current	Size		Rated current	Size		Rated current	Size
Q11 Type	A	F3 Type	A		F3 Type	A		F3 Type	A	
Type of coordination 2[1]										
3RW44 22	50	3NE4 120	80	0	3NE4 121	100	0	3NC2 280	80	22 x 58
3RW44 23	62	3NE4 121	100	0	3NE4 122	125	0	3NC2 200	100	22 x 58
3RW44 24	81	3NE4 121	100	0	3NE4 122	125	0	3NC2 200	100	22 x 58
3RW44 25	99	3NE4 122	125	0	3NE4 124	160	0			
3RW44 26	133	3NE4 124	160	0	3NE4 124	160	0			
3RW44 27	161	3NE3 224	160	1	3NE3 333	450	2			
3RW44 34	196	3NE3 225	200	1	3NE3 335	560	2			
3RW44 35	232	3NE3 225	200	1	3NE3 335	560	2			
3RW44 36	281	3NE3 227	250	1	3NE3 333	450	2			
3RW44 43	352	3NE3 230-0B	315	1	3NE3 333	450	2			
3RW44 44	433	3NE3 230-0B	315	1	3NE3 333	450	2			
3RW44 45	542	3NE3 233	450	1	3NE3 336	630	2			
3RW44 46	617	3NE3 333	450	2	3NE3 336	630	2			
3RW44 47	748	3NE3 335	560	2	3NE3 338-8	800	2			
3RW44 53	954	2 x 3NE3 335	560	2	3 x 3NE3 334-0B	500	2			
3RW44 54	1065	2 x 3NE3 335	560	2	3 x 3NE3 334-0B	500	2			
3RW44 55	1200	2 x 3NE3 335	560	2	3 x 3NE3 334-0B	500	2			
3RW44 56	1351	2 x 3NE3 336	630	2	2 x 3NE3 340-8	900	2			
3RW44 57	1524	2 x 3NE3 336	630	2	3 x 3NE3 340-8	900	2			
3RW44 58	1680	2 x 3NE3 336	630	2	3 x 3NE3 340-8	900	2			
3RW44 65	1864	2 x 3NE3 340-8	900	2	3 x 3NE3 338-8	800	2			
3RW44 66	2103	2 x 3NE3 340-8	900	2	3 x 3NE3 338-8	800	2			

Soft starter		Line contactors up to 400 V	Circuit-breakers		Line protection, maximum		
	Rated current	(optional)	440 V +10 %	Rated current	690 V +5 %	Rated current	Size
Q11 Type	A	Q21 Type	Q1 Type	A	F1 Type	A	
Type of coordination 2[1]							
3RW44 22	50	3RT10 36-1AP04	3RV10 4.-4KA10	75	3NA3 824-6	80	00
3RW44 23	62	3RT10 44-1AP04	3RV10 4.-4LA10	90	3NA3 830-6	100	00
3RW44 24	81	3RT10 46-1AP04	3RV10 4.-4MA10	100	3NA3 132-6	125	1
3RW44 25	99	3RT10 54-1AP36	3VL27 16-.DC36	160	3NA3 136-6	160	1
3RW44 26	133	3RT10 55-6AP36	3VL27 16-.DC36	160	3NA3 240-6	200	2
3RW44 27	161	3RT10 56-6AP36	3VL37 20-.DC36	200	3NA3 244-6	250	2
3RW44 34	196	3RT10 64-6AP36	3VL37 25-.DC36	250	3NA3 360-6	400	3
3RW44 35	232	3RT10 65-6AP36	3VL47 31-.DC36	315	3NA3 360-6	400	3
3RW44 36	281	3RT10 66-6AP36	3VL47 40-.DC36	400	2 x 3NA3 360-6	2 x 400	3
3RW44 43	352	3RT10 75-6AP36	3VL47 40-.DC36	400	2 x 3NA3 365-6	2 x 500	3
3RW44 44	433	3RT10 76-6AP36	3VL57 50-.DC36	500	2 x 3NA3 365-6	2 x 500	3
3RW44 45	542	3TF68 44-0CM7	3VL57 63-.DC36	800	3 x 3NA3 365-6	3 x 500	3
3RW44 46	617	3TF68 44-0CM7	3VL67 80-.AB36	800	3 x 3NA3 365-6	3 x 500	3
3RW44 47	748	3TF69	3VL67 80-.AB36	800	3 x 3NA3 365-6	3 x 500	3
3RW44 53	954	2 x 3TF68 44-0CM7	3VL77 10-.AB36	1000	3 x 3NA3 365-6	3 x 500	3
3RW44 54	1065	2 x 3TF68 44-0CM7	3VL77 12-.AB36	1250	3 x 3NA3 365-6	3 x 500	3
3RW44 55	1200	2 x 3TF69 44-0CM7	3VL87 16-.AB36	1600	3 x 3NA3 365-6	3 x 500	3
3RW44 56	1351	2 x 3TF69 44-0CM7	3VL87 16-.AB36	1600	3 x 3NA3 372	3 x 630	3
3RW44 57	1524	2 x 3TF69 44-0CM7	3VL87 16-.AB36	1600	3 x 3NA3 372	3 x 630	3
3RW44 58	1680	—	3WL12 20	2000	2 x 3NA3 480	2 x 1000	4
3RW44 65	1864	—	3WL12 25	2500	2 x 3NA3 482	2 x 1250	4
3RW44 66	2103	—	3WL12 25	2500	2 x 3NA3 482	2 x 1250	4

1) The types of coordination are explained in more detail in the Technical information LV 1 T under – Fuseless Load Feeders.

10.3.8 Accessories

| For soft starters	Version	Order No.
Type		
Soft Starter ES 2006 PC communication program		
 3ZS1 313-1CC10-0YA0	**Soft Starter ES 2006 Smart** Parameterization and service software for SIRIUS 3RW44 soft starters for parameterizing through the system interface on the device. Executes on PC/PG under Windows 2000/XP, without PC cable Type of supply: CD, single license	**3ZS1 313-1CC10-0YA0**
	Soft Starter ES 2006 Professional Parameterization and service software for SIRIUS 3RW44 soft starters for parameterizing through the system interface on the device and PROFIBUS DP interface (PROFIBUS as optional communication module necessary). Executes on PC/PG under Windows 2000/XP, without PC cable Type of supply: CD, single license	**3ZS1 313-2CC10-0YA0**
PC cables		
 3UF7 940-0AA00-0	**For PC/PG communication with SIRIUS 3RW44 soft starters** through the system interface, for connecting to the serial interface of the PC/PG	**3UF7 940-0AA00-0**
PROFIBUS Communication module		
	Module to be plugged into the soft starter to connect the soft starter to the PROFIBUS net	**3RW4 900-0KC00**
External display and operation module		
	to show and operate the functions supplied by the soft starter via externally mounted display and operation module (for example in the cubicle door)	**3RW4 900-0AC00**
	Connection cable from serial interface of 3RW44 soft starter to external display and operation module • Length 0.5 m, flat • Length 0.5 m, round • Length 1.0 m, round • Length 2.5 m, round	**3UF7 932-0AA00-0** **3UF7 932-0BA00-0** **3UF7 937-0BA00-0** **3UF7 933-0BA00-0**
Box terminal blocks for soft starters		
 3RT19	**Box terminal blocks** 3RW44 2. Included in delivery 3RW44 3. • Up to 70 mm^2 • Up to 120 mm^2 3RW44 4. • Up to 240 mm^2	**3RT19 55-4G** **3RT19 56-4G** **3RT19 66-4G**
Covers for soft starters		
 3RT19 .6-4EA2	**Terminal covers for box terminals** Additional touch protection to be fitted at the box terminals (2 units required per device) 3RW44 2. and 3RW44 3. 3RW44 4.	**3RT19 56-4EA2** **3RT19 66-4EA2**
	Terminal covers for cable lugs and busbar connections 3RW44 2. and 3RW44 3. 3RW44 4.	**3RT19 56-4EA1** **3RT19 66-4EA1**

10.3.9 Spare Parts

For soft starters	Version	Order No.
Type		
Fans		
Fans		
3RW44 2. and 3RW44 3.	AC 115 V AC 230 V	**3RW49 36-8VX30** **3RW49 36-8VX40**
3RW44 4.	AC 115 V AC 230 V	**3RW49 47-8VX30** **3RW49 47-8VX40**
3RW44 5.	AC 115 V AC 230 V	**3RW49 57-8VX30** **3RW49 57-8VX40**

3RW49

10.4　Tripping Characteristics

10.4.1 Motor Protection Tripping Characteristics: 3RW44 with Symmetry
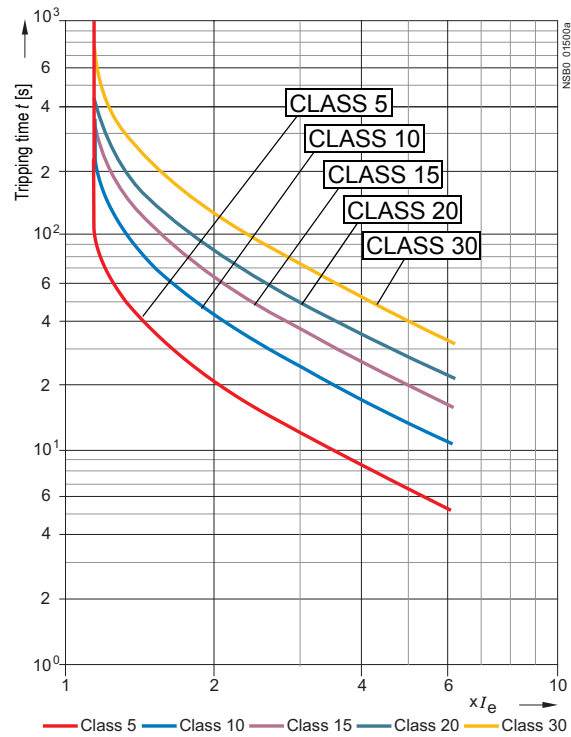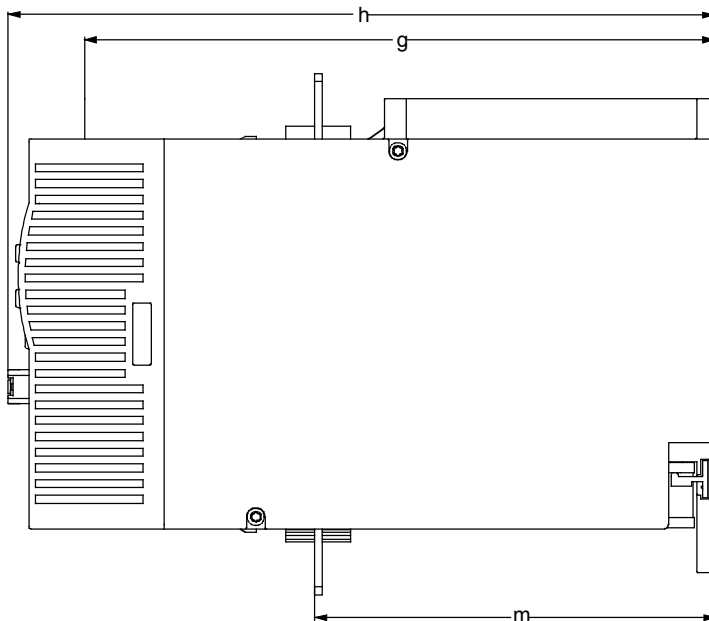

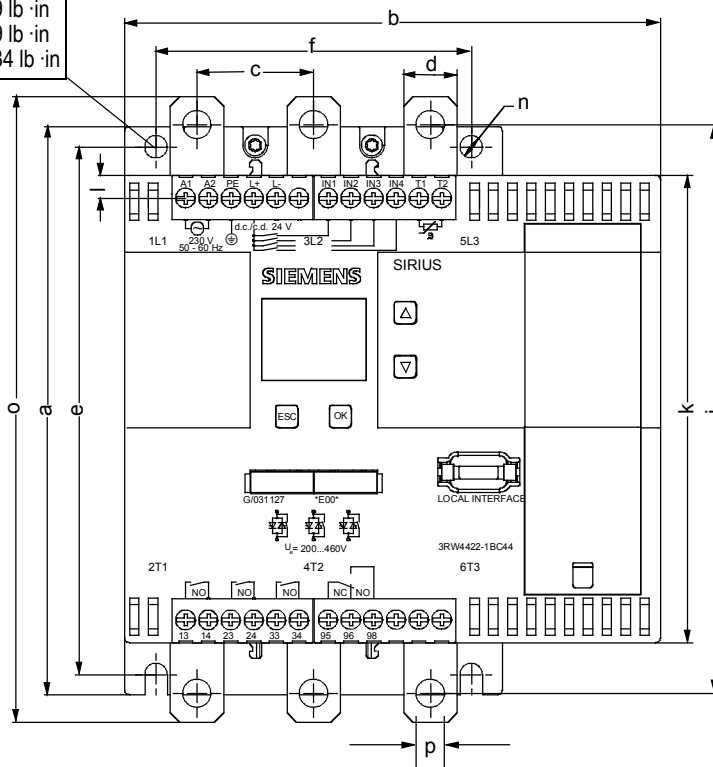### 10.4.2 Motor Protection Tripping Characteristics: 3RW44 with Asymmetry
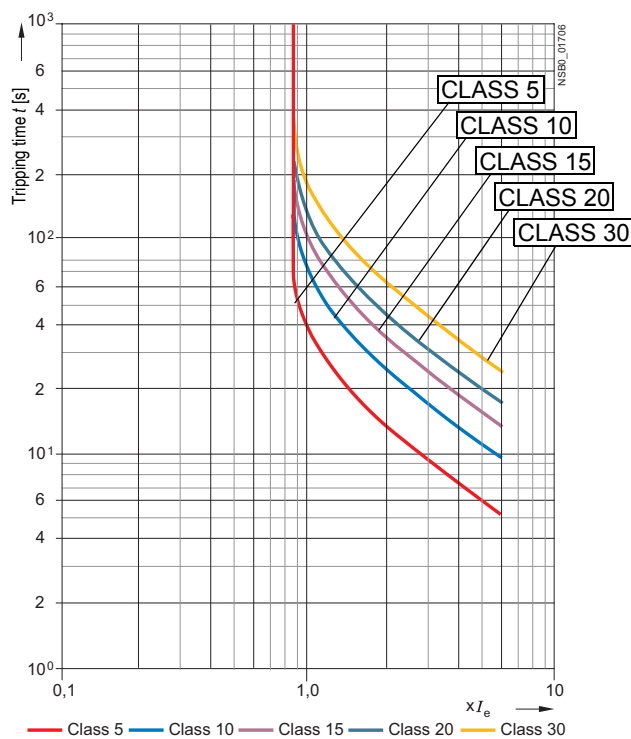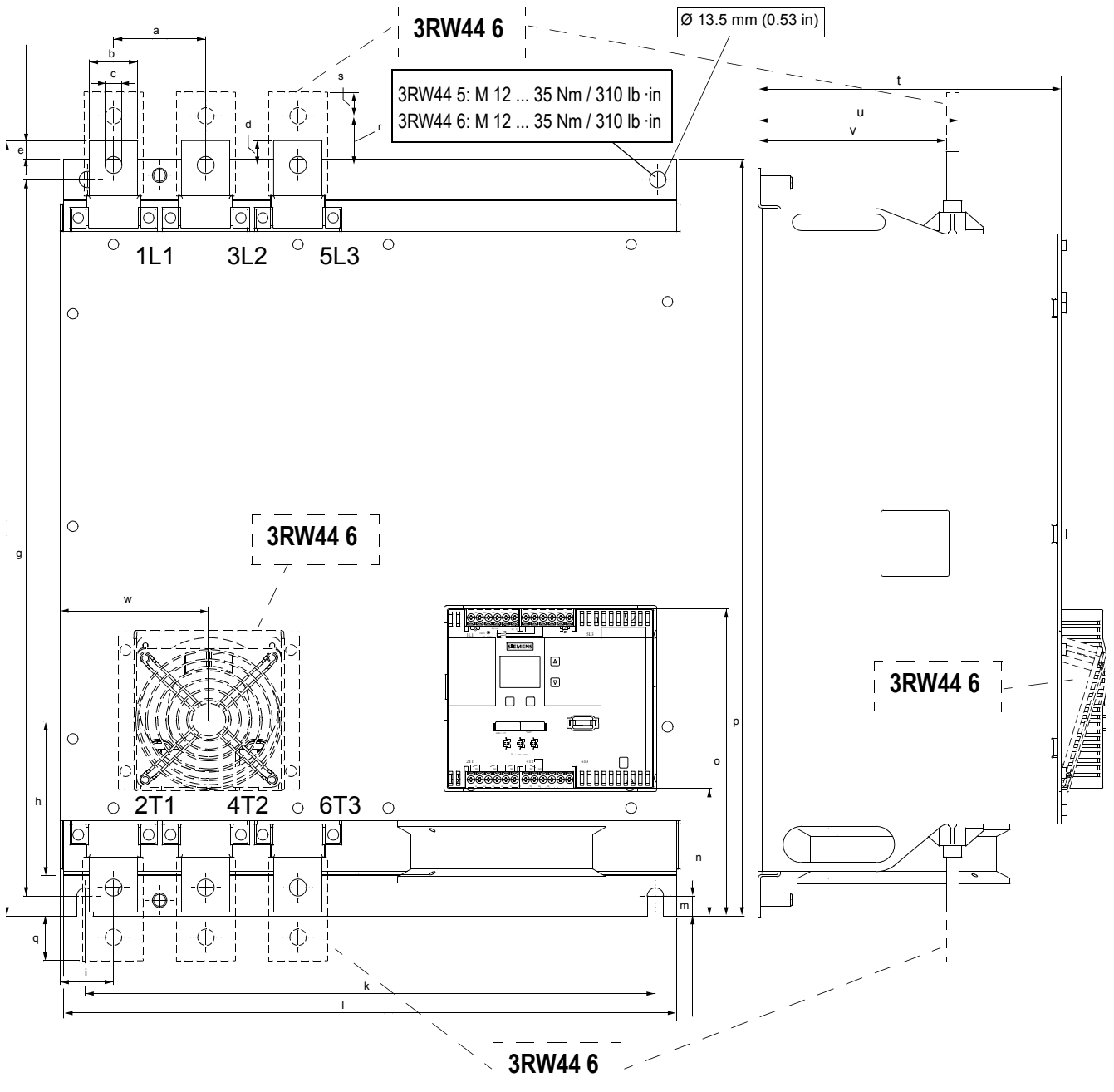
10.5   Dimensional Drawings

3RW44 2
3RW44 3
3RW44 4

3RW44 2: M 6 ... 10 Nm / 89 lb ·in
3RW44 3: M 6 ... 10 Nm / 89 lb ·in
3RW44 4: M 8 ... 15 Nm / 134 lb ·in

| Type	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p
3RW44 2	180 (7.09)	170 (6.69)	37 (1.46)	11 (0.43)	167 (6.57)	100 (3.94)	240 (9.45)	270 (10.63)	180 (7.09)	148 (5.83)	7.5 (0.30)	153 (6.02)	7 (0.28)	184 (7.24)	6.6 (0.26)
3RW44 3	180 (7.09)	170 (6.69)	37 (1.46)	17 (0.67)	167 (6.57)	100 (3.94)	240 (9.45)	270 (10.63)	180 (7.09)	148 (5.83)	7.5 (0.30)	153 (6.02)	7 (0.28)	19 (7.80)	9 (0.35)
3RW44 4	210 (8.27)	210 (8.27)	48 (1.89)	25 (0.98)	190 (7.48)	140 (5.51)	269 (10.59)	298 (11.73)	205 (8.07)	166 (6.54)	16 (0.63)	166 (6.54)	9 (0.35)	230 (9.06)	11 (0.43)

mm (inch)

3RW44 5 / 3RW44 6

3RW44 6

Ø 13.5 mm (0.53 in)

3RW44 5: M 12 ... 35 Nm / 310 lb ·in
3RW44 6: M 12 ... 35 Nm / 310 lb ·in

1L1   3L2   5L3

3RW44 6

3RW44 6

2T1   4T2   6T3

3RW44 6

Type	a	b	c	d	e	f	g	h	i	k	l	m	n
3RW44 5	76 (3)	40 (1.6)	14 (0.6)	20 (0.8)	15.5 (0.7)	638.5 (25.2)	590 (9.45)	—	44 (1.8)	470 (18)	510 (20)	16.5 (0.7)	105 (4.1)
3RW44 6	85 (3.35)	50 (1.97)	14 (0.6)	—	—	667 (26.3)	660 (26)	160 (6.3)	37.5 (1.48)	535 (21)	576 (22.7)	16.5 (0.7)	103 (4.06)

mm (inch)

Type	o	p	q	r	s	t	u	v	w
3RW44 5	253 (10)	623 (24.6)	—	—	—	249 (9.8)	162 (6.4)	152 (5.9)	—
3RW44 6	251 (9.88)	693 (27.3)	43.5 (1.71)	40 (1.6)	20 (0.78)	249 (9.8)	162 (6.4)	151.4 (5.96)	123 (4.84)

mm (inch)
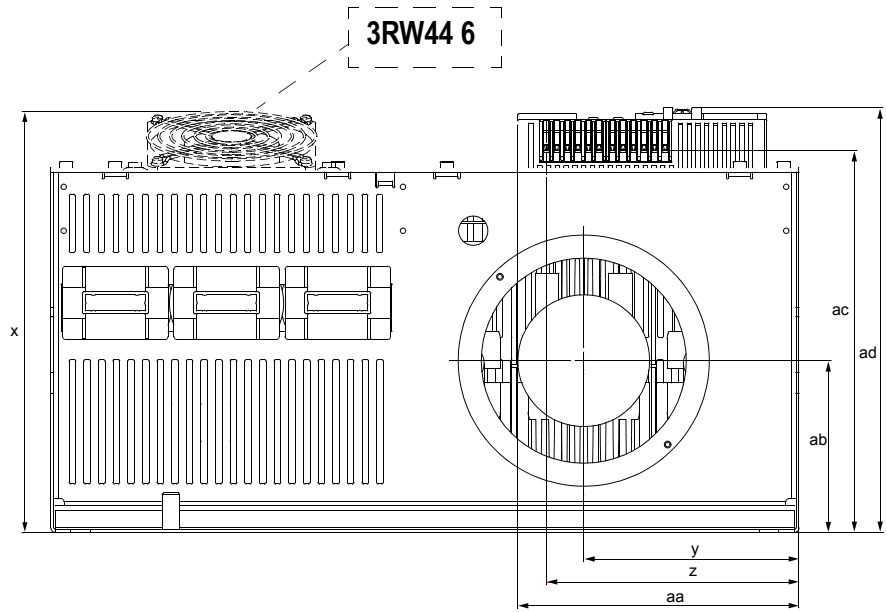
Type	x	y	z	aa	ab	ac	ad
3RW44 5	290 (11.4)	147 (5.7)	173 (6.9)	195 (7.7)	118 (4.6)	261 (10.2)	290 (11.5)
3RW44 6	289.5 (11.4)	175 (6.9)	173 (6.8)	—	118 (4.65)	261 (10.28)	290 (11.42)

mm (inch)

External display and control unit RW49 00 0AC00
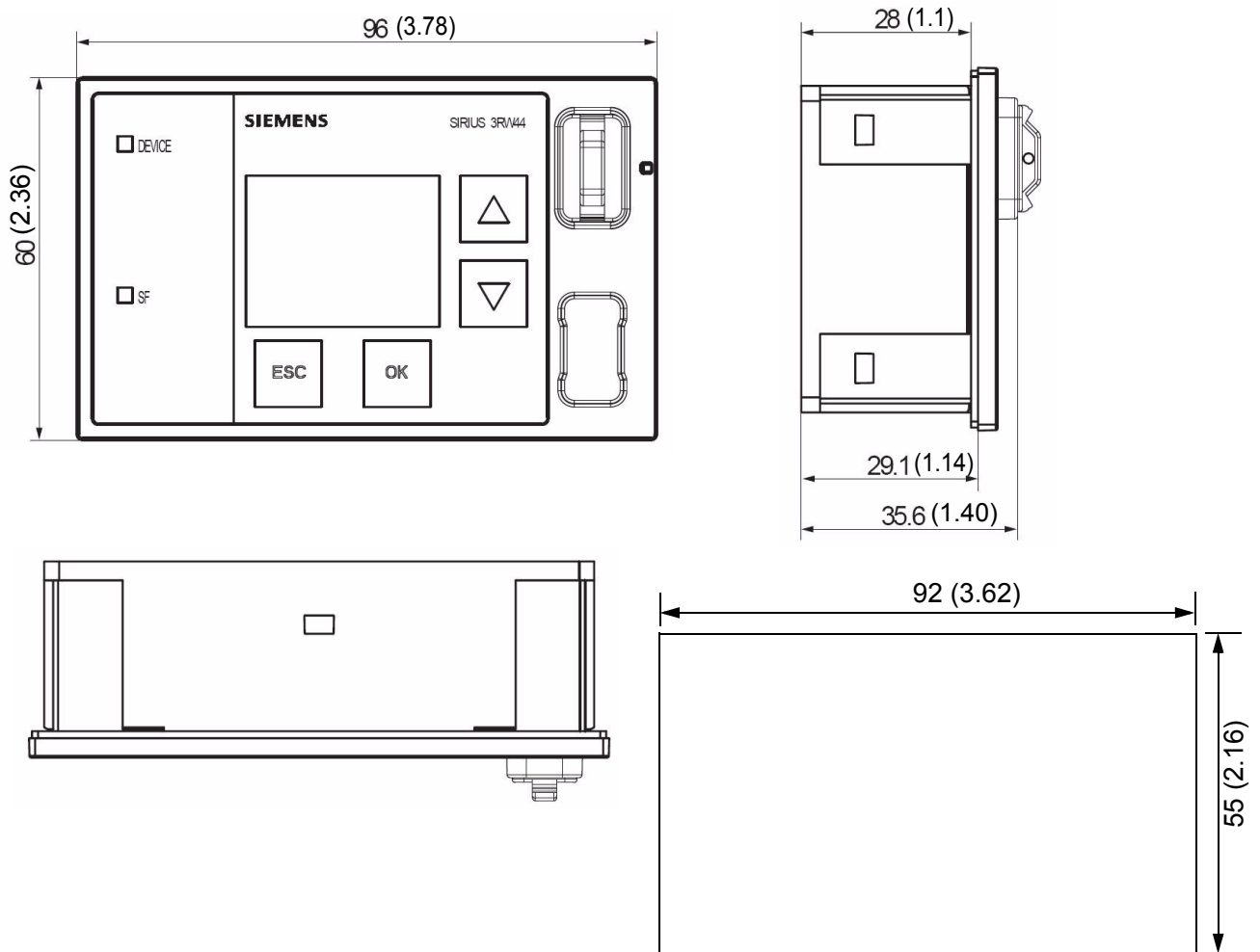
Dimensions in mm (inch)

Configuration Data

Siemens AG

Technical Support Low-Voltage Control Systems

Tel.: +49 (0) 911-895-5900

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

E-mail: technical-assistance@siemens.com

1. Motor data

Siemens motor? ....

Rated output: .... kW

Rated voltage: V

Line frequency: .... Hz

Rated current: .... A

Inrush current: .... A

Rated operating speed: ....rpm

Rated torque: .... Nm

Stall torque: .... Nm

Mass moment of inertia: .... kg*m^2

Speed characteristic curve / torque characteristic curve

(The differences in speed of the value pairs do not have to be identical)

n_M rpm											n_M
M_M / M_B											

Torque characteristic curve / current characteristic curve

(The differences in speed of the value pairs do not have to be identical)

n_M rpm					n_M
M_M / M_B					

2. Load data

Load type (e.g. pump, mill, ...):..

Rated operating speed:.. rpm

Rated torque or rated output ....Nm or kW

Mass moment of inertia ....kg*m^2

Mass moment of inertia ....kg*m^2

Speed characteristic curve / torque characteristic curve

(The differences in speed of the value pairs do not have to be identical)

n_M rpm												
M_M / M_B												

3. Start conditions

Start frequency.. Starts

Operating cycle: Ramp-up time .... s

Operating time .... s

Idle time.. s

Stopping time .... s

Ambient temperature.. °C

	Yes	Value
Starting current limitation?	☐	....
Acceleration torque limitation?	☐	....
Maximum starting time?	☐	....

4. Personal data

Last name, first name: ....

Company: ....

Department: ....

Street: ....

Postal code, city:...

Country: ....

Tel.:...

Fax: ....

E-mail: ....

Index

To
SIEMENS AG
A&D CD MM 3

92220 Amberg, Germany

Fax: 09621 / 80-3337

Sender (please fill in)
Name
Company / department
Address
Telephone
Fax

SIRIUS 3RW44 Soft Starters System Manual

Have you noticed any errors while reading this manual?
Please use this form to inform us about any errors.
All complaints and suggestions for improvements are very welcome.

- -

- -

- -

- -

- -

- -

- -

- -

- -

- -

- -