Soft starters SIRIUS 3RW30 / 3RW40







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Soft starters SIRIUS 3RW30 / 3RW40

Manual

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure 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.

A DANGER

indicates that death or severe personal injury will result if proper precautions are not taken.

WARNING

indicates that death or severe personal injury may result if proper precautions are not taken.

A CAUTION

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

CAUTION

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

NOTICE

indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation for the specific task, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction

1.1 Important notes

Purpose of the manual

This manual contains fundamental information and practical tips for using SIRIUS soft starters. The SIRIUS 3RW30 and 3RW40 soft starters are electronic motor control devices that facilitate optimal starting and stopping three-phase induction motors. The manual describes all of the functions of the SIRIUS 3RW30 and 3RW40 soft starters.

Target group

This manual is intended for any user involved in

- Commissioning
- · Servicing and maintaining
- · Planning and configuring systems

Basic knowledge required

A general knowledge of the field of electrical engineering is required to understand this manual.

Scope of validity

The manual is valid for the SIRIUS 3RW30 and 3RW40 soft starters. It describes the components that are valid at the time of publication. SIEMENS reserves the right to include a Product Information for each new component, and for each component of a later version.

Standards and approvals

The SIRIUS 3RW30 and 3RW40 soft starters are based on the IEC/EN 60947-4-2 standard.

Disclaimer of liability

It is the responsibility of the manufacturer to ensure that a system or machine is functioning properly as a whole. SIEMENS AG, its regional offices, and associated companies (hereinafter referred to as "SIEMENS") cannot guarantee all the properties of a whole plant system or machine that has not been designed by SIEMENS.

Similarly, SIEMENS can assume no liability for recommendations that appear or are implied in the following description. No new guarantee, warranty, or liability claims beyond the scope of the SIEMENS general terms of supply are to be derived or inferred from the following description.

1.1 Important notes

Orientation aids

The manual contains various features supporting quick access to specific information:

- At the beginning of the manual you will find a table of contents.
- A comprehensive index at the end of the manual allows quick access to information on specific subjects.

Continuously updated information

Your regional contact for low-voltage switchgear with communications capability will be happy to help you with any queries you have regarding the soft starters. A list of contacts and the latest version of the manual are available on the Internet at (www.Lenntech.com):

Correction sheet

A correction sheet is included at the end of the manual. Please use it to record your suggestions for improvements, additions, and corrections, and return the sheet to us. This will help us to improve the next edition of the manual.

Safety information

2.1 Before commencing work: Isolating the equipment from the supply system and ensuring that it cannot be reconnected.

DANGER

Hazardous voltage Will cause death or serious injury.

- Disconnect the system and all devices from the power supply before starting work.
- Secure against switching on again.
- Verify that the equipment is not live.
- Ground and short-circuit.
- Erect barriers around or cover adjacent live parts.

DANGER

Hazardous voltage Will cause death or serious injury.

Qualified Personnel.

The equipment / system may only be commissioned and operated by qualified personnel. For the purpose of the safety information in these Operating Instructions, a "qualified person" is someone who is authorized to energize, ground, and tag equipment, systems, and circuits in accordance with established safety procedures.

2.2 Five safety rules for work in or on electrical systems

A set of rules, which are summarized in DIN VDE 0105 as the "five safety rules", are defined for work in or on electrical systems as a preventative measure against electrical accidents:

- 1. Isolate
- 2. Secure against switching on again
- 3. Verify that the equipment is not live
- 4. Ground and short-circuit
- 5. Erect barriers around or cover adjacent live parts

These five safety rules must be applied in the above order prior to starting work on an electrical system. After completing the work, proceed in the reverse order.

It is assumed that every electrician is familiar with these rules.

2.2 Five safety rules for work in or on electrical systems

Explanations

- 1. The isolating distances between live and deenergized parts of the system must vary according to the operating voltage that is applied.
 - "Isolate" refers to the all-pole disconnection of live parts.
 - All-pole disconnection can be achieved, e.g. by.:
 - Switching off the miniature circuit breaker
 - Switching off the motor circuit breaker
 - Unscrewing fusible links
 - Removing LV HRC fuses
- 2. The feeder must be secured against inadvertent restarting to ensure that it remains isolated for the duration of the work. This can be achieved, for instance, by securing the motor and miniature circuit breakers with lockable blocking elements in the disconnected state, either using a lock or by unscrewing the fuses.
- 3. The deenergized state of the equipment should be verified using suitable test equipment, e.g. a two-pole voltmeter. Single-pole test pins are not suitable for this purpose. The absence of power must be established for all poles, phase to phase, and phase to N/PE.
- 4. Grounding and short-circuiting are only mandatory if the system has a nominal voltage greater than 1 kV. In this case, the system should always be grounded first and then connected to the live parts to be short-circuited.
- 5. These parts should be covered, or barriers erected around them, to avoid accidental contact during the work with adjacent parts that are still live.

Product description 3

3.1 Fields of application

Soft starters are used to start three-phase induction motors with reduced torque and reduced starting current.

SIRIUS soft starter family

The SIEMENS SIRIUS soft starter family comprises three different versions with different functionalities and prices.

3RW30 and 3RW40

Simple or standard applications are covered by the SIRIUS 3RW30 and 3RW40 soft starters and are described in this manual.

3RW44

The SIRIUS 3RW44 soft starter is used if higher functionality is specified, e.g. communication over PROFIBUS or the availability of measuring and monitoring values, as well as for ultraheavy-duty starting. The SIRIUS 3RW44 soft starter is described in a separate system manual.

3.2 Basic physical principles of a three-phase induction motor

SIRIUS soft starters are used to reduce the current and torque of a three-phase induction motor during the startup process.

3.2.1 Three-phase induction motor

Fields of application

Three-phase induction motors are used in a wide range of applications in commerce, industry, and trade owing to their simple, robust design and their minimal maintenance.

Problem

If a three-phase induction motor is started directly, its typical current and torque characteristics can cause disturbances in the supply system and the load machine.

3.2 Basic physical principles of a three-phase induction motor

Starting current

Three-phase induction motors have a high direct starting current I_{starting} . Depending on the motor type, this current can be between three and fifteen times as high as the rated operational current. Seven or eight times the motor's rated current can be assumed as a typical value.

Disadvantage

This results in the following disadvantage:

• Higher load on the electrical supply system. The supply system must therefore be dimensioned for this higher power during the motor startup.

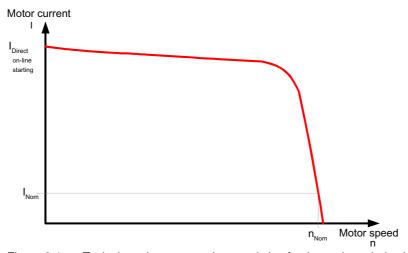


Figure 3-1 Typical starting current characteristic of a three-phase induction motor

Starting torque

The starting torque and the breakdown torque can usually be assumed to be between two and four times the rated torque. From the point of view of the load machine, this means that the starting and acceleration forces exert a higher mechanical load on the machine and the product being conveyed compared to nominal operation.

Disadvantages

This results in the following disadvantages

- A higher load is placed on the machine's mechanical components
- · The costs for replacing worn parts and maintaining the application are higher

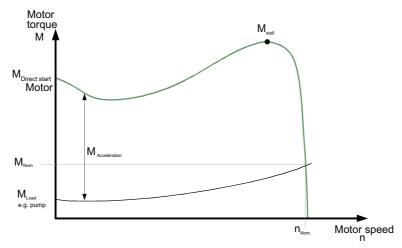


Figure 3-2 Typical starting torque characteristic of a three-phase induction motor

Remedy

The SIRIUS 3RW30 and 3RW40 electronic soft starters allow the current and torque characteristics during starting to be optimally adapted to the requirements of each application.

3.3 Functional principle of the SIRIUS 3RW30 and 3RW40 soft starters

The SIRIUS 3RW30 and 3RW40 soft starters have two antiparallel thyristors in two out of the three phases. One thyristor for the positive half-wave and one for the negative half-wave is provided in each phase (refer to Fig. "Phase angle control and schematic diagram of a two-phase controlled soft starter with integral bypass contacts"). The current in the third, uncontrolled phase is the sum of the currents in the controlled phases.

The rms value of the motor voltage is increased (from a settable starting voltage) to the rated motor voltage within a definable ramp-up time by means of the phase angle control.

The motor current changes in proportion to the voltage applied to the motor. As a result, the starting current is reduced by the factor of this voltage.

There is a quadratic relationship between the torque and the voltage applied to the motor. As a result, the starting torque is reduced quadratically in relation to this voltage.

Example

SIEMENS 1LG4253AA motor (55 kW)

Rated data at 400 V

 P_e : 55 kW I_e : 100 A

I_{direct starting}: Approx. 700 A

 M_e : 355 Nm; e.g.: $M_e = 9.55 \times 55 \text{ kW } \times \frac{1000}{1480 \text{ min}^{-1}}$

 n_e : 1480 rpm

M_{direct starting}: Approx. 700 Nm

Set starting voltage: 50 % (½ of mains voltage)

=> I_{starting} ½ of direct starting current (approx. 350 A)

=> M_{starting} ¼ of direct starting torque (approx. 175 Nm)

The diagrams below show the starting current and torque characteristics for a three-phase induction motor in combination with a soft starter:

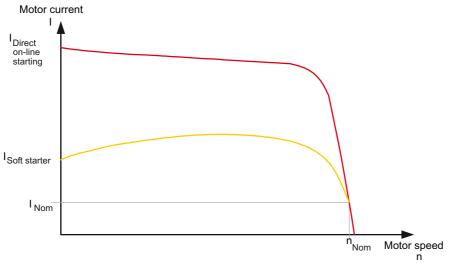


Figure 3-3 Reduced current characteristic of a three-phase induction motor during starting with a SIRIUS 3RW30 or 3RW40 soft starter

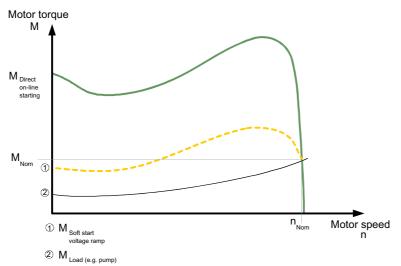


Figure 3-4 Reduced torque characteristic of a three-phase induction motor during starting with a SIRIUS 3RW30 or 3RW40 soft starter

Soft start /soft stop

This means that, since the motor voltage is controlled by the electronic soft starter during the startup process, the consumed starting current and the starting torque generated in the motor are also controlled.

The same principle is applied during the stop process. This ensures that the torque generated in the motor is gradually reduced, so that the application can stop smoothly (the soft stop function is only supported by the 3RW40).

The frequency remains constant during this process and corresponds to the mains frequency, in contrast to frequency controlled starting and stopping of a frequency converter.

Bypass mode

Once the motor has been started up correctly, the thyristors are subject to fully advanced control, meaning that the whole mains voltage is applied to the motor terminals. As the motor voltage does not have to be controlled during operation, the thyristors are bridged by integral bypass contacts that are rated for AC1 current. This minimizes the waste heat generated during uninterrupted duty (which is caused by the thyristor's power loss), and minimizes heating up of the switching device's environment.

The bypass contacts are protected by an integrated, electronic arc quenching system during operation. If they are opened in the event of a fault, e.g. if the control voltage is temporarily interrupted, mechanical vibrations occur, or the coil operating mechanism or the main contact spring has reached the end of its service life and is defective, the equipment is not damaged.

The diagram below shows the method of operation of the SIRIUS 3RW30 and 3RW40 soft starters:

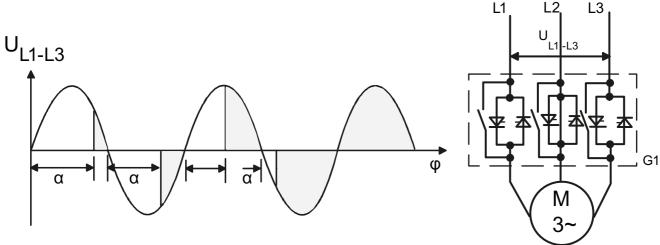


Figure 3-5 Phase angle control and schematic diagram of a two-phase controlled soft starter with integral bypass contacts

3.3.1 Method of operation of a two-phase controlled soft starter

A special method of operation is used for the SIRIUS 3RW30 and 3RW40 two-phase controlled soft starters based on SIEMENS' patented "polarity balancing" control principle.

Two-phase control

The SIRIUS 3RW30 and 3RW40 soft starters are two-phase controlled soft starters, in other words they are designed with two antiparallel thyristors in each of phases L1 and L3. Phase 2 is an uncontrolled phase, which is merely guided through the starter by a copper connection.

In a two-phase controlled soft starter, the current that results from the superimposition of the two controlled phases flows in the uncontrolled phase. The main advantages of two-phase control include the more compact size compared to a three-phase version and the lower hardware costs.

The occurrence of DC components, caused by the phase angle and the overlapping phase currents, is a negative physical effect of two-phase control during the startup process that can mean a louder noise is produced by the motor. The "polarity balancing" control principle was developed and patented by SIEMENS to prevent these DC components during starting.

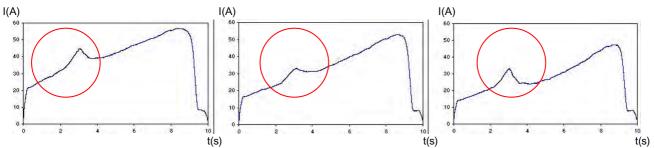


Figure 3-6 Current characteristic and occurrence of DC components in the three phases without "polarity balancing"

Polarity balancing

"Polarity balancing" effectively eliminates these DC components during the ramp-up phase. It allows the motor to be started up with a constant speed, torque, and current rise.

The acoustic quality of the startup process comes very close to that of a three-phase controlled startup. This is made possible by the continuous dynamic alignment and balancing of current half-waves with different polarities during the motor startup.

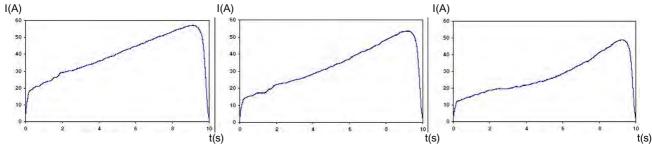


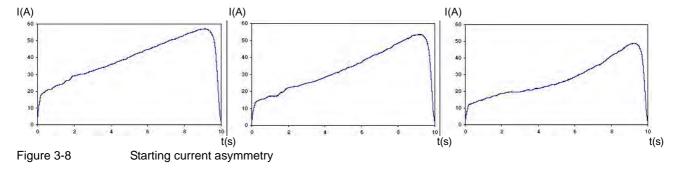
Figure 3-7 Current characteristic in the three phases without DC components thanks to "polarity balancing"

3.3.2 Starting current asymmetry

With two-phase control the starting current is asymmetrical for physical reasons, because the current in the uncontrolled phase is the sum of the currents in the two controlled phases.

This asymmetry can be as much as 30 to 40% during starting (ratio of minimum current to maximum current in all three phases).

Even though this cannot be influenced, it is not critical in most applications. It could cause an insufficiently rated fuse to trip in the uncontrolled phase, for instance. For recommended fuse ratings, refer to the tables in chapter Technical data [Page 121].



3.3 Functional principle of the SIRIUS 3RW30 and 3RW40 soft starters

Note

If wye-delta starters are exchanged for soft starters in an existing system, you should check the fuse ratings in the feeder in order to avoid false tripping. This is particularly important in connection with heavy-duty starting or if the fuse that is installed has already been operated close to the thermal tripping limit with the wye-delta assembly.

All elements of the main circuit (such as fuses, motor starter protectors, and switching devices) must be dimensioned for direct starting and according to the on-site short-circuit conditions, and ordered separately.

For recommended fuse and motor starter protector ratings for the feeder with soft starter, refer to chapter Technical data [Page 121].

3.3.3 Applications and use

Applications and selection criteria

The SIRIUS 3RW30 and 3RW40 soft starters represent a good alternative to direct or wyedelta starters.

The most important advantages are:

- Soft start
- Soft stop (3RW40 only)
- Uninterrupted switching without current peaks that place a heavy load on the system
- Simple installation and commissioning
- Compact, space-saving design

Applications

The typical applications include:

- · Conveyor belts
- · Roller conveyors
- Compressors
- Fans
- Pumps
- Hydraulic pumps
- Agitators
- · Circular saws / band saws

Advantages

Conveyor belts and transport systems:

- Smooth starting
- · Smooth stopping

Rotary pumps and piston pumps:

- No pressure surges
- Increased service life of the pipe system

Agitators and mixers:

· Reduced starting current

Fans:

• Protection for the gearbox and V belt

Comparison of device functions 3.4

				Diamananan Diserra
		SIRIUS 3RW30 Standard applications	SIRIUS 3RW40 Standard applications	SIRIUS 3RW44 High Feature applications
Rated current at 40 °C / 50 °C	Α	3106 / 3 9		29 1214 / 26 1076
Rated operational voltage	V	200480	200600	200690
Motor rating at 400 V / 460 V •Standard connection •Inside-delta circuit	kW /hp	1.555 / 1.5 75	5.5250 / 7.5 300 -	15710 / 15 950 221200 / 30 1700
Ambient temperature	°C	-25+60	-25+60	0 + 6 0
Soft start/soft stop		✓ ¹⁾	V	V
Voltage ramp		V	✓	✓
Starting/stopping voltage	%	40100	40100	20100
Ramp-up and ramp-down time	s	020	0 2 0	1 3 6 0
Torque control		-	-	✓
Starting/stopping torque	%	-	-	20100
Torque limiting	%	-	-	20200
Ramp time	S	-	-	1360
Integrated jumper contact system		V	V	✓
Intrinsic device protection		-	✓	✓
Motor overload protection		-	✓ ⁷⁾	✓
Thermistor motor protection		-	v ²⁾	✓
Integrated remote RESET		_	✓ ³⁾	✓
Settable current limiting		-	<u> </u>	✓
Inside-delta circuit		-	-	✓
Breakaway torque		-	_	✓
Creep speed in both directions of rotation		_	-	✓
Pump stop		-	-	✓ ⁴⁾
DC braking		_	-	✓ ^{4) 5)}
Combined braking		-	_	√ ^{4) 5)}
Motor heating		-	-	√
Communication		-	-	With PROFIBUS DP (option)
External display and operator control module		-	-	(option)
Status measured value display		-	-	V
Error log		-	-	V
Events list		-	-	V
Min/max pointer function		-	-	v
Trace function		-		√ ⁶⁾
Programmable control inputs and outputs		-	-	V
Number of parameter sets		1	1	3
Parameterizing software (SoftStarterES)		-	-	V
Power semiconductors (thyristors)		2 controlled phases	2 controlled phases	3 controlled phases
Screw terminals		V	V	V
Spring-loaded terminals		V	'	<i>V</i>
UL/CSA		V	V	V
CE mark		/	<i>'</i>	, 4)
Soft starting under heavy-duty starting		_		✓ ⁴⁾
Support for configuration ✓ Function available; – function not available 1) For 3RW30 only soft start. 2) Optional up to size \$3 (device variants)		3) For 3RW402. to 3RW 3RW405. and 3RW40	7. optional. 6) Ti	ance ++49 9118955900 lot possible in inside-delta circuit. irace function with SoftStarterES software.

4) If necessary, overdimension soft starter and motor.

7) Acc. to ATEX

2) Optional up to size S3 (device variants).

Product combinations 4

4.1 SIRIUS modular system

Switching, protecting, and starting motors

In order to simplify the assembly of load feeders, the SIRIUS modular system offers standard components that are optimally harmonized and are easy to combine. Just 7 sizes cover the entire performance range up to 250 kW / 300 hp. The individual switching devices can be assembled to form complete load feeders, either using link modules or by mounting directly.

For a selection of matching device combinations, e.g. soft starters and motor starter protectors, refer to chapter Technical data [Page 121].

4.1 SIRIUS modular system

SIRIUS motor starter protectors

SENTRON circuit breakers















3RV20 11 (S00) 3RV20 21 (S0)

VL250/3VL3

VL400/3VL4 VL630/3VL5

SIRIUS contactors









3RT1. 4 (S3)



3RT1. 5 (S6)





3RT1. 7 (S12)

3RT20 1 (S00) 3RT20 2 (S0)

SIRIUS overload relays











3RB20 46 (S3)





SIRIUS soft starters



3RW30 1 (S00) Figure 4-1



3RW40 2 (S0) 3RW40 3 (S2)

SIRIUS modular system









3RW40 5 (S6)

3RW40 7 (S10/S12)

Functions

5.1 Start modes

You can choose between different startup functions reflecting the wide range of applications and functionality of the SIRIUS 3RW30 and 3RW40 soft starters. The motor start can be optimally adapted to each particular application.

5.1.1 Voltage ramp

The SIRIUS 3RW30 and 3RW40 soft starters achieve soft starting by means of a voltage ramp. The motor terminal voltage is increased from a parameterizable starting voltage up to the mains voltage within a definable ramp-up time.

Starting voltage

The starting voltage determines the starting torque of the motor. A lower starting voltage results in a lower starting torque and a lower starting current. The starting voltage selected must be sufficiently high to ensure that motor starts up smoothly as soon as the start command is received by the soft starter.

Ramp time

The length of the set ramp time determines the time taken to increase the motor voltage from the parameterized starting voltage to the mains voltage. This influences the motor's acceleration torque, which drives the load during the ramp-up process. A longer ramp time results in a lower acceleration torque as the motor is started up. The startup is slower and smoother as a result. The ramp time should be long enough for the motor to reach its nominal speed. If the time selected is too short, in other words if the ramp time ends before the motor has started up successfully, a very high starting current that can even equal the direct starting current at the same speed occurs at this instant.

The SIRIUS 3RW40 soft starter limits the current to the value set with the current limiting potentiometer (refer to chapter Current limiting and ramp-up detection (3RW40 only) [Page 29]). As soon as the current limiting value is also reached, the voltage ramp or the ramp time is interrupted and the motor is started with the current limiting value until it has started up successfully. In this case, the motor ramp-up time may be longer than the maximum parameterizable 20 seconds ramp time (for further information about the maximum ramp-up times and switching frequencies, refer to chapter 3RW40 2. to 7. power electronics [Page 148] ff).

The SIRIUS 3RW40 soft starter has intrinsic device protection, current limiting, and ramp-up detection functions. These functions do not form part of the SIRIUS 3RW30 soft starter.

CAUTION

Risk of property damage

When using the 3RW30: Make sure the selected ramp time is longer than the actual motor ramp-up time. If not, the SIRIUS 3RW30 may be damaged because the internal bypass contacts close when the set ramp time elapses. If the motor has not finished starting up, an AC3 current that could damage the bypass contact system will flow.

When using the 3RW40: The 3RW40 has an integrated ramp-up detection function that prevents this operating state from occurring.

The maximum ramp time for the SIRIUS 3RW30 soft starter is 20 seconds An appropriately dimensioned SIRIUS 3RW40 or 3RW44 soft starter should be chosen for startup processes with a motor ramp-up time > 20 seconds.

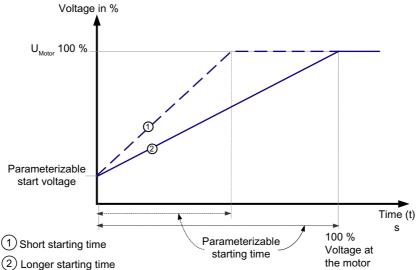


Figure 5-1 Principle of the voltage ramp

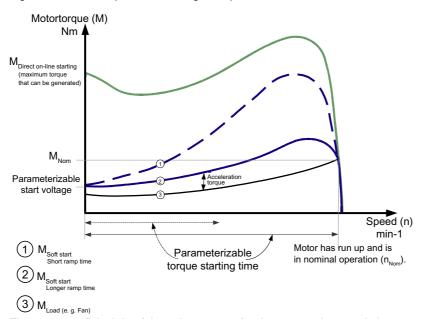


Figure 5-2 Principle of the voltage ramp for the torque characteristic

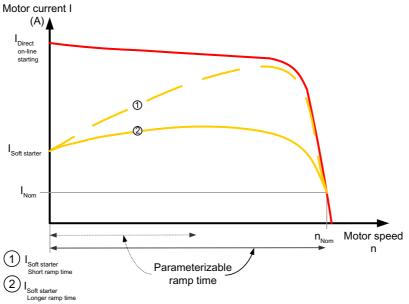


Figure 5-3 Principle of the voltage ramp for the starting current characteristic

Typical applications of the voltage ramp

The voltage ramp principle is valid for all applications, e.g. pumps, compressors, conveyor belts.

5.1.2 Current limiting and ramp-up detection (3RW40 only)

The SIRIUS 3RW40 soft starter measures the phase current (motor current) continuously with the help of integrated current transformers.

The motor current that flows during the startup process can be actively limited by means of the soft starter. The current limiting function takes priority over the voltage ramp function. As soon as a parameterizable current limit is reached, in other words, the voltage ramp is interrupted and the motor is started with the current limiting value until it has started up successfully. The current limiting function is always active with SIRIUS 3RW40 soft starters. If the current limiting potentiometer is set to the clockwise stop (maximum), the starting current is limited to five times the set rated motor current.

Current limiting value

The current limiting value is set to the current required during starting as a factor of the rated motor current. Since the starting current is asymmetrical, the set current corresponds to the arithmetic mean value for the three phases.

Example

If the current limiting value is set to 100 A, the currents might be approx. 80 A in L1, 120 A in L2, and 100 A in L3 (refer to chapter Starting current asymmetry [Page 21]).

5.2 Stop modes

As soon as the selected current limiting value is reached, the motor voltage is reduced or controlled by the soft starter to prevent the current from exceeding the limit. The set current limiting value must be high enough to ensure that the torque generated in the motor is sufficient to accelerate the motor to nominal speed. Three to four times the value of the motor's rated operational current (le) can be assumed as typical here.

The current limiting function is always active because it is required by the intrinsic device protection. If the current limiting potentiometer is set to the clockwise stop (maximum), the starting current is limited to five times the set rated motor current.

Ramp-up detection (3RW40 only)

The SIRIUS 3RW40 soft starter is equipped with an integrated ramp-up detection function. If it detects a motor startup, the motor voltage is immediately increased to 100 % of the mains voltage. The internal bypass contacts close and the thyristors are bridged.

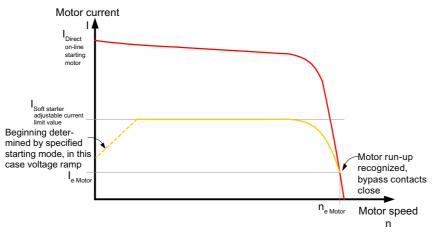


Figure 5-4 Current limiting with soft starter

Typical applications for current limiting

Current limiting is used for applications with large centrifugal masses (mass inertias) and therefore longer ramp-up times, e.g. fans, circular saws etc.

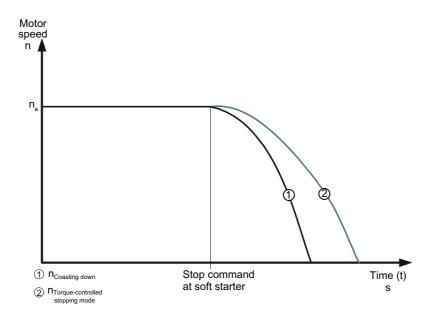
5.2 Stop modes

You can choose between different stop modes reflecting the wide range of applications for SIRIUS soft starters. The motor stop can be optimally adapted to each particular application.

If a start command is issued during the stop process, the process is interrupted and the motor is started again with the set start mode.

Note

If you select "soft stop" (3RW40 only) as the stop mode, the feeder (soft starter, cables, feeder protective devices, and motor) may need to be dimensioned for higher values because the current exceeds the rated motor current during the stop process.



5.2.1 Stop without load (3RW30 and 3RW40)

"Stop without load" means the power supplied to the motor via the soft starter is interrupted when the ON command is removed from the starter. The motor coasts to a standstill, driven only by the mass inertia (centrifugal mass) of the rotor and load. This is also referred to as a natural stop. A large centrifugal mass means a longer stop time without load.

Typical applications for stop without load

Stop without load is used for loads that place no special demands on the startup characteristic, e.g. fans.

5.2.2 Soft stop (3RW40 only)

In "soft stop" mode, the natural stop process of the load is decelerated. The function is used when the load must be prevented from stopping abruptly. This is typically the case in applications with a low mass inertia or a high counter-torque.

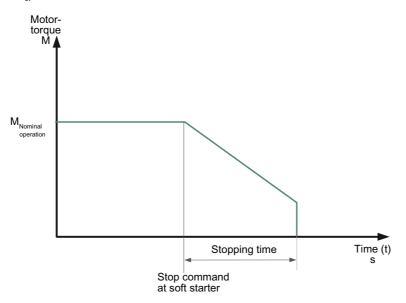
Ramp-down time

The "Ramp-down time" potentiometer on the soft starter allows you to specify how long power should still be supplied to the motor after the ON command is removed. The torque generated in the motor is reduced by means of a voltage ramp function within this ramp-down time and the application stops smoothly.

If the motor is stopped abruptly in pump applications, as is normal with wye-delta or direct starting, for instance, water hammer can occur. Water hammer is caused by the sudden flow separation, leading to pressure fluctuations on the pump. It has the effect of producing noise and mechanical impacts on the pipelines as well as on any flaps and valves installed there.

5.3 Motor protection / intrinsic device protection (3RW40 only)

Water hammer can be reduced compared to direct or wye-delta starting by using the SIRIUS 3RW40 soft starter. An optimum pump stop is achieved using a SIRIUS 3RW44 soft starter with an integrated pump stop function (refer to chapter Comparison of device functions [Page 24]).



Typical applications for soft stop

Use soft stop for

- · Pumps to reduce water hammer.
- Conveyor belts to prevent the conveyed product from tilting.

5.3 Motor protection / intrinsic device protection (3RW40 only)

NOTICE

If the soft starter is disconnected because the motor overload protection or the intrinsic device protection trips, you must wait a defined cooling time (recovery time) prior to acknowledging the fault or starting the motor again. (Motor overload tripping time: 60 seconds, temperature sensor: after cooling, intrinsic device protection tripping time: > 30 seconds)

5.3.1 Motor protection function

The motor overload protection function is implemented on the basis of the winding temperature. This indicates whether the motor is overloaded or functioning in the normal operating range.

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

The two types of protection must be combined to achieve full motor protection. This combination is recommended to protect the motor optimally.

Note

Thermistor motor protection evaluation

The thermistor motor protection evaluation function is optionally available for the SIRIUS 3RW40 2 to 3RW40 4 soft starters in the 24 V AC/DC control voltage version.

Motor overload protection

The current flow during motor operation is measured by measuring the current with transformers integrated in the soft starter. The temperature rise in the winding is calculated based on the rated operational current set for the motor.

A trip is generated by the soft starter when the characteristic is reached, depending on the trip class (CLASS setting).

ATEX

"Increased safety" type of protection EEx e acc. to ATEX Directive 94/9/EC

The SIRIUS 3RW40 soft starter sizes S0 to S12 are suitable for starting explosion-proof motors with the "increased safety" type of protection EEx e (type of protection / marking: Ex II (2) GD).

Wire the fault output (95 96) to an upstream switching device in such a way that if a fault occurs, this device disconnects the feeder (refer to Fig. "3RW40 wiring fault with 3RV").

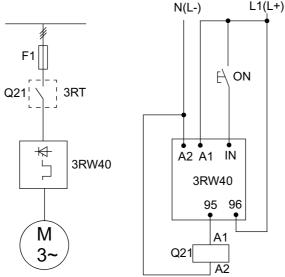


Figure 5-5 3RW40 wiring fault

5.3 Motor protection / intrinsic device protection (3RW40 only)

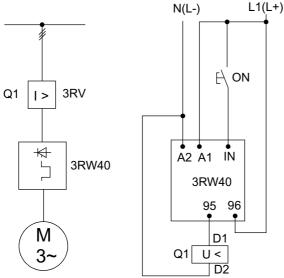


Figure 5-6 3RW40 wiring fault with 3RV



WARNING

Danger of death or serious injury.

The 3RW40 is not suitable for installation in hazardous areas. The device is only allowed to be installed in a control cabinet with the IP4x degree of protection. Appropriate measures (e.g. encapsulation) must be taken if it is to be installed in a hazardous area.

Trip class (electronic overload protection)

The trip class (CLASS) specifies the maximum time within which a protective device must trip from a cold state at 7.2 x the rated operational current (motor protection to IEC 60947). The tripping characteristics represent this time as a function of the tripping current (refer to chapter Motor protection tripping characteristics for 3RW40 (with symmetry) [Page 161]). You can set different CLASS characteristics according to the startup class.

Note

The rated data of the soft starters refers to normal starting (CLASS 10). The starters may need to be calculated with a size allowance for heavy-duty starting (> CLASS 10). You can only set a rated motor current that is lower than the soft starter rated current (for the permissible settings, refer to chapter Technical data [Page 121]).

Recovery time (motor overload protection)

A recovery time of 60 seconds, during which the motor cools down and cannot be restarted, starts if the thermal motor model is tripped.

Protection against voltage failure in the event of a fault

If the control supply voltage fails during a trip, the current tripping state of the thermal motor model and the current recovery time are stored in the soft starter. When the control supply voltage is restored, the current tripping state of the thermal motor model and the intrinsic device protection prior to the power failure are likewise automatically restored. If the control voltage is disconnected during operation (without a preceding fault trip), the starter is not protected against voltage failure.

Temperature sensor

Note

Temperature sensor

The temperature sensor evaluation function is optionally available for the SIRIUS 3RW40 24 to 3RW40 47 soft starters in the 24 V AC/DC control voltage version.

This motor protection function measures the motor's stator winding temperature directly with the help of a sensor installed in the motor, in other words the motor must have a sensor wound into the stator winding.

You can choose between two different sensor types for the evaluation.

- 1. Type A PTC thermistors ("type A sensors") for connection to terminals T11/21 and T12
- 2. Thermoclick sensors for connection to terminals T11/21 and T22

The wiring and sensors are monitored for wire breakage and short-circuits.

Recovery time (thermistor motor protection)

If the thermistor motor protection is tripped, the soft starter cannot be restarted until the sensor installed in the motor has cooled down. The recovery time varies according to the temperature state of the sensor.

5.3.2 Intrinsic device protection (3RW40 only)

Thyristor protection (thermal)

SIRIUS 3RW40 soft starters are equipped with integrated intrinsic device protection to prevent thermal overloading of the thyristors.

This is achieved on the one hand by means of current measuring transformers in the three phases and on the other, by measuring the temperature with temperature sensors on the thyristor's heat sink.

If the fixed, internally set trip value is exceeded, the soft starter is automatically disconnected.

Recovery time (intrinsic device protection)

If the intrinsic device protection is tripped, the soft starter cannot be restarted until a recovery time of at least 30 seconds has elapsed.

Thyristor protection (short-circuit)

SITOR semiconductor fuses must be connected upstream to protect the thyristors against short-circuits (e.g. in case of cable damage or an interturn fault in the motor; refer to chapter Soft starter assembly with type of coordination 2 [Page 61]). For the fuse selection tables, refer to chapter Technical data [Page 121].

Protection against voltage failure (in the event of a fault)

If the control supply voltage fails during a trip, the current tripping state of the thermal intrinsic device protection model and the current recovery time are stored in the soft starter. When the control supply voltage is restored, the current tripping state of the thermal intrinsic device protection prior to the power failure are likewise automatically restored.

NOTICE

If the control voltage is disconnected during operation (e.g. in "automatic mode"), the starter is not protected against voltage failure. You must wait five minutes between two starts to ensure that the motor protection and the intrinsic device protection are working correctly.

5.4 Functions of the RESET buttons

5.4.1 SIRIUS 3RW40 2, 3RW40 3, and 3RW40 4 soft starters

5.4.1.1 RESET MODE button and LED

By pressing the RESET MODE button, you define the reset procedure in case of a fault. This is indicated by the RESET MODE LED.





Yellow = AUTO
Off = MANUAL
Green = REMOTE

Note

On the SIRIUS 3RW40 2. soft starter, the RESET MODE button is located underneath the label (refer to chapter Operator controls, displays, and connections on the 3RW40 [Page 70])

5.4.1.2 **Manual RESET**

Manual RESET with the RESET / TEST button (RESET MODE LED = off)

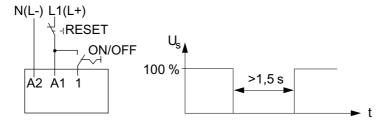
You can reset a fault by pressing the RESET / TEST button.



5.4.1.3 Remote RESET

Remote RESET (RESET MODE LED = green)

You can reset a fault signal by disconnecting the control supply voltage for >1.5 s.



5.4.1.4 **AUTO RESET**

AUTO RESET (RESET MODE LED = yellow)

If you set the RESET mode to AUTO, a fault is automatically reset as follows:

- If the motor overload protection function trips: after 60 s
- If the intrinsic device protection function trips: after 30 s
- If the thermistor evaluation function trips: after the temperature sensor in the motor has cooled down



WARNING

Automatic restart

Danger of death, serious injury, or property damage.

The automatic RESET mode (AUTO RESET) must not be used in applications where there is a risk of serious injury to persons or substantial damage to property if the motor starts up again unexpectedly. The start command (e.g. issued by a contact or the PLC) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

5.4.1.5 **Acknowledging faults**

For information about whether or not faults can be acknowledged as well as the corresponding LED and output contact states, refer to chapter Diagnostics and fault signals [Page 44].

5.4.2 SIRIUS 3RW40 5 and 3RW40 7 soft starters

5.4.2.1 RESET MODE button and AUTO LED

By pressing the RESET MODE button, you define the reset procedure in case of a fault. This is indicated by the AUTO LED.



Yellow = AUTO
Off = MANUAL (REMOTE)

5.4.2.2 Manual RESET

Manual RESET with the RESET / TEST button (AUTO LED = off)

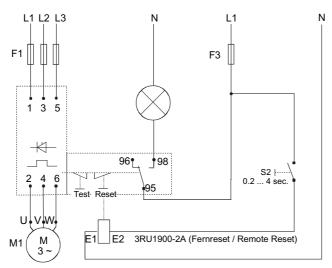
You can reset a fault by pressing the RESET / TEST button.



5.4.2.3 Remote RESET

Remote RESET (AUTO LED = green)

You can initiate a remote RESET by controlling the optional module for RESET (3RU1900-2A).



5.4.2.4 AUTO RESET

AUTO RESET (AUTO LED = yellow)

If you set the RESET mode to AUTO, a fault is automatically reset as follows:

- If the motor overload protection function trips: after 60 s
- If the intrinsic device protection function trips: after 30 s



Automatic restart

Can result in death, serious injury, or property damage.

The automatic RESET mode (AUTO RESET) must not be used in applications where there is a risk of serious injury to persons or substantial damage to property if the motor starts up again unexpectedly. The start command (e.g. issued by a contact or the PLC) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

5.4.2.5 Acknowledging faults

For information about whether or not faults can be acknowledged as well as the corresponding LED and output contact states, refer to chapter Diagnostics and fault signals [Page 44].

5.4.3 Other functions of the RESET button

5.4.3.1 Motor protection trip test

You initiate a motor overload trip by pressing the RESET / TEST button for longer than five seconds. The SIRIUS 3RW40 soft starter is tripped by the fault signal at the OVERLOAD LED, the FAILURE / OVERLOAD contact 95-98 closes, and the motor that is connected and running is switched off.



RESET / TEST button on the 3RW40 2, 3RW40 3, and 3RW40 4



RESET / TEST button on the 3RW40 5 and 3RW40 7

5.4.3.2 Reparameterizing the ON / RUN output contact

For information about reparameterizing the output with the RESET / TEST button, refer to chapter Parameterizing the 3RW40 outputs [Page 110] .

5.5 Functions of the inputs

5.5.1 Start input (terminal 1) on 3RW30 and 3RW40 2 to 3RW40 4

Rated control voltage is present at terminal A1 / A2: The startup process of the soft starter begins when a signal is present at terminal 1 (IN). The starter operates until the signal is removed again.

If a ramp-down time is parameterized (3RW40 only), a soft stop starts as soon as the signal is removed.

The potential of the signal at terminal 1 must correspond to the potential of the rated control voltage at terminal A1 / A2.



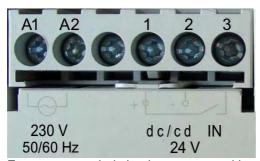
For recommended circuits, e.g. control by means of pushbuttons, contactor contacts, or a PLC, refer to chapter Typical circuit diagrams [Page 167].

5.5.2 Start input (terminal 3) on 3RW40 5 and 3RW40 7

Rated control voltage is present at terminal A1 / A2: The startup process of the soft starter begins when a signal is present at terminal 3 (IN). The starter operates until the signal is removed again. If a ramp-down time is parameterized, a soft stop starts as soon as the signal is removed.

The 24 V DC control voltage supplied by the soft starter must be taken from terminal 1 (+) as voltage for the signal at terminal 3.

If you select direct control by a PLC, the "M" of the PLC's reference potential must be connected to terminal 2 (-).



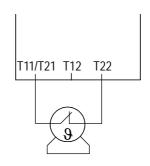
For recommended circuits, e.g. control by means of pushbuttons, contactor contacts, or a PLC, refer to chapter Typical circuit diagrams [Page 167].

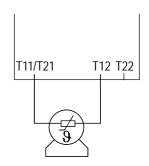
5.5.3 Thermistor input / connection on 3RW40 2 to 3RW40 4

24 V AC/DC rated control voltage

After removing the copper jumper between T11/21 and T22, you can connect and evaluate either a Klixon thermistor integrated in the motor winding (at terminal T11/T21-T22) or a type A PTC (at terminal T11/T21-T12).







Klixon

Type A PTC

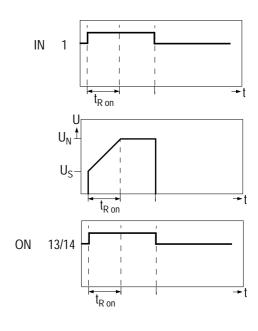
5.6 Functions of the outputs

5.6.1 3RW30: Output terminal 13 / 14 ON

The potential-free output contact at terminal 13/14 (ON) closes if a signal is present at terminal 1 (IN); it remains closed until the start command is removed.

The output can be used, for instance, to control a line contactor connected upstream or to implement latching if you selected pushbutton control. For recommended circuits, refer to chapter Typical circuit diagrams [Page 167].





5.6 Functions of the outputs

For a state diagram of the contact in the various operating states, refer to chapter Diagnostics and fault signals [Page 44].

5.6.2 3RW40: Output terminals 13 / 14 ON / RUN and 23 / 24 BYPASSED

ON

The potential-free output contact at terminal 13/14 (ON) closes if a signal is present at terminal 1 (IN); it remains closed until the start command is removed (factory default). The ON function can be used, for instance, as a latching contact if you selected pushbutton control.

Reparameterizing from ON to RUN

You can reparameterize the function of the ON output on the 3RW40 to RUN by simultaneously pressing the RESET TEST and RESET MODE buttons (refer to chapter Commissioning the 3RW40 [Page 98]).

RUN

The RUN output remains closed as long as the motor is controlled by the soft starter, in other words during the startup phase, in bypass mode, and during the soft stop (if set). This output function can be used, for instance, if a line contactor connected upstream must be controlled by the soft starter, especially if the soft stop function is set.

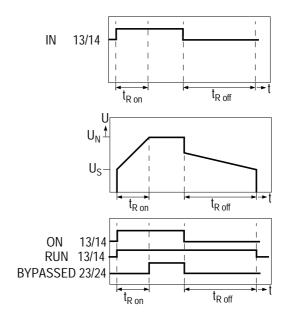
BYPASSED

The BYPASSED function can be used, for instance, to indicate that the motor has started up successfully.

The BYPASSED output at terminal 23 / 24 closes as soon as the SIRIUS 3RW40 soft starter detects that the motor has started up (refer to chapter Ramp-up detection [Page 104]).

The integral bypass contacts simultaneously close and the thyristors are bridged. The integral bypass contacts and output 23 / 24 open again as soon as the start input IN is removed.





For a state diagram of the contacts and the LEDs in the various operating and fault states, refer to chapter Diagnostics and fault signals [Page 44].

For recommended circuits, refer to chapter Typical circuit diagrams [Page 167].

5.6.3 3RW40: Group fault output at terminal 95 / 96 / 98 OVERLOAD / FAILURE

If there is no rated control voltage or if a failure occurs, the potential-free FAILURE / OVERLOAD output is switched.



For recommended circuits, refer to chapter Typical circuit diagrams [Page 167].

For a state diagram of the contacts in the various fault and operating states, refer to chapter Diagnostics and fault signals [Page 44].

5.7 Diagnostics and fault signals

5.7.1 3RW30: LEDs and troubleshooting

				LED	LEDs on 3RW30			Auxiliary contact	
		S	Soft sta	arter					
3RW30							E/BYPASSED/ FAILURE (gn/rd)	13 14/ (ON)	
U _s = 0								_/_	
Operat	ing state		IN						
Off			0	\	-\(\) gn				
Start			1	\tag{+}	gn	gn			
Bypassed			1	\ \	gn	- gn			
Fault									
Impermissible electronics supply voltage 1))		-\-\-rd	_/_		
Bypass overload ²⁾				\(\tau \)	ylw		-\-\-rd	_/_	
- Missing load voltage ¹⁾ - Phase failure, missing load ¹⁾				\tag{\tau}	gn		-\-\-rd	_/_	
Device fault 3)			\tag{\tau}	-\to-rd		-\	_/_		
LEDs									
	\		gn =	rd =	_	lw =			
Off	ON	Flashing	Green	Red	Y	ellow			

¹⁾ The fault is automatically reset by an outgoing event. An automatic restart is initiated and the 3RW restarted if a start command is present at the input.



Automatic restart

Danger of death, serious injury, or property damage.

If you do not want the motor to start automatically, you must integrate suitable additional components, e.g. phase failure or load monitoring devices, into the control and main circuits.

- 2) The fault can be acknowledged by removing the start command at the start input.
- 3) Switch off the control voltage, then switch it on again. If the fault is still present, contact your SIEMENS partner or Technical Assistance.

For notes on troubleshooting, refer to the table below.

Fault	Cause	Remedy		
Impermissible electronics supply voltage	The control supply voltage does not correspond to the soft starter's rated voltage.	Check the control supply voltage; an incorrect control supply voltage could be caused by a power failure or a voltage dip.		
Bypass overload	A current > 3.5 x I _e of the soft starter occurs for > 60 ms in bypass mode (e.g. because the motor is blocked).	Check the motor and load, and check the soft starter's dimensions.		
Missing load voltage, phase failure / missing load	Cause 1: Phase L1 / L2 / L3 is missing or fails / collapses when the motor is operating.	Connect L1 / L2 / L3 or correct the voltage dip.		
	Tripped as a result of a dip in the permissible rated operational voltage > 15 % for > 100 ms during the startup process or > 200 ms in bypass mode.			
	Cause 2: The motor that is connected is too small and the fault occurs as soon as it is switched to bypass mode.	If less than 10 % of the soft starter's rated current is flowing, the motor cannot be operated with soft starter. Use another soft starter.		
	Cause 3: Motor phase T1 / T2 / T3 is not connected.	Connect the motor properly (e.g. jumpers in the motor terminal box, repair switch closed etc.)		
Device fault	Soft starter defective.	Contact your SIEMENS partner or Technical Assistance.		

5.7.2 3RW40: LEDs and troubleshooting

U _S =0 Operating state IN Off O gn					LEDs on				Auxiliary contacts				
SRW40 DEVICE (rd/gn/yhw) Glaver of the part of the p				:	Soft starter		Motor pro	Motor protection					
Off Operating state IN Off Operating state IN Off Operating state In O	3RW40			E	BYPASSED FAILURE	OVERLOAD	MODE / AUTO						
Start Start	U _S = 0										_/_	لح ا	
Start 1 gn gn gn gn gn gn gn	Operating state		IN										
Bypassed 1 gn gn gn Stop 0 gn gn gn gn gn gri gn Stri hinibited, device too hot (cooling time may vary according to thyristor temperature) Fault Impermissible electronics supply voltage 2) Impermissible electronics supply voltage 2) Impermissible electronics supply voltage 3) gn Grd Grd Grd Grd Grd Grd Grd Gr	Off		0	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	ın				_/_	_/_	_/_	7	
Warning Le/ impermissible CLASS setting 2) Start inhibited, device too hot (cooling time any vary according to thyristor temperature) Fault Impermissible electronics supply voltage 2) Impermissible left (CLASS setting and IN cooling time any vary according to thyristor temperature) Fault Impermissible left (CLASS setting and IN cooling time and ti	Start		1	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	n	gn					_/_	7	
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Start inhibited, device too hot (cooling time amay vary according to thyristor temperature) Fault Impermissible electronics supply voltage 2) Impermissible electronics supply voltage 2) Impermissible electronics supply voltage 2) Motor protection tripping, overload relay 10 cooling time 60 s/ thermistor motor protection Wire breakage / short-circuit 1) 3) Thermal overload on device 3) Cooling time 30 s) Wilw crd cooling time 60 short-circuit 1) 3/ Paise failure, missing load 3) Press Test tive 60 short-circuit 1) 4 cooling time 60 short-circuit 1) 4 cooling time 7 short-circuit	Warning												
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Impermissible electronics supply voltage 2)	Start inhibited, device too hot (cooling time 3) may vary according to thyristor temperature)			(s) ³⁾ yl	v				_/_	_/_	_/_	7	
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OU L ON LEISOND LEICKERING LAFEEN MEINWEREN L	Off ON Fla	ashing	Flickering	= Green Yel			5) Device fault cannot be acknowledged. Contact your SIEMENS partner or Technical Assistance.						



Automatic restart

Can result in death, serious injury, or property damage.

The automatic RESET mode (AUTO RESET) must not be used in applications where there is a risk of serious injury to persons or substantial damage to property if the motor starts up again unexpectedly. The start command (e.g. issued by a contact or the PLC) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output on the 3RW40 (terminals 95 and 96), or the signaling contact of the motor or miniature circuit breaker on all devices, in the controller.

Notes on troubleshooting

Warning	Cause	Remedy
Impermissible I _e CLASS setting (control voltage present, no start command)	The rated operational current I _e set for the motor (control voltage present, no start command) exceeds the associated, maximum permissible setting current referred to the selected CLASS setting (chapter Motor current settings [Page 107]).	Check the rated operational current set for the motor, select a lower CLASS setting, or calculate the soft starter with a size allowance. As long as the 3RW40 is not controlled IN (0->1), this is only a status signal. However, it becomes a fault signal if the start command is applied.
Start inhibited, device too hot	The acknowledgment and the motor start are inhibited for a defined time by the inherent device protection following an overload trip, to allow the 3RW40 to cool down. Possible causes Too many starts, Motor ramp-up time too long, Ambient temperature in switching device's environment too high, Minimum installation clearances not complied with.	The device cannot be started until the temperature of the thyristor or the heat sink has cooled down enough to guarantee sufficient reserve for a successful startup. The time until restarting is allowed can vary but is a minimum of 30 s. Rectify the causes and possibly retrofit the optional fan (3RW40 2. to 3RW40 4.).

5.7 Diagnostics and fault signals

Fault	Cause	Remedy
Impermissible electronics supply voltage:	The control supply voltage does not correspond to the soft starter's rated voltage.	Check the control supply voltage; could be caused by a power failure, voltage dip, or incorrect control supply voltage. Use a stabilized power supply unit if due to mains fluctuations.
Impermissible le/CLASS setting and IN (0->1) (control voltage present, IN start command changes from 0 to 1)	The rated operational current I _e set for the motor (control voltage present, start command present) exceeds the associated, maximum permissible setting current referred to the selected CLASS setting (chapter Motor current settings [Page 107]).	Check the rated operational current set for the motor, select a lower CLASS setting, or calculate the soft starter with a size allowance.
	For the maximum permissible settings, refer to chapter "Technical data [Page 121]".	
Motor protection tripping Overload relay / thermistor:	The thermal motor model has tripped. After an overload trip, restarting is inhibited until the recovery time has elapsed Overload relay tripping time: 60 s - Thermistor tripping time: When the temperature sensor (thermistor) in the motor has cooled down.	- Check whether the motor's rated operational current I _e is set correctly, or - Change the CLASS setting, or - Possibly reduce the switching frequency, or - Deactivate the motor protection (CLASS OFF), or - Check the motor and the application.
Thermistor protection: wire breakage / short-circuit (optional for 3RW40 2. to 3RW40 4. devices):	Temperature sensor at terminals T11/T12/T22 is short-circuited or defective, a cable is not connected, or no sensor is connected.	Check the temperature sensor and the wiring
Thermal overload on the device:	Overload trip of the thermal model for the power unit of the 3RW40 Possible causes Too many starts, Motor ramp-up time too long, Ambient temperature in switching device's environment too high, Minimum installation clearances not complied with.	Wait until the device has cooled down again, possibly increase the current limiting value set for starting, or reduce the switching frequency (too many consecutive starts). Possibly retrofit the optional fan (3RW40 2. to 3RW40 4.). Check the load and the motor, check whether the ambient temperature in the soft starter's environment is too high (derating above 40 °C, refer to chapter Technical data [Page 121]), comply with the minimum clearances.

Fault	Cause	Remedy		
Missing load voltage, phase failure / missing load:	Cause 1: Phase L1 / L2 / L3 is missing or fails / collapses when the motor is operating.	Connect L1 / L2 / L3 or correct the voltage dip.		
	Tripped as a result of a dip in the permissible rated operational voltage > 15 % for > 100 ms during the startup process or > 200 ms in bypass mode.			
	Cause 2: The motor that is connected is too small and the fault occurs as soon as it is switched to bypass mode.	Set the correct rated operational current for the connected motor or set it to the minimum value (if the motor current is less than 10 % of the set I _e , the motor cannot be operated with this starter).		
	Cause 3: Motor phase T1 / T2 / T3 is not connected.	Connect the motor properly (e.g. jumpers in the motor terminal box, repair switch closed etc.)		
Device fault	Soft starter defective.	Contact your SIEMENS partner or Technical Assistance.		

5.7 Diagnostics and fault signals

Application planning

6.1 Application examples

6.1.1 Roller conveyor application

Using the 3RW30 with roller conveyors

Roller conveyors are employed, for example, in parcel distribution systems for transporting parcels to and from individual workstations. For this purpose, the direction of rotation of the 11 kW / 15 hp motor that is used has to be adjustable in order for the conveyor to work in both directions.

The following requirements must be met by the roller conveyor:

- The roller conveyor has to start smoothly, to prevent damage to the transported goods due to slipping or tilting.
- The machine's wear and maintenance intervals should be minimized, which is why slippage of the belt drive during startup must be prevented.
- The high current load upon motor startup must be reduced by means of a voltage ramp.
- The feeder assembly should be as small as possible so as not to exceed the control cabinet's space capacity.

The SIRIUS 3RW30 soft starter offers the following advantages:

- The roller conveyor is rapidly accelerated to the nominal speed without torque surges thanks to the optimum setting of the voltage ramp during startup.
- · The motor's starting current is reduced.
- Reversing operation of the conveyor belt is realized through contactor interconnection with SIRIUS 3RA13 reversing contactor combinations.
- The feeder and the motor protection are implemented with SIRIUS 3RV motor starter protectors.
- The use of SIRIUS system components guarantees maximum wiring reductions and space savings.

6.1.2 Hydraulic pump application

Using the 3RW40 with hydraulic pumps

The SIRIUS 3RW40 is optimally suited for soft starting and stopping of hydraulic pumps. With a rating of 200 kW / 250 hp, this soft starter is used, for example, in the production of sheet parts to drive the presses.

The drives for hydraulic pumps must meet the following requirements:

- The motor's starting current has to be reduced to minimize the load on the higher-level mains transformer during startup.
- Integrated motor protection is called for to reduce wiring expenditure and space requirements in the control box.
- The hydraulic pump must be started and stopped in a soft manner to minimize the mechanical load on the drive and the pump caused by torque surges during starting and stopping.

The SIRIUS 3RW40 soft starter offers the following advantages:

- The settable current limiting of the SIRIUS 3RW40 limits the load on the mains transformer during the motor startup.
- Motor protection is ensured by the motor overload relay with settable tripping times integrated in the soft starter.
- The adjustable voltage ramp ensures that the hydraulic pump is started and stopped without torque surges.

Installation

7.1 Installing the soft starter

7.1.1 Unpacking

CAUTION

Do not lift the device by the cover in order to unpack it, especially sizes 3RW40 55 to 3RW40 76, because this could lead to damage.

7.1.2 Permissible mounting position

3RW40 2 to 3RW40 4 (with optional additional fan) 3RW40 3RW40 5 to 3RW40 7



Vertical mounting Horizontal mounting

NOTICE

The permissible switching frequency values can vary according to the selected mounting position. For information about factors and how to determine the new switching frequency, refer to chapter Configuration [Page 73].

Note

An optional fan can be ordered for the 3RW40 24 to 3RW40 47 sizes; this fan is integrated in the device for 3RW40 55 to 3RW40 76. The 3RW30 cannot be equipped with a fan.

7.1.3 Mounting dimensions, clearances, and assembly type

The minimum clearances from other devices must be complied with to ensure unobstructed cooling as well as the free supply and discharge of air to and from the heat sink.

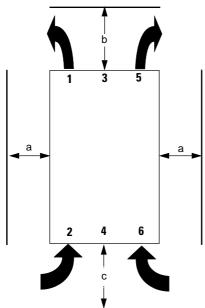


Figure 7-1 Clearances from other devices

MLFB	a (mm)	a (in)	b (mm)	b (in)	c (mm)	c (in)
3RW30 1./3RW30 2.	15	0.59	60	2.36	40	1.56
3RW30 3./3RW30 4	30	1.18	60	2.36	40	1.56
3RW40 2.	15	0.59	60	2.36	40	1.56
3RW40 3./3RW40 4.	30	1.18	60	2.36	40	1.56
3RW40 5./3RW40 7.	5	0.2	100	4	75	3

NOTICE

Allow sufficient clearances for the cooling air to circulate freely. The device is ventilated from bottom to top.

7.1.4 Assembly type: Standalone assembly, side-by-side assembly, direct mounting

Standalone assembly



The term "standalone assembly" is used if the clearances a / b / c described in chapter Mounting dimensions, clearances, and assembly type [Page 54] are complied with.

Side-by-side assembly



The term "side-by-side assembly" is used if the lateral clearance a described in chapter Mounting dimensions, clearances, and assembly type [Page 54] are not complied with, e.g. if several switching devices are assembled side by side.

Direct mounting



The term "direct mounting" is used if the top clearance b described in chapter Mounting dimensions, clearances, and assembly type [Page 54] is not complied with, e.g. if the soft starter is mounted directly on a motor starter protector (e.g. 3RV2) using a link module (e.g. 3RV29).

NOTICE

The permissible switching frequency values can vary according to the selected assembly type. For information about factors and how to determine the new switching frequency, refer to chapter Configuration [Page 73].

7.1.5 Installation requirements

Degree of protection IP00

The SIRIUS 3RW30 / 3RW40 soft starters conform to the IP00 degree of protection.

The devices must be installed in control cabinets with the IP54 degree of protection (pollution degree 2), taking account of the ambient conditions.

Make sure no liquids, dust, or conductive objects can get inside the soft starter. The soft starter produces waste heat (power loss) while it is operating (refer to chapter Technical data [Page 121]).

CAUTION

Provide adequate cooling at the place of installation to prevent the switching device from overheating.

Installation / mounting

8.1 General information

General information

A motor feeder comprises a **disconnector**, a **contact**, and a **motor** as a minimum.

Line protection against short-circuits must be implemented, together with overload protection for the line and motor.

Disconnector

The isolating function with line protection against overload and short-circuits can be achieved with a motor starter protector or a fuse disconnector, for instance. The motor overload protection function is integrated in the SIRIUS 3RW40 soft starter. The motor overload protection for the SIRIUS 3RW30 soft starter can be implemented with a motor circuit breaker, for instance, or using a motor overload relay in conjunction with a contactor (for the fuse and motor starter protector assignment, refer to Technical data [Page 121]).

Contact

The contact function is taken care of by the SIRIUS 3RW30 or 3RW40 soft starter.



Hazardous voltage

Danger of death or serious injury.

If mains voltage is present at the input terminals of the soft starter, hazardous voltage may still be present at the soft starter output even if a start command has not been issued. This voltage must be isolated by means of a disconnector (open isolating distance, e.g. with an open switch disconnector) whenever work is carried out on the feeder (refer to chapter Five safety rules for work in or on electrical systems [Page 58]).

Note

All elements of the main circuit (such as fuses, motor starter protectors, and switching devices) must be dimensioned for direct starting and according to the on-site short-circuit conditions, and ordered separately.

For recommended fuse and motor starter protector ratings for the feeder with soft starter, refer to chapter Technical data [Page 121].

8.2 Five safety rules for work in or on electrical systems

A set of rules, which are summarized in DIN VDE 0105 as the "five safety rules", are defined for work in or on electrical systems as a preventative measure against electrical accidents:

- 1. Isolate
- 2. Secure against switching on again
- 3. Verify that the equipment is not live
- 4. Ground and short-circuit
- 5. Erect barriers around or cover adjacent live parts

These five safety rules must be applied in the above order prior to starting work on an electrical system. After completing the work, proceed in the reverse order.

It is assumed that every electrician is familiar with these rules.

Explanations

1. The isolating distances between live and deenergized parts of the system must vary according to the operating voltage that is applied.

"Isolate" refers to the all-pole disconnection of live parts.

All-pole disconnection can be achieved, e.g. by.:

- Switching off the miniature circuit breaker
- Switching off the motor circuit breaker
- Unscrewing fusible links
- Removing LV HRC fuses
- 2. The feeder must be secured against inadvertent restarting to ensure that it remains isolated for the duration of the work. This can be achieved, for instance, by securing the motor and miniature circuit breakers with lockable blocking elements in the disconnected state, either using a lock or by unscrewing the fuses.
- 3. The deenergized state of the equipment should be verified using suitable test equipment, e.g. a two-pole voltmeter. Single-pole test pins are not suitable for this purpose. The absence of power must be established for all poles, phase to phase, and phase to N/PE.
- 4. Grounding and short-circuiting are only mandatory if the system has a nominal voltage greater than 1 kV. In this case, the system should always be grounded first and then connected to the live parts to be short-circuited.
- 5. These parts should be covered, or barriers erected around them, to avoid accidental contact during the work with adjacent parts that are still live.

8.3 General feeder assembly (type of coordination 1)

The SIRIUS 3RW30 or 3RW40 soft starter is connected into the motor feeder between the motor starter protector and the motor.

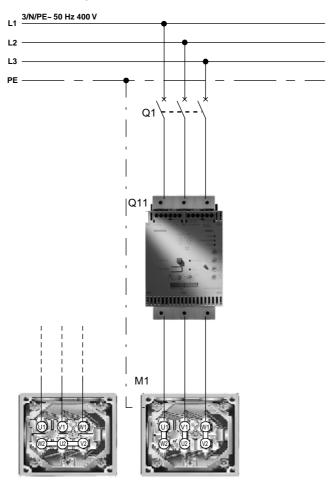


Figure 8-1 Block diagram of the SIRIUS 3RW40 soft starter

Note

For the component design, refer to chapter Technical data [Page 121].

8.4 Soft starter with line contactor (type of coordination 1)

If electrical isolation is specified, you can install a motor contactor between the soft starter and the motor starter protector.

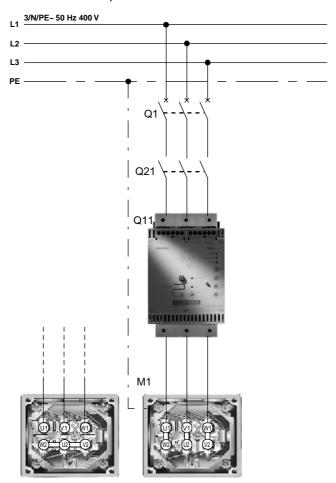


Figure 8-2 Block diagram of a feeder with an optional main / line contactor

Note

For the component design, refer to chapter Technical data [Page 121].

NOTICE

If a main or line contactor is used, it should not be connected between the soft starter and the motor. The soft starter could otherwise indicate a "Missing load voltage" fault in case of a start command and delayed connection of the contactor.

8.5 Soft starter assembly with type of coordination 2

The SIRIUS 3RW40 soft starter has internal protection to prevent overloading of the thyristors. The SIRIUS 3RW30 soft starter has no internal protection to prevent overloading of the thyristors. The soft starter must always be dimensioned according to the duration of the startup process and the desired starting frequency. If the feeder of the SIRIUS 3RW30 or 3RW40 soft starter is assembled accordingly with the feeder components recommended in chapter Technical data [Page 121] (e.g. motor starter protector or LV HRC fuse), type of coordination 1 is achieved. In order to achieve type of coordination 2, all thyristors must be additionally protected against short-circuits by means of special semiconductor fuses (e.g. SIEMENS SITOR). A short-circuit can occur, for instance, as a result of a defect in the motor windings or in the motor's power supply cable.

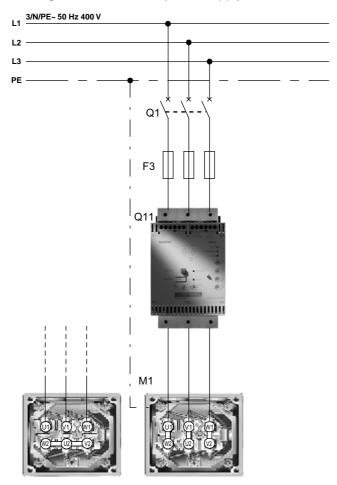


Figure 8-3 Block diagram of a feeder with semiconductor fuses

Note

For the component design, refer to chapter Technical data [Page 121].

Note

Minimum and maximum configuration of the semiconductor fuses

The fuses for the minimum and maximum configuration are specified in chapter Technical data [Page 121].

Minimum configuration: The fuse is optimized for the thyristor's I2t value.

If the thyristor is cold (ambient temperature) and the startup process lasts a maximum of 20 s at 3.5 times the rated current of the device, the fuse does not trip.

Maximum configuration: The maximum current permitted for the thyristor can flow without the fuse tripping.

The maximum configuration is recommended for heavy-duty starting.

CAUTION

Risk of property damage

Type of coordination 1 in accordance with IEC 60947-4-1:

The device is defective following a short-circuit failure and therefore unsuitable for further use (personnel and equipment must not be put at risk).

Type of coordination 2 in accordance with IEC 60947-4-1:

The device is suitable for further use following a short-circuit failure (personnel and equipment must not be put at risk).

The type of coordination only refers to soft starters in conjunction with the stipulated protective device (motor starter protector / fuse), not to additional components in the feeder.

8.6 Capacitors to improve the power factor



A CAUTION

No capacitors must be connected to the output terminals of the soft starter. If so, the soft starter will be damaged.

Active filters, e.g. for power factor correction, must not be operated parallel to the motor control device.

If capacitors are to be used to correct the power factor, they must be connected on the device's line side. If an isolating or main contactor is used together with the electronic soft starter, the capacitors must be disconnected from the soft starter when the contactor is open.

8.7 Maximum cable length

The cable between the soft starter and the motor must not be more than 300 m long (3RW30 and 3RW40).

The voltage drop due to the length of the cable to the motor may need to be considered when dimensioning the cable.

Cable lengths up to 500 m are permitted for SIRIUS 3RW44 soft starters (refer to the 3RW44 System Manual (http://support.automation.siemens.com/WW/ [lisapi.dll?query=3RW44&func=cslib.cssearch&content=skm%2Fmain.asp&lang=de&siteid=csius&objaction=cssearch&searchinprim=0&nodeid0=20025979)).

8.7 Maximum cable length

Connecting

9.1 Electrical connection

9.1.1 Control and auxiliary terminals

The SIRIUS 3RW30 and 3RW40 soft starters can be supplied with two different connection technologies:

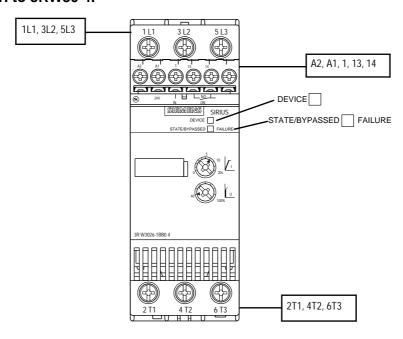
- Screw-type technology
- · Spring-loaded technology

9.1.2 Main circuit connection

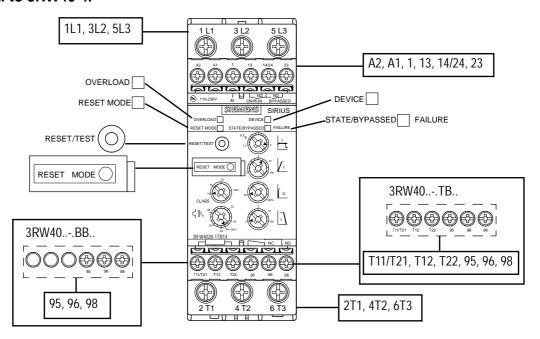
SIRIUS 3RW30 and 3RW40 soft starters up to the 55 kW / 75 hp size at 400 V / 480 V are designed with removable terminals at the main circuit connections.

9.1 Electrical connection

Sizes 3RW30 1. to 3RW30 4.



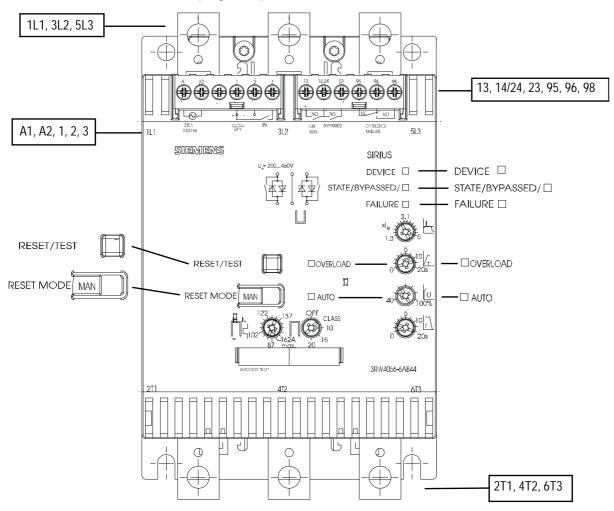
Sizes 3RW40 2. to 3RW40 4.



Sizes 3RW40 5. and 3RW40 7.

Sizes 3RW40 5. and 3RW40 7. have busbar connections for the main circuit connection.

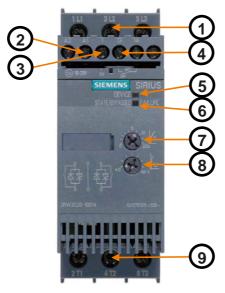
Box terminals can be retrofitted on these devices as optional accessories (refer to chapter Accessories [Page 199]).



9.1 Electrical connection

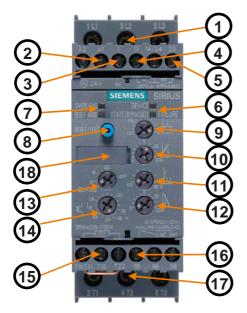
Operation 10

10.1 Operator controls, displays, and connections on the 3RW30

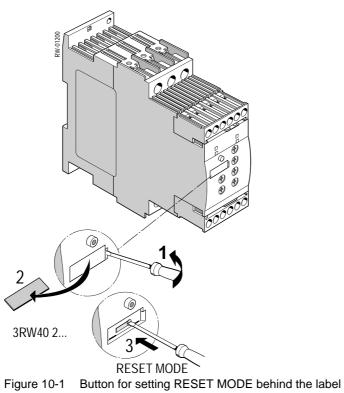


- 1 Operating voltage (three-phase mains voltage)
- 2 Control supply voltage
- 3 IN start input
- 4 ON output
- 5 DEVICE status LED
- 6 STATE / BYPASSED / FAILURE status LED
- 7 Ramp-up time
- 8 Starting voltage
- 9 Motor terminals

10.2 Operator controls, displays, and connections on the 3RW40



- 1 Operating voltage (three-phase mains voltage)
- 2 Control supply voltage
- 3 IN start input
- 4 ON / RUN output
- 5 BYPASSED output
- 6 DEVICE / STATE / BYPASSED / FAILURE status LEDs
- 7 OVERLOAD, RESET MODE status LEDs
- 8 TEST / RESET button
- 9 Current limiting
- 10 Ramp-up time
- 11 Starting voltage
- 12 Ramp-down time
- 13 Trip class
- 14 Motor current
- Thermistor input (can be optionally ordered with 24 V AC/DC control voltage for 3RW40 2. to 3RW40 4. devices)
- 16 Fault output
- 17 Motor terminals
- 18 RESET MODE button (behind the label on the 3RW40 2., refer to the diagram below)



10.2 Operator controls, displays, and connections on the 3RW40

Configuration

11.1 Configuration in general

The SIRIUS 3RW30 and 3RW40 electronic soft starters are designed for normal starting. A larger size may need to be selected for longer ramp-up times or a higher starting frequency.

An appropriately dimensioned SIRIUS 3RW40 or 3RW44 soft starter should be chosen for startup processes with motor ramp-up times > 20 s.

The motor feeder between the soft starter and motor must not contain any capacitive elements (such as compensation systems). Active filters must not be operated in combination with soft starters.

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

The harmonic component load of the starting current must be taken into consideration when selecting motor starter protectors (trip selection).

Note

Voltage dips generally occur in all start modes (direct starting, wye-delta starting, soft starting) when a three-phase motor is switched on. The infeed transformer must always be dimensioned so that the voltage dip at the motor startup remains within the permissible tolerance. If the infeed transformer is insufficiently dimensioned, the control voltage should be supplied from a separate circuit (independently of the main voltage) in order to prevent the voltage dip from disconnecting the 3RW.

Note

All elements of the main circuit (such as fuses, motor starter protectors, and switching devices) must be dimensioned for direct starting and according to the on-site short-circuit conditions, and ordered separately.

If wye-delta starters are exchanged for soft starters in an existing system, you should check the fuse ratings in the feeder in order to avoid false tripping. This is particularly important in connection with heavy-duty starting or if the fuse that is installed has already been operated close to the thermal tripping limit with the wye-delta assembly.

For recommended fuse and motor starter protector ratings for the feeder with soft starter, refer to chapter Technical data [Page 121].

11.1.1 Configuration procedure

1. Select the correct starter

What application must be started and what functionality must be provided by the soft starter? Chapter Selecting the optimum soft starter [Page 74]

2. Take account of the startup class and the switching frequency

Chapters Startup class [Page 76] and Calculating the permissible switching frequency [Page 81]

11.1 Configuration in general

3. Take account of a possible reduction in the soft starter's rated data due to the ambient conditions and the type of assembly.

Chapter Reducing the rated data [Page 80]

11.1.2 Selecting the optimum soft starter

Selection aid

You can choose the optimum starter from the soft starter types available based on the intended application or the required functionality.

Normal starting (CLASS 10) applications	3RW30	3RW40	3RW44
Pump	+	+	+
Pump with special stop (against water hammer)	-	-	+
Heat pump	+	+	+
Hydraulic pump	х	+	+
Press	х	+	+
Conveyor belt	х	+	+
Roller conveyor	х	+	+
Conveyor worm	х	+	+
Escalator	-	+	+
Piston compressor	-	+	+
Screw compressor	-	+	+
Small fan ¹⁾	-	+	+
Centrifugal blower	-	+	+
Bow thruster	-	+	+

⁺ Recommended soft starter

¹⁾ Small fan: Mass inertia (centrifugal mass) of fan < 10 x mass inertia of motor

Heavy-duty starting (CLASS 20) applications	3RW30	3RW40	3RW44
Agitator	-	Х	+
Extruder	-	Х	+
Turning machine	-	Х	+
Milling machine	-	Х	+

⁺ Recommended soft starter

x Possible soft starter

x Possible soft starter

Ultra-heavy-duty starting (CLASS 30) applications	3RW30	3RW40	3RW44
Large fan ²⁾	-	-	+
Circular saw / band saw	-	-	+
Centrifuge	-	-	+
Mill	-	-	+
Crusher	-	-	+

⁺ Recommended soft starter

2) Large fan: Mass inertia (centrifugal mass) of fan >= 10 x mass inertia of motor

Soft starter functions	3RW30	3RW40	3RW44	
Soft start function	+	+	+	
Soft stop function	-	+	+	
Integrated intrinsic device protection	-	+	+	
Integrated electronic motor overload protection	-	+	+	
Settable current limiting	-	+	+	
Special pump stop function	-	-	+	
Braking in ramp-down	-	-	+	
Settable breakaway torque	-	-	+	
Communication via PROFIBUS (optional)	-	-	+	
External operation and indication display (optional)	-	-	+	
Soft Starter ES parameterization software	-	-	+	
Special functions, e.g. measured values, display languages etc.	-	-	+	
Motor overload protection acc. to ATEX	-	+	-	

⁺ Recommended soft starter

Note

SIRIUS 3RW44 soft starter

For more information about the SIRIUS soft starter, refer to the 3RW44 System Manual. You can download (http://support.automation.siemens.com/WW/ [lisapi.dll?func=cslib.csinfo&lang=de&objID=20356385&subtype=133300) the manual free of charge.

11.2 Startup class

11.2 Startup class

To achieve the optimum soft starter design, it is important to know and take into account the ramp-up time (startup class) of the application. Long ramp-up times mean a higher thermal load on the thyristors of the soft starter. An appropriately dimensioned SIRIUS 3RW40 or 3RW44 soft starter should be chosen for startup processes with a motor ramp-up time > 20 s. The maximum permissible ramp-up time for SIRIUS 3RW30 soft starters is 20 seconds. SIRIUS soft starters are designed for continuous operation with normal starting (CLASS 10), an ambient temperature of 40 °C, and a defined switching frequency (refer to chapter Technical data [Page 121]). If other data applies, the starters may need to be calculated with a size allowance. Using the SIEMENS Win-Soft Starter selection and simulation software, you can enter your application data and requirements to obtain an optimally dimensioned soft starter (refer to chapter Win-Soft Starter selection and simulation software [Page 162]).

CAUTION

Risk of property damage

When using the 3RW30: Make sure the selected ramp time is longer than the actual motor ramp-up time. If not, the SIRIUS 3RW30 may be damaged because the internal bypass contacts close when the set ramp time elapses. If the motor has not finished starting up, an AC3 current that could damage the bypass contact system will flow.

When using the 3RW40: The 3RW40 has an integrated ramp-up detection function that prevents this operating state from occurring.

Selection criteria

Note

You must select the size of your SIRIUS soft starters according to the rated motor current (rated current_{soft starter} >= rated motor current).

11.2.1 Application examples for normal starting (CLASS 10) with 3RW30 and 3RW40

Recommended basic parameter settings

Assuming the conditions and constraints indicated below apply, the size of the soft starters can be equivalent to the motor rating for a normal starting characteristic (CLASS 10).

You can find a suitable soft starter for the required motor rating based on the required startup class in chapter Technical data [Page 121].

For typical applications where normal starting applies as well as recommended parameter settings for the soft starter, refer to the table below.

Normal starting (CLASS 10)

The soft starter rating can be equivalent to the motor rating.

Application	Conveyor belt	Roller conveyor	Compressor	Small fan ¹⁾	Pump	Heat / hydraulic pump
Start parameters						
Voltage ramp and current limiting Starting voltage	70 10 Off (5 x I _M)	60 10 Off (5 x I _M)	50 10 4 x I _M	40 10 4 x I _M	40 10 4 x I _M	40 10 4 x I _M
Stop mode	Soft stop (3RW40 only)	Soft stop (3RW40 only)	Stop without load	Stop without load	Soft stop (3RW40 only)	Stop without load

1) Small fan: Mass inertia (centrifugal mass) of fan < 10 x mass inertia of motor

General conditions and constraints				
CLASS 10 (normal starting)				
3RW30: Maximum ramp-up time 3 s, 300 % startin	g current, 20 starts / hour			
3RW40: Maximum ramp-up time 10 s, 300 % current limiting, 5 starts / hour				
ON time 30 %				
Standalone assembly				
Installation altitude	Max. 1000 m / 3280 ft			
Ambient temperature kW	40 °C / 104 °F			

11.2.2 Application examples for heavy-duty starting (CLASS 20): 3RW40 only

Recommended basic parameter settings

Assuming the conditions and constraints indicated below apply, the soft starter size must be at least one power class higher than the motor rating for heavy-duty starting (CLASS 20).

You can find a suitable soft starter for the required motor rating based on the required startup class in chapter Technical data [Page 121].

For typical applications where heavy-duty starting can apply as well as recommended parameter settings for the soft starter, refer to the table below.

Heavy-duty starting (CLASS 20)

The soft starter must be at least one power class larger than the motor rating.

Application	Agitator	Extruder	Milling machine
Start parameters			
 Voltage ramp and 			
current limiting			
 Starting voltage % 	40	70	40
 Ramp-up time s 	20	10	20
 Current limiting value (3RW40) 	4 x I _M	Off (5 x I _M)	4 x I _M
Stop mode	Stop without load	Stop without load	Stop without load

General conditions and constraints				
CLASS 20 (heavy-duty starting)				
3RW40 2. / 3RW40 3. / 3RW40 4.	Maximum ramp-up time 20 s, 300 % current limiting, max. 5 starts / hour			
3RW40 5. / 3RW40 7.	Maximum ramp-up time 40 s, 350 % current limiting, max. 1 start / hour			
ON time	30 %			
Standalone assembly				
Installation altitude	Max. 1000 m / 3280 ft			
Ambient temperature kW	40 °C / 104 °F			

Note

The settings and device dimensions indicated in these tables are examples only; they are merely provided for information purposes and are not binding. The actual settings depend on the application and must be optimized when the equipment is commissioned.

If other conditions and constraints apply, either refer to chapter Technical data [Page 121] or check your requirements and selection with the Win-Soft Starter software or with Technical Assistance (chapter Important notes [Page 11])

11.3 ON time and switching frequency

Based on the rated motor current and the startup class, the SIRIUS 3RW30 and 3RW40 soft starters are dimensioned for a maximum permissible switching frequency in combination with a relative ON time (refer to chapter Technical data [Page 121]). If these values are exceeded, a larger soft starter may have to be selected.

ON time

The relative ON time in % is the ratio between the load duration and the cycle duration for loads that are frequently switched on and off.

The ON time (OT) can be calculated using the following formula:

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

where:

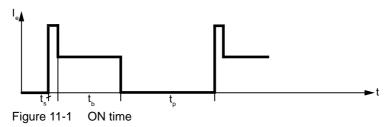
OT = ON time [%]

 $t_s = ramp-up time [s]$

t_b = operating time [s]

 $t_{D} = idle time [s]$

The following diagram illustrates this process.



Switching frequency

The maximum permissible switching frequency must not be exceeded because the devices could be damaged due to thermal overloading.

Optional additional fan

The switching frequency of the 3RW40 2. to 3RW40 4. soft starters can be increased by installing an optional additional fan. For information about factors and how to determine the maximum switching frequency if an additional fan is installed, refer to chapter Calculating the permissible switching frequency [Page 81].

11.4 Reducing the rated data

You can reduce the rated data of the SIRIUS 3RW30 and 3RW40 soft starters if

- The installation altitude is higher than 1000 m.
- The ambient temperature in the switching device's environment exceeds 40 °C.
- The lateral clearances described earlier are not complied with, e.g. side-by-side assembly or direct mounting of other switching devices (assembly type).
- The vertical mounting position is not complied with.

11.5 Installation altitude and ambient temperature

Installation altitude

The permissible installation altitude must not be higher than 5000 m above sea level (higher than 5000 m on request).

If the installation altitude exceeds 1000 m, the rated operational current must be reduced for thermal reasons.

If the installation altitude exceeds 2000 m, the rated voltage must also be reduced owing to the restricted dielectric strength. A maximum permissible rated voltage of 460 V applies at installation altitudes between 2000 m and 5000 m above sea level.

The following diagram shows the reduction in the rated device current as a function of the installation altitude:

The rated operational current I_e must be reduced at altitudes higher than 1000 m above sea level.

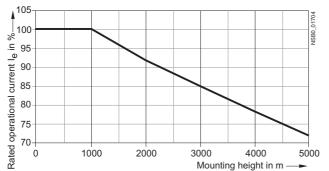


Figure 11-2 Reduction as a function of the installation altitude

Ambient temperature

The maximum permissible ambient temperature of the soft starter must not exceed 60 °C.

SIRIUS 3RW30 and 3RW40 soft starters are designed for operation with nominal current at an ambient temperature of 40 °C. If this temperature is exceeded, e.g. owing to an impermissible temperature rise in the control cabinet, other loads, or a general increase in the ambient temperature, the resulting deterioration in the soft starter's performance must be

taken into account when the device is dimensioned (refer to chapter Technical data [Page 121]).

CAUTION

Risk of property damage.

The soft starter may be damaged if the maximum installation altitude (5000 m above sea level) or an ambient temperature of 60 °C is ignored.

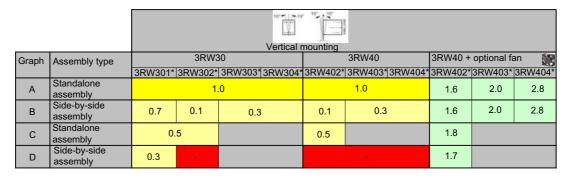
Mounting position, assembly type

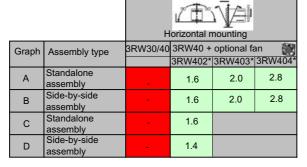
The mounting position and assembly type (refer to chapter Installing the soft starter [Page 53]) can influence the soft starter's permissible switching frequency. Refer to chapter Calculating the permissible switching frequency [Page 81] for the permissible mounting and assembly combinations as well as the resulting factors for the soft starter switching frequencies.

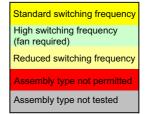
11.6 Calculating the permissible switching frequency

11.6.1 Table of permissible assembly combinations with switching frequency factors

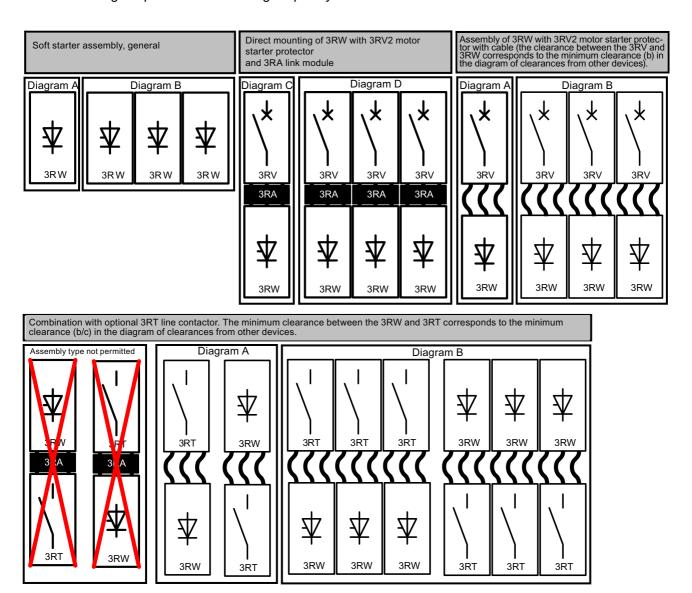
The factors indicated in the table refer to the switching frequency (starts / hour) as specified in chapter Technical data [Page 121].

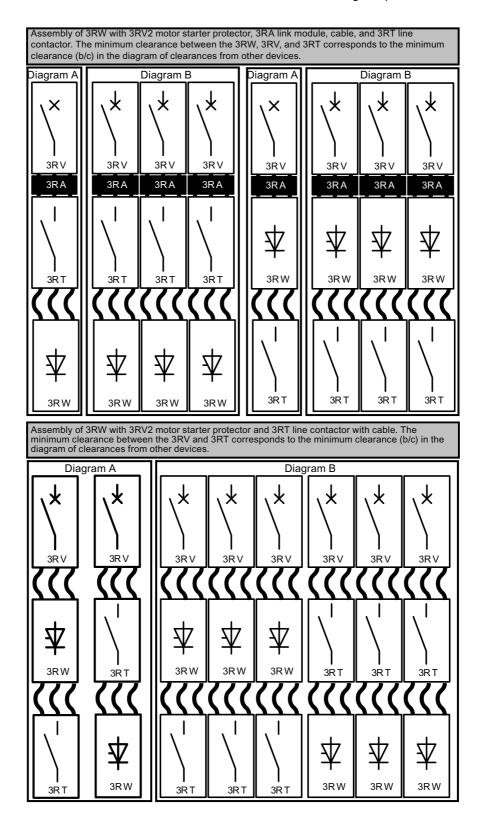






11.6 Calculating the permissible switching frequency





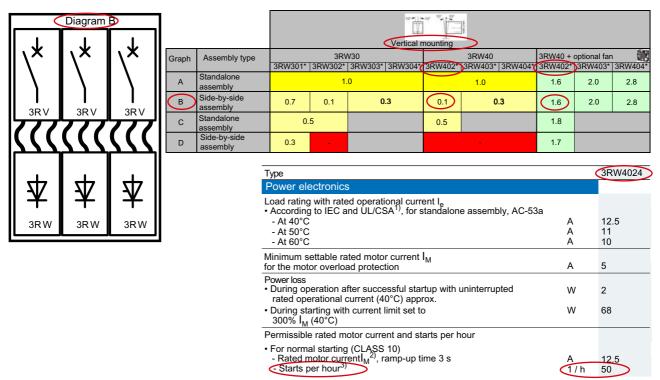
	MLFB	a (mm)	a (in)	b (mm)	b (in)	c (mm)	c (in)
4 1	3RW30 1./3RW30 2.	15	0.59	60	2.36	40	1.56
	3RW30 3./3RW30 4	30	1.18	60	2.36	40	1.56
, j	3RW40 2.	15	0.59	60	2.36	40	1.56
1 3 5	3RW40 3./3RW40 4.	30	1.18	60	2.36	40	1.56
2 4 6 C	3RW40 5./3RW40 7.	5	0.2	100	4	75	ω
Figure 11-3 Clearances from other devices							

11.6.2 Calculating the switching frequency (example)

Problem

The maximum permissible switching frequency of a 5.5 kW (12.5 A) 3RW4024 soft starter must be determined. The requirements are side-by-side assembly and vertical mounting. A ramp-up time of approx. 3 s at an ambient temperature of 40 °C is specified as a supplementary condition (e.g. a pump motor with CLASS 10 starting). The soft starter must be connected to a 3RV2021 motor starter protector by means of cables. (Clearance between 3RV and 3RW >= 40 mm)

Calculating the number of starts / hour of a 3RW40 for side-by-side assembly and vertical mounting



Assembly of a 3RV2021 motor starter protector and connection of a 3RW40 24 soft starter with cables and vertical mounting for CLASS 10 starting:

Switching frequency of 3RW40 with standalone assembly: 50 1/h
Switching frequency factor for diagram B without a fan: 0.1
Switching frequency factor for diagram B with a fan 1): 1.6

Maximum permissible switching frequency:

Without fan 50 1/h x 0.1 = 5 1/hWith fan 1 : 50 1/h x 1.6 = 80 1/h

1) Optional fan: 3RW49 28-8VB00

Result

The pump could be started five times an hour providing the above assembly conditions are complied with (side-by-side assembly, vertical mounting). A switching frequency of up to 80 starts per hour can be achieved by equipping the 3RW4026 with the optional 3RW4928-8VB00 fan.

11.7 Configuration aids

11.7.1 Online configurator

Using the online configurator, you can select soft starters based on the rated motor data and the specified device functionality. The selection of the soft starter is subject to fixed conditions and constraints, such as switching frequency, startup class etc. These conditions cannot be changed. You can find the online configurator at www.siemens.de/sanftstarter (https://mall.automation.siemens.com/WW/guest/configurators/ipc/
ipcFrameset.asp?serumpage=guilpc&urlParams=PROD%5FID%3D3RW&MLFB=&proxy=mall%2Eautomation%2Esiemens%2Ecom&retURL=%2FWW%2Fguest%2Findex%2Easp%3FnodelD%3D9990301%26lang%3Dde&lang=en).

11.7.2 Win-Soft Starter selection and simulation software

The Win-Soft Starter software can be used to simulate and select all SIEMENS soft starters, taking into account various parameters such as the supply system conditions, motor data, load data, high switching frequencies etc.

It is a useful tool, which does away with the need for time-consuming and complex manual calculations if you need to select the optimum soft starter for your particular case.

Further information under:

www.siemens.de/sanftstarter > software > Win-Soft Starter (http://www.automation.siemens.com/mcms/low-voltage/en/industrial-controls/solid-state-switching-devices/soft/software/win-soft-starter/Pages/default.aspx)

11.7.3 Technical Assistance

SIEMENS Technical Assistance offers personal support to help you find the optimum device and provides assistance with technical queries relating to low-voltage switchgear and controlgear

Technical Assistance:	Phone: +49 (0) 911-895-5900 (8°° - 17°° CET) Fax: +49 (0) 911-895-5907
	e-mail: (mailto:technical-assistance@siemens.com)
	Internet: (www.siemens.com/lowvoltage/technical-assistance)

11.7.4 SIRIUS soft starter training course (SD-SIRIUSO)

SIEMENS offers a two-day training course on SIRIUS electronic soft starters to keep both customers and our own employees up to date with the latest information about configuring, commissioning, and maintenance.

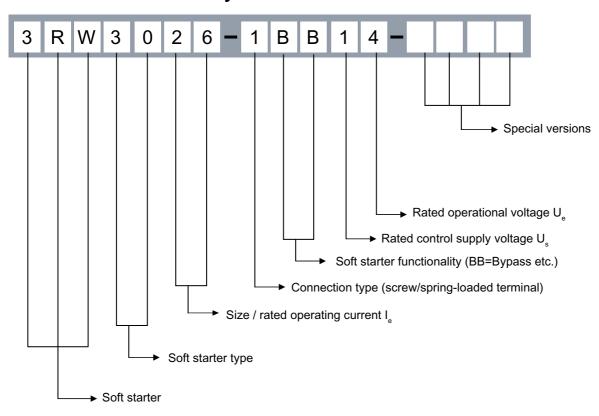
Please address all inquiries and enrollments to:

Training Center Erlangen
A&D PT 4
Werner-von-Siemens-Str. 65
D-91052 Erlangen
Phone: 1440 0131 730363

Phone: ++49 9131 729262 Fax: ++49 9131 728172

e-mail: (<u>mailto:sibrain.industry@siemens.com</u>) Internet: (<u>http://www.siemens.com/sitrain</u>)

11.8 Order number system for the 3RW30

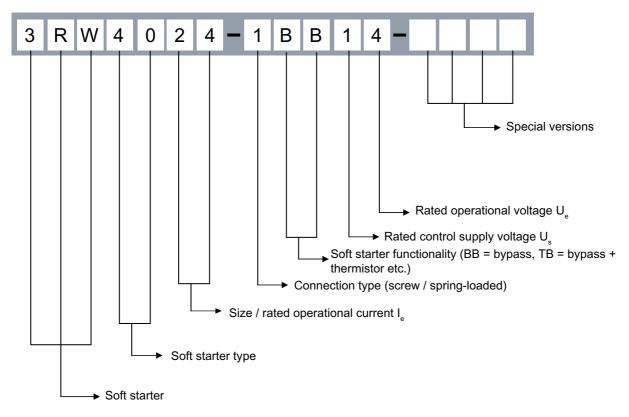


Rated current and rated power at U_e = 400 V / 460 V and T_{amb} = 40 °C / 50 °C

13	le = 3.6 A / 3 A	Pe = 1.5 kW / 1.5 hp	Size S00
14	le = 6.5 A / 4.8 A	Pe = 3 kW / 3 hp	
16	Ie = 9.0 A / 7.8 A	Pe = 4 kW / 5 hp	
17	le = 12.5 A / 11 A	Pe = 5.5 kW / 7.5 hp	
18	le = 17.6 A / 17 A	Pe = 7.5 kW / 10 hp	
26	le = 25 A / 23 A	Pe = 11 kW / 15 hp	Size S0
27	le = 32 A / 29 A	Pe = 15 kW / 20 hp	
28	Ie = 38 A / 34 A	Pe = 18.5 kW / 25 hp	
36	le = 45 A / 42 A	Pe = 22 kW / 30 hp	Size S2
37	Ie = 63 A / 58 A	Pe = 30 kW / 40 hp	
38	le = 72 A / 62 A	Pe = 37 kW / 40 hp	
46	le = 80 A / 73 A	Pe = 45 kW / 50 hp	Size S3
47	le = 106 A / 398 A	Pe = 55 kW / 75 hp	

For more information, refer to chapter Technical data [Page 121].

11.9 Order number system for the 3RW40



Rated current and rated power at U_e = 400 V / 460 V and T_{amb} = 40 °C / 50 °C

24	le = 12.5 A / 11 A	Pe = 5.5 kW / 7.5 hp	Size S0
26	le = 25 A / 23 A	Pe = 11 kW / 15 hp	
27	le = 32 A / 29 A	Pe = 15 kW / 20 hp	
28	le = 38 A / 34 A	Pe = 18.5 kW / 25 hp	
36	le = 45 A / 42 A	Pe = 22 kW / 30 hp	Size S2
37	le = 63 A / 58 A	Pe = 30 kW / 40 hp	
38	le = 72 A / 62 A	Pe = 37 kW / 40 hp	
46	le = 80 A / 73 A	Pe = 45 kW / 50 hp	Size S3
47	le = 106 A / 98 A	Pe = 55 kW / 75 hp	
55	le = 132 A / 117 A	Pe = 75 kW / 75 hp	Size S6
56	le = 160 A / 145 A	Pe = 90 kW / 100 hp	
73	le = 230 A / 205 A	Pe = 132 kW / 150 hp	Size S12
74	le = 280 A / 248 A	Pe = 160 kW / 200 hp	
75	le = 350 A / 315 A	Pe = 200 kW / 250 hp	
76	le = 432 A / 385 A	Pe = 250 kW / 300 hp	

For more information, refer to chapter Technical data [Page 121].

11.9 Order number system for the 3RW40

Commissioning 12

12.1 Before commencing work: Isolating the equipment from the supply system and ensuring that it cannot be reconnected.

DANGER

Hazardous voltage Will cause death or serious injury.

- Disconnect the system and all devices from the power supply before starting work.
- Secure against switching on again.
- · Verify that the equipment is not live.
- Ground and short-circuit.
- · Erect barriers around or cover adjacent live parts.

DANGER

Hazardous voltage Will cause death or serious injury.

Qualified Personnel.

The equipment / system may only be commissioned and operated by qualified personnel. For the purpose of the safety information in these Operating Instructions, a "qualified person" is someone who is authorized to energize, ground, and tag equipment, systems, and circuits in accordance with established safety procedures.

12.2 Commissioning the 3RW30

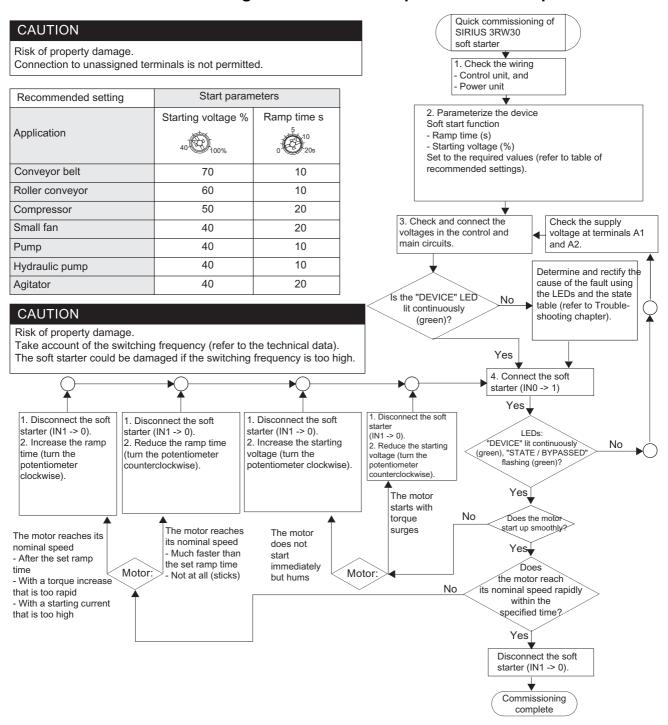
Commissioning, description of the start and output parameters



12.2.1 Commissioning procedure

- 1. Check the voltages and wiring.
- 2. Set the start parameters (for recommended parameters, refer to the quick commissioning table).
- 3. Start up the motor and if necessary optimize the parameters (refer to the quick commissioning table).
- 4. Document the parameter settings if required (refer to chapter Table of parameters used [Page 205]).

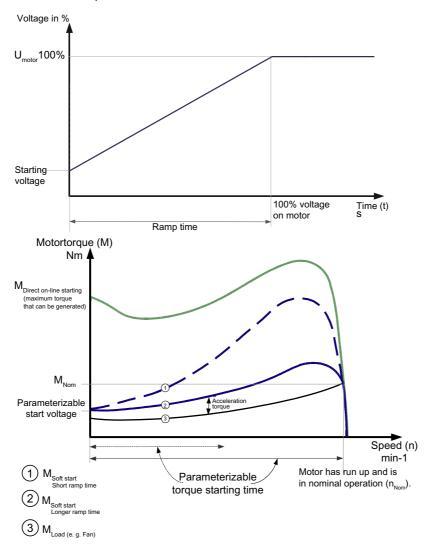
12.2.2 Quick commissioning of the 3RW30 and optimization of the parameters



12.2.3 Setting the soft start function

Voltage ramp

The SIRIUS 3RW30 achieves soft starting by means of a voltage ramp. The motor terminal voltage is increased from a parameterizable starting voltage to the mains voltage within a definable ramp time.



12.2.4 Setting the starting voltage

U potentiometer



The starting voltage value is set with the U potentiometer. This value determines the starting torque of the motor. A lower starting voltage results in a lower starting torque (softer start) and a lower starting current.

The starting voltage selected must be sufficiently high to ensure that motor starts up smoothly as soon as the start command is received by the soft starter.

12.2.5 Setting the ramp time

t potentiometer



You define the length of the required ramp time with the t potentiometer. The ramp time determines the time taken to increase the motor voltage from the parameterized starting voltage to the mains voltage. This time merely influences the motor's acceleration torque, which drives the load during the ramp-up process. The actual motor starting times are load-dependent and can differ from the 3RW soft starter settings.

A longer ramp time results in a lower starting current and a reduced acceleration torque as the motor starts up. The startup is slower and smoother as a result. The ramp time must be long enough for the motor to reach its nominal speed. If the time selected is too short, in other words if the ramp time ends before the motor has started up successfully, a very high starting current that can even equal the direct starting current at the same speed occurs at this instant.

The SIRIUS 3RW30 soft starter can be damaged in this application (set ramp time shorter than the actual motor ramp-up time). A maximum ramp-up time of 20 s is possible for the 3RW30. An appropriately dimensioned SIRIUS 3RW40 or 3RW44 soft starter should be chosen for startup processes with a motor ramp-up time > 20 s.

CAUTION

Risk of property damage

Make sure the selected ramp time is longer than the actual motor ramp-up time. If not, the SIRIUS 3RW30 may be damaged because the internal bypass contacts close when the set ramp time elapses. If the motor has not finished starting up, an AC3 current that could damage the bypass contact system will flow.

When using the 3RW40: The 3RW40 has an integrated ramp-up detection function that prevents this operating state from occurring.

12.2.6 ON output

ON output contact

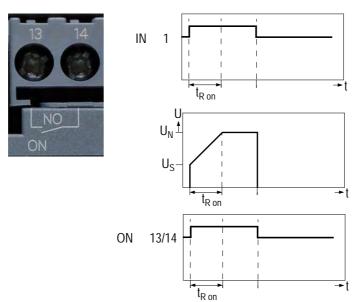


Figure 12-1 State diagram of the ON output contact

The output contact at terminal 13/14 (ON) closes if a signal is present at terminal 1 (IN); it remains closed until the start command is removed.

The output can be used, for instance, to control a line contactor connected upstream or to implement latching if you selected pushbutton control. For recommended circuits, refer to chapter Typical circuit diagrams [Page 167].

For the state diagram of the contacts in the various operating states, refer to chapter 3RW30: LEDs and troubleshooting [Page 44].

12.3 3RW30: LEDs and troubleshooting

			LI	LEDs on 3RW30			Auxiliary contact	
					Soft starter			
3RW30					/ICE n/ylw)	_	E/BYPASSED/ FAILURE (gn/rd)	13 14/ (ON)
U _S = 0								_/_
Operating state			IN					
Off			0	\				_/_
Start		1	+	- gn		gn		
Bypassed		1	\	- gn		-) gn		
Fault	Fault							
Impermissible electronics supply voltage 1)				(-\-\-\\-rd	_/_
Bypass overload 2)				\ \	é ylw		-\-\-\\-rd	_/_
- Missing load voltage 1) - Phase failure, missing load 1)				+	⊱ gn		- <u></u> rd	
Device fault 3)			-\	- rd		-\(\)- rd	_/_	
LEDs								
	\	•	gn =	rd =	1 -	/lw =		
Off	ON	Flashing	Green	Red	Y	'ellow		

1) The fault is automatically reset by an outgoing event. An automatic restart is initiated and the 3RW restarted if a start command is present at the input.

WARNING

Automatic restart

Danger of death, serious injury, or property damage.

If you do not want the motor to start automatically, you must integrate suitable additional components, e.g. phase failure or load monitoring devices, into the control and main circuits.

- 2) The fault can be acknowledged by removing the start command at the start input.
- 3) Switch off the control voltage, then switch it on again. If the fault is still present, contact your SIEMENS partner or Technical Assistance.

For notes on troubleshooting, refer to the table below.

Fault	Cause	Remedy
Impermissible electronics supply voltage	The control supply voltage does not correspond to the soft starter's rated voltage.	Check the control supply voltage; an incorrect control supply voltage could be caused by a power failure or a voltage dip.
Bypass overload	A current $> 3.5 \times I_e$ of the soft starter occurs for > 60 ms in bypass mode (e.g. because the motor is blocked).	Check the motor and load, and check the soft starter's dimensions.

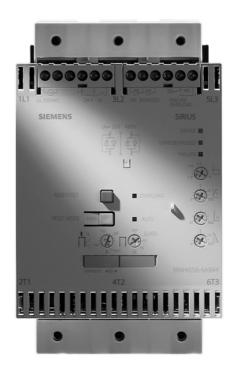
12.4 Commissioning the 3RW40

Fault	Cause	Remedy	
Missing load voltage, phase failure / missing load	Cause 1: Phase L1 / L2 / L3 is missing or fails / collapses when the motor is operating.	Connect L1 / L2 / L3 or correct the voltage dip.	
	Tripped as a result of a dip in the permissible rated operational voltage > 15 % for > 100 ms during the startup process or > 200 ms in bypass mode.		
	Cause 2: The motor that is connected is too small and the fault occurs as soon as it is switched to bypass mode.	If less than 10 % of the soft starter's rated current is flowing, the motor cannot be operated with soft starter. Use another soft starter.	
	Cause 3: Motor phase T1 / T2 / T3 is not connected.	Connect the motor properly (e.g. jumpers in the motor terminal box, repair switch closed etc.)	
Device fault	Soft starter defective.	Contact your SIEMENS partner or Technical Assistance.	

12.4 Commissioning the 3RW40

Commissioning, description of the start, stop, motor protection, and output parameters

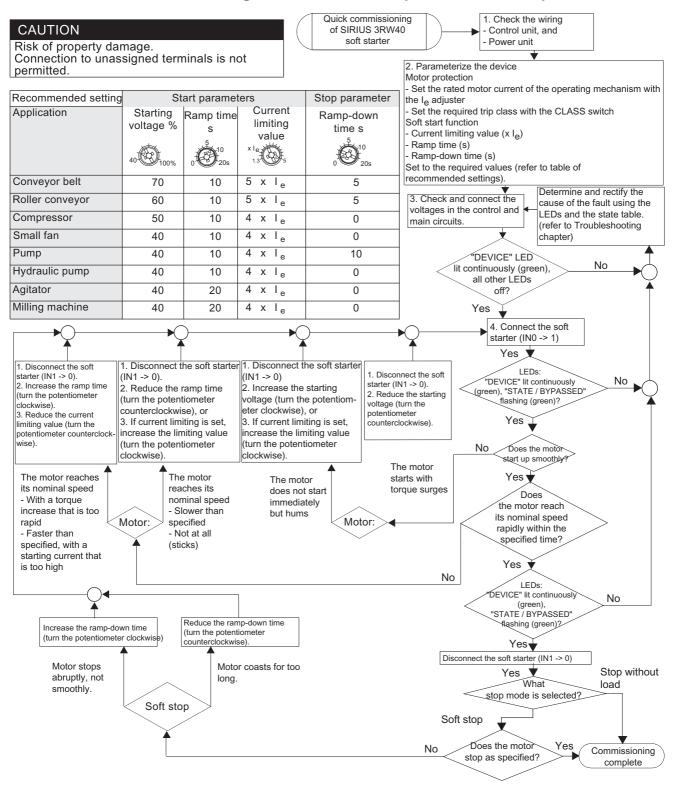




12.4.1 Commissioning procedure

- 1. Check the voltages and wiring.
- 2. Set the start and stop parameters (for recommended parameters, refer to the quick commissioning table).
- 3. Set the motor overload function (if required)
- 4. Define the RESET mode if a failure occurs.
- 5. Start up the motor and if necessary optimize the parameters (refer to the quick commissioning table).
- 6. Document the parameter settings if required.

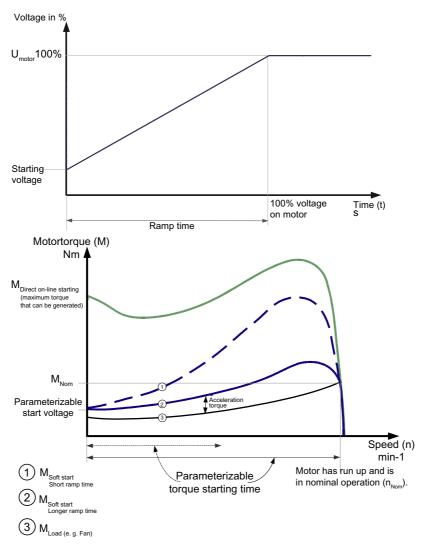
12.4.2 Quick commissioning of the 3RW40 and optimization of the parameters



12.4.3 Setting the soft start function

Voltage ramp

The SIRIUS 3RW40 achieves soft starting by means of a voltage ramp. The motor terminal voltage is increased from a parameterizable starting voltage to the mains voltage within a definable ramp time.



12.4.4 Setting the starting voltage

U potentiometer



The starting voltage value is set with the U potentiometer. This value determines the starting torque of the motor. A lower starting voltage results in a lower starting torque (softer start) and a lower starting current.

The starting voltage selected must be sufficiently high to ensure that motor starts up smoothly as soon as the start command is received by the soft starter.

12.4.5 Setting the ramp time

t potentiometer



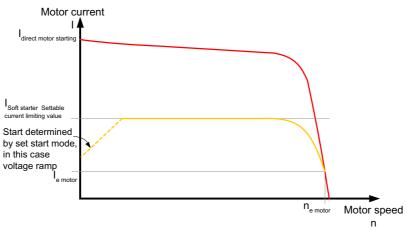
You define the length of the required ramp time with the t potentiometer. The ramp time determines the time taken to increase the motor voltage from the parameterized starting voltage to the mains voltage. This time merely influences the motor's acceleration torque, which drives the load during the ramp-up process. The actual motor starting times are load-dependent and can differ from the 3RW soft starter settings.

A longer ramp time results in a lower starting current and a reduced acceleration torque as the motor starts up. The startup is slower and smoother as a result. The ramp time must be long enough for the motor to reach its nominal speed. If the time selected is too short, in other words if the ramp time ends before the motor has started up successfully, a very high starting current that can even equal the direct starting current at the same speed occurs at this instant.

The SIRIUS 3RW40 soft starter additionally limits the current to the value set with the current limiting potentiometer. As soon as the current limiting value is reached, the voltage ramp or the ramp time is interrupted and the motor is started with the current limiting value until it has started up successfully. In this case, the motor ramp-up times may be longer than the maximum parameterizable 20 seconds ramp time or the ramp time that is actually set on the soft starter (for further information about the maximum ramp-up times and switching frequencies, refer to the Technical data chapter > 3RW30 13, 14, 16, 17, 18-.BB.. power electronics [Page 124]) ff. and 3RW40 24, 26, 27, 28 power electronics [Page 149] ff.).

12.4.6 Current limiting in conjunction with a starting voltage ramp and ramp-up detection

Current limiting



The SIRIUS 3RW40 soft starter measures the phase current (motor current) continuously with the help of integrated current transformers.

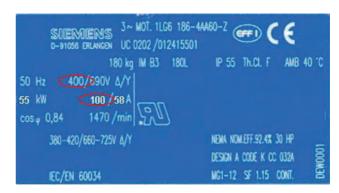
The motor current that flows during the startup process can be actively limited by means of the soft starter. The current limiting function takes priority over the voltage ramp function.

As soon as a parameterizable current limit is reached, in other words, the voltage ramp is interrupted and the motor is started with the current limiting value until it has started up successfully. The current limiting function is always active with SIRIUS 3RW40 soft starters. If the current limiting potentiometer is set to the clockwise stop (maximum), the starting current is limited to five times the set rated motor current.

12.4.7 Setting the motor current

I_p potentiometer





The rated operational current of the motor must be set with the I_e potentiometer according to the mains voltage and the motor connection (wye-delta). The electronic motor overload

12.4 Commissioning the 3RW40

protection also refers to this set value if it is active. For the permissible settings referred to the required motor overload trip class, refer to chapter Motor current settings [Page 107].

12.4.8 Setting the current limiting value

xl_e potentiometer



The current limiting value is set with the xI_e potentiometer to the maximum required starting current as a factor of the set rated motor current (I_e).

Example

- I_e potentiometer set to 100 A
- xl_e potentiometer set to 5 => current limiting 500 A.

As soon as the selected current limiting value is reached, the motor voltage is reduced or controlled by the soft starter to prevent the current from exceeding the limit. Since the starting current is asymmetrical, the set current corresponds to the arithmetic mean value for the three phases.

If the current limiting value is set to the equivalent of 100 A, the starting currents might be approx. 80 A in L1, 120 A in L2, and 100 A in L3 (refer to chapter Starting current asymmetry [Page 21]).

The set current limiting value must be high enough to ensure that the torque generated in the motor is sufficient to accelerate the motor to nominal speed. Three to four times the value of the motor's rated operational current (I_e) can be assumed as typical here.

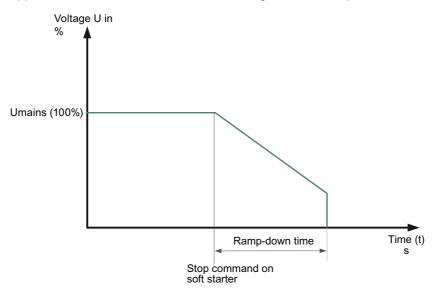
The current limiting function is always active because it is required by the intrinsic device protection. If the current limiting potentiometer is set to the clockwise stop (maximum), the starting current is limited to five times the set rated motor current.

12.4.9 Ramp-up detection

The SIRIUS soft starter has a motor ramp-up detection function that is always active regardless of the start mode. If it detects a motor startup, the motor voltage is immediately increased to 100 % of the mains voltage. The thyristors of the soft starter are bridged by the bypass contacts integrated in the device and the successful startup is indicated by means of the BYPASS output and the STATE / BYPASSED LED.

12.5 Setting the soft stop function

In "soft stop" mode, the natural stop process of the load is decelerated. The function is used when the load must be prevented from stopping abruptly. This is typically the case in applications with a low mass inertia or a high counter-torque.



12.5.1 Setting the ramp-down time

t potentiometer



You can set a ramp-down time with the t potentiometer. This determines how long power should still be supplied to the motor after the ON command is removed. The torque generated in the motor is reduced by means of a voltage ramp function within this ramp-down time and the application stops smoothly.

If the potentiometer is set to 0, there is no voltage ramp during stopping (stop without load).

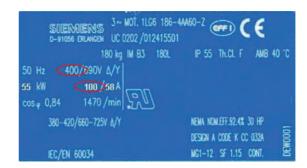
12.6 Setting the motor protection function

The motor overload protection function is implemented on the basis of the winding temperature. This indicates whether the motor is overloaded or functioning in the normal operating range.

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

12.6.1 Setting the electronic motor overload protection





I_e potentiometer

The rated operational current of the motor must be set with the I_e potentiometer according to the mains voltage and the motor connection (wye-delta).

The current flow during motor operation is measured by measuring the current with transformers integrated in the soft starter. This value is also used for the current limiting function. The temperature rise in the winding is calculated based on the rated operational current set for the motor.

CLASS potentiometer

You can set the required trip class (10, 15, or 20) with the CLASS potentiometer. A trip is generated by the soft starter when the standardized characteristic is reached, depending on the trip class (CLASS setting).

The trip class specifies the maximum time within which a protective device must trip from a cold state at 7.2 x the rated operational current (motor protection to IEC 60947). The tripping characteristics represent this time as a function of the tripping current (refer to chapter Motor protection tripping characteristics for 3RW40 (with symmetry) [Page 161]).

You can set different CLASS characteristics according to the startup class. If the potentiometer is set to OFF, the "electronic motor overload protection" function is deactivated.

Note

The rated data of the soft starters refers to normal starting (CLASS 10). The starters may need to be calculated with a size allowance for heavy-duty starting (> CLASS 10). You can only set a rated motor current that is lower than the soft starter rated current (refer to chapter Motor current settings [Page 107]); if not, a fault will be indicated by the OVERLOAD LED (red flashing) and it will not be possible to start the SIRIUS 3RW soft starter.

12.6.2 Motor current settings

Motor current settings

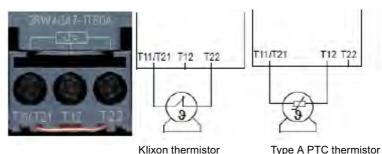
	I _e [A]	I _{min} [A]	I _{max} [A] CLASS 10	I _{max} [A] CLASS 15	I _{max} [A] CLASS 20
3RW40 24	12.5	5	12.5	11	10
3RW40 26	25.3	10.3	25.3	23	21
3RW40 27	32.2	17.2	32.2	30	27
3RW40 28	38	23	38	34	31
3RW40 36	45	22.5	45	42	38
3RW40 37	63	25.5	63	50	46
3RW40 38	72	34.5	72	56	50
3RW40 46	80	42.5	80	70	64
3RW40 47	106	46	106	84	77
3RW40 55	134	59	134	134	124
3RW40 56	162	87	162	152	142
3RW40 73	230	80	230	210	200
3RW40 74	280	130	280	250	230
3RW40 75	356	131	356	341	311
3RW40 76	432	207	432	402	372

12.6.3 Motor protection acc. to ATEX

Refer to the information in chapter Motor protection / intrinsic device protection (3RW40 only) [Page 32].

12.7 Thermistor motor protection

(Optional for 3RW40 2. to 3RW40 4. with 24 V AC/DC rated control voltage)



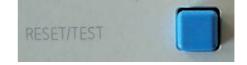
Type A PTC thermistor

Thermistor motor protection

After removing the copper jumper between T11/21 and T22, you can connect and evaluate either a Klixon thermistor integrated in the motor winding (at terminal T11/T21-T22) or a type A PTC (at terminal T11/T21-T12).

12.8 Motor protection trip test





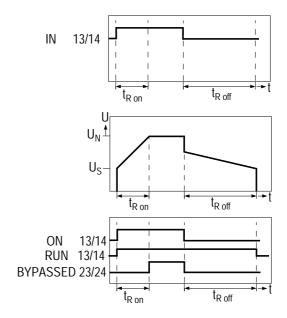
TEST / RESET button

You initiate a motor overload trip by pressing the RESET / TEST button for longer than five seconds. The SIRIUS 3RW40 soft starter is tripped by the fault signal at the OVERLOAD LED, the FAILURE / OVERLOAD contact 95-98 closes, and the motor that is connected and running is switched off.

12.9 Functions of the outputs

12.9.1 Functions of the BYPASSED and ON / RUN outputs





BYPASSED output contact

The BYPASSED output at terminal 23 / 24 closes as soon as the SIRIUS 3RW40 soft starter detects that the motor has started up (refer to chapter Ramp-up detection [Page 104]). The integral bypass contacts simultaneously close and the thyristors are bridged. The integral bypass contacts and output 23 / 24 open again as soon as the start input IN is removed.

ON / RUN output contact

ON function set: The potential-free output contact at terminal 13/14 (ON) closes if a signal is present at terminal 1 (IN); it remains closed until the start command is removed (factory default). The ON function can be used, for instance, as a latching contact if you selected pushbutton control (refer to chapter Control by pushbutton [Page 168]).

Reparameterizing the output of the ON function (factory default) to RUN

You can reparameterize the output function from ON to RUN by simultaneously pressing two buttons (refer to chapter Parameterizing the 3RW40 outputs [Page 110]).

RUN function set: The potential-free output contact at terminal 13/14 closes if a signal is present at terminal 1 (IN); it remains closed until the start command is removed and after that until the set ramp-down time has elapsed.

If the RUN function is set, you can control a line contactor during the startup process, operation, or the set soft stop (refer to chapter Control with an optional main / line contactor [Page 177])

12.9 Functions of the outputs

For recommended circuits, refer to chapter Typical circuit diagrams [Page 167].

12.9.2 Parameterizing the 3RW40 outputs

Programming the ON / RUN output 13/14 on the SIRIUS 3RW40 soft starter

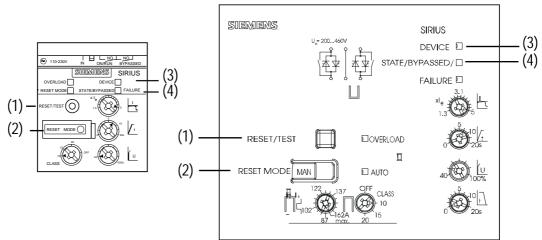
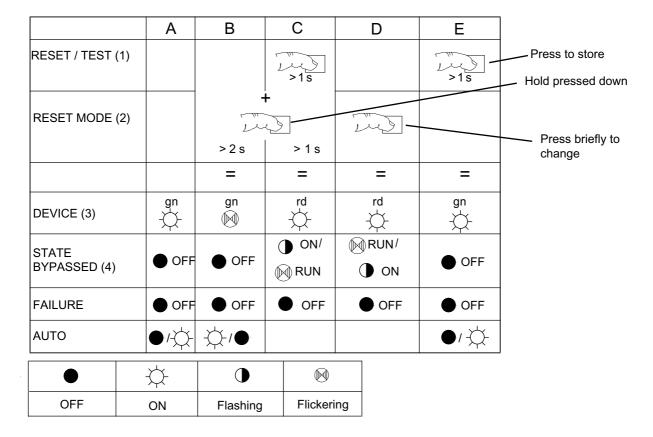


Figure 12-2 Overview of buttons / LEDs on the 3RW40 2 to 3RW40 4 and 3RW40 5 to 3RW40 7



Reparameterizing the ON / RUN output

A: Control voltage is present and the soft starter is in the normal, fault-free position: The DEVICE LED is continuously lit (green) while the STATE / BYPASSED and FAILURE LEDs are off.

The AUTO LED indicates the color of the set RESET mode.

B: Start programming:

(On the 3RW40 2 device, remove the RESET MODE cover as shown in chapter Setting the RESET MODE [Page 113].) Press the RESET MODE button (2) for longer than 2 s until the DEVICE LED (3) flickers (green). Hold the RESET MODE button (2) pressed down.

C: Simultaneously press the RESET / TEST button (1) for longer than 1 s until the DEVICE LED (3) lights up (red). The active mode set at the ON / RUN output is indicated by the STATE / BYPASSED / FAILURE LED (4):

STATE / BYPASSED / FAILURE LED (4) flashes (green): ON mode (factory setting). STATE / BYPASSED / FAILURE LED (4) flickers (green): RUN mode.

D: Change the mode:

Press the RESET MODE button (2) briefly. By pressing this button, you change the mode at the output, and the new mode is indicated by the STATE / BYPASSED / FAILURE LED (4): STATE / BYPASSED / FAILURE LED (4) flickers (green): RUN mode is set. STATE / BYPASSED / FAILURE LED (4) flashes (green): ON mode is set.

E: Exit programming and save the settings:

Press the RESET / TEST MODE button (1) for longer than 1 s until the DEVICE LED (3) lights up (green).

The LEDs indicate the following states again if the output was successfully parameterized:

12.9 Functions of the outputs

DEVICE LED: Continuously lit (green).
STATE / BYPASSED and FAILURE LEDs: Off.
The AUTO LED indicates the color of the set RESET mode.

12.9.3 Function of the FAILURE / OVERLOAD output



FAILURE / OVERLOAD output contact

If there is no rated control voltage or if a failure occurs, the potential-free FAILURE / OVERLOAD output is switched.

Note

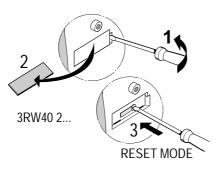
For information about whether or not faults can be acknowledged, as well as the recovery time and the corresponding LED and output contact states, refer to chapter Diagnostics and fault signals [Page 44].

12.10 RESET MODE and functions of the RESET / TEST button

12.10.1 SIRIUS 3RW40 2. to 3RW40 4. soft starters

12.10.1.1 Setting the RESET MODE

Position of the RESET button behind the label on the 3RW40 2.







AUTO RESET Yellow
Manual RESET Off
Remote RESET Green

RESET MODE button

By pressing the RESET MODE button, you define the reset procedure in case of a fault. This is indicated by the RESET MODE LED.

12.10.1.2 Manual RESET

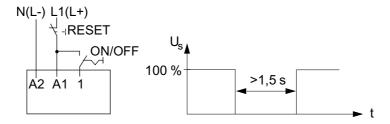


RESET / TEST button (RESET MODE LED off)

You can reset a fault by pressing the RESET / TEST button.

12.10 RESET MODE and functions of the RESET / TEST button

12.10.1.3 Remote RESET



Remote RESET (RESET MODE LED = green)

You can reset a fault signal by disconnecting the control supply voltage for >1.5 s.

12.10.1.4 AUTO RESET

AUTO RESET (RESET MODE LED = yellow)

If you set the RESET mode to AUTO, a fault is automatically reset.

Note

For information about whether or not faults can be acknowledged, as well as the recovery time and the corresponding LED and output contact states, refer to chapter Diagnostics and fault signals [Page 44].



WARNING

Automatic restart

Can result in death, serious injury, or property damage.

The automatic RESET mode (AUTO RESET) must not be used in applications where there is a risk of serious injury to persons or substantial damage to property if the motor starts up again unexpectedly. The start command (e.g. issued by a contact or the PLC) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output on the 3RW40 (terminals 95 and 96), or the signaling contact of the motor or miniature circuit breaker on all devices, in the controller.

12.10.2 SIRIUS 3RW40 5, to 3RW40 7, soft starters

12.10.2.1 Setting the RESET MODE



RESET MODE button

By pressing the RESET MODE button, you define the reset procedure in case of a fault. This is indicated by the AUTO LED.

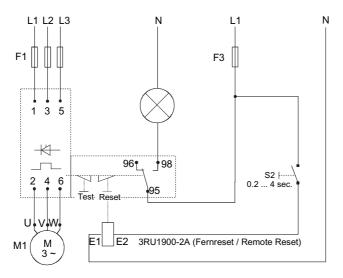
12.10.2.2 Manual RESET



RESET / TEST button (AUTO LED off)

You can reset a fault by pressing the RESET / TEST button.

12.10.2.3 Remote RESET



Remote RESET with module for RESET (AUTO LED = off)

You can perform a remote RESET (the RESET MODE set on the starter is MANUAL RESET) by controlling the optional module for RESET (3RU1900-2A).

12.10.2.4 AUTO RESET

AUTO RESET (AUTO LED = yellow)

If you set the RESET mode to AUTO, a fault is automatically reset.

Note

For information about whether or not faults can be acknowledged, as well as the recovery time and the corresponding LED and output contact states, refer to chapter Diagnostics and fault signals [Page 44].



Automatic restart

Can result in death, serious injury, or property damage.

The automatic RESET mode (AUTO RESET) must not be used in applications where there is a risk of serious injury to persons or substantial damage to property if the motor starts up again unexpectedly. The start command (e.g. issued by a contact or the PLC) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output on the 3RW40 (terminals 95 and 96), or the signaling contact of the motor or miniature circuit breaker on all devices, in the controller.

12.11 3RW40: LEDs and troubleshooting

				LEI			3RW40	W40			Auxiliary contacts		
			Soft starter			Motor pro	tection						
3RW40				VICE /gn/ylw)	STATE BYPAS FAILUF (gn/rd)	SED /	OVERLOAD (rd)	RESET MODE / AUTO (ylw/gn)	13 14 (ON)	13 14 (RUN)	24 23 (BYPASSED)	96 95 98 FAILURE / OVERLOAD	
U _S = 0										_/_	_/_	لح ا	
Operating state		IN											
Off		0	7	gn					_/_	_/_	_/_	7	
Start		1		; → gn	1	gn						7	
Bypassed		1	->		\ \	gn						7	
Stop		0			1	gn			_/_		_/_	\	
Warning		•											
I _e / impermissible CLA	SS settir	ng ²⁾	7	gn		/gn						\	
Start inhibited, device to may vary according to	too hot (o thyristor	cooling time temperature	2)3)	ylw)			_/_	_/_		7	
Fault													
Impermissible electronic voltage 2)	cs supply	1			\tau_	rd			_/_	_/_		لح ا	
Impermissible I _e / CL ₂ (0 -> 1) ²⁾		_	->	; → gn	\ \	rd	•		_/_	_/_	_/_	لح ا	
Motor protection tripping, overload relay 1) cooling time 60 s / thermistor cooling time may vary according to motor temperature		e ¹⁾	Ç gn)	\Rightarrow		_/_	_/_		اح ا		
Thermistor motor pro Wire breakage / short	tection		}	— gn			M		_/_	_/_	_/_	لح ا	
Thermal overload on (cooling time > 30 s)				ylw	\ \	rd			_/_	_/_	_/_	لح ا	
- Missing load voltage - Phase failure, missi		3)	->	 	-Ö-	rd			_/_	_/_	_/_	لح	
							ļ						
Device fault (cannot be device defective) 5)	oe ackno	wledged,	7	; → rd	\ \	rd			_/_	_/_		لح	
Test function									1			1	
Press TEST t>5 s ⁴⁾			7	Ç⊢ gn			-\-\-rd		_/_	_/_		اح ا	
RESET MODE (press	to chan	ige)					I				T	I	
Manual RESET													
Auto RESET)		-\-\-ylw						
Remote RESET)		- gn						
LED)s					1) Opti	onal, 3RW40 2. to	o 3RW40 4. in	24 V AC/DC or	nly			
			gn –	ylw _	rd =		Automatically reset if the setting is corrected or when the system returns to normal Must be acknowledged according to the selected RESET mode 4) Motor protection trip test						
Off ON FI	ashing	Flickering	= Green	= Yellow	_ F						rtner or Technical		



Automatic restart

Can result in death, serious injury, or property damage.

The automatic RESET mode (AUTO RESET) must not be used in applications where there is a risk of serious injury to persons or substantial damage to property if the motor starts up again unexpectedly. The start command (e.g. issued by a contact or the PLC) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output on the 3RW40 (terminals 95 and 96), or the signaling contact of the motor or miniature circuit breaker on all devices, in the controller.

Notes on troubleshooting

Warning	Cause	Remedy
Impermissible I _e CLASS setting (control voltage present, no start command)	The rated operational current I _e set for the motor (control voltage present, no start command) exceeds the associated, maximum permissible setting current referred to the selected CLASS setting (chapter Motor current settings [Page 107]).	Check the rated operational current set for the motor, select a lower CLASS setting, or calculate the soft starter with a size allowance. As long as the 3RW40 is not controlled IN (0->1), this is only a status signal. However, it becomes a fault signal if the start command is applied.
Start inhibited, device too hot	The acknowledgment and the motor start are inhibited for a defined time by the inherent device protection following an overload trip, to allow the 3RW40 to cool down. Possible causes Too many starts, Motor ramp-up time too long, Ambient temperature in switching device's environment too high, Minimum installation clearances not complied with.	The device cannot be started until the temperature of the thyristor or the heat sink has cooled down enough to guarantee sufficient reserve for a successful startup. The time until restarting is allowed can vary but is a minimum of 30 s. Rectify the causes and possibly retrofit the optional fan (3RW40 2. to 3RW40 4.).

Fault	Cause	Remedy
Impermissible electronics supply voltage:	The control supply voltage does not correspond to the soft starter's rated voltage.	Check the control supply voltage; could be caused by a power failure, voltage dip, or incorrect control supply voltage. Use a stabilized power supply unit if due to mains fluctuations.
Impermissible Ie/CLASS setting and IN (0->1) (control voltage present, IN start command changes from 0 to 1)	The rated operational current I _e set for the motor (control voltage present, start command present) exceeds the associated, maximum permissible setting current referred to the selected CLASS setting (chapter Motor current settings [Page 107]). For the maximum permissible settings,	Check the rated operational current set for the motor, select a lower CLASS setting, or calculate the soft starter with a size allowance.
	refer to chapter "Technical data [Page 121]".	
Motor protection tripping Overload relay / thermistor:	The thermal motor model has tripped. After an overload trip, restarting is inhibited until the recovery time has elapsed Overload relay tripping time: 60 s - Thermistor tripping time: When the temperature sensor (thermistor) in the	- Check whether the motor's rated operational current I _e is set correctly, or - Change the CLASS setting, or - Possibly reduce the switching frequency, or - Deactivate the motor protection (CLASS OFF), or
	motor has cooled down.	- Check the motor and the application.
Thermistor protection: wire breakage / short-circuit (optional for 3RW40 2. to 3RW40 4. devices):	Temperature sensor at terminals T11/ T12/T22 is short-circuited or defective, a cable is not connected, or no sensor is connected.	Check the temperature sensor and the wiring
Thermal overload on the device:	Overload trip of the thermal model for the power unit of the 3RW40 Possible causes Too many starts, Motor ramp-up time too long, Ambient temperature in switching device's environment too high, Minimum installation clearances not complied with.	Wait until the device has cooled down again, possibly increase the current limiting value set for starting, or reduce the switching frequency (too many consecutive starts). Possibly retrofit the optional fan (3RW40 2. to 3RW40 4.). Check the load and the motor, check whether the ambient temperature in the soft starter's environment is too high (derating above 40 °C, refer to chapter Technical data [Page 121]), comply with the minimum clearances.

12.11 3RW40: LEDs and troubleshooting

Fault	Cause	Remedy
Missing load voltage, phase failure / missing load:	Cause 1: Phase L1 / L2 / L3 is missing or fails / collapses when the motor is operating.	Connect L1 / L2 / L3 or correct the voltage dip.
	Tripped as a result of a dip in the permissible rated operational voltage > 15 % for > 100 ms during the startup process or > 200 ms in bypass mode.	
	Cause 2: The motor that is connected is too small and the fault occurs as soon as it is switched to bypass mode.	Set the correct rated operational current for the connected motor or set it to the minimum value (if the motor current is less than 10 % of the set I _e , the motor cannot be operated with this starter).
	Cause 3: Motor phase T1 / T2 / T3 is not connected.	Connect the motor properly (e.g. jumpers in the motor terminal box, repair switch closed etc.)
Device fault	Soft starter defective.	Contact your SIEMENS partner or Technical Assistance.

Technical data 13

13.1 3RW30

13.1.1 Overview

SIRIUS 3RW30 soft starters reduce the motor voltage through variable phase angle control and increase it from a selectable starting voltage up to the mains voltage within the ramp time. They limit the starting current and torque, so that the shocks that occur during direct starts or wye-delta starting are avoided. Mechanical loads and mains voltage dips can be effectively prevented in this way.

Soft starting reduces the stress on the connected equipment, resulting in lower wear and therefore longer periods of trouble-free production. The selectable starting voltage means the soft starters can be individually adjusted to the requirements of the application in question and – unlike wye-delta starters – are not restricted to two-stage starting with fixed voltage ratios.

SIRIUS 3RW30 soft starters are characterized above all by their small space requirements. Integral bypass contacts mean that no power loss has to be taken into account at the power semiconductors (thyristors) after the motor has started up. This cuts down on heat losses, enabling a more compact design and making external bypass circuits superfluous.

Soft starters rated up to 55 kW (at 400 V) can be supplied for standard applications in three-phase systems. Extremely small sizes, low power losses and simple startup are just three of the many advantages of this soft starter.

13.1.2 Selection and ordering data for standard applications and normal starting



Note

The rated motor current is extremely important when selecting a soft starter.

Refer to the information about selecting soft starters in chapter Configuration [Page 73].

Conditions for normal starting:

Max. ramp time 3 s, starting current 300 %, 20 starts / hour, ON time 30 %, standalone assembly, max. installation altitude 1000 m / 3280 ft, ambient temperature kW 40 °C / 104 °F. A larger model may need to be selected if other conditions and constraints apply or for a higher starting frequency. We recommend using the "Win-Soft Starter" selection and simulation software. For information about the rated currents for ambient temperatures > 40 °C, refer to chapter 3RW30..-.BB.. power electronics [Page 124].

13.1.3 3RW30..-.BB.. control electronics

Туре				3RW301., 3RW3	302.	3RW303., 3RW	304.
Control electronics							
Rated values Rated control supply voltage • Tolerance		Terminal A1 / A2	V %	24 ±20	110230 -15/+10	24 ±20	110230 -15/+10
Rated control supply current • STANDBY • During pickup • ON			mA mA mA	<50 <100 <100	6 15 15	20 <4000 20	<50 <500 <50
Rated frequency • Tolerance			Hz %	50/60 ±10			
Control input IN Power consumption with version • 24 V DC • 110/230 V AC			mA mA	ON / OFF approx. 12 AC: 3/6; DC: 1.5	5/3		
Relay outputs Output 1	ON	13/14		Operating indica	ation (NO)		
Rated operational current			A A	3AC-15/AC-14 a 1DC-13 at 24 V	at 230 V,		
Protection against overvoltages Short-circuit protection				Protection by means of varistor through contact 4 A gL/gG operational class; 6 A quick (fuse is not included in scope of supply)			
Operating indications			LED	DEVICE	STATE/BYPASSED/ FAILURE	DEVICE	STATE/BYPASSED/ FAILURE
Off Start Bypass				Green Green Green	Off Green flashing Green	Green Green Green	Off Green flashing Green
Fault signals • 24 V DC: U < 0.75 x Us or U > 1.25 x U _s • AC 110230 V: U < 0.75 x Us or U > 1.15 x U _s				Off Off	Red Red	Off Off	Red Red
Electrical overloading of bypass (reset by removing IN command)				Yellow	Red	Yellow	Red
Missing mains voltage, phase failure / missing load Device fault				Green Red	Red Red	Green Red	Red Red

13.1.4 3RW30..-.BB.. control times and parameters

Туре		3RW3013RW304.	
			Factory default
Control times and parameters			
Control times Closing delay (with connected control voltage) Closing delay (automatic / line contactor mode)	ms ms	<50 <300	
Mains failure bridging time Control supply voltage	ms	50	
Mains failure response time ¹⁾ Load current circuit	ms	500	1
Start parameters Ramp-up time Starting voltage	s %	020 40100	7.5 40
Ramp-up detection		No	
Operating mode output 13/14 Rising edge at Falling edge at	Start command Off command	ON	

¹⁾ Mains failure detection only in standby state, not during operation.

13.1.5 3RW30..-.BB.. power electronics

Туре		3RW301BB.43RW304BB.4
Power electronics		
Rated operational voltage Tolerance	V AC %	200480 -15/+10
Rated frequency Tolerance	Hz %	50/60 ±10
Continuous duty at 40°C (% of I _e)	%	115
Minimum load (% of I _e)	%	10 (at least 2 A)
Maximum cable length between soft starter and motor	m	300
Permissible installation altitude	m	5000 (Derating from 1000, see characteristic curves); higher on request
Permissible mounting position (auxiliary fan not available)		10° 10° 10° 10° 10° 10° 10° 10° 10° 10°
Permissible ambient temperature Operation Storage	°C	-25+60; (derating from +40) -40+80
Degree of protection		IP20 for 3RW30 1. and 3RW30 2.; IP00 for 3RW30 3. and 3RW30 4.

13.1.6 3RW30 13, 14, 16, 17, 18-.BB.. power electronics

Туре		3RW3013	3RW3014	3RW3016	3RW3017	3RW3018
Power electronics						
Current carrying capacity rated operating current I _e •Acc. to IEC and UL/CSA ¹⁾ , for standalone assembly, AC-53a -At 40°C -At 50°C -At 60°C	A A A	3.6 3.3 3	6.5 6 5.5	9 8 7	12.5 12 11	17.6 17 14
Power loss •During operation after startup of the motor at uninterrupted rated operat. curr. (40°C) approx. •During starting at 300% I _M (40°C)	W	0,25	0,5 52	1	2	4
Permissible rated motor current and starts per hour for normal starting (class 10): -Rated motor curr. I _M ²⁾ ,ramp-up time 3s -Starts per hour ³⁾ -Rated motor curr. I _M ²⁾ ,ramp-up time 4s -Starts per hour ³⁾	A 1/h A 1/h	3.6 / 3.3 200 / 150 3.6 / 3.3 150 / 100	6,5 / 6,0 87 / 60 6,5 / 6,0 64 / 46	9 / 8 50 / 50 9 / 8 35 / 35	12.5 / 12.0 85 / 70 12.5 / 12.0 62 / 47	17.6 / 17.0 62 / 46 17.6 / 17.0 45 / 32

¹⁾ Measurement at 60°C in accordance with UL/CSA not required.

²⁾ At 300% I_{M} . Tamb = 40 °C / 50 °C

³⁾ For intermittent duty S4 with ON time 30%, T_{amb} =40°C / 50 °C, vertical standalone assembly. The specified switching frequencies do not apply to automatic mode.

13.1.7 3RW30 26, 27, 28-.BB.. power electronics

Туре		3RW3026	3RW3027	3RW3028
Power electronics				
Current carrying capacity rated operating current I _e +Acc. to IEC and UL/CSA ¹⁾ , for standalone assembly, AC-53a -At 40°C -At 50°C -At 60°C	A A A	25.3 23 21	32.2 29 26	38 34 31
Power loss •During operation after startup of the motor at uninterrupted rated operat. curr.(40°C) approx. •During starting at 300% I _M (40°C)	W	8 188	13 220	19 256
Permissible rated motor current and starts per hour at normal starting (class 10) -Rated motor curr. $I_{\rm M}^{2}$,ramp-up time 3s -Starts per hour ³) -Rated motor curr. $I_{\rm M}^{2}$,ramp-up time 4s -Starts per hour ³)	A 1/h A 1/h	25 / 23 23 / 23 25 / 23 15 / 15	32 / 29 23 / 23 32 / 29 16 / 16	38 / 34 19 / 19 38 / 34 12 / 12

¹⁾ Measurement at 60°C in accordance with UL/CSA not required.

13.1.8 3RW30 36, 37, 38, 46, 47-.BB.. power electronics

Туре		3RW3036	3RW3037	3RW3038	3RW3046	3RW3047
Power electronics						
Current carrying capacity rated operating current I _e •Acc. to IEC and UL/CSA ¹⁾ , for standalone assembly, AC-53a -At 40°C -At 50°C -At 60°C	A	45	65	72	80	106
	A	42	58	62.1	73	98
	A	39	53	60	66	90
Power loss •During operation after startup of the motor at uninterrupted rated operat. curr.(40°C)approx. •During starting at 300% I _M (40°C)	W	6	12	15	12	21
	W	316	444	500	576	768
Permissible rated motor current and starts per hour at normal starting (class 10) -Rated motor curr. I _M ²⁾ ,ramp-up time 3s -Starts per hour ³⁾ -Rated motor curr. I _M ²⁾ ,ramp-up time 4s	A	45 / 42	63 / 58	72 / 62	80 / 73	106 / 108
	1/h	38 / 38	23 / 23	22 / 22	22 / 22	15 / 15
	A	45 / 42	63 / 58	72 / 62	80 / 73	106 / 98
-Starts per hour ³⁾	1/h	26 / 26	15 / 15	15 / 15	15 / 15	10 / 10

¹⁾ Measurement at 60°C in accordance with UL/CSA not required.

²⁾ At 300% I_M. Tamb = 40 °C / 50 °C

³⁾ For intermittent duty S4 with ON time 30%, T_{amb}=40°C / 50 °C, vertical standalone assembly. The specified switching frequencies do not apply to automatic mode. Factors for permissible switching frequency with different mounting position, direct assembly, side-by-side assembly, see Configuration chapter.

²⁾ At 300% I_M . Tamb = 40 °C / 50 °C

For intermittent duty S4 with ON time 70%, T_{amb}=40°C / 50°C, vertical standalone assembly. The specified switching frequencies do not apply to automatic mode.

13.1.9 3RW30 main conductor cross-sections

Soft starter	Туре		3RW301.	3RW302.	3RW303.	3RW304.
Conductor cross-section	ons					
Screw terminals	Main conductors					
Front clamping point connected	• Solid	mm ²	2 x (12.5); 2 x (2.56) acc. to IEC 60947	2 x (12.5); 2 x (2.56) acc. to IEC 60947; max. 1 x 10	2 x (1.516)	2 x (2.516)
NSB00477	Finely stranded with end sleeve	mm^2	2 x (1.52.5); 2 x (2.56)	2 x (12.5); 2 x (2.56)	1 x (0.7525)	1 x (2.535)
	Stranded	mm^2	-	_	1 x (0.7535)	1 x (470)
	AWG cables Solid Solid or stranded Stranded	AWG AWG AWG	2 x (16 12) 2 x (1410) 1 x 8	2 x (16 12) 2 x (1410) 1 x 8	1 x (182)	1 x (102/0)
Rear clamping point	• Solid	mm^2	-	_	2 x (1.516)	2 x (2.516)
connected	 Finely stranded with end sleeve 	mm^2	_	_	1 x (1.525)	1 x (2.550)
	Stranded	mm^2	-	_	1 x (1.535)	1 x (1070)
NSB00048	AWG cables Solid or stranded	AWG	-	_	1 x (162)	1 x (102/0)
Both clamping points	• Solid	mm^2	-	_	2 x (1.516)	2 x (2.516)
connected	Stranded	mm^2	_	_	2 x (1.525)	2 x (1050)
	 Finely stranded with end sleeve 	mm^2	_	_	2 x (1.516)	2 x (2.535)
NSB00481	AWG cables Solid or stranded	AWG	-	_	2 x (162)	2 x (101/0)
	Tightening torque	Nm lb.in	22.5 1822	22.5 1822	4.5 40	6.5 58
	Tools		PZ2	PZ2	PZ2	Allen screw 4 mm
	Degree of protection		IP20	IP20	IP20 (terminal compartment IP00)	IP20 t (terminal compartment IP00)
Spring-loaded terminals	Main conductors					
	• Solid	mm^2	14	110	_	_
	Finely stranded with end sleeve	mm ²	12.5	16; end sleeves, without plastic collar	-	_
	AWG cables Solid or stranded (finely stranded) Stranded	AWG AWG	1614 1612	1610 1 x 8	_ _	_
	Tools		DIN ISO 2380- 1A0; 5 x 3	DIN ISO 2380- 1A0; 5 x 3	_	_
	Degree of protection		IP20	IP20	_	_
Busbar connections	Main conductors					
	With cable lug according to DIN 46234 or max. 20 mm wide Stranded Finely-stranded	mm ² mm ²		_	_	2 x (1070) 2 x (1050)
	AWG cables, solid or stranded	AWG	-	_	_	2 x (71/0)

13.1.10 3RW30 auxiliary conductor cross-sections

Soft starters	Туре		3RW3013RW304.
Conductor cross-se	ctions		
Auxiliary conductors (1	or 2 conductors can be connected):		
	Screw terminals		
	SolidFinely stranded with end sleeve	mm ² mm ²	2 x (0.52.5) 2 x (0.51.5)
	AWG cables Solid or stranded Finely stranded with end sleeve	AWG AWG	2 x (2014) 2 x (2016)
	Terminal screws Tightening torque	Nm lb.in	0.81.2 710.3
	Spring-loaded terminals		
	SolidFinely stranded with end sleeveAWG cables, solid or stranded	mm ² mm ² AWG	2 x (0.252.5) 2 x (0.251.25) 2 x (2414)

13.1.11 Electromagnetic compatibility according to EN 60947-4-2

	Standard	Parameters
Electromagnetic compatibility according to EN 60947-4-2		
EMC interference immunity		
Electrostatic discharge (ESD)	EN 61000-4-2	±4 kV contact discharge, ±8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Frequency range: 80 to 2000 MHz with 80% at 1 kHz Degree of severity 3: 10 V/m
Conducted RF interference	EN 61000-4-6	Frequency range: 150 kHz80 MHz with 80% at 1 kHz Interference 10 V
RF voltages and RF currents on cables		
• Burst	EN 61000-4-4	±2 kV / 5 kHz
• Surge	EN 61000-4-5	±1 kV line to line ±2 kV line to ground
EMC interference emission		
EMC interference field strength	EN 55011	Limit value of Class A at 301000 MHz, Limit value of Class B for 3RW302.; 24 V AC/DC
Radio interference voltage	EN 55011	Limit value of Class A at 0.1530 MHz, Limit value of Class B for 3RW302.; 24 V AC/DC
Radio interference suppression filters		
Degree of noise suppression A (industrial applications)	Not required	
Degree of noise suppression B (applications for residential areas) Control voltage • 230 V AC/DC • 24 V AC/DC		3RW301. and 3RW302; <i>W</i> 303. and 3RW304. (see table)

Degree of noise suppression B cannot be obtained through the use of filters as the strength of the electromagnetic field is not attenuated by the filter.

13.1.12 Recommended filters

Soft starter types	Nominal current	Recommended filters ¹⁾					
	Soft starter	Voltage range 200 to 480 V	Voltage range 200 to 480 V				
		Filter types	Terminals				
	A		Α	mm ²			
3RW30 36 3RW30 37 3RW30 38	45 63 72	4EF1512-1AA10 4EF1512-2AA10 4EF1512-3AA10	50 66 90	16 25 25			
3RW30 46 3RW30 47	80 106	4EF1512-3AA10 4EF1512-4AA10	90 120	25 50			

The radio interference suppression filter is used to remove the conducted interference from the main circuit. The field-related emissions comply with degree of noise suppression B. The filter should be selected under standard conditions: 10 starts per hour, ramp-up time 4 s at 300% I_e

13.1.13 Types of coordination

Types of coordination

The type of coordination according to which the motor feeder with soft starter is mounted depends on the application-specific requirements. Normally, fuseless mounting (combination of motor starter protector and soft starter) is sufficient.

If type of coordination 2 needs to be fulfilled, semiconductor fuses must be fitted in the motor feeder.

- Type of coordination 1 in accordance with IEC 60947-4-1:
 The device is defective following a short-circuit failure and therefore unsuitable for further use. (Personnel and equipment must not be put at risk).
- Type of coordination 2 in accordance with IEC 60947-4-1:
 The device is suitable for further use following a short-circuit failure. (Personnel and equipment must not be put at risk).

The type of coordination only refers to soft starters in conjunction with the stipulated protective device (motor starter protector / fuse), not to additional components in the feeder.

13.1.14 Fuseless version

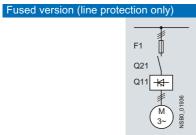


Soft starters	Nominal	Motor starter protect	ors ¹⁾		
ToC 1	current	400 V +10%			Rated current
Q11		Q1		I _{q max}	
Туре	Α	Туре		kA	A
Type of coord	ination 1 ²⁾				
3RW30 03	3	3RV1011-1EA10	3RV20 11-1EA (provis.)	50	4
3RW30 13 3RW30 14	3.6 6.5	3RV1021-1FA10 3RV1021-1HA10	3RV20 11-1FA 3RV20 11-1HA	10 10	5 8
3RW30 16 3RW30 17 3RW30 18	9 12.5 17.6	3RV1021-1JA10 3RV1021-1KA10 3RV1021-4BA10	3RV20 11-1JA 3RV20 11-1KA 3RV20 21-4BA	10 10 10	10 12.5 20
3RW30 26 3RW30 27 3RW30 28	25 32 38	3RV1021-4DA10 3RV1031-4EA10 3RV1031-4FA10	3RV20 21-4DA 3RV20 21-4EA 3RV20 21-4FA	55 55 55	25 32 40
3RW30 36 3RW30 37 3RW30 38	45 63 72	3RV1031-4GA10 3RV1041-4JA10 3RV1041-4KA10		20 20 20	45 63 75
3RW30 46 3RW30 47	80 106	3RV1041-4LA10 3RV1041-4MA10		11 11	90 100

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

²⁾ The types of coordination are described in chapter Types of coordination [Page 128].

13.1.15 Fused version (line protection only)



Soft starters	Nominal	Line protection, r	naximum		Line contacto	'S		
ToC 1	current		Rated	Size	(optional)			
Q11		F1	current		Q21			
Type	Α	Type	Α					
Type of coord	dination 1 ¹⁾ : I _q =	65 kA at 480 V +	10%					
3RW30 03 ²⁾	3	3NA3805 ³⁾	20	000	3RT10 15	3RT20 15		
3RW30 13	3.6	3NA3803-6	10	000	3RT10 15	3RT20 15		
3RW30 14	6.5	3NA3805-6	16	000	3RT10 15	3RT20 15		
3RW30 16	9	3NA3807-6	20	000	3RT10 16	3RT20 16		
3RW30 17 3RW30 18	12.5 17.6	3NA3810-6 3NA3814-6	25 35	000 000	3RT10 24 3RT10 26	3RT20 18 3RT20 26		
3RW30 26	25	3NA3822-6	63	00	3RT10 26	3RT20 26		
3RW30 27	32	3NA3824-6	80	00	3RT10 34	3RT20 27		
3RW30 28	38	3NA3824-6	80	00	3RT10 35	3RT20 28		
3RW30 36	45	3NA3130-6	100	1	3RT10 36			
3RW30 37 3RW30 38	63 72	3NA3132-6 3NA3132-6	125 125	1	3RT10 44 3RT10 45			
3RW30 46	80	3NA3136-6	160	1	3RT10 45			
3RW30 47	106	3NA3136-6	160	1	3RT10 46			

¹⁾ The types of coordination are described in chapter Types of coordination [Page 128]. Type of coordination 1 only refers to soft starters in conjunction with the stipulated protective device (motor starter protector / fuse), not to any additional components in the feeder.

 $^{^{2)}}$ I_q = 50 kA at 400 V.

³⁾ 3NA3 805-1 (NH00), 5SB2 61 (DIAZED), 5SE2 201-6 (NEOZED).

13.1.16 **Fused version with SITOR 3NE1 fuses**

3NE1020-2

3NE1020-2

3NE1820-0

3NE1820-0

3NE1021-0

3NE1022-0

3RW30 28 3RW30 36

3RW30 37

3RW30 38

3RW30 46

3RW30 47

45

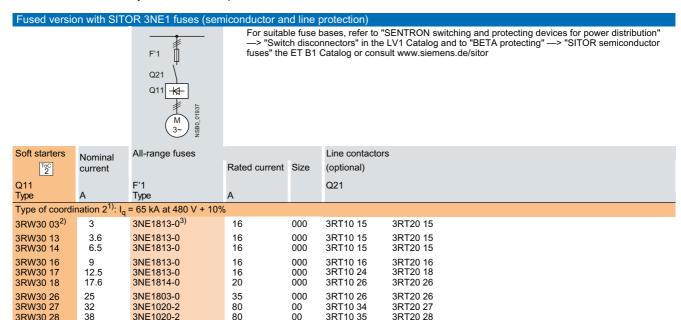
63

72

80

106

Assembly as for type of coordination 2, with SITOR all-range fuses (F'1) for combined thyristor and line protection.



3RT10 35

3RT10 36

3RT10 44

3RT10 45

3RT10 45

3RT10 46

3RT20 28

80

80

80

80

100

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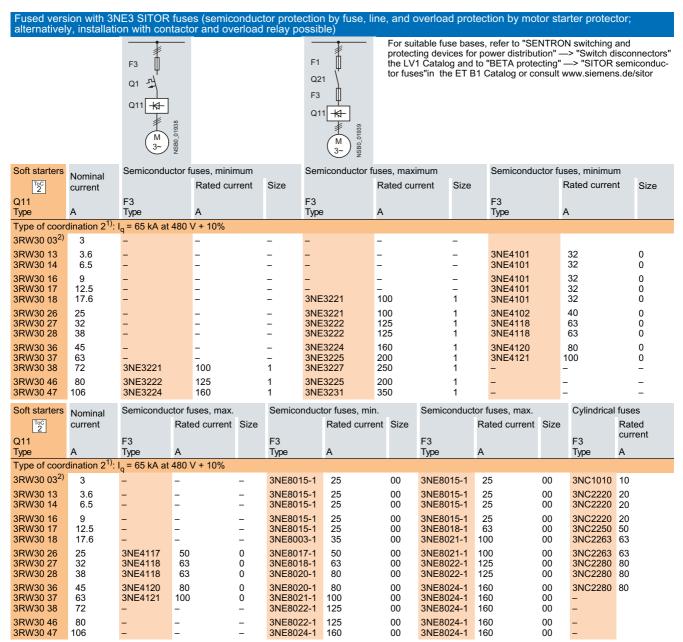
¹⁾ The types of coordination are described in chapter Types of coordination [Page 128]. Type of coordination 2 only refers to soft starters in conjunction with the stipulated protective device (motor starter protector / fuse), not to additional components in the feeder.

²⁾ $I_a = 50 \text{ kA at } 400 \text{ V}.$

³⁾ No SITOR fuse required! Alternatively: 3NA3 803 (NH00), 5SB2 21 (DIAZED), 5SE2 206 (NEOZED)

13.1.17 Fused version with SITOR 3NE3/4/8 fuses

Assembly as for type of coordination 2, with additional SITOR fuses (F3) for thyristor protection only.



Soft starters	Nominal	Line contac	tors	Motor starter prot	ectors		Line protection,	Line protection, maximum		
ToC 2	current	(optional)		400 V +10%		Rated current		Rated current	Size	
Q11 Type	A	Q21		Q1 Type		A	F1 Type	A		
Type of coor	rdination 2 ¹⁾	: I _a = 65 kA at	480 V + 10%							
3RW30 03 ²⁾	3	3RT10 15	3RT20 15	3RV1011-1EA10	3RV20 11-1EA (provis.)	4	3NA3805 ³⁾	20	000	
3RW30 13 3RW30 14	3.6 6.5	3RT10 15 3RT10 15	3RT20 15 3RT20 15	3RV1021-1FA10 3RV1021-1HA10	3RV20 11-1FA 3RV20 11-1HA	5 8	3NA3803-6 3NA3805-6	10 16	000 000	
3RW30 16 3RW30 17 3RW30 18	9 12.5 17.6	3RT10 16 3RT10 24 3RT10 26	3RT20 16 3RT20 18 3RT20 26	3RV1021-1JA10 3RV1021-1KA10 3RV1021-1BA10	3RV20 11-1JA 3RV20 11-1KA 3RV20 21-4BA	10 12.5 20	3NA3807-6 3NA3810-6 3NA3814-6	20 25 35	000 000 000	
3RW30 26 3RW30 27 3RW30 28	25 32 38	3RT10 26 3RT10 34 3RT10 35	3RT10 26 3RT20 27 3RT20 28	3RV1031-4DA10 3RV1031-4EA10 3RV1031-4EA10	3RV20 21-4DA 3RV20 21-4EA 3RV20 21-4FA	25 32 40	3NA3822-6 3NA3824-6 3NA3824-6	63 80 80	00 00 00	
3RW30 36 3RW30 37 3RW30 38	45 63 72	3RT10 36 3RT10 44 3RT10 45		3RV1031-4GA10 3RV1041-4JA10 3RV1041-4KA10		45 63 75	3NA3130-6 3NA3132-6 3NA3132-6	100 125 125	1 1 1	
3RW30 46 3RW30 47	80 106	3RT10 45 3RT10 46		3RV1041-4LA10 3RV1041-4MA10		90 100	3NA3136-6 3NA3136-6	160 160	1 1	

 $^{^{1)}}$ The types of coordination are described in $^{2)}$ I_q = 50 kA at 400 V. chapter Types of coordination [Page 128]. Type of coordination 2 only refers to soft starters in conjunction with the stipulated protective device (motor starter protector / fuse), not to additional components in the feeder.

13.2 3RW40

13.2.1 Overview

SIRIUS 3RW40 soft starters have all the same advantages as the 3RW30 soft starters.

SIRIUS 3RW40 soft starters are characterized above all by their small space requirements. Integral bypass contacts mean that no power loss has to be taken into account at the power semiconductors (thyristors) after the motor has started up. This cuts down on heat losses, enabling a more compact design and making external bypass circuits superfluous.

At the same time, this soft starter comes with additional integrated functions such as settable current limiting, motor overload and intrinsic device protection, and optional thermistor motor protection. The higher the motor rating, the more important these functions become because they make it unnecessary to purchase and install protection equipment (such as overload relays).

Internal intrinsic device protection prevents thermal overloading of the thyristors and the power unit defects this can cause. As an option, the thyristors can also be protected against short-circuiting with semiconductor fuses.

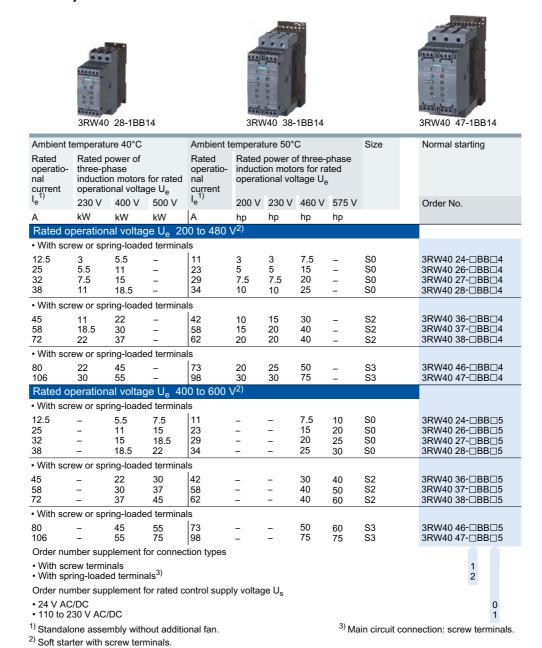
Thanks to integrated status and fault monitoring, this compact soft starter offers many different diagnostics options. Up to four LEDs and relay outputs permit differentiated monitoring and diagnostics of the operating mechanism by indicating the operating state as well as, for example, mains or phase failures, missing load, impermissible tripping times / CLASS settings, thermal overloading, or device faults.

Soft starters rated up to 250 kW (at 400 V) can be supplied for standard applications in three-phase systems. Extremely small sizes, low power losses, and simple commissioning are just three of the many advantages of the SIRIUS 3RW40 soft starters.

"Increased safety" type of protection EEx e according to ATEX Directive 94/9/EC

The SIRIUS 3RW40 soft starter sizes S0 to S12 are suitable for starting explosion-proof motors with the "increased safety" type of protection EEx e.

13.2.2 Selection and ordering data for standard applications and normal starting (CLASS 10)



13.2 3RW40

Note

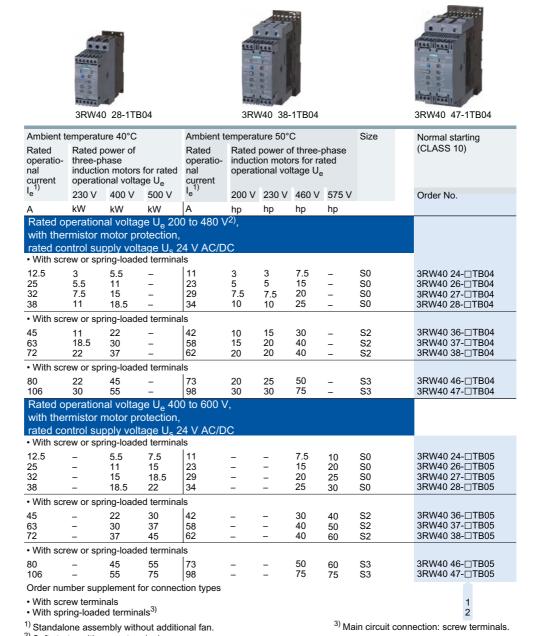
The rated motor current is extremely important when selecting a soft starter.

Refer to the information about selecting soft starters in chapter Configuration [Page 73].

Conditions for normal starting (CLASS 10):

Max. ramp-up time 10 s, current limiting 300 %, 5 starts / hour, ON time 30 %, standalone assembly, max. installation altitude 1000 m / 3280 ft, ambient temperature kW 40 °C / 104 °F. A larger model may need to be selected if other conditions and constraints apply or for a higher starting frequency. We recommend using the "Win-Soft Starter" selection and simulation software. For information about the rated currents for ambient temperatures > 40 °C, refer to chapter 3RW40 2. to 7. power electronics [Page 148].

13.2.3 Selection and ordering data for standard applications and normal starting (CLASS 10) (with thermistor motor protection evaluation)



²⁾ Soft starter with screw terminals.

13.2 3RW40

Note

The rated motor current is extremely important when selecting a soft starter.

Refer to the information about selecting soft starters in chapter Configuration [Page 73].

Conditions for normal starting (CLASS 10):

Max. ramp-up time 10 s, current limiting 300 %, 5 starts / hour, ON time 30 %, standalone assembly, max. installation altitude 1000 m / 3280 ft, ambient temperature kW 40 °C / 104 °F. A larger model may need to be selected if other conditions and constraints apply or for a higher starting frequency. We recommend using the "Win-Soft Starter" selection and simulation software. For information about the rated currents for ambient temperatures > 40 °C, refer to chapter 3RW40 2. to 7. power electronics [Page 148].

Selection and ordering data for standard applications and normal starting 13.2.4 (CLASS 10)





Size

3RW40	56-6BB44						
Ambient temperature 40°C Am							
Rated	Rated power of	Ra					
operatio-	three-phase	op					
nal induction motors for rated							
current	operational voltage U _e	cui					

230 V 400 V 500 V

kW

kW

nbient temperature 50°C								
ated peratio- al irrent	induction	on moto	f three-p rs for ra tage U _e					
1)	200 V 230 V 460 V 5							

hn

Normal starting (CLASS 10)

Order No.

, ·	1444	17.4.4	1 () (ļ/ 1	ΠP	ΠP	ΠP	ΠP		
Rated or										
With screw or spring-loaded terminals										
134 162	37 45	75 30	_	117 145	30 40	40 50	75 100	-	S6	3RW40 55-□BB□4 3RW40 56-□BB□4
• With scre	ew or spr	ing-loade	d termina	ls						
230 280	75 90	132 160	_	205 248	60 75	75 100	150 200	-	S12	3RW40 73-□BB□4 3RW40 74-□BB□4
356 432	110 132	200 250	_	315 385	100 125	125 150	250 300	-		3RW40 75-□BB□4 3RW40 76-□BB□4
Date day		-1 11	- 11 40	0.1- 000 1	(2)					·

432	132	250	-	385	125	150	300	-		3RVV4U 76-∐BB∐4
Rated	operatio									
With screw or spring-loaded terminals										
134 162	_	75 90	90 110	117 145	- -	-	75 100	100 150	S6	3RW40 55-□BB□5 3RW40 56-□BB□5
• With so	crew or sp	oring-load	ed termin	als						
230 280	-	132 160	160 200	205 248	_	_	150 200	200 250	S12	3RW40 73-□BB□5 3RW40 74-□BB□5
356 432	_	200 250	250 315	315 385	- -	_	250 300	300 400		3RW40 75-□BB□5 3RW40 76-□BB□5

Order number supplement for connection types³⁾

- With spring-loaded terminalsWith screw terminals

Order number supplement for rated control supply voltage U_s⁴⁾

- 115 V AC 230 V AC

¹⁾ Standalone assembly.

²⁾ Soft starter with screw terminals. ³⁾ Main circuit connection: busbar connection.

⁴⁾ Control by way of the internal 24 V DC supply or direct control by means of PLC possible

13.2 3RW40

Note

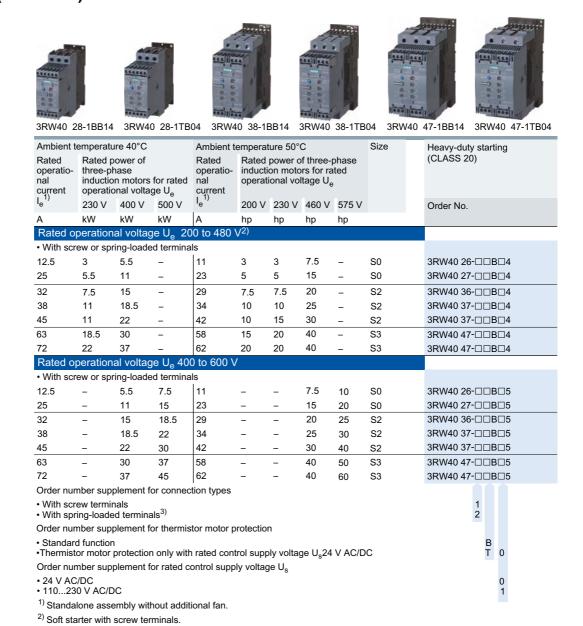
The rated motor current is extremely important when selecting a soft starter.

Refer to the information about selecting soft starters in chapter Configuration [Page 73].

Conditions for normal starting (CLASS 10):

Max. ramp-up time 10 s, current limiting 300 %, 5 starts / hour, ON time 30 %, standalone assembly, max. installation altitude 1000 m / 3280 ft, ambient temperature kW 40°C / 104°F . A larger model may need to be selected if other conditions and constraints apply or for a higher starting frequency. We recommend using the "Win-Soft Starter" selection and simulation software. For information about the rated currents for ambient temperatures > 40°C , refer to chapter 3RW40 2. to 7. power electronics [Page 148].

13.2.5 Selection and ordering data for standard applications and heavy-duty starting (CLASS 20)



3) Main circuit connection: screw terminals.

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13.2 3RW40

Note

The rated motor current is extremely important when selecting a soft starter.

Refer to the information about selecting soft starters in chapter Configuration [Page 73].

Conditions for normal starting (CLASS 10):

Max. ramp-up time 20 s, current limiting 300 %, 5 starts / hour, ON time 30 %, standalone assembly, max. installation altitude 1000 m / 3280 ft, ambient temperature kW 40 °C / 104°. A larger model may need to be selected if other conditions and constraints apply or for a higher starting frequency. We recommend using the "Win-Soft Starter" selection and simulation software. For information about the rated currents for ambient temperatures > 40 °C, refer to chapter 3RW40 24, 26, 27, 28 power electronics [Page 149].

13.2.6 Selection and ordering data for standard applications and heavy-duty starting (CLASS 20)



Ambient temperature 40°C



.0 56	6-6BB44	3RW40	76-6E

Rated	Rated power of						
operatio-	three-phase						
nal	induction motors for rated						
current I _e ¹⁾	operational voltage U _e						
l _e ''	230 V	400 V	500 V				
Α	kW	kW	kW	l			

Ambient temperature 50°C Rated power of three-phase induction motors for rated Rated operatiooperational voltage U_e current I_e¹⁾ 200 V 230 V 460 V 575 V

Heavy-duty starting (CLASS 20)

hp hp

Size

Ord	ler	No

Rated operational voltage U _e 200 to 460 V ²⁾											
	• With scre	With screw or spring-loaded terminals									
	80	22	45	-	73	20	25	50	_	S6	3RW40 55-□BB□4
	106	30	55	_	98	25	30	60	_	S6	3RW40 55-□BB□4
	134	37	75	_	117	30	40	75	-	S6	3RW40 56-□BB□4
	162	45	90	-	145	40	50	100	_	S12	3RW40 73-□BB□4
	230	75	132	-	205	60	75	150	-	S12	3RW40 74-□BB□4
	280	90	160	-	248	75	100	200	-	S12	3RW40 75-□BB□4
	356	110	200	_	315	100	125	250	_	S12	3RW40 76-□BB□4

000	110	200	_	1010	100	120	200	_	012	3177740 70 1100114
Rated										
• With s	crew or s									
80	-	45	55	73	-	_	50	60	S6	3RW40 55-□BB□5
106	-	55	75	98	-	-	60	75	S6	3RW40 55-□BB□5
134	-	75	90	117	-	-	75	100	S6	3RW40 56-□BB□5
162	-	90	110	145	-	-	100	150	S12	3RW40 73-□BB□5
230	-	132	160	205	_	-	150	200	S12	3RW40 74-□BB□5
280	-	160	200	248	_	-	200	250	S12	3RW40 75-□BB□5
356	_	200	250	315	_	_	250	300	S12	3RW40 76-□BB□5

Order number supplement for connection types³⁾

- With spring-loaded terminals
- With screw terminals

Order number supplement for rated control supply voltage U_s⁴⁾

- 115 V AC 230 V AC

¹⁾ Standalone assembly.

²⁾ Soft starter with screw terminals. 3) Main circuit connection: busbar connection.

⁴⁾ Control by way of the internal 24 V DC supply or direct control by means of PLC possible

13.2 3RW40

Note

The rated motor current is extremely important when selecting a soft starter.

Refer to the information about selecting soft starters in chapter Configuration [Page 73].

Conditions for normal starting (CLASS 10):

Max. ramp-up time 40 s, current limiting 350 %, 1 starts / hour, ON time 30 %, standalone assembly, max. installation altitude 1000 m / 3280 ft, ambient temperature kW 40 °C / 104 °F. A larger model may need to be selected if other conditions and constraints apply or for a higher starting frequency. We recommend using the "Win-Soft Starter" selection and simulation software. For information about the rated currents for ambient temperatures > 40 °C, refer to chapter 3RW40 55, 56, 73, 74, 75, 76 power electronics [Page 151].

13.2.7 3RW40 2., 3., 4. control electronics

Туре				3RW402.		3RW403., 3RW40	4.
Control electronics							
Rated values Rated control supply voltage • Tolerance		Terminal A1 / A2	V %	24 ±20	110230 -15/+10	24 ±20	110230 -15/+10
Rated control supply current • STANDBY • During pickup • ON without fan • ON with fan			mA mA mA	<150 <200 <250 <300	<50 <100 <50 <70	<200 <5000 <200 <250	<50 <1500 <50 <70
Rated frequency • Tolerance			Hz %	50/60 ±20			
Control inputs IN				ON / OFF			
Rated operational current • AC • DC			mA mA	Approx. 12 Approx. 12	3/6 1.5/3	Approx. 12 Approx. 12	3/6 1.5/3
Relay outputs Output 1 Output 2 Output 3	ON / RUN mode ¹⁾ BYPASSED OVERLOAD/FAILURE	13/14 23/24 95/96/98		Operating indication Bypass indication Overload / fault ind	(NO)		
Rated operational current			A A	3AC-15/AC-14 at 2 1DC-13 at 24 V	230 V,		
Protection against overvoltages				Protection by mea	ns of varistor through	gh contact	
Short-circuit protection				4 A gL/gG operation 6 A quick (fuse is	onal class; not included in scop	e of supply)	

¹⁾ Factory default: ON mode.

13.2.8 3RW40 5., 7. control electronics

Туре				3RW405.		3RW407.	
Control electronics							
Rated values Rated control supply voltage • Tolerance		Terminal A1 / A2	V AC %	115 -15/+10	230	115 -15/+10	230
Rated control supply current STANDBY During pickup ON ¹⁾ Rated frequency Tolerance			mA mA mA Hz %	15 <1700 440 50/60 ±10	<850 200	15 <400 660 50/60 ±10	<2000 360
Control inputs IN Rated operational current Rated operational voltage			mA V DC	ON / OFF Approx. 10 according to DIN 19240 24 from internal supply DC+ or external DC supply (according to DIN 19240) through terminals and IN			iinals and IN
Relay outputs Output 1 Output 2 Output 3	ON / RUN mode ²⁾ BYPASSED OVERLOAD/FAILURE	13/14 23/24 95/96/98		Operating indicati Bypass indication Overload / fault in	(NÒ)		
Rated operational current Protection against overvoltages Short-circuit protection			A A	3AC-15/AC-14 at 230 V, 1DC-13 at 24 V Protection by means of varistor through contact 4 A gL/gG operational class; 6 A quick (fuse is not included in scope of supply)			
1) Values for the coil power consump	otion at +10% U _n , 50 Hz.			2) Factory default	: ON mode.		

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13.2.9 3RW40 2., 3., 4. control electronics

Туре		3RW402., 3RW403., 3RW404.			
Control electronics					
Operating indications Off Start Bypass Stop	LED	DEVICE Green Green Green Green	STATE/BYPASSED/FAILURE Off Green flashing Green Green flashing	OVERLOAD Off Off Off Off	
Alarm signals Impermissible I _e / CLASS setting Start inhibited / thyristors too hot		Green Yellow flashing	Not relevant Not relevant	Red flashing Off	
Fault signals • 24 V: $U < 0.75 \times U_s$ or $U > 1.25 \times U_s$ • 110230 V: $U < 0.75 \times U_s$ or $U > 1.15 \times U_s$ Impermissible $I_{e'}$ (CLASS setting for edge 0->1 on input IN Motor protection tripping (overload thermistor) Thermistor defective (wire breakage, short-circuit)		Off Off Green Green Green	Red Red Off Off	Off Off Red flashing Red Red flickering	
Thermal overload of the thyristors Missing mains voltage, phase failure / missing load Device fault		Yellow Green Red	Red Red Red	Off Off Off	

13.2.10 3RW40 5., 7. control electronics

Туре		3RW405. and 3RW407.			
Control electronics					
Operating indications LE Off Start Bypass Stop	Ds	DEVICE Green Green Green Green	STATE/BYPASSED Off Green flashing Green Green flashing	FAILURE Off Off Off Off	OVERLOAD Off Off Off Off
Alarm signals Impermissible I _e / CLASS setting Start inhibited / thyristors too hot		Green Yellow flashing	Not relevant Not relevant	Not relevant Not relevant	Red flashing Off
Fault signals U < 0.75 x U _s or U > 1.15 x U _s Impermissible I _e / CLASS setting for edge 0->1 on input IN Motor protection tripping		Off Green Green	Off Off Off	Red Red Off	Off Red flashing Red
Thermal overload of the thyristors Missing mains voltage, phase failure / missing load Device fault		Yellow Green Red	Off Off Off	Red Red Red	Off Off Off

13.2.11 3RW40 protection functions

Туре		3RW40	
			Factory default
Protection functions			
Motor protection functions Trips in the event of Trip class to IEC 60947-4-1 Phase failure sensitivity	Class %	Thermal overloading of the motor 10/15/20 >40	10
Overload warning Thermistor protection according to IEC 60947-8, type A / IEC 60947-5-1 Reset option after tripping		No Yes ¹⁾ Manual / automatic / remote reset ²⁾ (MAN / AUTO / REMOTE ²⁾)	
Recovery time	min	5	
Device protection functions Trips in the event of Reset option after tripping		Thermal overloading of the thyristors or bypass ³⁾ Manual / automatic / remote reset ²⁾ (MAN / AUTO / REMOTE ²⁾)	
Recovery time • During overloading of the thyristors • During overloading of the bypass	s s	30 60	

¹⁾ Optional up to size S3 (device version).

13.2.12 3RW40 control times and parameters

Туре		3RW40	
			Factory default
Control times and parameters			
Control times Closing delay (with connected control voltage) Closing delay (automatic / line contactor mode) Recovery time (closing command during active stop)	ms ms ms	<50 <300 100	
Mains failure bridging time Control supply voltage	ms	50	
Mains / phase failure response time Load current circuit During starting and stopping During bypass	s s	1 5	
Reclosing lockout after overload trip Motor protection trip Device protection trip - During overloading of the thyristors - During overloading of the bypass	min s s	5 30 60	
Start parameters Ramp-up time Starting voltage Starting current limiting	s %	020 40100 1.35 x I _e	7.5 40 5 x l _e
Stop parameter Ramp-down time	s	020	0
Reset mode parameters (for motor / device protection Manual reset Automatic reset Remote reset (REMOTE) ¹⁾	n trip) LED LED LED	Off Yellow Green	Off
Ramp-up detection		Yes	
Operating mode output 13/14 Rising edge at Falling edge at	Start command Off command Ramp-down end	ON RUN	ON

¹⁾ Integrated remote reset (REMOTE) available only for 3RW40 2. to 3RW40 4.; remote reset with accessory module 3RU19 available for 3RW405. and 3RW407.

Integrated remote reset (REMOTE) available only for 3RW40 2. to 3RW40 4.; remote reset with accessory module 3RU19 available for 3RW405. and 3RW407.

³⁾ Bypass protection up to size S3.

13.2.13 3RW40 2. to 7. power electronics

Туре		3RW402B.4, 3RW403B.4, 3RW404B.4	3RW402B.5, 3RW403B.5, 3RW404B.5	3RW405BB.4, 3RW407BB.4	3RW405BB.5, 3RW407BB.5
Power electronics					
Rated operational voltage Tolerance	V AC %	200480 -15/+10	400600 -15/+10	200460 -15/+10	400600 -15/+10
Maximum thyristor blocking voltage	V AC	1600		1400	1800
Rated frequency Tolerance	Hz %	50/60 ±10			
Continuous duty at 40°C (% of I _e)		115			
Minimum load (% of minimum selectable rated motor current $\mathbf{I}_{\mathbf{M}}$)	%	20 (at least 2 A)			
Maximum cable length between soft starter and motor	m	300			
Permissible installation altitude	m	5000 (Derating from 10	000, see characteris	tic curves); higher or	request
Permissible mounting position					
With auxiliary fan (for 3RW402 3RW404.)		90° ***** 90°	2,5° 22,5° 65900 GSN		
Without auxiliary fan (for 3RW402 3RW404.)		10° 10° 1	0° 10° 10° 10° 10° 10° 10° 10° 10° 10° 1	- (fan integrated i	n the soft starter)
Permissible ambient temperature Operation Storage	°C °C	-25+60; (deration-40+80	ng from +40)		
Degree of protection		IP20 for 3RW40 3		IP00	

13.2.14 3RW40 24, 26, 27, 28 power electronics

Туре		3RW4024	3RW4026	3RW4027	3RW4028
Power electronics					
Current carrying capacity rated operating current I _e •Acc. to IEC and UL/CSA ¹), for standalone assembly, AC-53a					
-At 40°C	Α	12.5	25.3	32.2	38
-At 50 °C	Α	11	23	29	34
-At 60 °C	Α	10	21	26	31
Minimum settable rated motor current I _M for motor overload protection	Α	5	10	17	23
Power loss					
•During operation after startup of the motor at uninterrupted rated operat. curr. (40°C) approx.	W	2	8	13	19
•During starting at 300 % current limiting I _M (40°C)	W	68	188	220	256
Permissible rated motor current and starts per hour					
•For normal starting (class 10):					
-Rated motor curr. $I_{M}^{(2)}$, ramp-up t. 3s	Α	12.5 / 11	25 / 23	32 / 29	38 / 34
-Rated motor curr. $I_M^{(2)}$, ramp-up t. 3s -Starts per hour $^{(3)}$	1/h	50 / 50	23 / 23	23 / 23	19 / 19
-Rated motor curr. $\frac{1}{2}M^{(2)4)}$, ramp-up t. 4s	Α	12.5 / 11	25 / 23	32 / 29	38 / 34
-Starts per hour ^{3)^{IVI}}	1/h	36 / 36	15 / 15	16 / 16	12 / 12
•For heavy-duty starting (class 15)					
-Rated motor curr. $I_M^{(2)}$, ramp-up t. 4,5s -Starts per hour ³⁾	Α	11 / 10	23 / 21	30 / 27	34 / 31
-Starts per hour ^{3)***}	1/h	49 / 49	21 / 21	18 / 18	18 / 18
-Rated motor curr. $I_{M}^{2)4}$, ramp-up t. 6s	Α	11 / 10	23 / 21	30 / 27	34 / 31
-Starts per hour ^{3)^w}	1/h	36 / 36	14 / 14	13 / 13	13 / 13
•For heavy-duty starting (class 20)					
-Rated motor curr. I_{M}^{2} , ramp-up t. 6s	Α	10 / 9	21 / 19	27 / 24	31 / 28
-Starts per hour ^{3)^w}	1/h	47 / 47	21 / 21	20 / 20	18 / 18
-Rated motor curr. $I_{M}^{2)4}$, ramp-up t. 8s	Α	10/9	21 / 19	27 / 24	31 / 28
-Starts per hour ^{3)^M}	1/h	34 / 34	15 / 15	14 / 14	13 / 13

¹⁾ Measurement at 60°C in accordance with UL/CSA not required.

^{2) 300 %} current limiting on soft starter I_M . Tamb = 40 °C / 50 °C.

³⁾ For intermittent duty S4 with ON time 30%, T_{amb}=40°C / 50 °C, vertical standalone assembly. The specified switching frequencies do not apply to automatic mode. Factors for permissible switching frequency with different mounting position, direct assembly, side-by-side assembly and installation of an optional additional fan, see Configuration chapter.

⁴⁾ Maximum settable rated motor current I_{M} , depending on the CLASS setting.

13.2.15 3RW40 36, 37, 38, 46, 47 power electronics

Туре		3RW4036	3RW4037	3RW4038	3RW4046	3RW4047
Power electronics						
Current carrying capacity rated operating current I _e •Acc. to IEC and UL/CSA ¹⁾ , for standalone assembly, AC-53a -At 40°C -At 50°C -At 60°C	A A A	45 42 39	63 58 53	72 62.1 60	80 73 66	106 98 90
Minimum settable rated motor current \mathbf{I}_{M} for motor overload protection	Α	23	26	35	43	46
Power loss •During operation after startup of the motor at uninterrupted rated operat. curr. (40°C) approx.	W	6	12	15	12	21
•During starting at 300 % current limiting I _M (40°C)	W	316	444	500	576	768
Permissible rated motor current and starts per hour						
•For normal starting (class 10): -Rated motor curr. I_M^{2} , ramp-up t. 3s -Starts per hour ³ -Rated motor curr. $I_M^{2/4}$, ramp-up t. 4s -Starts per hour ³	A 1/h A 1/h	45 / 42 38 / 38 45 / 42 26 / 26	63 / 58 23 / 23 63 / 58 15 / 15	72 / 62 22 / 22 72 / 62 15 / 15	80 / 73 22 / 22 80 / 73 15 / 15	106 / 98 15 / 15 106 / 98 10 / 10
•For heavy-duty starting (class 15) -Rated motor curr. I_M^{2} , ramp-up t. 4,5s -Starts per hour ³ -Rated motor curr. $I_M^{2/4}$, ramp-up t. 6s -Starts per hour ³	A 1/h A 1/h	42 / 38 30 / 30 42 / 38 21 / 21	50 / 46 34 / 34 50 / 46 24 / 24	56 / 52 34 / 34 56 / 52 24 / 24	70 / 64 24 / 24 70 / 64 16 / 16	84 / 77 23 / 23 84 / 77 17 / 17
•For heavy-duty starting (class 20) -Rated motor curr. I_M^{2} , ramp-up t. 6s -Starts per hour ³ -Rated motor curr. $I_M^{2/4}$, ramp-up t. 8s -Starts per hour ³	A 1/h A 1/h	38 / 34 30 / 30 38 / 34 21 / 21	46 / 42 31 / 31 46 / 42 22 / 22	50 / 46 34 / 34 50 / 46 24 / 24	64 / 58 23 / 23 64 / 58 16 / 16	77 / 70 23 / 23 77 / 70 16 / 16

¹⁾ Measurement at 60°C in accordance with UL/CSA not required.

^{2) 300 %} current limiting on soft starter I_M . Tamb = 40 °C / 50 °C

³⁾ For intermittent duty S4 with ON time 30%, T_{amb}=40°C / 50 °C, vertical standalone assembly. The specified switching frequencies do not apply to automatic mode. Factors for permissible switching frequency with different mounting position, direct assembly, side-by-side assembly and installation of an optional additional fan, see Configuration chapter.

⁴⁾ Maximum settable rated motor current $\mathbf{I}_{\mathbf{M}}$, depending on the CLASS setting.

13.2.16 3RW40 55, 56, 73, 74, 75, 76 power electronics

Туре		3RW4055	3RW4056	3RW4073	3RW4074	3RW4075	3RW4076
Power electronics							
Current carrying capacity rated operating current I _e •Acc. to IEC and UL/CSA ¹), for standalone assembly, AC-53a							
-At 40°C	Α	134	162	230	280	356	432
-At 50 °C	Α	117	145	205	248	315	385
-At 60 °C	Α	100	125	180	215	280	335
Minimum settable rated motor current $\mathbf{I}_{\mathbf{M}}$ for motor overload protection	Α	59	87	80	130	131	207
Power loss •During operation after startup of the motor at uninterrupted rated operat. curr. (40°C) approx.	W	60	75	75	90	125	165
•During starting at 350% ²⁾ current limiting I _M (40°C)	W	1043	1355	2448	3257	3277	3600
Permissible rated motor current and starts per hour							
•For normal starting (class 10):							
-Rated motor curr. I_{M}^{2} ramp-up t. 10s	Α	134 / 117	162 / 145	230 / 205	280 / 248	356 / 315	432 / 385
-Rated motor curr. I _M ²⁾ , ramp-up t. 10s -Starts per hour ³⁾	1/h	20 / 20	8/8	14 / 14	20 / 20	16 / 16	17 / 17
-Rated motor curr. I _M ²⁾⁴⁾ ,ramp-up t. 20s	Α	134 / 117	162 / 145	230 / 205	280 / 248	356 / 315	432 / 385
-Starts per hour ³⁾	1/h	7/7	1.4 / 1.4	3/3	8/8	5 / 5	5/5
•For heavy-duty starting (class 15)							
-Rated motor curr. $I_{M}^{(2)}$, ramp-up t. 15s	Α	134 / 117	152 / 140	210 / 200	250 / 220	341 / 315	402 / 385
-Starts per hour ^{3)^M}	1/h	11 / 11	8/8	11 / 11	13 / 13	11 / 11	12 / 12
-Rated motor curr. I _M ²⁾⁴⁾ ,ramp-up t. 30s	Α	134 / 117	152 / 140	210 / 200	250 / 220	341 / 315	402 / 385
-Starts per hour ³⁾	1/h	1.2 / 1.2	1.7 / 1.7	1 / 1	6/6	2/2	2/2
•For heavy-duty starting (class 20)							
-Rated motor curr. $I_M^{(2)}$, ramp-up t. 20s	Α	124 / 112	142 / 132	200 / 185	230 / 205	311 / 280	372 / 340
-Starts per hour ³⁾	1/h	12 / 12	9/9	10 / 10	10 / 10	10 / 10	10 / 10
-Rated motor curr. I _M ^{2/4)} ,ramp-up t. 40s -Starts per hour ³⁾	A 1/h	124 / 112 2 / 2	142 / 132 2 / 2	200 / 185 1 / 1	230 / 205 5 / 5	311 / 280 1 / 1	372 / 340 1 / 1

¹⁾ Measurement at 60°C in accordance with UL/CSA not required.

^{2) 350%} current limiting on soft starter I_M . Tamb = 40 °C / 50 °C

³⁾ For intermittent duty S4 with ON time 70%, T_{amb}=40°C / 50 °C, vertical standalone assembly. The specified switching frequencies do not apply to automatic mode.

⁴⁾ Maximum settable rated motor current $\mathbf{I}_{\mathrm{M}},$ depending on the CLASS setting.

13.2.17 3RW40 2., 3., 4. main conductor cross-sections

Main conductors	Soft starters	Туре		3RW402.	3RW403.	3RW404.
Solid	Conductor cross-section	ons				
Stranded	Screw terminals	Main conductors				
Stranded		• Solid	mm ²	2 x (2.56) according to IEC 60947;	2 x (1.516)	2 x (2.516)
AWG cables	NSB00475	With end sleeve	mm^2		1 x (0.7525)	1 x (2.535)
Solid or stranded		Stranded	mm^2	_	1 x (0.7535)	1 x (470)
Solid or stranded		AWG cables				
Stranded		- Solid	AWG	2 x (16 12)		
Rear clamping point connected		- Solid or stranded	AWG	2 x (1410)	1 x (182)	2 x (101/0)
Number N		- Stranded	AWG	1 x 8	- '	_ ` ,
Stranded Stranded Stranded AWG - 1x (1.535) 1x (1070)	Rear clamping point	• Solid	mm^2	_	2 x (1.516)	2 x (2.516)
Stranded		With end sleeve	mm^2	_	` '	, ,
AWG cables		Stranded	mm^2	_		
Spring-loaded terminals Spring-loaded te	00480	AWG cables			((/
Solid Soli	N S S S S S S S S S S S S S S S S S S S	- Solid or stranded	AWG	_	1 x (162)	2 x (101/0)
With end sleeve	Both clamping points	• Solid	mm ²	_	` '	, ,
Stranded				_		
- AWG cables - Solid or stranded		Stranded	mm^2	_	` '	, ,
*Tightening torque Nm 22.5 4.5 6.5 58 Tools PZ2 PZ2 Allen screw 4 mm Degree of protection P20 P20 P20 P20					(/	(1 11)
Bi.in 1822 40 58 Tools Degree of protection P22 P22 P22 Allen screw 4 mm P20 Reminal compartment IP00) Spring-loaded terminals Main conductors Solid mm² 110 -	NSB0048		AWG	-	2 x (162)	1 x (102/0)
Degree of protection IP20		Tightening torque				
Spring-loaded terminals Main conductors Solid Finely stranded with end sleeve MWG cables Solid or stranded (finely stranded) Stranded Tools Degree of protection Main conductors With cable lug according to DIN 46234 or 20 mm wide Stranded Stranded Finely-stranded Main conductors With cable lug according to DIN 46234 or 20 mm wide Stranded Finely-stranded Main conductors With cable lug according to Main according to DIN 46234 or 20 mm wide Stranded Finely-stranded Main conductors With cable lug according to DIN 46234 or 20 mm wide Stranded Finely-stranded Main conductors With cable lug according to DIN 46234 or 20 mm wide Stranded Finely-stranded Main conductors With cable lug according to DIN 46234 or 20 mm wide Stranded Finely-stranded Main conductors With cable lug according to DIN 46234 or 20 mm wide Stranded Finely-stranded Main conductors With cable lug according to DIN 46234 or 20 mm wide Stranded Main conductors With cable lug according to DIN 46234 or 20 mm wide Stranded Finely-stranded Main conductors With cable lug according to DIN 46234 or 20 mm wide Stranded Stranded Finely-stranded Main conductors With cable lug according to DIN 46234 or 20 mm wide Stranded Stranded Finely-stranded		Tools		PZ2	PZ2	Allen screw 4 mm
• Solid		Degree of protection		IP20		
• Finely stranded with end sleeve mm² 16 end sleeves without plastic collar • AWG cables - Solid or stranded (finely stranded) AWG 1610 - - Stranded AWG 1 x 8 Tools DIN ISO 2380-1A0; 5 x 3 - Degree of protection IP20 - Busbar connections Main conductors • With cable lug according to DIN 46234 or 20 mm wide - Stranded	Spring-loaded terminals	Main conductors				
*AWG cables - Solid or stranded (finely stranded) - Stranded AWG - Stranded AWG - Stranded AWG - Stranded AWG - Stranded - Finely-stranded *Without plastic collar without plastic collar without plastic collar without plastic collar without plastic collar *Without plastic collar without plastic collar without plastic collar **AWG - 1 x 8 - DIN ISO 2380-1A0; 5 x 3 - DIN ISO		• Solid	mm^2	110	_	
- Solid or stranded (finely stranded) AWG 1610 - Stranded AWG 1 x 8 - Tools DIN ISO 2380-1A0; 5 x 3 - Degree of protection IP20 - Busbar connections Main conductors • With cable lug according to DIN 46234 or 20 mm wide - Stranded		Finely stranded with end sleeve	mm^2		-	
- Stranded AWG 1 x 8		AWG cables				
Tools DIN ISO 2380-1A0; 5 x 3 -		- Solid or stranded (finely stranded)	AWG	1610	-	
Degree of protection IP20		- Stranded	AWG	1 x 8	-	
Busbar connections		Tools		DIN ISO 2380-1A0; 5 x 3	-	
• With cable lug according to DIN 46234 or 20 mm wide - Stranded mm² - 2 x (1070) - Finely-stranded mm² - 2 x (1050)		Degree of protection		IP20	_	
20 mm wide - Stranded	Busbar connections	Main conductors				
- Finely-stranded mm ² – 2 x (1050)						
		- Stranded	mm^2	-		2 x (1070)
• AWG cables, solid or stranded AWG – 2 x (71/0)		- Finely-stranded	mm^2	-		2 x (1050)
		 AWG cables, solid or stranded 	AWG	_		2 x (71/0)

13.2.18 3RW40 5., 7. main conductor cross-sections

Conductor cross-sections				3RW407.
Screw terminals	Main conductors:			
With box terminal			3RT19 55-4G (55 kW)	3RT19 66-4G
Front clamping point connected	Finely stranded with end sleeve	mm ²	1670	70240
	Stranded	mm ²	1670	95300
(SB00479	Ribbon cable conductors (number x width x thickness)	mm	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 cables, solid or stranded	AWG	62/0	3/0600 kcmil
Rear clamping point connected	Finely stranded with end sleeve	mm ²	1670	120185
	Stranded	mm ²	1670	120240
NSB00480	Ribbon cable conductors (number x width x thickness)	mm	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
S S S S S S S S S S S S S S S S S S S	AWG cables, solid or stranded	AWG	62/0	250500 kcmil
Both clamping points connected	Finely stranded with end sleeve	mm ²	Max. 1 x 50, 1 x 70	Min. 2 x 50; max. 2 x 185
=	Stranded	mm ²	Max. 2 x 70	Max. 2 x 70; max. 2 x 240
184	 Ribbon cable conductors (number x width x thickness) AWG cables, solid or stranded 	mm AWG	Max. 2 x (6 x 15.5 x 0.8) Max. 2 x 1/0	Max. 2 x (20 x 24 x 0.5) Min. 2 x 2/0; max. 2 x 500 kcmil
NSB00888	Terminal screws Tightening torque	Nm lb.in	M10 (hexagon socket, A/F4) 1012 90110	M12 (hexagon socket, A/F5) 2022 180195
Screw terminals	Main conductors:			
With box terminal			3RT19 56-4G	
Front or rear clamping point connected	Finely stranded with end sleeve	mm ²	16120	
	Stranded	mm ²	16120	
\SB00479 \NSB00480	• Ribbon cable conductors (number x width x thickness)	mm	Min. 3 x 9 x 0.8 Max. 6 x 15.5 x 0.8	
	AWG cables, solid or stranded	AWG	6250 kcmil	
Both clamping points connected	Finely stranded with end sleeve	mm ²	Max. 1 x 95, 1 x 120	
	Stranded	mm ²	Max. 2 x 120	
NSB00481	Ribbon cable conductors (number x width x thickness) AWG cables, solid or stranded	mm AWG	Max. 2 x (10 x 15.5 x 0.8) Max. 2 x 3/0	
Screw terminals	Main conductors:			
	Without box terminal / busbar connection			
	 Finely stranded with cable lug Stranded with cable lug AWG cables, solid or stranded 	mm ² mm ² AWG	1695 ¹⁾ 25120 ¹⁾ 4250 kcmil	50240 ²⁾ 70240 ²⁾ 2/0500 kcmil
	Connecting bar (max. width) Terminal screws	mm	17	25
	- Tightening torque	Nm lb.in	M8x25 (A/F13) 1014 89124	M10x30 (A/F17) 1424 124210

When connecting cable lugs to DIN 46235, use 3RT19 56-4EA1 terminal cover for conductor cross-sections from 95 mm² to ensure the required clearance between phases.

²⁾ When connecting cable lugs to DIN 46234 or DIN 46235, use 3RT19 66-4EA1 terminal cover for conductor cross-sections from 240 mm² or 185 mm² respectively to ensure the required clearance between phases.

13.2.19 3RW40 .. auxiliary conductor cross-sections

Soft starters	Туре		3RW40
Conductor cross-se	ections		
Auxiliary conductors (1 or 2 conductors can be connected)		
	Screw terminals		
	SolidFinely stranded with end sleeve	mm ² mm ²	2 x (0.52.5) 2 x (0.51.5)
	 AWG cables Solid or stranded Finely stranded with end sleeve 	AWG AWG	2 x (2014) 2 x (2016)
	Terminal screws Tightening torque	Nm lb.in	0.81.2 710.3
	Spring-loaded terminals		
	 Solid 3RW40 2. to 3RW40 4. 3RW40 5., 3RW40 7. 	mm ² mm ²	2 x (0.252.5) 2 x (0.251.5)
	Finely stranded with end sleeveAWG cables, solid or stranded	mm ² AWG	2 x (0.251.5) 2 x (2414) for 3RW4023RW404.; 2 x (2416) for 3RW405. and 3RW407.

13.2.20 Electromagnetic compatibility according to EN 60947-4-2

	Standard	Parameters
Electromagnetic compatibility according to EN 60947-4-2		
EMC interference immunity		
Electrostatic discharge (ESD)	EN 61000-4-2	± 4 kV contact discharge, ± 8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Frequency range: 80 to 1000 MHz with 80% at 1 kHz Degree of severity 3: 10 V/m
Conducted RF interference	EN 61000-4-6	Frequency range: 150 kHz80 MHz with 80% at 1 kHz Interference 10 V
RF voltages and RF currents on cables		
• Burst	EN 61000-4-4	± 2 kV / 5 kHz
• Surge	EN 61000-4-5	±1 kV line to line ±2 kV line to ground
EMC interference emission		
EMC interference field strength	EN 55011	Limit value of Class A at 301000 MHz, Limit value of Class B for 3RW402.; 24 V AC/DC
Radio interference voltage	EN 55011	Limit value of Class A at 0.1530 MHz, Limit value of Class B for 3RW402.; 24 V AC/DC
Radio interference suppression filters		
Degree of noise suppression A (industrial applications)	Not required	
Degree of noise suppression B (applications for residential areas) Control voltage • 110230 V AC/DC • 115/230 V AC • 24 V AC/DC	Not available ¹⁾ Not available ¹⁾ Not required for 3RW Required for 3RW40	V402.; 33. and 3RW404. (see table)

Degree of noise suppression B cannot be obtained through the use of filters as the strength of the electromagnetic field is not attenuated by the filter.

13.2.21 Recommended filters

Soft starter types	Nominal current	Recommended filters ¹⁾								
	Soft starters	Voltage range 200 to 480 V								
		Filter types Nominal current filters Terminals								
	A		A	mm^2						
3RW40 36 3RW40 37 3RW40 38	45 63 72	4EF1512-1AA10 4EF1512-2AA10 4EF1512-3AA10	50 66 90	16 25 25						
3RW40 46 3RW40 47	80 106	4EF1512-3AA10 4EF1512-4AA10	90 120	25 50						

The radio interference suppression filter is used to remove the conducted interference from the main circuit. The field-related emissions comply with degree of noise suppression B. The filter should be selected under standard conditions: 10 starts per hour, ramp-up time 4 s at 300% I_e

feeder.

13.2.22 Types of coordination

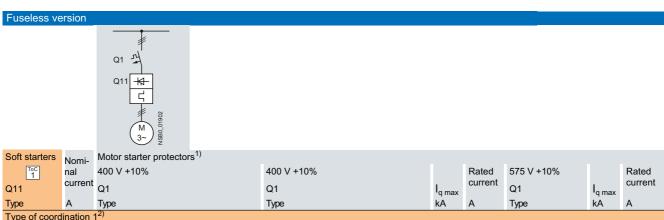
Types of coordination

The type of coordination according to which the motor feeder with soft starter is mounted depends on the application-specific requirements. Normally, fuseless mounting (combination of motor starter protector and soft starter) is sufficient. If type of coordination 2 needs to be fulfilled, semiconductor fuses must be fitted in the motor feeder.

- Type of coordination 1 in accordance with IEC 60947-4-1:

 The device is defective following a short-circuit failure and therefore unsuitable for further use (personnel and equipment must not be put at risk).
- Type of coordination 2 in accordance with IEC 60947-4-1:
 The device is suitable for further use following a short-circuit failure (personnel and equipment must not be put at risk).
 The type of coordination only refers to soft starters in conjunction with the stipulated protective device (motor starter protector / fuse), not to additional components in the

13.2.23 Fuseless version

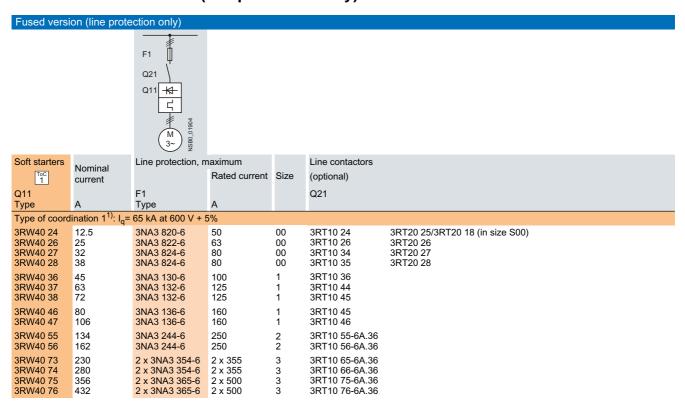


	ToC 1	nal	400 V +10%	400 V +10%		Rated current	575 V +10%		Rated current
Q	11	current	Q1	Q1	I _{q max}	current	Q1	I _{q max}	current
	<i>у</i> ре	Α	Туре	Туре	kA	Α	Туре	kA	Α
T	ype of coord	ination '	1 ²⁾						
31	RW40 24	12.5	3RV1 021-1KA10 3RV20 21-4AA/ 3RV20 11-4AA (in size S00)	3RV1 321-1KC10 3RV23 21-4AC/ 3RV23 11-4AC (in size S00)	55	16	-	-	-
	RW40 26	25	3RV1 021-4DA10 3RV20 21-4DA	3RV1 321-4DC10 3RV23 21-4DC	55	25	-	-	-
	RW40 27 RW40 28	32 38	3RV1 031-4EA10 3RV20 21-4EA 3RV1 031-4FA10 3RV20 21-4FA	3RV1 331-4EC10 3RV23 21-4EC 3RV1 331-4FC10 3RV23 21-4FC	55 55	32 40	_	_	_
-	RW40 36	45	3RV1 031-4GA10	3RV1 331-4GC10	20	45	-	_	_
	RW40 37 RW40 38	63 72	3RV1 041-4JA10 3RV1 041-4KA10	3RV1 341-4JC10 3RV1 341-4KC10	20 20	63 75	_	_	_
	RW40 46	80	3RV1 041-4LA10	3RV1 341-4LC10	11	90	_	_	_
31	RW40 47	106	3RV1 041-4MA10	3RV1 341-4MC10	11	100	-	-	_
	RW40 55 RW40 56	134 162	3VL3 720-2DC36 3VL3 720-2DC36		35 35	200 200	3VL3 720-1DC36 3VL3 720-1DC36	12 12	200 200
31	RW40 73	230	3VL4 731-2DC36		65	315	3VL5 731-3DC36	35	315
	RW40 74	280	3VL4 731-2DC36		65	315	3VL5 731-3DC36	35	315
	RW40 75 RW40 76	356 432	3VL4 740-2DC36 3VL5 750-2DC36		65 65	400 500	3VL5 740-3DC36 3VL5 750-3DC36	35 35	400 500

¹⁾ The rated motor current must be considered when selecting the devices. The 3RV13 and 3RV23 motor starter protectors are used for starter combinations (without motor protection). In this case, motor protection is provided by the 3RW40 soft starter.

²⁾ The types of coordination are described in chapter Types of coordination [Page 155].

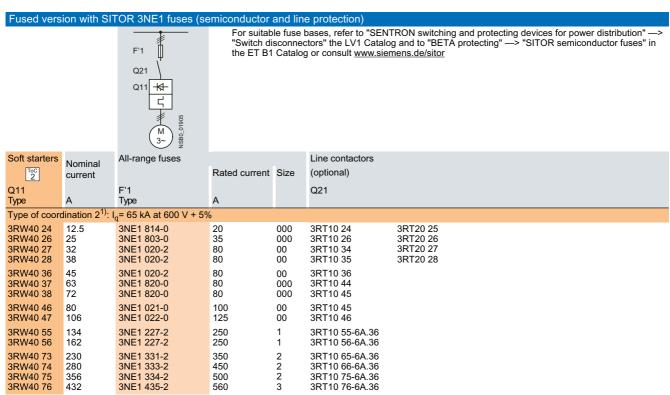
13.2.24 Fused version (line protection only)



¹⁾ The types of coordination are described in chapter Types of coordination [Page 155]. Type of coordination 1 only refers to soft starters in conjunction with the stipulated protective device (motor starter protector / fuse), not to additional components in the feeder.

13.2.25 Fused version with SITOR 3NE1 fuses

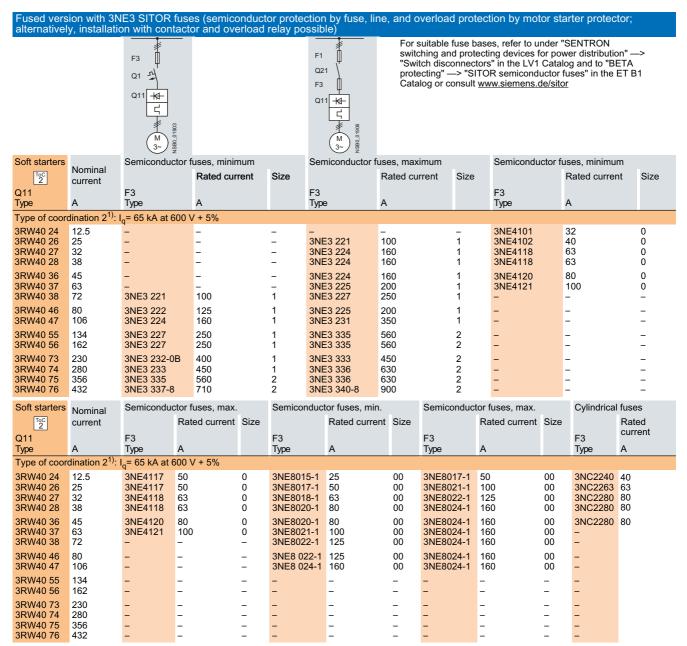
Assembly as for type of coordination 2, with SITOR all-range fuses (F´1) for combined thyristor and line protection.



¹⁾ The types of coordination are described in chapter Types of coordination [Page 155]. Type of coordination 2 only refers to soft starters in conjunction with the stipulated protective device (motor starter protector / fuse), not to additional components in the feeder.

13.2.26 Fused version with SITOR 3NE3/4/8 fuses

Assembly as for type of coordination 2, with additional SITOR fuses (F3) for thyristor protection only.

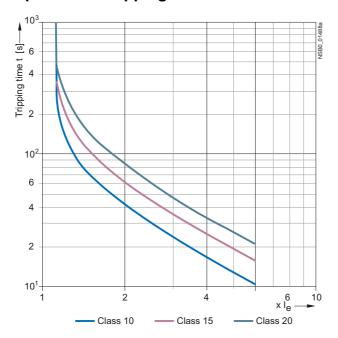


13.2 3RW40

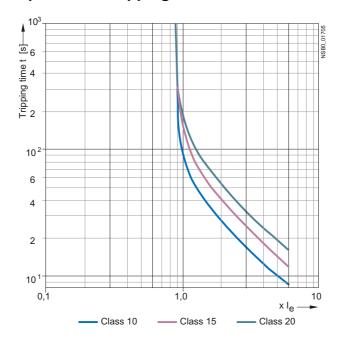
Soft starters	Nomi-	Line contactors		Motor starter protect	ctors				Line protection, m	aximum	
ToC 2	nal	(optional)		400 V +10%		Rated current	575 V +10%	Rated current		Rated current	Size
Q11	current	Q21		Q1		Current	Q1	Current	F1	Current	
Туре	Α			Туре		Α	Туре	Α	Туре	Α	
Type of coor	dination	12 ¹⁾ : I _q = 65 kA at 6	600 V + 5%								
3RW40 24	12.5	3RT10 24	3RT20 25/ 3RT20 18 (in size S00	3RV1 021-4KA10	3RV20 21-4AA/ 3RV20 11-4AA (in size S00)	16	-	-	3NA3 820-6	50	00
3RW40 26	25	3RT10 26	3RT20 26	3RV1 021-4DA10	3RV20 21-4DA	25	_	-	3NA3 822-6	63	00
3RW40 27	32 38	3RT10 34	3RT20 27	3RV1 031-4EA10	3RV20 21-4EA	32	_	-	3NA3 824-6	80	00
3RW40 28		3RT10 35	3RT20 28	3RV1 031-4FA10	3RV20 21-4FA	40	_	_	3NA3 824-6	80	00
3RW40 36 3RW40 37	45 63	3RT10 36 3RT10 44		3RV1 031-4GA10		45 63	_	-	3NA3 130-6 3NA3 132-6	100 125	1
3RW40 38	72	3RT10 44 3RT10 45		3RV1 041-4JA10 3RV1 041-4KA10		75	_	_	3NA3 132-6	125	1
3RW40 46	80	3RT10 45		3RV1 041-4LA10		90	_	_	3NA3 136-6	160	1
3RW40 47	106	3RT10 46		3RV1 041-4MA10		100	-	-	3NA3 136-6	160	1
3RW40 55	134	3RT10 55-6A.36		3VL3 720		200	3VL3 720	200	3NA3 244-6	250	2
3RW40 56	162	3RT10 56-6A.36		3VL3 720		200	3VL3 720	200	3NA3 244-6	250	2
3RW40 73	230	3RT10 65-6A.36		3VL4 731		315	3VL5 731	315	2 x 3NA3 354-6	2 x 355	3
3RW40 74 3RW40 75	280 356	3RT10 66-6A.36 3RT10 75-6A.36		3VL4 731 3VL4 740		315 400	3VL5 731 3VL5 740	315 400	2 x 3NA3 354-6 2 x 3NA3 365-6	2 x 355 2 x 500	3
3RW40 76	432	3RT10 76-6A.36		3VL5 750		500	3VL5 750	500	2 x 3NA3 365-6	2 x 500	-

¹⁾ The types of coordination are described in chapter Types of coordination [Page 155]. Type of coordination 2 only refers to soft starters in conjunction with the stipulated protective device (motor starter protector / fuse), not to additional components in the feeder.

13.2.27 Motor protection tripping characteristics for 3RW40 (with symmetry)



13.2.28 Motor protection tripping characteristics for 3RW40 (with asymmetry)



13.3 Win-Soft Starter selection and simulation software

13.3 Win-Soft Starter selection and simulation software

This software can be used to simulate and select all SIEMENS soft starters, taking into account various parameters such as the supply system conditions, motor data, load data, specific application requirements, etc.

It is a useful tool, which does away with the need for time-consuming and complex manual calculations if you need to select the optimum soft starter for your particular case.

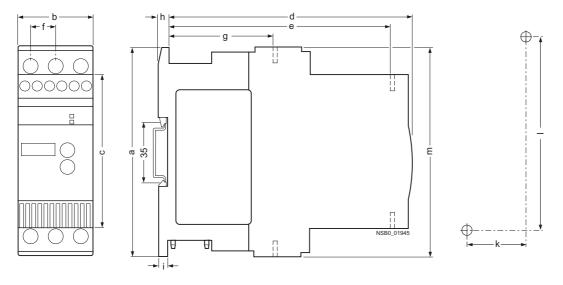
The Win-Soft Starter selection and simulation software can be downloaded from (http://www.automation.siemens.com/mcms/low-voltage/en/industrial-controls/controls/solid-state-switching-devices/soft/software/Pages/default.aspx)

More information about soft starters can likewise be found on the Internet at (http://www.siemens.com/softstarter)

Dimension drawings

14

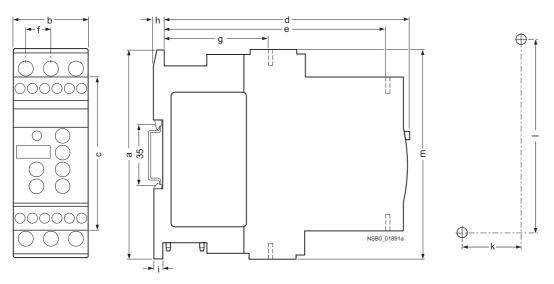
14.1 3RW30 for standard applications



Type / dimensions (mm)	а	b	С	d	е	f	g	h	i	k	I	m
3RW3011.	95	45	62	146	126	14.4	63	5	6.5	35	85	95
3RW3012.	95	45	62	146	126	14.4	63	5	6.5	35	85	117.2
3RW3021.	125	45	92	146	126	14.4	63	5	6.5	35	115	125
3RW3022.	125	45	92	146	126	14.4	63	5	6.5	35	115	150
3RW303.	160	55	110	163	140	18	63	5	6.5	30	150	144
3RW304.	170	70	110	181	158	22.5	85	5	10	60	160	160

Distances from grounded parts (mm)	Lateral	Тор	Bottom	Fixing screws	Tightening torques (Nm)
3RW301.	5	60	40	M4	1
3RW302.	5	60	40	M4	1
3RW303.	30	60	40	M4	1
3RW304.	30	60	40	M4	2

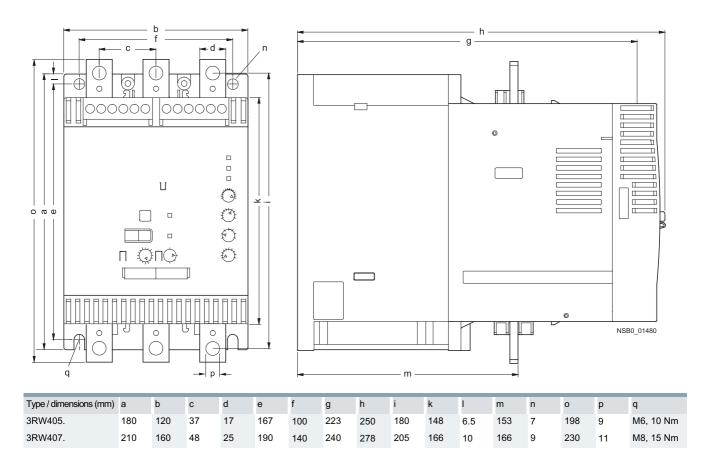
14.2 3RW40 for standard applications



Type / dimensions (mm)	а	b	С	d	е	f	g	h	i	k	I	m
3RW4021.	125	45	92	149	126	14.4	63	5	6.5	35	115	125
3RW4022.	125	45	92	149	126	14.4	63	5	6.5	35	115	150
3RW403.	160	55	110	165	140	18	63	5	6.5	30	150	144
3RW404.	170	70	110	183	158	22.5	85	5	10	60	160	160

Distances from grounded parts (mm)	Lateral	Тор	Bottom	Fixing screws	Tightening torques (Nm)
3RW402.	5	60	40	M4	1
3RW403.	30	60	40	M4	1
3RW404.	30	60	40	M4	2

14.2 3RW40 for standard applications



14.2 3RW40 for standard applications

Typical circuit diagrams 15

15.1 Typical circuit for the optional thermistor motor protection evaluation

A thermistor motor protection evaluation function is optionally available for the 24 V AC/DC control voltage version of the 3RW40 2 to 3RW40 4.

Note

If a thermistor is connected (PTC type A or Klixon), you must remove the copper jumper between terminals T11/21 and T22.

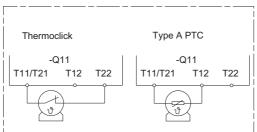


Figure 15-1 Optional thermistor motor protection evaluation

15.2 Control by pushbutton

15.2.1 Control of the 3RW30 by pushbutton

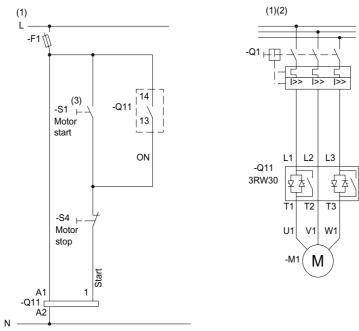


Figure 15-2 Wiring of the 3RW30 control and main circuits

- (1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .
- (2) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]



(3) Automatic restart. Can result in death, serious injury, or property damage.

Faults caused by incorrect control voltage, a missing load, or a phase failure (refer to chapter 3RW30: LEDs and troubleshooting [Page 44]) are automatically reset when the system returns to normal. An automatic restart is initiated and the 3RW restarted if a start command is present at the input.

If you do not want the motor to start automatically, you must integrate suitable additional components, e.g. phase failure or load monitoring devices, into the control and main circuits.

15.2.2 Control of the 3RW40 by pushbutton

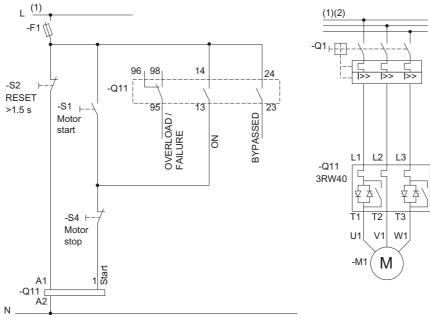


Figure 15-3 Wiring of the 3RW40 2 to 3RW40 4 control circuit and the 3RW40 2 to 3RW40 7 main circuit

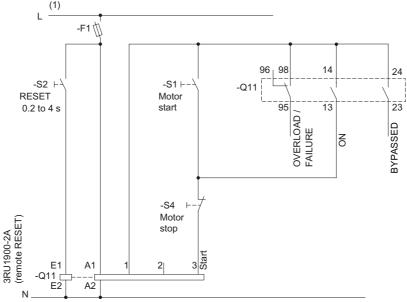


Figure 15-4 Wiring of the 3RW40 5 to 3RW40 7 control circuit

- (1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121].
- (2) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

15.3 Control by switch

15.3.1 Control of the 3RW30 by switch

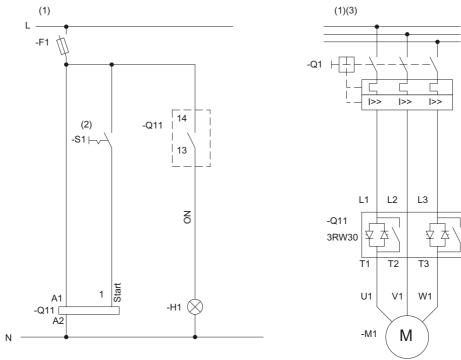


Figure 15-5 Wiring of the control and main circuits

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .



(2) Automatic restart. Can result in death, serious injury, or property damage.

Faults caused by incorrect control voltage, a missing load, or a phase failure (refer to chapter 3RW30: LEDs and troubleshooting [Page 44]) are automatically reset when the system returns to normal. An automatic restart is initiated and the 3RW restarted if a start command is present at the input.

If you do not want the motor to start automatically, you must integrate suitable additional components, e.g. phase failure or load monitoring devices, into the control and main circuits.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

15.3.2 Control of the 3RW40 by switch

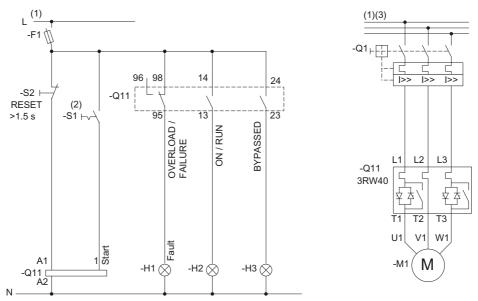


Figure 15-6 Wiring of the 3RW40 2 to 3RW40 4 control circuit and the 3RW40 2 to 3RW40 7 main circuit

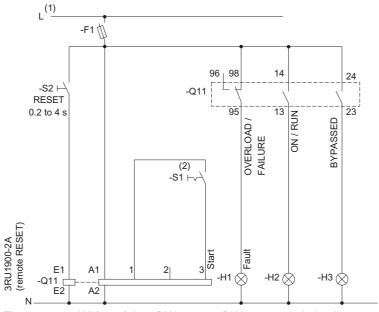


Figure 15-7 Wiring of the 3RW40 5 to 3RW40 7 control circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

MARNING

(2) Automatic restart.

Can result in death, serious injury, or property damage.

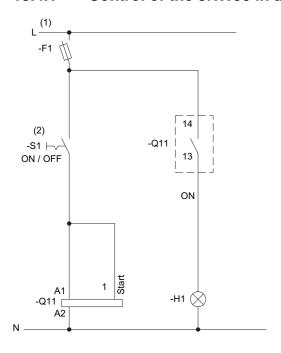
The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

15.4 Control in automatic mode

15.4.1 Control of the 3RW30 in automatic mode



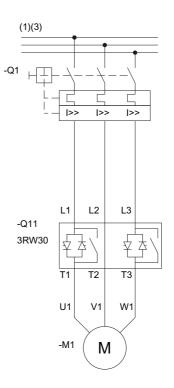


Figure 15-8 Wiring of the 3RW30 control and main circuits

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

WARNING

(2) Automatic restart. Can result in death, serious injury, or property damage.

Faults caused by incorrect control voltage, a missing load, or a phase failure (refer to chapter 3RW30: LEDs and troubleshooting [Page 44]) are automatically reset when the system returns to normal. An automatic restart is initiated and the 3RW restarted if a start command is present at the input.

If you do not want the motor to start automatically, you must integrate suitable additional components, e.g. phase failure or load monitoring devices, into the control and main circuits.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

15.4.2 Control of the 3RW40 in automatic mode

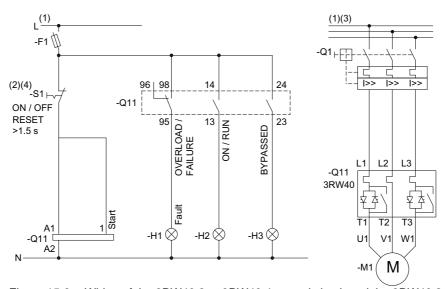


Figure 15-9 Wiring of the 3RW40 2 to 3RW40 4 control circuit and the 3RW40 2 to 3RW40 7 main circuit

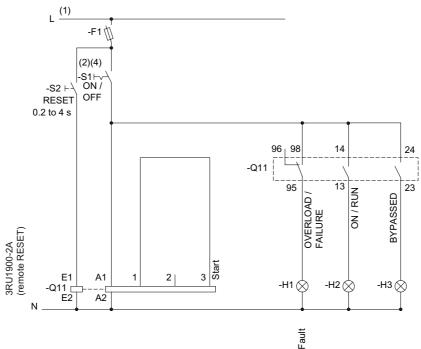


Figure 15-10 Wiring of the 3RW40 5 to 3RW40 7 control circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121].



(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

Note

(4) Idle time until restart.

Owing to the intrinsic protection (3RW), an idle time of at least five minutes must be allowed prior to restarting if the device is switched on and off by means of the control voltage under field conditions.



For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

15.5 Control by PLC

15.5.1 Control of the 3RW30 with 24 V DC by PLC

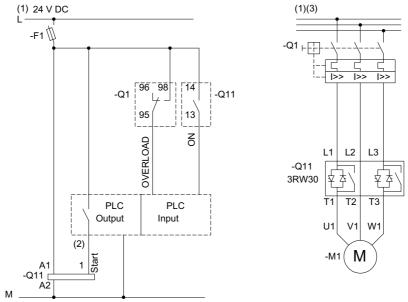


Figure 15-11 Wiring of the 3RW30 control and main circuits

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

WARNING

(2) Automatic restart. Can result in death, serious injury, or property damage.

Faults caused by incorrect control voltage, a missing load, or a phase failure (refer to chapter 3RW30: LEDs and troubleshooting [Page 44]) are automatically reset when the system returns to normal. An automatic restart is initiated and the 3RW restarted if a start command is present at the input.

If you do not want the motor to start automatically, you must integrate suitable additional components, e.g. phase failure or load monitoring devices, into the control and main circuits.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

15.5.2 Control of the 3RW40 by PLC

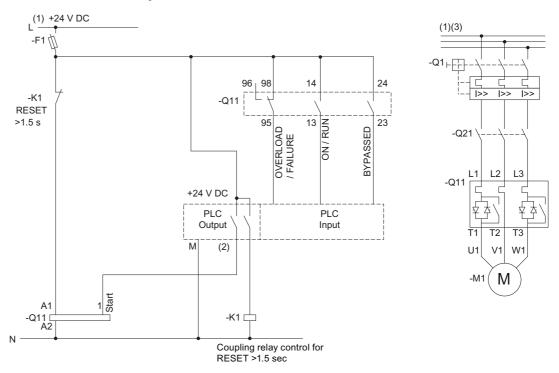


Figure 15-12 Wiring of the 3RW40 2 to 3RW40 4 control circuit (with 24 V control voltage) and the 3RW40 2 to 3RW40 7 main circuit

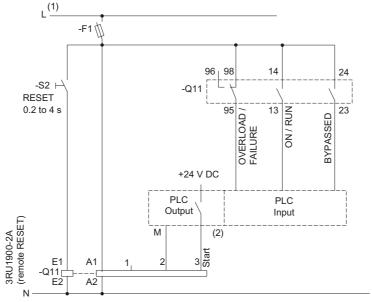


Figure 15-13 Wiring of the 3RW40 5 to 3RW40 7 control circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .



(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

15.6 Control with an optional main / line contactor

15.6.1 Control of the 3RW30 with a main contactor

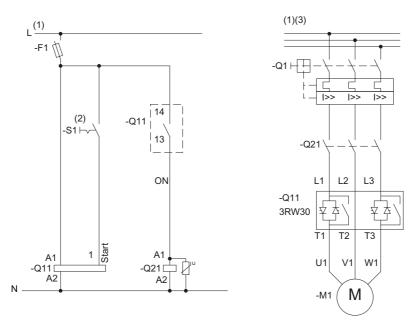


Figure 15-14 Wiring of the 3RW30 control and main circuits

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

MARNING

(2) Automatic restart. Can result in death, serious injury, or property damage.

Faults caused by incorrect control voltage, a missing load, or a phase failure (refer to chapter 3RW30: LEDs and troubleshooting [Page 44]) are automatically reset when the system returns to normal. An automatic restart is initiated and the 3RW restarted if a start command is present at the input.

If you do not want the motor to start automatically, you must integrate suitable additional components, e.g. phase failure or load monitoring devices, into the control and main circuits.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

15.6.2 Control of the 3RW40 with a main contactor

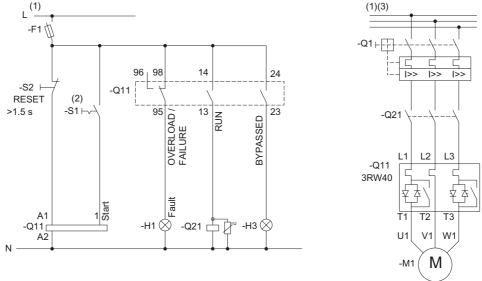


Figure 15-15 Wiring of the 3RW40 2 to 3RW40 4 control circuit and the 3RW40 2 to 3RW40 7 main circuit

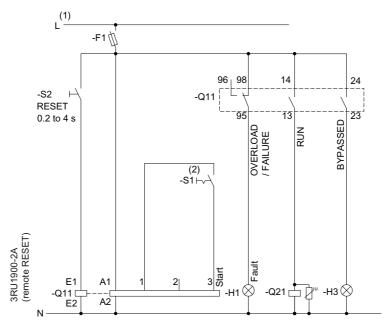


Figure 15-16 Wiring of the 3RW40 5 to 3RW40 7 control circuit

Note

If a soft stop is required, the function of output 13/14 must be reparameterized to "RUN" (refer to Commissioning the 3RW40 [Page 98]).

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .



(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

15.7 Reversing circuit

15.7.1 3RW30 reversing circuit

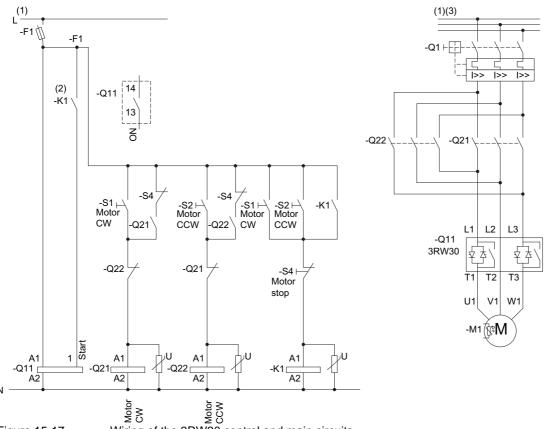


Figure 15-17 Wiring of the 3RW30 control and main circuits

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

WARNING

(2) Automatic restart. Can result in death, serious injury, or property damage.

Faults caused by incorrect control voltage, a missing load, or a phase failure (refer to chapter 3RW30: LEDs and troubleshooting [Page 44]) are automatically reset when the system returns to normal. An automatic restart is initiated and the 3RW restarted if a start command is present at the input.

If you do not want the motor to start automatically, you must integrate suitable additional components, e.g. phase failure or load monitoring devices, into the control and main circuits.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

3RW40 reversing circuit 15.7.2

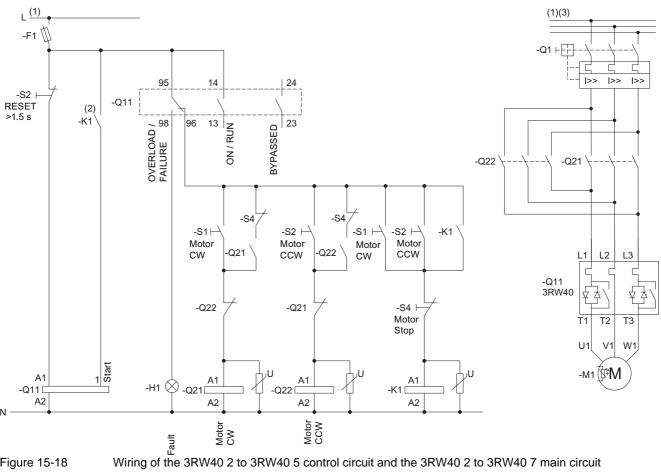


Figure 15-18

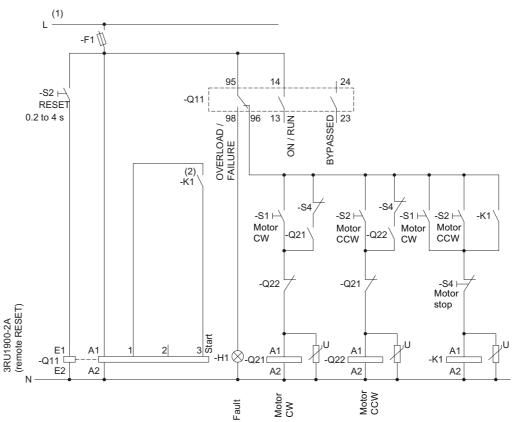


Figure 15-19 Wiring of the 3RW40 5 to 3RW40 7 control circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .



WARNING

(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

NOTICE

No soft stop possible. Set the ramp-down time to 0 s with the potentiometer.

15.8 Control of a magnetic parking brake

15.8.1 3RW30 motor with magnetic parking brake

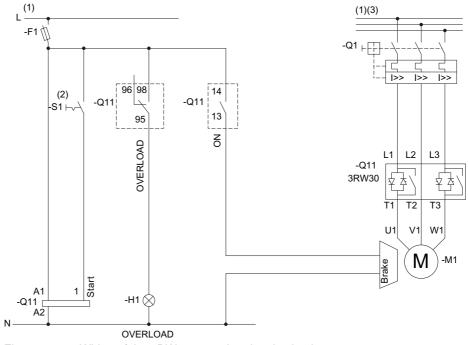


Figure 15-20 Wiring of the 3RW30 control and main circuits

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

MARNING

(2) Automatic restart. Can result in death, serious injury, or property damage.

Faults caused by incorrect control voltage, a missing load, or a phase failure (refer to chapter 3RW30: LEDs and troubleshooting [Page 44]) are automatically reset when the system returns to normal. An automatic restart is initiated and the 3RW restarted if a start command is present at the input.

If you do not want the motor to start automatically, you must integrate suitable additional components, e.g. phase failure or load monitoring devices, into the control and main circuits.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

3RW40 2 to 3RW40 4, control of a motor with a magnetic parking brake 15.8.2

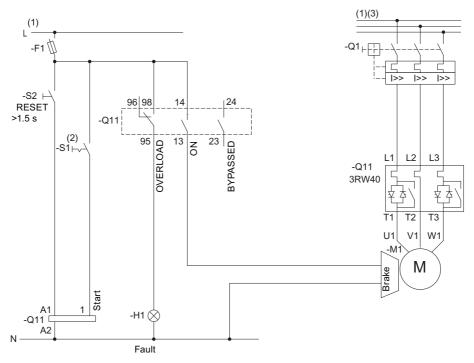


Figure 15-21 Wiring of the 3RW40 2 to 3RW40 4 control / main circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121].



WARNING

(2) Automatic restart.

Can result in death, serious injury, or property damage.

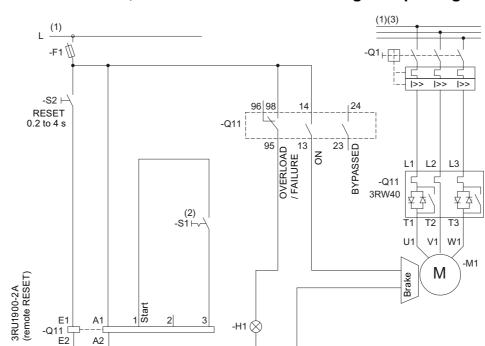
The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

NOTICE

No soft stop possible. Set the ramp-down time to 0 s with the potentiometer.



15.8.3 3RW40 5 to 3RW40 7, control of a motor with a magnetic parking brake

Figure 15-22 Wiring of the 3RW40 5 to 3RW40 7 control / main circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

Fault



(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

NOTICE

No soft stop possible. Set the ramp-down time to 0 s with the potentiometer.

15.9 Emergency stop

15.9.1 3RW30 emergency stop and 3TK2823 safety relay

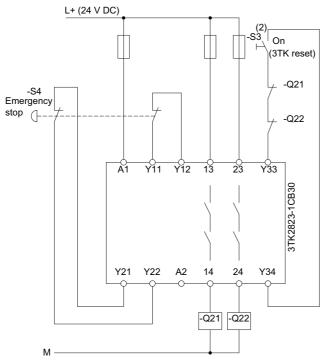


Figure 15-23 Wiring of the emergency stop control circuit and the 3TK28 safety relay

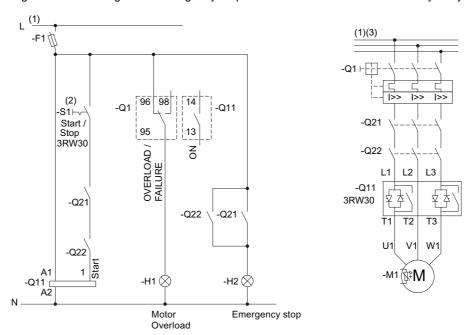


Figure 15-24 Wiring of the 3RW30 control and main circuits

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

▲ WARNING

- (2) Automatic restart. Can result in death, serious injury, or property damage.
- If the 3TK28 is reset

Faults caused by incorrect control voltage, a missing load, or a phase failure (refer to chapter 3RW30: LEDs and troubleshooting [Page 44]) are automatically reset when the system returns to normal.

An automatic restart is initiated and the 3RW restarted if a start command is present at the input.

If you do not want the motor to start automatically, you must integrate suitable additional components, e.g. phase failure or load monitoring devices, into the control and main circuits.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

15.9.2 3RW40 2 to 3RW40 4 emergency stop and 3TK2823 safety relay

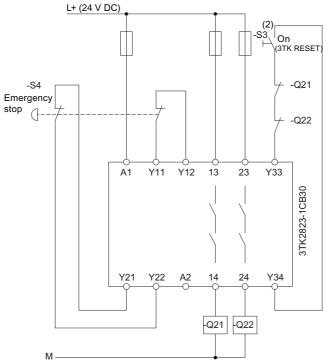


Figure 15-25 Wiring of the emergency stop control circuit and the 3TK28 safety relay

15.9 Emergency stop

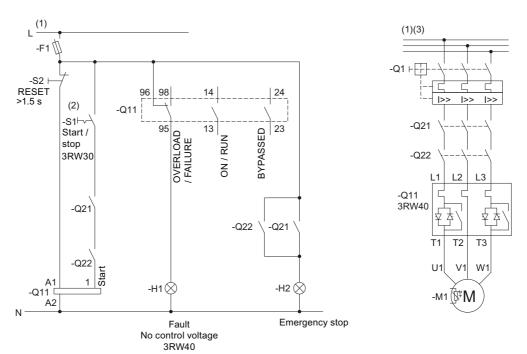


Figure 15-26 Wiring of the 3RW40 2 to 3RW40 4 control circuit and the 3RW40 2 to 3RW40 7 main circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .



(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command (3TK or 3RW) if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

NOTICE

If the soft stop function is set (ramp-down time potentiometer set to >0 s) and the emergency stop circuit is tripped, a "Missing load voltage, phase failure / missing load" fault may be indicated on the soft starter. In this case, the soft starter must be reset according to the selected RESET MODE.

15.9.3 3RW40 5 to 3RW40 7 emergency stop and 3TK2823 safety relay

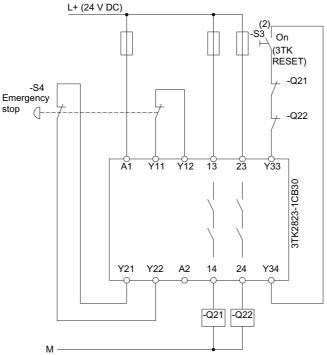


Figure 15-27 Wiring of the emergency stop control circuit and the 3TK28 safety relay

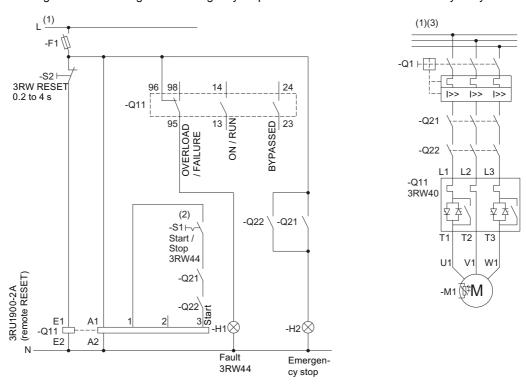


Figure 15-28 Wiring of the 3RW40 5 to 3RW40 7 control circuit and the 3RW40 2 to 3RW40 7 main circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

Λ

WARNING

(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command (3TK or 3RW) if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

NOTICE

If the soft stop function is set (ramp-down time potentiometer set to >0 s) and the emergency stop circuit is tripped, a "Missing load voltage, phase failure / missing load" fault may be indicated on the soft starter. In this case, the soft starter must be reset according to the selected RESET MODE.

15.10 3RW and contactor for emergency starting

15.10.1 3RW30 and contactor for emergency starting

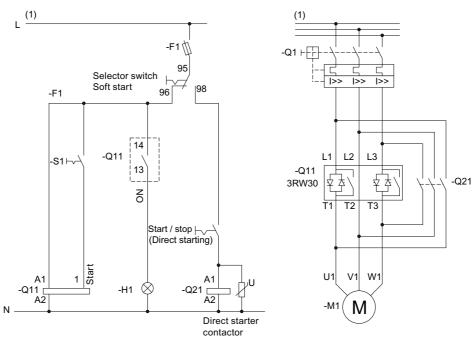


Figure 15-29 Wiring of the 3RW30 control and main circuits

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121].

WARNING

(2) Automatic restart. Can result in death, serious injury, or property damage.

Faults caused by incorrect control voltage, a missing load, or a phase failure (refer to Troubleshooting chapter) are automatically reset when the system returns to normal. An automatic restart is initiated and the 3RW restarted if a start command is present at the input. If you do not want the motor to start automatically, you must integrate suitable additional components, e.g. phase failure or load monitoring devices, into the control and main circuits.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

15.10.2 3RW40 and contactor for emergency starting

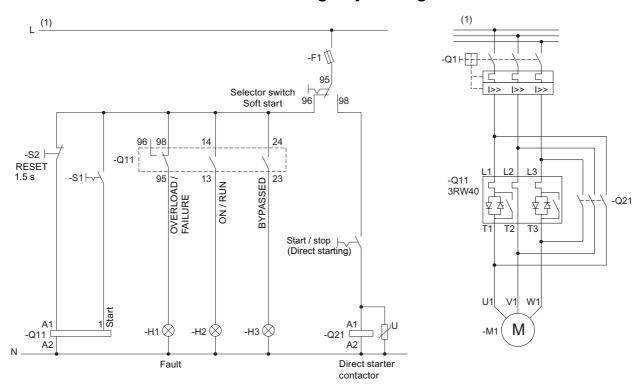


Figure 15-30 Wiring of the 3RW40 2 to 3RW40 4 control circuit and the 3RW40 2 to 3RW40 7 main circuit

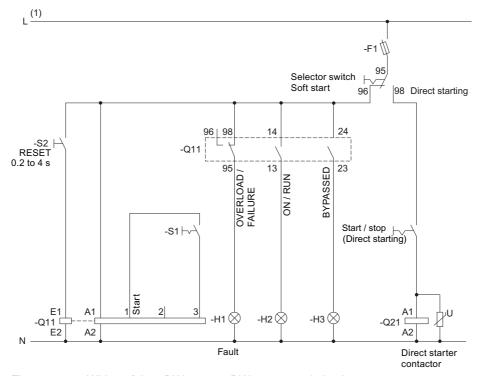


Figure 15-31 Wiring of the 3RW40 5 to 3RW40 7 control circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121].



WARNING

(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

15.11 Dahlander / multispeed motor

15.11.1 3RW30 and Dahlander motor starting

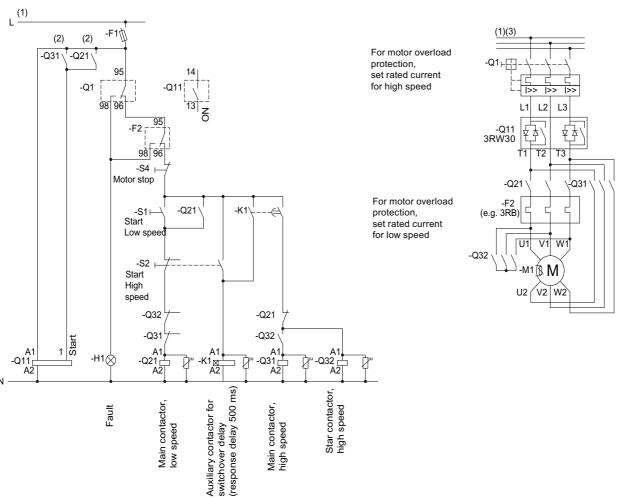


Figure 15-32 Wiring of the 3RW30 control and main circuits

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .



(2) Automatic restart. Can result in death, serious injury, or property damage.

Faults caused by incorrect control voltage, a missing load, or a phase failure (refer to chapter 3RW30: LEDs and troubleshooting [Page 44]) are automatically reset when the system returns to normal. An automatic restart is initiated and the 3RW restarted if a start command is present at the input.

If you do not want the motor to start automatically, you must integrate suitable additional components, e.g. phase failure or load monitoring devices, into the control and main circuits.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

15.11.2 3RW40 2 to 3RW40 4 and Dahlander motor starting

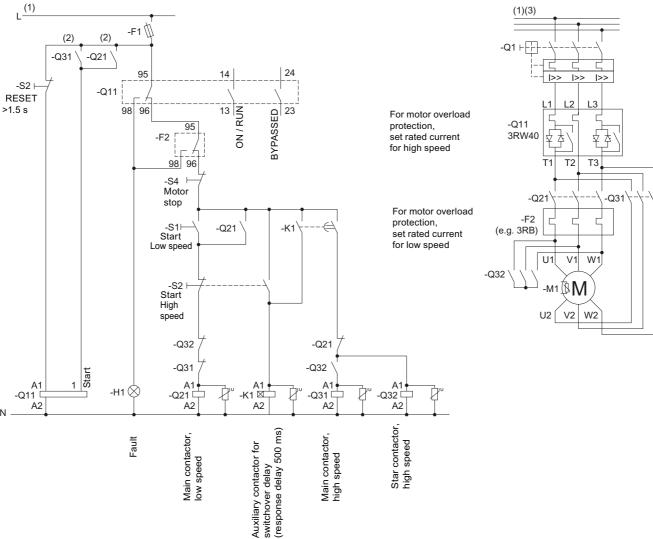


Figure 15-33 Wiring of the 3RW40 2 to 3RW40 4 control circuit and the 3RW40 2 to 3RW40 7 main circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .

Λ

WARNING

(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

For the optional thermistor motor protection evaluation, refer to Typical circuit for the optional thermistor motor protection evaluation [Page 167].

NOTICE

No soft stop possible. Set the ramp-down time to 0 s with the potentiometer.

15.11.3 3RW40 5 to 3RW40 7 and Dahlander motor starting

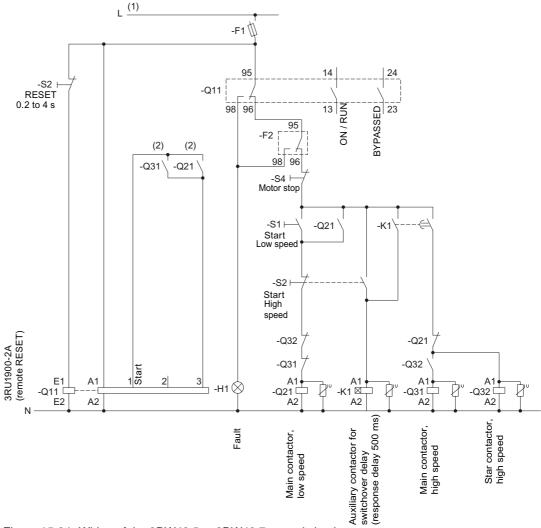


Figure 15-34 Wiring of the 3RW40 5 to 3RW40 7 control circuit

15.11 Dahlander / multispeed motor

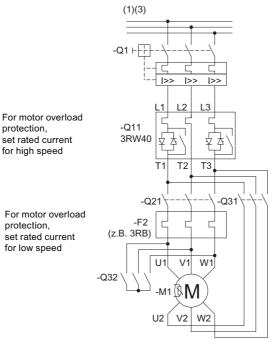


Figure 15-35 Wiring of the 3RW40 5 to 3RW40 7 main circuit

(1) For the permissible values for the main and control voltage (dependent on the MLFB), refer to chapter Technical data [Page 121] .



(2) Automatic restart.

Can result in death, serious injury, or property damage.

The start command (e.g. issued by the PLC or switch S1) must be reset prior to issuing a RESET command because the motor attempts to restart again automatically following this RESET command if a start command is still present. This particularly applies if the motor protection has tripped. For safety reasons, you are advised to integrate the group fault output (terminals 95 and 96) in the controller.

(3) Alternatively, the motor feeder can be assembled as a fuseless or fused version with type of coordination 1 or 2. For the assignment of fuses and switching devices, refer to chapter Technical data [Page 121]

NOTICE

No soft stop possible. Set the ramp-down time to 0 s with the potentiometer.

Accessories 16

16.1 Box terminal blocks for soft starters

	For soft starter type	Size	Version	Order No.
Box terminal blocks	for soft starters for roun	d and ribbon cables		
Libit billion	3RW40 5.	S6	• Max. 70 mm ²	3RT19 55-4G
			 Max. 120 mm² 	3RT19 56-4G
	3RW40 7.	S12	• Max. 240 mm ²	3RT19 66-4G

16.2 Auxiliary conductor terminals

	For soft starter type	Size	Order No.					
Auxiliary conductor terminals, 3-pole								
	3RW30 4. 3RW40 4.	S3	3RT19 46-4F					

16.3 Covers for soft starters

	For soft starter type	Size	Order No.					
Terminal covers for bo	ox terminals							
A harman	Additional touch protection	Additional touch protection to be fitted at the box terminals (2 units required per device)						
	3RW30 3.	S2	3RT19 36-4EA2					
a calca	3RW40 3.							
SHAPEN SHAPEN	3RW30 4.	S3	3RT19 46-4EA2					
	3RW40 4.							
	3RW40 5.	S6	3RT19 56-4EA2					
	3RW40 7.	S12	3RT19 66-4EA2					
Terminal covers for ca	ble lug and busbar connections	S						
and the same of th	For complying with the pha (2 units required per conta		touch protection if box terminal is removed					
1 1 1	3RW30 4.	S3	3RT19 46-4EA1					
all dela	3RW40 4.							
	3RW40 5.	S6	3RT19 56-4EA1					
	3RW40 7.	S12	3RT19 66-4EA1					

	For soft starter type	Size	Order No.
Sealing covers			
	3RW40 2 to 3RW40 4.	S0, S2, S3	3RW49 00-0PB10
	3RW40 5. and	S6	3RW49 00-0PB00
	3RW40 7	S12	

16.4 Modules for RESET

	For soft starter type	Size	ersion	Order No.			
Modules for rem	ote RESET, electrical						
	Operating range 0.85 to 1.1 x Us, Power consumption AC 80 VA, DC 70 W, ON time 0.2 s to 4 s, Switching frequency 60/h						
	3RW40 5. and	S6,	AC/DC 24 V 30 V	3RU19 00-2AB71			
	3RW40 7.	S12	AC/DC 110 V 127 V	3RU19 00-2AF71			
			AC/DC 220 V 250 V	3RU19 00-2AM71			
Mechanical RES	ET, comprising						
ál.	3RW40 5. and 3RW40 7.	S6,	Resetting plunger, holder, and former	3RU19 00-1A			
		S12	Suitable pushbutton IP65, 22 mm dian 12 mm stroke	neter, 3SB30 00-0EA11			
			Extension plunger	3SX13 35			
Cable releases v	vith holder for RESET						
-10-10-1	For 6.5 mm diameter l	noles i	ne control panel; max. control panel thick	ness 8 mm			
	3RW40 5. and	S6,	Length 400 mm	3RU19 00-1B			
	3RW40 7.	S12	Length 600 mm	3RU19 00-1C			

Note

Remote RESET is already integrated in the 3RW40 2. to 3RW40 4. soft starters.

16.5 Link modules to 3RV10 motor starter protectors

	For soft starter type	Size	Motor starter protector size	Order No.
Link modules to 3	RV10 motor starter protect	ors		
	3RW30 13, 3RW30 14, 3RW30 16, 3RW30 17, 3RW30 18	S00	S0	3RA19 21-1A
	3RW30 26 3RW40 24 3RW40 26	S0	S0	3RA19 21-1A
•	3RW30 36 3RW40 36	S2	S2	3RA19 31-1A
	3RW30 46, 3RW30 47	S3	S3	3RA19 41-1A
	3RW40 46, 3RW40 47			

16.6 Link modules to 3RV20 motor starter protectors

	For soft starter type	Size	Motor starter protector size	Order No.
Link modules to 3	RV20 motor starter protect	tors ¹⁾		
MEMILIA A	With screw terminals	i		
	3RW30 1.	S00	S00	3RA29 21-1BA00
	3RW30 2.	S0	S0	3RA29 21-1BA00
, , ,	3RW40 2.	S0	S0	3RA29 21-1BA00
	With spring-loaded term	minals		
	3RW30 1.	S00	S00	3RA29 11-2GA00
	3RW30 2.	S0	S0	3RA29 21-2GA00
	3RW40 2	S0	S0	3RA29 21-2GA00

¹⁾ Size S0 can be used up to 32 A.

16.7 Optional fan to increase the switching frequency (3RW40 2. to 3RW40 4.).

16.7 Optional fan to increase the switching frequency (3RW40 2. to 3RW40 4.).

	For soft starter type	Size	Order No.
Fan (to increase th	e switching frequency and for devi	ce mounting in posit	ions different from the normal position)
	3RW40 2.	S0	3RW49 28-8VB00
	3RW40 3., 3RW40 4	S2, S3	3RW49 47-8VB00

16.8 Spare parts for fans (3RW40 5., 3RW40 7.)

For soft starter type	Size	Version Rated control supply voltage U _s	Order No.
3RW40 5BB3.	S6	115 V AC	3RW49 36-8VX30
3RW40 5BB4.	S6	230 V AC	3RW49 36-8VX40
3RW40 7BB3.	S12	115 V AC	3RW47 36-8VX30
3RW40 7BB4.	S12	230 V AC	3RW47 36-8VX40

16.9 Operating instructions

For soft starter type	Size	Order No.				
Operating instructions for soft starters						
3RW30 1. to 3RW30 4.	S00 to S3	3ZX10 12-0RW30-2DA1				
3RW40 2. to 3RW40 4.	S0 to S3	3ZX10 12-0RW40-1AA1				
3RW40 5., 3RW40 7.	S6 , S12	3ZX10 12-0RW40-2DA1				

Note

The operating instructions are included in the scope of supply.

Appendix

A.1 Configuration data

Configuration data

Siemens AG

Technical Support Low-Voltage Control Systems

Phone: +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: Mains frequency: Hz Rated current: Α Starting current: Α Rated speed: rpm Nm Rated torque: Breakdown torque: Nm

Speed / torque characteristic curve

Mass moment of inertia:

(The speed increments of the value pairs do not have to be equal)

n _M 1/m						"n _{syn} "
M_{M}/M_{B}						

Speed / current characteristic curve

(The speed increments of the value pairs do not have to be equal)

n _M 1/m			"n _{syn} "
I _M / I _B			

kg*m2

A.1 Configuration data

		1. Loa	d data										
		Load type (e.g. pump, mill etc.):											
		Rated speed: Rated torque or rated output Mass moment of inertia (load-specific)								rpm Nm or kW			
										kg*m²			
		Mass moment of inertia (motor-specific)							kg*m ²				
					. (N	.g III		
		Speed	/ torque	characte	eristic cur	ve							
		(The s	peed inc	rements	of the va	lue pairs	do not h	ave to be	e equal)				
ո _L 1/m												"n _{syn} "	
И _L / М _В													
		1. Sta	rt conditi	ons									
	Starting frequency									Sta	ırts		
		Switch cycles	-	Rampup	time								
				Operatin	ig time								
				Idle time	:								
				Ramp-de	own time	:							
		Ambie	ent temp	erature						°C			
							Ye	s	Valu	ie			
		Starting current limitation?											
		Starting current limitation? Acceleration torque limitation?											
	Maximum ramp-up time?												
		1 Dor	sonal de	toilo									
		_											
			ame, firs										
		•											
			de, town	•									
		Counti	y										

e-mail:

A.2 Table of parameters used

You can document your parameter settings in the table below.

	nistor	Mixon							
	Thermistor	ЭТЯ	×						
	Output ON / RUN	ВЛИ	×						
	Outp ON/	NO							
	RESET MODE LED	Manual AUTO Remote							
		DTO F	×						
		lanual Al							
3RW40 parameters	CLASS value	10 OFF	10 class	STRYES	STAND SERVICE	STANS S	CLASS	CLASS S	CLASS S
3RW40 p	Factor le limit value	x e c c c c c c c c c c c c c c c c c c	3x72A	1 1 1 1 1 1 1 1 1	ر اا او المراقب	4 ll _e ²⁸ 28 A A A A A A A A A A A A A A A A A A		4 De 30 A A A A A A A A A A A A A A A A A A	d D _e ≥ 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2
	le motor A	- e 28 29 A 29 A		ς η _ν ε ε ε ε ε ε ε ε ε ε ε ε ε ε ε ε ε ε ε	ς η ₀ ³⁰ γ γ γ γ γ γ γ γ γ γ γ γ γ γ γ γ γ γ γ	5 Po ™ 2 S S S S S S S S S S S S S S S S S S	ζ [] ₀ ²	\$ \$\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	The second secon
	t ramp-down s	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	10						
ieters r 3RW40	t ramp-up s	000000000000000000000000000000000000000							
Parameters 3RW30 or 3RW40	U starting %	4000%		e la	en Company	ا ا	e Company	ا ا	e o o o o o o o o o o o o o o o o o o o
	edył WA& belletanl		Pump XYZ 3RW4038-1TB04	3RWB	3RWB	3RWB	3RWB	3RWB	3RWB
	Plant identifier		Pump XYZ						

A.3 Correction sheet

TO FROM (please

complete):

SIEMENS AG Name

A&D CD MM3

Company / Department

92220 Amberg / Germany

Address

Phone

Fax: 0 96 21 / 80-33 37 Fax

System Manual for SIRIUS 3RW30 / 3RW40 soft starters

Have you noticed any errors while reading this manual?

If so, please use this form to tell us about them.

We welcome comments and suggestions for improvement.

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