

Soft Starter

3RW44

Manual · 10/2010



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Soft Starter 3RW44

Manual

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This manual contains notices you have to observe in order to guarantee your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.



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Prescribed Usage

Note the following:



Warning

The device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

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Although we have carefully checked the contents of this publication for conformity with the hardware and software described, we cannot guarantee complete conformity since errors cannot be excluded. The information provided in this manual is checked at regular intervals and any corrections which might become necessary will be included in the next editions.

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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 systems

Required basic knowledge

In order to understand this manual, general knowledge in the field of general electrical engineering is required.

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 with 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.

Access aids

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 can find a list of contact persons, as well as 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.com/industrial-controls/technical-assistance
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Correction sheet

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

Introduction

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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, 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.

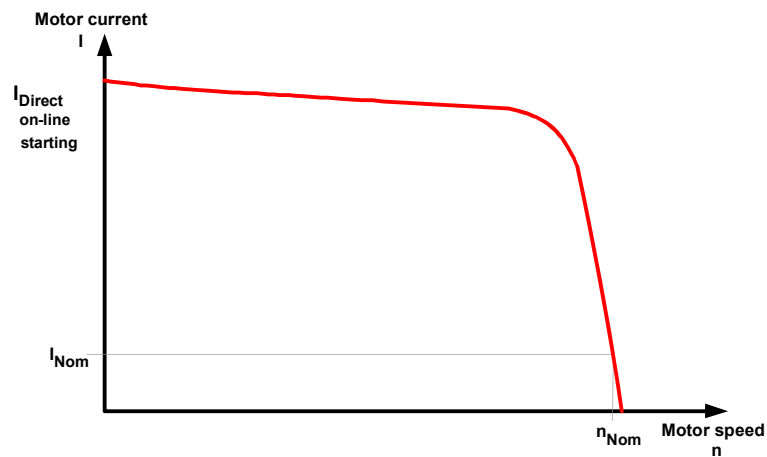


Figure 1-1: Typical starting current behavior of a 3-phase asynchronous motor

Start torque

The start torque and the stalling torque can usually be assumed to be between 2 and 4 times the rated operating 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

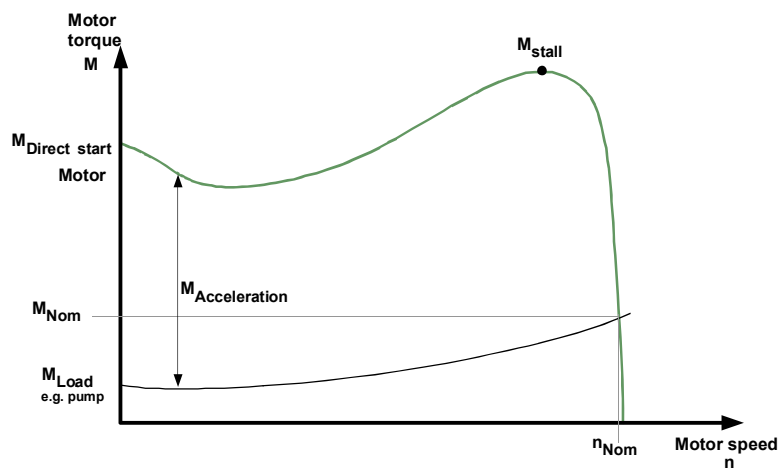


Figure 1-2: Typical starting torque behavior of a 3-phase asynchronous motor

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, 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 using various control methods.

The motor current acts proportional to the voltage applied to the motor. The starting current is thus 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 in relation to 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
$I_{\text{Direct on line starting}}$:	approx. 700 A
M_e :	355 Nm ; Example: $M_e = 9.55 \times 55 \text{ kW} \times \frac{1000}{1480 \text{ min}^{-1}}$
n_e :	1480 min^{-1}
$M_{\text{Direct on line starting}}$:	approx. 700 Nm
Set start voltage:	50 % (1/2 line voltage)

=> I_{Start} 1/2 of the direct on line 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:

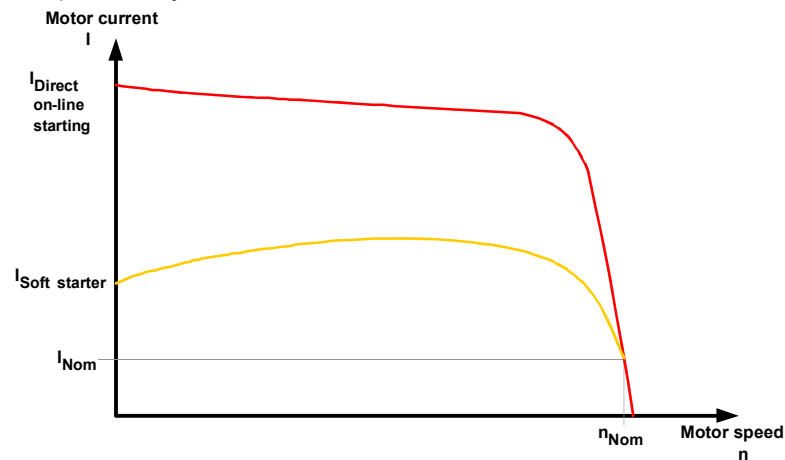


Figure 1-3: Reduced current behavior of the 3-phase asynchronous motor during start-up with the SIRIUS 3RW44 soft starter

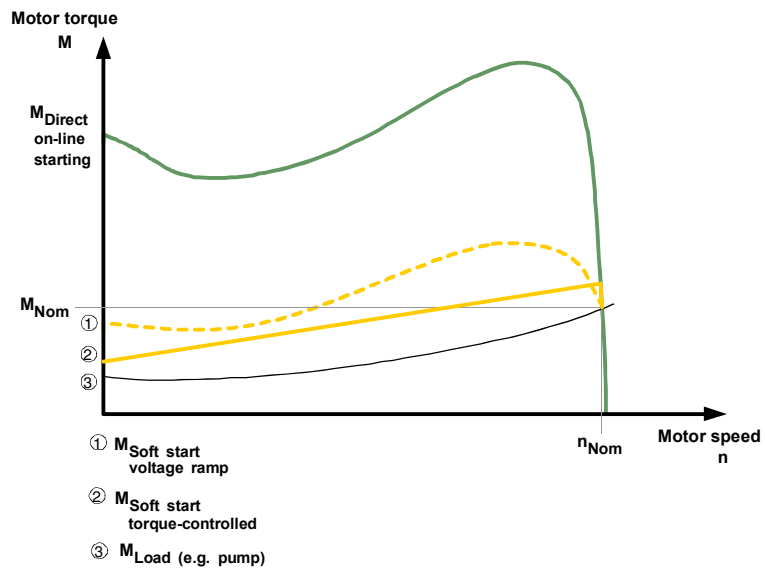


Figure 1-4: Reduced torque behavior of the 3-phase asynchronous motor during start-up with the SIRIUS 3RW44 soft starter

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 line frequency, contrary to the frequency-controlled starting and stopping of a frequency converter.

Upon completion of motor run-up, the thyristors are fully utilized, resulting in the complete line 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 which develops during continuous operation and 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:

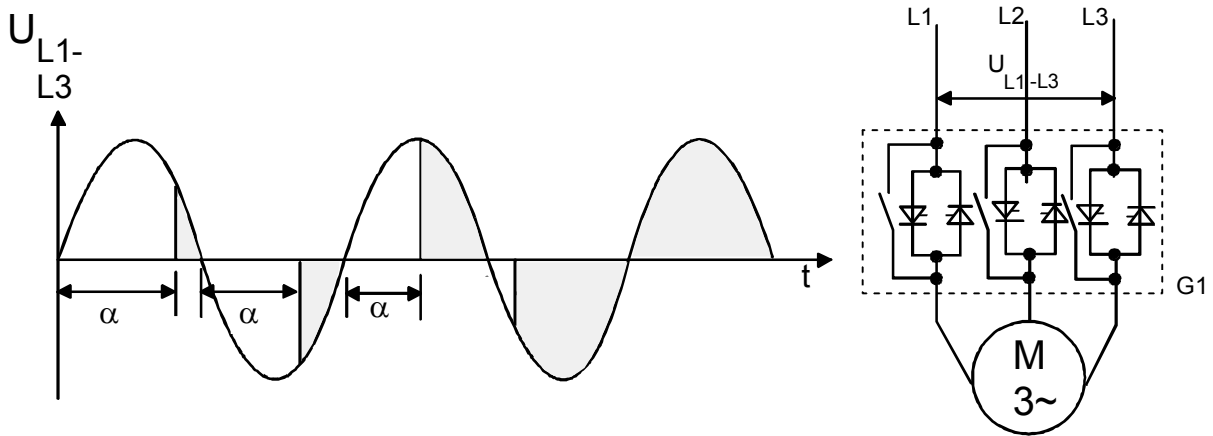


Figure 1-5: Phase angle control and schematic layout of a soft starter with internal bypass contacts

1.2 Application and Use

Applications and selection criteria

3RW44 soft starters are an alternative to star-delta starters and frequency converters.

Their major benefits are soft starting and soft stop, 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 start-up 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
- Circular saws/ribbon saws
- ...

Advantages

Conveyor belts and transport systems:

- Jerk-free starting
- Jerk-free braking

Centrifugal pumps, reciprocating pumps:

- Water hammering is avoided
- Increased service life of the pipe system

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 altitude	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

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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 during the stopping time, there is an additional current load in contrast to coasting down.

Capacitive elements (e.g. compensation systems) must not 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 on line starting according to the local short-circuit conditions, and should be ordered separately.

The harmonic component 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 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 Win Soft Starter selection and simulation program can be downloaded at: <http://www.siemens.com/softstarter> >Software.

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:

SITRAIN – Training for Automation and Industrial Solutions
Germany

Phone: +49 (0) 911 895 7575

Fax: +49 (0) 911 895 7576

<mailto:info@sitrain.com>

<http://www.siemens.com/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 the optimum soft starter for your application will be dimensioned (refer to Chapter 10.3.9 "Accessories" software).

Selection criteria

Note

The appropriate size of the SIRIUS 3RW44 soft starter 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 limiting value	deactivated	deactivated	$4 \times I_M$	$4 \times I_M$	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 stop	Soft stop	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 limiting value	$4 \times I_M$	$4 \times I_M$	$4 \times I_M$
• 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	Circular saws/ribbon saws
Starting parameters				
• Voltage ramp and current limiting				
- Start voltage	30	50	50	30
- Starting time	60	60	60	60
- Current limiting 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 the Chapter "Important Notes" .

2.3 On-time and Switching Frequency

In terms of motor rated current and normal or 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 cycle duration of loads that are frequently switched on and off.

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

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

Explanation of the formula:

OT On-time [%]
 t_s Starting time [s]
 t_b Operating time [s]
 t_p Idle time [s]

The following graph illustrates the procedure.

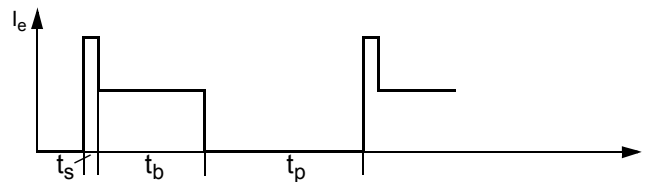


Figure 2-1: On-time OT

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 ≤ 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.

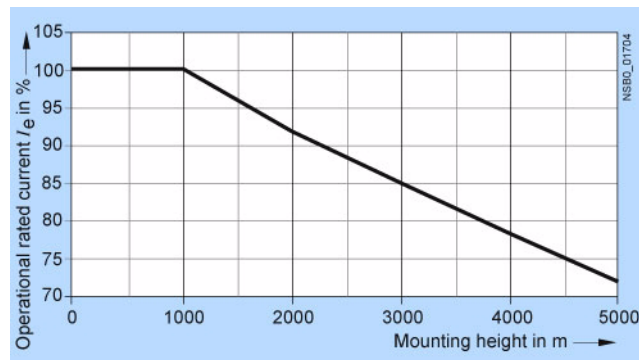


Figure 2-2: Current reduction in relation to the installation altitude

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 control 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 Basic Factory Settings

Apply the basic 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 basic factory settings without requiring additional auxiliary tools.

To reset to the basic 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	Rated operating power 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	1,076 A	
	44	- 132 kW	250 A		66	- 710 kW	1,214 A	
IV	Type of connection							
	1	Standard screw connection (main/auxiliary conductor connection) (for devices \leq 3RW44 27)						
	2	Main conductor: Busbar connection / auxiliary conductor: Spring-type terminal (for devices $>$ 3RW44 27)						
	3	Main conductor: Screw connection / auxiliary conductor: Spring-type terminal (for devices \leq 3RW44 27)						
	6	Main conductor: Busbar connection / auxiliary conductor: Screw-type terminal (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 operational voltage U_e :							
	4	200 to 460 V						
	5	400 to 600 V						
	6	400 to 690 V						

Installation, Connection and Branch Layout

3

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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.

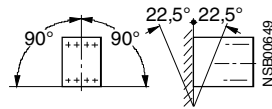


Figure 3-1: Mounting position

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 control cabinets (degree of pollution 2).

Make sure that no liquids, dust or conductive parts can enter the soft starter.

Operation of the soft starter produces waste heat (power 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, aeration and de-aeration of the heat sink, it is essential that the minimum clearance to other devices is strictly observed.

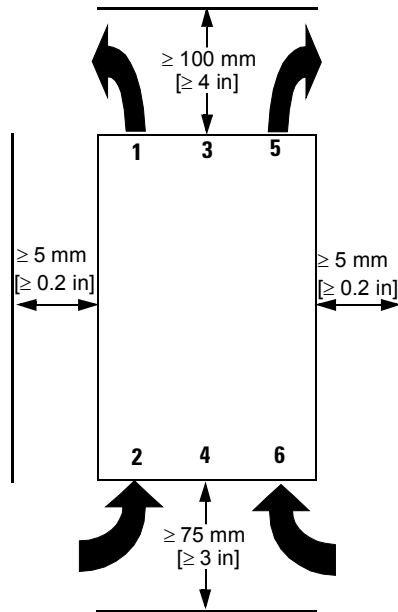


Figure 3-2: Clearance to other devices

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 that the group error output (terminals 95 and 96) be integrated into the control.

3.2.1 General

A motor branch consists of (at least) a **disconnecter**, a **switching element** and a **motor**.

Protection functions must include line protection against short-circuits and overload protection for line and motor.

Disconnecter

The disconnecting function with line protection against overload and short-circuits can be achieved by using, for example, a circuit breaker or a fuse disconnecter.

(For fuse and circuit breaker assignment, refer to Chapter 10.3.7 "Branch Component Layout (Standard Circuit)" and Chapter 10.3.8 "Branch Component Layout (Inside Delta Circuit)".

Switching element

The 3RW44 soft starter performs the functions of the switching element and the motor protection.



Danger

Dangerous voltage.

Danger to life or risk of serious injury.

If line 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, this must be disconnected using a disconnecter (open isolating distance, e.g. with open switch disconnecter)!

3.2.2 Soft Starters in Standard Circuits

The SIRIUS 3RW44 soft starter is connected in the motor branch between the disconnecter or circuit breaker and the motor. The 3RW44 soft starter automatically detects the type of connection of the soft starter, meaning that 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/Type of connection". In this case, the display reads "Star/delta". If the circuitry is faulty or the motor is not connected, the display shows "Unknown".

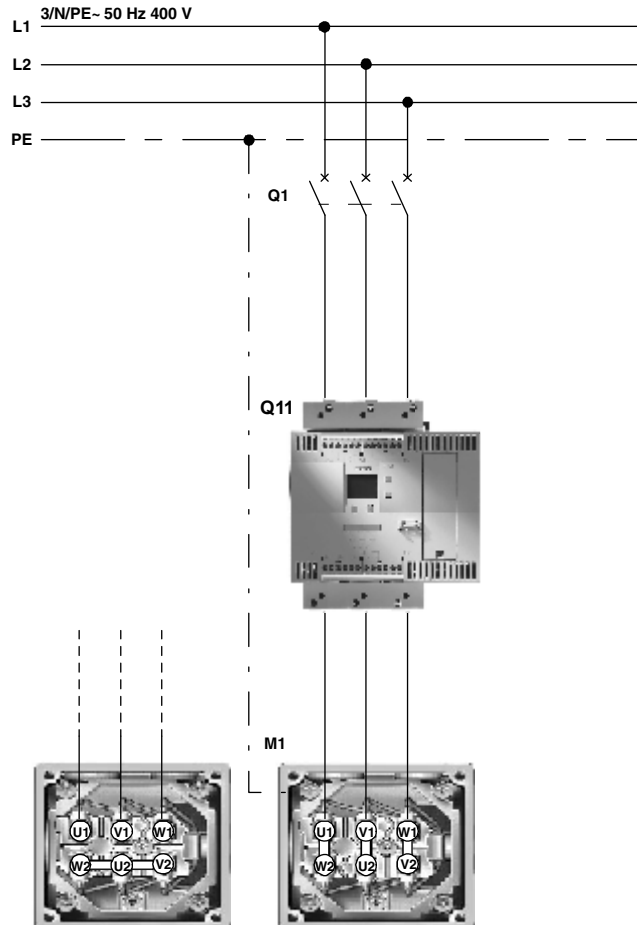


Figure 3-3: Schematic circuit diagrams for 3RW44 soft starters in standard circuits

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. The soft starter would otherwise not recognize the current circuit version (standard circuit or inside delta circuit) and would output the error message: "Missing load phase 1-3", or ensure 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 line voltage prevails.

Example

Line 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 to the delta winding of the motor. This requires at least 6 motor lines.

The 3RW44 soft starter automatically detects how it is connected, meaning that 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/Type of connection". 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 must always be set in the quick start 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 line 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 electrical 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").

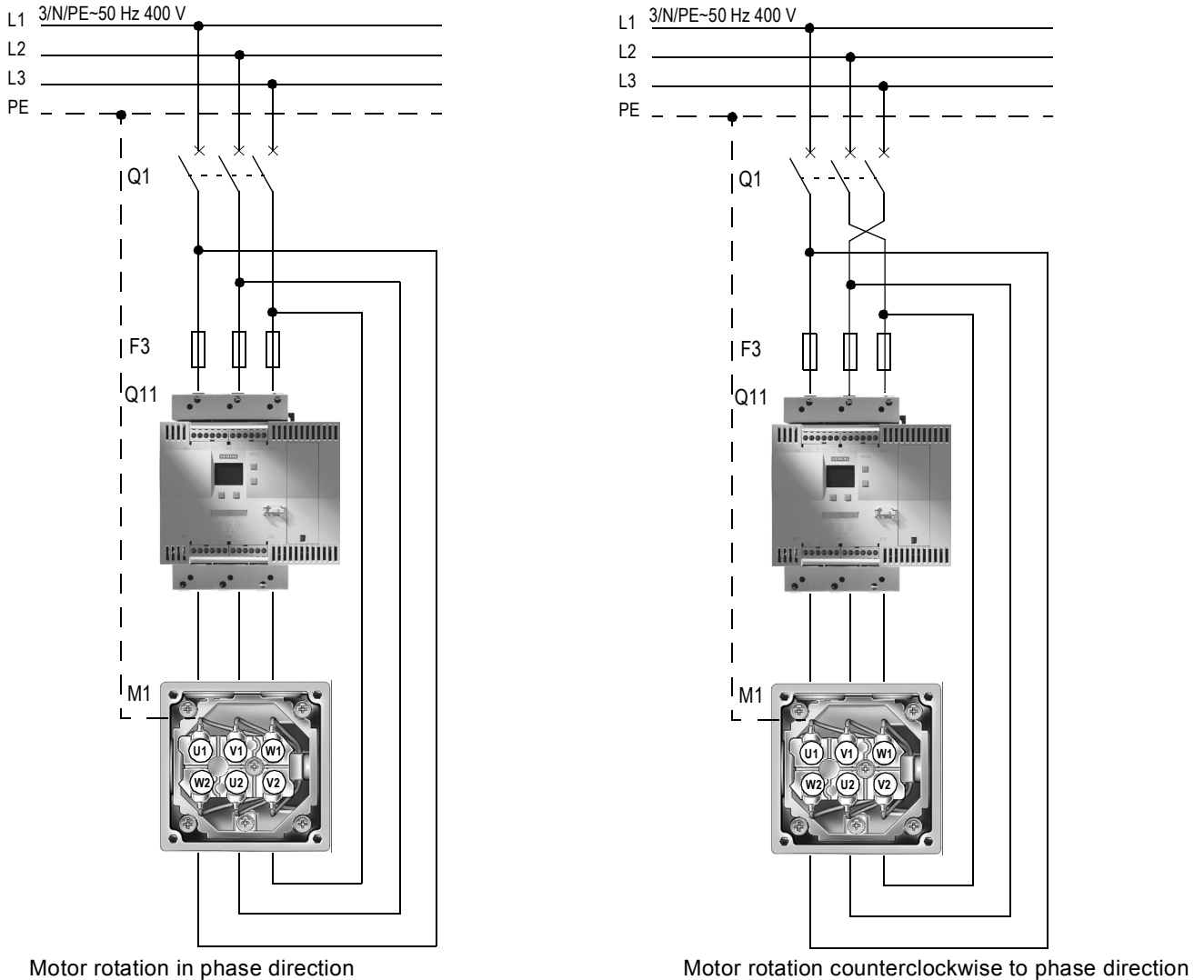


Figure 3-5: Schematic circuit diagram of a 3RW44 soft starter in an inside delta circuit

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. The soft starter would otherwise 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 Disconnecter (Main Contactor)

If galvanic decoupling is required, a motor contactor can be installed between the soft starter and the disconnecter, or a fault output relay can be used. (Refer to Chapter 10.3 "Technical Data" for the contactor assignment)

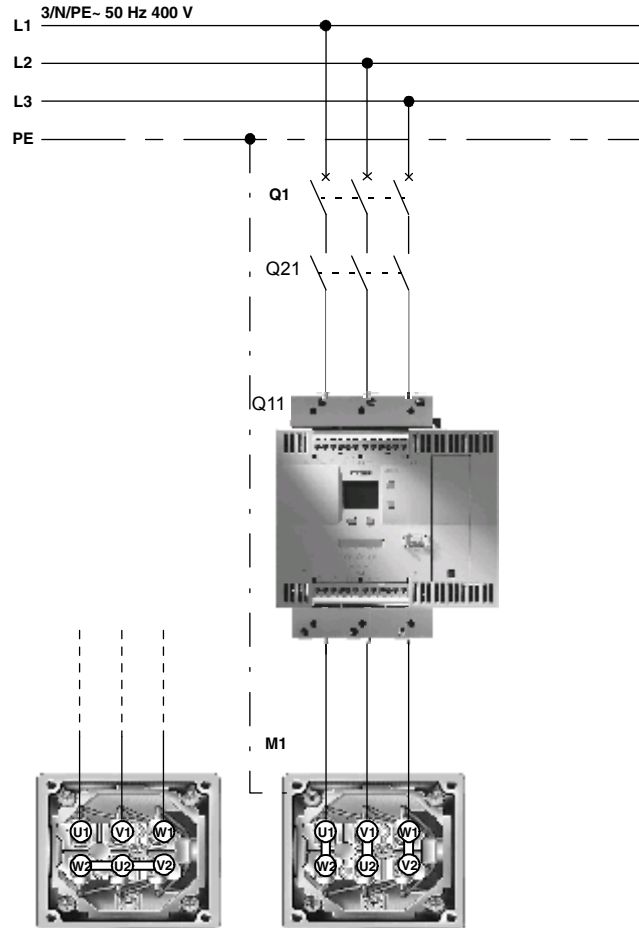


Figure 3-6: Schematic circuit diagram of branch with optional main contactor / contactor disconnector

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. The soft starter would otherwise not recognize the current circuit version (standard circuit or inside delta circuit) and would output the error message: "Load phases 1-3 missing".

Notice

With 3RW44 product version *E08* (FW V 1.9.0) the simultaneous and/or prior switch-off of the main contactor and removal of the on command at the soft starter may lead to direct on line starting behavior of the motor when restarting. Include a tripping delay of 1 s for the main conductor or control the main conductor via an output with parameterized "On-time" function as described in circuit diagram 9.1.2.

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 cable, 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)

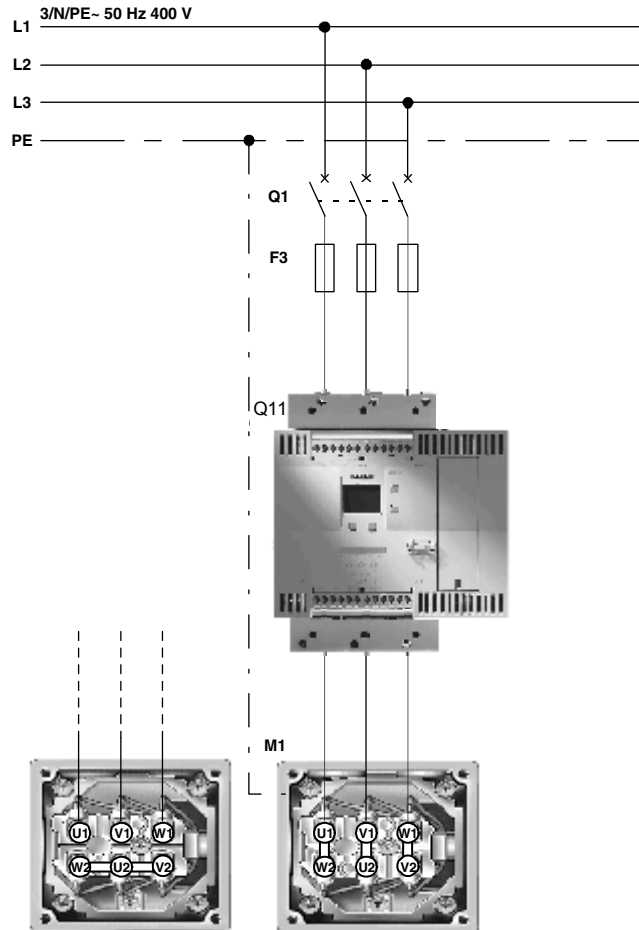


Figure 3-7: Schematic circuit diagram of branch with semiconductor fuses

Note

Chapter 10.3.7 "Branch Component Layout (Standard Circuit)" indicates fuses for minimum and maximum dimensionings.

Minimum dimensioning: The fuse is optimized for the I^2t value of the thyristor. If the thyristor is cold (ambient temperature) and the starting procedure lasts a maximum of 20 s with 3.5 times the rated device current, the fuse does not yet trip.

Maximum dimensioning: The fuse does not trip and the thyristor is not damaged even if the maximum permissible current for the thyristor is flowing.

Maximum dimensioning is recommended for heavy starting.

3.4 Capacitors for Power Factor Improvement



Caution

Capacitors must not be connected to the output terminals of the soft starter. If this occurs, 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 in operation.

If capacitors for reactive power compensation are used, they must be connected on the line side of the device. If a contactor disconnect 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 3RW44 in Generator Operation (with 3-Phase Asynchronous Motor)

The 3RW44 soft starters are suitable for generator operation.

Note

Depending on the operating speed, connect the generator to the system while in the subsynchronous range (motor operation) and slowly move the machine into the supersynchronous range. Connecting the generator directly in the supersynchronous range may cause soft starter faults.

3.6 Electrical Connection

3.6.1 Control and Auxiliary Current Connection

The SIRIUS 3RW44 soft starter is supplied with two different connection systems:

- Screw-type terminals
- Spring-loaded terminals

Two control voltage versions are available:

- 115 V AC
- 230 V AC

3.6.2 Main Current Connection

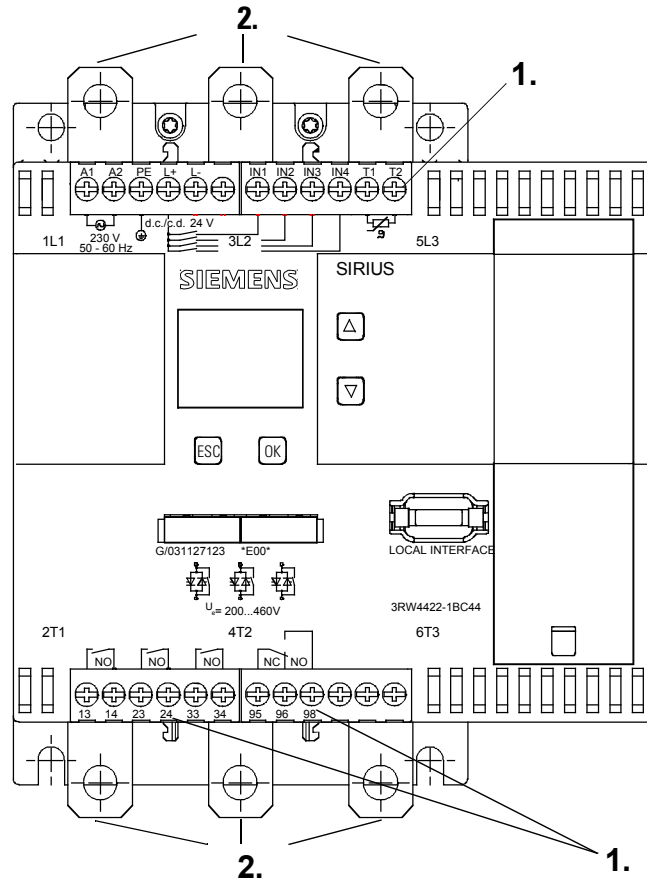
All soft starters are equipped with busbar connections for the main current connection.

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 10.3.9 "Accessories").




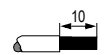
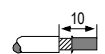
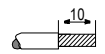
1.	A1, A2, PE, L+, L-, IN1, IN2, IN3, IN4, T1, T2, 13, 14, 23, 24, 33, 34, 95, 96, 98: Control/auxiliary circuit
2.	L1/L2/L3 Main circuit infeed
3.	T1/T2/T3 Main circuit outgoing feeder load













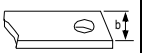



Figure 3-8: Connections

Notice

The connection of the 3-phase network supply to terminals T1/T2/T3 is not permissible.

3.6.3 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....
 Ø 5 ... 6 mm / PZ2	0.8 ... 1.2 Nm 7 to 10.3 lb·in	—
	1 x 0.5 ... 4.0 mm ² 2 x 0.5 ... 2.5 mm ²	2 x 0.25 ... 1.5 mm ²
	2 x 0.5 ... 1.5 mm ² 1 x 0.5 ... 2.5 mm ²	2 x 0.25 ... 1.5 mm ²
	—	2 x 0.25 ... 1.5 mm ²
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-....	
	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 mm ² 2 x AWG 7 ... 1/0		2 x 25 ... 120 mm ² 2 x AWG 4 ... 250 kcmil		2 x 70 ... 240 mm ² 2 x AWG 2/0 ... 500 kcmil		2 x 70 ... 240 mm ² 2 x AWG 2/0 ... 500 kcmil
	2 x 10 ... 50 mm ² 2 x AWG 7 ... 1/0		2 x 16 ... 95 mm ² 2 x AWG 6 ... 3/0		2 x 50 ... 240 mm ² 2 x AWG 2/0 ... 500 kcmil		2 x 50 ... 240 mm ² 2 x AWG 2/0 ... 500 kcmil
	min. 3 x 9 x 0.8 max. 10 x 15.5 x 0.8		b ≤ 17 mm		b ≤ 25 mm		b ≤ 60 mm
	2 x 2.5 ... 16 mm ²	—	—	—	—	—	—
	2 x 2.5 ... 35 mm ² 1 x 2.5 ... 50 mm ²	—	—	—	—	—	—
	2 x 10 ... 50 mm ² 1 x 10 ... 70 mm ² 2 x AWG 10 ... 1/0 1 x AWG 10 ... 2/0	—	—	—	—	—	—

Display, Controls and Device Interfaces

4

Chapter	Subject	Page
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4.2	Device Interfaces	4-3
4.2.1	Local Device Interface	4-3
4.2.2	PROFIBUS Interface (Optional)	4-3
4.3	External Display and Control Unit (Optional)	4-3

4.1 Display and Controls

Graphic display

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

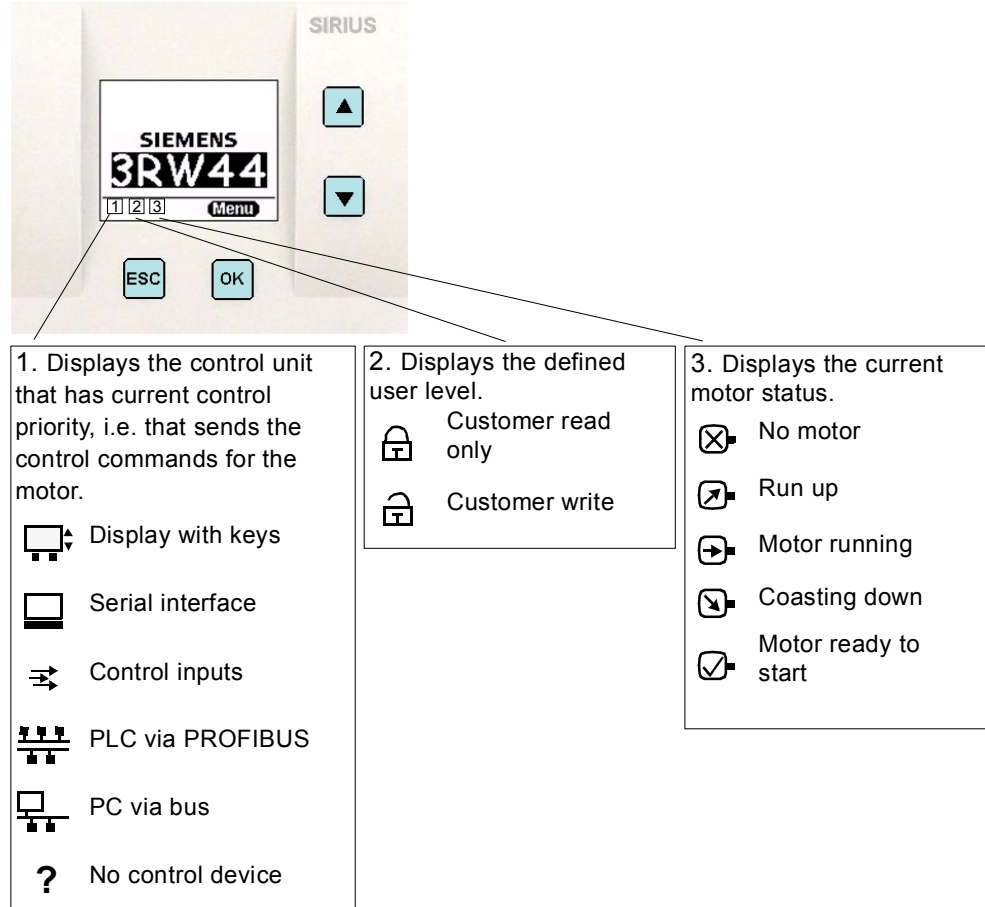






Figure 4-1: Explanation of symbols

Controls

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

- 

The current function, depending 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 arrow keys are used to navigate through the menu items or to change number values in the settings menu item.
- 

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" operating, monitoring and parameterizing software (refer to Chapter 10.3.9 "Accessories", Software) using a PC and connecting cable.

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 to PROFIBUS, operated and parameterized via the interface. The "Soft Starter ES" operating, monitoring and parameterizing software (refer to Chapter 10.3.9 "Accessories", Software) can also be connected to this interface using a PC and connecting cable.

Simultaneous operation of a 3RW44 with a PROFIBUS interface is not possible in networks where one external 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 and control unit's display will be shown normally.

The control keys of the 3RW44 will be inactive, meaning that normal handling is only possible via the external display and control unit.

→ For ordering data, see Chapter 10.3.9.

Commissioning

5

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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 must be handled in different ways but are self-explanatory.

5.1.1 Menu Structure and Navigation

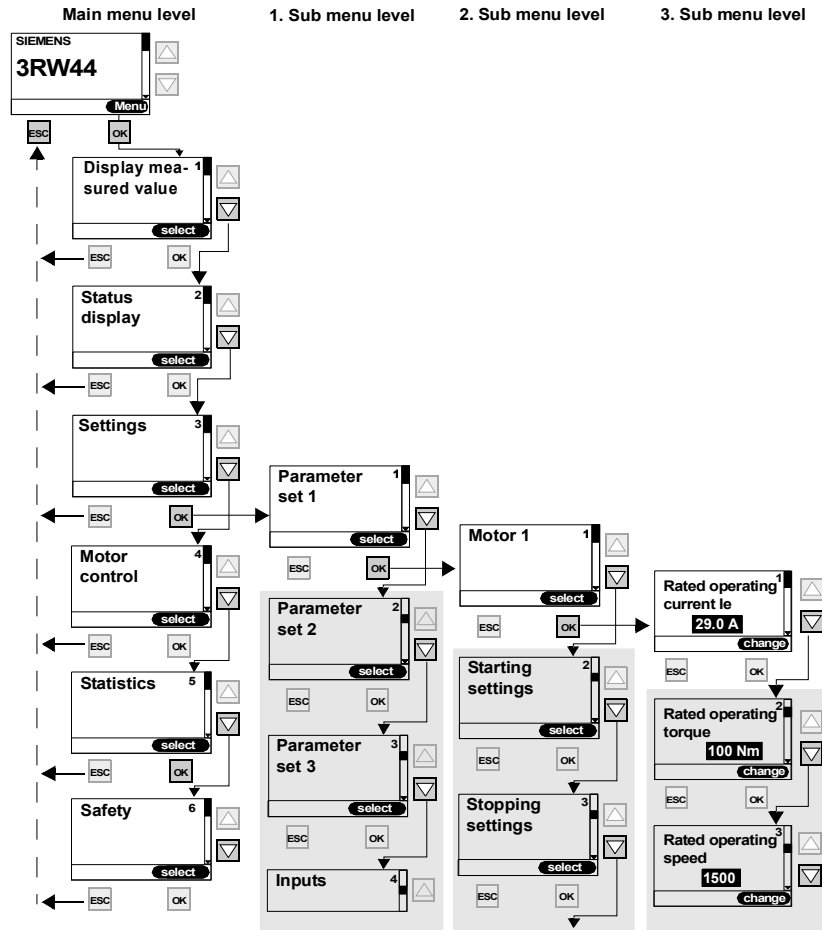


Figure 5-1: Menu structure

5.1.2 Changing Parameters: For Example Motor Data

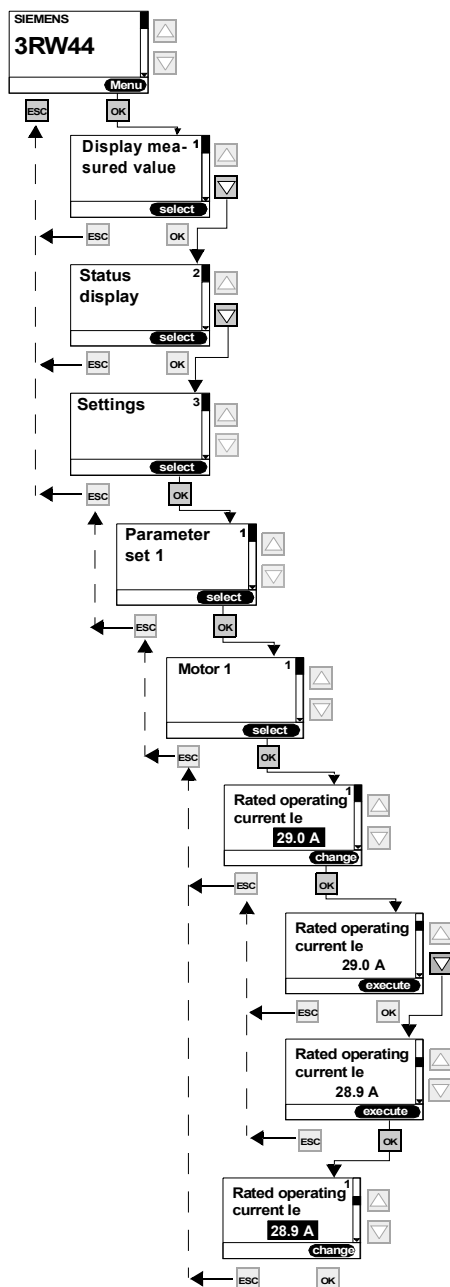


Figure 5-2: Changing values, e.g. adjusting motor data

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 line 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 limiting 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
Circular saws/ribbon saws	30	60	4 x I _e	deactivated (0 ms)	Coasting down	X	X

Notice

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

Quick start menu, when switching on for the first time or after executing a command "Basic factory settings"

Information on quick start menu:

After applying 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 once to commission the soft starter for the first time.

If you confirm the last item, "Save settings?", by entering "yes" in the quick start menu, you can only return to this menu by resetting the device back to its basic factory settings. (See manual or operating instructions)

This overwrites all settings made up until that point.

Information on application selection:

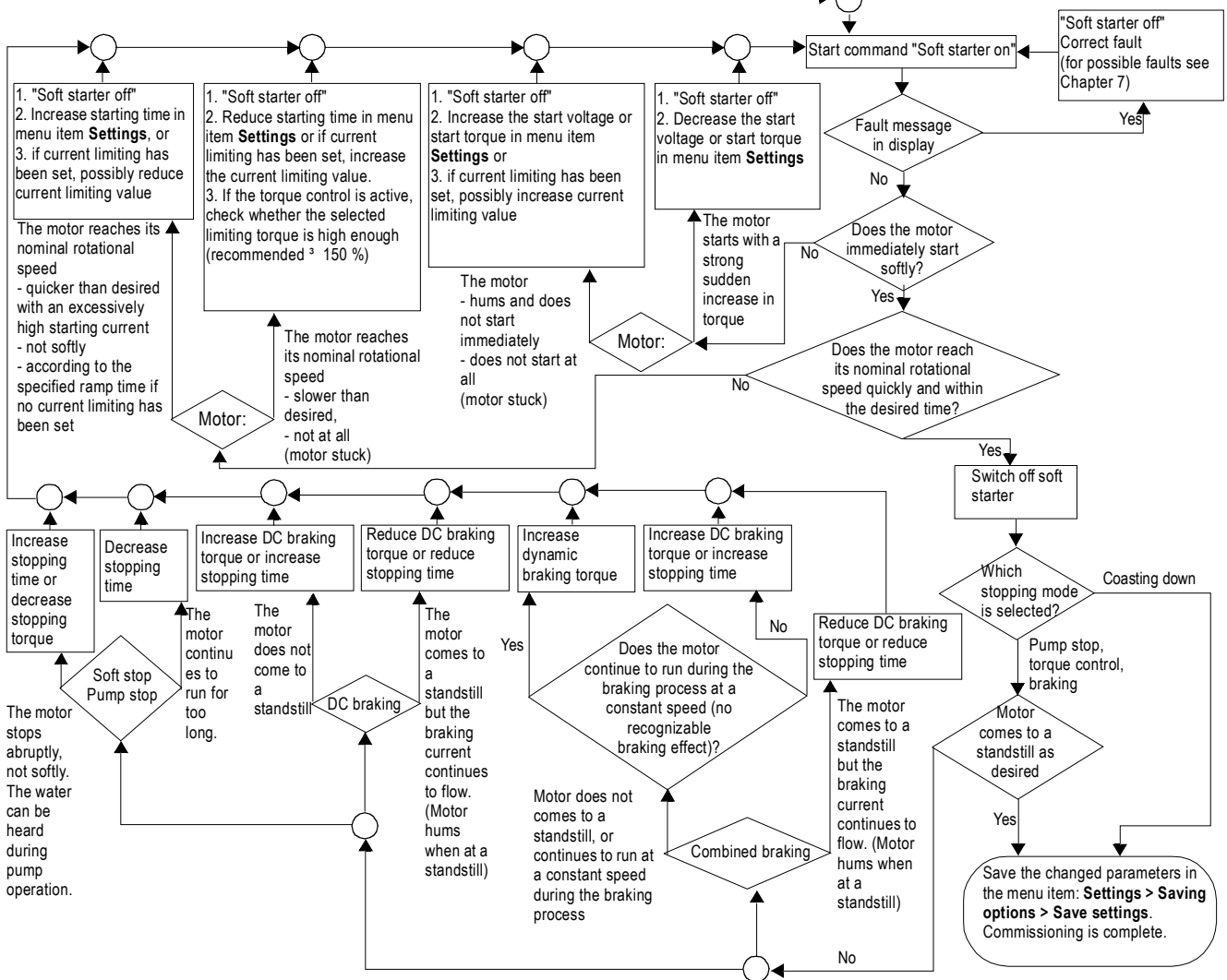
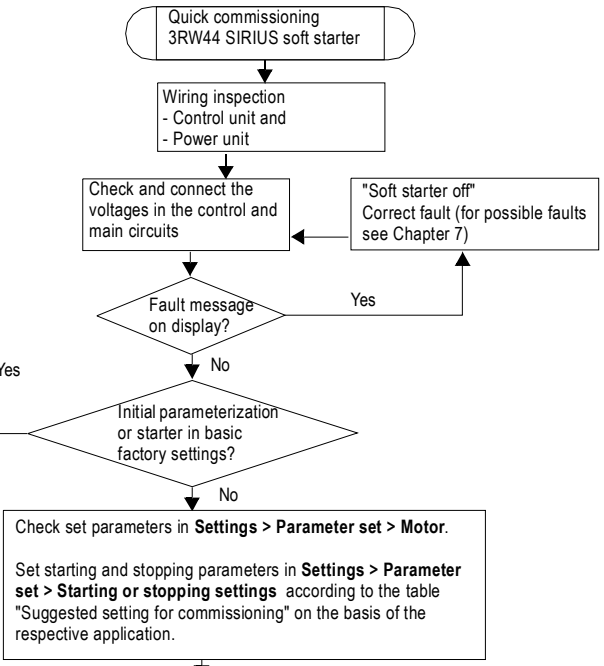
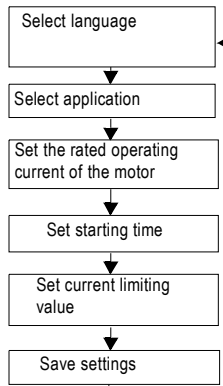
Standard parameters are recommended due to the set type of application.

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 from Section "Start command 'Soft starter on'" onwards.



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, if necessary, using the "Settings" menu item as described in Chapter 5.4.3 "Specifying the Starting Mode".

The values of the basic factory settings 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?" by entering "Yes" in the quick start menu, you can only return to this menu by resetting the device back to its basic factory settings (refer to "Restoring the factory settings" on Page5-40). This overwrites all settings made up until that point.

Quick start menu

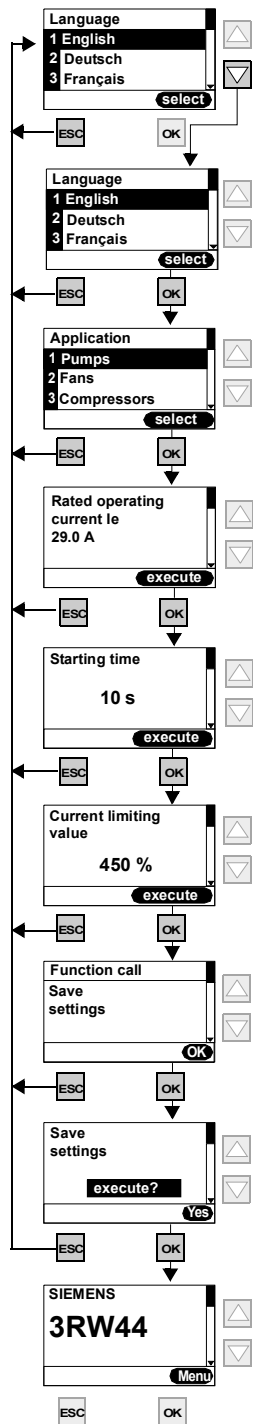


Figure 5-3: Quick start menu

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 EPROM 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"

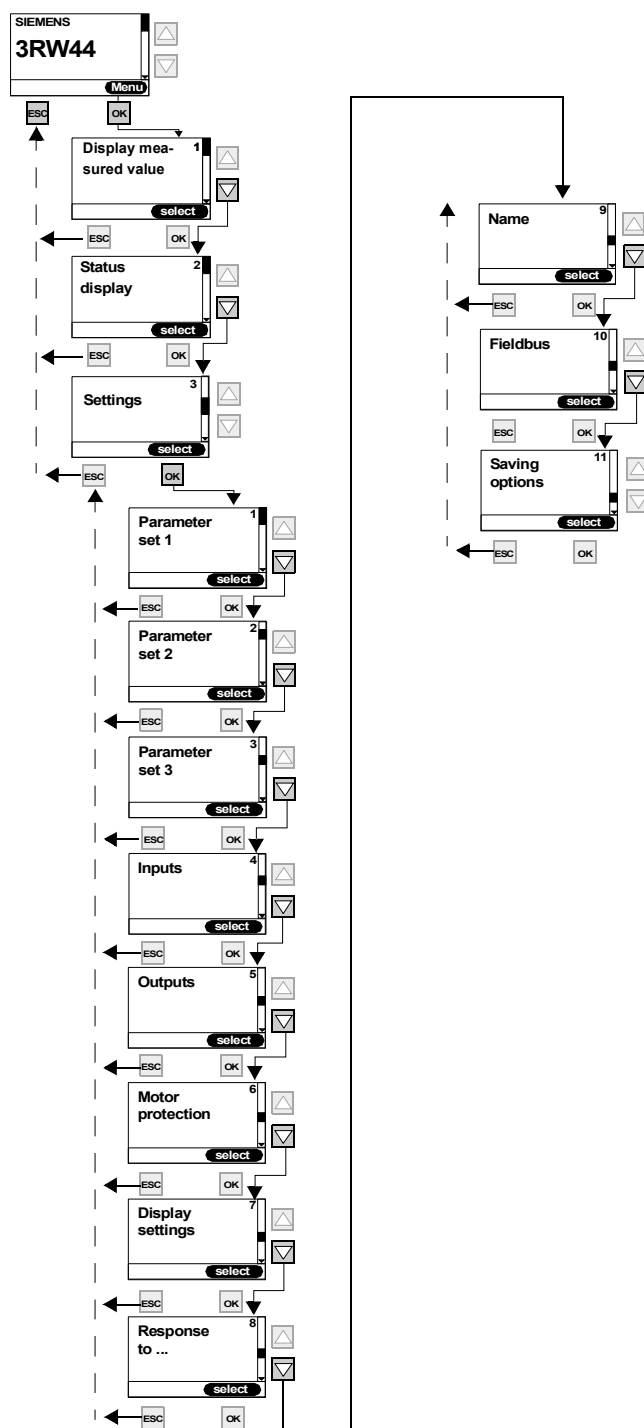


Figure 5-4: Main menu item "Settings"

5.4 Making Settings in the Selected Parameter Set

5.4.1 Selecting the Parameter Set

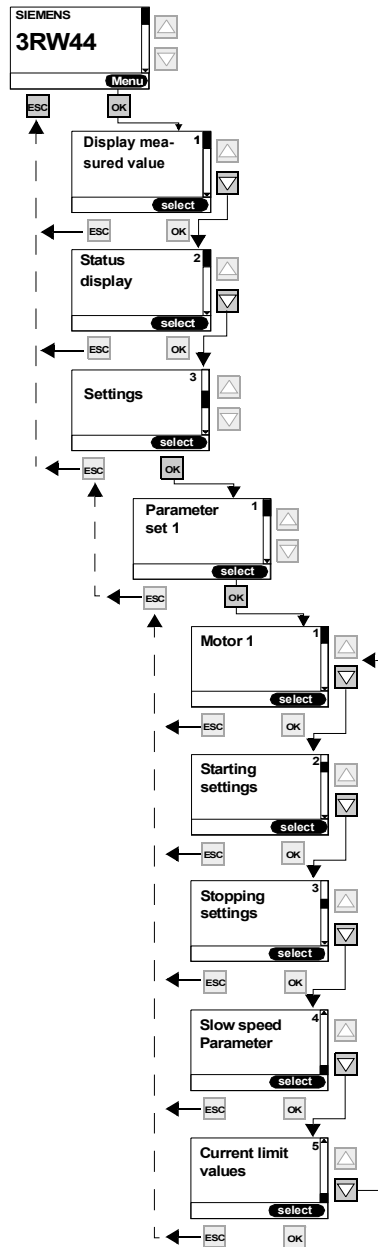


Figure 5-5: Select parameter set

5.4.2 Entering the Motor Data

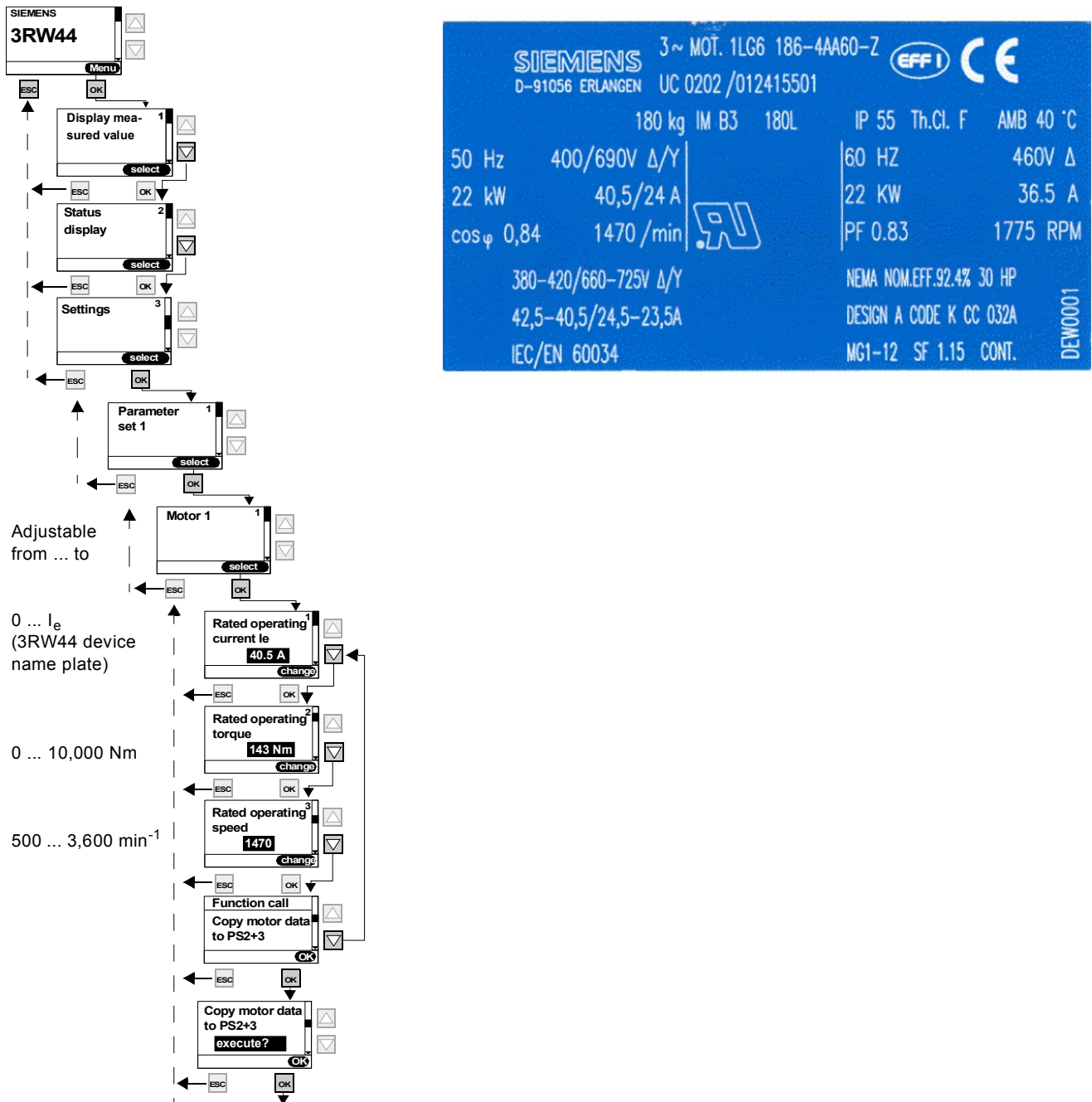


Figure 5-6: Entering the motor data and name plate

Rated operating current I_e **Notice**

Always set the rated operating current of the motor stated on the motor name plate based on the prevailing line voltage. This setting is independent of the type of connection of the soft starter (soft starter in standard or inside delta circuit). Value to be set in the above example for a line 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 operating torque

If the rated operating 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

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

If no value is specified, the value of the basic 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 with rated data (current, speed, torque) that differ from the values already entered is connected to the soft starter (e.g. for testing purposes), these rated data must be adapted to the new motor. If 0 Nm is entered as the rated operating torque, the value is automatically calculated once by the soft starter.

5.4.3 Specifying the Starting Mode

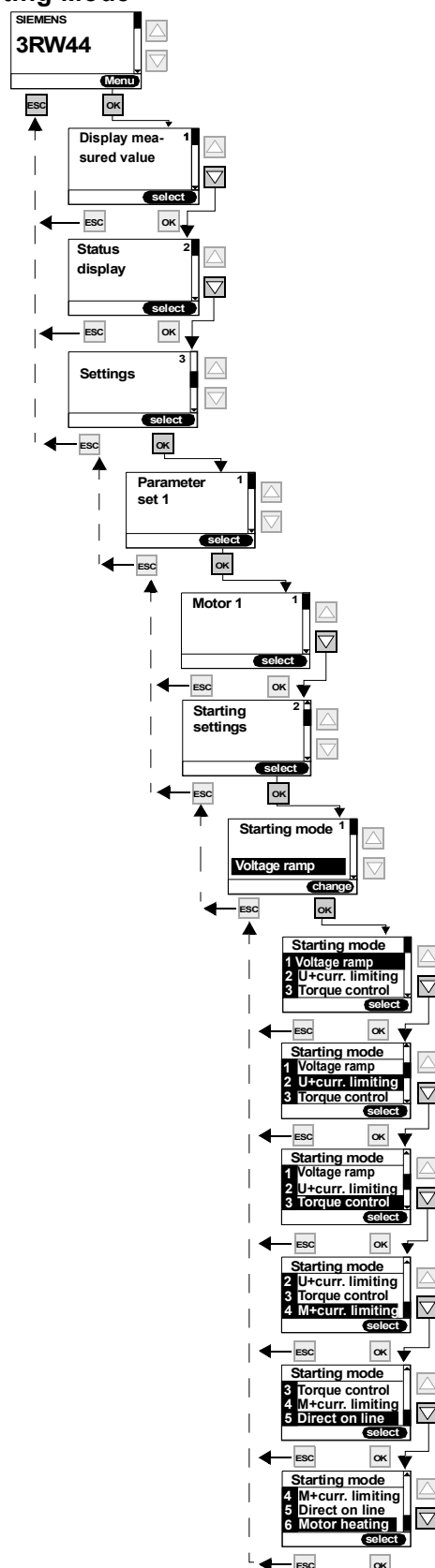


Figure 5-7: Specifying the starting mode

"Voltage ramp" starting mode

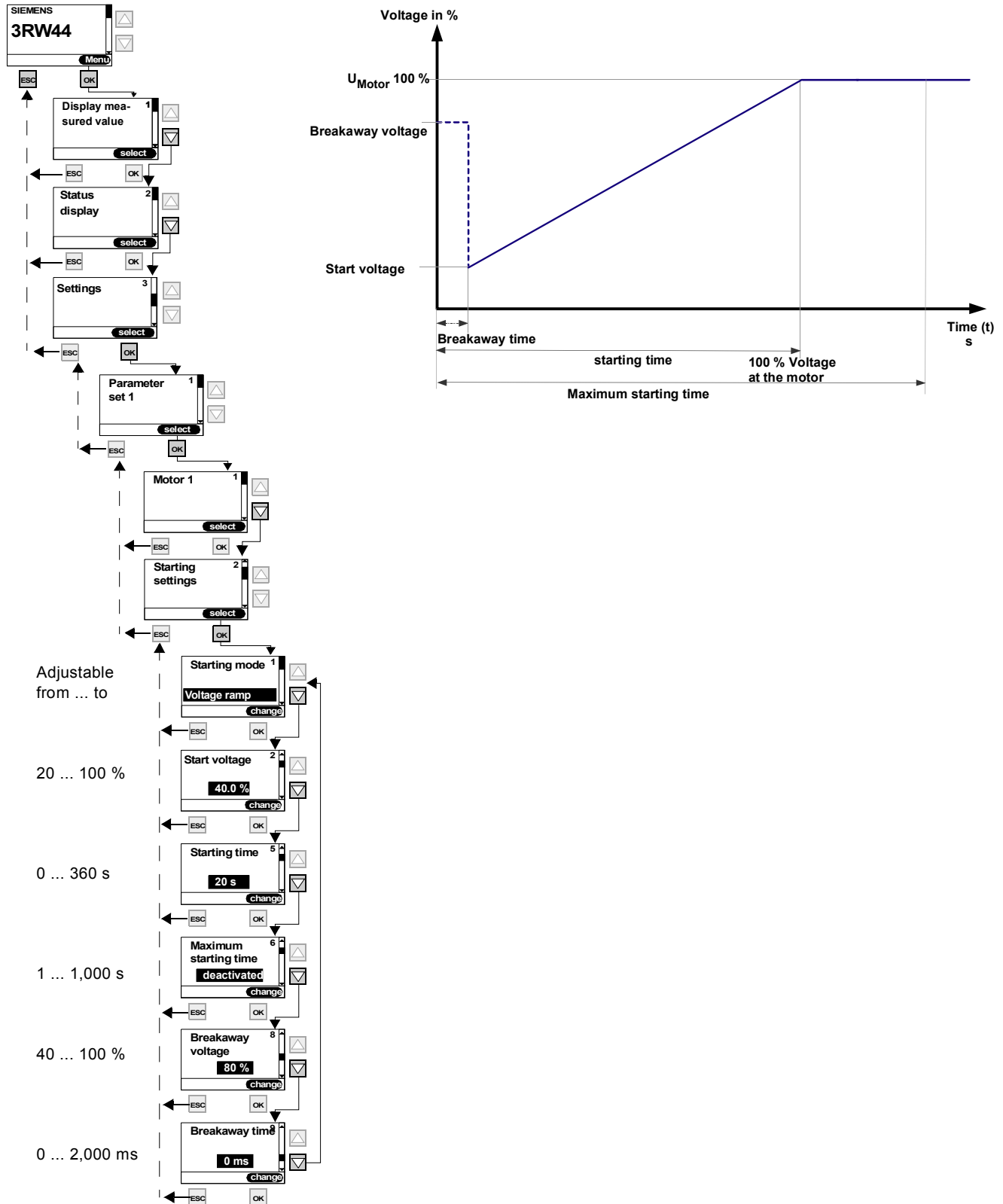


Figure 5-8: "Voltage ramp" starting mode

"Voltage ramp with current limiting" starting mode"

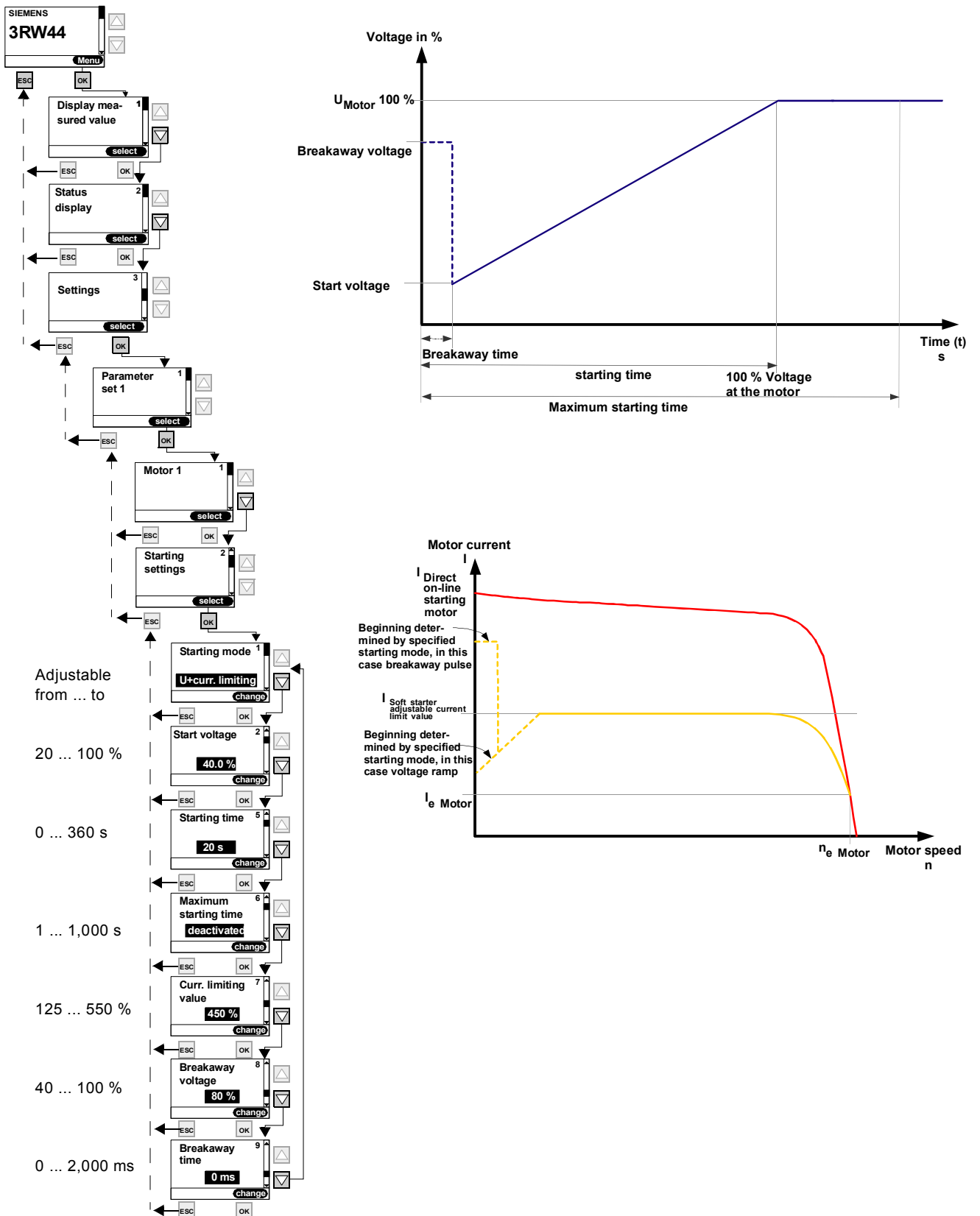
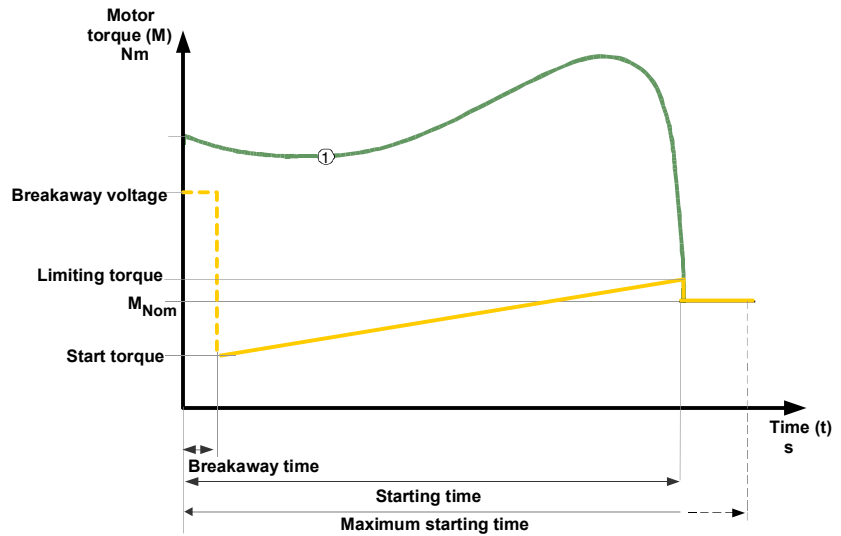
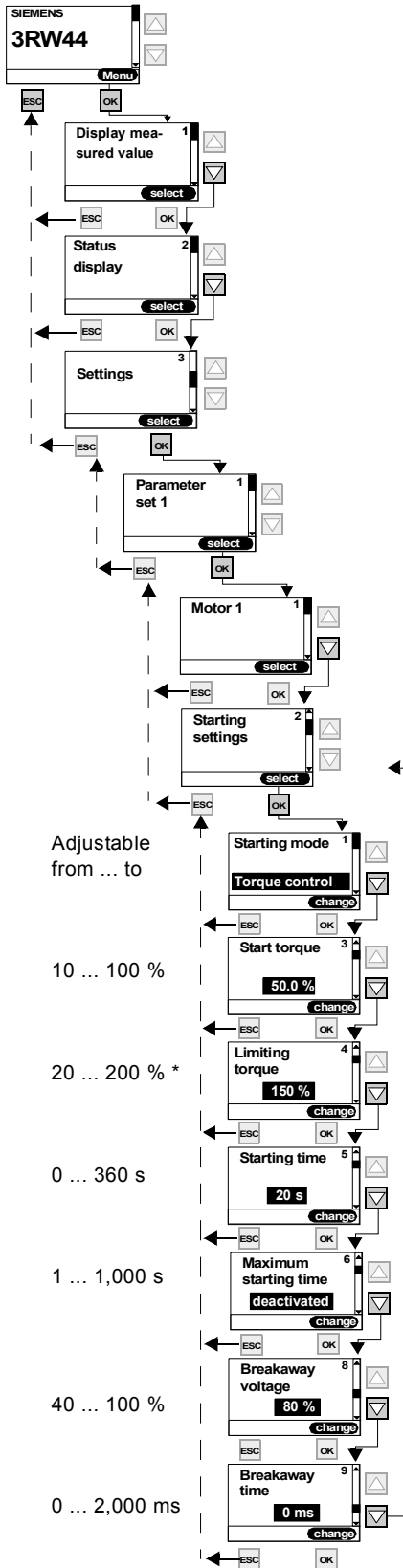


Figure 5-9: "Voltage ramp with current limiting" starting mode

"Torque control" starting mode



Limiting torque

*) Notice

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

Figure 5-10: "Torque control" starting mode

"Torque control with current limiting" starting mode

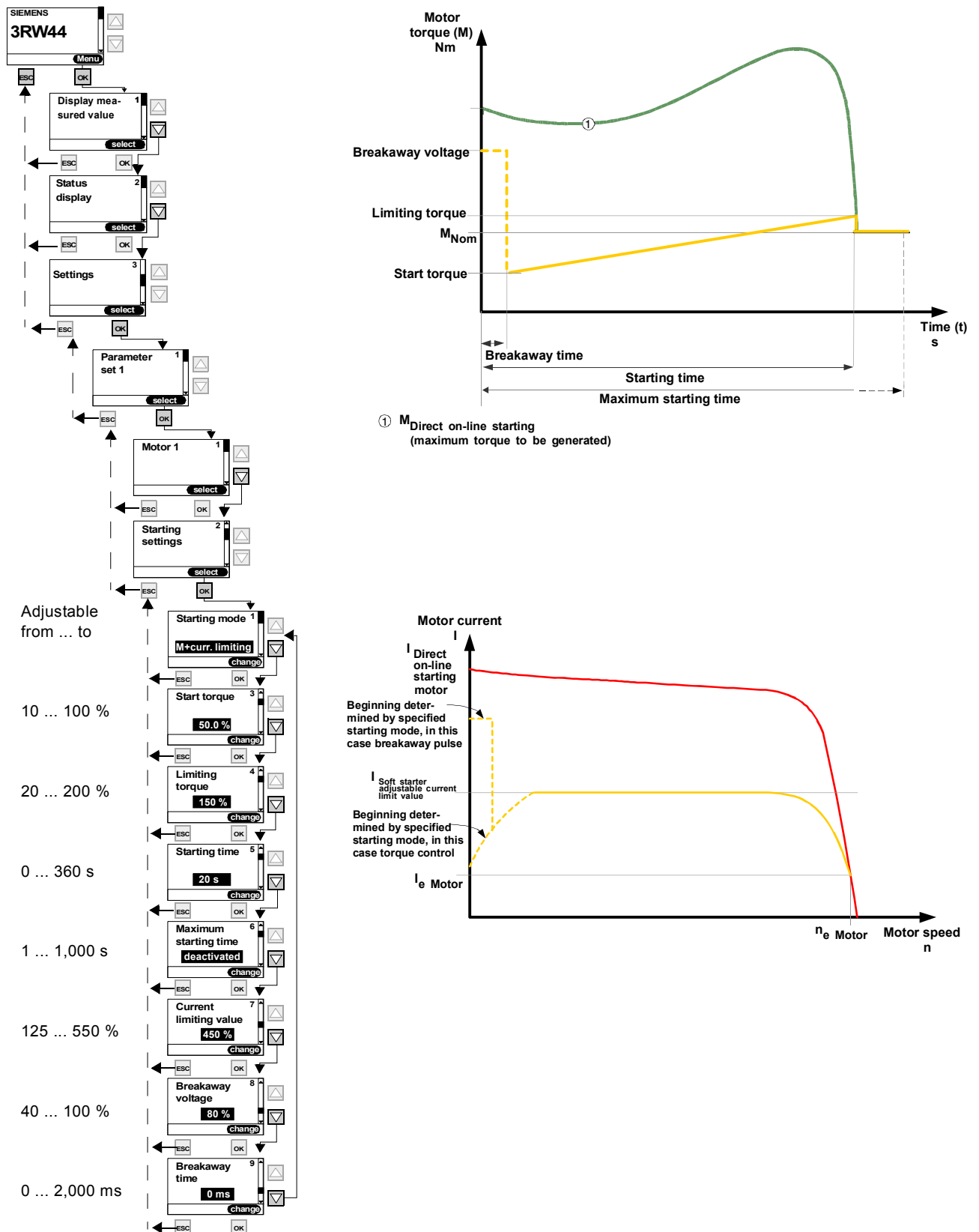


Figure 5-11: "Torque control with current limiting" starting mode

"Direct on line starting" starting mode

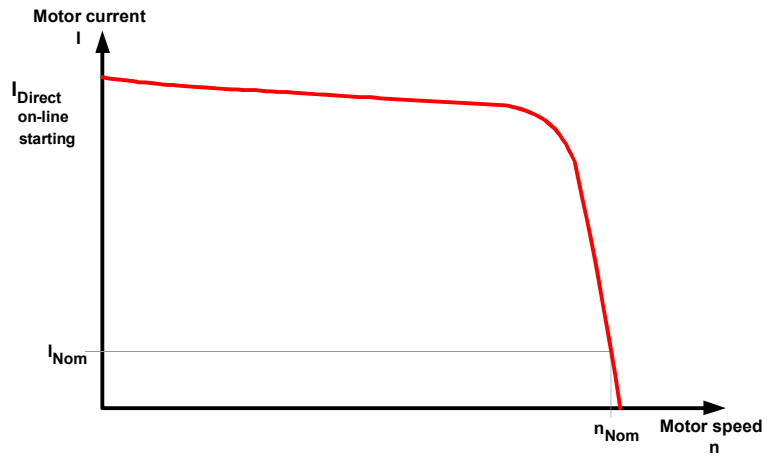
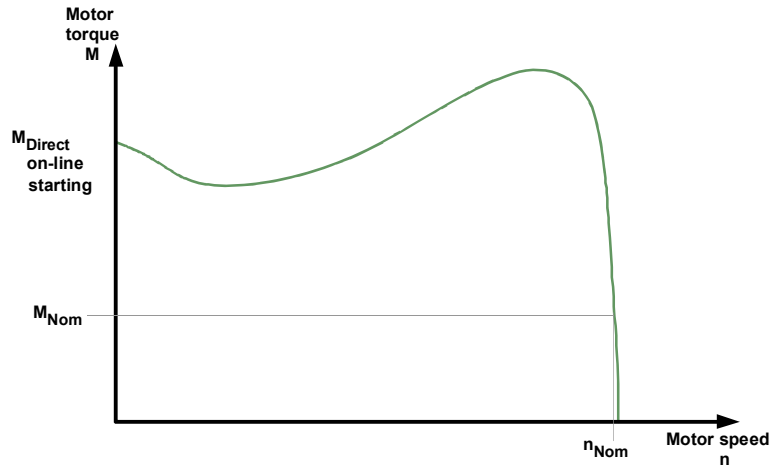
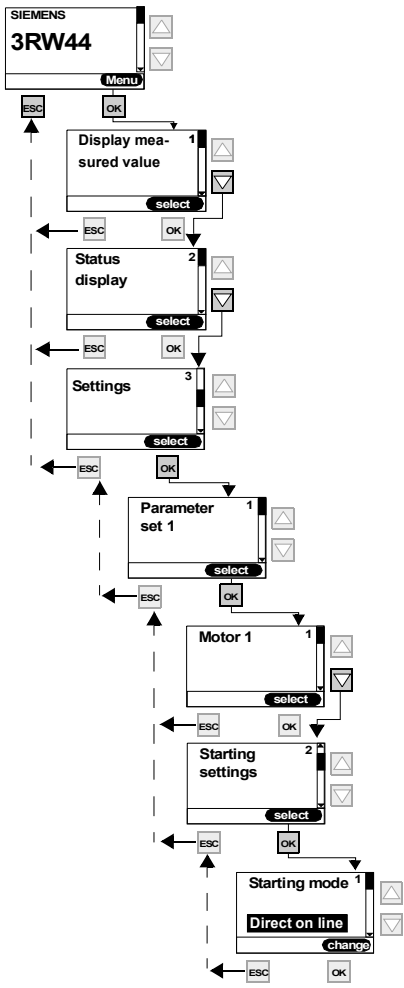
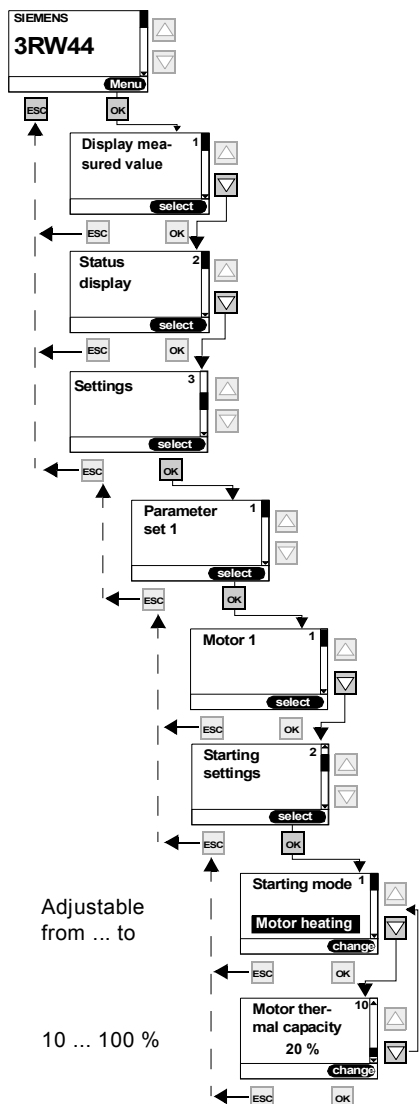


Figure 5-12: "Direct on line starting" starting mode

"Motor heating" starting mode



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 (Thermo click/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

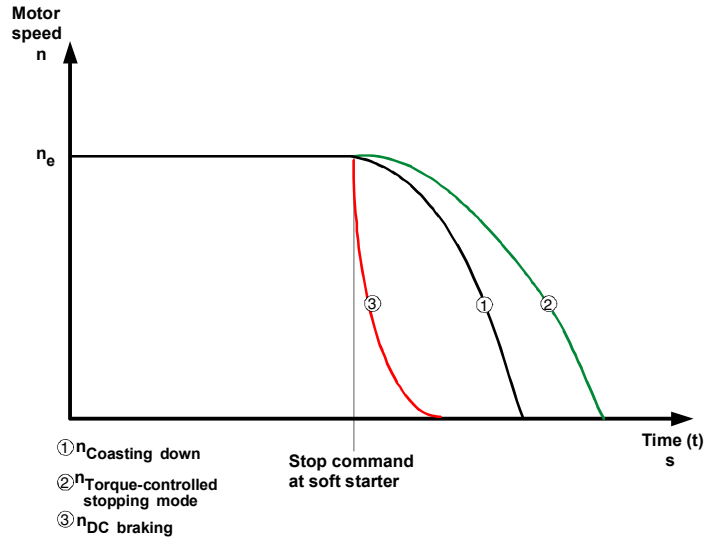
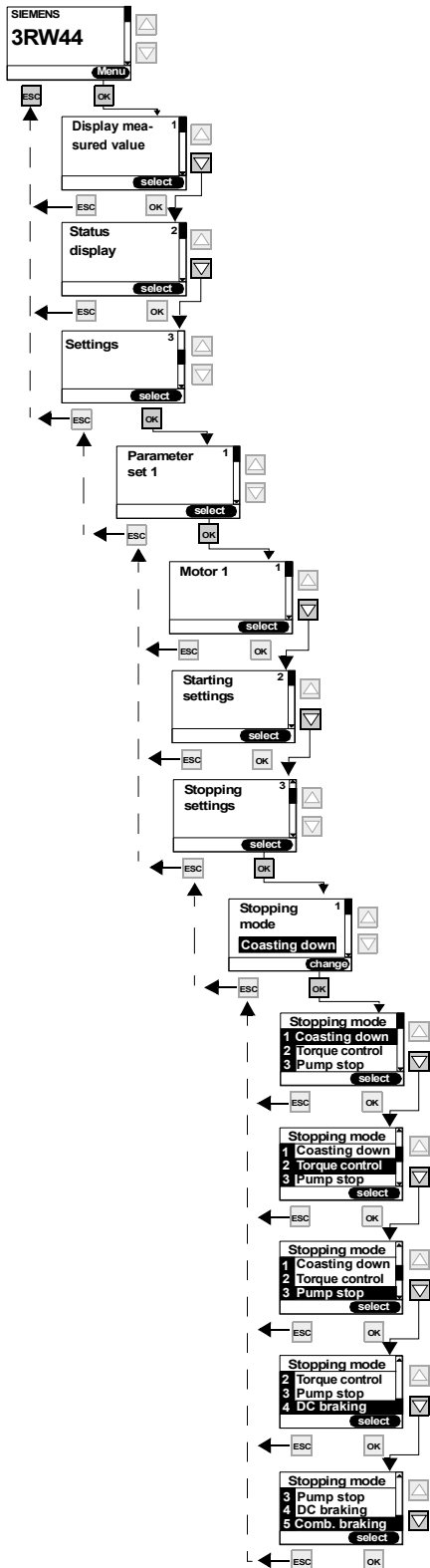


Figure 5-14: Specifying the stopping mode

"Coasting down" stopping mode

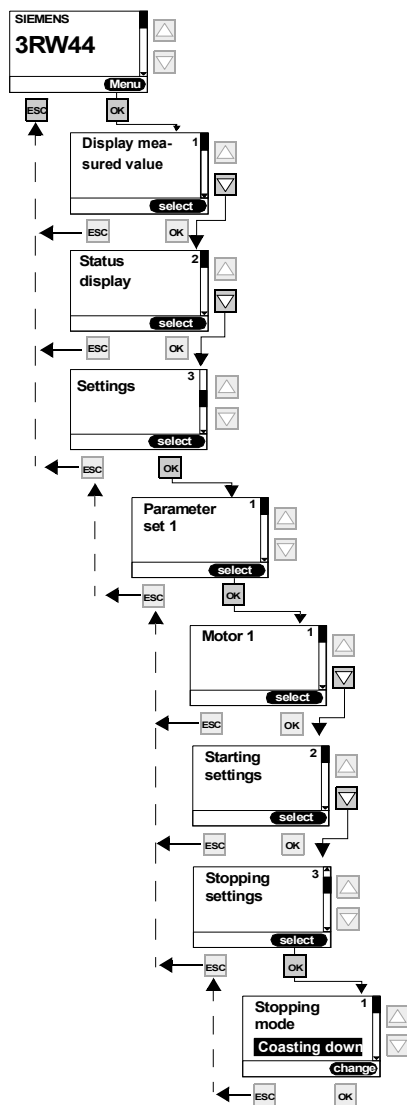


Figure 5-15: "Coasting down" stopping mode

"Torque control" stopping mode (soft stop)

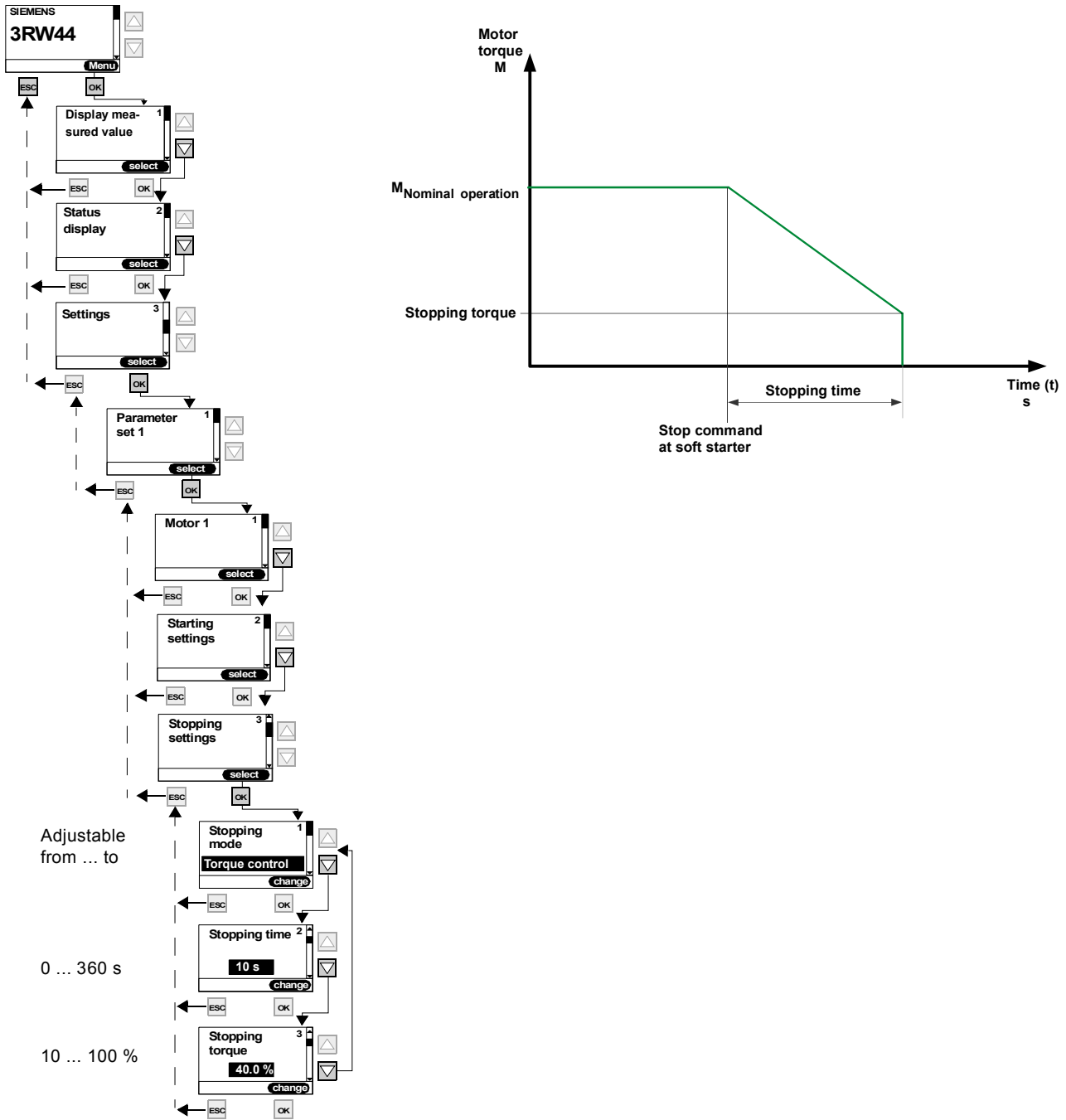


Figure 5-16: "Torque control" stopping mode

"Pump stop" stopping mode

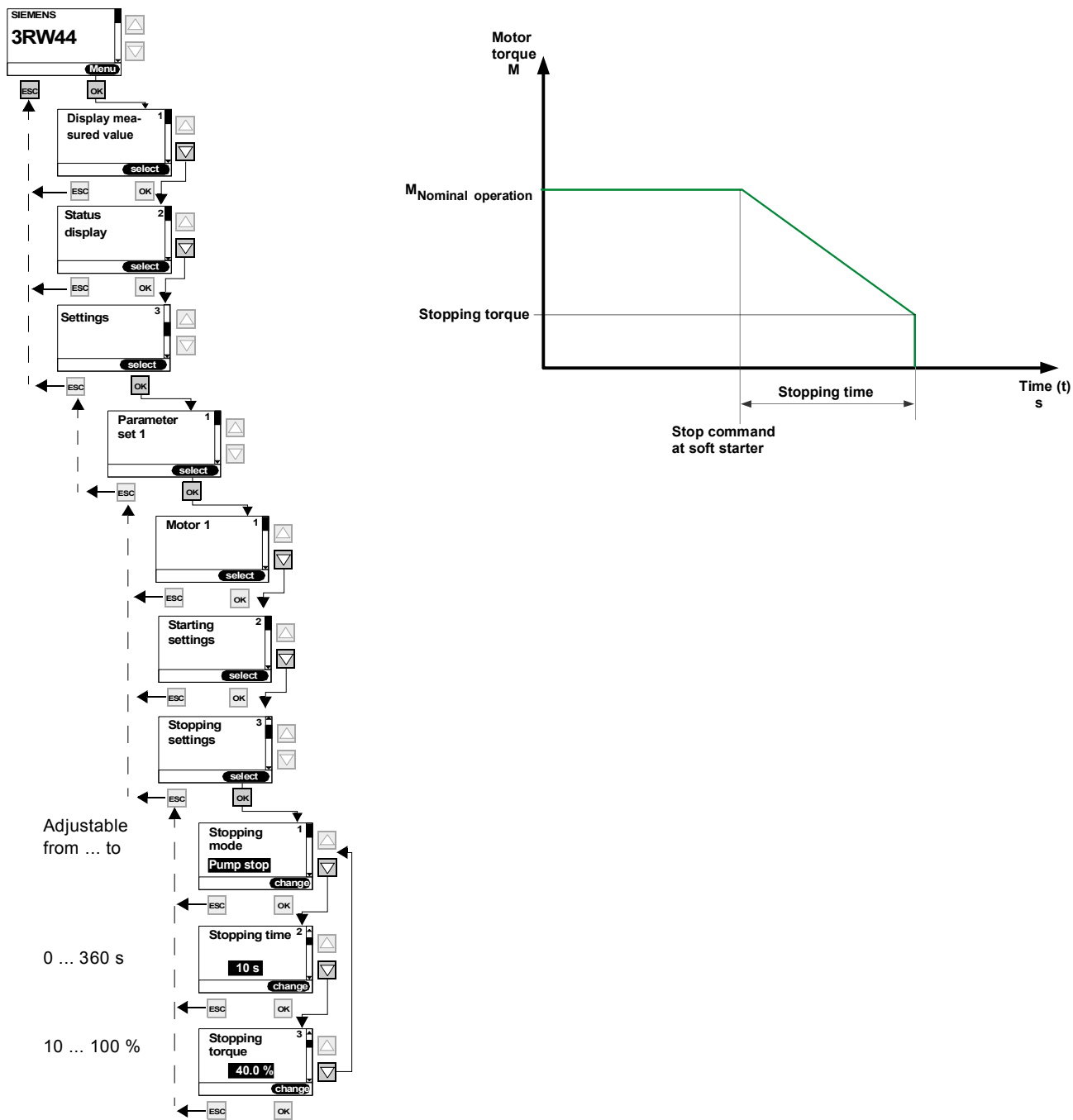
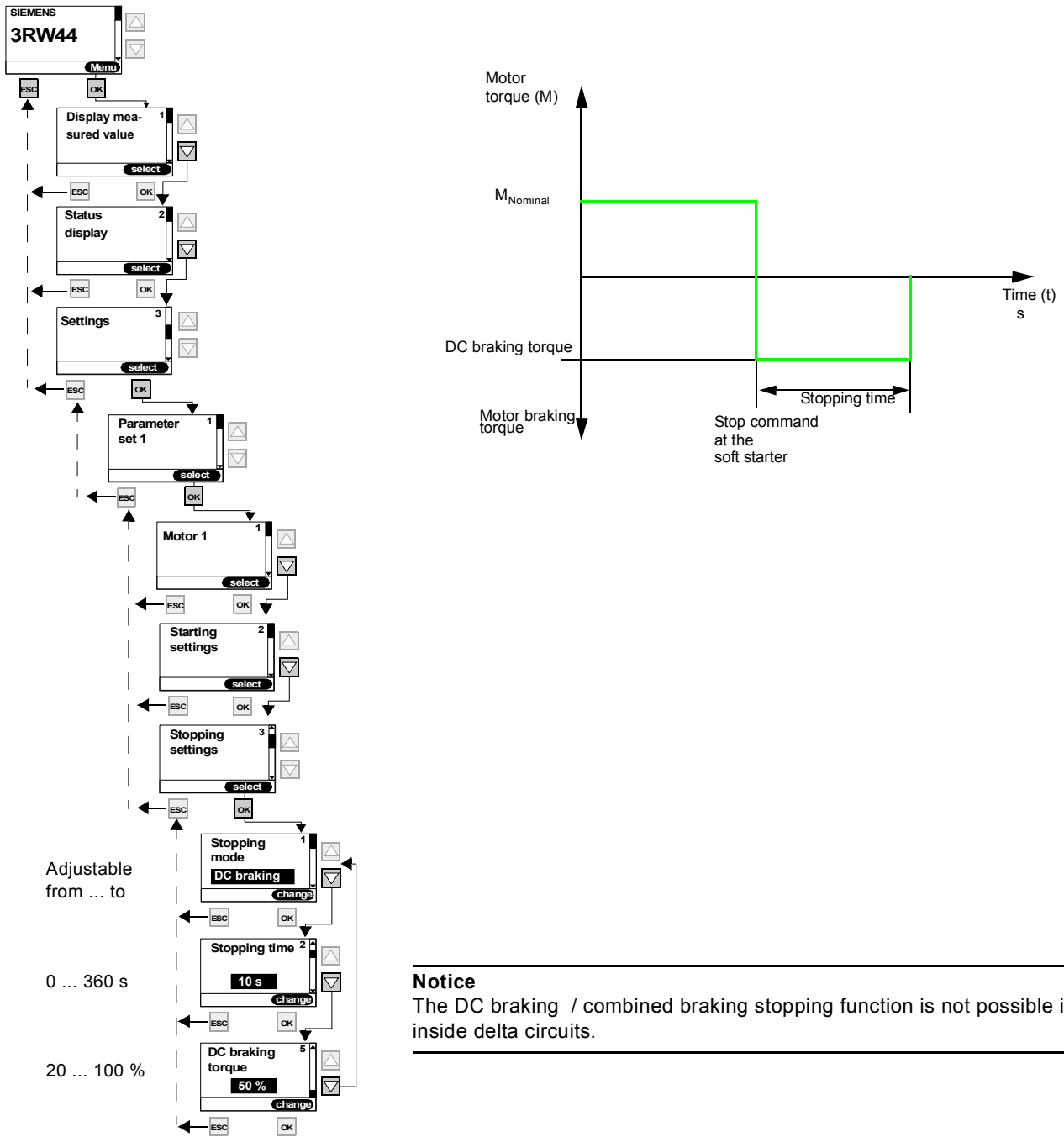


Figure 5-17: "Pump stop" stopping mode

"DC braking" stopping mode



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

Figure 5-18: "DC braking" stopping mode

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

"Combined braking" stopping mode

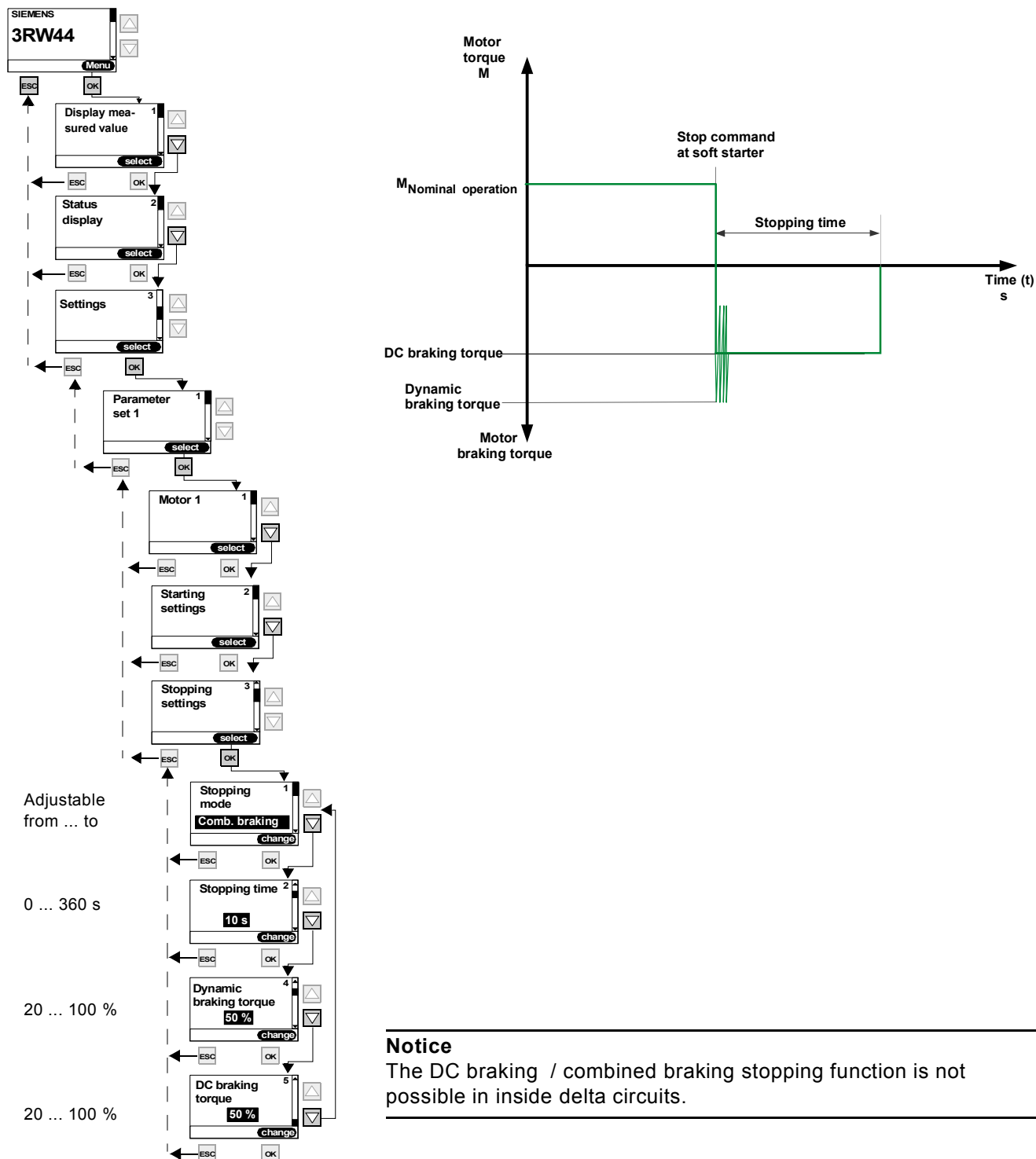
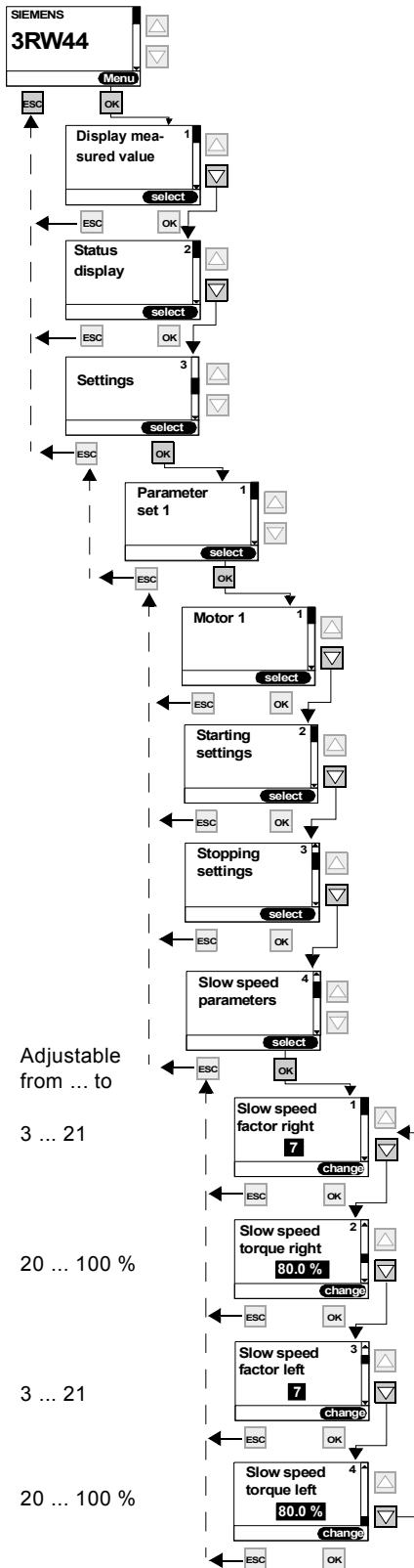


Figure 5-19: "Combined braking" stopping mode

5.4.5 Setting Slow Speed Parameters



Slow-speed parameters

Note

To operate the motor with the specified slow speed parameters, the "Slow speed" function must be assigned to one control input, and the "Motor right PS1/2/3" or "Motor left PS1/2/3" function must at the same time be assigned to the other. Also refer to the circuit suggestion in 9.1.7.

Directions of rotation:

Right: rotation in line phase direction

Left: rotation counter-clockwise to the line phase direction

Figure 5-20: Setting slow speed parameters

5.4.6 Specifying Current Limit Values

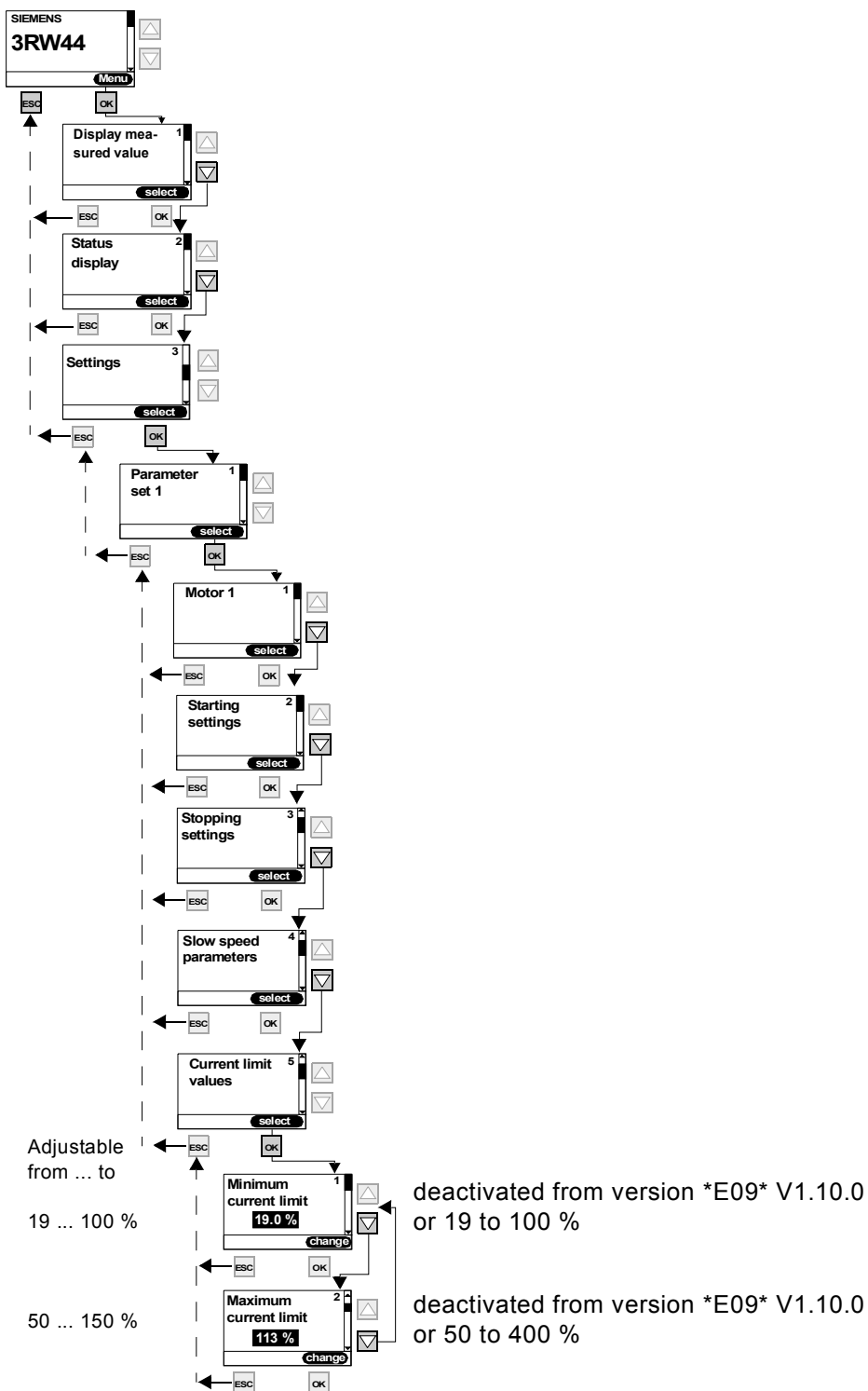
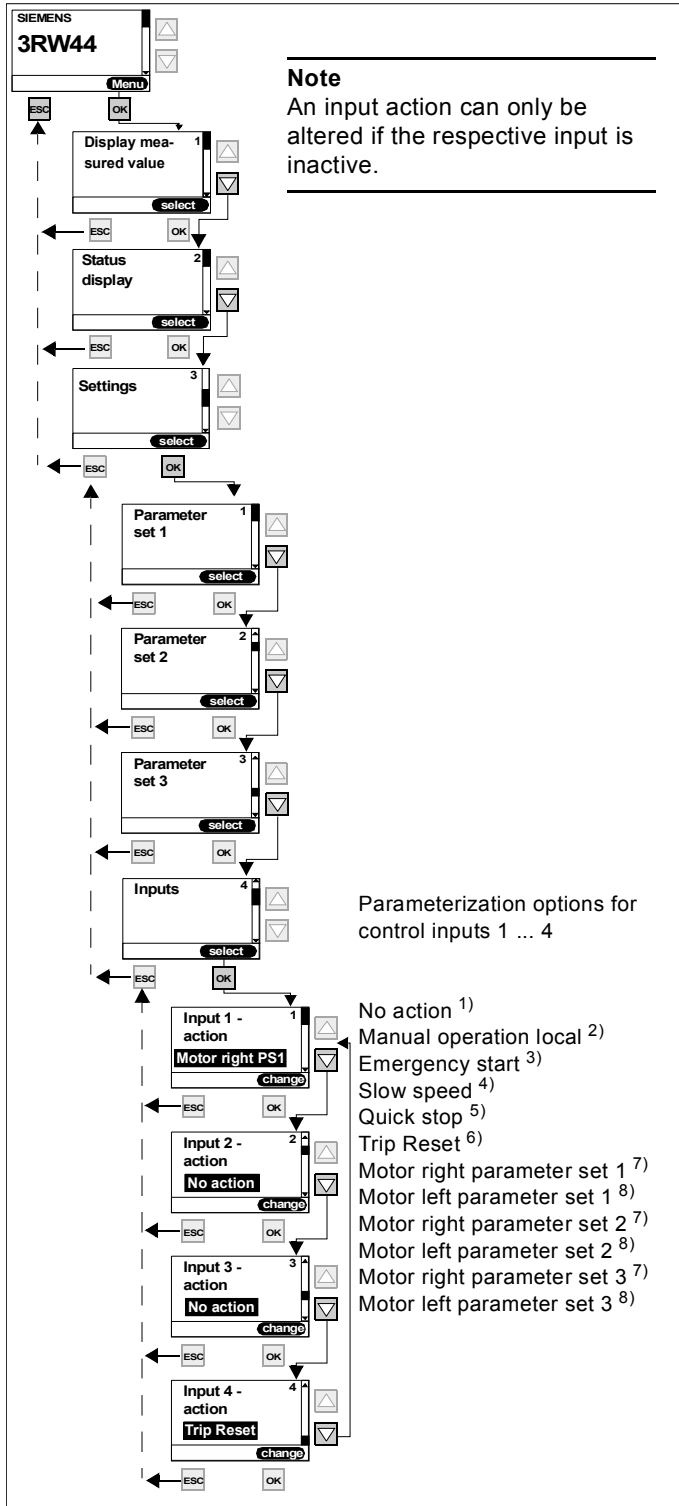


Figure 5-21: Specifying current limit values

5.4.7 Parameterizing the Inputs



Notice

If the same action is assigned to two different inputs, both of the inputs must also be operated in order 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 inherent 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 function via PROFIBUS is 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 detected, impermissible Ie / 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, and, for example, "Motor right > parameter set 1" 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) **Quickstop:**

If the input is activated, a normal tripping with the currently set stopping function is carried out (no group error appears). The quickstop 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 "Slow 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).

Note

The "Trip Reset" input is edge-triggered, the level change from 0 to 24 V DC is analyzed at the input. All other input functions are analyzed on top of the already pending 24 V DC level.

Figure 5-22: Parameterizing the inputs

5.4.8 Parameterizing the Outputs

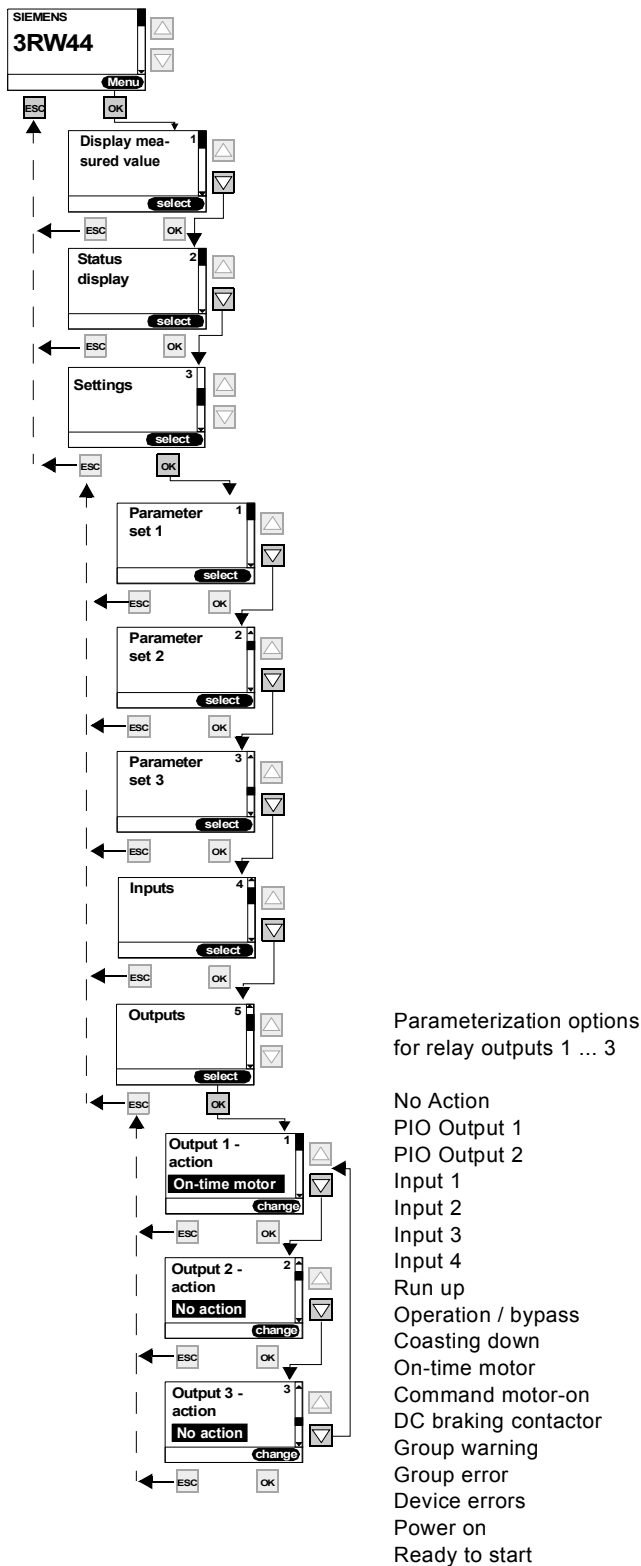
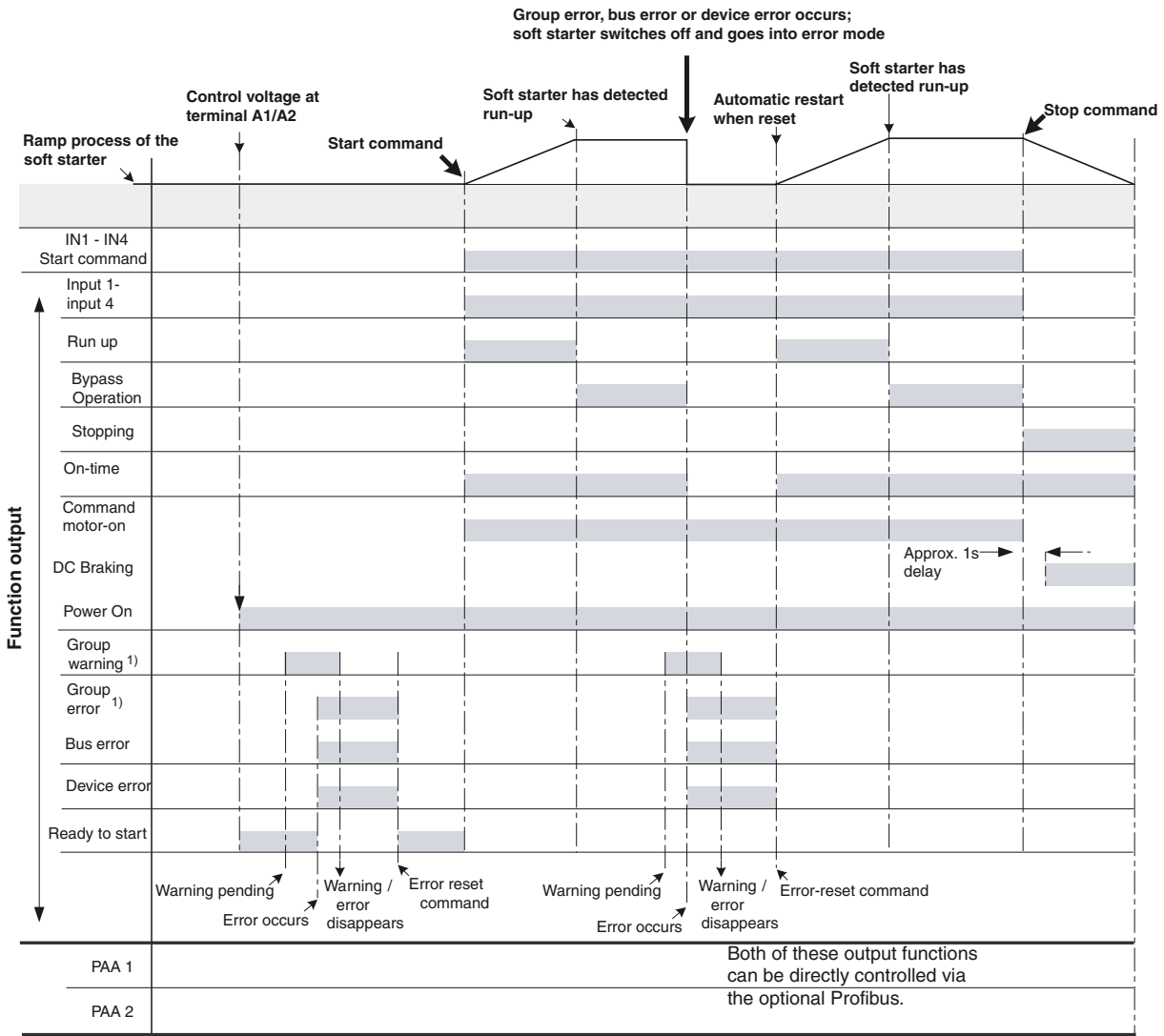


Figure 5-23: Parameterizing the outputs

Status diagram of the outputs



1) Note

Possible group warnings / group faults see Chapter 7.1.2 "Warnings and Group Errors".

5.4.9 Selecting Motor Protection Settings

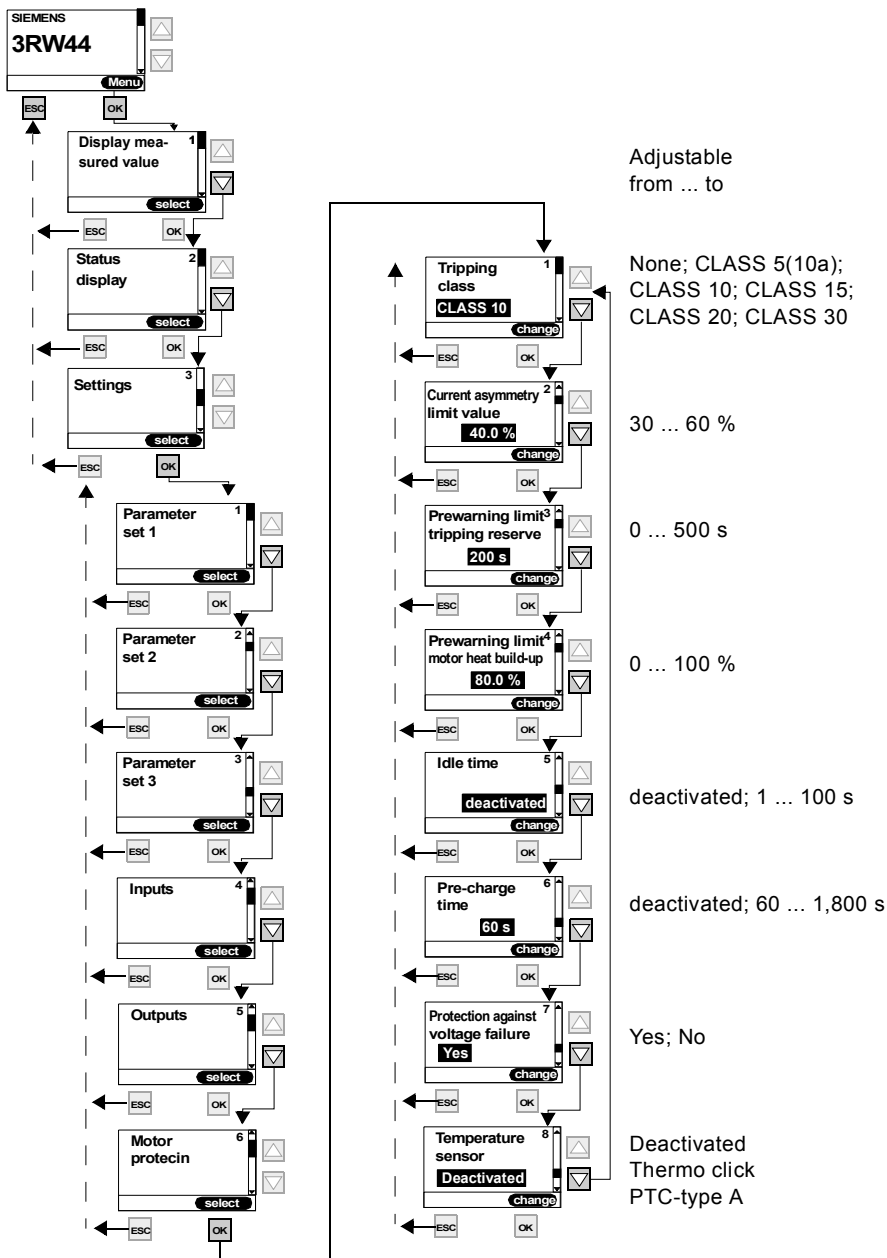


Figure 5-24: Selecting motor protection settings

Notice

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

Notice

If a CLASS setting other than 5(10a) or 10 is 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 I_e / CLASS settings" may be issued.

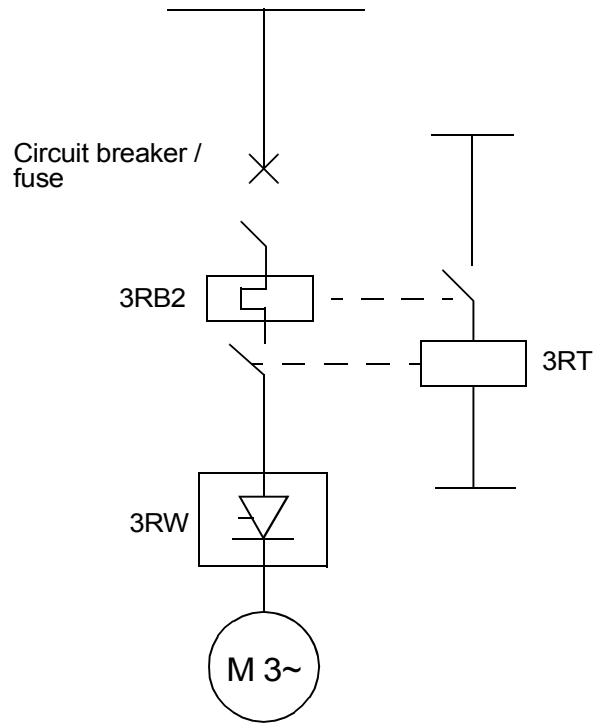
For the maximum permissible set value for the rated operating current I_e of the motor based on the CLASS settings, please refer to Chapter 10.3.2 "Technical Data Power Unit".

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 switching element (e.g. contactor 3RT), the 3RW44 can be installed in series to this overload relay, meaning 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

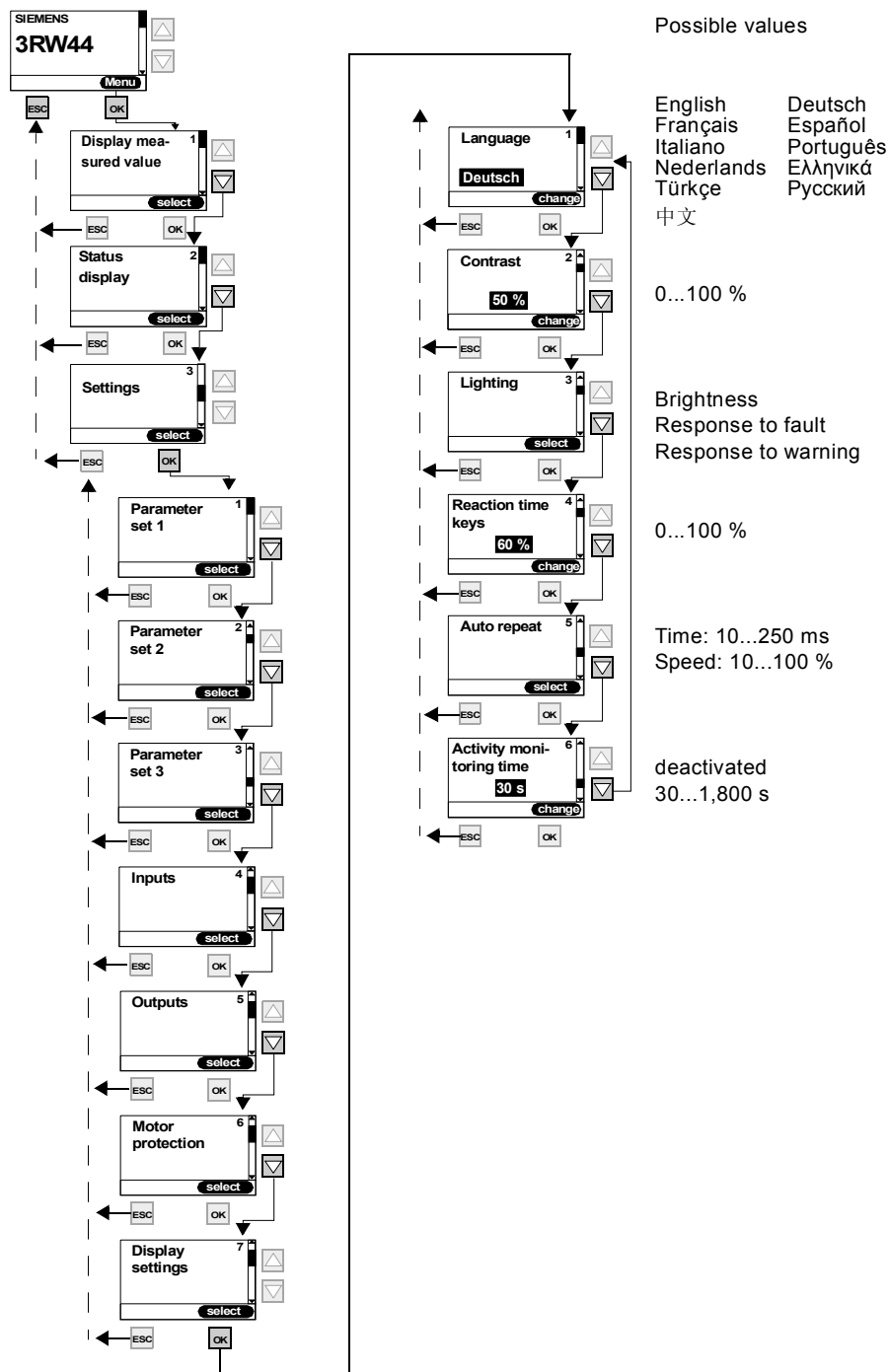


Figure 5-25: Selecting display settings

5.4.11 Specifying the Behavior of the Protective Functions

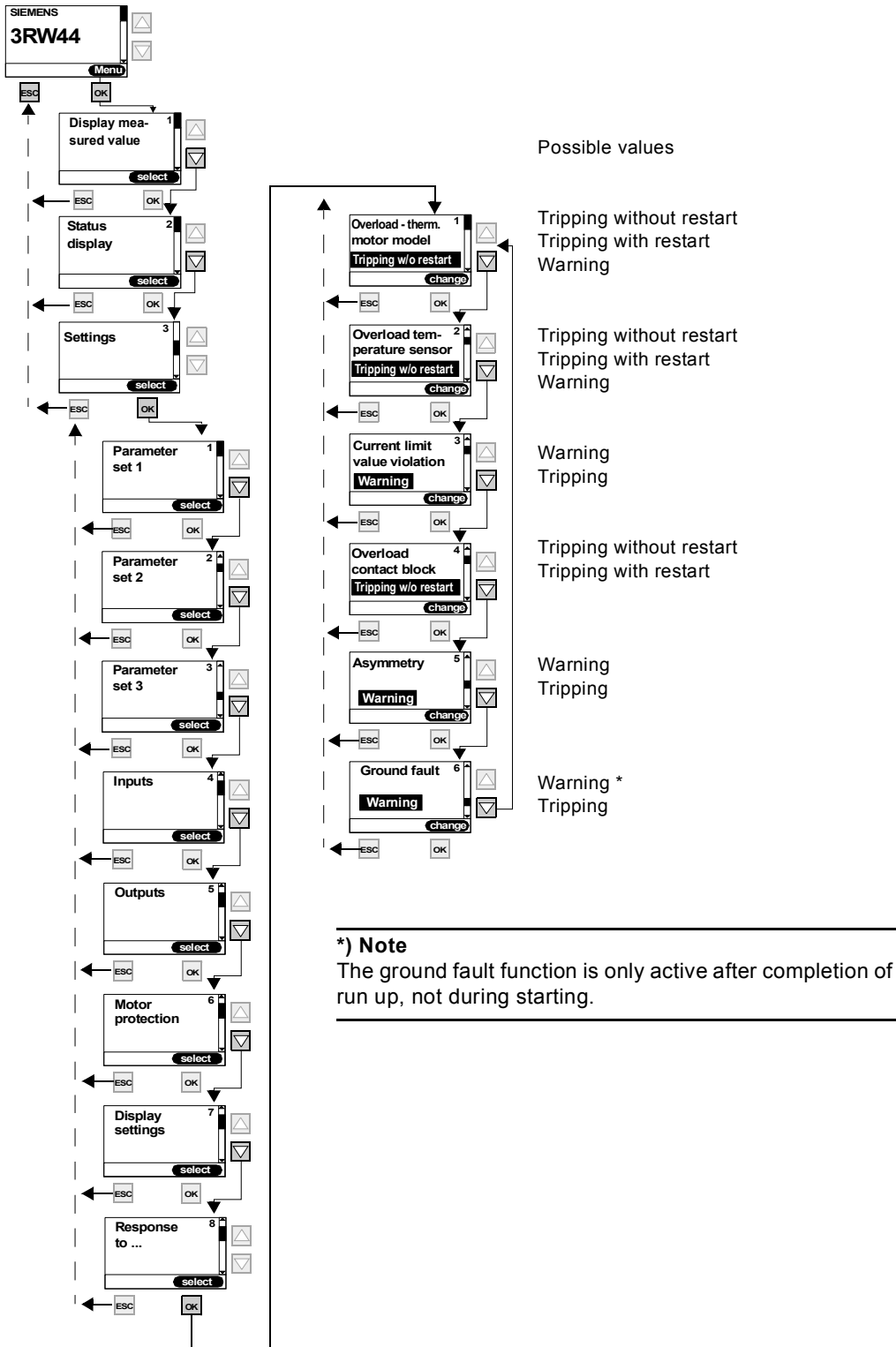


Figure 5-26: Specifying the behavior of the protective functions

5.4.12 Specifying the Names on the Device Display

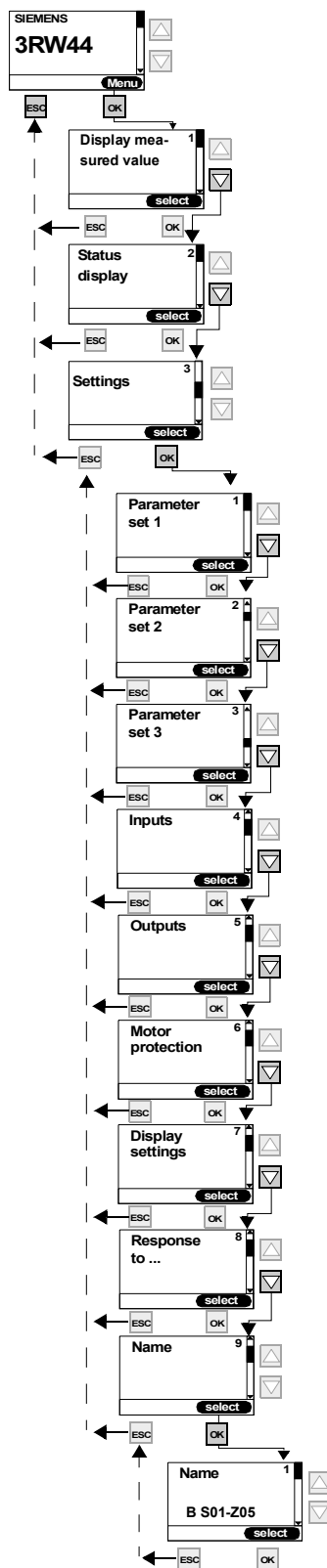
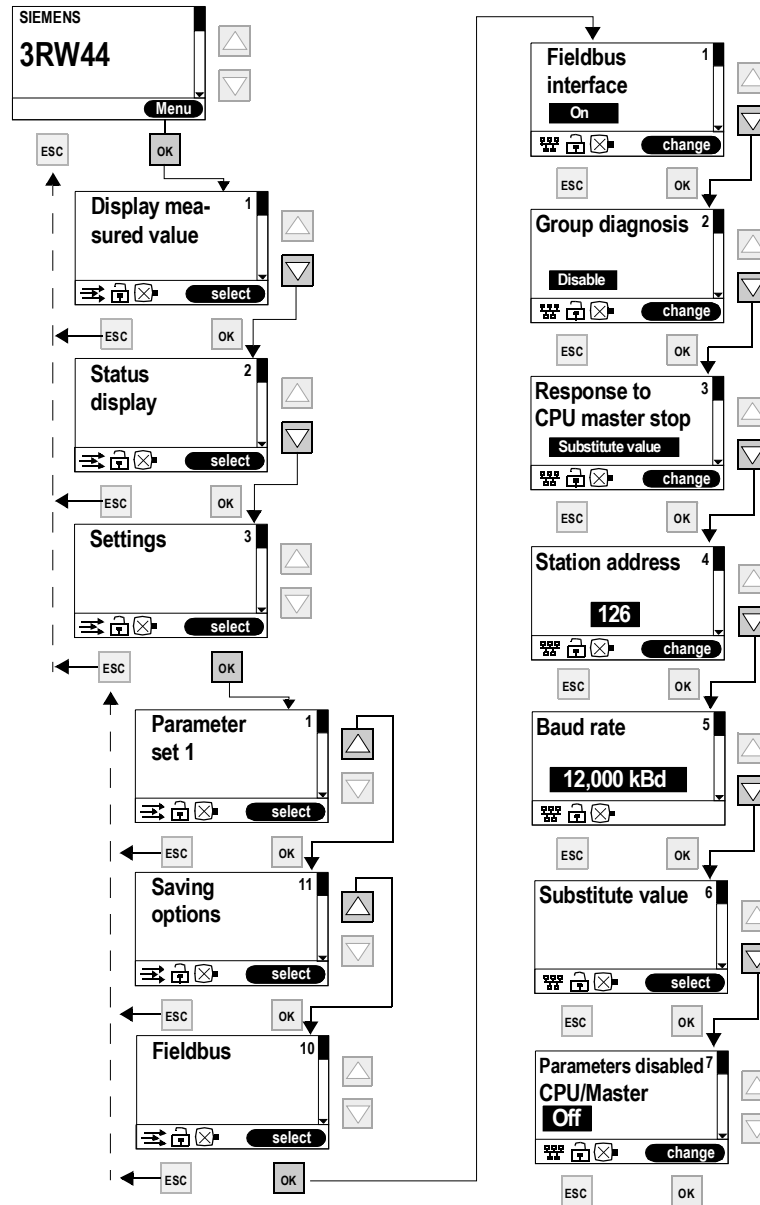


Figure 5-27: Specifying the names on the device display

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".

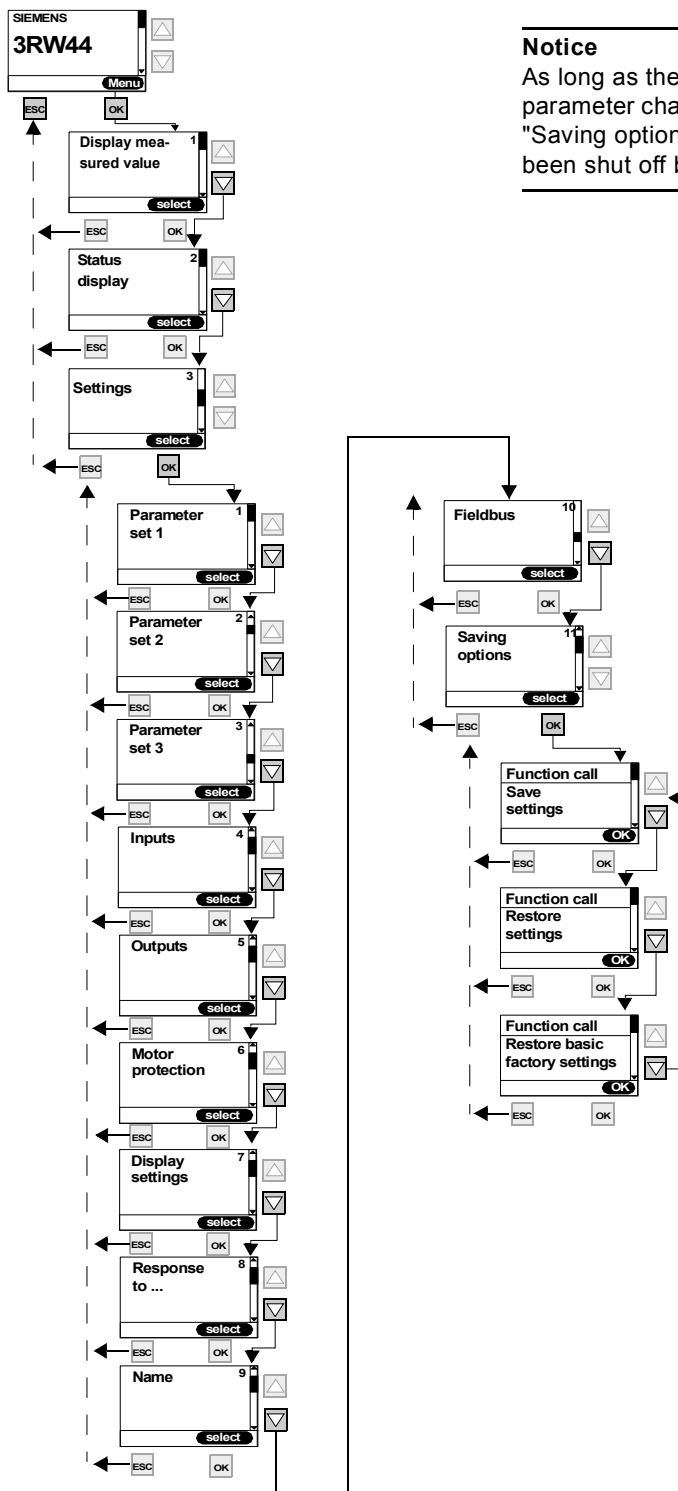


Notice

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 file 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 is controlled by 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

Save settings

Selected settings will be saved.

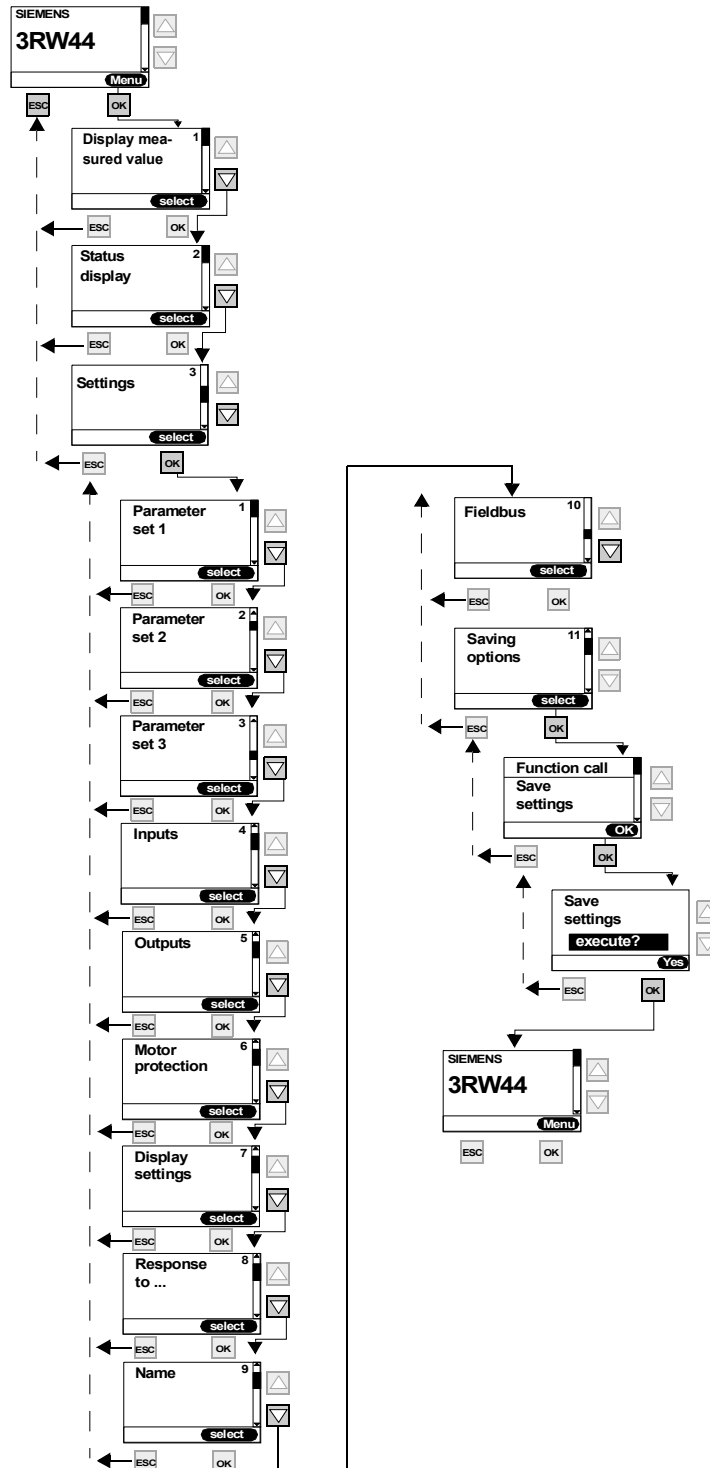


Figure 5-29: Save settings

Restore settings

Selected settings which have not been saved will be discarded and the previously saved settings will be restored.

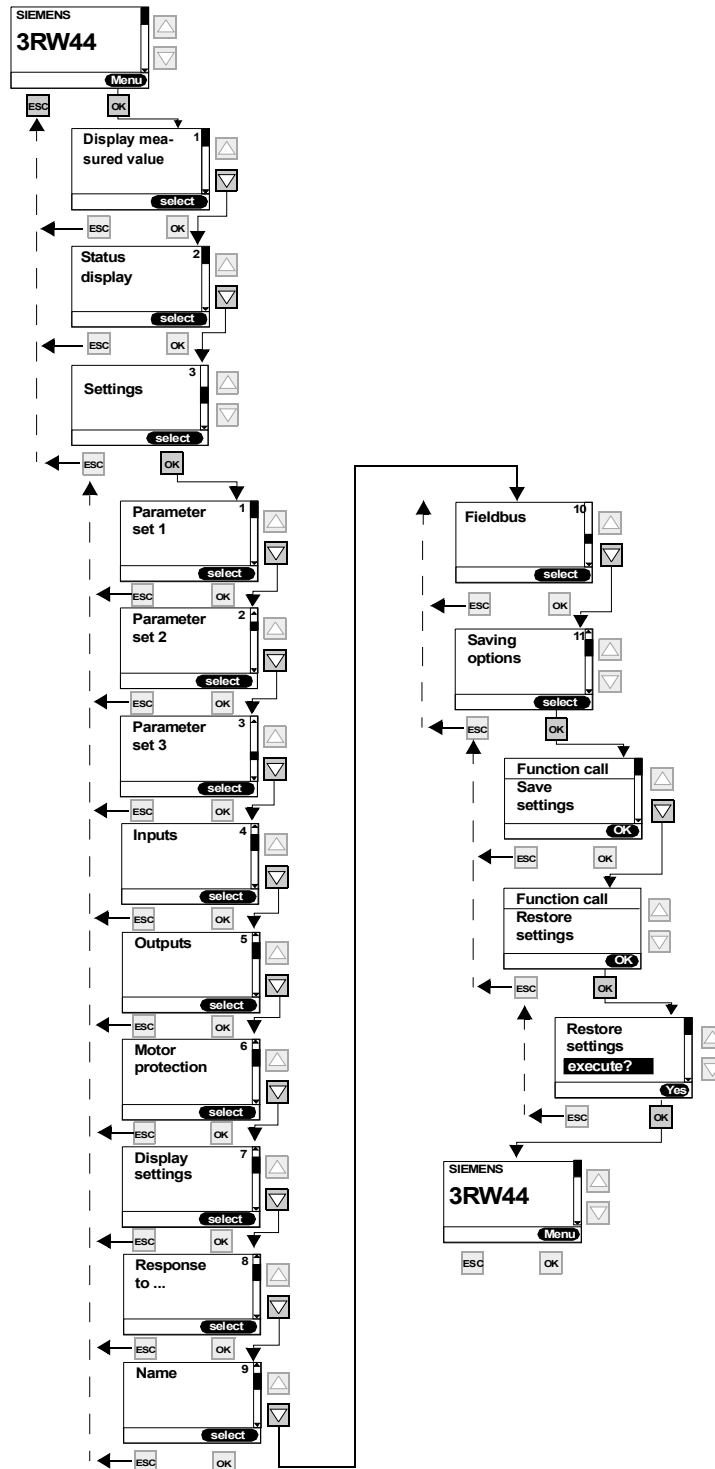


Figure 5-30:Restore settings

Restoring the factory settings

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

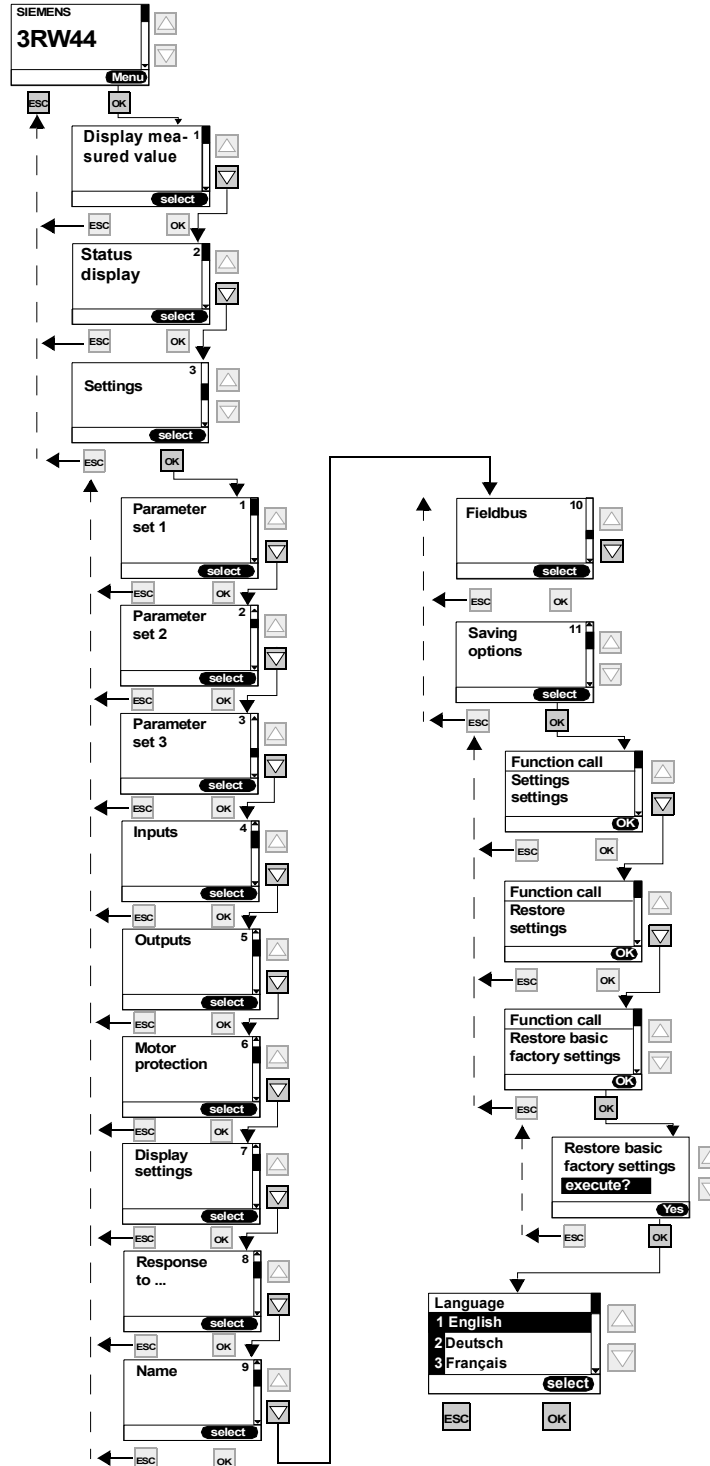


Figure 5-31: Restoring factory settings

5.5 Other Device Functions

5.5.1 Display measured value

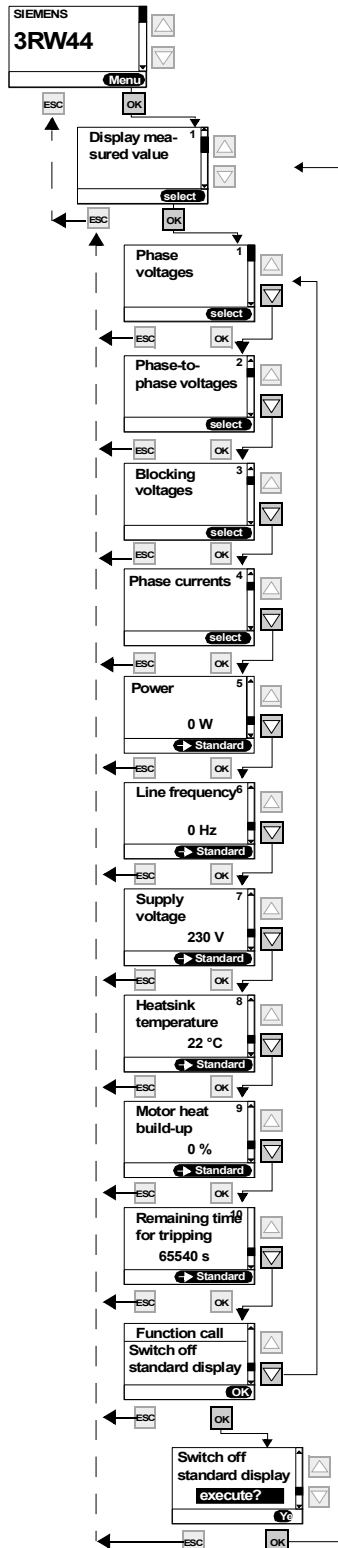


Figure 5-32: Display measured value

Note

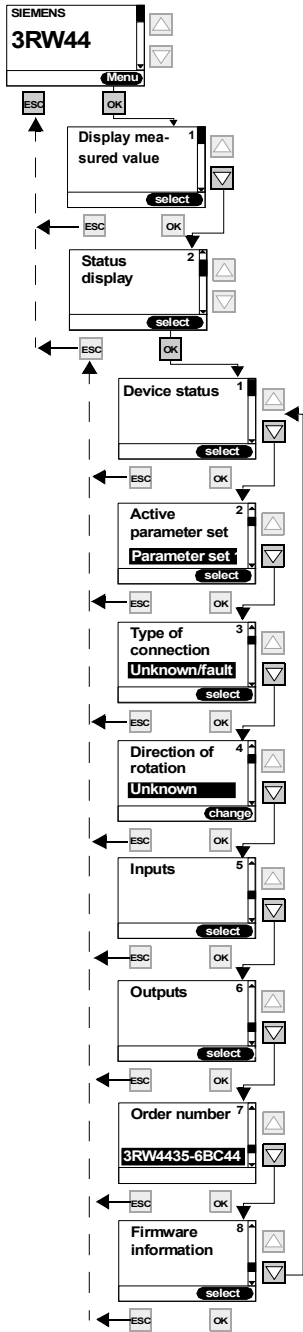
When using the 3RW44 soft starter in an IT system with ground fault monitoring: 3RW44, product version \leq *E06* and the PROFIBUS DP communication module must not be used in this network configuration. 3RW44 soft starters, from product version *E07* onwards, can be used in combination with the PROFIBUS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

Note

The "Phase currents" display always shows the currents in the supply cable. This means that, 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 displayed in the inside delta circuit may deviate from the currents that are actually running through the supply cables.

5.5.2 Status Display



Explanation of the messages:

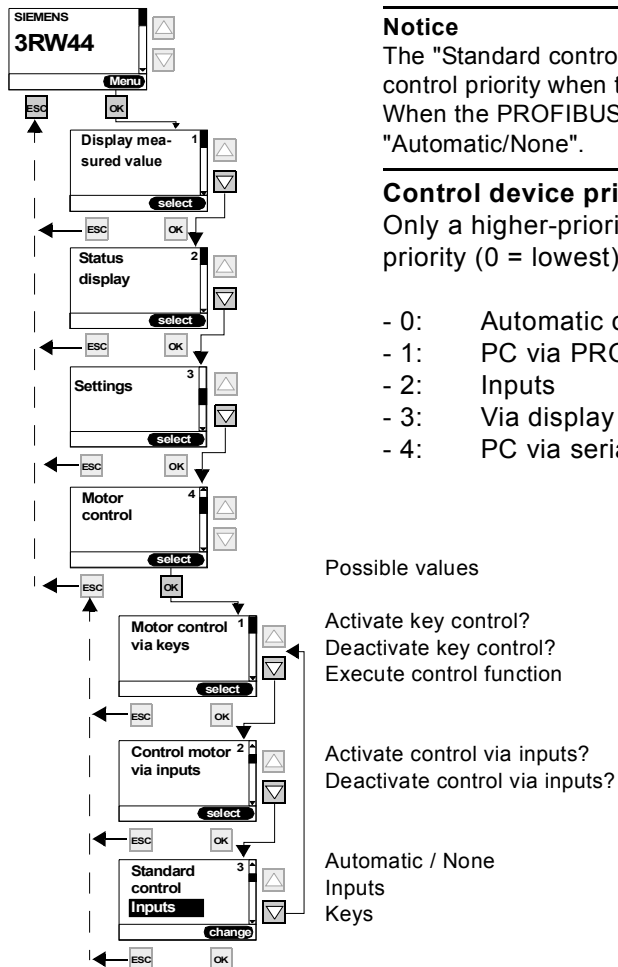
- Unknown/fault:** No connected motor detected.
- Star/delta:** Soft starter connected in a standard circuit.
- Inside delta:** Soft starter connected in an inside delta circuit.

- Unknown:** No line phase direction of the main voltage detected at terminals L1-L2-L3.
- Right:** Clockwise line phase direction of the main voltage detected at terminals L1-L2-L3.
- Left:** Counter-clockwise line phase direction of the main voltage detected at 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 given control priority when the control supply voltage is applied. When the PROFIBUS communication module is activated, 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).

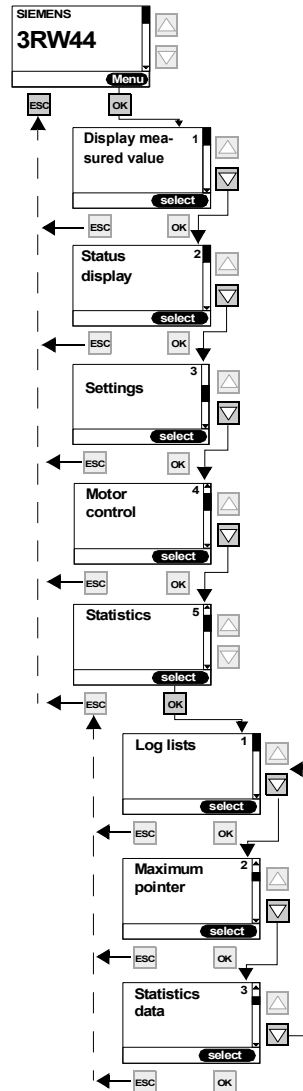
- 0: Automatic operation (input control through PLC via PROFIBUS)
- 1: PC via PROFIBUS (Soft Starter ES software required)
- 2: Inputs
- 3: Via display keys
- 4: PC via serial interface (Soft Starter ES software required)

Possible values

- Activate key control?
- Deactivate key control?
- Execute control function
- Activate control via inputs?
- Deactivate control via inputs?
- Automatic / None
- Inputs
- Keys

Figure 5-34: Motor control

5.5.4 Statistics

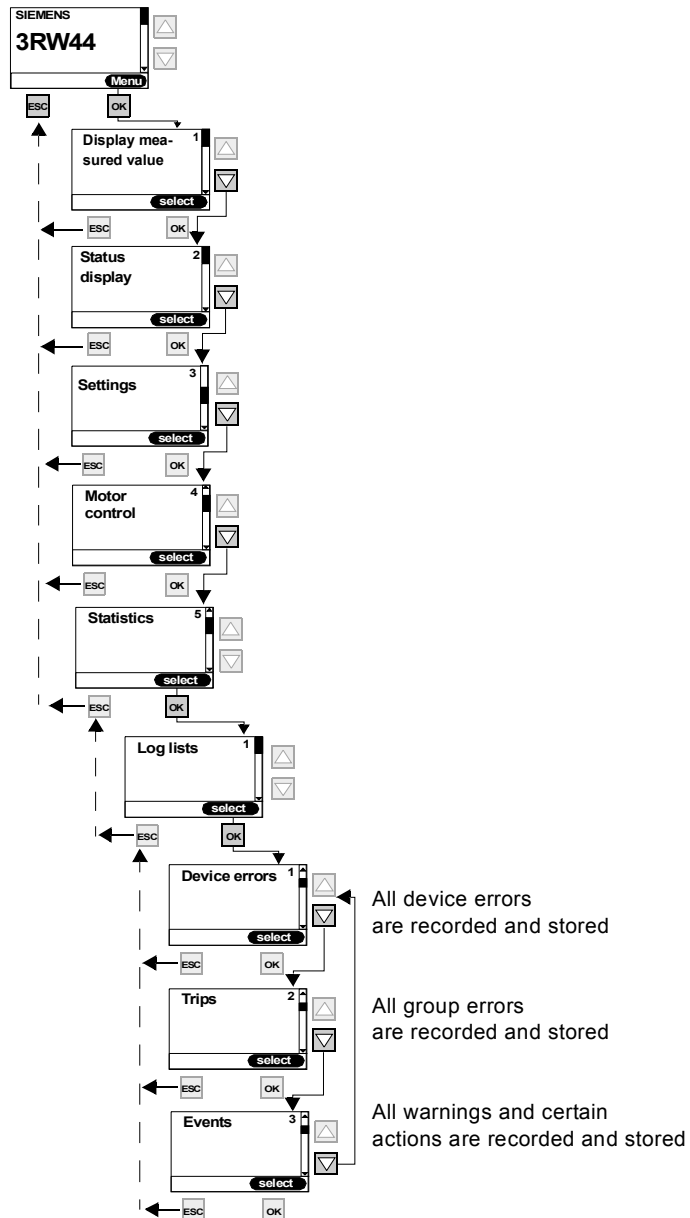


Notice

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 can only be used in combination with "Soft Starter ES" parameterizing and diagnostics software. This menu item will be available in the device display from 04/2006.

Figure 5-35: Statistics

5.5.4.1 Log lists

**Notice**

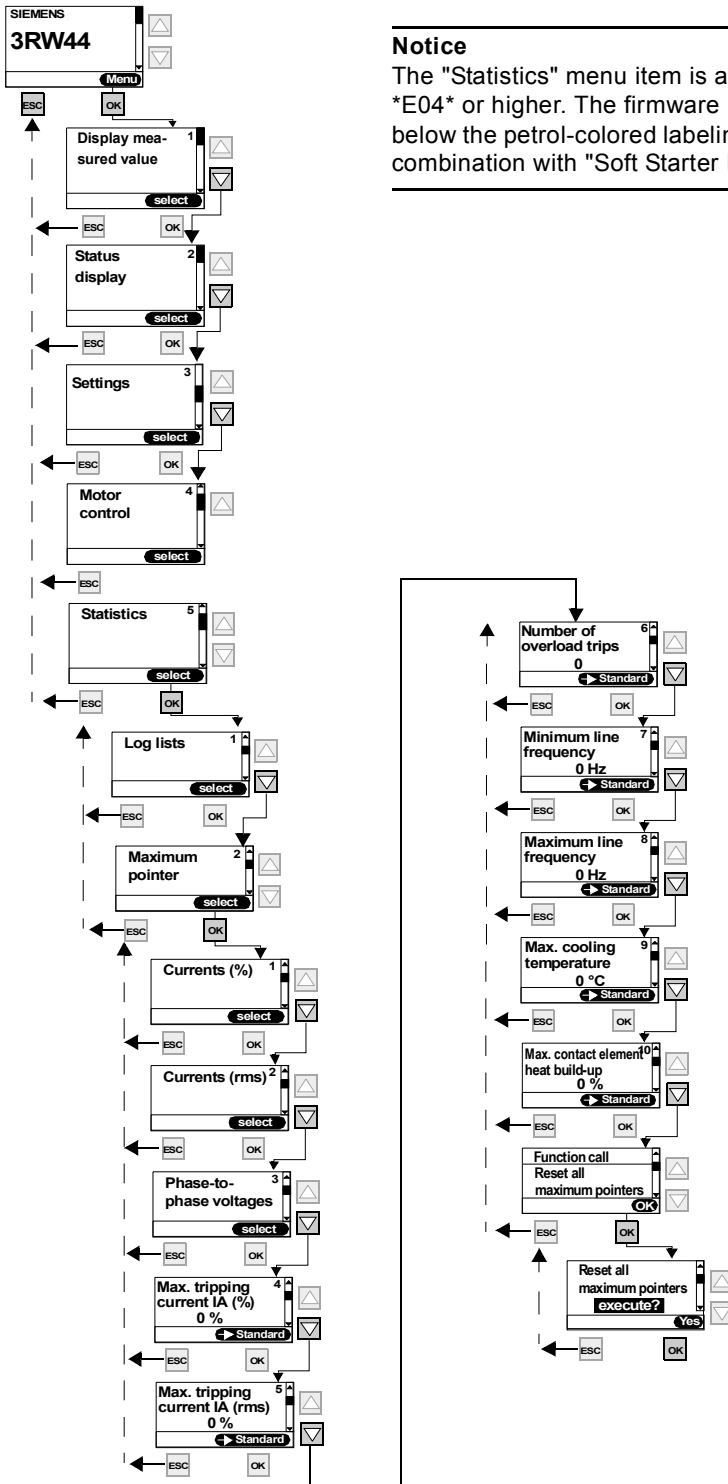
The "Statistics" menu item is available for devices with firmware product version *E04* or higher. The firmware product version is listed on the front of the device below the petrol-colored labeling field. The "Log lists" sub-item can only be used in combination with "Soft Starter ES" parameterizing 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 is running.

5.5.4.2 Maximum Pointer

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

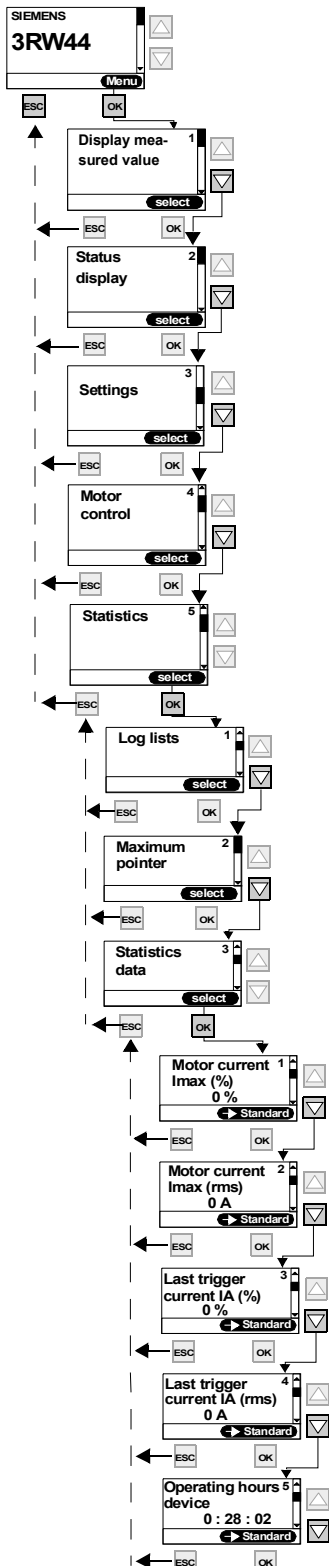


Notice

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 can only be used in combination with "Soft Starter ES" parameterizing and diagnostics software.

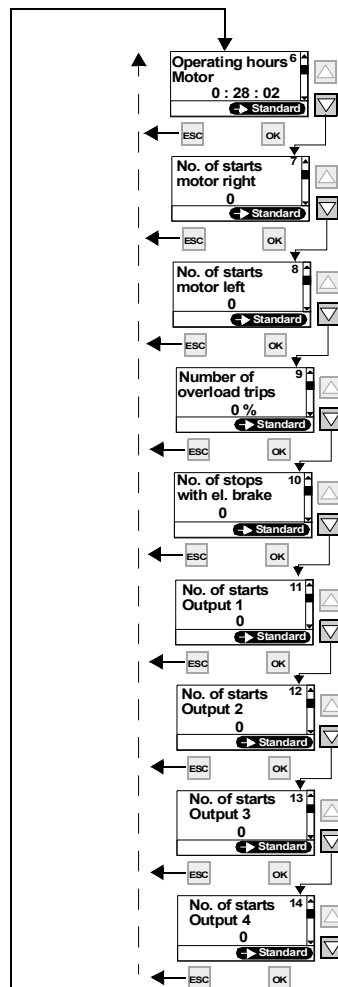
Figure 5-36: Maximum pointer

5.5.4.3 Statistics Data



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 can only be used in combination with "Soft Starter ES" parameterizing and diagnostics software.



Note

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

Note

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

Note

The value is increase by one when the output is activated.

Note

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

Figure 5-37: Statistics data

5.5.5 Safety (Specifying the User Level, Parameterization Protection)

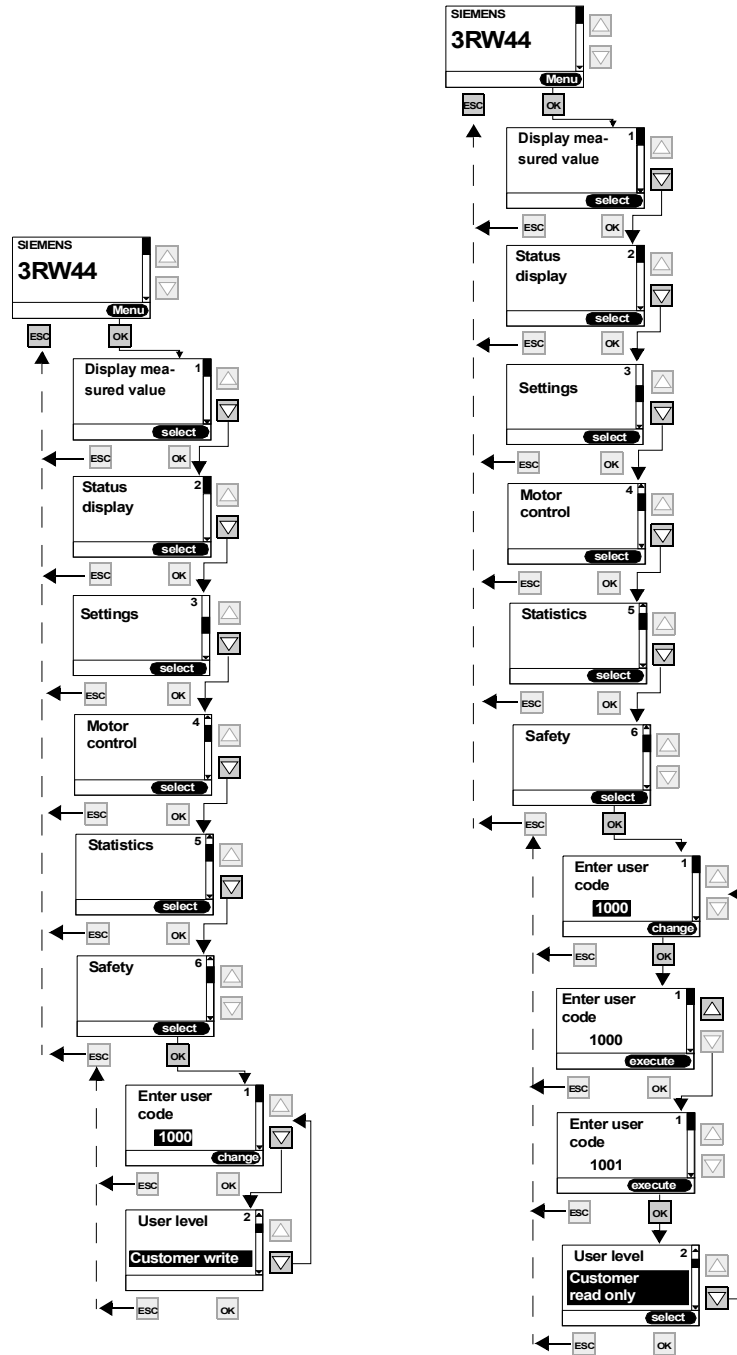


Figure 5-38: Safety

Device Functions

6

Chapter	Subject	Page
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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 in such a way 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 can be used to determine the time after which the drive must have completed its 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 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.

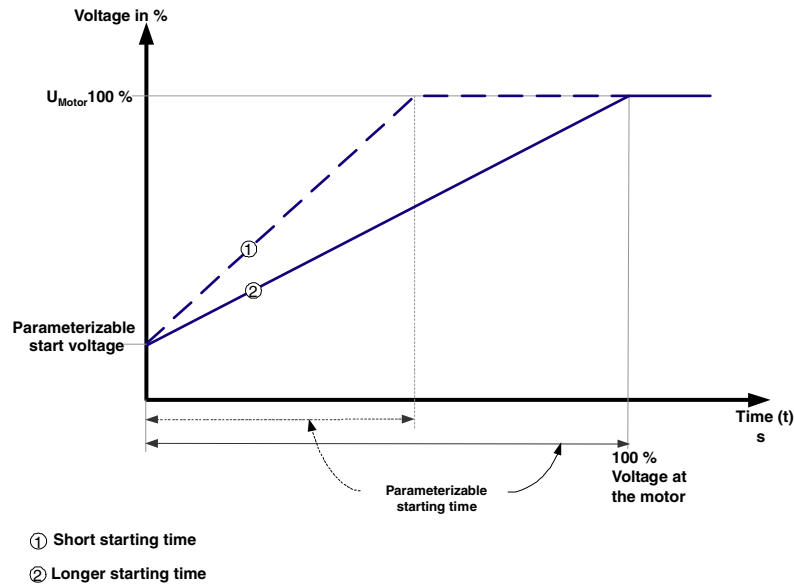


Figure 6-1: Function principle of voltage ramp

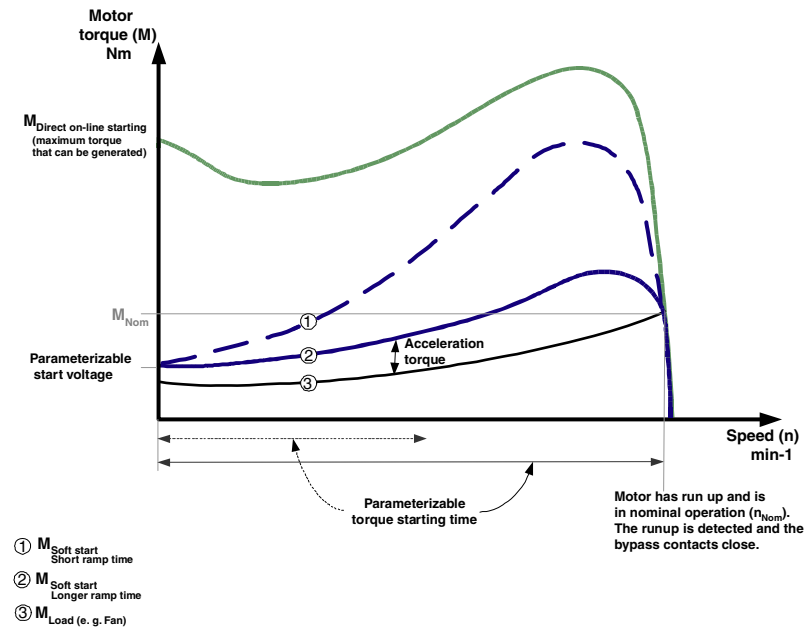


Figure 6-2: Function principle of voltage ramp / torque curve

Typical applications for voltage ramps

The voltage ramp function principle is suitable for all types of application. If test runs with the application are carried out using motors that are smaller than those to be used in the actual system, 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 are 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 ($= \cos \varphi =$ 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 the 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 starting procedure, the motor data of the motor connected to the soft starter should be entered in the selected parameter set using the menu item "Setting".

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 run-up. This value can thus also act as an adjustable torque limitation. In order to achieve a successful run-up, the parameter value should be set to approx. 150 %. It should, however, be at least high enough so that the motor does not get stuck during run-up. 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 in such a way 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 can be used to determine the time after which the drive must have completed its 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 set 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 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 on line start at the same speed.

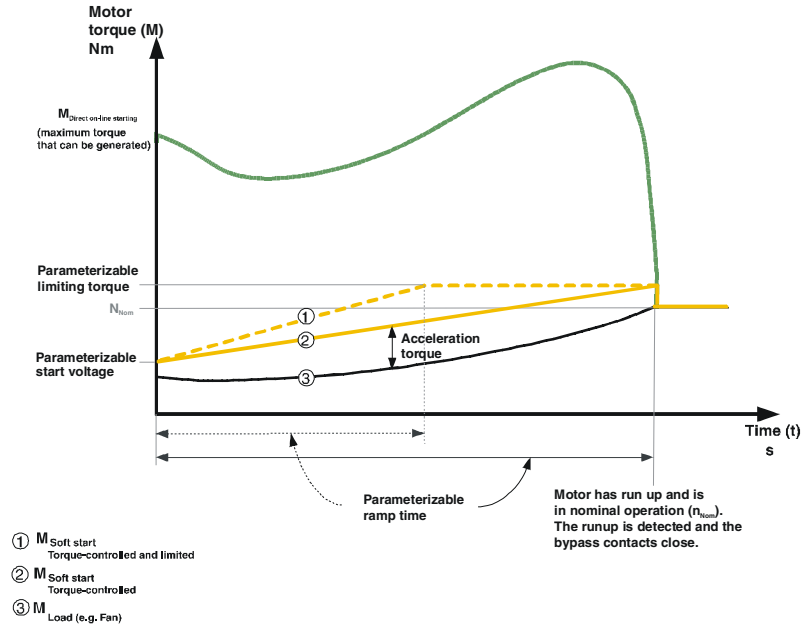


Figure 6-3: Function principle of torque control

Typical applications for torque control

Torque control is suitable for all applications, especially in cases where a consistent and smooth start 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 set breakaway time.

Breakaway voltage

The breakaway voltage setting determines height of the the breakaway torque to be generated. Its maximum value can be 100 % of the start torque generated in direct on line starting. The pulse should be at least 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 set time has elapsed, the motor does not remain stationary again but rather directly continues to accelerate in the selected starting mode. If 0 ms is set as the breakaway time (default), the breakaway pulse function is deactivated.

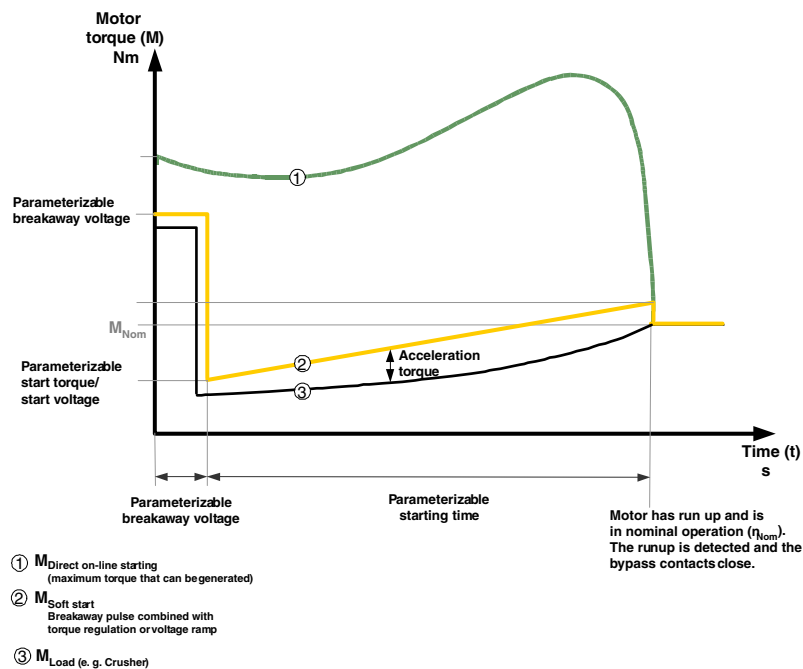


Figure 6-4: Function principle of breakaway pulse / torque control

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 set 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 and 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 limiting value on the soft starter.

The current limiting can be activated if "Voltage ramp+current limiting" or "Torque control+current limiting" has been selected as the 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 set breakaway pulse is superimposed on the current limiting during the breakaway time.

Current limiting value

As a factor of the motor rated current, the current limiting value is set to the maximum current required during the starting procedure. If the set current limiting value is reached, the motor voltage is lowered (or regulated) by the soft starter in such a way that the current will not exceed the set current limiting value. The set current limiting value must be at least selected high enough for enough torque to be created in the motor to bring the drive into rated operation. A typical value can be 3 to 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 close and the thyristors are bridged.

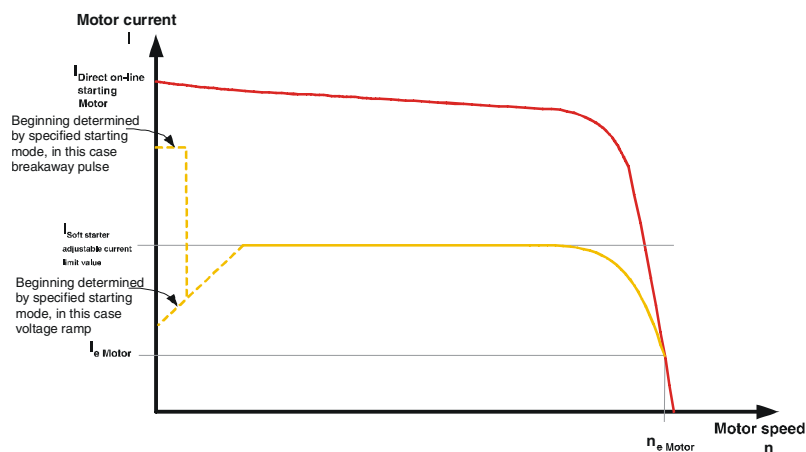


Figure 6-5: Current limiting with soft starter

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 for the soft starter to be dimensioned larger.

Run-up recognition

The soft starter features an internal run-up recognition. If a completed motor run-up is recognized, the internal bypass contacts 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 for example 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 (Thermo click/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 during the stopping procedure, this procedure 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 the motor), since the current exceeds the rated motor current during the stopping procedure.

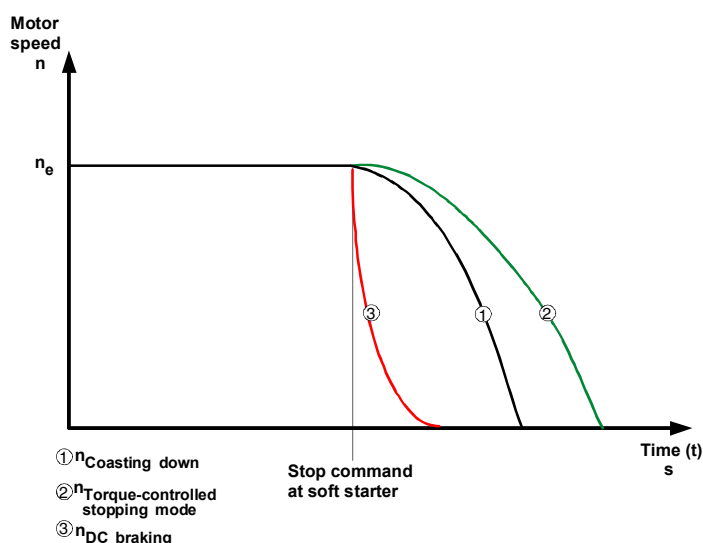


Figure 6-6: Stopping modes in general

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 also referred to 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 stopping" and "Pump stop" mode, the coasting down / natural run-down procedure 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 procedure, the motor data of the motor connected to the soft starter should be entered in the selected parameter set using the menu item "Setting".

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 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 can occur if the drive is stopped abruptly without using pump stop. These water hammers are caused by the sudden stall and the accompanying pressure deviations in the pump. They cause noise and a mechanical impact on the piping system, as well as on the flaps and valves it contains.

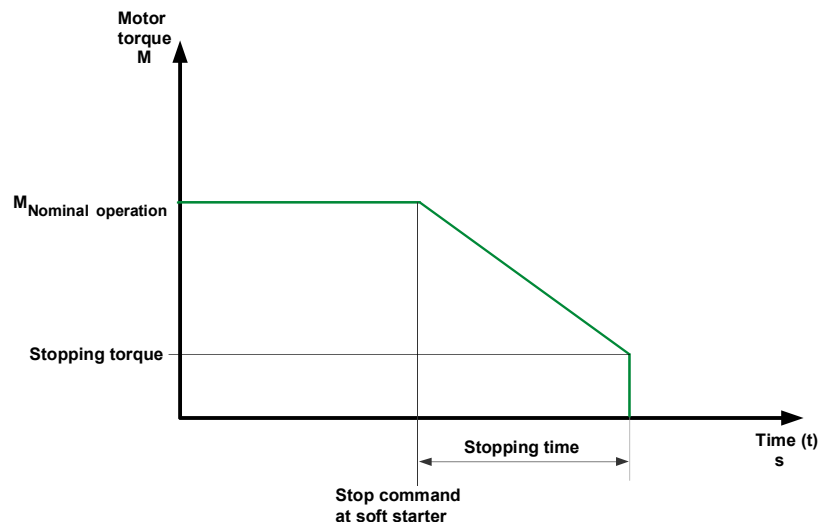


Figure 6-7: Soft stop / pump stop

Typical applications for soft stop / pump stop

Use soft stop / pump stop

- in pumps to prevent water hammers.
- in conveyor belts to prevent materials 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 into 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-circuited rotor winding, creating a braking torque.

Notice

The DC braking / combined braking stopping function is not possible in inside delta circuits.

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. It may be necessary to overdimension the soft starter.

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 braking time of uniform length 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 set 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 speed of the motor. The braking process is then continued using the DC braking 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 the braking torque should be 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 centrifugal mass (J) of the load should not exceed that of the motor. The stopping time should be long enough for the motor to come 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.

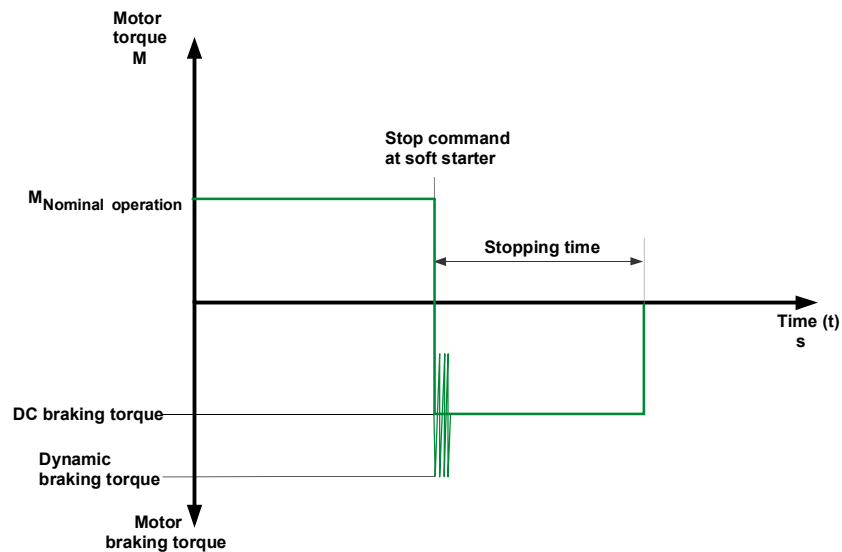


Figure 6-8: Combined braking

Stopping mode: DC braking

If the DC braking function is selected, the stopping time and DC braking torque parameters can be set on the starter. With this braking type, one output of the soft starter must be switched over to DC braking to control an external braking contactor. Please refer to Chapter 9 for circuit suggestions.

The optimum parameters must be adjusted on the machine under appropriate load conditions.

DC braking torque

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

Stopping time

The stopping time determines how long the braking torque should be 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.

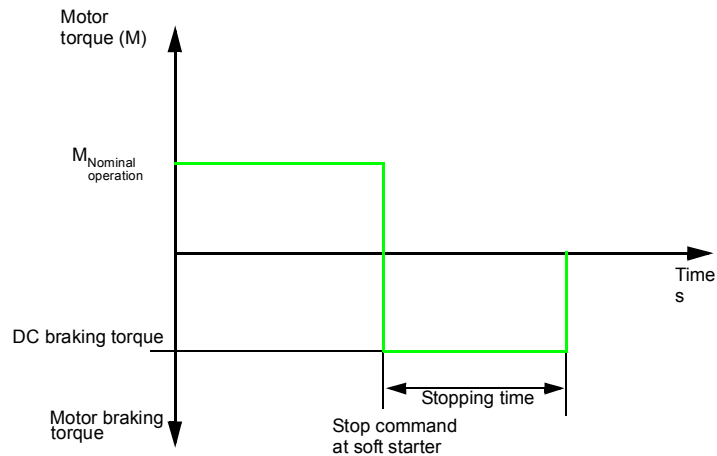


Figure 6-9: DC braking

Typical applications for DC braking

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

6.4 Slow Speed Function

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

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

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

The slow speed factor and the slow speed 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 speed ($n_{\text{Slow speed}}$) that is lower than the rated operating speed either in or against the line phase direction.

$$n_{\text{Slow speed}} = \frac{n_{\text{Nom}}}{\text{Slow speed factor}}$$

Slow speed torque

The torque generated in the motor can be influenced using the slow speed torque. The maximum torque which can be created depends on the slow speed torque that is set. 100 % slow torque can correspond to approx. 30 % of the motor rated operating torque.

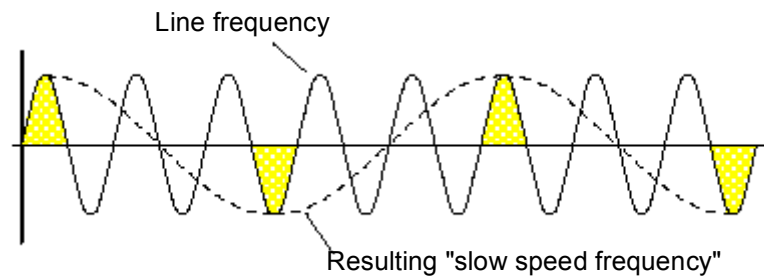


Figure 6-10: Slow speed function

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 speed resulting from the slow speed function and the slow speed 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 suggestion in Chapter 9.1.7.

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 Limit Values for Load Monitoring

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

Minimum current limit value

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

Maximum current limit value

The maximum current 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) in order to obtain so-called full motor protection. This combination is recommended for optimum motor protection.

Motor overload protection

The current flow is measured during motor operation using current measurement via 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 overdimension the 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 set thermal prewarning limit of the motor is reached. Tripping of the motor protection occurs at 100 %.

Idle time

The idle time is a specified 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 lead to tripping where motor protection according to IEC 60947 is used.

The following graphic illustrates the cooling behavior with and without idle time:

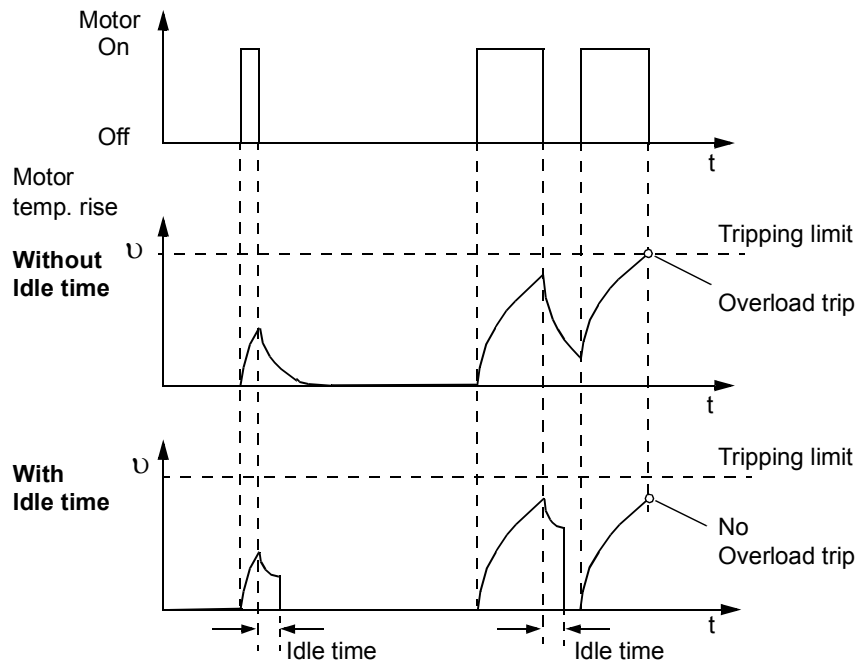


Figure 6-11: Idle time

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 according 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 that parallel protection measures be taken.

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; the motor is prevented 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. a motor with a measuring sensor wound into the stator winding is required.

Two different types of measuring sensors are available for the evaluation.

- PTC type A thermistors ("Type A sensors")
- Thermo click

The wiring and the sensors are checked for wire breaks and 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, additionally, by measuring the temperature with thermosensors at the thyristor heatsink.

If a fixed warning threshold is exceeded, a message is generated 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 observed 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. The corresponding selection tables can be found in Chapter 10.3.7 "Branch Component Layout (Standard Circuit)" and in Chapter 10.3.8 "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

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7.1 Diagnosis, Messages

7.1.1 Status Messages

Message	Cause / Remedy
Checking voltage	Main voltage not yet applied.
Checking line phases	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.
Motor running	Device is in bridging mode (bypass contactor). Starting completed.
Stopping mode active	Motor is stopped using the set stopping mode.
Cooling time 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 time (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 is active	The emergency start function is activated.
Quickstop active	The quickstop function is activated.

7.1.2 Warnings and Group Errors

Message	Warning	Error without restart	Error with restart	Cause / Remedy
No line voltage		x		<ol style="list-style-type: none"> Start command output even though the main voltage has not yet been applied. Remedy: Switch on line voltage. 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 Limit Motor Heat Build-Up", "Remaining Time for Tripping" or "Current limit exceeded/undershot" (can also be traced via the entries in Log list / Events). Remedy: See the description of the respective messages Main voltage is removed simultaneously to the ON-command, although no stopping mode (not "Coasting Down") is parameterized. Remedy: Control the main contactor via an output that is parameterized to "On-time" or use the stopping mode "Coasting Down"

Message	Warning	Error without restart	Error with restart	Cause / Remedy
<p>Incorrect start conditions (for product version < *E04* devices)</p> <p>Phase angle control failure (for product version ≥ *E04* devices)</p>		x		<p>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).</p> <p>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.</p>
<p>Loss of phase L1</p>		x		<p>Option 1: Phase L1 missing, drops or fails while motor is running. A trip occurs due to a voltage drop in the permissible rated operational voltage of >15 % >100 ms during starting, or >200 ms in bypass operation. Remedy: Connect L1 or rectify voltage drop.</p> <p>Option 2: The connected motor is too small and the error message is issued immediately after switching to bridging mode. Remedy: Set rated operating current for connected motor correctly or set to minimum (if motor current is lower than 10 % of the set I_e, the motor cannot be operated with this starter).</p> <p>Option 3: Starter used in IT system with ground fault monitoring: 3RW44, product version ≤ *E06* and the PROFIBUS DP communication module must not be used in this network configuration. Remedy: Replace starter with 3RW44, product version ≥ *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 measured value display of the 3RW44.</p>
<p>Loss of phase L2</p>		x		<p>Option 1: Phase L2 missing, drops or fails while motor is running. A trip occurs due to a voltage drop in the permissible rated operational voltage of >15 % >100 ms during starting, or >200 ms in bypass operation. Remedy: Connect L2 or rectify voltage drop.</p> <p>Option 2: The connected motor is too small and the error message is issued immediately after switching to bridging mode. Remedy: Set rated operating current for connected motor correctly or set to minimum (if motor current is lower than 10 % of the configured I_e, the motor cannot be operated with this starter).</p> <p>Option 3: Starter used in IT system with ground fault monitoring: 3RW44, product version ≤ *E06* and the PROFIBUS DP communication module must not be used in this network configuration. Remedy: Replace starter with 3RW44, product version ≥ *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 measured value display of the 3RW44.</p>

Message	Warning	Error without restart	Error with restart	Cause / Remedy
Loss of phase L3		x		<p>Option 1: Phase L3 missing, drops or fails while motor is running. A trip occurs due to a voltage drop in the permissible rated operational voltage of >15 % >100 ms during starting, or >200 ms in bypass operation. Remedy: Connect L3 or rectify voltage drop.</p> <p>Option 2: The motor that is connected is too small and the error message is issued immediately after switching to bridging mode. Remedy: Set rated operating current for connected motor correctly or set to minimum (if motor current is lower than 10 % of the configured I_e, the motor cannot be operated with this starter).</p> <p>Option 3: Starter used in IT system with ground fault monitoring: 3RW44, product version \leq *E06* and the PROFIBUS DP communication module must 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 measured value display of the 3RW44.</p>
Missing load phase T1		x		<p>Motor phase T1 is not connected. Remedy: Connect motor correctly.</p>
Missing load phase T2		x		<p>Motor phase T2 is not connected. Remedy: Connect motor correctly.</p>
Missing load phase T3		x		<p>Motor phase T3 is not connected. Remedy: Connect motor correctly.</p>
Supply voltage below 75 %		x		<p>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.</p>
Supply voltage below 85 %		x		<p>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.</p>
Supply voltage above 110 %		x		<p>Control supply voltage is above 110 % of the required nominal voltage for longer than 2 s (voltage peaks, wrong control supply voltage). Remedy: Check control supply voltage.</p>
Current unbalance exceeded	x	x		<p>Phase currents are asymmetric (asymmetric load). Message is output when the asymmetry is greater than the set limit (parameter: Current asymmetry limit value). Remedy: Check load or change parameter value.</p>
Thermal motor model overload	x	x	x	<p>The thermal motor model has tripped. After an overload trip, restarting is blocked until the pre-charge time has elapsed.</p> <p>Remedy in the case of unwanted tripping: <ul style="list-style-type: none"> - Check whether the motor rated operating current I_e is incorrectly set or - Change CLASS setting or - Reduce switching frequency, or - Deactivate motor protection (CLASS OFF) </p>
Prewarning limit motor heat build-up	x			<p>Motor heat build-up is greater than the parameter value for: Prewarning limit motor heat build-up. The thermal motor model approaches an overload trip, depending on the set value. For heavy starting and set values of tripping class \geq CLASS 20, we recommend increasing the "Prewarning Limit Motor Heat Build-Up" parameter value to 95 %.</p>
Remaining time for tripping undershot	x			<p>Time until overload tripping of the thermal motor model is shorter than the set value for the "Prewarning limit remaining time for tripping" parameter. For heavy starting and set values of tripping class \geq CLASS 20, we recommend increasing the "Prewarning limit tripping reserve" parameter value to 0 s (deactivated).</p>
Line overvoltage (for product version < *E04* devices) Line voltage too high (for product version \geq *E04* devices)		x		<p>Applied 3-phase line voltage is not suitable for the device or longer voltage peaks occur. Tripping occurs due to the permitted rated voltage being exceeded by >10 % >500 ms. From product version *E02* upwards, the internal tripping limit has been increased to >18 % >2000 ms. Remedy: Apply correct voltage.</p>

Message	Warning	Error without restart	Error with restart	Cause / Remedy
Current range exceeded		x		<p>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 on line starting, breakaway pulses 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 dimensioned too small for the motor.</p> <p>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 limit motor heat build-up", "Remaining time for tripping" or "Current limit exceeded/undershot" (can also be traced via the entries in Log list / Events). Remedy: Refer to the description of the respective messages.</p>
Motor stalled - switched off (for product version < *E07* devices only)		x		<p>A very high current suddenly occurs in bridging mode, e.g. when the motor stalls ($I > 4 \times I_{eMotor}$ higher than 100 ms). Remedy: Check motor.</p>
Overcurrent (for product version < *E07* devices only)		x		<p>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).</p>
Power unit overheated		x	x	<p>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").</p>
Power unit overtemperature	x			<p>The temperature of the thermal model for the power unit is higher than the permissible temperature for continuous operation. 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").</p>
Temperature sensor short-circuit	x	x	x	<p>Temperature sensor is short-circuited at terminals T1 / T2. Remedy: Check temperature sensor.</p>
Temperature sensor open	x	x	x	<p>Temperature sensor faulty at terminals T1 / T2, one line is not connected or no sensor is connected at all. Remedy: Check temperature sensor or, if none is connected: deactivate temperature sensor.</p>
Temperature sensor overload	x	x	x	<p>Temperature sensor has tripped at terminals T1 / T2, motor overheated. Remedy: Wait until the motor has cooled down and, if necessary, check motor.</p>
Max. starting time exceeded		x		<p>The set maximum starting time is shorter than the actual run-up time of the motor. Remedy: Extend "Max. starting time" parameter, increase current limiting value or check load connected to the motor for mechanical faults.</p>
Current limit exceeded / undershot	x	x		<p>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 for the current limit value violation, or adjust the limit value according to the existing load conditions.</p>
Ground fault detected	x	x		<p>One phase is connected to ground (only possible in bypass operation). Remedy: Check connections and wiring.</p>
Manual operation local connection break	x			<p>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.</p>

Message	Warning	Error without restart	Error with restart	Cause / Remedy
Impermissible I _e / CLASS settings		x		<p>The set rated operating current I_e 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 on 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".</p> <p>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 Delta Circuit"), so that the "Status display / Type of connection" menu item (Chapter 5.5.2 "Status Display") shows "Unknown / fault".</p> <p>Remedy: Check the set rated operating current of the motor in all 3 parameter sets, reduce the CLASS setting or overdimension the soft starter. In the case of inside delta circuits, check the wiring of the motor feeder to ensure that it corresponds to the specified circuit diagrams.</p> <p>If the motor is not activated, this is only a status message. However, the message becomes an error without restart once a start command is issued.</p>
No external start parameters received (for product version ≥ *E06* devices)		x		<p>Only when operated with PROFIBUS DP. Incorrect or non-permissible parameter values have been sent by the PLC.</p> <p>Remedy: The incorrect parameter can be read out and corrected to a permissible value via the Soft Starter ES software.</p>
PIO error (for product version ≥ *E06* devices)			x	<p>PIO error (process image of the outputs faulty) is displayed:</p> <ul style="list-style-type: none"> • If Motor right and Motor left have been simultaneously selected (Cause 1) or • parameter set 4 has been selected via the PLC (Cause 2). <p>Remedy:</p> <ul style="list-style-type: none"> • Automatic deletion once Motor right and Motor left are deactivated again (for Cause 1), or • a valid parameter set (PS 1-3) is set (for Cause 2).
Bypass element protective tripping (for product version ≥ *E07* devices)		x		<p>A very high current occurs in bridging mode. Tripping depends on the time and strength of the current. The error can only be reset after 30 s (cooling).</p> <p>Remedy: Check the motor and the soft starter dimensioning.</p>

7.1.3 Device Errors

Message	Cause / Remedy
Contact element damaged (for product version \geq *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 (via the soft starter), but no start command has been issued. ¹⁾ 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.) ¹⁾ 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.) ¹⁾ 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.) ¹⁾ 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 element 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 on 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 time of approx. 30 to 60 minutes by switching the control supply voltage off and then on 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 fault-free operation). For all 3RW44 starters: If switching the control supply voltage off and on again does not cause the error message to reset, contact your SIEMENS contact partner or Technical Assistance.
Heatsink thermistor short	The temperature sensor on 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 \leq *E06* and the PROFIBUS DP communication module must not be used in this network configuration. 3RW44 soft starters from product version *E07* onwards 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 measured value display of the 3RW44.

1) Possible ohmic value for a defective thyristor: <2 kOhm (L-T).

PROFIBUS DP Communication Module

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8.1 Introduction

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

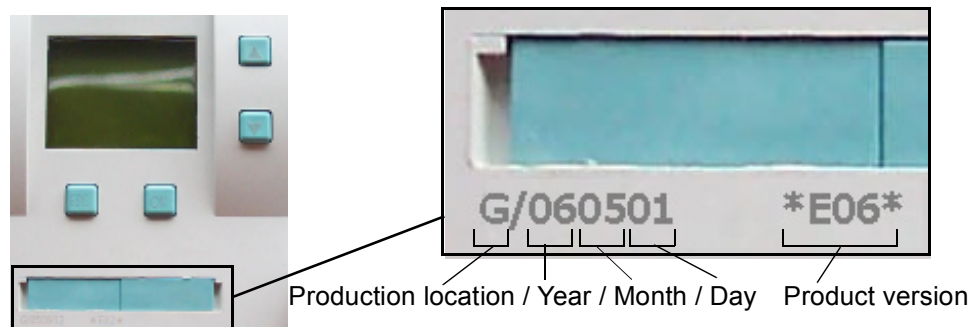
Using the PROFIBUS DP communication module, the 3RW44 soft starter can be linked to the Profibus branch with all its functionality.

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 of product version "E06" or higher, implemented for devices from production date 060501 onwards.



Notice

IT systems with ground fault monitoring:

3RW44, product version \leq *E06* and the PROFIBUS DP communication module must 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 measured value display of the 3RW44.

Notice

For 3RW44 PROFIBUS DP communication module, product version \leq *E03*:

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.

For 3RW44 PROFIBUS DP communication module from product version *E04* onwards: From this version onwards, DPV1 operation (read, write data set and alarms) is also possible downstream from a Y link.

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. It supports the S7 model (diagnosis alarms).

Writing data

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

Reading data

Reading data means that data are 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. See "Configuration with the GSD File" on Page 8-15.

8.2 Data Transmission

8.2.1 Data Transmission Options

The following figure illustrates the data transmission options:

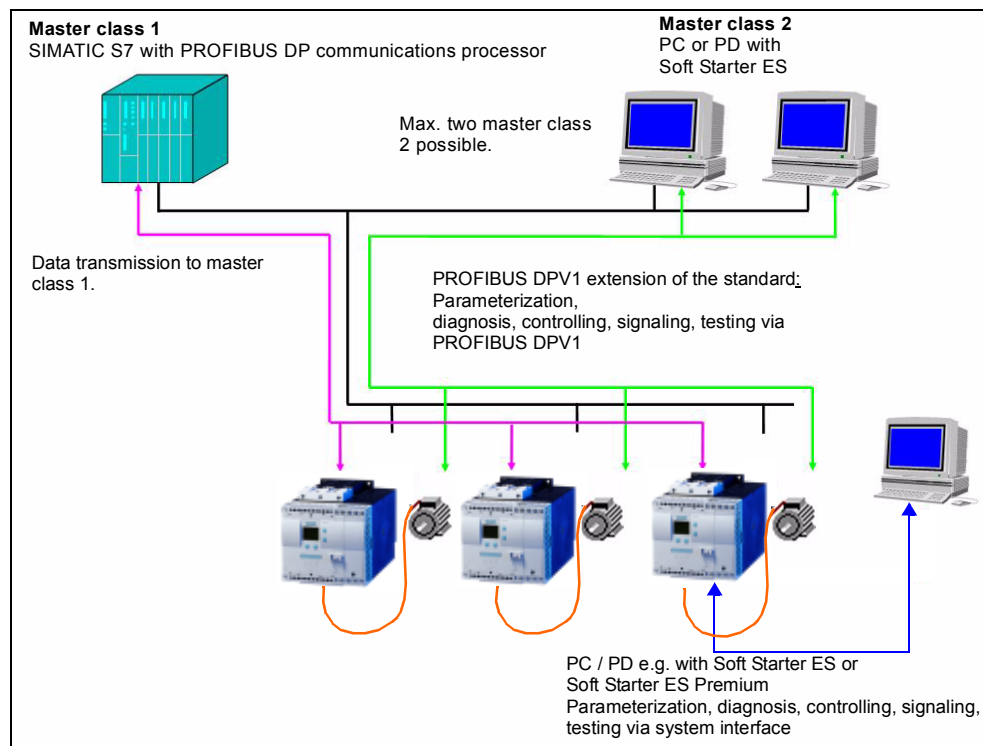


Figure 8-1: Data transmission options

8.2.2 Communication Principle

The following figure illustrates the communication principle, in which different data are transmitted depending on the operating modes of the master and slave:

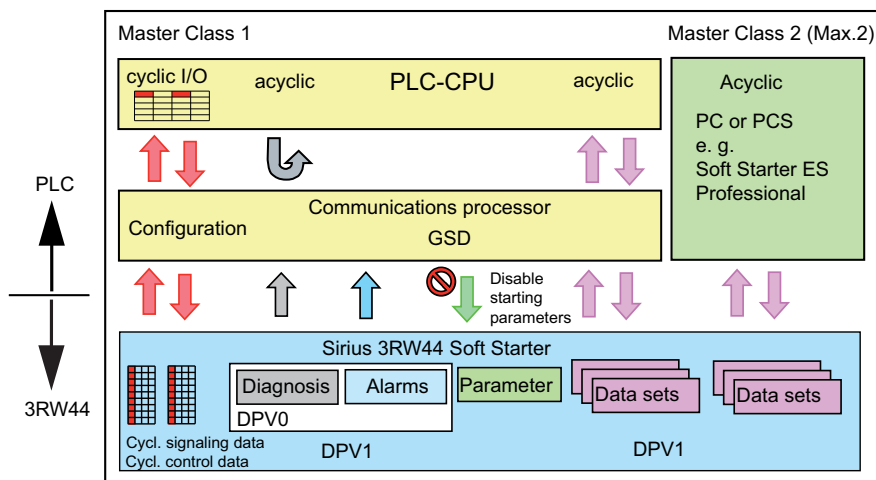


Figure 8-2: Communication principle

8.3 Installation of the PROFIBUS DP Communication Module



Warning

Dangerous electrical voltage! Can cause electric shock and burns. 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)

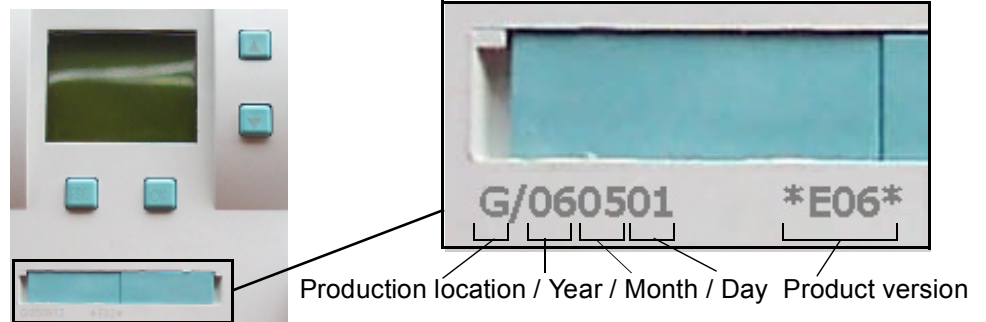
Caution

Risk of damage to property.

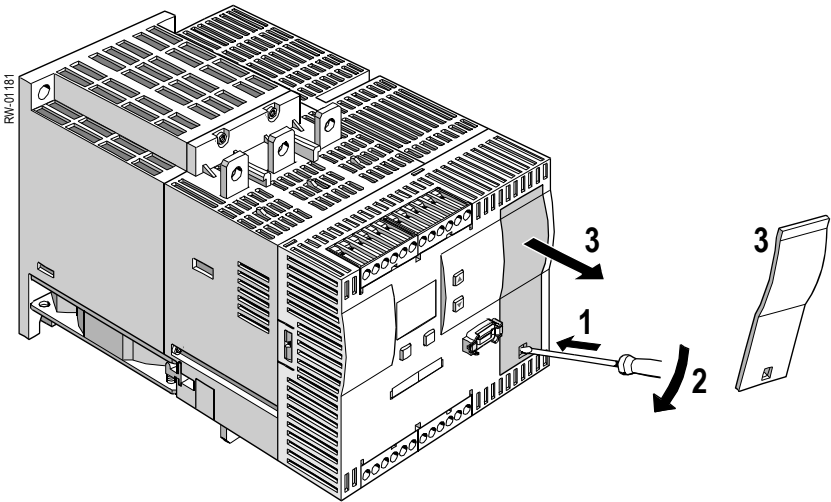
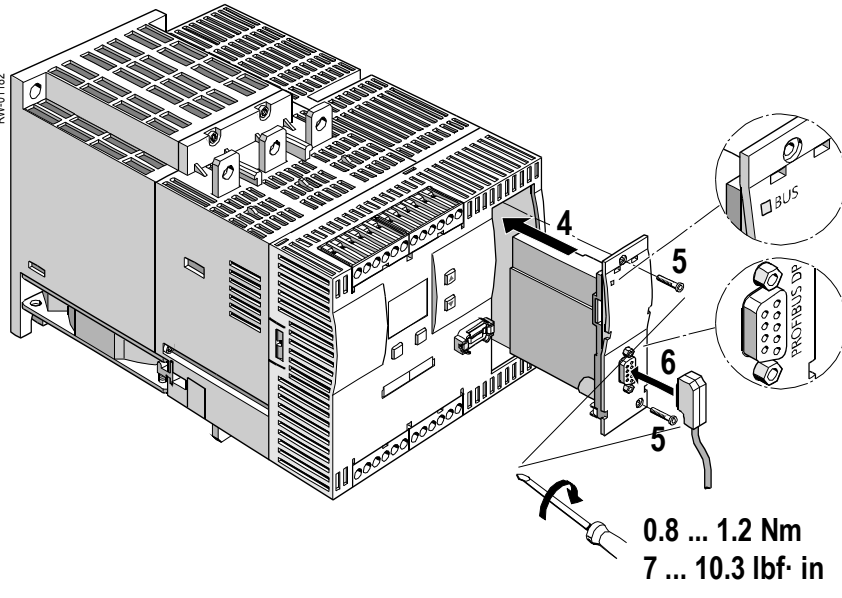
Before inserting the PROFIBUS DP communication module, de-energize the 3RW44 soft starter.

Notice

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



Proceed as follows:

Step	Description
	<p>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).</p>
	<p>Insert the PROFIBUS DP communication module into the device (4).</p> <p>Screw the PROFIBUS DP communication module into place using the screws included in the scope of supply (5).</p> <p>Plug the PROFIBUS connecting cable into the socket of the communication module (6). Screw the PROFIBUS connecting cable firmly into place.</p> <p>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.</p> <p>0.8 ... 1.2 Nm 7 ... 10.3 lbf·in</p>

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 Premium" or the "Soft Starter ES + SP1" software.

Notice

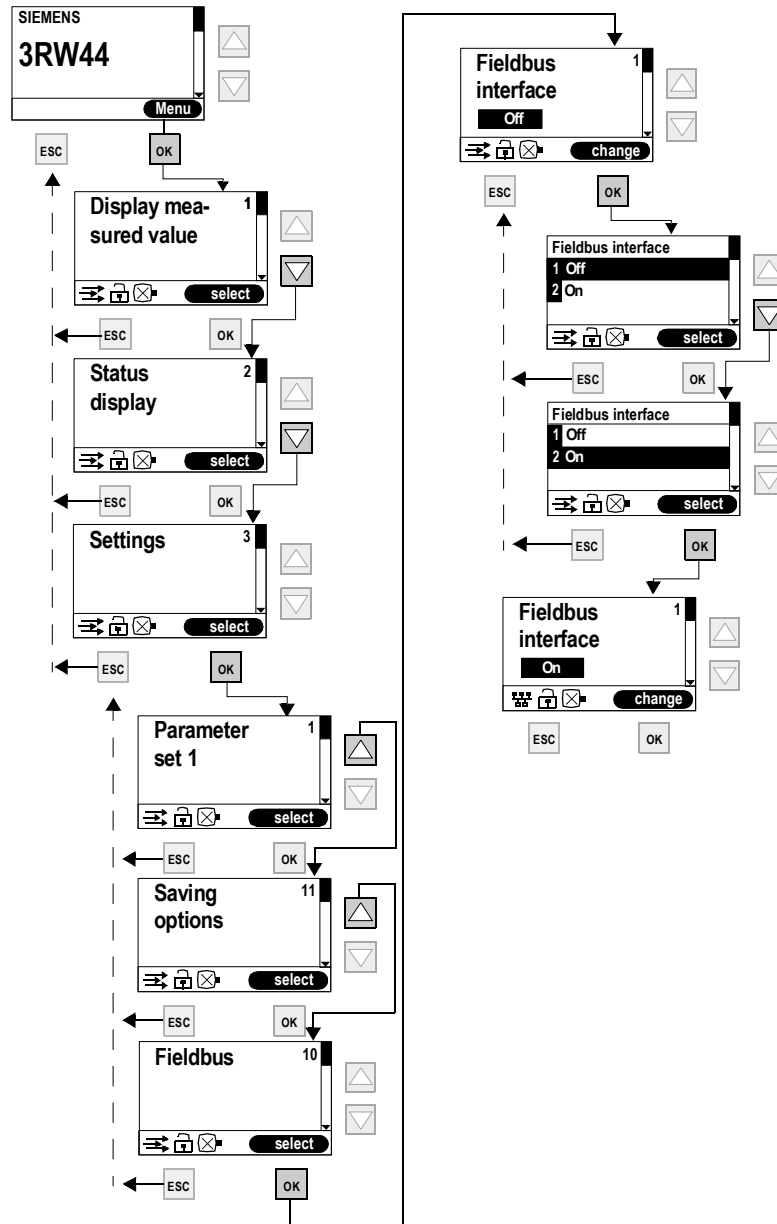
After the communication module has been activated, the control priority automatically switches from the inputs to the PROFIBUS DP communication module.


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 the factory default.

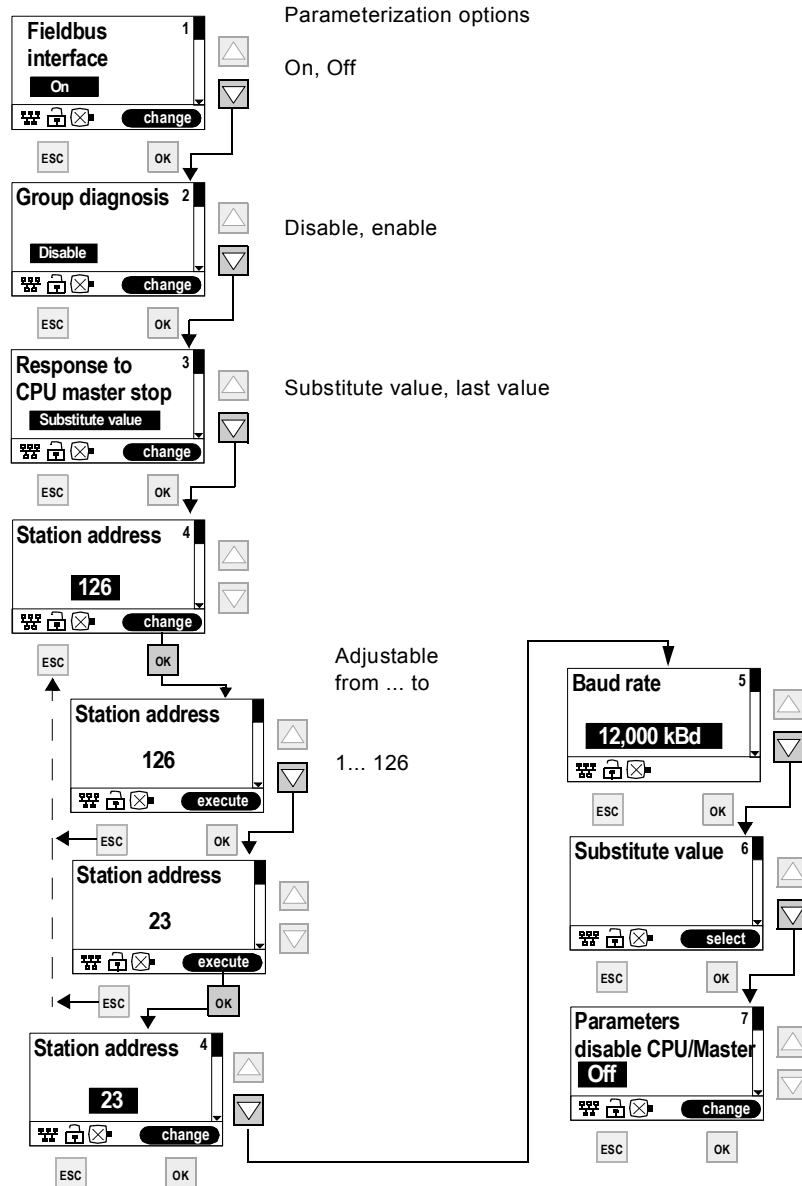
8.4.2 Activating the PROFIBUS DP Communication Module via the Display, Setting the Station Address and Saving the Settings

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.

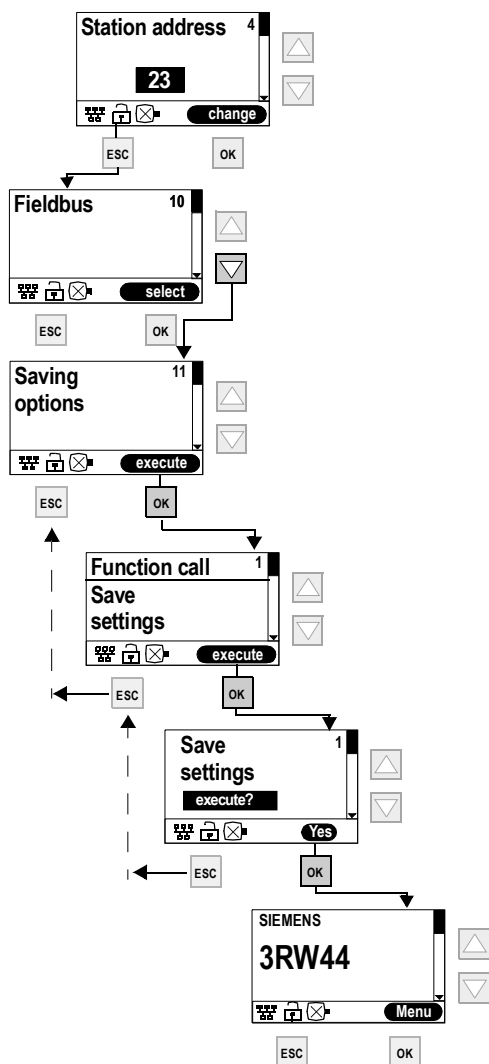
The next step is to set the desired station address for the 3RW44 as a PROFIBUS slave.
 In this example, the station address is set to "23".



Notice

If the parameter "Parameters disabled CPU/Master" is set to "Off" (factory setting), then the parameters set on the soft starter will be overwritten with the values stored in the GSD file 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:



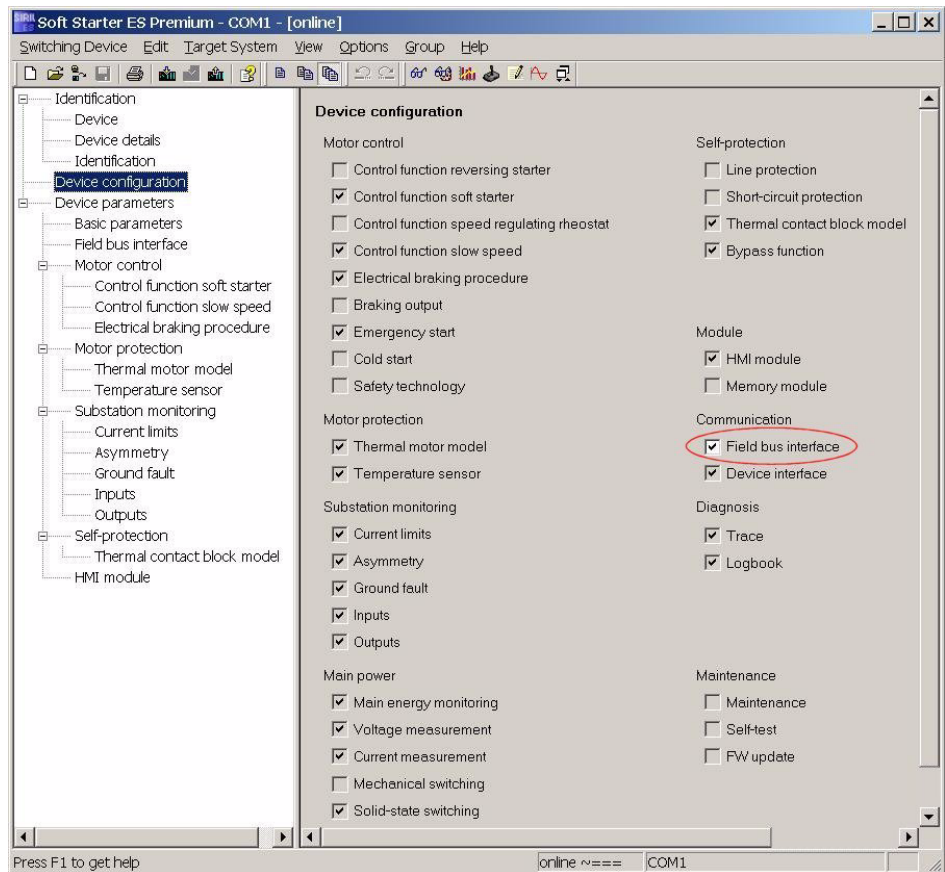
Notice

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 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".

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 Premium" or the "Soft Starter ES + SP1" Software

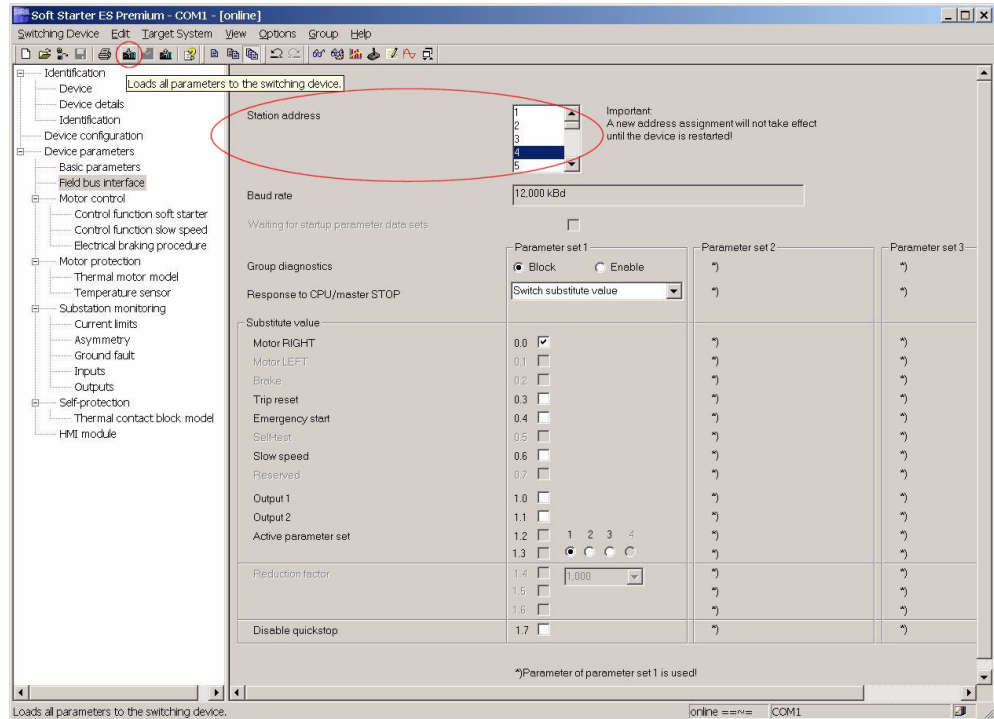
Carry out the following steps to activate the communication module:


1. Use an interface cable to connect the 3RW44 soft starter to a PC on which the "Soft Starter ES Premium" or the "Soft Starter ES + Service Pack 1" software is installed.
2. Start the "Soft Starter ES Premium" or "Soft Starter ES + 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 section deals with the configuration and parameterization of soft starters.

- Configuring: Systematic arrangement of the individual soft starters (structure).
- Parameterization: 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 from correction version K5.1.2.0 onwards.
- 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) up to order number 6ES7315-2AF02.

8.5.2 Configuration with the GSD File

Definition of the GSD

The device master data (GSD) contain 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. The soft starter is embedded into your system as a standard slave via the GSD file.

You can download the GSD file

- from the Internet at <http://support.automation.siemens.com/WW/view/en/113630>

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 with the Soft Starter ES Premium Software

Sirius 3RW44 soft starters can also be configured using the Soft Starter ES Premium software.

There are two possibilities when using PROFIBUS DP:

- Stand-alone program on a PC/PD with PROFIBUS DP connection
- Integration with the object manager (OM) in STEP 7

Detailed information regarding Soft Starter ES can be found in the program's online help.

8.5.4 Diagnostics Package

A free diagnostics package is available for 3RW44 soft starters. It contains HMI diagnostic screens for touch panels. The diagnostics package is available in German and English.

You can download the diagnostics package at:

<http://support.automation.siemens.com/WW/view/en/28557893>

8.5.5 Soft Starter ES Parameterizing Software

Soft Starter ES is the central software for commissioning, operating and diagnosis of the SIRIUS 3RW44 High Feature soft starter series.

You can download the Soft Starter ES parameterizing software at

<http://support.automation.siemens.com/WW/view/en/28323168>. This is a free 14-day trial version.

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 onwards	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" on Page 3-2
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 Premium" or the "Soft Starter ES + 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 for 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 Data (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 x24 V DC and DO 16 x24 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 <ul style="list-style-type: none"> • 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 from the hardware catalog to the PROFIBUS 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	<p>Drag the module from the selection list of the dropdown menu to slot 1 of the Sirius 3RW44:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Slot</th> <th>Module/ DP ID</th> <th>Order number</th> <th>I addr.</th> <th>O addr.</th> <th>Comment</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>192</td> <td>3RW4422-<i>BC</i>**</td> <td>2...3^{*)}</td> <td>2...3^{*)}</td> <td></td> </tr> </tbody> </table> <p>*) Depending on the structure</p> <p>Open the "DP slave characteristics" dialog with a double click.</p>	Slot	Module/ DP ID	Order number	I addr.	O addr.	Comment	1	192	3RW4422- <i>BC</i> **	2...3 ^{*)}	2...3 ^{*)}	
Slot	Module/ DP ID	Order number	I addr.	O addr.	Comment								
1	192	3RW4422- <i>BC</i> **	2...3 ^{*)}	2...3 ^{*)}									
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 an "Incorrect parameter value" in data set 92.

The following table shows which parameters are dependent on each other and how these must 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 10-12).
Maximum current limit value	Greater than	Minimum current limit value Chapter 5.4.6 "Specifying Current Limit Values" 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	<p>Create the user program in the LAD/STL/CSF editor in OB1. Example: Reading an input and controlling an output:</p> <p>OB1 : Title:</p> <p>Comment:</p> <p>Network 1: Title:</p> <p>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).</p> <pre> 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 </pre>
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	<p>Observe the status LEDs on the DP master CPU315-2 DP:</p> <p>5 V DC: Lights up SF DP: Off BUSF: Off</p>
3	<p>Observe the status LEDs on the PROFIBUS module:</p> <p>LED BUS: Lights up green</p>

Table 8-6: Switching on

8.6.5 Flow Diagram PROFIBUS DP - Starting the Soft Starter

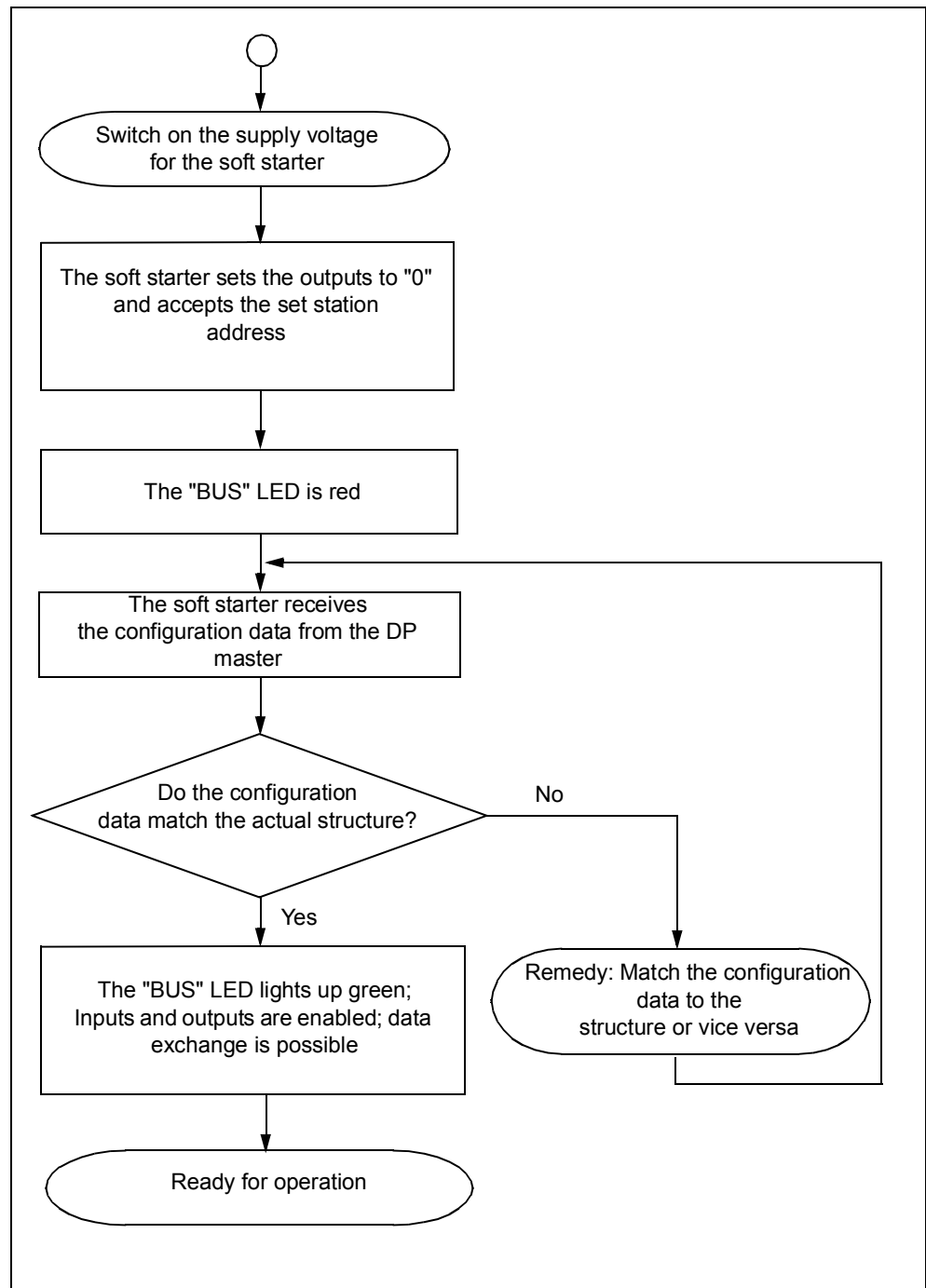


Figure 8-3: PROFIBUS DP - starting the soft starter

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 statuses 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:

Parameter set 1	Parameter set 2	Parameter set 3	Process image error
PS1	PS2	PS3	
0	1	0	1
0	0	1	1

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	Basic factory settings restored (red flickering for 5 sec)
	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 parameter 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 should 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

8.9.3 Structure of the Slave Diagnosis

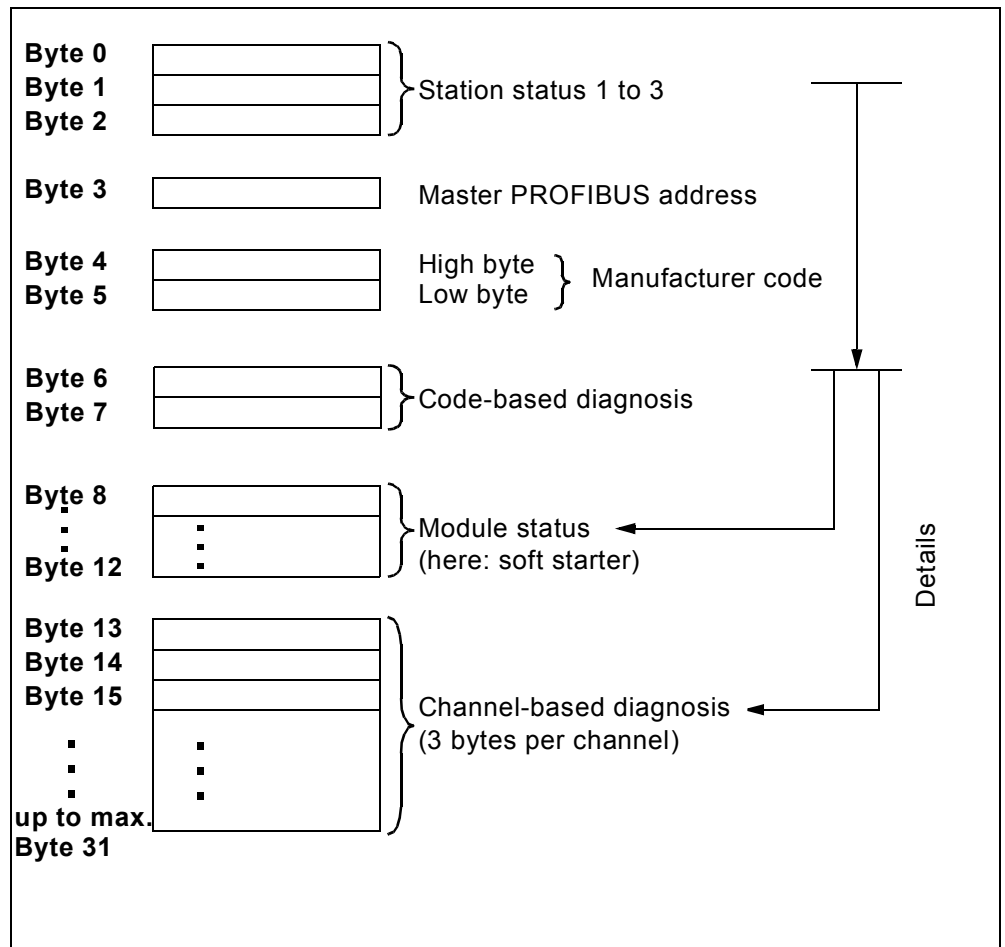


Figure 8-4: Structure of the slave diagnosis

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.	<ul style="list-style-type: none"> • 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 on the DP slave?
1	1: The DP slave is not yet ready for data exchange.	<ul style="list-style-type: none"> • Wait, since the DP slave is just starting up.
2	1: The configuration data sent to the DP slave by the DP master do not match the structure of the DP slave.	<ul style="list-style-type: none"> • Has the correct station type or the correct structure for the DP slave been entered into the configuration software?
3	1: There is an external diagnosis. (Group diagnosis display)	<ul style="list-style-type: none"> • Analyze the code-based 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).	<ul style="list-style-type: none"> • Check the configuration.
5	1: The DP master cannot interpret the reply from the DP slave.	<ul style="list-style-type: none"> • Check the bus design.
6	1: The DP slave type does not match the software configuration.	<ul style="list-style-type: none"> • 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).	<ul style="list-style-type: none"> • Bit is always 1 when you are accessing the DP slave with the PD or another DP master, for example. 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 only updated if 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: <ul style="list-style-type: none"> • There are more diagnosis messages than the DP slave can store. • The DP master cannot write all diagnosis messages sent by the DP slave in its diagnosis buffer (channel-based 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-Based Diagnosis

Definition

Code-based diagnosis indicates whether or not there are any faulty soft starters. The code-based diagnosis begins with byte 6 and comprises 2 bytes.

Code-based diagnosis

The structure of the code-based diagnosis for soft starters is as follows:

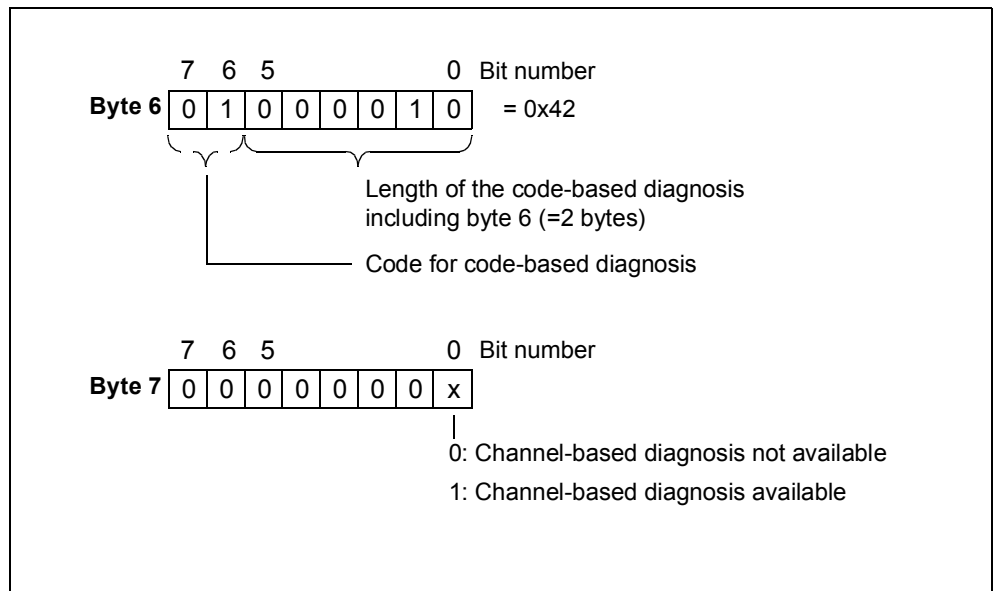


Figure 8-5: Structure of the code-based diagnosis

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-based diagnosis. The module status starts after the code-based diagnosis and comprises 5 bytes.

Module status structure

The structure of the module status is as follows:

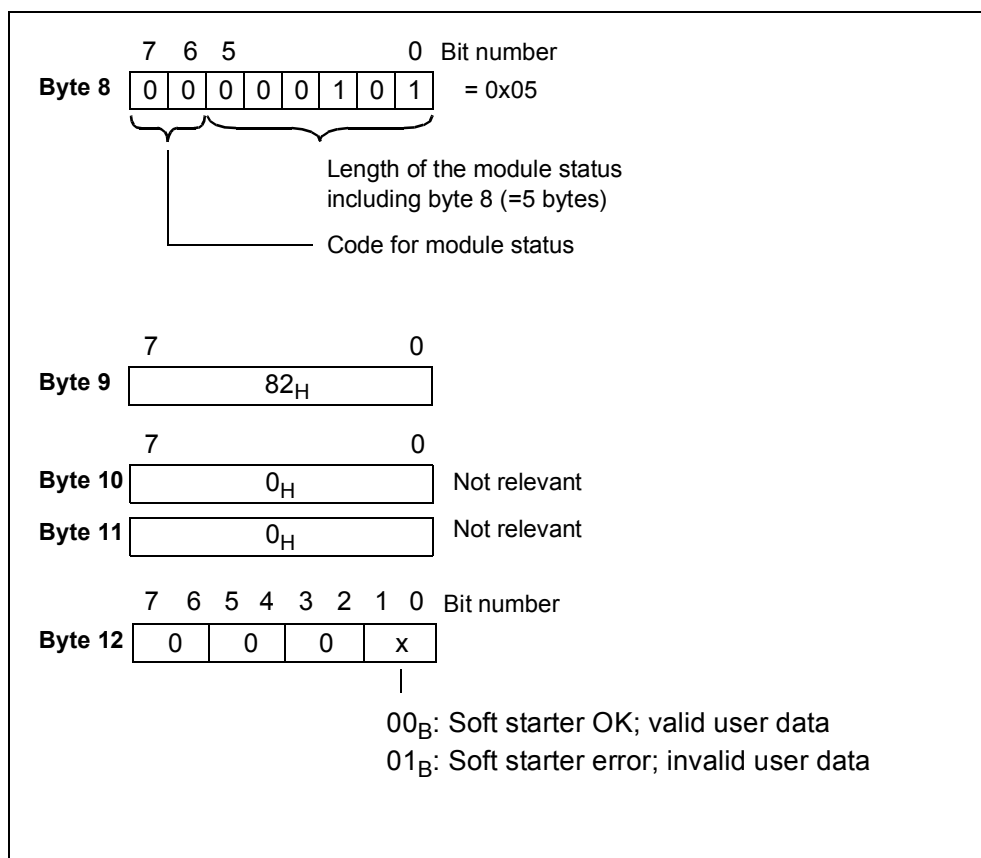


Figure 8-6: Structure of the module status

8.9.9 Channel-Based Diagnosis

Definition

The channel-based diagnosis provides information about channel errors of the modules (here: soft starter) and represents a specification of the code-based diagnosis. The channel-based 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-based diagnosis does not affect the module status.

The number of channel-based diagnosis messages is restricted to 9 (also refer to station status 3, bit 7).

Channel-based diagnosis

The structure of the channel-based diagnosis is as follows:

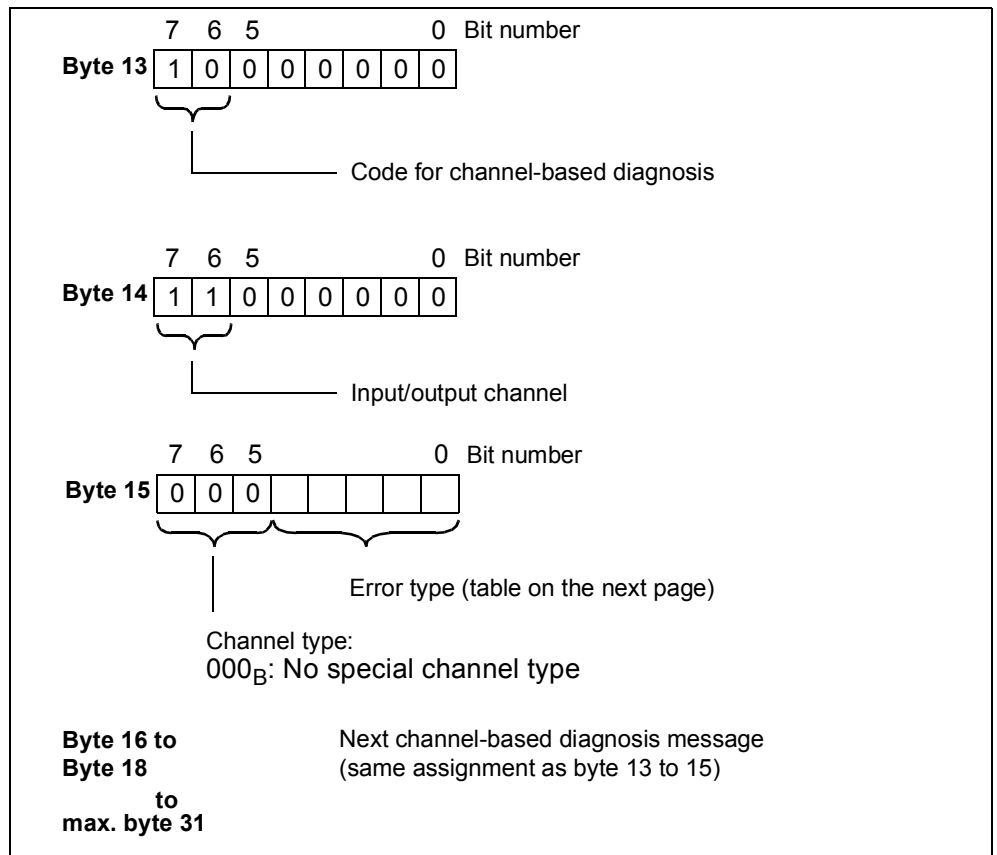


Figure 8-7: Structure of the channel-based diagnosis

Notice

The channel-based 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Overload of the temperature sensor • Overload of the thermal motor model 	The signal bit is updated continuously.
E5	00101: Overtemperature	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Wire break in the temperature sensor 	The signal bit is updated continuously
E7	00111: Maximum limit value exceeded	<ul style="list-style-type: none"> • I_e limit value exceeded 	
E8	01000: Minimum limit value undershot	<ul style="list-style-type: none"> • I_e limit value undershot 	
E9	01001: Error	<ul style="list-style-type: none"> • Internal error/device error • Contact block defective 	The signal bit can be deleted when the cause of the error has been remedied by <ul style="list-style-type: none"> • Switching the supply voltage off/on • Issuing the "Restart" command if possible
E16	10000: Parameter error	<ul style="list-style-type: none"> • Incorrect parameter value 	The signal bit is always deleted after acknowledgement with "Trip reset".
E17	10001: No supply or load voltage	<ul style="list-style-type: none"> • Electronics supply voltage too low • No supply voltage at the contact block • No line voltage 	The signal bit is deleted when the cause for the switch-off has been remedied or acknowledged automatically.
E24	11000: Actuator switch-off	<ul style="list-style-type: none"> • Switch-off due to overload • Switch-off due to residual current • Switch-off due to asymmetry • Switch-off due to ground fault 	The signal bit is always deleted after acknowledgement with "Trip reset". Additional acknowledgement in combination with other errors.
E26	11010: External error	<ul style="list-style-type: none"> • 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 current formats, in

- 6-bit current format,
- 8-bit current format and
- 9-bit current format:

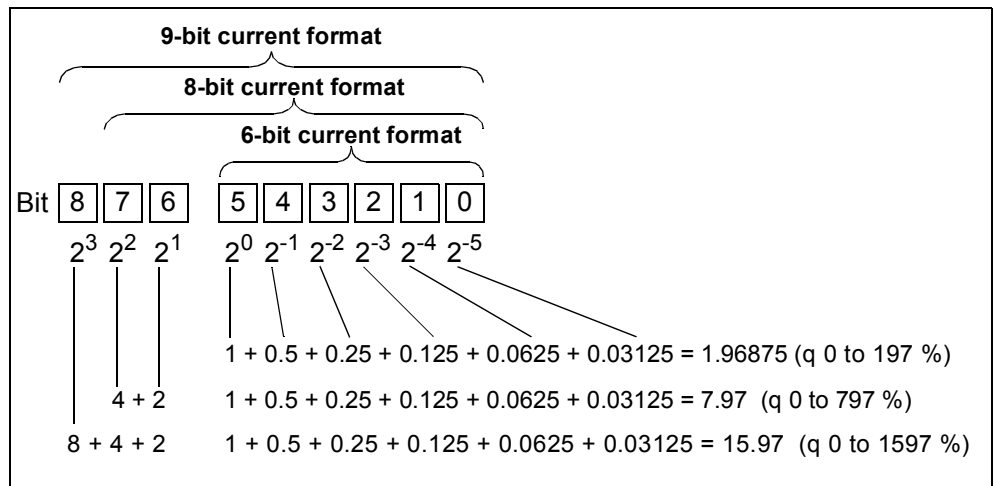


Figure 8-8: Current formats

Current values are

- Motor current I_{\max} (6-bit current format)
- Phase currents $I_{L1\max}$, $I_{L2\max}$, $I_{L3\max}$ (8-bit current format)
- Last 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 230 V AC supply voltage of the soft starter has been switched on.
Both operating hour 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 range of 0 to 65535.
- Number of starts motor right / left
The soft starter counts the number of starts in the range of 0 to 2^{32} .
Example: The value is increased 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 $60 \text{ A} \times 1.1 = 66 \text{ A}$
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 $60 \text{ A} \times 4.55 = 273 \text{ A}$

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 are 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: Each 1 byte, 8-bit current format.
The measured maximum and minimum phase current in bridging mode is stored for each 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 sent 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"	<ul style="list-style-type: none"> • Data set can only be written
80 _H	A1 _H	Negative acknowledgement "Write data set"	<ul style="list-style-type: none"> • Data set can only be read
80 _H	A2 _H	Protocol error	<ul style="list-style-type: none"> • Layer 2 (field bus) • Device interface • Incorrect coordination
80 _H	A9 _H	This function is not supported!	<ul style="list-style-type: none"> • DPV1 service does not support reading/writing of the data set
Technology access			
80 _H	B0 _H	Unknown data set number	<ul style="list-style-type: none"> • Data set number not known in the soft starter
80 _H	B1 _H	Incorrect data set length when writing	<ul style="list-style-type: none"> • Data set length differs from data set length specified
80 _H	B2 _H	Incorrect slot number	<ul style="list-style-type: none"> • Slot number not 1 or 4
80 _H	B6 _H	Communication partner declined data acceptance!	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Incorrect parameter value
Device resources			
80 _H	C2 _H	Temporary lack of resources in the device!	<ul style="list-style-type: none"> • 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"
- in the STEP 7 online help

Byte arrangements

When data are stored which are longer than one byte, the bytes are arranged as follows ("big endian")

Byte arrangement		Data type
Byte 0	High byte	Double word
Byte 1	Low byte	
Byte 2	High byte	
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 specifies 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 $I_{act-bit0}$
1110		1 Motor current $I_{act-bit1}$
1111		2 Motor current $I_{act-bit2}$
1112		3 Motor current $I_{act-bit3}$
1113		4 Motor current $I_{act-bit4}$
1114		5 Motor current $I_{act-bit5}$
1115		6 Manual operation local 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 ... 2^{32} s	1 second	Oldest entry
4 - 5	ID number of the device error	0 ... $\pm 32,767$	1	
6 - 9	Operating hours - device	1 ... 2^{32} s	1 second	Second oldest entry
10 - 11	ID number of the device error	0 ... $\pm 32,767$	1	
etc.				
120 - 123	Operating hours - device	1 ... 2^{32} s	1 second	Last, newest entry
124 - 125	ID number of the tripping	0 ... $\pm 32,767$	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 element fault

8.12.4 Data Set 73 Log List - Reading the Trippings

Byte	Meaning	Value range	Increment	Comment
0 - 3	Operating hours - device	1 ... 2^{32} s	1 second	Oldest entry
4 - 5	ID number of the device error	0 ... $\pm 32,767$	1	
6 - 9	Operating hours - device	1 ... 2^{32} s	1 second	Second oldest entry
10 - 11	ID number of the device error	0 ... $\pm 32,767$	1	
etc.				
120 - 123	Operating hours - device	1 ... 2^{32} s	1 second	Last, newest entry
124 - 125	ID number of the tripping	0 ... $\pm 32,767$	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 line voltage
324	Temperature sensor overload
325	Temperature sensor open
326	Temperature sensor short-circuit
327	Thermal motor model overload
334	I_e limit value exceeded
335	I_e limit value 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	Line voltage too high
1482	Current range exceeded

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 ... 2^{32} s	1 second	Oldest entry
4 - 5	ID number of the device error	0 ... $\pm 32,767$ *)	1	
6 - 9	Operating hours - device	1 ... 2^{32} s	1 second	Second oldest entry
10 - 11	ID number of the device error	0 ... $\pm 32,767$ *)	1	
etc.				
120 - 123	Operating hours - device	1 ... 2^{32} s	1 second	Last, newest entry
124 - 125	ID number of the tripping	0 ... $\pm 32,767$ *)	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-circuit	± (coming/going event)
327	Thermal motor model overload	± (coming/going event)
334	I _e limit value exceeded	± (coming/going event)
335	I _e limit value 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	Basic 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 defective	E9	For example, contactor welded/blocked or power semiconductor short-circuited. The signal bit can only be deleted by switching the supply voltage off / on 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 line voltage	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-circuit	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	Thermal 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	I _e limit value exceeded	E7	Limit value exceeded. The signal bit is updated continuously.
335	4 ³	I _e limit value undershot	E8	Limit value undershot. The signal bit is updated continuously.
336	4 ⁴	I _e 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 statuses: "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 by 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 by update (new "Trip reset") or by "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 elapsed. 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 operation via field bus (O&M controlled). The signal bit is updated continuously.
359	7 ⁴	Manual operation local operating mode	—	Manual operation 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 starting.
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.
	8 ⁴⁻⁷	Reserved = 0	—	

ID No.	Byte ^{Bit}	Signal bit	E No. *)	Meaning/Acknowledgment
Device function				
	9 ⁰⁻²	Reserved = 0	—	
369	9 ³	Basic 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	—	
1438	17 ³	Output 4 active	—	

ID No.	Byte ^{Bit}	Signal bit	E No. *)	Meaning/Acknowledgment
	17 ⁴⁻⁷	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 element 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 ¹⁻²	Reserved = 0	—	
1479	20 ³	Phase angle control failure	—	
	20 ⁴⁻⁷	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 exceeded	—	
	21 ³⁻⁷	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 - remaining time for tripping 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 numbers, 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, depending on the interface via which the command is received.
701	6	Restore basic factory settings	Restore basic 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]	Increment	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 ... 1,800 s / [0 ... 18,000]	0.1 s	
	6 ⁰⁻⁶	Motor heat build-up	0 ... 200 % / [0 ... 100]	2 %	
502	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} (rms)	0 ... 1,500 V / [0 ... 15,000]	0.1 V	
511	24 - 25	Phase-to-phase voltage U_{L2-L3} (rms)	0 ... 1,500 V / [0 ... 15,000]	0.1 V	
512	26 - 27	Phase-to-phase voltage U_{L3-L1} (rms)	0 ... 1,500 V / [0 ... 15,000]	0.1 V	
513	28 - 31	Phase current I_{L1} (rms)	0 ... 20,000 A / [0 ... 2,000,000]	0.01 A	
514	32 - 35	Phase current I_{L2} (rms)	0 ... 20,000 A / [0 ... 2,000,000]	0.01 A	
515	36 - 39	Phase current I_{L3} (rms)	0 ... 20,000 A / [0 ... 2,000,000]	0.01 A	
516	40 - 41	Electronics supply voltage	0 ... 1,500 V / [0 ... 15,000]	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 ... 1,800 s / [0 ... 18,000]	0.1 s	
520	46 - 47	Remaining time for tripping of the thermal motor model	0 ... 10,000 s / [0 ... 10,000]	1 s	
521	48 - 51	Output power	0 ... 2,147,483 W / [0 ... 21,474,830]	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 ... 1,000 % / [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 ... 65,535 / [0 ... 65,535]	1	
	18	Reserved = 0			
	19	Reserved = 0			
607	20	Motor current I_{max} (rms)	0 ... 20,000 A / [0 ... 2,000,000]	0.01 A	
606	24	Last trigger current IA (rms)	0 ... 20,000 A / [0 ... 2,000,000]	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 ... 1,000 % 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.	ByteBit	Meaning	Value range / [coding]	Increment	Comment
Maximum pointer					
656	4	Phase current $I_{L1 \text{ min}}$ (%)	0 ... 797 % / [0 ... 255]	3.125 %	In bypass operation
657	5	Phase current $I_{L2 \text{ min}}$ (%)	0 ... 797 % / [0 ... 255]	3.125 %	In bypass operation
658	6	Phase current $I_{L3 \text{ min}}$ (%)	0 ... 797 % / [0 ... 255]	3.125 %	In bypass operation
	7	Reserved = 0			
653	8	Phase current $I_{L1 \text{ max}}$ (%)	0 ... 797 % / [0 ... 255]	3.125 %	In bypass operation
654	9	Phase current $I_{L2 \text{ max}}$ (%)	0 ... 797 % / [0 ... 255]	3.125 %	In bypass operation
655	10	Phase current $I_{L3 \text{ max}}$ (%)	0 ... 797 % / [0 ... 255]	3.125 %	In bypass operation
	11	Reserved = 0			
652	12	Maximum tripping current $I_{A \text{ max}}$ (%)	0 ... 1,000 % / [0 ... 320]	3.125 %	Current during switch-off due to error
651	14	Number of motor overload trips	0 ... 65,535 / [0 ... 65,535]	1	Motor protection, temperature sensor, stalling
659	16	Maximum tripping current $I_{A \text{ max}}$ (rms)	0 ... 20,000 A / [0 ... 2,000,000]	0.01 A	Current during switch-off due to error
660	20	Phase current $I_{L1 \text{ min}}$ (rms)	0 ... 20,000 A / [0 ... 2,000,000]	0.01 A	In bypass operation
661	24	Phase current $I_{L2 \text{ min}}$ (rms)	0 ... 20,000 A / [0 ... 2,000,000]	0.01 A	In bypass operation
662	28	Phase current $I_{L3 \text{ min}}$ (rms)	0 ... 20,000 A / [0 ... 2,000,000]	0.01 A	In bypass operation
663	32	Phase current $I_{L1 \text{ max}}$ (rms)	0 ... 20,000 A / [0 ... 2,000,000]	0.01 A	In bypass operation
664	36	Phase current $I_{L2 \text{ max}}$ (rms)	0 ... 20,000 A / [0 ... 2,000,000]	0.01 A	In bypass operation
665	40	Phase current $I_{L3 \text{ max}}$ (rms)	0 ... 20,000 A / [0 ... 2,000,000]	0.01 A	In bypass operation
666	44	Phase-to-phase voltage $U_{L1 - L2 \text{ min}}$ (rms)	0 ... 1,500 V / [0 ... 15,000]	0.1 V	Reset to 0 after loss of phase or switch-off of the main voltage.
667	46	Phase-to-phase voltage $U_{L2 - L3 \text{ min}}$ (rms)	0 ... 1,500 V / [0 ... 15,000]	0.1 V	
668	48	Phase-to-phase voltage $U_{L3 - L1 \text{ min}}$ (rms)	0 ... 1,500 V / [0 ... 15,000]	0.1 V	
669	50	Phase-to-phase voltage $U_{L1 - L2 \text{ max}}$ (rms)	0 ... 1,500 V / [0 ... 15,000]	0.1 V	
670	52	Phase-to-phase voltage $U_{L2 - L3 \text{ max}}$ (rms)	0 ... 1,500 V / [0 ... 15,000]	0.1 V	
671	54	Phase-to-phase voltage $U_{L3 - L1 \text{ max}}$ (rms)	0 ... 1,500 V / [0 ... 15,000]	0.1 V	
672	56	Electronics supply voltage $U_{NS \text{ min}}$ (rms)	0 ... 1,500 V / [0 ... 15,000]	0.1 V	Reset to zero during "Power on".

ID No.	Byte ^{Bit}	Meaning	Value range / [coding]	Increment	Comment
Maximum pointer					
673	58	Electronics supply voltage $U_{NS \max}$ (rms)	0 ... 1,500 V / [0 ... 15,000]	0.1 V	
674	60	Maximum heatsink temperature	1 ... -40 °C / [- 40 ... 127]	1 °C	
675	61	Maximum contact block temperature rise	0 ... 250 % / [0 ... 250]	1 %	
676	62	Minimum line frequency	0 ... 100 Hz / [0 ... 200]	0.5 Hz	During network failure 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 ... 1,000 % 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 (byte 0) (3RW44)
	83	0x00	ID number (byte 1) (3RW44)
	84	0x80	ID number (byte 2) (3RW44)
	85	0xDE	ID number (byte 3) (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 days
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 = 2,000
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 ... 2,000 A [0 ... 200,000]	0.01 A
3	16 ⁰	Load type	x	3-phase [0]	
4	16 ¹	Protection against voltage failure	x	<ul style="list-style-type: none"> • No [0] • Yes [1] 	
	16 ²⁻⁷	Reserved = 0			
136	17	Prewarning limit - motor heat build-up	x	0 ... 95 % [0 ... 19]	5 %
5	18 ⁰⁻²	Response to overload - thermal motor model	x	<ul style="list-style-type: none"> • Tripping without restart [0] • Tripping with restart [1] • Warning [2] 	
	18 ³⁻⁷	Reserved = 0			
6	19 ⁰⁻⁴	Tripping class	x	<ul style="list-style-type: none"> • 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 ... 1,800 s [2 ... 60]	30 s
8	21	Idle time	x	0 ... 255 s [0 ... 255]	1 s
137	22-23	Prewarning limit - remaining time for tripping	x	0 ... 500 s [0 ... 500]	1 s
10	24 ⁰⁻¹	Response to overload - temperature sensor	x	<ul style="list-style-type: none"> • Tripping without restart [0] • Tripping with restart [1] • Warning [2] 	
	24 ²⁻³	Reserved = 0			
9	24 ⁴⁻⁶	Temperature sensor	x	<ul style="list-style-type: none"> • Deactivated [0] • Thermo click [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	<ul style="list-style-type: none"> No [0] Yes [1] 	
	25 - 26	Reserved = 0			
15	28	Minimum current limit value		18.75 ... 100 % [6 ... 32]	3.125 %
16	29	Maximum current limit value		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	<ul style="list-style-type: none"> Warning [0] Tripping [1] 	
	32 ⁷	Reserved = 0			
	33 ⁰⁻¹	Reserved = 0			
140	33 ²	Response to overload - contact block	x	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Warning [0] Tripping [1] 	
22	34 ⁷	Response to ground fault	x	<ul style="list-style-type: none"> 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 limiting value		<ul style="list-style-type: none"> 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		<ul style="list-style-type: none"> 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		<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Disable [0] • Enable [1] 	
34	56 ⁷	Response to CPU/master STOP	x	<ul style="list-style-type: none"> • Switch substitute value [0] • Retain last value [1] 	
	57 - 75	Reserved = 0			
26	76	Input 1 - Action	x	<ul style="list-style-type: none"> • 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			

ID No.	Byte ^{Bit}	Meaning	Only for data set 131	Value range [coding]	Factor
163	96	Output 1 - Action	x	<ul style="list-style-type: none"> • No action (default) [0] • Control source PIO-DO 1.0 output 1 [1] • Control source PIO-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 ... 1,000 s [0 ... 10,000]	0.1 s
170	116 - 117	Starting time		0 ... 360 s [0 ... 3,600]	0.1 s
171	118 - 119	Stopping time		0 ... 360 s [0 ... 3,600]	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 %

ID No.	Byte ^{Bit}	Meaning	Only for data set 131	Value range [coding]	Factor
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
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 value > minimum current limit value
- DC braking can only be selected when the "DC braking contactor" 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 operating speed	500 ... 3,600 rpm [500 ... 3,600]	1 rpm
	12 - 18	Reserved = 0		
113	19 - 20	Rated operating 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	<ul style="list-style-type: none"> • English [0] • German [1] • French [2] • Spanish [3] • Italian [4] • Portuguese [5] 	
181	8 ⁴⁻⁷	Lighting brightness	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Unchanged [0] • On [1] • Blinking [2] • Flickering [3] 	
183	10 ⁴⁻⁷	Lighting response to warning	<ul style="list-style-type: none"> • 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 ... 1,800 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. During writing, the value entered is ignored, as the baud rate is always automatically detected by the soft starter.

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

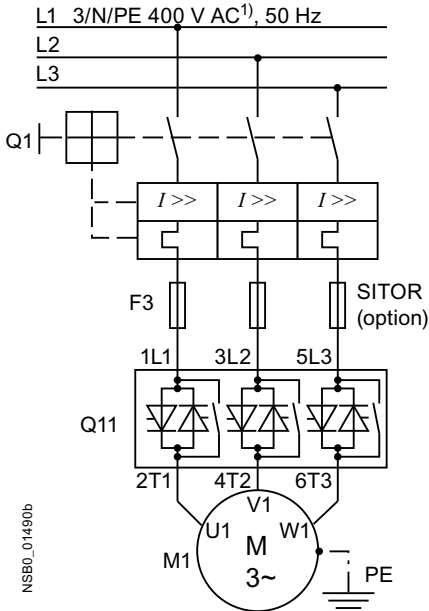
Chapter	Subject	Page
9.1	Connection Examples for Main and Control Circuits	9-2
9.1.1	3RW44 in a Standard Circuit with Control via Keys	9-2
9.1.2	3RW44 in a Standard Circuit with Line Contactor and Control via PLC	9-3
9.1.3	3RW44 in a Standard Circuit and DC Braking Stopping Function for Device Types 3RW44 22 to 3RW44 25	9-4
9.1.4	3RW44 in a Standard Circuit and DC Braking Stopping Function for Device Types 3RW44 26 to 3RW44 47	9-5
9.1.5	3RW44 in an Inside Delta Circuit	9-6
9.1.6	3RW44 in a Standard Circuit and Control as per Contactor	9-7
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	9-8
9.1.8	Activation via PROFIBUS with Switching to Manual Operation Local (e. g. at the Control Cabinet)	9-9
9.1.9	3RW44 in a Standard Circuit and Reversing Operation via Main Contactors with one Parameter Set without Soft Stop	9-10
9.1.10	Reversing Operation with Soft Stop	9-11
9.1.11	Soft Starter for Pole-Changing Motor with Separate Windings and 2 Parameter Sets	9-12
9.1.12	Soft Starters for Dahlander Motors with 2 Parameter Sets	9-13
9.1.13	Parallel Starting of 3 Motors	9-14
9.1.14	Soft Starter for Serial Starting with 3 Parameter Sets	9-16
9.1.15	Soft Starter for Activation of a Motor with a Magnetic Fixing Brake	9-18
9.1.16	Emergency Stop Monitoring according to EN 954-1 Category 4 with Safety Relay 3TK2823 and 3RW44	9-19
9.1.17	Soft Starter with Direct Switching (DOL) as Emergency Start	9-21
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9.1.19	Soft Starter and Frequency Converter on one Motor	9-23

9.1 Connection Examples for Main and Control Circuits

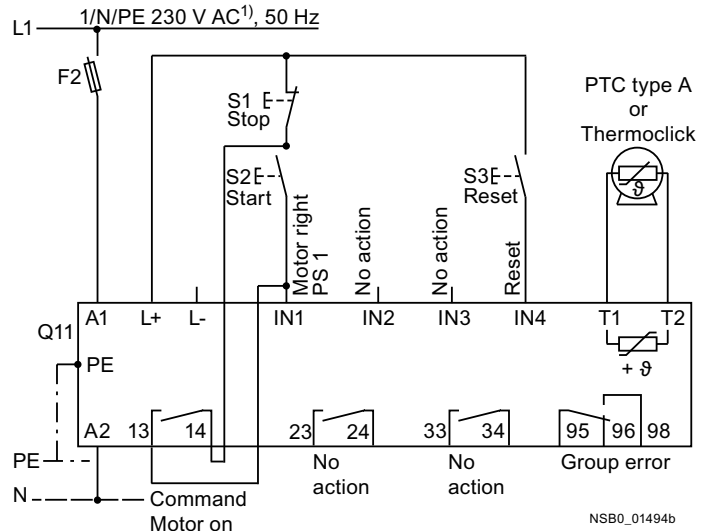
9.1.1 3RW44 in a Standard Circuit with Control via Keys

Main circuit

Option 1a:
Standard circuit with circuit breaker and SITOR fuse
(pure semiconductor protection)



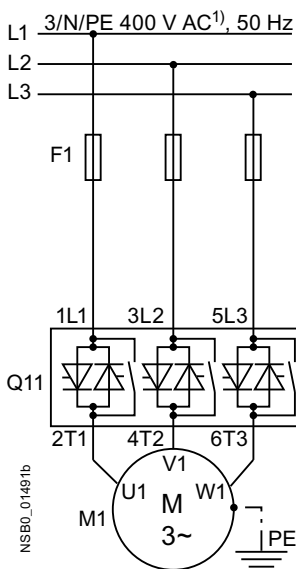
Control circuit



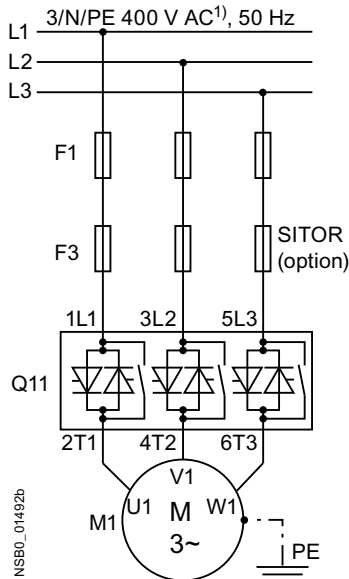
Alternative branch layout in a standard circuit

Main circuit

Option 1b:
Standard circuit with all-range fuse
(line and semiconductor protection)



Option 1c:
Standard circuit with line and SITOR fuse (pure
semiconductor protection)

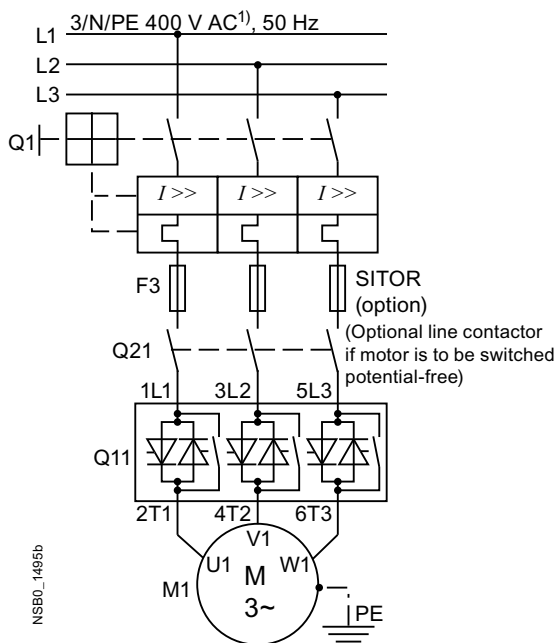


1) For permissible main and control voltage values, refer to Technical Data, pages 10-12 to 10-16.

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

Main circuit

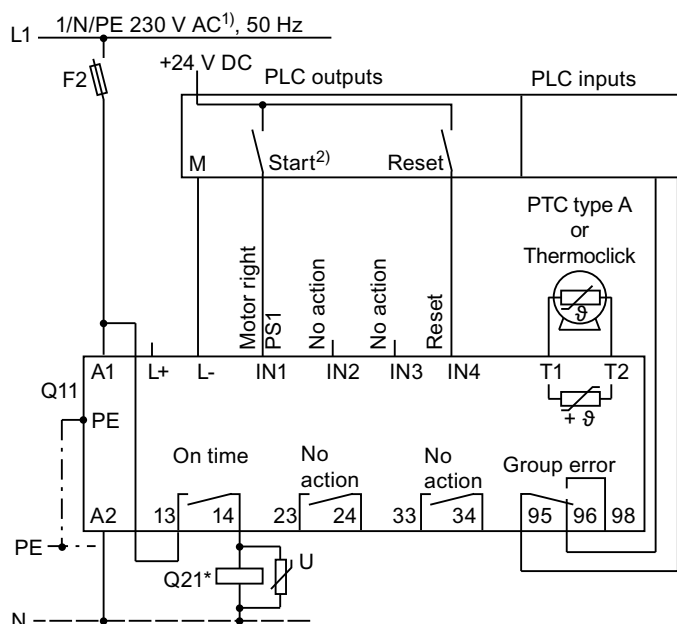
Standard circuit with optional main contactor



NSBO_1495b

Control circuit

Activation of an optional main contactor and activation via PLC



*(Optional line contactor if motor is to be switched potential-free)

NSBO_01496b

1) For permissible main and control voltage values, refer to Technical Data, pages 10-12 to 10-16.

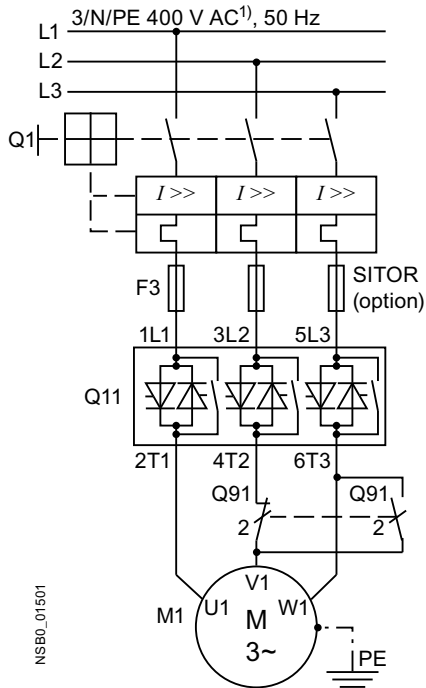
2) Caution: risk of restart!

The start command (e.g. via PLC) must be reset when a group fault occurs, since an automatic restart is executed when a start command is pending after the reset command is issued. This particularly applies to motor protection tripping.

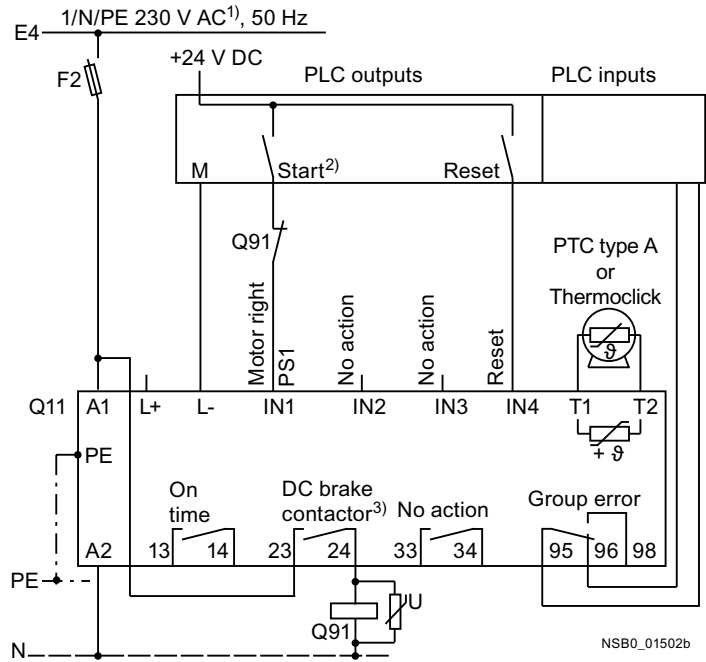
For safety reasons, we recommend integrating the group error output (terminals 95 and 96) into the control.

9.1.3 3RW44 in a Standard Circuit and DC Braking³⁾ Stopping Function for Device Types 3RW44 22 to 3RW44 25

Main circuit



Control circuit



1) For permissible main and control voltage values, refer to Technical Data, pages 10-12 to 10-16.

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 group error 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.

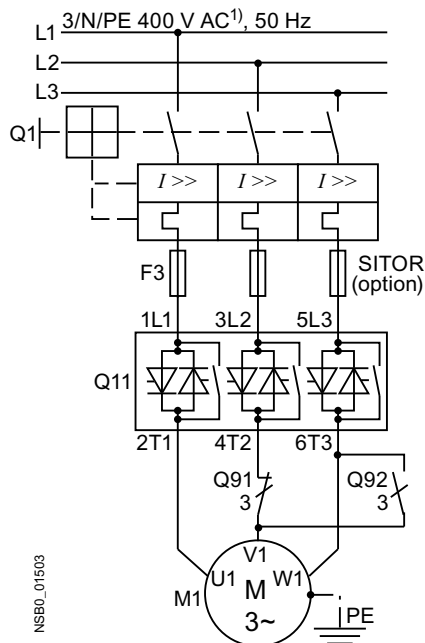
For types, refer to the "Branch component layout (standard circuit)" table on page 10-21.

The "DC braking" function is recommended for applications with larger centrifugal masses ($J_{load} > J_{motor}$).

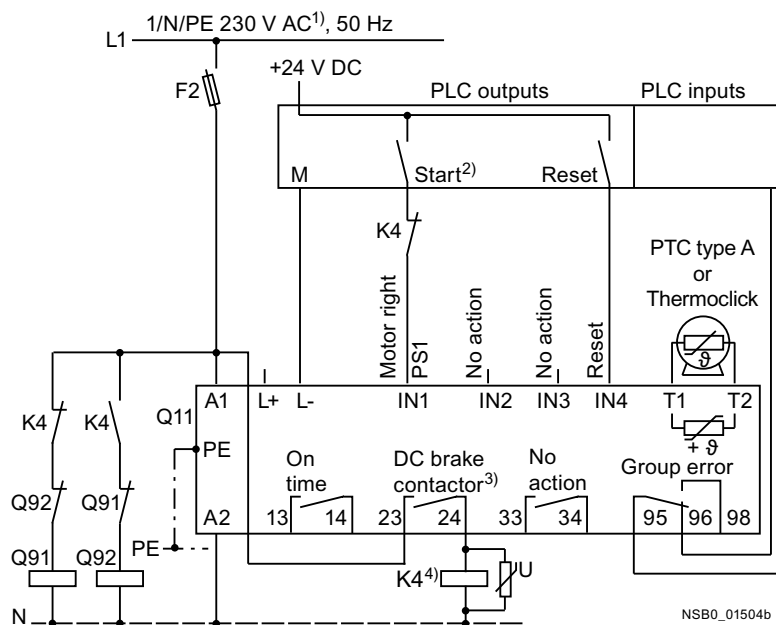
Output 2 must be set to "DC braking contactor".

9.1.4 3RW44 in a Standard Circuit and DC Braking³⁾ 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 10-12 to 10-16.

2) Caution: risk of restart!

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 particularly applies to motor protection tripping. For safety reasons, we recommend integrating the group error 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 layout (standard circuit)" table on page 10-21.

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".

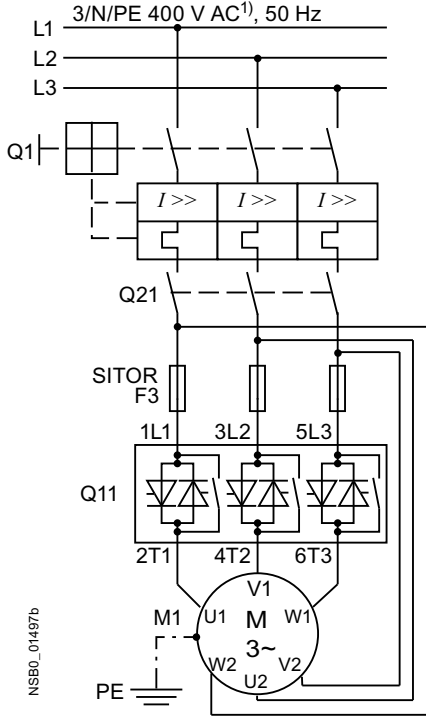
4) K4 auxiliary relay, e.g.:

LZX:RT4A4T30 (230 V AC rated control supply voltage),

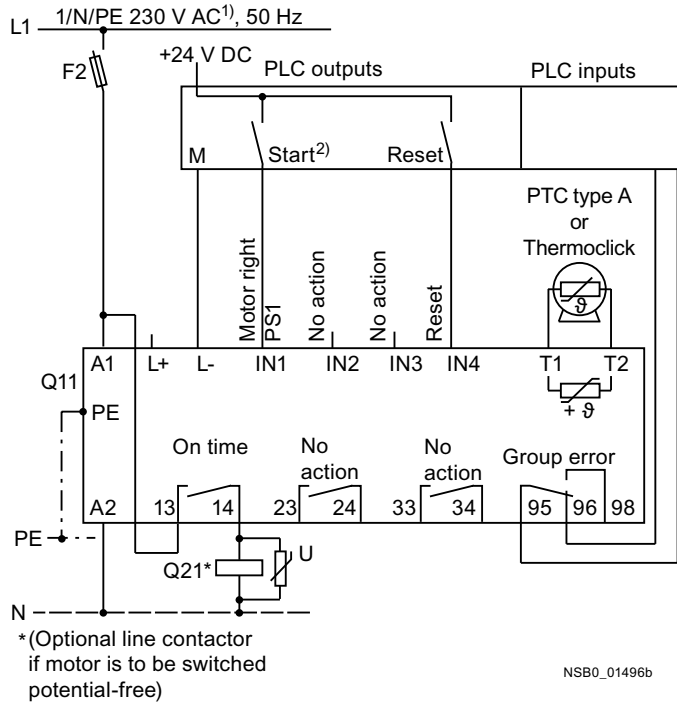
LZX:RT4A4S15 (115 V AC rated control supply voltage).

9.1.5 3RW44 in an Inside Delta Circuit

Main circuit Option 1a:

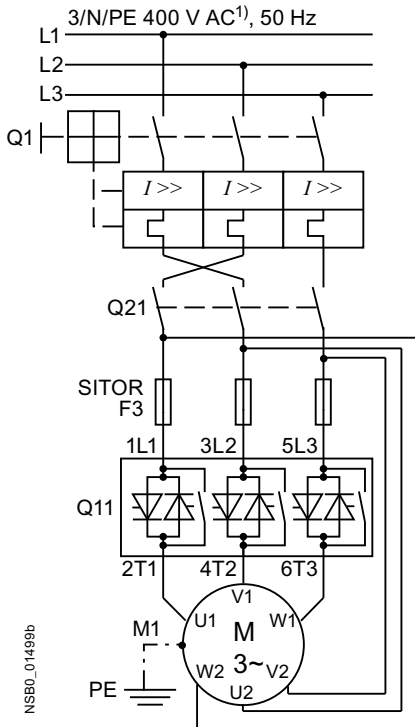


Control circuit Option 1: Activation via PLC



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.

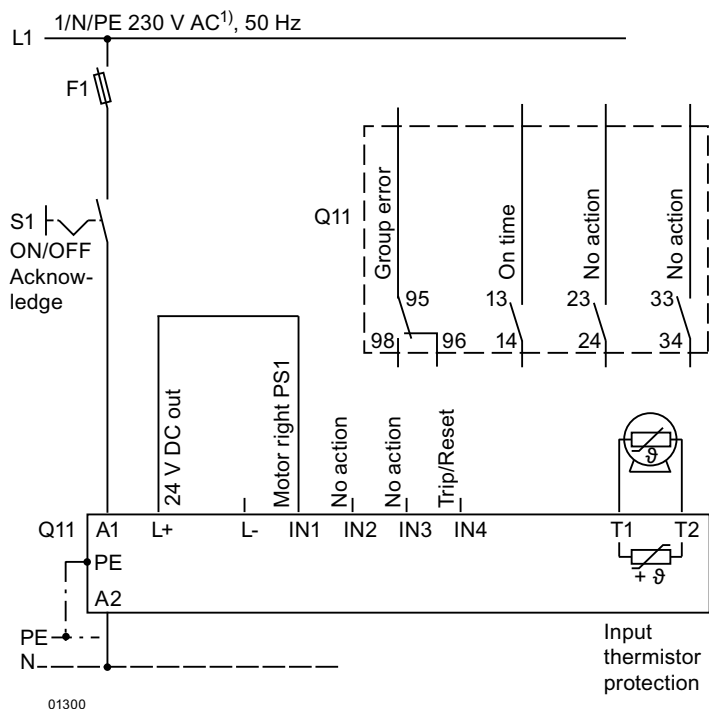
1) For permissible main and control voltage values, refer to Technical Data, pages 10-12 to 10-16.

2) Caution: risk of restart!

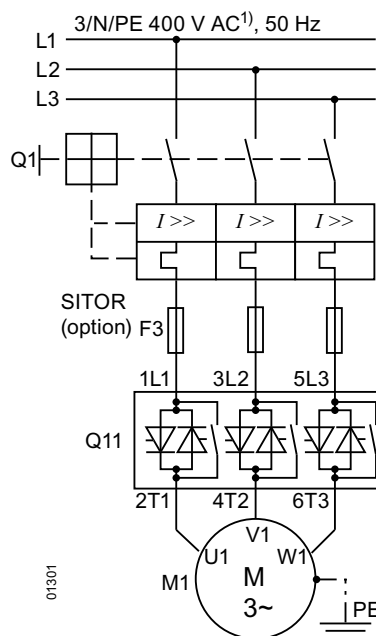
The start command (e.g. by the PLC) must be reset before a reset command is issued, as an automatic restart is executed when a start command is pending after the reset command is issued. This particularly applies to motor protection tripping. For safety reasons, we recommend integrating the group error 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

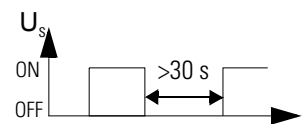


Note

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

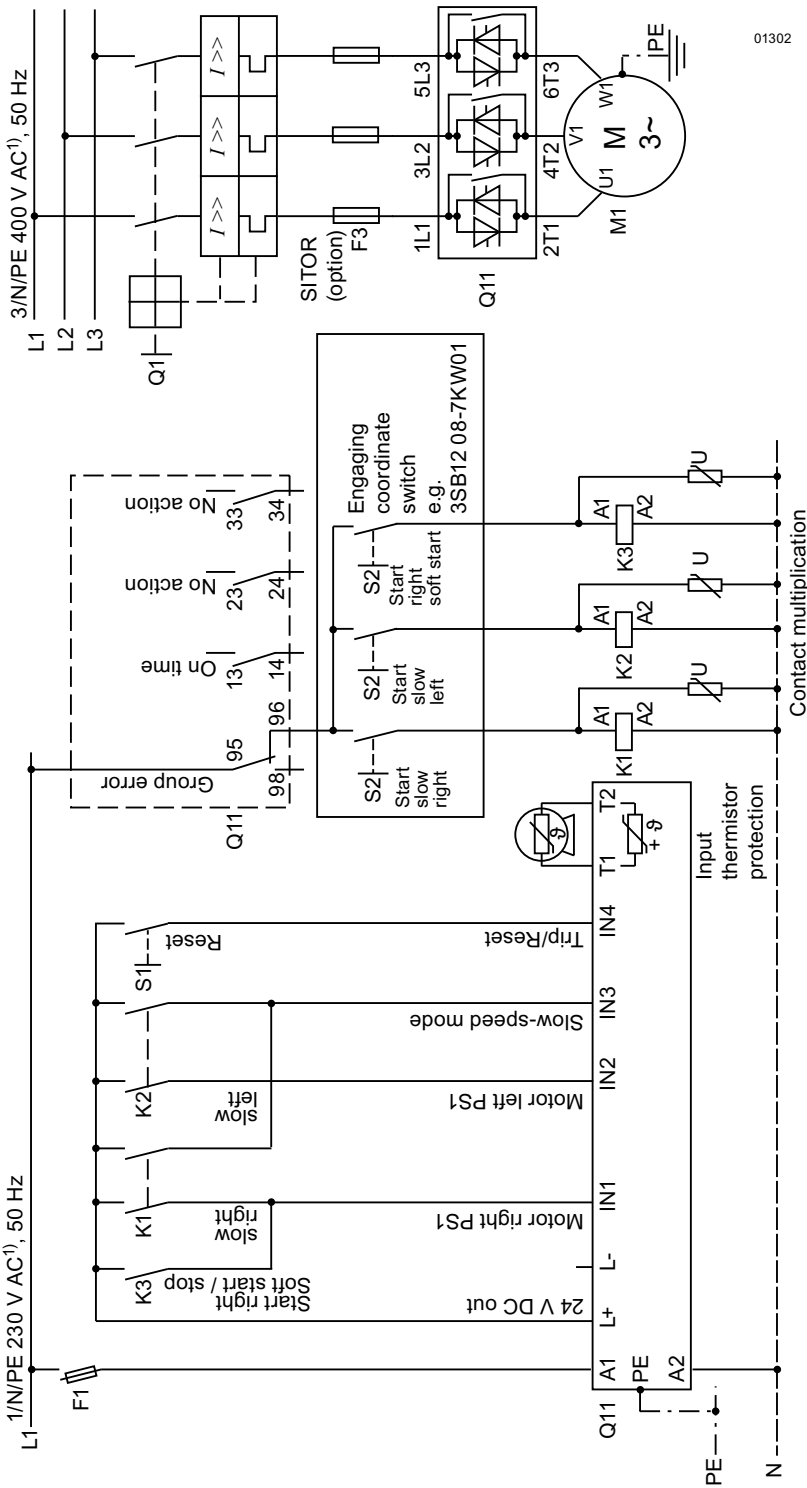
Notice

After the control supply voltage has been switched off 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 10-12 to 10-16.

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



01302

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 heating can become unreliable in continuous operation at slow speed.

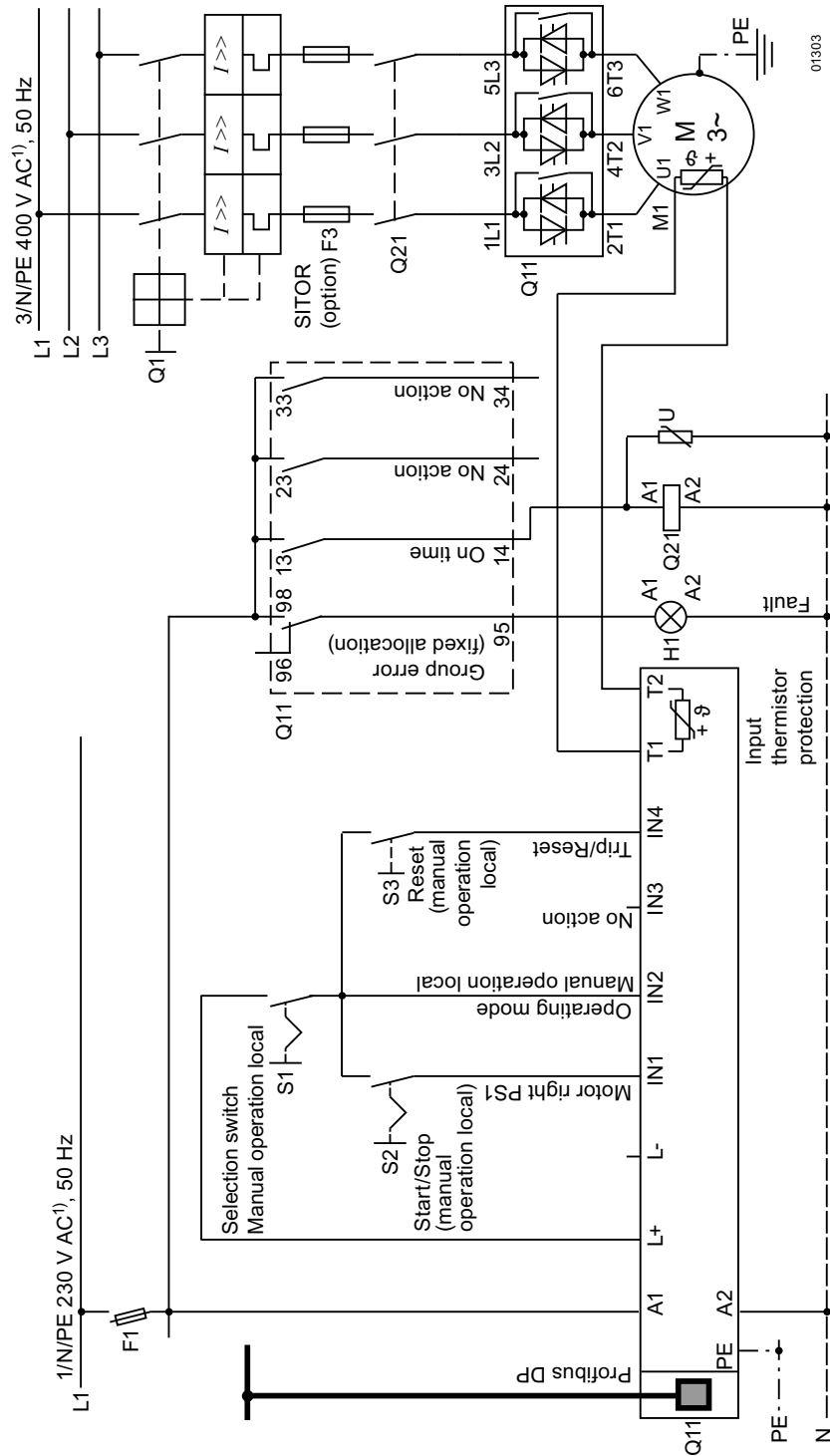
Caution - risk of restart:

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 especially applies to motor protection tripping.

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 10-12 to 10-16.

9.1.8 Activation via PROFIBUS with Switching to Manual Operation Local
(e. g. at the Control Cabinet)

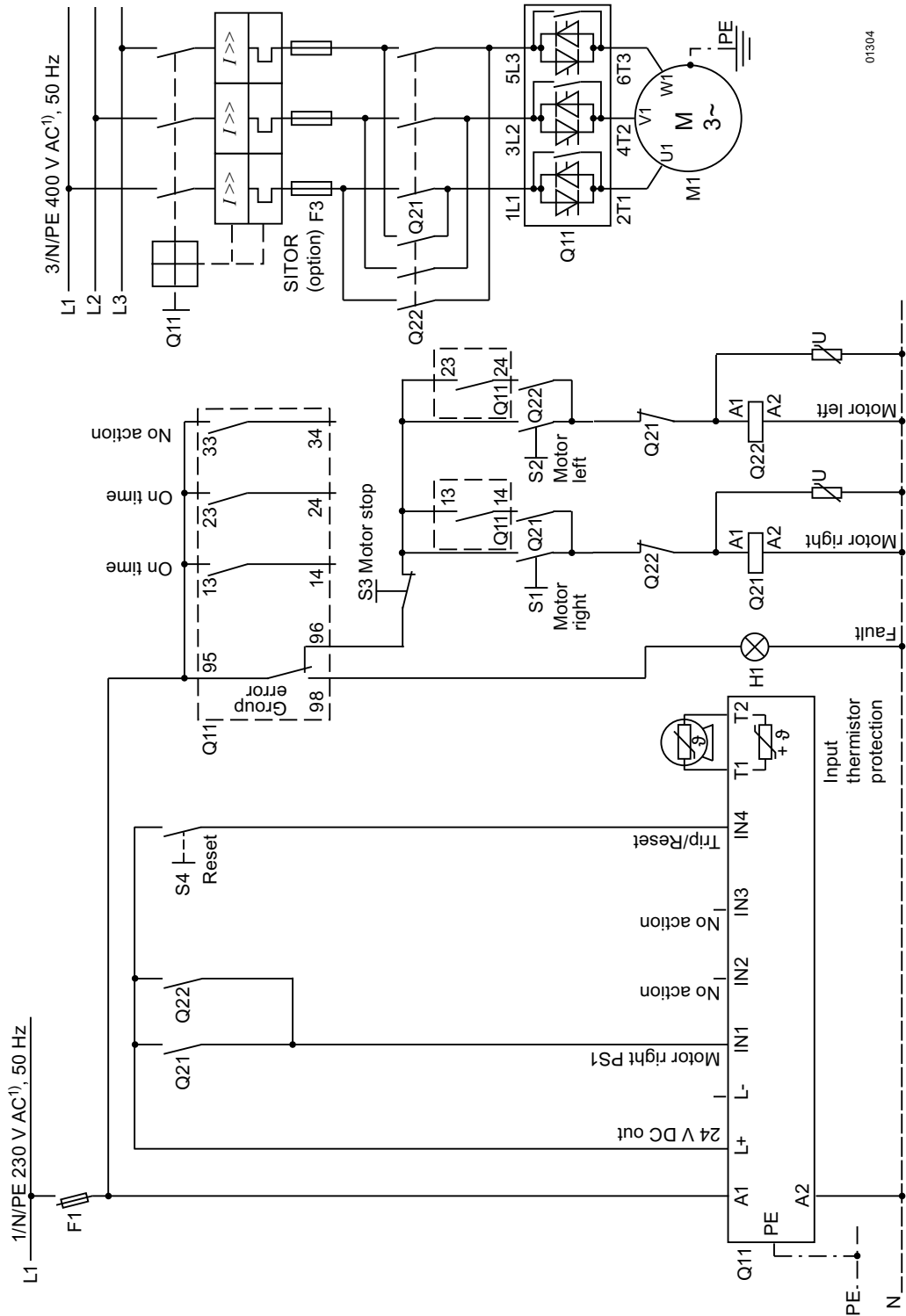


1) For permissible main and control voltage values, refer to Technical Data, pages 10-12 to 10-16.

9.1.9 3RW44 in a Standard Circuit and Reversing Operation via Main Contactors with one Parameter Set without Soft Stop

Notice

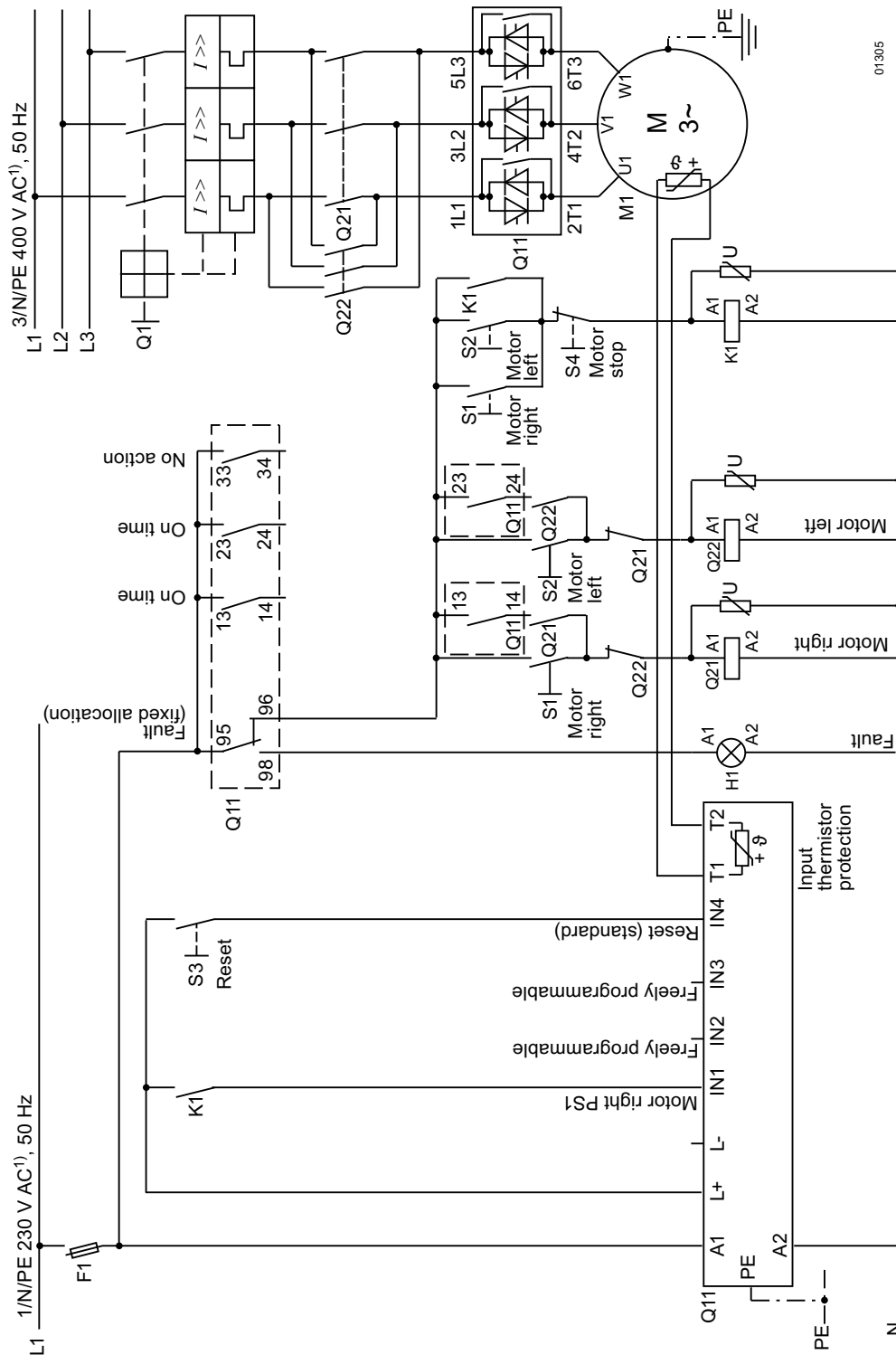
The "Coasting down" stopping mode must be set on the 3RW44.



01304

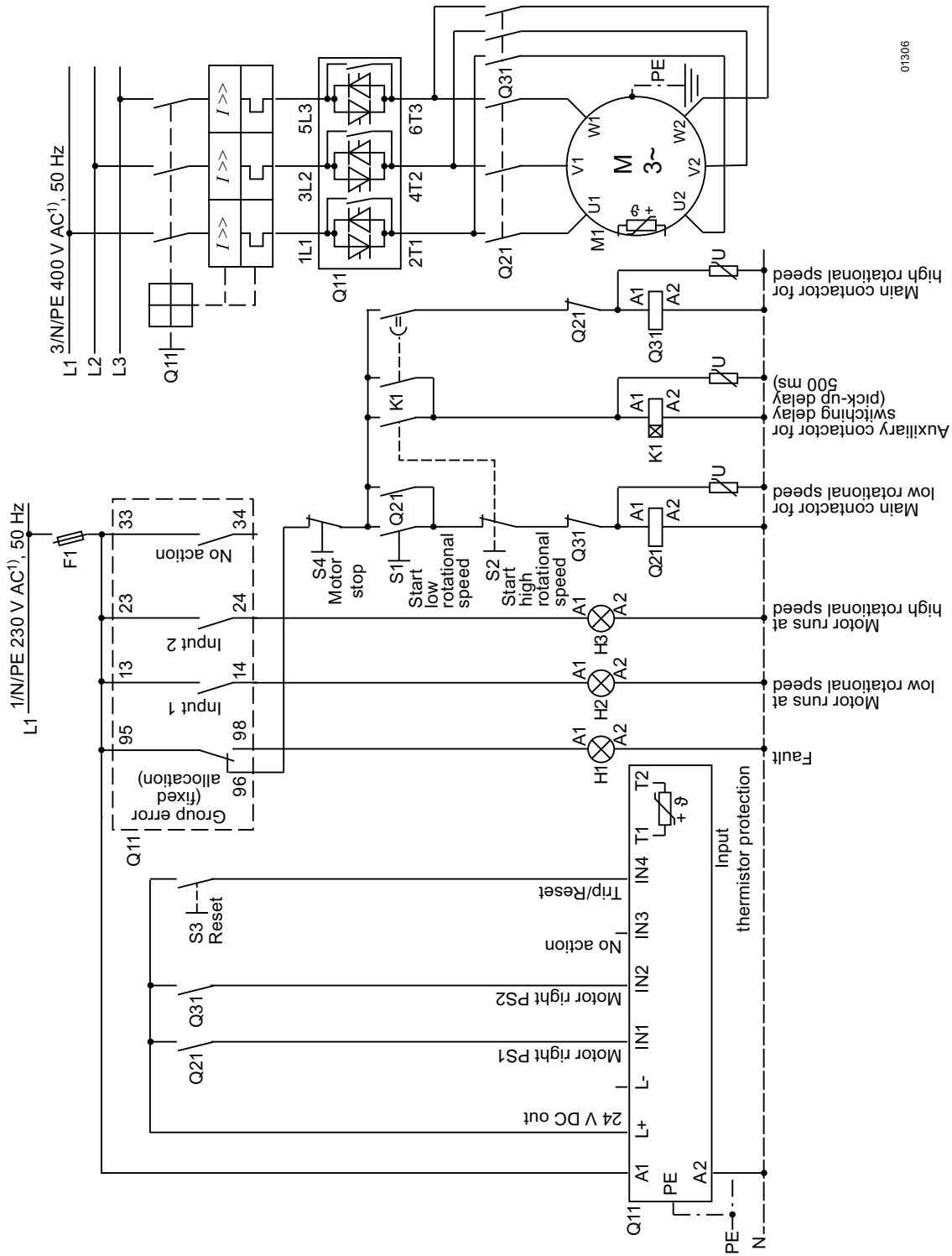
1) For permissible main and control voltage values, refer to Technical Data, pages 10-12 to 10-16.

9.1.10 Reversing Operation with Soft Stop



1) For permissible main and control voltage values, refer to Technical Data, pages 10-12 to 10-16.

9.1.11 Soft Starter for Pole-Changing Motor with Separate Windings and 2 Parameter Sets



01306

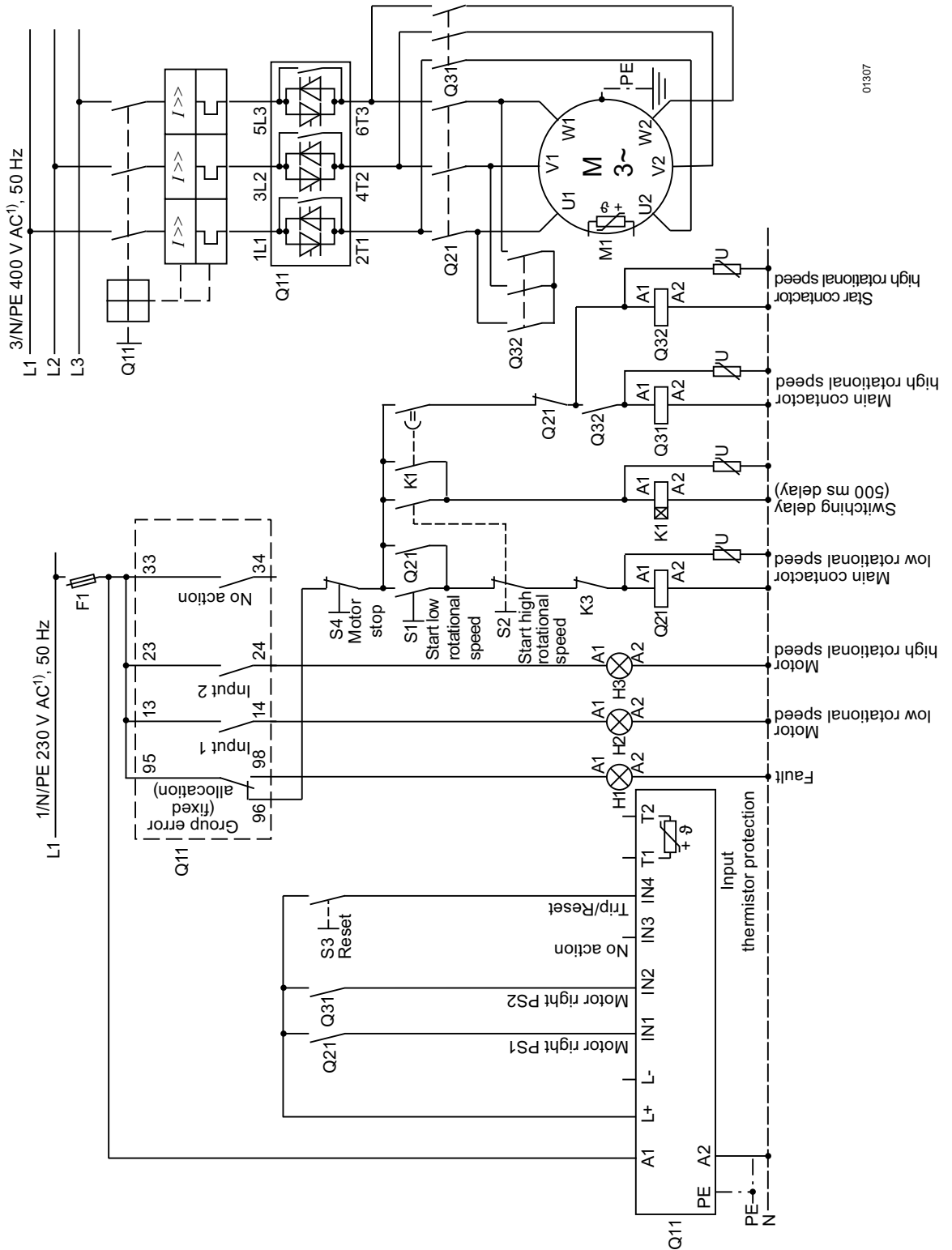
Notice
The "Coasting down" stopping mode must be set on the 3RW44.

1) For permissible main and control voltage values, refer to Technical Data, pages 10-12 to 10-16.

9.1.12 Soft Starters for Dahlander Motors with 2 Parameter Sets

Notice

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

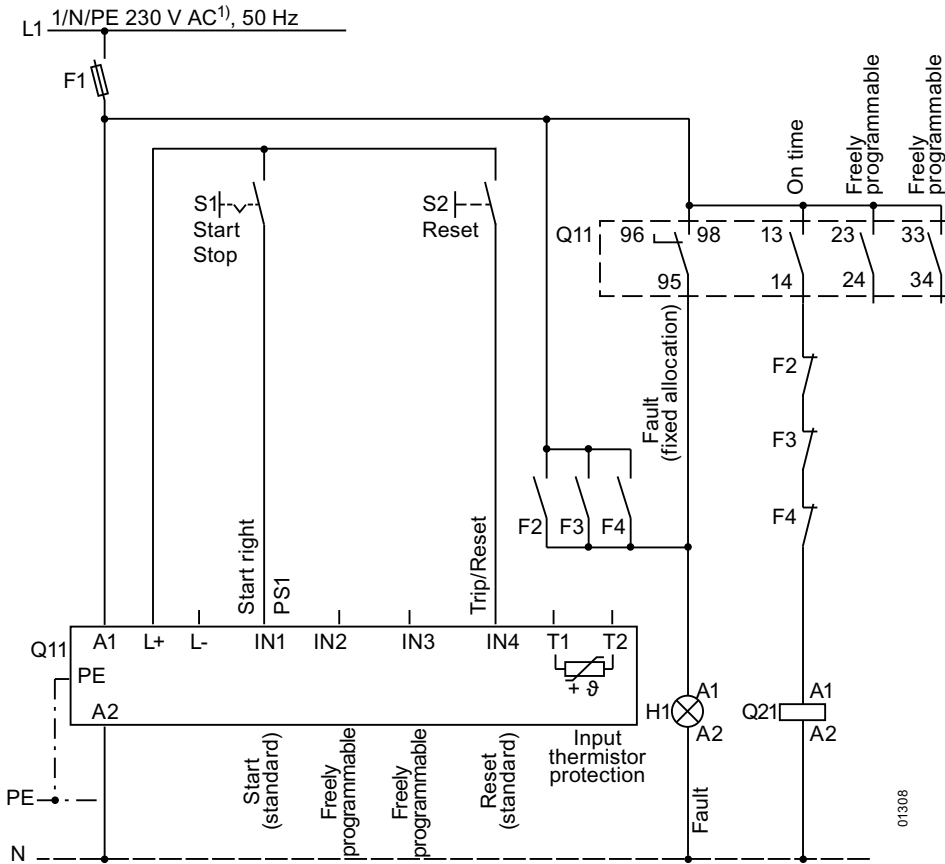


01307

1) For permissible main and control voltage values, refer to Technical Data, pages 10-12 to 10-16.

9.1.13 Parallel Starting of 3 Motors

Control circuit



1) For permissible main and control voltage values, refer to Technical Data, pages 10-12 to 10-16.

Notice

The rated output of the 3RW44 to be configured must be at least as high as the sum of the motor rated outputs.

The loads should have similar mass moments of inertia and torque curves.

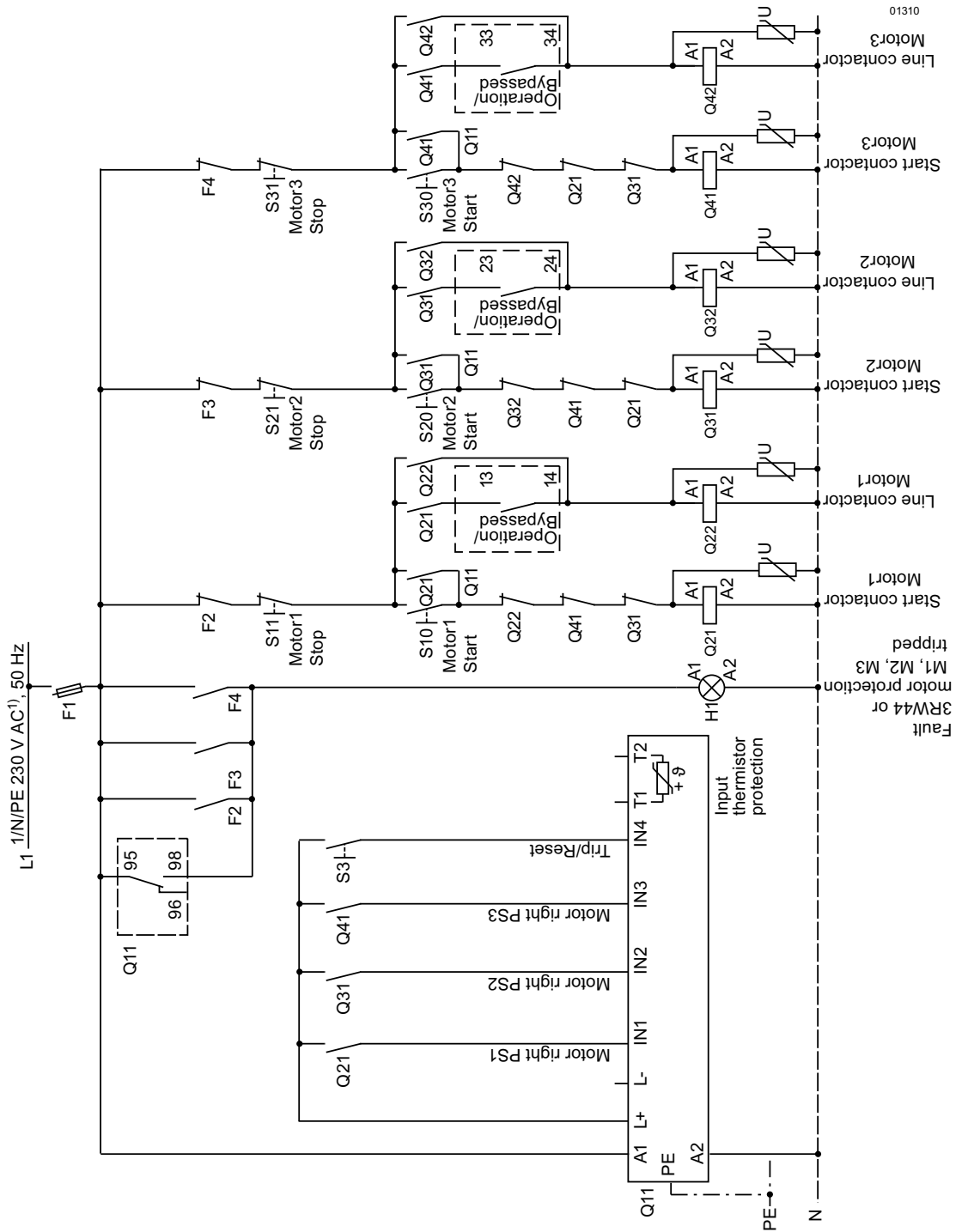
9.1.14 Soft Starter for Serial Starting with 3 Parameter Sets

Notice

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

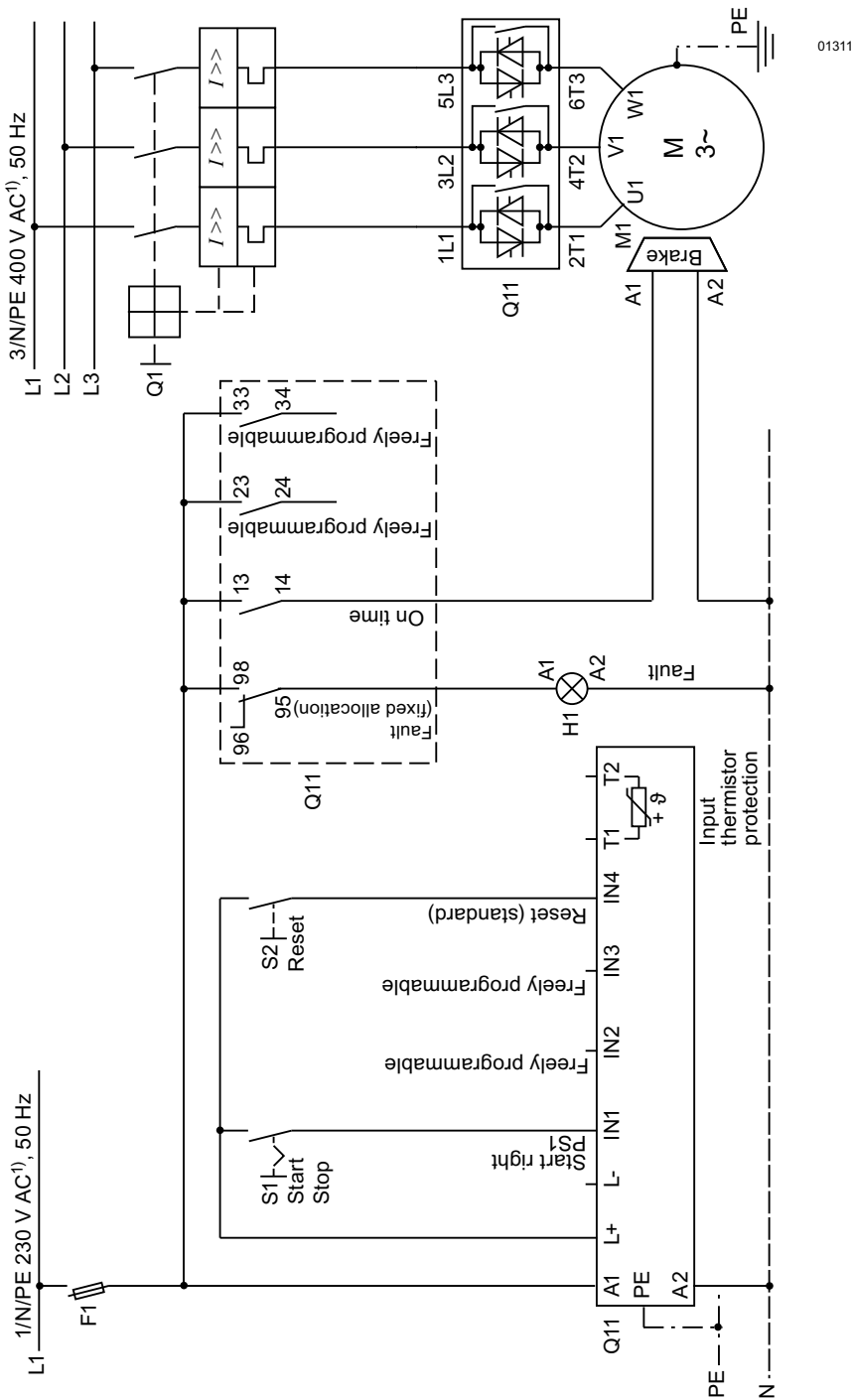
Note

In the case of increased operating sequences, the 3RW44 should be dimensioned at least one capacity level higher than the highest connected motor output.



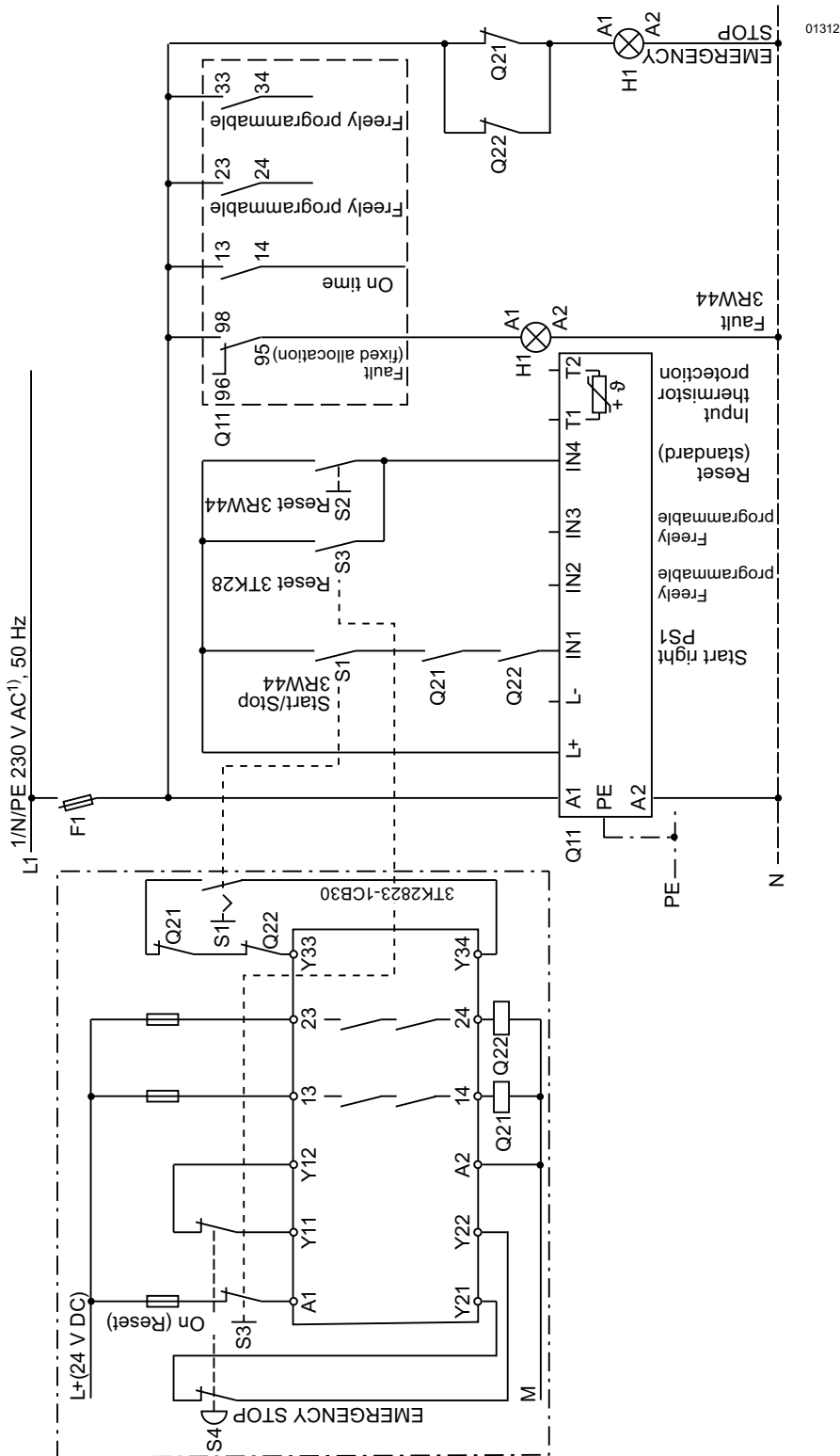
1) For permissible main and control voltage values, refer to Technical Data, pages 10-12 to 10-16.

9.1.15 Soft Starter for Activation of a Motor with a Magnetic Fixing Brake



1) For permissible main and control voltage values, refer to Technical Data, pages 10-12 to 10-16.

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



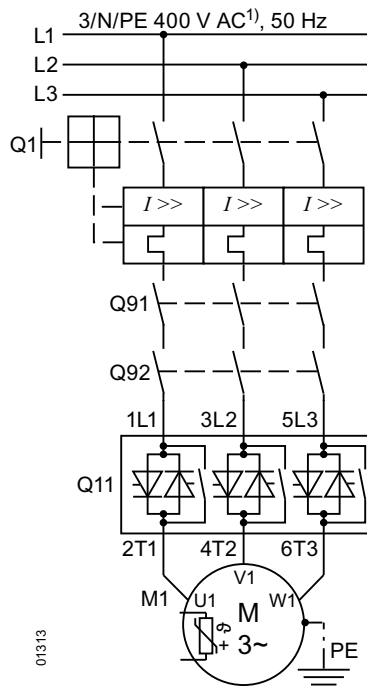
Notice

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

1) For permissible main and control voltage values, refer to Technical Data, pages 10-12 to 10-16.

Emergency stop monitoring according to EN 954-1 category 4 with safety relay 3TK2823 and 3RW44

Main circuit



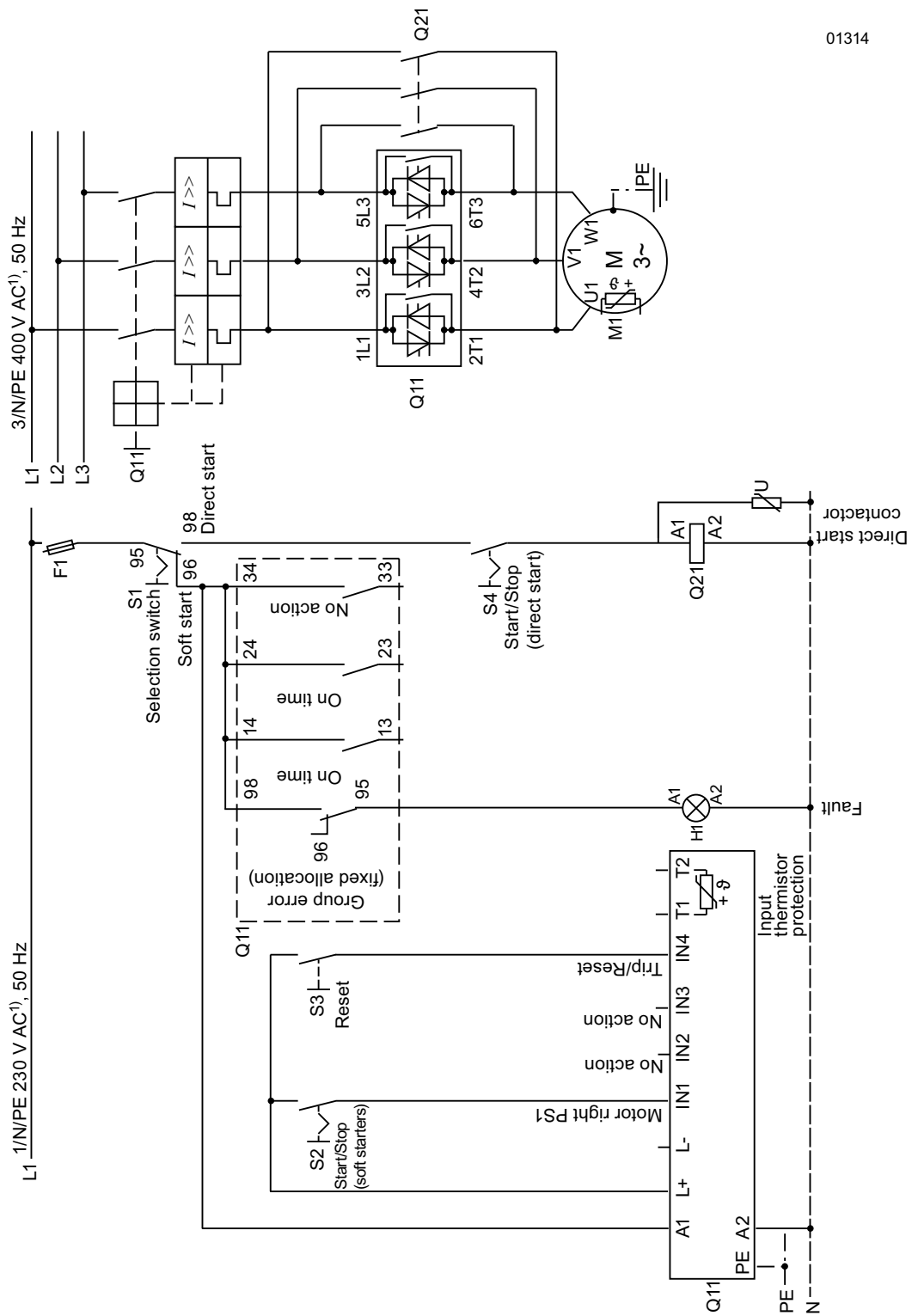
01313

1) For permissible main and control voltage values, refer to Technical Data, pages 10-12 to 10-16.

Notice

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

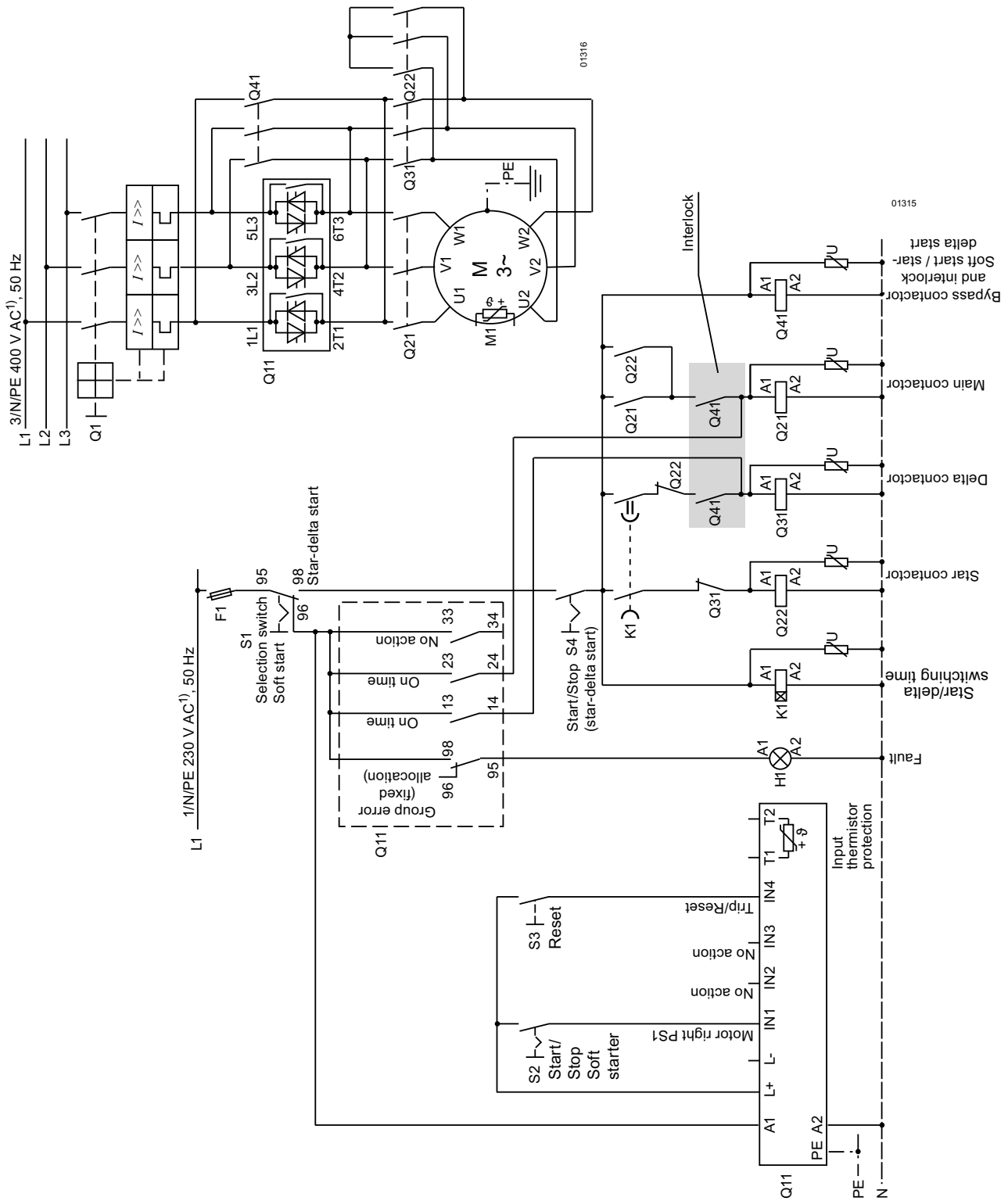
9.1.17 Soft Starter with Direct Switching (DOL) as Emergency Start



01314

1) For permissible main and control voltage values, refer to Technical Data, pages 10-12 to 10-16.

9.1.18 Soft Starter with Star-Delta Starter as Emergency Start (3RW44 in a Standard Circuit)



1) For permissible main and control voltage values, refer to Technical Data, pages 10-12 to 10-16.

General Technical Data

10

Chapter	Subject	Page
10.1	Menu Structure	10-2
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10.3	Technical Data	10-5
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10.3.2	Technical Data Power Unit	10-12
10.3.3	Technical Data Control Unit	10-16
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10.4.2	Motor Protection Tripping Characteristics: 3RW44 with Asymmetry	10-29
10.5	Dimension Drawings	10-30

	Factory Settings	Customer Settings	Motor control	Statistics	Safety	Factory Settings	Customer Settings
			ESC	ESC	ESC	1000	
			OK	OK	OK		
Response to warning			Motor control via keys	Log lists	Enter user code		
Unchanged			Key control	Device errors	User level		
On			activate	Trips	Customer read (> 1000)		
Blinking	x		deactivate	Events	Customer write (1000)		
Flickering			Select parameter set	Maximum pointer			
Reaction time keys	60 %		Parameter set 1	Currents (%)			
Auto repeat			Parameter set 2	Phase current L1 min			
Time	80 ms		Parameter set 3	Phase current L2 min			
Speed	80 %		Execute control function	Phase current L3 min			
Activity monitoring time	30 s		Motor right	Phase current L1 max			
Response to ...			Motor left **	Phase current L2 max			
Overload - therm. motor model			Slow speed	Phase current L3 max			
Tripping without restart	x		Emergency start	Currents (rms)			
Tripping with restart			Output 1	Phase current L1 min			
Warning			Output 2	Phase current L2 min			
Overload - temperature sensor			Control motor via inputs	Phase current L3 min			
Tripping without restart	x		Control via inputs	Phase current L1 max			
Tripping with restart			activate	Phase current L2 max			
Warning			deactivate	Phase current L3 max			
Current limit value violation			Standard control	Phase-to-phase voltages			
Warning	x		Automatic / None	UL1 - L2 min (rms)			
Tripping			Inputs	UL2 - L3 min (rms)			
Overload - contact block			Keys	UL3 - L1 min (rms)			
Tripping without restart	x			UL1 - L2 max (rms)			
Tripping with restart				UL2 - L3 max (rms)			
Asymmetry				UL3 - L1 max (rms)			
Warning				Maximum tripping current IA (%)			
Tripping	x			Maximum tripping current IA (rms)			
Ground fault				Number of overload trips			
Warning	x			Minimum line frequency			
Tripping				Maximum line frequency			
Name				Max. cooling temperature			
Name				Max. contact block temperature			
Fieldbus				Reset all maximum pointers			
Fieldbus interface				Statistics data			
Off	x			Motor current Imax (%)			
On				Motor current Imax (rms)			
Group diagnosis				Last trigger current IA (%)			
Disable	x			Last trigger current IA (rms)			
Enable				Operating hours - device			
Behavior on CPU/master-stop				Operating hours - motor			
Substitute value	x			No. of starts motor right			
Hold last value				No. of starts motor left			
Station address	126			Number of overload trips			
Baud rate				Number of braking stops			
Substitute value				No. of starts output 1			
Motor right				No. of starts output 2			
Motor left				No. of starts output 3			
Slow speed				No. of starts output 4			
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							

** 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 apply to modules that are transported and stored in their original packing.

Type of condition	Permissible range
Temperature	From -25 °C to +80 °C
Atmospheric pressure	From 700 to 1,060 hPa
Relative humidity	From 10 to 95 %

10.3 Technical Data

10.3.1 Selection and Ordering Data

Normal starting (CLASS 10) in a standard circuit

Rated operational voltage U_e	Rated operating current I_e	Ambient temperature 40 °C				Rated operating current I_e	Ambient temperature 50 °C				Order No.	
		Rated output of three-phase induction motors for rated operational voltage U_e					Rated output of three-phase induction motors for rated operational 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. supplement for type of connection										Screw-type terminals Spring-type terminals	↑ 1 3 ↑
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	—	—	970	350	400	850	—	3RW44 65-□BC□4		
1214	400	710	—	—	1076	350	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	900	3RW44 58-□BC□5	
1076	—	630	800	—	970	—	—	850	1100	3RW44 65-□BC□5		
1214	—	710	900	—	1076	—	—	950	1200	3RW44 66-□BC□5		
	Order No. supplement for type of connection										Spring-type terminals Screw-type terminals	↑ 2 6 ↑
	Order No. supplement for rated control supply voltage U_s										115 V AC 230 V AC	3 4

General Technical Data

Rated operational voltage U_e	Ambient temperature 40 °C					Ambient temperature 50 °C				Order No.	
	Rated operating current I_e	Rated output of three-phase induction motors for rated operational voltage U_e				Rated operating current I_e	Rated output of three-phase induction motors for rated operational 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	900	3RW44 58-□BC□6
	1076	—	630	800	1100	970	—	—	850	1100	3RW44 65-□BC□6
1214	—	710	900	1200	1076	—	—	950	1200	3RW44 66-□BC□6	
Order No. supplement for type of connection Order No. supplement for rated control supply voltage U_S										↑ 2 ↑ 6 ↑ 3 ↑ 4	
										Spring-type terminals Screw-type terminals 115 V AC 230 V AC	

Heavy starting (CLASS 20) in a standard circuit

Rated operational voltage U_e	Ambient temperature 40 °C					Ambient temperature 50 °C					Order No.	
	Rated operating current I_e	Rated output of three-phase induction motors for rated operational voltage U_e				Rated operating current I_e	Rated output of three-phase induction motors for rated operational voltage U_e					
		230 V kW	400 V kW	500 V kW	690 V kW		200 V HP	230 V HP	460 V HP	575 V HP		
V	A					A						
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 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 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 27-□BC□6	
	Order No. supplement for type of connection										Screw-type terminals Spring-type terminals	↑ 1 3 ↑
200 ... 460	93	22	45	—	—	82	25	25	60	—	3RW44 34-□BC□4	
	113	30	55	—	—	100	30	30	75	—	3RW44 35-□BC□4	
	134	37	75	—	—	117	30	40	75	—	3RW44 36-□BC□4	
	162	45	90	—	—	145	40	50	100	—	3RW44 43-□BC□4	
	203	55	110	—	—	180	50	60	125	—	3RW44 45-□BC□4	
	250	75	132	—	—	215	60	75	150	—	3RW44 46-□BC□4	
	313	90	160	—	—	280	75	100	200	—	3RW44 47-□BC□4	
	356	110	200	—	—	315	100	125	250	—	3RW44 47-□BC□4	
	432	132	250	—	—	385	125	150	300	—	3RW44 53-□BC□4	
	551	160	315	—	—	494	150	200	400	—	3RW44 53-□BC□4	
	615	200	355	—	—	551	150	200	450	—	3RW44 55-□BC□4	
	693	200	400	—	—	615	200	250	500	—	3RW44 57-□BC□4	
	780	250	450	—	—	693	200	250	600	—	3RW44 65-□BC□4	
880	250	500	—	—	780	250	300	700	—	3RW44 65-□BC□4		
970	315	560	—	—	850	300	350	750	—	3RW44 65-□BC□4		
400 ... 600	93	—	45	55	—	82	—	—	60	75	3RW44 34-□BC□5	
	113	—	55	75	—	100	—	—	75	75	3RW44 35-□BC□5	
	134	—	75	90	—	117	—	—	75	100	3RW44 36-□BC□5	
	162	—	90	110	—	145	—	—	100	125	3RW44 43-□BC□5	
	203	—	110	132	—	180	—	—	125	150	3RW44 45-□BC□5	
	250	—	132	160	—	215	—	—	150	200	3RW44 46-□BC□5	
	313	—	160	200	—	280	—	—	200	250	3RW44 47-□BC□5	
	356	—	200	250	—	315	—	—	250	300	3RW44 47-□BC□5	
	432	—	250	315	—	385	—	—	300	400	3RW44 53-□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 57-□BC□5	
	780	—	450	560	—	693	—	—	600	750	3RW44 55-□BC□5	
880	—	500	630	—	780	—	—	700	850	3RW44 65-□BC□5		
970	—	560	710	—	850	—	—	750	950	3RW44 65-□BC□5		
400 ... 690	93	—	45	55	90	82	—	—	60	75	3RW44 34-□BC□6	
	113	—	55	75	110	100	—	—	75	75	3RW44 35-□BC□6	
	134	—	75	90	132	117	—	—	75	100	3RW44 36-□BC□6	
	162	—	90	110	160	145	—	—	100	125	3RW44 43-□BC□6	
	203	—	110	132	200	180	—	—	125	150	3RW44 45-□BC□6	
	250	—	132	160	250	215	—	—	150	200	3RW44 46-□BC□6	
	313	—	160	200	315	280	—	—	200	250	3RW44 47-□BC□6	
	356	—	200	250	355	315	—	—	250	300	3RW44 47-□BC□6	
	432	—	250	315	400	385	—	—	300	400	3RW44 53-□BC□6	
	551	—	315	355	560	494	—	—	400	500	3RW44 53-□BC□6	
	615	—	355	400	630	551	—	—	450	600	3RW44 55-□BC□6	
	693	—	400	500	710	615	—	—	500	700	3RW44 57-□BC□6	
	780	—	450	560	800	693	—	—	600	750	3RW44 65-□BC□6	
880	—	500	630	900	780	—	—	700	850	3RW44 65-□BC□6		
970	—	560	710	1000	850	—	—	750	950	3RW44 65-□BC□6		
	Order No. supplement for type of connection										Spring-type terminals Screw-type terminals 115 V AC 230 V AC	↑ 2 6 ↑ 3 4
	Order No. supplement for rated control supply voltage U_s											

Very heavy starting (CLASS 30) in a standard circuit

Rated operational voltage U_e	Ambient temperature 40 °C					Ambient temperature 50 °C					Order No.
	Rated operating current I_e	Rated output of three-phase induction motors for rated operational voltage U_e				Rated operating current I_e	Rated output of three-phase induction motors for rated operational voltage U_e				
		230 V kW	400 V kW	500 V kW	690 V kW		200 V HP	230 V HP	460 V HP	575 V HP	
V	A					A					
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 24-□BC□4
	47	11	22	—	—	42	10	15	25	—	3RW44 25-□BC□4
	57	15	30	—	—	51	15	15	30	—	3RW44 25-□BC□4
400 ... 600	29	—	15	18.5	—	26	—	—	15	20	3RW44 22-□BC□5
	36	—	18.5	22	—	32	—	—	20	25	3RW44 24-□BC□5
	47	—	22	30	—	42	—	—	25	30	3RW44 25-□BC□5
	57	—	30	37	—	51	—	—	30	40	3RW44 25-□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 24-□BC□6
	47	—	22	30	45	42	—	—	25	30	3RW44 25-□BC□6
	57	—	30	37	55	51	—	—	30	40	3RW44 25-□BC□6
	Order No. supplement for type of connection					Screw-type terminals Spring-type terminals					↑ 1 ↑ 3
200 ... 460	77	18.5	37	—	—	68	20	20	50	—	3RW44 34-□BC□4
	93	22	45	—	—	82	25	25	60	—	3RW44 35-□BC□4
	113	30	55	—	—	100	30	30	75	—	3RW44 43-□BC□4
	134	37	75	—	—	117	30	40	75	—	3RW44 43-□BC□4
	162	45	90	—	—	145	40	50	100	—	3RW44 43-□BC□4
	203	55	110	—	—	180	50	60	125	—	3RW44 46-□BC□4
	250	75	132	—	—	215	60	75	150	—	3RW44 47-□BC□4
	313	90	160	—	—	280	75	100	200	—	3RW44 53-□BC□4
	356	110	200	—	—	315	100	125	250	—	3RW44 53-□BC□4
	432	132	250	—	—	385	125	150	300	—	3RW44 53-□BC□4
	551	160	315	—	—	494	150	200	400	—	3RW44 55-□BC□4
	615	200	355	—	—	551	150	200	450	—	3RW44 58-□BC□4
	693	200	400	—	—	615	200	250	500	—	3RW44 65-□BC□4
780	250	450	—	—	693	200	250	600	—	3RW44 65-□BC□4	
880	250	500	—	—	780	250	300	700	—	3RW44 65-□BC□4	
970	315	560	—	—	850	300	350	750	—	3RW44 66-□BC□4	
400 ... 600	77	—	37	45	—	68	—	—	50	50	3RW44 34-□BC□5
	93	—	45	55	—	82	—	—	60	75	3RW44 35-□BC□5
	113	—	55	75	—	100	—	—	75	75	3RW44 43-□BC□5
	134	—	75	90	—	117	—	—	75	100	3RW44 43-□BC□5
	162	—	90	110	—	145	—	—	100	125	3RW44 43-□BC□5
	203	—	110	132	—	180	—	—	125	150	3RW44 46-□BC□5
	250	—	132	160	—	215	—	—	150	200	3RW44 47-□BC□5
	313	—	160	200	—	280	—	—	200	250	3RW44 53-□BC□5
	356	—	200	250	—	315	—	—	250	300	3RW44 53-□BC□5
	432	—	250	315	—	385	—	—	300	400	3RW44 53-□BC□5
	551	—	315	355	—	494	—	—	400	500	3RW44 55-□BC□5
	615	—	355	400	—	551	—	—	450	600	3RW44 58-□BC□5
	693	—	400	500	—	615	—	—	500	700	3RW44 65-□BC□5
780	—	450	560	—	693	—	—	600	750	3RW44 65-□BC□5	
880	—	500	630	—	780	—	—	700	850	3RW44 65-□BC□5	
—	—	—	—	—	850	—	—	750	900	3RW44 66-□BC□5	
400 ... 690	77	—	37	45	75	68	—	—	50	50	3RW44 34-□BC□6
	93	—	45	55	90	82	—	—	60	75	3RW44 35-□BC□6
	113	—	55	75	110	100	—	—	75	75	3RW44 43-□BC□6
	134	—	75	90	132	117	—	—	75	100	3RW44 43-□BC□6
	162	—	90	110	160	145	—	—	100	125	3RW44 43-□BC□6
	203	—	110	132	200	180	—	—	125	150	3RW44 46-□BC□6
	250	—	132	160	250	215	—	—	150	200	3RW44 47-□BC□6
	313	—	160	200	315	280	—	—	200	250	3RW44 53-□BC□6
	356	—	200	250	355	315	—	—	250	300	3RW44 53-□BC□6
	432	—	250	315	400	385	—	—	300	400	3RW44 53-□BC□6
	551	—	315	355	560	494	—	—	400	500	3RW44 55-□BC□6
	615	—	355	400	630	551	—	—	450	600	3RW44 58-□BC□6
	693	—	400	500	710	615	—	—	500	700	3RW44 65-□BC□6
780	—	450	560	800	693	—	—	600	750	3RW44 65-□BC□6	
880	—	500	630	900	780	—	—	700	850	3RW44 65-□BC□6	
—	—	—	—	—	850	—	—	750	900	3RW44 66-□BC□6	
	Order No. supplement for type of connection					Spring-type terminals Screw-type terminals 115 V AC 230 V AC					↑ 2 6 ↑ 3 4
	Order No. supplement for rated control supply voltage U_s										

Normal starting (CLASS 10) in an inside delta circuit

Rated operational voltage U_e	Ambient temperature 40 °C					Ambient temperature 50 °C					Order No.
	Rated operating current I_e	Rated output of three-phase induction motors for rated operational voltage U_e				Rated operating current I_e	Rated output of three-phase induction motors for rated operational voltage U_e				
		230 V kW	400 V kW	500 V kW	690 V kW		200 V HP	230 V HP	460 V HP	575 V HP	
V	A										
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. supplement for type of connection										Screw-type terminals	↑ 1 ↑ 3
										Spring-type terminals	
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	—	—	1680	650	750	1500	—	3RW44 65-□BC□4	
2103	710	1200	—	—	1864	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	—	1680	—	—	1500	1900	3RW44 65-□BC□5	
2103	—	1200	1500	—	1864	—	—	1700	2100	3RW44 66-□BC□5	
Order No. supplement for type of connection										Spring-type terminals	↑ 2 6
Order No. supplement for rated control supply voltage U_s										Screw-type terminals	
										115 V AC	↑ 3 4
										230 V AC	

Heavy starting (CLASS 20) in an inside delta circuit

Rated operational voltage U_e	Ambient temperature 40 °C					Ambient temperature 50 °C					Order No.
	Rated operating current I_e	Rated output of three-phase induction motors for rated operational voltage U_e				Rated operating current I_e	Rated output of three-phase induction motors for rated operational 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	50	15	22	—	—	45	10	15	30	—	3RW44 23-□BC□4
	62	18.5	30	—	—	55	15	20	40	—	3RW44 24-□BC□4
	81	22	45	—	—	73	20	25	50	—	3RW44 25-□BC□4
	99	30	55	—	—	88	25	30	60	—	3RW44 25-□BC□4
	133	37	75	—	—	118	30	40	75	—	3RW44 27-□BC□4
400 ... 600	50	—	22	30	—	45	—	—	30	40	3RW44 23-□BC□5
	62	—	30	37	—	55	—	—	40	50	3RW44 24-□BC□5
	81	—	45	45	—	73	—	—	50	60	3RW44 25-□BC□5
	99	—	55	55	—	88	—	—	60	75	3RW44 25-□BC□5
	133	—	75	90	—	118	—	—	75	100	3RW44 27-□BC□5
	Order No. supplement for type of connection										
	Screw-type terminals										↑
	Spring-type terminals										↑
											1
200 ... 460	161	45	90	—	—	142	40	50	100	—	3RW44 34-□BC□4
	196	55	110	—	—	173	50	60	125	—	3RW44 35-□BC□4
	232	75	132	—	—	203	60	75	150	—	3RW44 36-□BC□4
	281	90	160	—	—	251	75	100	200	—	3RW44 43-□BC□4
	352	110	200	—	—	312	100	125	250	—	3RW44 44-□BC□4
	433	132	250	—	—	372	125	150	300	—	3RW44 45-□BC□4
	542	160	315	—	—	485	150	200	400	—	3RW44 47-□BC□4
	617	200	355	—	—	546	150	200	450	—	3RW44 47-□BC□4
	748	250	400	—	—	667	200	250	600	—	3RW44 53-□BC□4
	954	315	560	—	—	856	300	350	750	—	3RW44 53-□BC□4
	1065	355	630	—	—	954	350	400	850	—	3RW44 55-□BC□4
	1200	400	710	—	—	1065	350	450	950	—	3RW44 57-□BC□4
	1351	450	800	—	—	1200	450	500	1050	—	3RW44 65-□BC□4
	1524	500	900	—	—	1351	450	600	1200	—	3RW44 65-□BC□4
	1680	560	1000	—	—	1472	550	650	1300	—	3RW44 65-□BC□4
—	—	—	—	—	1680	650	750	1500	—	3RW44 66-□BC□4	
400 ... 600	161	—	90	110	—	142	—	—	100	125	3RW44 34-□BC□5
	196	—	110	132	—	173	—	—	125	150	3RW44 35-□BC□5
	232	—	132	160	—	203	—	—	150	200	3RW44 36-□BC□5
	281	—	160	200	—	251	—	—	200	250	3RW44 43-□BC□5
	352	—	200	250	—	312	—	—	250	300	3RW44 44-□BC□5
	433	—	250	315	—	372	—	—	300	350	3RW44 45-□BC□5
	542	—	315	355	—	485	—	—	400	500	3RW44 47-□BC□5
	617	—	355	450	—	546	—	—	450	600	3RW44 47-□BC□5
	748	—	400	500	—	667	—	—	600	750	3RW44 53-□BC□5
	954	—	560	630	—	856	—	—	750	950	3RW44 53-□BC□5
	1065	—	630	710	—	954	—	—	850	1050	3RW44 55-□BC□5
	1200	—	710	800	—	1065	—	—	950	1200	3RW44 57-□BC□5
	1351	—	800	900	—	1200	—	—	1050	1350	3RW44 65-□BC□5
	1524	—	900	1000	—	1351	—	—	1200	1500	3RW44 65-□BC□5
	1680	—	1000	1200	—	1472	—	—	1300	1650	3RW44 65-□BC□5
—	—	—	—	—	1680	—	—	1500	1900	3RW44 66-□BC□5	
	Order No. supplement for type of connection										↑
	Spring-type terminals										↑
	Screw-type terminals										↑
	115 V AC										2
	230 V AC										3
	Order No. supplement for rated control supply voltage U_s										6
											4

Very heavy starting (CLASS 30) in an inside delta circuit

Rated operational voltage U_e	Ambient temperature 40 °C					Ambient temperature 50 °C					Order No.
	Rated operating current I_e	Rated output of three-phase induction motors for rated operational voltage U_e				Rated operating current I_e	Rated output of three-phase induction motors for rated operational 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	50	15	22	—	—	45	10	15	30	—	3RW44 23-□BC□4
	62	18.5	30	—	—	55	15	20	40	—	3RW44 24-□BC□4
	81	22	45	—	—	73	20	25	50	—	3RW44 25-□BC□4
	99	30	55	—	—	88	25	30	60	—	3RW44 25-□BC□4
	133	37	75	—	—	118	30	40	75	—	3RW44 27-□BC□4
400 ... 600	50	—	22	30	—	45	—	—	30	40	3RW44 23-□BC□5
	62	—	30	37	—	55	—	—	40	50	3RW44 24-□BC□5
	81	—	45	45	—	73	—	—	50	60	3RW44 25-□BC□5
	99	—	55	55	—	88	—	—	60	75	3RW44 25-□BC□5
	133	—	75	90	—	118	—	—	75	100	3RW44 27-□BC□5
Order No. supplement for type of connection										Screw-type terminals Spring-type terminals	↑ 1 3 ↑
200 ... 460	161	45	90	—	—	142	40	50	100	—	3RW44 35-□BC□4
	196	55	110	—	—	173	50	60	125	—	3RW44 36-□BC□4
	232	75	132	—	—	203	60	75	150	—	3RW44 43-□BC□4
	281	90	160	—	—	251	75	100	200	—	3RW44 43-□BC□4
	352	110	200	—	—	312	100	125	250	—	3RW44 45-□BC□4
	433	132	250	—	—	372	125	150	300	—	3RW44 47-□BC□4
	542	160	315	—	—	485	150	200	400	—	3RW44 53-□BC□4
	617	200	355	—	—	546	150	200	450	—	3RW44 53-□BC□4
	748	250	400	—	—	667	200	250	600	—	3RW44 53-□BC□4
	954	315	560	—	—	856	300	350	750	—	3RW44 55-□BC□4
	1065	355	630	—	—	954	350	400	850	—	3RW44 58-□BC□4
	1200	400	710	—	—	1065	350	450	950	—	3RW44 65-□BC□4
	1351	450	800	—	—	1200	450	500	1050	—	3RW44 65-□BC□4
	1524	500	900	—	—	1351	450	600	1200	—	3RW44 65-□BC□4
	—	—	—	—	—	1472	550	650	1300	—	3RW44 66-□BC□4
400 ... 600	161	—	90	110	—	142	—	—	100	125	3RW44 35-□BC□5
	196	—	110	132	—	173	—	—	125	150	3RW44 36-□BC□5
	232	—	132	160	—	203	—	—	150	200	3RW44 43-□BC□5
	281	—	160	200	—	251	—	—	200	250	3RW44 43-□BC□5
	352	—	200	250	—	312	—	—	250	300	3RW44 45-□BC□5
	433	—	250	315	—	372	—	—	300	350	3RW44 47-□BC□5
	542	—	315	355	—	485	—	—	400	500	3RW44 53-□BC□5
	617	—	355	450	—	546	—	—	450	600	3RW44 53-□BC□5
	748	—	400	500	—	667	—	—	600	750	3RW44 53-□BC□5
	954	—	560	630	—	856	—	—	750	950	3RW44 55-□BC□5
	1065	—	630	710	—	954	—	—	850	1050	3RW44 58-□BC□5
	1200	—	710	800	—	1065	—	—	950	1200	3RW44 65-□BC□5
	1351	—	800	900	—	1200	—	—	1050	1350	3RW44 65-□BC□5
	1524	—	900	1000	—	1351	—	—	1200	1500	3RW44 65-□BC□5
	—	—	—	—	—	1472	—	—	1300	1650	3RW44 66-□BC□5
Order No. supplement for type of connection										Spring-type terminals Screw-type terminals	↑ 2 6 ↑ 3 4
Order No. supplement for rated control supply voltage U_s										115 V AC 230 V AC	

Marginal conditions

	CLASS 10 (normal starting):	CLASS 20 (heavy starting):	CLASS 30 (very heavy starting):
Maximum starting time:	10 s	40 s	60 s
Current limiting	300 %	Set to 350 %	Set to 350 %
Starts/hour	5	max. 1	max. 1

General marginal conditions

On-time motor	30%		
Stand-alone installation			
Installation altitude	max. 1,000 m / 3,280 ft		
Ambient temperature	kW: 40 °C / 1,104 °F	hp: 50 °C / 122 °F	

The motor outputs listed are only rough values. The dimensioning of the soft starter should always be carried out on the basis of the motor current (rated operating current). A model with a higher output may be necessary for deviating conditions.

The motor output specifications are based on DIN 42973 (kW) and NEC 96/UL508 (hp).

For optimum dimensioning and/or deviations from the boundary conditions described, we recommend the use of the "Win Soft Starter" selection and simulation program, which can be downloaded at: <http://www.siemens.com/softstarter> >Software

10.3.2 Technical Data Power Unit

Type		3RW44 ...-BC.4	3RW44 ...-BC.5	3RW44 ...-BC.6
Power electronics				
Rated operational voltage for standard circuit	V	200 ... 460 AC	400 ... 600 AC	400 ... 690 AC
Tolerance	%	-15 / +10	-15 / +10	-15 / +10
Rated operational voltage for inside delta circuit	V	200 ... 460 AC	400 ... 600 AC	400 ... 600 AC
Tolerance	%	-15 / +10	-15 / +10	-15 / +10
Maximum blocking voltage thyristor	V	1400	1800	1800
Rated frequency	Hz	50 ... 60		
Tolerance	%	±10		
Continuous operation at 40 °C (% of I _g)	%	115		
Minimum load (% of set motor current I _M)	%	8		
Maximum cable length between soft starter and motor	m	500 ^{a)}		
Permissible installation height	m	5000 (for derating above 1000, see characteristic curves); higher on request		
Permissible mounting position and installation type (stand-alone installation)				
Permissible ambient temperature				
Operation	°C	0 ... +60; (derating above +40)		
Storage	°C	-25 ... +80		
Degree of protection		IP00		

^{a)} During configuration, the voltage drop on the motor line must be taken into consideration up to the motor connection. It may be necessary to select a larger dimensioned soft starter with regard to the rated operational voltage and/or the rated operating current.

Type		3RW44 22	3RW44 23	3RW44 24	3RW44 25	3RW44 26	3RW44 27
Power electronics							
Rated operating current I _g		29	36	47	57	77	93
Carrying capacity, rated operating current I _g							
• According to IEC and UL / CSA ¹⁾ , for single mounting, AC-53a							
- At 40 / 50 / 60 °C	A	29 / 26 / 23	36 / 32 / 29	47 / 42 / 37	57 / 51 / 45	77 / 68 / 59	93 / 82 / 72
Minimum selectable nominal motor current I _M for motor overload protection	A	5	7	9	11	15	18
Power loss							
• Uninterrupted rated operating current after run up (40 / 50 / 60 °C) approx.	W	8 / 7.5 / 7	10 / 9 / 8.5	32 / 31 / 29	36 / 34 / 31	45 / 41 / 37	55 / 51 / 47
• When starting with current limiting set at 350 % I _M (40 / 50 / 60 °C)	W	400 / 345 / 290	470 / 410 / 355	600 / 515 / 440	725 / 630 / 525	940 / 790 / 660	1160 / 980 / 830
Permitted rated motor current and starts per hour							
• For normal starting (CLASS 5)							
- Rated motor current I _M ²⁾ , run-up time 5 s	A	29 / 26 / 23	36 / 32.5 / 29	47 / 42 / 37	57 / 51 / 45	77 / 68 / 59	93 / 82 / 72
- Starts per hour ³⁾	1/h	41	34	41	41	41	41
- Rated motor current I _M ²⁾ , run-up time 10 s	A	29 / 26 / 23	36 / 32.5 / 29	47 / 42 / 37	57 / 51 / 45	77 / 68 / 59	93 / 82 / 72
- Starts per hour ³⁾	1/h	20	15	20	20	20	20
• For normal starting (CLASS 10)							
- Rated motor current I _M ²⁾ , run-up time 10 s	A	29 / 26 / 23	36 / 32.5 / 29	47 / 42 / 37	57 / 51 / 45	77 / 68 / 59	93 / 82 / 72
- Starts per hour ³⁾	1/h	20	15	20	20	20	20
- Rated motor current I _M ²⁾ , run-up time 20 s	A	29 / 26 / 23	36 / 32.5 / 29	47 / 42 / 37	57 / 51 / 45	77 / 68 / 59	93 / 82 / 72
- Starts per hour ³⁾	1/h	10	6	10	10	8	8
• For normal starting (CLASS 15)							
- Rated motor current I _M ²⁾ , run-up time 15 s	A	29 / 26 / 23	36 / 32.5 / 29	47 / 42 / 37	57 / 51 / 45	77 / 68 / 59	93 / 82 / 72
- Starts per hour ³⁾	1/h	13	9	13	13	13	13
- Rated motor current I _M ²⁾ , run-up time 30 s	A	29 / 26 / 23	36 / 32.5 / 29	47 / 42 / 37	57 / 51 / 45	77 / 68 / 59	93 / 82 / 72
- Starts per hour ³⁾	1/h	6	4	6	6	6	6
• For heavy starting (CLASS 20)							
- Rated motor current I _M ²⁾ , run-up time 20 s	A	29 / 26 / 23	36 / 32.5 / 29	47 / 42 / 37	57 / 51 / 45	77 / 68 / 59	88 / 80 / 72
- Starts per hour ³⁾	1/h	10	6	10	10	10	10
- Rated motor current I _M ²⁾ , run-up time 40 s	A	29 / 26 / 23	36 / 32.5 / 29	47 / 42 / 37	57 / 51 / 45	77 / 68 / 59	88 / 80 / 72
- Starts per hour ³⁾	1/h	4	2	4	5	1.8	0.8
• For very heavy starting (CLASS 30)							
- Rated motor current I _M ²⁾ , run-up time 30 s	A	29 / 26 / 23	36 / 32.5 / 29	47 / 42 / 37	57 / 51 / 45	65 / 60 / 54	77 / 70 / 63
- Starts per hour ³⁾	1/h	6	4	6	6	6	6
- Rated motor current I _M ²⁾ , run-up time 60 s	A	29 / 26 / 23	36 / 32.5 / 29	47 / 42 / 37	57 / 51 / 45	65 / 60 / 54	77 / 70 / 63
- Starts per hour ³⁾	1/h	1.8	0.8	3.3	1.5	2	1

1) Measurement at 60 °C not required according to UL/CSA.

2) Current limiting on soft starter set at 350 % I_M; on-time OT = 70 %.
Maximum selectable rated motor current I_M, depending on the CLASS settings.

3) During intermittent duty S4 with on-time OT = 70 %, T_u = 40 / 50 / 60 °C, vertical stand-alone installation. The listed switching frequencies do not apply to automatic operation.

Type		3RW44 34	3RW44 35	3RW44 36
Power electronics				
Rated operating current I_e		113	134	162
Carrying capacity, rated operating current I_e				
• According to IEC and UL / CSA ¹⁾ , for single mounting, AC-53a				
- At 40 °C	A	113	134	162
- At 50 °C	A	100	117	145
- At 60 °C	A	88	100	125
Minimum selectable nominal motor current I_M For motor overload protection	A	22	26	32
Power loss				
• Uninterrupted rated operating current after run up (40 / 50 / 60 °C) approx.	W	64 / 58 / 53	76 / 67 / 58	95 / 83 / 71
• When starting with current limiting set at 350 % I_M (40 / 50 / 60 °C)	W	1350 / 1140 / 970	1700 / 1400 / 1140	2460 / 1980 / 1620
Permitted rated motor current and starts per hour				
• For normal starting (CLASS 5)				
- Rated motor current $I_M^{(2)}$, run-up time 5 s	A	113 / 100 / 88	134 / 117 / 100	162 / 145 / 125
- Starts per hour ³⁾	1/h	41	39	41
- Rated motor current $I_M^{(2)}$, run-up time 10 s	A	113 / 100 / 88	134 / 117 / 100	162 / 145 / 125
- Starts per hour ³⁾	1/h	20	15	20
• For normal starting (CLASS 10)				
- Rated motor current $I_M^{(2)}$, run-up time 10 s	A	113 / 100 / 88	134 / 117 / 100	162 / 145 / 125
- Starts per hour ³⁾	1/h	20	15	20
- Rated motor current $I_M^{(2)}$, run-up time 20 s	A	113 / 100 / 88	134 / 117 / 100	162 / 145 / 125
- Starts per hour ³⁾	1/h	9	6	7
• For normal starting (CLASS 15)				
- Rated motor current $I_M^{(2)}$, run-up time 15 s	A	113 / 100 / 88	134 / 117 / 100	162 / 145 / 125
- Starts per hour ³⁾	1/h	13	9	12
- Rated motor current $I_M^{(2)}$, run-up time 30 s	A	113 / 100 / 88	134 / 117 / 100	162 / 145 / 125
- Starts per hour ³⁾	1/h	6	6	1
• For heavy starting (CLASS 20)				
- Rated motor current $I_M^{(2)}$, run-up time 20 s	A	106 / 97 / 88	125 / 113 / 100	147 / 134 / 122
- Starts per hour ³⁾	1/h	9	9	10
- Rated motor current $I_M^{(2)}$, run-up time 40 s	A	106 / 97 / 88	125 / 113 / 100	147 / 134 / 122
- Starts per hour ³⁾	1/h	1.5	2	1
• For very heavy starting (CLASS 30)				
- Rated motor current $I_M^{(2)}$, run-up time 30 s	A	91 / 84 / 76	110 / 100 / 90	120 / 110 / 100
- Starts per hour ³⁾	1/h	6	6	6
- Rated motor current $I_M^{(2)}$, run-up time 60 s	A	91 / 84 / 76	110 / 100 / 90	120 / 110 / 100
- Starts per hour ³⁾	1/h	2	2	2

1) Measurement at 60 °C not required according to UL/CSA.

2) Current limiting on soft starter set at 350 % I_M ; on-time OT = 70 %.
Maximum selectable rated motor current I_M , depending on the CLASS settings.

3) During intermittent duty S4 with on-time OT = 70 %, $T_U = 40/50/60$ °C, vertical stand-alone installation. The listed switching frequencies do not apply to automatic operation.

General Technical Data

Type		3RW44 43	3RW44 44	3RW44 45	3RW44 46	3RW44 47
Power electronics						
Rated operating current I_e		203	250	313	356	432
Carrying capacity, rated operating current I_e						
• According to IEC and UL / CSA ¹⁾ , for single 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
Minimum selectable nominal motor current I_M						
For motor overload protection	A	40	50	62	71	86
Power loss						
• Uninterrupted rated operating current after run up (40 / 50 / 60 °C) approx.	W	89 / 81 / 73	110 / 94 / 83	145 / 126 / 110	174 / 147 / 126	232 / 194 / 159
• When starting with current limiting set at 350 % I_M (40 / 50 / 60 °C)	W	3350 / 2600 / 2150	4000 / 2900 / 2350	4470 / 4000 / 3400	5350 / 4050 / 3500	5860 / 5020 / 4200
Permitted rated motor current and starts per hour						
• For normal starting (CLASS 5)						
- Rated motor current $I_M^{(2)}$, run-up time 5 s	A	203 / 180 / 156	250 / 215 / 185	313 / 280 / 250	356 / 315 / 280	432 / 385 / 335
- Starts per hour ³⁾	1/h	41	41	41	41	39
- Rated motor current $I_M^{(2)}$, run-up time 10 s	A	203 / 180 / 156	250 / 215 / 185	313 / 280 / 250	356 / 315 / 280	432 / 385 / 335
- Starts per hour ³⁾	1/h	20	20	19	17	16
• For normal starting (CLASS 10)						
- Rated motor current $I_M^{(2)}$, run-up time 10 s	A	203 / 180 / 156	250 / 215 / 185	313 / 280 / 250	356 / 315 / 280	432 / 385 / 335
- Starts per hour ³⁾	1/h	20	20	19	17	16
- Rated motor current $I_M^{(2)}$, run-up time 20 s	A	203 / 180 / 156	250 / 215 / 185	313 / 280 / 250	356 / 315 / 280	432 / 385 / 335
- Starts per hour ³⁾	1/h	9	10	6	4	5
• For normal starting (CLASS 15)						
- Rated motor current $I_M^{(2)}$, run-up time 15 s	A	203 / 180 / 156	240 / 215 / 185	313 / 280 / 250	325 / 295 / 265	402 / 385 / 335
- Starts per hour ³⁾	1/h	13	13	10	13	11
- Rated motor current $I_M^{(2)}$, run-up time 30 s	A	203 / 180 / 156	240 / 215 / 185	313 / 280 / 250	325 / 295 / 265	402 / 385 / 335
- Starts per hour ³⁾	1/h	3	6	1	2	1
• For heavy starting (CLASS 20)						
- Rated motor current $I_M^{(2)}$, run-up time 20 s	A	195 / 175 / 155	215 / 195 / 180	275 / 243 / 221	285 / 263 / 240	356 / 326 / 295
- Starts per hour ³⁾	1/h	10	10	10	10	10
- Rated motor current $I_M^{(2)}$, run-up time 40 s	A	195 / 175 / 155	215 / 195 / 180	275 / 243 / 221	285 / 263 / 240	356 / 326 / 295
- Starts per hour ³⁾	1/h	1	5	1	3	1
• For very heavy starting (CLASS 30)						
- Rated motor current $I_M^{(2)}$, run-up time 30 s	A	162 / 148 / 134	180 / 165 / 150	220 / 201 / 182	240 / 223 / 202	285 / 260 / 235
- Starts per hour ³⁾	1/h	6	6	6	6	6
- Rated motor current $I_M^{(2)}$, run-up time 60 s	A	162 / 148 / 134	180 / 165 / 150	220 / 201 / 182	240 / 223 / 202	285 / 260 / 235
- Starts per hour ³⁾	1/h	3	3	3	2	1

1) Measurement at 60 °C not required according to UL/CSA.

2) Current limiting on soft starter set at 350 % I_M ; on-time OT = 70 %.
Maximum selectable rated motor current I_M , depending on the CLASS settings.

3) During intermittent duty S4 with on-time OT = 70 %, $T_u = 40/50/60$ °C, vertical stand-alone installation. The listed switching frequencies do not apply to automatic operation.

Type		3RW44 53	3RW44 54	3RW44 55	3RW44 56	3RW44 57	3RW44 58	3RW44 65	3RW44 66
Power electronics									
Carrying capacity, rated operating current I_e									
• According to IEC and UL / CSA ¹⁾ , for single mounting, AC-53a, at 40 °C	A	551	615	693	780	880	970	1076	1214
• According to IEC and UL / CSA ¹⁾ , for single mounting, AC-53a, at 50 °C	A	494	551	615	693	780	850	970	1076
• According to IEC and UL / CSA ¹⁾ , for single mounting, AC-53a, at 60 °C	A	438	489	551	615	693	760	880	970
Minimum selectable nominal motor current I_M for motor overload protection	A	110	123	138	156	176	194	215	242
Power loss									
• Uninterrupted rated operating current after run up (40 °C) approx.	W	159	186	220	214	250	270	510	630
• Uninterrupted rated operating current after run up (50 °C) approx.	W	135	156	181	176	204	215	420	510
• Uninterrupted rated operating current after run up (60 °C) approx.	W	113	130	152	146	168	179	360	420
• When starting with current limiting set at 350 % I_M (40 °C)	W	7020	8100	9500	11100	13100	15000	15000	17500
• When starting with current limiting set at 350 % I_M (50 °C)	W	6111	7020	8100	9500	11000	12500	13000	15000
• When starting with current limiting set at 350 % I_M (60 °C)	W	5263	5996	7020	8100	8100	10700	11500	13000
Permitted rated motor current and starts per hour									
• For normal starting (CLASS 5)									
- Rated motor current $I_M^{(2)}$, run-up time 5 s, at 40 °C	A	551	615	693	780	880	970	1076	1214
- Rated motor current $I_M^{(2)}$, run-up time 5 s, at 50 °C	A	494	551	615	693	780	850	970	1076
- Rated motor current $I_M^{(2)}$, run-up time 5 s, at 60 °C	A	438	489	551	615	693	760	880	970
- Starts per hour ³⁾	1/h	41	41	37	33	22	17	30	20
- Rated motor current $I_M^{(2)}$, run-up time 10 s, at 40 °C	A	551	615	693	780	880	970	1076	1214
- Rated motor current $I_M^{(2)}$, run-up time 10 s, at 50 °C	A	494	551	615	693	780	850	970	1076
- Rated motor current $I_M^{(2)}$, run-up time 10 s, at 60 °C	A	438	489	551	615	693	760	880	970
- Starts per hour ³⁾	1/h	20	20	16	13	8	5	10	6
• For normal starting (CLASS 10)									
- Rated motor current $I_M^{(2)}$, run-up time 10 s, at 40 °C	A	551	615	693	780	880	970	1076	1214
- Rated motor current $I_M^{(2)}$, run-up time 10 s, at 50 °C	A	494	551	615	693	780	850	970	1076
- Rated motor current $I_M^{(2)}$, run-up time 10 s, at 60 °C	A	438	489	551	615	693	760	880	970
- Starts per hour ³⁾	1/h	20	20	16	13	8	5	11	6
- Rated motor current $I_M^{(2)}$, run-up time 20 s, at 40 °C	A	551	615	693	780	880	970	1076	1214
- Rated motor current $I_M^{(2)}$, run-up time 20 s, at 50 °C	A	494	551	615	693	780	850	970	1076
- Rated motor current $I_M^{(2)}$, run-up time 20 s, at 60 °C	A	438	489	551	615	693	760	880	970
- Starts per hour ³⁾	1/h	10	9	6	4	0.3	0.3	3	0.5
• For normal starting (CLASS 15)									
- Rated motor current $I_M^{(2)}$, run-up time 15 s, at 40 °C	A	551	615	666	723	780	821	1020	1090
- Rated motor current $I_M^{(2)}$, run-up time 15 s, at 50 °C	A	494	551	615	693	710	755	950	1000
- Rated motor current $I_M^{(2)}$, run-up time 15 s, at 60 °C	A	438	489	551	615	650	693	850	920
- Starts per hour ³⁾	1/h	13	13	11	9	8	8	7	5
- Rated motor current $I_M^{(2)}$, run-up time 30 s, at 40 °C	A	551	615	666	723	780	821	1020	1090
- Rated motor current $I_M^{(2)}$, run-up time 30 s, at 50 °C	A	494	551	615	693	710	755	950	1000
- Rated motor current $I_M^{(2)}$, run-up time 30 s, at 60 °C	A	438	489	551	615	650	693	850	920
- Starts per hour ³⁾	1/h	6	4	3	1	0.4	0.5	1	1
• For heavy starting (CLASS 20)									
- Rated motor current $I_M^{(2)}$, run-up time 20 s, at 40 °C	A	551	591	633	670	710	740	970	1030
- Rated motor current $I_M^{(2)}$, run-up time 20 s, at 50 °C	A	494	551	615	634	650	685	880	940
- Rated motor current $I_M^{(2)}$, run-up time 20 s, at 60 °C	A	438	489	551	576	590	630	810	860
- Starts per hour ³⁾	1/h	10	10	7	8	8	9	7	5
- Rated motor current $I_M^{(2)}$, run-up time 40 s, at 40 °C	A	551	591	633	670	710	740	970	1030
- Rated motor current $I_M^{(2)}$, run-up time 40 s, at 50 °C	A	494	551	615	634	650	685	880	940
- Rated motor current $I_M^{(2)}$, run-up time 40 s, at 60 °C	A	438	489	551	576	590	630	810	860
- Starts per hour ³⁾	1/h	4	2	1	1	0.4	1	1	1
• For very heavy starting (CLASS 30)									
- Rated motor current $I_M^{(2)}$, run-up time 30 s, at 40 °C	A	500	525	551	575	600	630	880	920
- Rated motor current $I_M^{(2)}$, run-up time 30 s, at 50 °C	A	480	489	520	540	550	580	810	850
- Rated motor current $I_M^{(2)}$, run-up time 30 s, at 60 °C	A	438	455	480	490	500	530	740	780
- Starts per hour ³⁾	1/h	6	6	6	6	6	6	6	6
- Rated motor current $I_M^{(2)}$, run-up time 60 s, at 40 °C	A	500	525	551	575	600	630	880	920
- Rated motor current $I_M^{(2)}$, run-up time 60 s, at 50 °C	A	480	489	520	540	550	580	810	850
- Rated motor current $I_M^{(2)}$, run-up time 60 s, at 60 °C	A	438	455	480	490	500	530	740	780
- Starts per hour ³⁾	1/h	2	1	1	1	1.5	1	1	1

1) Measurement at 60 °C not required according to UL / CSA.

2) Current limiting on soft starter set at 350 % I_M ; on-time OT = 70 %.

Maximum selectable rated motor current I_M , depending on the CLASS settings.

3) During intermittent duty S4 with on-time OT = 70 %, $T_U = 40 / 50 / 60$ °C, vertical stand-alone installation. The listed switching frequencies do not apply to automatic operation.

10.3.3 Technical Data Control Unit

Type	Terminal		3RW44 ...BC3.	3RW44 ...BC4.
Control unit				
Rated values				
Rated control supply voltage	A1 / A2 / PE	V	115 AC	230 AC
• 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 setting
Control unit				
Control inputs				
Input 1	IN1			Start motor right parameter set 1 No Action No Action Trip Reset
Input 2	IN2			
Input 3	IN3			
Input 4	IN4			
Supply	L+ / L-			
• Rated operating current		mA	Approx. 10 per input according to DIN 19240 Internal voltage: 24 V DC from internal supply via terminal L+ to IN1 ... IN4. Maximum load at L+ approx. 55 mA External voltage: DC external voltage (according to DIN 19240) via terminals L- and IN1 ... IN4 (min. 12 V DC, max. 30 V DC)	
• Rated operational voltage	L+			
	L-			
Thermistor motor protection input				
Input	T1/T2		PTC type A or Thermo click	deactivated
Relay outputs (floating auxiliary contacts)				
Output 1	13/14			On-time motor
Output 2	23/24			No Action
Output 3	33/34			No Action
Output 4	95/96/98			Group error
Switching capacity of the relay outputs				
230 V / AC-15		A	3 at 240 V	
24 V / DC-13		A	1 at 24 V	
Overvoltage protection			Protection using varistor via relaycontact 4 A utilization category gL/gG; 6 A quick (fuse not included in scope of delivery)	
Short-circuit protection				
Protective functions				
Motor protection functions				
Tripping when			motor is thermally overloaded	10
Tripping class according to IEC 60947-4-1		CLASS	5 / 10 / 15 / 20 / 30	
Phase loss sensitivity		%	>40	
Overload warning			Yes	Manual Manual 1
Reset and recovery			Manual / automatic	
Reset option after trip			Manual / automatic	
Pre-charge time		Min.	1 ... 30	
Device protection functions				
Tripping when			thyristors thermally overloaded	Manual
Reset option after trip			Manual / automatic	
Pre-charge time		Min.	0.5	
Bypass protection functions				
Tripping when			bypass contacts thermally overloaded	
Reset option after trip			Manual	
Pre-charge time		Min.	1	

Type	3RW44 ..	Factory setting
Control times and parameters		
Control times		
Switch-on delay (when control voltage applied)	ms	< 50
Switch-on delay (automatic operation)	ms	< 4000
Pre-charge time (ON command with active stopping mode)	ms	< 100
Network failure bridging time		
Control supply voltage	ms	100
Network failure reaction time		
Load circuit	ms	100
Reclosing lockout after overload trip		
Motor protection tripping	Min.	1 ... 30
Device protection tripping	s	30
Setting options for starting		
Voltage ramp start voltage	%	20 ... 100
Start torque control	%	10 ... 100
Limiting torque control	%	20 ... 200
Starting time	s	0 ... 360
Maximum starting time	s	1 ... 1000
Current limiting value	%	125 ... 550 ¹⁾
Breakaway voltage	%	40 ... 100
Breakaway time	s	0 ... 2
Motor thermal capacity	%	1 ... 100
Slow speed mode counter-clockwise / clockwise		
Speed factor in relation to nominal operating speed ($n = n_{\text{nominal}}/\text{factor}$)		3 ... 21
Slow speed torque ²⁾	%	20 ... 100
Setting options for stopping		
Stopping torque control	%	10 ... 100
Stopping time	s	0 ... 360
Dynamic braking torque	%	20 ... 100
DC braking torque	%	20 ... 100
Operating messages		
		Checking voltage Checking line phases Ready to start Start mode active Motor running Stopping mode active Emergency start active
Warnings / error messages		
		No line voltage Phase angle control failure Phase loss • L1 / L2 / L3 Missing load phase • T1 / T2 / T3 Failure • Switching element 1 (thyristor) / switching element 2 (thyristor) / switching Flash memory error Supply voltage • below 75 % • below 85 % • above 110 % Current unbalance exceeded Thermal motor model overload Prewarning limit exceeded • Motor heat build-up • Remaining time for tripping Bypass element fault Line voltage too high Device not identified Versions not matching Current range exceeded Bypass element protective tripping Overcurrent Motor stalling – tripping Current limit exceeded Power unit • Overheated • Overtemperature







3RW44 22 - 3RW44 47: 550 %
 3RW44 53 - 3RW44 57: 500 %
¹⁾ max. current limiting value: 3RW44 58 - 3RW44 66: 450 %

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

Type	3RW44 ..	Factory setting
Control times and parameters		
Warnings / error messages (continued)	<ul style="list-style-type: none"> Temperature sensor <ul style="list-style-type: none"> • Overload • Wire breakage • Short-circuit Ground fault <ul style="list-style-type: none"> • Detected • Tripping Connection break in manual operating mode Max. number of starts exceeded I_g limit value over / undershot Cool-down time <ul style="list-style-type: none"> • Motor active • Contact block active Heatsink thermistor <ul style="list-style-type: none"> • Wire breakage • Short-circuit Quick stop active Contact block defective Impermissible I_g / CLASS settings No external start parameters received PIO error 	
Control inputs Input 1 Input 2 Input 3 Input 4 Parameterization options for control inputs 1 ... 4	No Action Manual operation local operating mode Emergency start Slow 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 Parameterization options for relay inputs 1 ... 3	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 Fans DC braking contactor Group warning Group error Bus error Device errors Power on Ready to start	On-time motor No Action No Action Group error
Motor temperature sensor	deactivated Thermo click PTC type A	deactivated

¹⁾ Parameter motor left only possible in combination with slow speed.

10.3.4 Conductor Cross-Sections

Type		3RW44 2.	3RW44 3.	3RW44 4.	3RW44 5. 3RW44 6.
Conductor cross-sections					
Screw-type terminals	Main conductor:				
With box terminal			3RT19 55-4G (55 kW)	3RT19 66-4G	—
Front terminal connected 	• Finely stranded with cable end sleeve	mm ²	2.5 ... 35	16 ... 70	70 ... 240
	• Finely stranded without cable end sleeve	mm ²	4 ... 50	16 ... 70	70 ... 240
	• Solid	mm ²	2.5 ... 16	—	—
	• Stranded	mm ²	4 ... 70	16 ... 70	95 ... 300
	• Ribbon cable (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 terminal connected 	• Finely stranded with cable end sleeve	mm ²	2.5 ... 50	16 ... 70	120 ... 185
	• Finely stranded without cable end sleeve	mm ²	10 ... 50	16 ... 70	120 ... 185
	• Solid	mm ²	2.5 ... 16	—	—
	• Stranded	mm ²	10 ... 70	16 ... 70	120 ... 240
	• Ribbon cable (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 terminals connected 	• Finely stranded with cable end sleeve	mm ²	2 x (2.5 ... 35)	max. 1 x 50, 1 x 70	min. 2 x 50; max. 2 x 185
	• Finely stranded without cable end sleeve	mm ²	2 x (4 ... 35)	max. 1 x 50, 1 x 70	min. 2 x 50; max. 2 x 185
	• Solid	mm ²	2 x (2.5 ... 16)	—	—
	• Stranded	mm ²	2 x (4 ... 50)	max. 2 x 70	max. 2 x 70; max. 2 x 240
	• Ribbon cable (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
	• Connecting screws		M6 (hexagon socket, A/F4)	M10 (hexagon socket, A/F4)	M12 (hexagon socket, A/F5)
- Tightening torque	Nm lbf.in	4 ... 6 36 ... 53	10 ... 12 90 ... 110	20 ... 22 180 ... 195	
Screw-type terminals	Main conductor:				
With box terminal		—	3RT19 56-4G	—	—
Front or rear terminal connected  	• Finely stranded with cable end sleeve	mm ²	—	16 ... 120	—
	• Finely stranded without cable end sleeve	mm ²	—	16 ... 120	—
	• Stranded	mm ²	—	16 ... 120	—
	• Ribbon cable (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 terminals connected 	• Finely stranded with cable end sleeve	mm ²	—	max. 1 x 95, 1 x 120	—
	• Finely stranded without cable end sleeve	mm ²	—	max. 1 x 95, 1 x 120	—
	• Stranded	mm ²	—	max. 2 x 120	—
	• Ribbon cable (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-type terminals	Main conductor:				
	<u>Without box terminal / busbar connections</u>				
	• Finely stranded with cable lug	mm ²	—	16 ... 95 ¹⁾	50 ... 240 ²⁾
	• Stranded with cable lug	mm ²	—	25 ... 120 ¹⁾	70 ... 240 ²⁾
	• AWG conductors, solid or stranded	AWG	—	4 ... 250 kcmil	2/0 ... 500 kcmil
	• Connecting bar (max. width)	mm	—	17	25
	• Connecting screws		—	M8 x 25 (A/F13)	M10 x 30 (A/F17)
	- Tightening torque	Nm lbf.in	—	10 ... 14 89 ... 124	14 ... 24 124 ... 210
			—	—	M12 x 40 20 ... 35 177 ... 310

1) When connecting cable lugs according to DIN 46235 from a conductor cross-section of 95 mm², the 3RT19 56-4EA1 terminal cover is required to ensure phase clearance.

2) When connecting cable lugs according to DIN 46234 from a conductor cross-section of 240 mm² as well as DIN 46235 from a conductor cross-section of 185 mm², the 3RT19 66-4EA1 terminal cover is required to ensure phase clearance.

Soft starters	Type	3RW44 ..	
Conductor cross-sections			
Auxiliary conductor (1 or 2 conductors can be connected):			
Screw-type terminals			
• Solid	mm ²	2 x (0.5 ... 2.5)	
• Finely stranded with cable end sleeve	mm ²	2 x (0.5 ... 1.5)	
• AWG conductors	AWG	2 x (20 ... 14)	
- solid or stranded	AWG	2 x (20 ... 16)	
- Finely stranded with cable end sleeve			
• Connecting screws	Nm	0.8 ... 1.2	
- Tightening torque	lbf.in	7 ... 10.3	
Spring-type terminals			
• Solid	mm ²	2 x (0.25 ... 1.5)	
• Finely stranded with cable 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	Parameter
Electromagnetic Compatibility according to EN 60947-4-2		
<i>EMC interference immunity</i>		
Electrostatic discharge (ESD)	EN 61000-4-2	±4 kV contact discharge, ±8 kV air discharge
Electromagnetic HF fields	EN 61000-4-3	Frequency range: 80 ... 1000 MHz with 80 % at 1 kHz Severity 3, 10 V/m
Conducted HF interference	EN 61000-4-6	Frequency range: 150 kHz ... 80 MHz with 80 % at 1 kHz Interference 10 V
HF voltages and HF currents on conductors	EN 61000-4-4 EN 61000-4-5	±2 kV/5 kHz ±1 kV line to line ±2 kV line to ground
<i>EMC emission</i>		
EMC radio 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
<i>Is a radio interference suppression filter required?</i>		
Radio interference suppression A (industrial application)	No	

10.3.6 Utilization Classes

Regulation DIN EN 60947-4-1 (VDE 0660 Part 102), and/or IEC 60947-4-1 differentiate two utilization classes designated as "Utilization class 1" and "Utilization class 2". With both utilization classes, the short-circuit to be controlled is safely switched off. The only difference is the degree of damage to the device after a short-circuit.

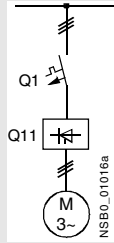
TcC 1	Utilization class 1	The fuseless load feeder can be inoperative after each short-circuit tripping. Damage to the contactor and the overload release is permissible. With 3RA1 load feeders, the circuit breaker itself always has utilization category 2.
TcC 2	Utilization class 2	After a short-circuit tripping, there must be no damage to the overload release or any other part. The 3RA1 fuseless load feeder can be restarted without any components needing to be replaced. Only welding of the contactor contacts is permissible, as long as they can be separated easily without any noticeable damage.
These utilization classes are highlighted in the Technical Data by an orange background.		

10.3.7 Branch Component Layout (Standard Circuit)

Fuse assignment

The utilization class according to which the motor branch with soft starter is dimensioned depends on the requirements of the application. Normally, a fuseless design (combination of circuit breaker + soft starter) is sufficient. If the requirements for utilization class 2 must be met, semiconductor fuses must be used in the motor branch.

Standard circuit fuseless design

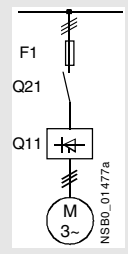


Soft starters T _{9C} 1 Q11 Type	Nominal current A	Circuit breaker ¹⁾ Q1 Type	Rated current A
Utilization class 1 ²⁾ : 3RW44 22 ... 3RW44 27: $I_q = 32$ kA; 3RW44 34 and 3RW44 35: $I_q = 16$ kA; 3RW44 36 ... 3RW44 66: $I_q = 65$ kA			
3RW44 22	29	3RV10 42-4HA10	50
3RW44 23	36	3RV10 42-4JA10	63
3RW44 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	1250
3RW44 65	1076	3VL77 12-3AB36	1250
3RW44 66	1214	3VL77 12-3AB36	1250

1) The rated motor current must be taken into consideration during device selection.

2) For utilization class, see page 10-20.

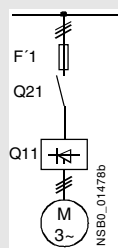
Standard circuit fused design (line protection only)



Soft starters Q11 Type	Nominal current A	Line fuse, maximum			Line contactor up to 400 V (option) Q21 Type	Braking contactor ¹⁾²⁾ (Circuit suggestions from page 9-2) Q91 Type Q92 Type	
		690 V +5 % E1 Type	Rated current A	Size			
Utilization class 1³⁾: 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	3RT10 64	3RT10 66
3RW44 54	615	2 x 3NA3 365-6	2 x 500	3	3TF68	3RT10 64	3RT10 75
3RW44 55	693	2 x 3NA3 365-6	2 x 500	3	3TF69	3RT10 65	3RT10 75
3RW44 56	780	2 x 3NA3 365-6	2 x 500	3	3TF69	3RT10 65	3RT10 75
3RW44 57	880	2 x 3NA3 365-6	2 x 500	3	—	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 "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 type, see table).
The "DC braking" function is recommended for applications with larger centrifugal masses ($J_{load} > J_{motor}$).
- 2) Additional K4 auxiliary relay:
LZX:RT4A4T30 (3RW44 soft starter with 230 V AC rated control supply voltage),
LZX:RT4A4S15 (3RW44 soft starter with 115 V AC rated control supply voltage).
- 3) "Utilization class 1" refers to the soft starter in combination with the protective device listed (circuit breaker/fuse), not to other components in the branch. For utilization class, see page 10-20.

Standard circuit fused design with SITOR 3NE1 all-range fuse (semiconductor and line protection)

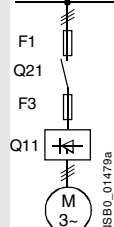
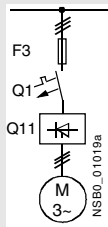


For suitable fuse bases, see LV1 catalog at "SETRON Switching and Protection Devices for Power Distribution" -> "Switch Disconnectors" and ET B1 Catalog at "BETA Protecting" -> "SITOR Semiconductor Fuses" and/or at www.siemens.com/sitor > SITOR Semiconductor Fuses

Soft starters Q11 Type	Nominal current A	All-range fuse			Line contactor up to 400 V (option) Q21 Type	Braking contactor ¹⁾²⁾ (circuit suggestions from page 9-2) Q91 Type Q92 Type		
		E'1 Type	Rated current A	Voltage V		Size		
Utilization class 2³⁾: 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	3RT10 64	3RT10 66
3RW44 54	615	2 x 3NE1 334-2	500	690 +10 %	2	3TF68	3RT10 64	3RT10 75
3RW44 55	693	2 x 3NE1 334-2	500	690 +10 %	2	3TF69	3RT10 65	3RT10 75
3RW44 56	780	2 x 3NE1 435-2	560	690 +10 %	3	3TF69	3RT10 65	3RT10 75
3RW44 57	880	2 x 3NE1 435-2	560	690 +10 %	3	—	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 435-2	560	690 +10 %	3	—	3RT10 76	3TF68

- 1) 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 type, see table).
The "DC braking" function is recommended for applications with larger centrifugal masses ($J_{load} > J_{motor}$).
- 2) Additional K4 auxiliary relay:
LZX:RT4A4T30
(3RW44 soft starter with 230 V AC rated control supply voltage),
LZX:RT4A4S15
(3RW44 soft starter with 115 V AC rated control supply voltage).
- 3) "Utilization class 2" refers to the soft starter in combination with the protective device listed (circuit breaker/fuse), not to other components in the branch. For utilization class, see page 10-20.

Standard circuit fused design with SITOR 3NE or 3NC semiconductor fuse
(semiconductor protection using fuse, line and overload protection using circuit breaker)



For suitable fuse bases, see LV1 catalog at
 "SENTRON Switching and Protection Devices for Power Distribution" ->
 "Switch Disconnectors" and ET B1 Catalog at "BETA Protecting" ->
 "SITOR Semiconductor Fuses" and/or
 at www.siemens.com/sitor > SITOR Semiconductor Fuses

Soft starters TC2 Q11 Type	Nominal current A	Semiconductor fuse minimum 690 V +10 %			Semiconductor fuse maximum 690 V +10 %			Semiconductor fuse (cylinder)		
		E3 Type	Rated current A	Size	E3 Type	Rated current A	Size	E3 Type	Rated current A	Size
Utilization class 2¹⁾: 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 121	100	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 332-0B	400	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			

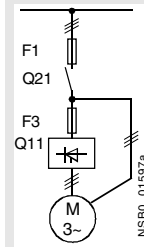
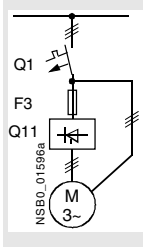
1) "Utilization class 2" refers to the soft starter in combination with the protective device listed (circuit breaker/fuse), not to other components in the branch. For utilization class, see page 10-20.

Soft starters T _{5C} 2	Nominal current	Line contactor up to 400 V (option)	Braking contactor ¹⁾²⁾ (Circuit suggestions from page 9-2)		Circuit breaker		Line fuse, maximum		
			Q11 Type	Q21 Type	Q91 Type	Q92 Type	440 V +10 %	Rated current	690 V +5 %
Utilization class 2³⁾: 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	160	3NA3 244-6	250	2
3RW44 35	134	3RT10 55	3RT10 36	3RT10 45	3VL17 16	160	3NA3 244-6	250	2
3RW44 36	162	3RT10 56	3RT10 44	3RT10 45	3VL37 25	250	3NA3 365-6	500	3
3RW44 43	203	3RT10 64	3RT10 44	3RT10 54	3VL47 31	315	2 x 3NA3 354-6	2 x 355	3
3RW44 44	250	3RT10 65	3RT10 44	3RT10 55	3VL47 31	315	2 x 3NA3 354-6	2 x 355	3
3RW44 45	313	3RT10 75	3RT10 54	3RT10 56	3VL47 40	400	2 x 3NA3 365-6	2 x 500	3
3RW44 46	356	3RT10 75	3RT10 54	3RT10 56	3VL47 40	400	2 x 3NA3 365-6	2 x 500	3
3RW44 47	432	3RT10 76	3RT10 55	3RT10 64	3VL57 50	500	2 x 3NA3 365-6	2 x 500	3
3RW44 53	551	3TF68	3RT10 64	3RT10 66	3VL67 80	800	2 x 3NA3 365-6	2 x 500	3
3RW44 54	615	3TF68	3RT10 64	3RT10 75	3VL67 80	800	2 x 3NA3 365-6	2 x 500	3
3RW44 55	693	3TF69	3RT10 65	3RT10 75	3VL67 80	800	2 x 3NA3 365-6	2 x 500	3
3RW44 56	780	3TF69	3RT10 65	3RT10 75	3VL77 10	1000	2 x 3NA3 365-6	2 x 500	3
3RW44 57	880	—	3RT10 75	3RT10 76	3VL77 10	1000	2 x 3NA3 365-6	2 x 500	3
3RW44 58	970	—	3RT10 75	3RT10 76	3VL77 12	1250	3 x 3NA3 365-6	3 x 500	3
3RW44 65	1076	—	3RT10 75	3TF68	3VL77 12	1250	3 x 3NA3 365-6	3 x 500	3
3RW44 66	1214	—	3RT10 76	3TF68	3VL77 12	1250	3 x 3NA3 365-6	3 x 500	3

- 1) 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 type, see table).
The "DC braking" function is recommended for applications with larger centrifugal masses ($J_{load} > J_{motor}$).
- 2) Additional K4 auxiliary relay:
LZX:RT4A4T30 (3RW44 soft starter with 230 V AC rated control supply voltage),
LZX:RT4A4S15 (3RW44 soft starter with 115 V AC rated control supply voltage).
- 3) "Utilization class 2" refers to the soft starter in combination with the protective device listed (circuit breaker/fuse), not to other components in the branch. For utilization class, see page 10-20.

10.3.8 Branch Component Layout (Inside Delta Circuit)

Inside delta circuit fused design with SITOR 3NE or 3NC fuses (semiconductor protection using fuse, line and overload protection using circuit breaker)



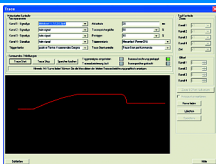



For suitable fuse bases, see LV1 catalog at "SENTRON Switching and Protection Devices for Power Distribution" -> "Switch Disconnectors" and ET B1 Catalog at "BETA Protecting" -> "SITOR Semiconductor Fuses" and/or at www.siemens.com/sitor > SITOR Semiconductor Fuses

Soft starters Q11 Type	Nominal current A	Semiconductor fuse minimum			Semiconductor fuse maximum			Semiconductor fuse (cylinder)		
		690 V +10 % E3 Type	Rated current A	Size	690 V +10 % E3 Type	Rated current A	Size	E3 Type	Rated current A	Size
Utilization class 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 121	100	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 332-0B	400	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 starters Q11 Type	Nominal current A	Line contactor up to 400 V (option) Q21 Type	Circuit breaker 440 V +10 %		Rated current A	Line fuse, maximum 690 V +5 %		
			Q1 Type	Rated current A		E1 Type	Rated current A	Size
Utilization class 2 ¹⁾								
3RW44 22	50	3RT10 36-1AP04	3RV10 42-4KA10	75	3NA3 824-6	80		00
3RW44 23	62	3RT10 44-1AP04	3RV10 42-4LA10	90	3NA3 830-6	100		00
3RW44 24	81	3RT10 46-1AP04	3RV10 42-4MA10	100	3NA3 132-6	125		1
3RW44 25	99	3RT10 54-1AP36	3VL27 16	160	3NA3 136-6	160		1
3RW44 26	133	3RT10 55-6AP36	3VL27 16	160	3NA3 240-6	200		2
3RW44 27	161	3RT10 56-6AP36	3VL37 20	200	3NA3 244-6	250		2
3RW44 34	196	3RT10 64-6AP36	3VL37 25	250	3NA3 360-6	400		3
3RW44 35	232	3RT10 65-6AP36	3VL47 31	315	3NA3 360-6	400		3
3RW44 36	281	3RT10 66-6AP36	3VL47 40	400	2 x 3NA3 360-6	2 x 400		3
3RW44 43	352	3RT10 75-6AP36	3VL47 40	400	2 x 3NA3 365-6	2 x 500		3
3RW44 44	433	3RT10 76-6AP36	3VL57 50	500	2 x 3NA3 365-6	2 x 500		3
3RW44 45	542	3TF68 44-0CM7	3VL57 63	800	3 x 3NA3 365-6	3 x 500		3
3RW44 46	617	3TF68 44-0CM7	3VL67 80	800	3 x 3NA3 365-6	3 x 500		3
3RW44 47	748	3TF69	3VL67 80	800	3 x 3NA3 365-6	3 x 500		3
3RW44 53	954	—	3VL77 10	1000	3 x 3NA3 365-6	3 x 500		3
3RW44 54	1065	—	3VL77 12	1250	3 x 3NA3 365-6	3 x 500		3
3RW44 55	1200	—	3VL87 16	1600	3 x 3NA3 365-6	3 x 500		3
3RW44 56	1351	—	3VL87 16	1600	3 x 3NA3 372	3 x 630		3
3RW44 57	1524	—	3VL87 16	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) "Utilization class 2" refers to the soft starter in combination with the protective device listed (circuit breaker/fuse), not to other components in the branch. For utilization class, see page 10-20.

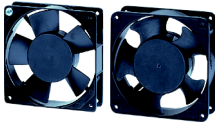
10.3.9 Accessories

For soft starters Type	Version	Order No.
PC communication program Soft Starter ES 2007		
	Soft Starter ES 2007 Basic Floating license for one user E-SW, software and documentation on CD, in 3 languages (German / English / French), Communication via system interface License key on USB stick, Class A, incl. CD	3ZS1 313-4CC10-0YA5
	Soft Starter ES 2007 Standard Floating license for one user E-SW, software and documentation on CD, in 3 languages (German / English / French), Communication via system interface License key on USB stick, Class A, incl. CD	3ZS1 313-5CC10-0YA5
	Soft Starter ES 2007 Premium Floating license for one user E-SW, software and documentation on CD, in 3 languages (German / English / French), Communication via system interface or PROFIBUS License key on USB stick, Class A, incl. CD	3ZS1 313-6CC10-0YA5
PC cable		
	for PC / PD communication with SIRIUS 3RW44 soft starters via the system interface, for connection to the serial interface of the PC / PD	3UF7 940-0AA00-0
3UF7 940-0AA00-0		
USB-to-serial adapter		
	For connection of the PC cable to the USB interface of the PC Recommended for use in combination with 3RW44 soft starters, SIMOCODE pro 3UF7, 3RK3 modular safety system, ET 200S/ ECOFAST/ET 200pro motor starters, AS-i safety monitor, AS-i analyzer	3UF7 946-0AA00-0
PROFIBUS communication module		
	Module for insertion into the soft starter for integration of the starter into the PROFIBUS network with DPV1 slave functionality. When connected to Y link, the soft starter only has DPV0 slave functionality.	3RW49 00-0KC00
3RW49 00-0KC00		
External display and control module		
	For display and operation of the functions provided by the soft starter via an externally mounted display and control module with degree of protection IP54 (e.g. in the control cabinet door)	3RW4 900-0AC00
3RW49 00-0AC00	Connecting cable From the device interface (serial) of the 3RW44 soft starter to the external display and control module <ul style="list-style-type: none"> • 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

General Technical Data

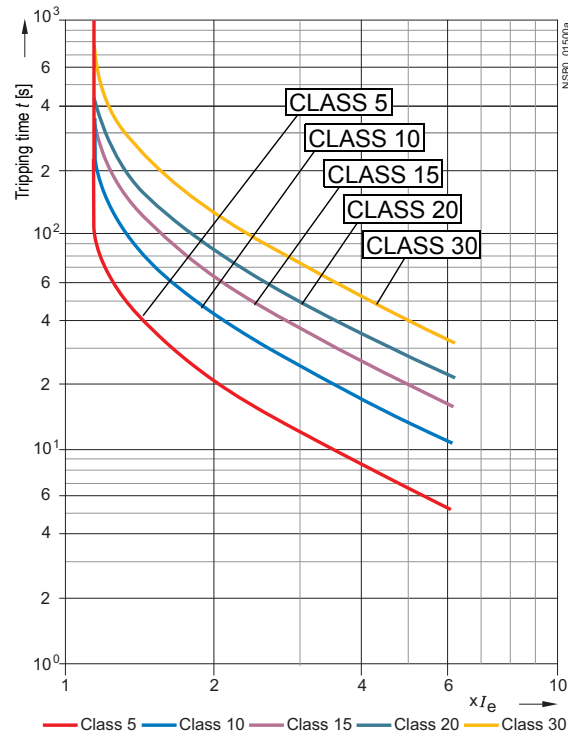
For soft starters	Version	Order No.
Type		
Box terminal block for soft starters		
 3RT19	Box terminal block 3RW44 2. 3RW44 3. 3RW44 4.	Included in the scope of delivery • Up to 70 mm ² • Up to 120 mm ² Auxiliary conductor connection for box terminals • Up to 240 mm ² (with auxiliary conductor connection)
		3RT19 55-4G 3RT19 56-4G 3RT19 66-4G
	Covers for soft starters	
	 3RT19.6-4EA2	Terminal covers for box terminals Additional touch protection for mounting to the box terminals (2 covers required per device) 3RW44 2. and 3RW44 3. 3RW44 4.
	Terminal cover for cable lugs and busbar connections 3RW44 2. and 3RW44 3. 3RW44 4.	3RT19 56-4EA1 3RT19 66-4EA1
Operating instructions		
For 3RW44 soft starters The operating instructions are included in the scope of delivery of the soft starters.		3ZX1012-0RW44-0AA0 on request

10.3.10 Spare parts

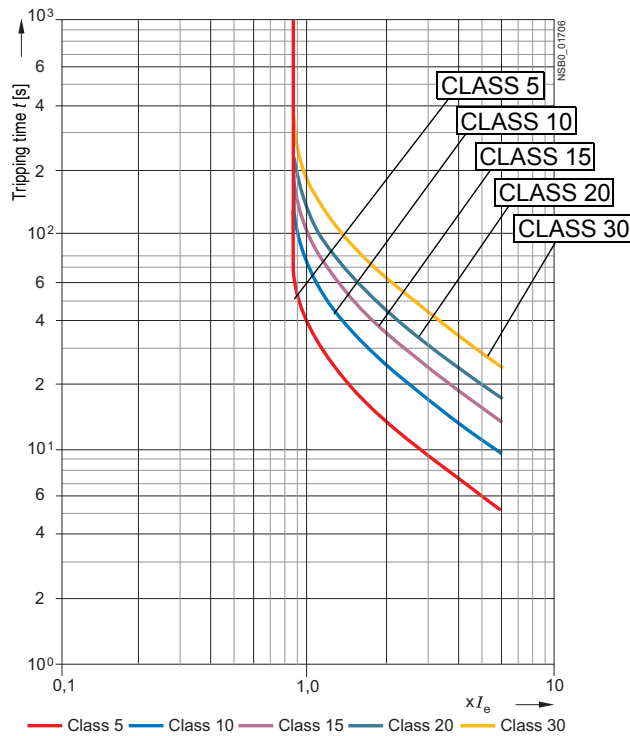
For soft starters	Version	Order No.
Type		
Fans		
 3RW49	Fans 3RW44 2. and 3RW44 3. 3RW44 4. 3RW44 5. and 3RW44 6 ¹⁾ 3RW44 6 ²⁾	115 V AC 230 V AC 115 V AC 230 V AC 115 V AC 230 V AC 115 V AC 230 V AC
		3RW49 36-8VX30 3RW49 36-8VX40 3RW49 47-8VX30 3RW49 47-8VX40 3RW49 57-8VX30 3RW49 57-8VX40 3RW49 66-8VX30 3RW49 66-8VX40
	1) 3RW44 6. connection on the output side. 2) For connection to the front side.	

10.4 Tripping Characteristics

10.4.1 Motor Protection Tripping Characteristics: 3RW44 with Symmetry

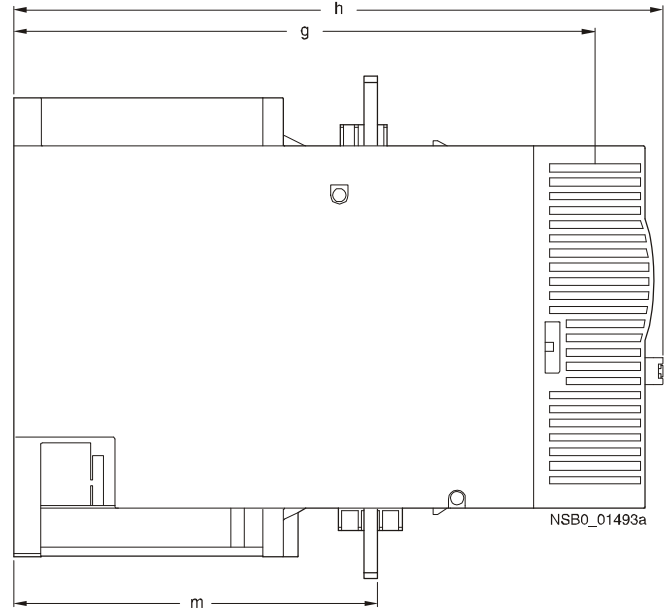
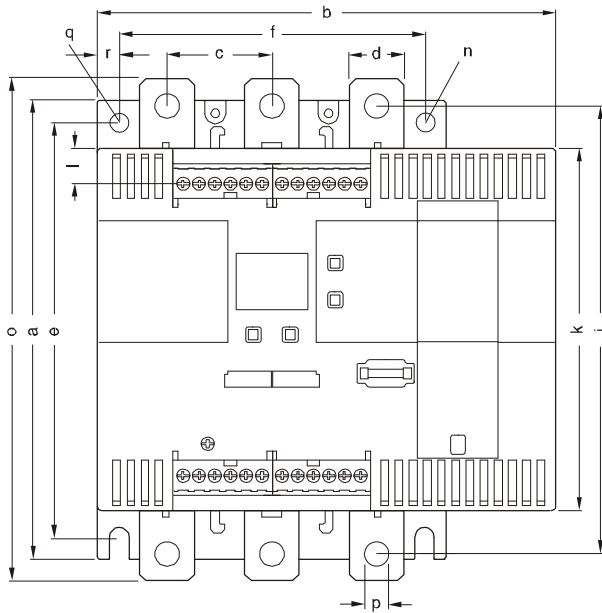


10.4.2 Motor Protection Tripping Characteristics: 3RW44 with Asymmetry



10.5 Dimension Drawings

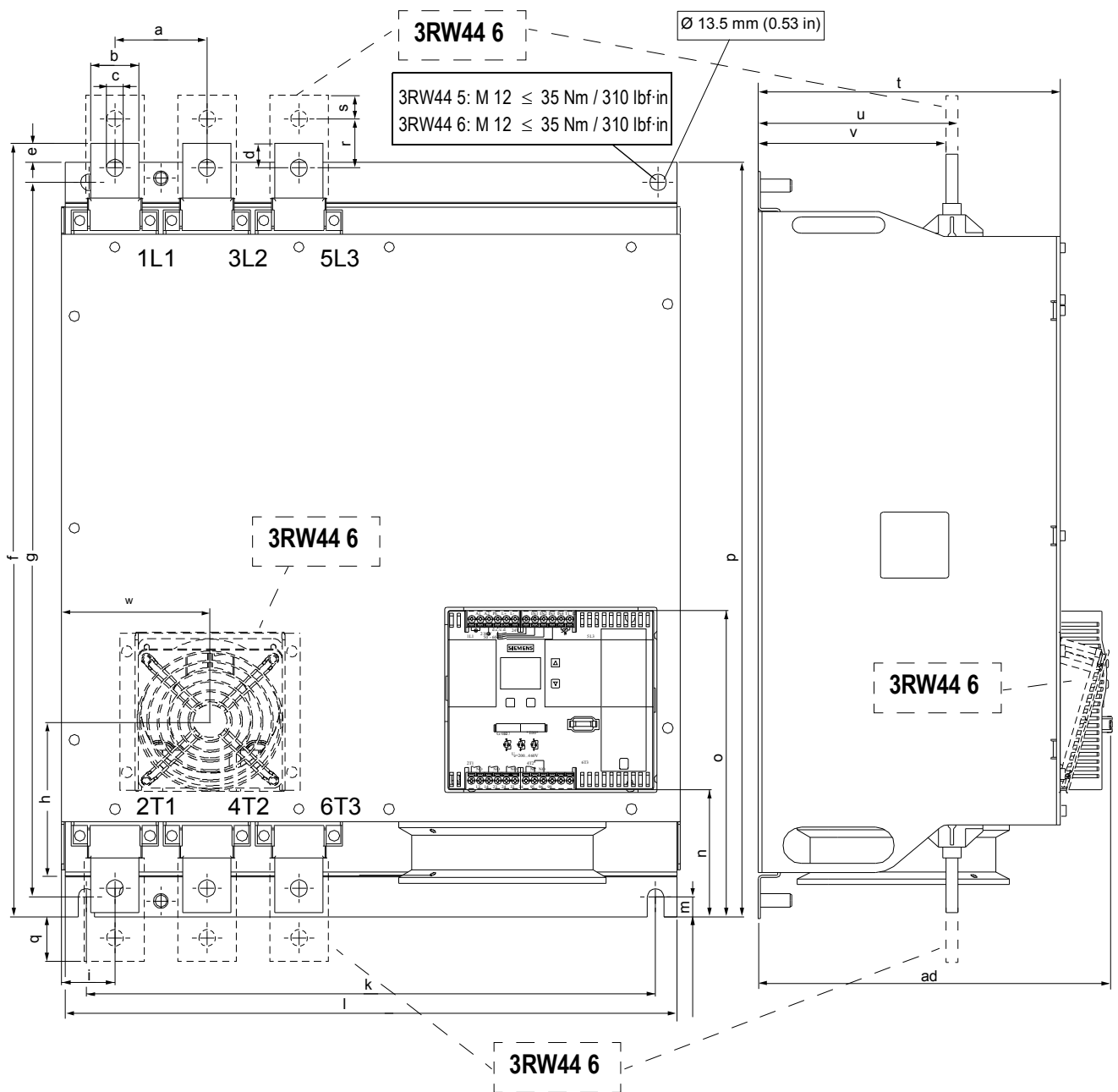
3RW44 2
3RW44 3
3RW44 4



Type	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	q
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)	174 (6.85)	148 (5.83)	7,5 (0.30)	153 (6.02)	7 (0.28)	184 (7.24)	6,6 (0.26)	M6 10 Nm (89 lbf.in)	10 (0.39)
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)	174 (6.85)	148 (5.83)	7,5 (0.30)	153 (6.02)	7 (0.28)	198 (7.80)	9 (0.35)	M6 10 Nm (89 lbf.in)	10 (0.39)
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)	M8 15 Nm (134 lbf.in)	10 (0.39)

mm (inch)

3RW44 5 / 3RW44 6

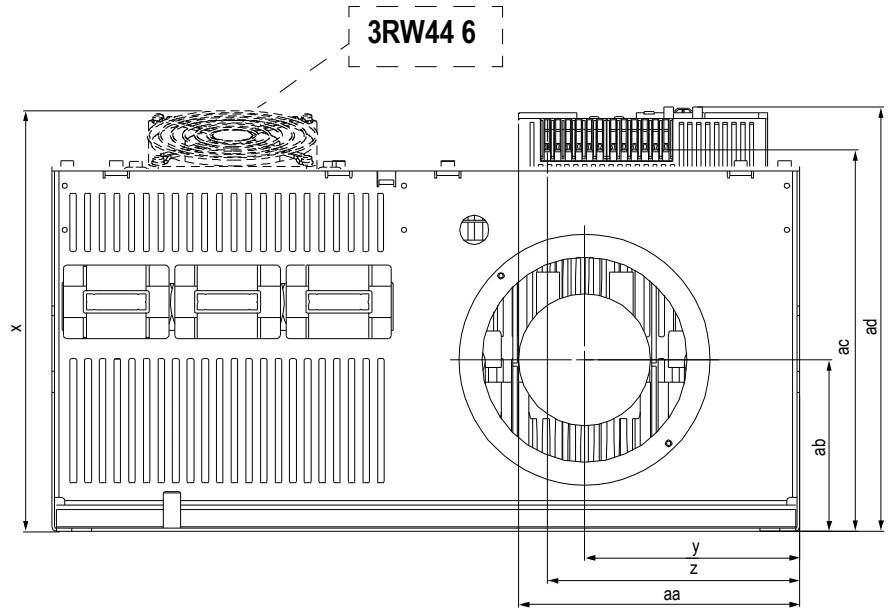


Type	a	b	c	d	e	f	g	h	i	k	l	m	n
3RW44 5	76 (3)	40 (1.6)	14 (0.6)	20 (0.8)	15,5 (0.7)	638,5 (25.2)	590 (9.45)	—	44 (1.8)	470 (18)	510 (20)	16,5 (0.7)	105 (4.1)
3RW44 6	85 (3.35)	50 (1.97)	14 (0.6)	—	—	667 (26.3)	660 (26)	160 (6.3)	37,5 (1.48)	535 (21)	576 (22.7)	16,5 (0.7)	103 (4.06)

mm (inch)

Type	o	p	q	r	s	t	u	v	w	ad
3RW44 5	253 (10)	623 (24.6)	—	—	—	249 (9.8)	162 (6.4)	152 (5.9)	—	290
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)	290

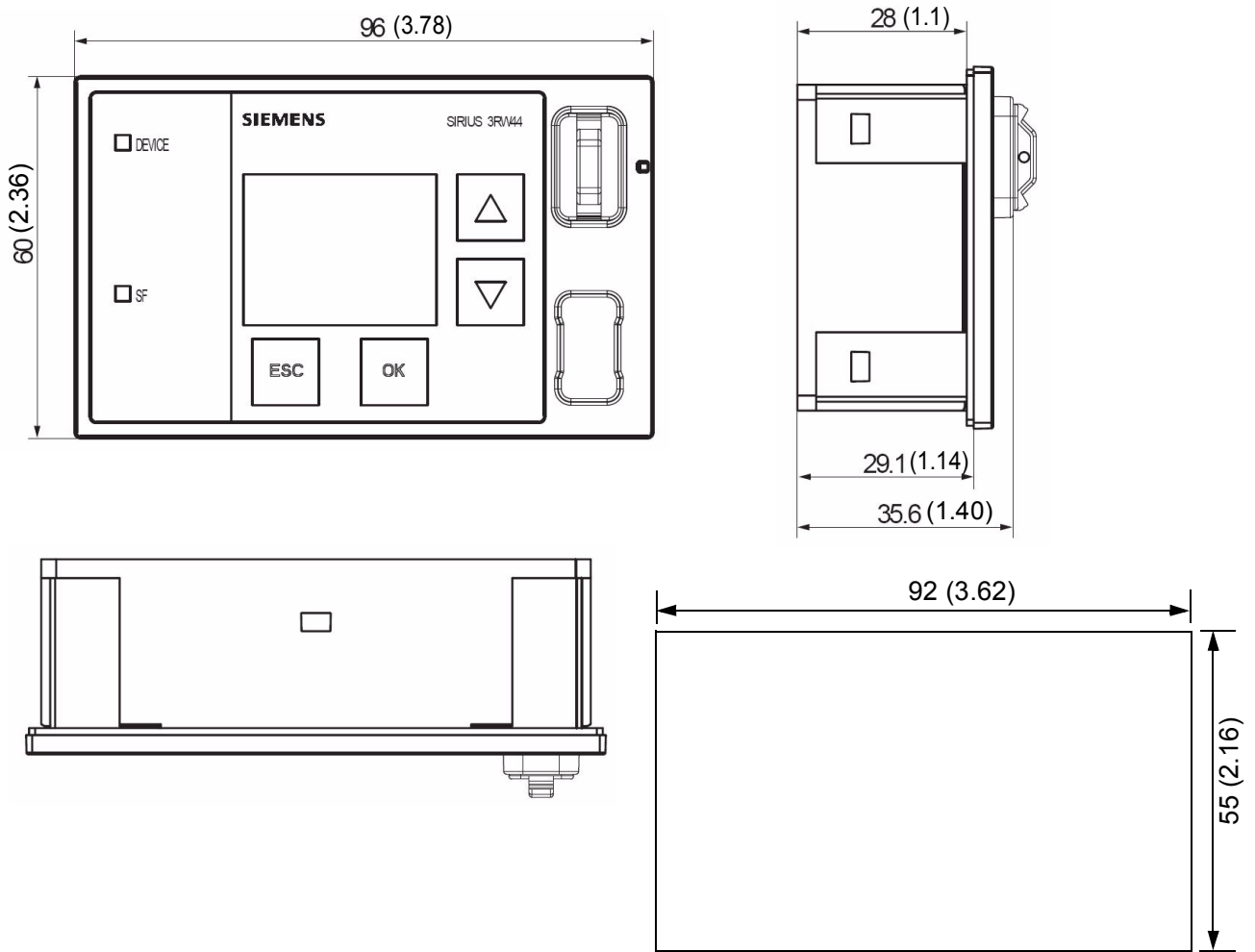
mm (inch)



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 module 3RW49 00-0AC00



Dimensions in mm (inch)

Installation cutout for external display and control module 3RW49 00-0AC00

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 operating torque: Nm

Stall torque: Nm

Mass moment of inertia: kg*m²

Speed characteristic curve / torque characteristic curve

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

n _M rpm													"n _{syn} "
M _M / M _B													

Speed characteristic curve / current characteristic curve

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

n _M rpm						"n _{syn} "
I _M / I _B						

Configuration Data

2. Load data

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

Rated operating speed: rpm

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

Mass moment of inertia (load-based)kg*m²

Mass moment of inertia (motor-based).....kg*m²

Speed characteristic curve / torque characteristic curve

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

n _L rpm													
M _L / M _B													

3. Start conditions

Start frequency..... Starts

Operating cycle: Run-up time s

Operating time s

Idle time s

Stopping time s

Ambient temperature..... °C

Yes	Value
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

Starting current limitation?

Acceleration torque limitation?

Maximum starting time?

4. Personal data

Surname, first name:

Company:

Department:

Street:

Postal code, city:

Country:

Phone.:

Fax:

E-mail:

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Fax: 09621 / 80-3337

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

SIRIUS 3RW44 Soft Starters Manual

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