Motor Starters, Soft Starters and Load Feeders

Introduction

Overview


3RW30


3RW40


3RW44


3RA11


3RA12


3RV19


3RA61

		Order No.	Page
For operation in the control cabinet			
3RW soft starters for standard applications			
	• Application areas - Fans - Building/construction machines - Escalators - Air conditioning systems - Assembly lines - Actuators - Pumps - Presses - Transport systems - Fans - Compressors and coolers		
3RW30 soft starters	• SIRIUS 3RW30 soft starters for soft starting and smooth ramp-down of three-phase asynchronous motors • Performance range of up to 55 kW (at 400 V)	**3RW30**	6/5
3RW40 soft starters	• SIRIUS 3RW40 soft starters with the integral functions - Solid-state motor overload and intrinsic device protection and - Adjustable current limiting For the soft starting and stopping of three-phase asynchronous motors • Performance range of up to 250 kW (at 400 V)	**3RW40**	6/17
3RW soft starters for High-Feature applications			
	• Application areas - Pumps - Compressors - Industrial refrigerating systems - Conveying systems - Machine tools - Fans - Cooling systems - Water transport - Hydraulics - Mills		
3RW44 soft starters	• In addition to soft starting and soft ramp-down, the solid-state SIRIUS 3RW44 soft starters provide numerous functions for higher-level requirements • Performance range - Up to 710 kW (at 400 V) in inline circuit and - Up to 1200 kW (at 400 V) in inside-delta circuit	**3RW44**	6/32
3RA1 load feeders			
	• The 3RA1 fuseless load feeders consist of the 3RV1 motor starter protector and the 3RT1 contactor. The motor starter protector and contactor are prewired and mechanically connected in pre-assembled assembly kits (link modules, wiring kits and standard mounting rail or busbar adapters). The motor starter protector and contactor are mechanically and electrically connected by means of the link module • 4 sizes (S00, S0, S2, S3) • Can be supplied for direct start or reversing duty as - Complete unit or - Single devices for self-assembly		
3RA11 direct-on-line starters for snapping onto standard mounting rails or for screw fixing	• Rated control supply voltage AC 50 Hz 230 V and 24 V DC for 35 mm standard mounting rail or screw fixing	**3RA11**	6/63
3RA11 direct-on-line starters for busbar systems	• Rated control supply voltage AC 50 Hz 230 V and 24 V DC for 40 mm and 60 mm busbar systems	**3RA11**	6/63
3RA12 reversing starters for snapping onto standard mounting rails or for screw fixing	• Rated control supply voltage AC 50 Hz 230 V and 24 V DC for 35 mm standard mounting rail or screw fixing	**3RA12**	6/63
3RA12 reversing starters for busbar systems	• Rated control supply voltage AC 50 Hz 230 V and 24 V DC for 40 mm and 60 mm busbar systems	**3RA12**	6/63
3RV19 infeed system	• Convenient means of energy supply and distribution	**3RV19**	6/79
3RA6 Compact Feeders			
	• Integrated functionality of a circuit breaker, contactor and solid-state overload relay and various functions of optional mountable accessories • Usable for direct starting of standard induction motors up to 32 A		
3RA61 direct-on-line starters	• Up to 15 kW/400 V, weld-free, wide setting range, removable terminals	**3RA61**	6/90
3RA62 reversing starters	• Up to 15 kW/400 V, weld-free, wide setting range, removable terminals	**3RA62**	6/90
Accessories for 3RA6 direct-on-line and reversing starters	• Auxiliary switches, AS-i add-on modules	**3RA69**	6/100
Infeed systems for 3RA6	• Modular expandability, up to 100 A, terminals up to 70 mm^2	**3RA68**	6/103


3RA62


3RA68


3RK1 301


3RK1 304


3RK1 322


3RE10

		Order No.	Page
ET 200S motor starters			
ET 200S motor starters	• Completely factory-wired motor starters for switching and protecting any AC loads, optionally as direct-on-line, reversing or soft starters	**3RK1 301**	6/110
Power modules for ET 200S motor starters	• For supplying and monitoring the auxiliary voltages for motor starters	**3RK1 903-0BA00**	6/117
Terminal modules for ET 200S motor starters	• Mechanical modules in which the motor starter and expansion modules are inserted	**3RK1 903**	6/118
Interface/solid-state modules	• Interface modules, power modules, reserve modules, digital/analog solid-state modules, F power and F solid-state modules, F terminal modules, 4 IQ-Sense sensor module, SSI module, 1 STEP step module, positioning modules, counter modules, terminal modules for power and solid-state modules	**6ES7 1**	LV 1
ET 200S Safety motor starters Solutions local/PROFIsafe			
ET 200S Failsafe motor starters	• High-Feature direct-on-line and reversing starters	**3RK1 301**	6/122
Safety modules local	• For safety category 4 acc. to EN 954-1	**3RK1 903**	6/124
Safety module PROFIsafe	• Sensor and actuator assignment are freely configurable (distributed safety concept)	**3RK1 903**	6/131
For operation in the field, high degree of protection			
ET 200pro motor starters			
ET 200pro motor starters	• Standard and High-Feature	**3RK1 304**	6/136
ET 200pro isolator modules	• With switch disconnector function for safe disconnection	**3RK1 304**	6/139
Safety modules	• Isolator module and 400 V disconnecting module	**3RK1 304**	6/140
Accessories for ET 200pro motor starters	• Interface, expansion and power modules	**6ES7 1**	LV 1
AS-Interface compact starters, 400 V AC			
	• Completely factory-wired load feeders with degree of protection IP65, designed for switching and protecting any type of AC loads, in particular standard induction motors in direct-on-line or reversing duty	**3RK1 322**	6/142
ECOFAST motor starters and soft starters			
3RK1 3 ECOFAST motor starters and soft starters	• Distributed motor starters for PROFIBUS and AS-Interface • Functionality ranges from direct-on-line starters, through reversing starters and soft starters as far as frequency converters	**3RK1 3**	6/148
3RE encapsulated starters			
	• The 3RE1 encapsulated starters are used for switching and for the inverse-time delayed protection of load feeders up to 22 kW at 400 V AC • The starters are available as direct-on-line starters for motors with a single direction of rotation and as reversing starters for motors with two directions of rotation		
3RE10 direct-on-line starters	• Molded-plastic enclosure, degree of protection IP65, including contactor	**3RE10**	6/152
3RE13 reversing starters	• Molded-plastic enclosure, degree of protection IP65, including contactor assembly	**3RE13**	6/152
Accessories	• Molded-plastic enclosure, degree of protection IP65, for direct-on-line and reversing starters	**3RE19**	LV 1
AS-Interface motor starters and soft starters			
IP65/67 motor starters and load feeders			
Motor starters, 24 V DC	• For the lowest performance range up to 70 W, 24 V DC motors and the associated sensor technology can also be directly and locally connected to AS-Interface quickly and easily. Three different versions are available: - Single direct-on-line starters - Double direct-on-line starters - Reversing starters	**3RK1 400-1**	6/159

General data

Overview

The advantages of the SIRIUS soft starters at a glance:

- Soft starting and smooth ramp-down[1)]
- Stepless starting
- Reduction of current peaks
- Avoidance of mains voltage fluctuations during starting
- Reduced load on the power supply network
- Reduction of the mechanical load in the operating mechanism
- Considerable space savings and reduced wiring compared with conventional starters
- Maintenance-free switching
- Very easy handling
- Fits perfectly in the SIRIUS modular system




		SIRIUS 3RW30 Standard applications	SIRIUS 3RW40 Standard applications	SIRIUS 3RW44 High-Feature applications
Rated current up to 40 °C	A	3 ... 106	12.5 ... 432	29 ... 1214
Rated operational voltage	V	200 ... 480	200 ... 600	200 ... 690
Motor rating at 400 V				
• Inline circuit	kW	1.5 ... 55	5.5 ... 250	15 ... 710
• Inside-delta circuit	kW	--	--	22 ... 1200
Ambient temperature	°C	-25 ... +60	-25 ... +60	0 ... +60
Soft starting/ramp-down		✔[1)]	✔	✔
Voltage ramp		✔	✔	✔
Starting/stopping voltage	%	40 ... 100	40 ... 100	20 ... 100
Starting and ramp-down time	s	0 ... 20	0 ... 20	1 ... 360
Torque control		--	--	✔
Starting/stopping torque	%	--	--	20 ... 100
Torque limit	%	--	--	20 ... 200
Ramp time	s	--	--	1 ... 360
Integral bypass contact system		✔	✔	✔
Intrinsic device protection		--	✔	✔
Motor overload protection		--	✔	✔
Thermistor motor protection		--	✔[2)]	✔
Integrated remote RESET		--	✔[3)]	✔
Adjustable current limiting		--	✔	✔
Inside-delta circuit		--	--	✔
Breakaway pulse		--	--	✔
Creep speed in both directions of rotation		--	--	✔
Pump ramp-down		--	--	✔[4)]
DC braking		--	--	✔[4) 5)]
Combined braking		--	--	✔[4) 5)]
Motor heating		--	--	✔
Communication		--	--	With PROFIBUS DP (optional)
External display and operator module		--	--	(optional)
Operating measured value display		--	--	✔
Error logbook		--	--	✔
Event list		--	--	✔
Slave pointer function		--	--	✔
Trace function		--	--	✔[6)]
Programmable control inputs and outputs		--	--	✔
Number of parameter sets		1	1	3
Parameterization software (Soft Starter ES)		--	--	✔
Power semiconductors (thyristors)		2 controlled phases	2 controlled phases	3 controlled phases
Screw terminals		✔	✔	✔
Spring-type terminals		✔	✔	✔
UL/CSA		✔	✔	✔
CE marking		✔	✔	✔
Soft starting under heavy starting conditions		--	--	✔[4)]
Configuring support		Win-Soft Starter, electronic selection slider ruler, Technical Assistance ++49 (0) 911 895 5900		

✔ Function is available; -- Function is not available.

1) Only soft starting available for 3RW30.
2) Optional up to size S3 (device variant).
3) Available for 3RW40 2. to 3RW40 4.; optional for 3RW40 5. and 3RW40 7..
4) Calculate soft starter and motor with size allowance where required.
5) Not possible in inside-delta circuit.
6) Trace function with Soft Starter ES software.

More information can be found on the Internet at http://www.siemens.com/softstarter

Overview

The SIRIUS 3RW30 soft starters reduce the motor voltage through variable phase control and increase it in ramp-like mode from a selectable starting voltage up to mains voltage. During starting, these devices limit the torque as well as the current and prevent the shocks which arise during direct starts or wye-delta starts. In this way, mechanical loads and mains voltage dips can be reliably reduced.

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

The SIRIUS 3RW30 soft starters are characterized above all by their small space requirements. Integrated bypass contacts mean that no power loss has to be taken into the bargain 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.

Various versions of the SIRIUS 3RW30 soft starters are available:

- Standard version for fixed-speed three-phase motors, sizes S00, S0, S2 and S3, with integrated bypass contact system
- Version for fixed-speed three-phase motors in a 22.5 mm enclosure without bypass

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

Function

The space required by the compact SIRIUS 3RW30 soft starter is often only about one third of that required by a contactor assembly for wye-delta starting of comparable rating. This not only saves space in the control cabinet and on the standard mounting rail but also does away completely with the wiring work needed for wye-delta starters. This is notable in particular for higher motor ratings which are only rarely available as fully wired solutions.

At the same time the number of cables from the starter to the motor is reduced from six to three. Compact dimensions, short start-up times, easy wiring and fast commissioning make themselves felt as clear-cut cost advantages.

The bypass contacts of these soft starters are protected during operation by an integrated solid-state arc quenching system. This prevents damage to the bypass contacts in the event of a fault, e. g. brief disconnection of the control voltage, mechanical shocks or life-related component defects on the coil operating mechanism or main contact spring.

The new series of devices comes with the "polarity balancing" control method, which is designed to prevent direct current components in two-phase controlled soft starters. On two-phase controlled soft starters the current resulting from superimposition of the two controlled phases flows in the uncontrolled phase. This results for physical reasons in an asymmetric distribution of the three phase currents during the motor ramp-up. This phenomenon cannot be influenced, but in most applications it is non-critical.

Controlling the power semiconductors results not only in this unbalance, however, but also in the previously mentioned direct current components which can cause severe noise generation on the motor at starting voltages of less than 50 %. The control method used for these soft starters eliminates these direct current components during the ramp-up phase and prevents the braking torque which they can cause.

It creates a motor ramp-up that is uniform in speed, torque and current rise, thus permitting a particularly gentle, two-phase starting of the motors. At the same time the acoustic quality of the starting operation comes close to the quality of a three-phase controlled soft starter. This is made possible by the on-going dynamic harmonizing and balancing of current half-waves of different polarity during the motor ramp-up. Hence the name "polarity balancing".

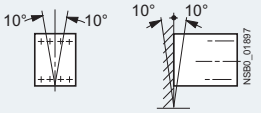
- Soft starting with voltage ramp; the starting voltage setting range U_s is 40 % to 100 % and the ramp time t_R can be set from 0 s to 20 s
- Integrated bypass contact system to minimize power loss
- Setting with two potentiometers
- Simple mounting and commissioning
- Mains voltages at 50/60 Hz, 200 to 480 V
- Two control voltage versions 24 V AC/DC and 110 to 230 V AC/DC
- Wide temperature range from -25 °C to +60 °C
- The built-in auxiliary contact ensures user-friendly control and possible further processing within the system (for status graphs see 6/16)

Technical specifications

Type				3RW30 1., 3RW30 2.		3RW30 3., 3RW30 4.	
Control electronics							
Rated values		Terminal					
Rated control supply voltage		A1/A2	V	24	110 ... 230	24	110 ... 230
• Tolerance			%	±20	-15/+10	±20	-15/+10
Rated control supply current							
• STANDBY			mA	< 50	6	20	< 50
• During pick-up			mA	< 100	15	< 4000	< 500
• ON			mA	< 100	15	20	< 50
Rated frequency			Hz	50/60			
• Tolerance			%	±10			
Control input							
IN				ON/OFF			
Power consumption with version							
• 24 V DC			mA	Approx. 12			
• 110/230 V AC			mA	AC: 3/6; DC: 1.5/3			
Relay outputs							
Output 1	ON	13/14		Operating indication (NO)			
Rated operational current			A	3 AC-15/AC-14 at 230 V,			
			A	1 DC-13 at 24 V			
Protection against overvoltages				Protection by means of varistor through contact			
Short-circuit protection				4 A gL/gG operational class;			
				6 A quick (fuse is not included in scope of supply)			
Operating indications			LEDs	**DEVICE**	**STATE/BYPASSED/ FAILURE**	**DEVICE**	**STATE/BYPASSED/ FAILURE**
Off				Green	Off	Green	Off
Start				Green	Green flashing	Green	Green flashing
Bypass				Green	Green	Green	Green
Error signals							
• 24 V DC: $U < 0.75 \times U_s$ or $U > 1.25 \times U_s$				Off	Red	Off	Red
• 110 ... 230 V AC: $U < 0.75 \times U_s$ or $U > 1.15 \times U_s$				Off	Red	Off	Red
Electrical overloading of bypass (reset by removing IN command)				Yellow	Red	--	--
Missing mains voltage, phase failure, missing load				Green	Red	Green	Red
Device fault				Red	Red	Red	Red

Type				3RW30 1. ... 3RW30 4.
				Factory default
Control times and parameters				
Control times				
Closing time (with connected control voltage)			ms	< 50
Closing time (automatic/mains contactor mode)			ms	< 300
Mains failure bridging time				
Control supply voltage			ms	50
Mains failure response time[1)]				
Load circuit			ms	500
Starting parameters				
• Starting time			s	0 ... 20
• Starting voltage			%	40 ... 100
Start-up detection				No
Operating mode output 13/14				
Rising edge at	Start command			ON
Falling edge at	Off command			

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

Type		3RW30 1.-.BB.4 ... 3RW30 4.-.BB.4
Power electronics		
Rated operational voltage Tolerance	V AC %	200 ... 480 -15/+10
Rated frequency Tolerance	Hz %	50/60 ±10
Uninterrupted 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 height	m	5000 (derating from 1000, see characteristic curves); higher on request
Permissible mounting position (auxiliary fan not available)		
Permissible ambient temperature Operation Storage	 °C °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.

Type		3RW30 13	3RW30 14	3RW30 16	3RW30 17	3RW30 18
Power electronics						
Load rating with rated operational current I_e • Acc. to IEC and UL/CSA[1], for individual mounting, AC-53a						
- At 40 °C	A	3.6	6.5	9	12.5	17.6
- At 50 °C	A	3.3	6	8	12	17
- At 60 °C	A	3	5.5	7	11	14
Power loss						
• In operation after completed starting with uninterrupted rated operational current (40 °C) approx.	W	0.25	0.5	1	2	4
• During starting with 300 % I_M (40 °C)	W	6	13	20	20	29
Permissible rated motor current and starts per hour for normal starting (Class 10)						
- Rated motor current I_M[2], starting time 3 s	A	3.6	6.5	9	12.5	17.6
- Starts per hour[3]	1/h	200	87	50	85	62
- Rated motor current I_M[2], starting time 4 s	A	3.6	6.5	9	12.5	17.6
- Starts per hour[3]	1/h	150	64	35	62	45

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

2) With 300 % I_M.

3) For intermittent duty S4 with ON period = 30 %, T_u = 40 °C, stand-alone installation vertical. The quoted switching frequencies do not apply for automatic mode.

Type		3RW30 26	3RW30 27	3RW30 28
Power electronics				
Load rating with rated operational current I_e • Acc. to IEC and UL/CSA[1], for individual mounting, AC-53a				
- At 40 °C	A	25.3	32.2	38
- At 50 °C	A	23	29	34
- At 60 °C	A	21	26	31
Power loss				
• In operation after completed starting with uninterrupted rated operational current (40 °C) approx.	W	8	13	19
• During starting with 300 % I_M (40 °C)	W	47	55	64
Permissible rated motor current and starts per hour for normal starting (Class 10)				
- Rated motor current I_M[2], starting time 3 s	A	25	32	38
- Starts per hour[3]	1/h	23	23	19
- Rated motor current I_M[2], starting time 4 s	A	25	32	38
- Starts per hour[3]	1/h	15	16	12

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

2) With 300 % I_M.

3) For intermittent duty S4 with ON period = 30 %, T_u = 40 °C, stand-alone installation vertical. The quoted switching frequencies do not apply for automatic mode.

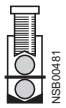
3RW30 for standard applications

Type		3RW30 36	3RW30 37	3RW30 38	3RW30 46	3RW30 47
Power electronics						
Load rating with rated operational current I_e						
• Acc. to IEC and UL/CSA[1], for individual mounting, AC-53a						
- At 40 °C	A	45	65	72	80	106
- At 50 °C	A	42	58	62.1	73	98
- At 60 °C	A	39	53	60	66	90
Power loss						
• In operation after completed starting with uninterrupted rated operational current (40 °C) approx.	W	6	12	15	12	21
• During starting with 300 % I_M (40 °C)	W	79	111	125	144	192
Permissible rated motor current and starts per hour for normal starting (Class 10)						
- Rated motor current I_M[2], starting time 3 s	A	45	63	72	80	106
- Starts per hour[3]	1/h	38	23	22	22	15
- Rated motor current I_M[2], starting time 4 s	A	45	63	72	80	106
- Starts per hour[3]	1/h	26	15	15	15	10

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

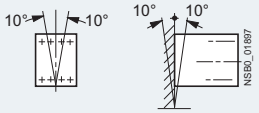
2) With 300 % I_M.

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

Soft starters	Type		3RW30 1.	3RW30 2.	3RW30 3.	3RW30 4.
Conductor cross-sections						
Screw terminals	**Main conductors**					
Front clamping point connected 	• Solid	mm^2	2 x (1 ... 2.5); 2 x (2.5 ... 6) acc. to IEC 60947	2 x (1 ... 2.5); 2 x (2.5 ... 6) acc. to IEC 60947; max. 1 x 10	2 x (1.5 ... 16)	2 x (2.5 ... 16)
	• Finely stranded with end sleeve	mm^2	2 x (1.5 ... 2.5); 2 x (2.5 ... 6)	2 x (1 ... 2.5); 2 x (2.5 ... 6)	1 x (0.75 ... 25)	1 x (2.5 ... 35)
	• Stranded	mm^2	--	--	1 x (0.75 ... 35)	1 x (4 ... 70)
	• AWG cables					
	- Solid	AWG	2 x (16 ... 12)	2 x (16 ... 12)		
	- Solid or stranded	AWG	2 x (14 ... 10)	2 x (14 ... 10)	1 x (18 ... 2)	1 x (10 ... 2/0)
	- Stranded	AWG	1 x 8	1 x 8	--	--
Rear clamping point connected	• Solid	mm^2	--	--	2 x (1.5 ... 16)	2 x (2.5 ... 16)
	• Finely stranded with end sleeve	mm^2	--	--	1 x (1.5 ... 25)	1 x (2.5 ... 50)
	• Stranded	mm^2	--	--	1 x (1.5 ... 35)	1 x (10 ... 70)
	• AWG cables					
	- Solid or stranded	AWG	--	--	1 x (16 ... 2)	1 x (10 ... 2/0)
Both clamping points connected	• Solid	mm^2	--	--	2 x (1.5 ... 16)	2 x (2.5 ... 16)
	• Stranded	mm^2	--	--	2 x (1.5 ... 25)	2 x (10 ... 50)
	• Finely stranded with end sleeve	mm^2	--	--	2 x (1.5 ... 16)	2 x (2.5 ... 35)
	• AWG cables					
	- Solid or stranded	AWG	--	--	2 x (16 ... 2)	2 x (10 ... 1/0)
	• Tightening torque	NM lb.in	2 ... 2.5 18 ... 22	2 ... 2.5 18 ... 22	4.5 40	6.5 58
	Tools		PZ 2	PZ 2	PZ 2	Allen screw 4 mm
	Degree of protection		IP20	IP20	IP20 (IP00 terminal compartment)	IP20 (IP00 terminal compartment)
Spring-type terminals	**Main conductors**					
	• Solid	mm^2	1 ... 4	1 ... 10	--	--
	• Finely stranded with end sleeve	mm^2	1 ... 2.5	1 ... 6, end sleeves without plastic collar	--	--
	• AWG cables					
	- Solid or stranded (finely stranded)	AWG	16 ... 14	16 ... 10	--	--
	- Stranded	AWG	16 ... 12	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 acc. to DIN 46234 or max. 20 mm wide					
	- Stranded	mm^2	--	--	--	2 x (10 ... 70)
	- Finely stranded	mm^2	--	--	--	2 x (10 ... 50)
	• AWG cables, solid or stranded	AWG	--	--	--	2 x (7 ... 1/0)

Soft starters	Type		3RW30 1. ... 3RW30 4.
Conductor cross-sections			
Auxiliary conductors (1 or 2 conductors can be connected)**:**			
	Screw terminals		
	• Solid	mm^2	2 x (0.5 ... 2.5)
	• Finely stranded with end sleeve	mm^2	2 x (0.5 ... 1.5)
	• AWG cables		
	- Solid or stranded	AWG	2 x (20 ... 14)
	- Finely stranded with end sleeve	AWG	2 x (20 ... 16)
	• Terminal screws		
	- Tightening torque	NM lb.in	0.8 ... 1.2 7 ... 10.3
	Spring-type terminals		
	• Solid	mm^2	2 x (0.25 ... 2.5)
	• Finely stranded with end sleeve	mm^2	2 x (0.25 ... 1.5)
	• AWG cables, solid or stranded	AWG	2 x (24 ... 14)

3RW30 for standard applications

Type			3RW30 03
Control electronics			
Rated values			
Rated control supply voltage		V	24 ... 230 AC/DC
• Tolerance		%	± 10
Rated control supply current		mA	25 ... 4
Rated frequency at AC		Hz	50/60
• Tolerance		%	± 10
Starting time		s	0.1 ... 20 (adjustable)
Starting voltage		%	40 ... 100 (adjustable)
Ramp-down time		s	0 ... 20 (adjustable)
Power electronics			
Rated operational voltage		V AC	200 ... 400
Tolerance		%	± 10
Rated frequency		Hz	50/60
Tolerance		%	±10
Uninterrupted duty (% of I_e)		%	100
Minimum load[1] (% of I_e); at 40 °C		%	9
Maximum conductor length between soft starter and motor		m	100[2]
Degree of protection acc. to IEC 60529			IP20 (IP00 terminal compartment)
Permissible installation height		m	5000 (derating from 1000, see characteristic curves); higher on request
Permissible mounting position			
Permissible ambient temperature			
Operation		°C	-25 ... +60; (derating from +40)
Storage		°C	-40 ... +80
Load rating with rated operational current I_e			
• Acc. to IEC and UL/CSA[1], for individual mounting, AC-53a			
- At 40 °C		A	3
- At 50 °C		A	2.6
- At 60 °C		A	2.2
• Acc. to IEC and UL/CSA[1], for butt-mounting, AC-53a			
- At 40 °C		A	2.6
- At 50 °C		A	2.2
- At 60 °C		A	1.8
Power loss			
• In operation after completed starting with uninterrupted rated operational current (40 °C) approx.		W	6.5
• At utilization of max. switching frequency		W	3
Permissible starts per hour			
• For intermittent duty S4, T_u = 40 °C, stand-alone installation vertical		1/h	1500
• ON period = 70 %		% I_e/s	300/0.2
Conductor cross-sections			
Screw terminals (1 or 2 conductors connectable) For standard screwdriver size 2 and Pozidriv 2	• **Main conductors**		
	- Solid	mm²	1 x (0.5 ... 4); 2 x (0.5 ... 2.5)
	- Finely stranded with end sleeve	mm²	1 x (0.5 ... 2.5); 2 x (0.5 ... 1.5)
	- Stranded	mm²	--
	- AWG cables, solid or stranded	AWG	2 x (20 ... 14)
	- Terminal screws		M3, PZ2
	- Tightening torque	NM	0.8 ... 1.2
		lb.in	7.1 ... 8.9
	• **Auxiliary conductors**		
	- Solid	mm²	1 x (0.5 ... 4); 2 x (0.5 ... 2.5)
	- Finely stranded with end sleeve	mm²	1 x (0.5 ... 2.5); 2 x (0.5 ... 1.5)
	- AWG cables, solid or stranded	AWG	2 x (20 ... 14)
	- Terminal screws		M3, PZ2
	- Tightening torque	NM	0.8 ... 1.2
		lb.in	7 ... 8.9
Spring-type terminals	**Main and auxiliary conductors**		
	• Solid	mm²	2 x (0.25 ... 1.5)
	• Finely stranded with end sleeve	mm²	2 x (0.25 ... 1)
	• AWG cables, solid or stranded	mm²	2 x (24 ... 16)

[1] The rated motor current (specified on the motor's name plate) should at least amount to the specified percentage of the SIRIUS soft starter unit's rated operational current I_e.

[2] If this value is exceeded, problems with line capacities may arise, which can result in false firing.

	Standard	Parameters
Electromagnetic compatibility Acc. to EN 60947-4-2		
EMC interference immunity		
Electrostatic discharge (ESD)	EN 61000-4-2	±4 kV contact discharge, ±8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Frequency range: 80 ... 2000 MHz with 80 % at 1 kHz Degree of severity 3: 10 V/m
Conducted RF interference	EN 61000-4-6	Frequency range: 150 kHz ... 80 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 earth
EMC interference emission		
EMC interference field strength	EN 55011	Limit value of Class A at 30 ... 1000 MHz, limit value of Class B for 3RW30 2.; 24 V AC/DC
Radio interference voltage	EN 55011	Limit value of Class A at 0.15 ... 30 MHz, limit value of Class B for 3RW30 2.; 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		Not available[1)] Not required for 3RW30 1. and 3RW30 2.; required for 3RW30 3. and 3RW30 4. (see Table)

[1)] 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.

Soft starter type	Rated current	Recommended filters[1)]		
	Soft starters	Voltage range 200 ... 480 V		
		Filter type	Rated current filters	Terminals
	A		A	mm^2
3RW30 36	45	4EF1512-1AA10	50	16
3RW30 37	63	4EF1512-2AA10	66	25
3RW30 38	72	4EF1512-3AA10	90	25
3RW30 46	80	4EF1512-3AA10	90	25
3RW30 47	106	4EF1512-4AA10	120	50

[1)] 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. Filter selection applies under standard conditions: 10 starts per hour, start time 4 s at 300 % I_e.

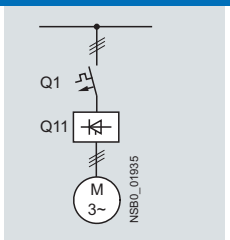
3RW30 for standard applications

Fuse assignment

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

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

Fuseless version

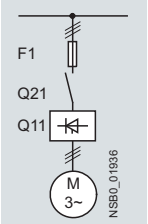


Soft starters ToC 1		Motor starter protectors[1]		
	Rated current	400 V +10 %		Rated current
Q11		Q1	$I_{q\ max}$	
Type	A	Type	kA	A
Type of coordination "1"[2]				
3RW30 03	3	3RV10 11-1EA10	50	4
3RW30 13	3.6	3RV10 21-1FA10	10	5
3RW30 14	6.5	3RV10 21-1HA10	10	8
3RW30 16	9	3RV10 21-1JA10	10	10
3RW30 17	12.5	3RV10 21-1KA10	10	12.5
3RW30 18	17.6	3RV10 21-4BA10	10	20
3RW30 26	25	3RV10 21-4DA10	55	25
3RW30 27	32	3RV10 31-4EA10	55	32
3RW30 28	38	3RV10 31-4FA10	55	40
3RW30 36	45	3RV10 31-4GA10	20	45
3RW30 37	63	3RV10 41-4JA10	20	63
3RW30 38	72	3RV10 41-4KA10	20	75
3RW30 46	80	3RV10 41-4LA10	11	90
3RW30 47	106	3RV10 41-4MA10	11	100

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

[2] The types of coordination are explained in more detail under "3RA1 Fuseless Load Feeders".

Fused version (line protection only)



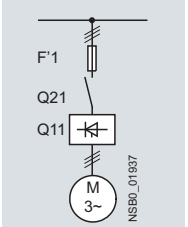
Soft starters ToC 1		Line protection, maximum			Line contactors
	Rated current		Rated current	Size	(optional)
Q11		F1			Q21
Type	A	Type	A		
Type of coordination "1"[1]: I_q = 65 kA at 480 V 10 %					
3RW30 03[2]	3	3NA3 805[3]	20	000	3RT10 15
3RW30 13	3.6	3NA3 803-6	10	000	3RT10 15
3RW30 14	6.5	3NA3 805-6	16	000	3RT10 15
3RW30 16	9	3NA3 807-6	20	000	3RT10 16
3RW30 17	12.5	3NA3 810-6	25	000	3RT10 24
3RW30 18	17.6	3NA3 814-6	35	000	3RT10 26
3RW30 26	25	3NA3 822-6	63	00	3RT10 26
3RW30 27	32	3NA3 824-6	80	00	3RT10 34
3RW30 28	38	3NA3 824-6	80	00	3RT10 35
3RW30 36	45	3NA3 130-6	100	1	3RT10 36
3RW30 37	63	3NA3 132-6	125	1	3RT10 44
3RW30 38	72	3NA3 132-6	125	1	3RT10 45
3RW30 46	80	3NA3 136-6	160	1	3RT10 45
3RW30 47	106	3NA3 136-6	160	1	3RT10 46

[1] The types of coordination are explained in more detail under "3RA1 Fuseless Load Feeders".
The type of coordination "1" refers only to soft starters in combination with the stipulated protective device (motor starter protector/circuit breaker/fuse), not to any additional components in the feeder.

[2] I_q = 50 kA at 400 V.

[3] 3NA3 805-1 (LV HRC00), 5SB2 61 (DIAZED), 5SE2 201-6 (NEOZED).

Fused version with 3NE1 SITOR fuses (semiconductor and line protection)



For matching fuse bases see Catalog LV 1 under "SENTRON Switching and Protection Devices for Power Distribution" —> "Switch Disconnectors", and Catalog ET B1 under "BETA Protecting" —> "SITOR Semiconductor Fuses" or go to www.siemens.com/sitor —>"Products" —>"BETA Protecting"—>"SITOR"

Soft starters		All-range fuses			Line contactors
ToC 2	Rated current		Rated current	Size	(optional)
Q11 Type	A	F'1 Type	A		Q21
Type of coordination "2"[1]: I_q = 65 kA at 480 V 10 %					
3RW30 03[2]	3	3NE1 813-0[3]	16	000	3RT10 15
3RW30 13	3.6	3NE1 813-0	16	000	3RT10 15
3RW30 14	6.5	3NE1 813-0	16	000	3RT10 15
3RW30 16	9	3NE1 813-0	16	000	3RT10 16
3RW30 17	12.5	3NE1 813-0	16	000	3RT10 24
3RW30 18	17.6	3NE1 814-0	20	000	3RT10 26
3RW30 26	25	3NE1 803-0	35	000	3RT10 26
3RW30 27	32	3NE1 020-2	80	00	3RT10 34
3RW30 28	38	3NE1 020-2	80	00	3RT10 35
3RW30 36	45	3NE1 020-2	80	00	3RT10 36
3RW30 37	63	3NE1 820-0	80	000	3RT10 44
3RW30 38	72	3NE1 820-0	80	000	3RT10 45
3RW30 46	80	3NE1 021-0	100	00	3RT10 45
3RW30 47	106	3NE1 022-0	125	00	3RT10 46

1) The types of coordination are explained in more detail under "3RA1 Fuseless Load Feeders".
The type of coordination "2" refers only to soft starters in combination with the stipulated protective device (motor starter protector/circuit breaker/fuse), not to any additional components in the feeder.

2) I_q = 50 kA at 400 V.

3) No SITOR fuse required!
Alternatively: 3NA3 803 (LV HRC00), 5SB2 21 (DIAZED), 5SE2 206 (NEOZED).

ToC 1 Type of coordination "1"

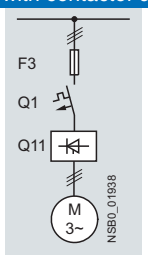
ToC 2 Type of coordination "2"

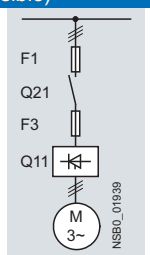
The types of coordination are explained in more detail under "3RA1 Fuseless Load Feeders".

These types of coordination are indicated in the Technical specifications by orange backgrounds.

3RW30 for standard applications

Fused version with 3NE3 SITOR fuses (semiconductor protection by fuse, line and overload protection by motor starter protector; alternatively, installation with contactor and overload relay possible)





For matching fuse bases see Catalog LV 1 under "SENTRON Switching and Protection Devices for Power Distribution" —> "Switch Disconnectors", and Catalog ET B1 under "BETA Protecting" —> "SITOR Semiconductor Fuses" or go to www.siemens.com/sitor —>"Products" —>"BETA Protecting" —>"SITOR"

Soft starters		Semiconductor fuses, minimum			Semiconductor fuses, maximum			Semiconductor fuses, minimum		
ToC 2	Rated current		Rated current	Size		Rated current	Size		Rated current	Size
Q11 Type	A	F3 Type	A		F3 Type	A		F3 Type	A	
Type of coordination "2"[1]: I_q = 65 kA at 480 V 10 %										
3RW30 03[2]	3	--	--	--	--	--	--			
3RW30 13	3.6	--	--	--	--	--	--	3NE4 101	32	0
3RW30 14	6.5	--	--	--	--	--	--	3NE4 101	32	0
3RW30 16	9	--	--	--	--	--	--	3NE4 101	32	0
3RW30 17	12.5	--	--	--	--	--	--	3NE4 101	32	0
3RW30 18	17.6	--	--	--	3NE3 221	100	1	3NE4 101	32	0
3RW30 26	25	--	--	--	3NE3 221	100	1	3NE4 102	40	0
3RW30 27	32	--	--	--	3NE3 222	125	1	3NE4 118	63	0
3RW30 28	38	--	--	--	3NE3 222	125	1	3NE4 118	63	0
3RW30 36	45	--	--	--	3NE3 224	160	1	3NE4 120	80	0
3RW30 37	63	--	--	--	3NE3 225	200	1	3NE4 121	100	0
3RW30 38	72	3NE3 221	100	1	3NE3 227	250	1	--	--	--
3RW30 46	80	3NE3 222	125	1	3NE3 225	200	1	--	--	--
3RW30 47	106	3NE3 224	160	1	3NE3 231	350	1	--	--	--

Soft starters		Semiconductor fuses max.			Semiconductor fuses min.			Semiconductor fuses max.			Cylindrical fuses	
ToC 2	Rated current		Rated current	Size		Rated current	Size		Rated current	Size		Rated current
Q11 Type	A	F3 Type	A		F3 Type	A		F3 Type	A		F3 Type	A
Type of coordination "2"[1]: I_q = 65 kA at 480 V 10 %												
3RW30 03[2]	3	--	--	--	3NE8 015-1	25	00	3NE8 015-1	25	00	3NC1 010	10
3RW30 13	3.6	--	--	--	3NE8 015-1	25	00	3NE8 015-1	25	00	3NC2 220	20
3RW30 14	6.5	--	--	--	3NE8 015-1	25	00	3NE8 015-1	25	00	3NC2 220	20
3RW30 16	9	--	--	--	3NE8 015-1	25	00	3NE8 015-1	25	00	3NC2 220	20
3RW30 17	12.5	--	--	--	3NE8 015-1	25	00	3NE8 018-1	63	00	3NC2 250	50
3RW30 18	17.6	--	--	--	3NE8 003-1	35	00	3NE8 021-1	100	00	3NC2 263	63
3RW30 26	25	3NE4 117	50	0	3NE8 017-1	50	00	3NE8 021-1	100	00	3NC2 263	63
3RW30 27	32	3NE4 118	63	0	3NE8 018-1	63	00	3NE8 022-1	125	00	3NC2 280	80
3RW30 28	38	3NE4 118	63	0	3NE8 020-1	80	00	3NE8 022-1	125	00	3NC2 280	80
3RW30 36	45	3NE4 120	80	0	3NE8 020-1	80	00	3NE8 024-1	160	00	3NC2 280	80
3RW30 37	63	3NE4 121	100	0	3NE8 021-1	100	00	3NE8 024-1	160	00	--	--
3RW30 38	72	--	--	--	3NE8 022-1	125	00	3NE8 024-1	160	00	--	--
3RW30 46	80	--	--	--	3NE8 022-1	125	00	3NE8 024-1	160	00	--	--
3RW30 47	106	--	--	--	3NE8 024-1	160	00	3NE8 024-1	160	00	--	--

Soft starters		Line contactors	Motor starter protectors		Line protection, maximum		
ToC 2	Rated current	(optional)	400 V +10 %	Rated current		Rated current	Size
Q11 Type	A	Q21	Q1 Type	A	F1 Type	A	
Type of coordination "2"[1]: I_q = 65 kA at 480 V 10 %							
3RW30 03[2]	3	3RT10 15	3RV10 11-1EA10	4	3NA3 805[3]	20	000
3RW30 13	3.6	3RT10 15	3RV10 21-1FA10	5	3NA3 803-6	10	000
3RW30 14	6.5	3RT10 15	3RV10 21-1HA10	8	3NA3 805-6	16	000
3RW30 16	9	3RT10 16	3RV10 21-1JA10	10	3NA3 807-6	20	000
3RW30 17	12.5	3RT10 24	3RV10 21-1KA10	12.5	3NA3 810-6	25	000
3RW30 18	17.6	3RT10 26	3RV10 21-1BA10	20	3NA3 814-6	35	000
3RW30 26	25	3RT10 26	3RV10 31-4DA10	25	3NA3 822-6	63	00
3RW30 27	32	3RT10 34	3RV10 31-4EA10	32	3NA3 824-6	80	00
3RW30 28	38	3RT10 35	3RV10 31-4FA10	40	3NA3 824-6	80	00
3RW30 36	45	3RT10 36	3RV10 31-4GA10	45	3NA3 130-6	100	1
3RW30 37	63	3RT10 44	3RV10 41-4JA10	63	3NA3 132-6	125	1
3RW30 38	72	3RT10 45	3RV10 41-4KA10	75	3NA3 132-6	125	1
3RW30 46	80	3RT10 45	3RV10 41-4LA10	90	3NA3 136-6	160	1
3RW30 47	106	3RT10 46	3RV10 41-4MA10	100	3NA3 136-6	160	1

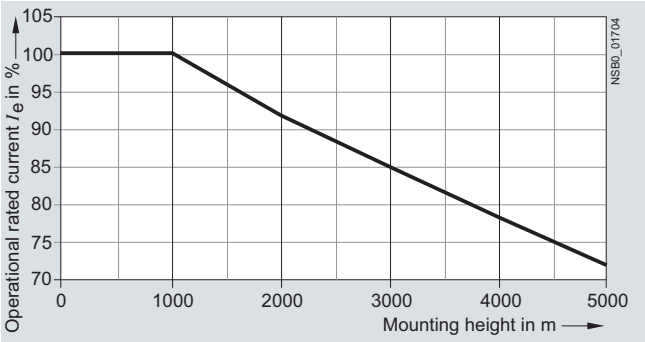
[1] The types of coordination are explained under "3RA1 Fuseless Load Feeders". The type of coordination "2" refers only to soft starters in combination with the stipulated protective device (motor starter protector/circuit breaker/fuse), not to any additional components in the feeder.

[2] I_q = 50 kA at 400 V.

[3] 3NA3 805-1 (LV HRC00), 5SB2 61 (DIAZED).

Characteristic curves

Permissible installation height



At an installation height above 2000 m, the max. permissible operational voltage is reduced to 460 V.

More information

Application examples for normal starting (Class 10)

Normal starting Class 10 (up to 20 s with 300 % $I_{n\ motor}$),
The soft starter rating can be selected to be as high as the rating of the motor used

Application		Conveyor belt	Roller conveyor	Compressor	Small fan	Pump	Hydraulic pump
Starting parameters							
• Voltage ramp and current limiting							
- Starting voltage	%	70	60	50	40	40	40
- Starting time	s	10	10	20	20	10	10

Note:
These tables present sample set values and device sizes. They are intended only for the purposes of information and are not binding. The set values depend on the application in question and must be optimized during commissioning.
The soft starter dimensions should be checked where necessary with the Win-Soft Starter software or with the help of Technical Assistance.

3RW30 for standard applications

Configuration

The 3RW solid-state motor controllers are designed for easy starting conditions. In the event of deviating conditions or increased switching frequency, it may be necessary to choose a larger device. For accurate dimensioning, use the Win-Soft Starter selection and simulation program.

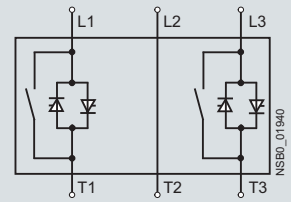
If necessary, an overload relay for heavy starting must be selected where long starting times are involved. PTC sensors are recommended.

In the motor feeder between the SIRIUS 3RW soft starter and the motor, no capacitive elements are permitted (e. g. no reactive-power compensation equipment). In addition, neither static systems for reactive-power compensation nor dynamic PFC (Power Factor Correction) must be operated in parallel during starting and ramp-down of the soft starter. This is important to prevent faults arising on the compensation equipment and/or the soft starter.

All elements of the main circuit (such as fuses, controls and overload relays) should be dimensioned for direct starting, following the local short-circuit conditions. Fuses, controls and overload relays must be ordered separately. Please observe the maximum switching frequencies specified in the technical specifications.

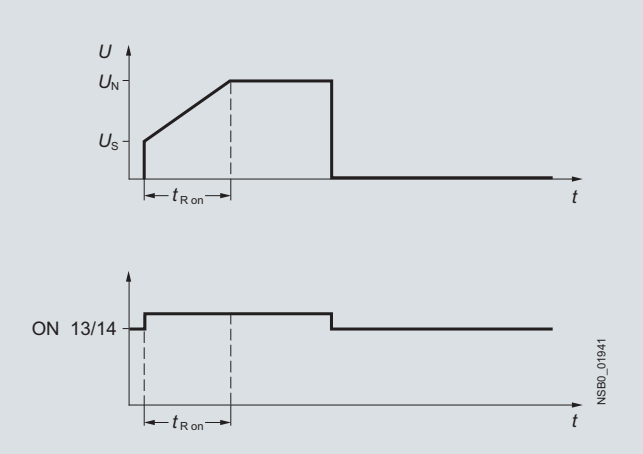
Note:
When induction motors are switched on, voltage drops occur as a rule on starters of all types (direct starters, wye-delta starters, soft starters). The infeed transformer must always be dimensioned such that the voltage dip when starting the motor remains within the permissible tolerance. If the infeed transformer is dimensioned with only a small margin, it is best for the control voltage to be supplied from a separate circuit (independently of the main voltage) in order to avoid the potential switching off of the soft starter.

Schematic circuit diagram



A bypass contact system is already integrated in the 3RW30 soft starter and therefore does not have to be ordered separately.

Status graphs



Win-Soft Starter selection and simulation program

With this software, you can simulate and select all Siemens soft starters, taking into account various parameters such as mains properties, motor and load data, and special application requirements.

The software is a valuable tool, which makes complicated, lengthy manual calculations for determining the required soft starters superfluous.

The Win-Soft Starter selection and simulation program can be downloaded from:
http://www.siemens.com/softstarter > Software

More information can be found on the Internet at:
http://www.siemens.com/softstarter

Overview

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

The SIRIUS 3RW40 soft starters are characterized above all by their small space requirements. Integrated bypass contacts mean that no power loss has to be taken into the bargain 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 adjustable current limiting, motor overload and intrinsic device protection, and optional thermistor motor protection. The higher the motor rating, the more important these functions because they make it unnecessary to purchase and install protection equipment such as overload relays.

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

Thanks to integrated status monitoring 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 failure, missing load, non-permissible tripping time/class setting, thermal overloading or device faults.

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

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

The 3RW40 soft starter sizes S0 to S12 are suitable for the starting of explosion-proof motors with "increased safety" type of protection EEx e.
See "Appendix" –> "Standards and approvals" –> "Type overview of approved devices for potentially explosive areas (ATEX explosion protection)".

Function

The space required by the compact SIRIUS 3RW40 soft starter is often only about one third of that required by a contactor assembly for wye-delta starting of comparable rating. This not only saves space in the control cabinet and on the standard mounting rail but also does away completely with the wiring work needed for wye-delta starters. This is notable in particular for higher motor ratings which are only rarely available as fully wired solutions.

At the same time the number of cables from the starter to the motor is reduced from six to three. Compact dimensions, short start-up times, easy wiring and fast commissioning make themselves felt as clear-cut cost advantages.

The bypass contacts of these soft starters are protected during operation by an integrated solid-state arc quenching system. This prevents damage to the bypass contacts in the event of a fault, e. g. brief disconnection of the control voltage, mechanical shocks or life-related component defects on the coil operating mechanism or main contact spring.

The starting current of particularly powerful operating mechanisms can place an unjustifiable load on the local supply system. Soft starters reduce this starting current by means of their voltage ramp. Thanks to the adjustable current limiting, the SIRIUS 3RW40 soft starter takes even more pressure off the supply system. It leaves the set start ramp during the ramp-up – the ramp gradient is fixed by the starting voltage and the ramp time – as soon as the selected current limit is reached. From this moment the voltage of the soft starter is controlled so that the current supplied to the motor remains constant. This process is ended either by completion of the motor ramp-up or by tripping by the intrinsic device protection or the motor overload protection. As the result of this function the actual motor ramp-up can well take longer than the ramp time selected on the soft starter.

Thanks to the integrated motor overload protection according to IEC 60947-4-2 there is no need of an additional overload relay on the new soft starters. The rated motor current, the setting of the overload tripping time (Class times) and the reset of the motor overload protection function can be adjusted easily and quickly. Using a 4-step rotary potentiometer it is possible to set different overload tripping times on the soft starter. In addition to Class 10, 15 and 20 it is also possible to switch off the motor overload protection if a different motor management control device is to be used for this function, e. g. with connection to PROFIBUS.

Device versions with thermistor motor protection evaluation are available up to a rating of 55 kW (at 400 V). A "Thermoclick" measuring probe can be connected directly, as can a PTC of type A. Thermal overloading of the motor, open circuits and short-circuits in the sensor circuit all result in the direct disconnection of the soft starter. And if ever the soft starter trips, various reset options are available the same as with intrinsic device protection and motor load protection: manually with the reset button, automatically or remotely through brief disconnection of the control voltage.

The new series of devices comes with the "polarity balancing" control method, which is designed to prevent direct current components in two-phase controlled soft starters. On two-phase controlled soft starters the current resulting from superimposition of the two controlled phases flows in the uncontrolled phase. This results for physical reasons in an asymmetric distribution of the three phase currents during the motor ramp-up. This phenomenon cannot be influenced, but in most applications it is non-critical.

Controlling the power semiconductors results not only in this unbalance, however, but also in the previously mentioned direct current components which can cause severe noise generation on the motor at starting voltages of less than 50 %.

The control method used for these soft starters eliminates these direct current components during the ramp-up phase and prevents the braking torque which they can cause. It creates a motor ramp-up that is uniform in speed, torque and current rise, thus permitting a particularly gentle, two-phase starting of the motors. At the same time the acoustic quality of the starting operation comes close to the quality of a three-phase controlled soft starter. This is made possible by the on-going dynamic harmonizing and balancing of current half-waves of different polarity during the motor ramp-up. Hence the name "polarity balancing".

3RW40 for standard applications

As an option the thyristors can also be protected by SITOR semiconductor fuses from short-circuiting so that the soft starter is still functional after a short-circuit (type of coordination 2). Three LEDs are used to indicate the operating state as well as possible errors, e. g. non-permissible tripping time (CLASS setting), mains or phase failure, missing load, thermal overloading or device faults.

- Soft starting with voltage ramp; the starting voltage setting range U_s is 40 to 100 % and the ramp time t_R can be set from 0 to 20 s.
- Smooth ramp-down with voltage ramp; the running down time t_{off} can be set between 0 s to 20 s.
- Solid-state motor overload and intrinsic device protection
- Optional thermistor motor protection (up to size S3)
- Remote reset (integrated up to size S3, optional for size S6 and larger)
- Adjustable current limiting
- Integrated bypass contact system to minimize power loss
- Setting with potentiometers
- Simple mounting and commissioning
- Integrated status monitoring and fault monitoring
- Mains voltages 50/60 Hz, 200 to 600 V
- Various control voltage versions
  - Sizes S0 to S3:
    24 V AC/DC and
    110 to 230 V AC/DC
  - Sizes S6 to S12:
    115 V AC and 230 V AC.
    Control by way of the internal 24 V DC supply and direct control by means of PLC are possible.
- Wide temperature range from -25 to +60 °C
- Built-in auxiliary contacts ensure user-friendly control and possible further processing within the system (for status graphs see page 31).

Technical specifications

Type				3RW40 2.		3RW40 3., 3RW40 4.	
Control electronics							
Rated values		Terminal					
Rated control supply voltage		A1/A2	V	24	110 ... 230	24	110 ... 230
• Tolerance			%	±20	-15/+10	±20	-15/+10
Rated control supply current							
• STANDBY			mA	< 150	< 50	< 200	< 50
• During pick-up			mA	< 200	< 100	< 5000	< 1500
• ON without fan			mA	< 250	< 50	< 200	< 50
• ON with fan			mA	< 300	< 70	< 250	< 70
Rated frequency			Hz	50/60			
• Tolerance			%	±10			
Control inputs							
IN				ON/OFF			
Rated operational current							
• AC			mA	Approx. 12	3/6	Approx. 12	3/6
• DC			mA	Approx. 12	1.5/3	Approx. 12	1.5/3
Relay outputs							
Output 1	ON/RUN mode[1]	13/14		Operating indication (NO)			
Output 2	BYPASSED	23/24		Bypass indication (NO)			
Output 3	OVERLOAD/FAILURE	95/96/98		Overload/error indication (NC/NO)			
Rated operational current			A	3 AC-15/AC-14 at 230 V,			
			A	1 DC-13 at 24 V			
Protection against overvoltages				Protection by means of varistor through contact			
Short-circuit protection				4 A gL/gG operational class; 6 A quick (fuse is not included in scope of supply)			

[1] Factory default: ON mode.

Type				3RW40 5.		3RW40 7.	
Control electronics							
Rated values		Terminal					
Rated control supply voltage		A1/A2	V AC	115	230	115	230
• Tolerance			%	-15/+10		-15/+10	
Rated control supply current STANDBY			mA	15		15	
Rated control supply current ON[1]			mA	440	200	660	360
Rated frequency			Hz	50/60		50/60	
• Tolerance			%	±10		±10	
Control inputs							
IN				ON/OFF			
Rated operational current			mA	Approx. 10 acc. to DIN 19240			
Rated operational voltage			V DC	24 from internal supply dc+ or external DC supply (acc. to DIN 19240) through terminals and IN			
Relay outputs							
Output 1	ON/RUN mode[2]	13/14		Operating indication (NO)			
Output 2	BYPASSED	23/24		Bypass indication (NO)			
Output 3	OVERLOAD/FAILURE	95/96/98		Overload/error indication (NC/NO)			
Rated operational current			A	3 AC-15/AC-14 at 230 V,			
			A	1 DC-13 at 24 V			
Protection against overvoltages				Protection by means of varistor through contact			
Short-circuit protection				4 A gL/gG operational class; 6 A quick (fuse is not included in scope of supply)			

[1] Values for the coil power consumption at +10 % U_n, 50 Hz.

[2] Factory default: ON mode.

Type		3RW40 2., 3RW40 3., 3RW40 4.		
Control electronics				
Operating indications	LEDs	**DEVICE**	**STATE/BYPASSED/FAILURE**	**OVERLOAD**
Off		Green	Off	Off
Start		Green	Green flashing	Off
Bypass		Green	Green	Off
Ramp-down		Green	Green flashing	Off
Alarm signals				
I_e/Class setting not permissible		Green	Not relevant	Red flashing
Start inhibited/thyristors too hot		Yellow flashing	Not relevant	Off
Error signals				
• 24 V: $U < 0.75 \times U_s$ or $U > 1.25 \times U_s$		Off	Red	Off
• 110 ... 230 V: $U < 0.75 \times U_s$ or $U > 1.15 \times U_s$		Off	Red	Off
Non-permissible I_e/Class setting for edge 0 –> 1 on input IN		Green	Red	Red flashing
Motor protection shut-down (overload thermistor)		Green	Off	Red
Thermistor defective (open circuit, short-circuit)		Green	Off	Red flickering
Thermal overloading of the thyristors		Yellow	Red	Off
Missing mains voltage, phase failure, missing load		Green	Red	Off
Device fault		Red	Red	Off

Type		3RW40 5. and 3RW40 7.			
Control electronics					
Operating indications	LEDs	**DEVICE**	**STATE/BYPASSED**	**FAILURE**	**OVERLOAD**
Off		Green	Off	Off	Off
Start		Green	Green flashing	Off	Off
Bypass		Green	Green	Off	Off
Ramp-down		Green	Green flashing	Off	Off
Alarm signals					
I_e/Class setting not permissible		Green	Not relevant	Not relevant	Red flashing
Start inhibited/thyristors too hot		Yellow flashing	Not relevant	Not relevant	Off
Error signals					
$U < 0.75 \times U_s$ or $U > 1.15 \times U_s$		Off	Off	Red	Off
Non-permissible I_e/Class setting for edge 0 –> 1 on input IN		Green	Off	Red	Red flashing
Motor protection shut-down		Green	Off	Off	Red
Thermal overloading of the thyristors		Yellow	Off	Red	Off
Missing mains voltage, phase failure, missing load		Green	Off	Red	Off
Device fault		Red	Off	Red	Off

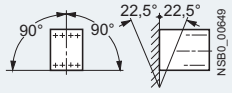
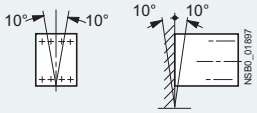
3RW40 for standard applications

Type			3RW40 . .	Factory default
Protection functions				
Motor protection functions				
Trips in the event of			Thermal overloading of the motor	
Trip class to IEC 60947-4-1		Class	10/15/20	10
Phase failure sensitivity		%	> 40	
Overload warning			No	
Thermistor protection acc. to IEC 60947-8, type A/IEC 60947-5-1			Yes[1]	
Reset option after tripping			Manual/automatic/remote reset[2] (MAN/AUTO/REMOTE[2])	
Recovery time		min	5	
Device protection functions				
Trips in the event of			Thermal overloading of the thyristors or bypass[3]	
Reset option after tripping			Manual/automatic/remote reset[2] (MAN/AUTO/REMOTE[2])	
Recovery time				
• During overloading of the thyristors		s	30	
• During overloading of the bypass		s	60	
Control times and parameters				
Control times				
Closing time (with connected control voltage)		ms	< 50	
Closing time (automatic/mains contactor mode)		ms	<300	
Recovery time (closing command in active ramp-down)		ms	100	
Mains failure bridging time				
Control supply voltage		ms	50	
Mains failure response time				
Load circuit		ms	500	
Reclosing lockout after overload trip				
Motor protection trip		min	5	
Device protection trip				
• During overloading of the thyristors		s	30	
• During overloading of the bypass		s	60	
Starting parameters				
Starting time		s	0 ... 20	7.5
Starting voltage		%	40 ... 100	40
Starting current limit			1.3 ... 5 x I_e	5 x I_e
Ramp-down parameters				
Ramp-down time		s	0 ... 20	0
Reset mode parameters (for motor/device protection shut-down)				
Manual reset	LEDs		Off	Off
Automatic reset	LEDs		Yellow	
Remote reset (REMOTE)[2]	LEDs		Green	
Start-up detection			Yes	
Operating mode output 13/14				
Rising edge at	Start command			
Falling edge at	Off command		ON	ON
	Ramp-down end		RUN	

[1] Optional up to size S3 (device variant).

[2] Integrated remote reset (REMOTE) available only for 3RW40 2. to 3RW40 4.; remote reset with 3RU19 accessory module available for 3RW40 5. and 3RW40 7..

[3] Bypass protection up to size S3.

Type		3RW40 2.-..B.4, 3RW40 3.-..B.4, 3RW40 4.-..B.4	3RW40 2.-..B.5, 3RW40 3.-..B.5, 3RW40 4.-..B.5	3RW40 5.-.BB.4, 3RW40 7.-.BB.4	3RW40 5.-.BB.5, 3RW40 7.-.BB.5
Power electronics					
Rated operational voltage Tolerance	V AC %	200 ... 480 -15/+10	400 ... 600 -15/+10	200 ... 460 -15/+10	400 ... 600 -15/+10
Maximum blocking voltage (thyristor)	V AC	1600		1400	1800
Rated frequency Tolerance	Hz %	50/60 ±10			
Uninterrupted duty at 40 °C (% of I_e)	%	115			
Minimum load (% of minimum selectable rated motor current I_M)	%	20 (at least 2 A)			
Maximum cable length between soft starter and motor	m	300			
Permissible installation height	m	5000 (derating from 1000, see characteristic curves); higher on request			
Permissible mounting position					
• With auxiliary fan (for 3RW40 2. ... 3RW40 4.)					
• Without auxiliary fan (for 3RW40 2. ... 3RW40 4.)				-- (fan integrated in the soft starter)	
Permissible ambient temperature Operation Storage	 °C °C	 -25 ... +60; (derating from +40) -40 ... +80			
Degree of protection		IP20 for 3RW40 2.; IP00 for 3RW40 3. and 3RW40 4.		IP00	

Type		3RW40 24	3RW40 26	3RW40 27	3RW40 28
Power electronics					
Load rating with rated operational current I_e					
• Acc. to IEC and UL/CSA[1], for individual mounting, AC-53a					
- At 40 °C	A	12.5	25.3	32.2	38
- At 50 °C	A	11	23	29	34
- At 60 °C	A	10	21	26	31
Smallest adjustable rated motor current I_M For the motor overload protection	A	5	10	17	23
Power loss					
• In operation after completed starting with uninterrupted rated operational current (40 °C) approx.	W	2	8	13	19
• During starting with current limit set to 300 % I_M (40°C)	W	17	47	55	64
Permissible rated motor current and starts per hour					
• **For normal starting (Class 10)**					
- Rated motor current I_M[2], starting time 3 s	A	12.5	25	32	38
- Starts per hour[3]	1/h	50	23	23	19
- Rated motor current I_M[2][4], starting time 4 s	A	12.5	25	32	38
- Starts per hour[3]	1/h	36	15	16	12
• **For heavy starting (Class 15)**					
- Rated motor current I_M[2], starting time 4.5 s	A	11	23	30	34
- Starts per hour[3]	1/h	49	21	18	18
- Rated motor current I_M[2][4], starting time 6 s	A	11	23	30	34
- Starts per hour[3]	1/h	36	14	13	13
• **For heavy starting (Class 20)**					
- Rated motor current I_M[2], starting time 6 s	A	10	21	27	31
- Starts per hour[3]	1/h	47	21	20	18
- Rated motor current I_M[2][4], starting time 8 s	A	10	21	27	31
- Starts per hour[3]	1/h	34	15	14	13

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

[2] Current limit on soft starter set to 300 % I_M.

[3] For intermittent duty S4 with ON period = 30 %, T_u = 40 °C, stand-alone installation vertical. The quoted switching frequencies do not apply for automatic mode.

[4] Maximum adjustable rated motor current I_M, dependent on CLASS setting.

3RW40 for standard applications

Type		3RW40 36	3RW40 37	3RW40 38	3RW40 46	3RW40 47
Power electronics						
Load rating with rated operational current I_e						
• Acc. to IEC and UL/CSA[1], for individual mounting, AC-53a						
- At 40 °C	A	45	63	72	80	106
- At 50 °C	A	42	58	62.1	73	98
- At 60 °C	A	39	53	60	66	90
Smallest adjustable rated motor current I_M						
For the motor overload protection	A	23	26	35	43	46
Power loss						
• In operation after completed starting with uninterrupted rated operational current (40 °C) approx.	W	6	12	15	12	21
• During starting with current limit set to 300 % I_M (40°C)	W	79	111	125	144	192
Permissible rated motor current and starts per hour						
• **For normal starting (Class 10)**						
- Rated motor current I_M[2], starting time 3 s	A	45	63	72	80	106
- Starts per hour[3]	1/h	38	23	22	22	15
- Rated motor current I_M[2)4], starting time 4 s	A	45	63	72	80	106
- Starts per hour[3]	1/h	26	15	15	15	10
• **For heavy starting (Class 15)**						
- Rated motor current I_M[2], starting time 4.5 s	A	42	50	56	70	84
- Starts per hour[3]	1/h	30	34	34	24	23
- Rated motor current I_M[2)4], starting time 6 s	A	42	50	56	70	84
- Starts per hour[3]	1/h	21	24	24	16	17
• **For heavy starting (Class 20)**						
- Rated motor current I_M[2], starting time 6 s	A	38	46	50	64	77
- Starts per hour[3]	1/h	30	31	34	23	23
- Rated motor current I_M[2)4], starting time 8 s	A	38	46	50	64	77
- Starts per hour[3]	1/h	21	22	24	16	16

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

2) Current limit on soft starter set to 300 % I_M.

3) For intermittent duty S4 with ON period = 30 %, T_u = 40 °C, stand-alone installation vertical. The quoted switching frequencies do not apply for automatic mode.

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

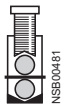
Type		3RW40 55	3RW40 56	3RW40 73	3RW40 74	3RW40 75	3RW40 76
Power electronics							
Load rating with rated operational current I_e							
• Acc. to IEC and UL/CSA[1], for individual mounting, AC-53a							
- At 40 °C	A	134	162	230	280	356	432
- At 50 °C	A	117	145	205	248	315	385
- At 60 °C	A	100	125	180	215	280	335
Smallest adjustable rated motor current I_M							
For the motor overload protection	A	59	87	80	130	131	207
Power loss							
• In operation after completed starting with uninterrupted rated operational current (40 °C) approx.	W	60	75	75	90	125	165
• During starting with current limit set to 350 %[2] 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 current I_M[2], starting time 10 s	A	134	162	230	280	356	432
- Starts per hour[3]	1/h	20	8	14	20	16	17
- Rated motor current I_M[2)4], starting time 20 s	A	134	162	230	280	356	432
- Starts per hour[3]	1/h	7	1.4	3	8	5	5
• **For heavy starting (Class 15)**							
- Rated motor current I_M[2], starting time 15 s	A	134	152	210	250	341	402
- Starts per hour[3]	1/h	11	8	11	13	11	12
- Rated motor current I_M[2)4], starting time 30 s	A	134	152	210	250	341	402
- Starts per hour[3]	1/h	1.2	1.7	1	6	2	2
• **For heavy starting (Class 20)**							
- Rated motor current I_M[2], starting time 20 s	A	124	142	200	230	311	372
- Starts per hour[3]	1/h	12	9	10	10	10	10
- Rated motor current I_M[2)4], starting time 40 s	A	124	142	200	230	311	372
- Starts per hour[3]	1/h	2	2	1	5	1	1

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

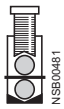
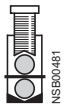
2) Current limit on soft starter set to 350 % I_M.

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

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

Soft starters	Type		3RW40 2.	3RW40 3.	3RW40 4.
Conductor cross-sections					
Screw terminals	**Main conductors**				
Front clamping point connected 	• Solid	mm^2	2 x (1.5 ... 2.5); 2 x (2.5 ... 6) acc. to IEC 60947; max. 1 x 10	2 x (1.5 ... 16)	2 x (2.5 ... 16)
	• With end sleeve	mm^2	2 x (1.5 ... 2.5); 2 x (2.5 ... 6)	1 x (0.75 ... 25)	1 x (2.5 ... 35)
	• Stranded	mm^2	--	1 x (0.75 ... 35)	1 x (4 ... 70)
	• AWG cables				
	- Solid	AWG	2 x (16 ... 12)		
	- Solid or stranded	AWG	2 x (14 ... 10)	1 x (18 ... 2)	2 x (10 ... 1/0)
	- Stranded	AWG	1 x 8	--	--
Rear clamping point connected 	• Solid	mm^2	--	2 x (1.5 ... 16)	2 x (2.5 ... 16)
	• With end sleeve	mm^2	--	1 x (1.5 ... 25)	1 x (2.5 ... 50)
	• Stranded	mm^2	--	1 x (1.5 ... 35)	1 x (10 ... 70)
	• AWG cables				
	- Solid or stranded	AWG	--	1 x (16 ... 2)	2 x (10 ... 1/0)
Both clamping points connected 	• Solid	mm^2	--	2 x (1.5 ... 16)	2 x (2.5 ... 16)
	• With end sleeve	mm^2	--	2 x (1.5 ... 16)	2 x (2.5 ... 35)
	• Stranded	mm^2	--	2 x (1.5 ... 25)	2 x (10 ... 50)
	• AWG cables				
	- Solid or stranded	AWG	--	2 x (16 ... 2)	1 x (10 ... 2/0)
	• Tightening torque	NM lb.in	2 ... 2.5 18 ... 22	4.5 40	6.5 58
	Tools		PZ 2	PZ 2	Allen screw 4 mm
	Degree of protection		IP20	IP20 (IP00 terminal compartment)	IP20 (IP00 terminal compartment)
Spring-type terminals	**Main conductors**				
	• Solid	mm^2	1 ... 10	--	
	• Finely stranded with end sleeve	mm^2	1 ... 6 end sleeves without plastic collar	--	
	• AWG cables				
	- Solid or stranded (finely stranded)	AWG	16 ... 10	--	
	- Stranded	AWG	1 x 8	--	
	Tools		DIN ISO 2380-1A0; 5 x 3	--	
	Degree of protection		IP20	--	
Busbar connections	**Main conductors**				
	• With cable lug acc. to DIN 46234 or max. 20 mm wide				
	- Stranded	mm^2	--		2 x (10 ... 70)
	- Finely stranded	mm^2	--		2 x (10 ... 50)
	• AWG cables, solid or stranded	AWG	--		2 x (7 ... 1/0)

3RW40 for standard applications

Soft starters	Type		3RW40 5.	3RW40 7.
Conductor cross-sections				
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	16 ... 70	70 ... 240
	• Finely stranded without end sleeve	mm^2	16 ... 70	70 ... 240
 NSB00479	• Stranded	mm^2	16 ... 70	95 ... 300
	• 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	6 ... 2/0	3/0 ... 600 kcmil
Rear clamping point connected	• Finely stranded with end sleeve	mm^2	16 ... 70	120 ... 185
	• Finely stranded without end sleeve	mm^2	16 ... 70	120 ... 185
 NSB00480	• Stranded	mm^2	16 ... 70	120 ... 240
	• 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	6 ... 2/0	250 ... 500 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
	• Finely stranded without end sleeve	mm^2	Max. 1 x 50, 1 x 70	Min. 2 x 50; max. 2 x 185
 NSB00481	• Stranded	mm^2	Max. 2 x 70	Max. 2 x 70; max. 2 x 240
	• Ribbon cable conductors (number x width x thickness)	mm	Max. 2 x (6 x 15.5 x 0.8)	Max. 2 x (20 x 24 x 0.5)
	• AWG cables, solid or stranded	AWG	Max. 2 x 1/0	Min. 2 x 2/0 Max. 2 x 500 kcmil
	• Terminal screws		M10 (hexagon socket, A/F4)	M12 (hexagon socket, A/F5)
	- Tightening torque	NM	10 ... 12	20 ... 22
		lb.in	90 ... 110	180 ... 195
Screw terminals	**Main conductors**			
With box terminal			3RT19 56-4G	
Front or rear clamping point connected	• Finely stranded with end sleeve	mm^2	16 ... 120	
	• Finely stranded without end sleeve	mm^2	16 ... 120	
 NSB00479  NSB00480	• Stranded	mm^2	16 ... 120	
	• Ribbon cable conductors (number x width x thickness)	mm	Min. 3 x 9 x 0.8 Max. 6 x 15.5 x 0.8	
	• AWG cables, solid or stranded	AWG	6 ... 250 kcmil	
Both clamping points connected	• Finely stranded with end sleeve	mm^2	Max. 1 x 95, 1 x 120	
	• Finely stranded without end sleeve	mm^2	Max. 1 x 95, 1 x 120	
 NSB00481	• Stranded	mm^2	Max. 2 x 120	
	• Ribbon cable conductors (number x width x thickness)	mm	Max. 2 x (10 x 15.5 x 0.8)	
	• AWG cables, solid or stranded	AWG	Max. 2 x 3/0	
Screw terminals	**Main conductors**			
	Without box terminal/busbar connection			
	• Finely stranded with cable lug	mm^2	16 ... 95[1)]	50 ... 240[2)]
	• Stranded with cable lug	mm^2	25 ... 120[1)]	70 ... 240[2)]
	• AWG cables, solid or stranded	AWG	4 ... 250 kcmil	2/0 ... 500 kcmil
	• Connecting bar (max. width)	mm	17	25
	• Terminal screws		M8 x 25 (A/F13)	M10 x 30 (A/F17)
	- Tightening torque	NM	10 ... 14	14 ... 24
		lb.in	89 ... 124	124 ... 210

[1)] When connecting cable lugs to DIN 46235, use 3RT19 56-4EA1 terminal cover for conductor cross-sections from 95 mm^2 to ensure phase spacing.

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

Soft starters	Type		3RW40 ..
Conductor cross-sections			
Auxiliary conductors (1 or 2 conductors can be connected)**:**			
	Screw terminals		
	• Solid	mm^2	2 x (0.5 ... 2.5)
	• Finely stranded with end sleeve	mm^2	2 x (0.5 ... 1.5)
	• AWG cables		
	- Solid or stranded	AWG	2 x (20 ... 14)
	- Finely stranded with end sleeve	AWG	2 x (20 ... 16)
	• Terminal screws		
	- Tightening torque	NM	0.8 ... 1.2
		lb.in	7 ... 10.3
	Spring-type terminals		
	• Solid		
	- 3RW40 2. ... 3RW40 4.	mm^2	2 x (0.25 ... 2.5)
	- 3RW40 5., 3RW40 7.	mm^2	2 x (0.25 ... 1.5)
	• Finely stranded with end sleeve	mm^2	2 x (0.25 ... 1.5)
	• AWG cables, solid or stranded	AWG	2 x (24 ... 14) for 3RW40 2. ... 3RW40 4.; 2 x (24 ... 16) for 3RW40 5. and 3RW40 7.

	Standard	Parameters
Electromagnetic compatibility acc. to EN 60947-4-2		
EMC interference immunity		
Electrostatic discharge (ESD)	EN 61000-4-2	±4 kV contact discharge, ±8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Frequency range: 80 ... 1000 MHz with 80 % at 1 kHz Degree of severity 3: 10 V/m
Conducted RF interference	EN 61000-4-6	Frequency range: 150 kHz ... 80 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 earth
EMC interference emission		
EMC interference field strength	EN 55011	Limit value of Class A at 30 ... 1000 MHz, limit value of Class B with 3RW40 2. 24 V AC/DC
Radio interference voltage	EN 55011	Limit value of Class A at 0.15 ... 30 MHz, limit value of Class B with 3RW40 2. 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 • 110 ... 230 V AC/DC • 115/230 V AC • 24 V AC/DC		 Not available[1)] Not available[1)] Not required for 3RW40 2.; required for 3RW40 3. and 3RW40 4. (see table)

[1)] 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.

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

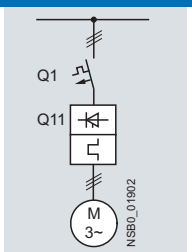
[1)] The radio interference suppression filter is used to remove the conducted interference from the main circuit. The field-related emissions comply with degree of noise suppression B. Filter selection applies under standard conditions: 10 starts per hour, start time 4 s at 300 % I_e.

3RW40 for standard applications

Fuse assignment

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

Fuseless version

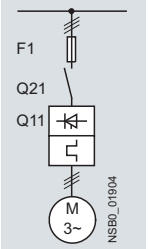


Soft starters		Motor starter protectors/circuit breakers[1]						
ToC 1	Rated current	400 V +10 %	400 V +10 %		Rated current	575 V +10 %		Rated current
Q11		Q1	Q1	$I_{q\ max}$		Q1	$I_{q\ max}$	
Type	A	Type	Type	kA	A	Type	kA	A
Type of coordination "1"[2]								
3RW40 24	12.5	3RV1 021-1KA10	3RV1 321-1KC10	55	16	--	--	--
3RW40 26	25	3RV1 021-4DA10	3RV1 321-4DC10	55	25	--	--	--
3RW40 27	32	3RV1 031-4EA10	3RV1 331-4EC10	55	32	--	--	--
3RW40 28	38	3RV1 031-4FA10	3RV1 331-4FC10	55	40	--	--	--
3RW40 36	45	3RV1 031-4GA10	3RV1 331-4GC10	20	45	--	--	--
3RW40 37	63	3RV1 041-4JA10	3RV1 341-4JC10	20	63	--	--	--
3RW40 38	72	3RV1 041-4KA10	3RV1 341-4KC10	20	75	--	--	--
3RW40 46	80	3RV1 041-4LA10	3RV1 341-4LC10	11	90	--	--	--
3RW40 47	106	3RV1 041-4MA10	3RV1 341-4MC10	11	100	--	--	--
3RW40 55	134	3VL3 720-2DC36		35	200	3VL3 720-1DC36	12	200
3RW40 56	162	3VL3 720-2DC36		35	200	3VL3 720-1DC36	12	200
3RW40 73	230	3VL4 731-2DC36		65	315	3VL5 731-3DC36	35	315
3RW40 74	280	3VL4 731-2DC36		65	315	3VL5 731-3DC36	35	315
3RW40 75	356	3VL4 740-2DC36		65	400	3VL5 740-3DC36	35	400
3RW40 76	432	3VL5 750-2DC36		65	500	3VL5 750-3DC36	35	500

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

[2] The types of coordination are explained in more detail under "3RA1 Fuseless Load Feeders".

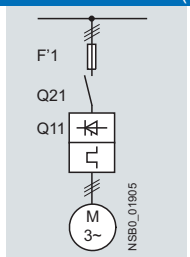
Fused version (line protection only)



Soft starters		Line protection, maximum			Line contactors
ToC 1	Rated current		Rated current	Size	(optional)
Q11		F1			Q21
Type	A	Type	A		
Type of coordination "1"[1]: I_q = 65 kA at 600 V +5 %					
3RW40 24	12.5	3NA3 820-6	50	00	3RT10 24
3RW40 26	25	3NA3 822-6	63	00	3RT10 26
3RW40 27	32	3NA3 824-6	80	00	3RT10 34
3RW40 28	38	3NA3 824-6	80	00	3RT10 35
3RW40 36	45	3NA3 130-6	100	1	3RT10 36
3RW40 37	63	3NA3 132-6	125	1	3RT10 44
3RW40 38	72	3NA3 132-6	125	1	3RT10 45
3RW40 46	80	3NA3 136-6	160	1	3RT10 45
3RW40 47	106	3NA3 136-6	160	1	3RT10 46
3RW40 55	134	3NA3 244-6	250	2	3RT10 55-6A.36
3RW40 56	162	3NA3 244-6	250	2	3RT10 56-6A.36
3RW40 73	230	2 x 3NA3 354-6	2 x 355	3	3RT10 65-6A.36
3RW40 74	280	2 x 3NA3 354-6	2 x 355	3	3RT10 66-6A.36
3RW40 75	356	2 x 3NA3 365-6	2 x 500	3	3RT10 75-6A.36
3RW40 76	432	2 x 3NA3 365-6	2 x 500	3	3RT10 76-6A.36

[1] The types of coordination are explained under "3RA1 Fuseless Load Feeders". The type of coordination "1" refers only to soft starters in combination with the stipulated protective device (motor starter protector/circuit breaker/fuse), not to any additional components in the feeder.

Fused version with 3NE1 SITOR fuses (semiconductor and line protection)



For matching fuse bases see Catalog LV 1 under "SENTRON Switching and Protection Devices for Power Distribution" —> "Switch Disconnectors", and Catalog ET B1 under "BETA Protecting" —> "SITOR Semiconductor Fuses" or go to www.siemens.com/sitor —>"Products" —>"BETA Protecting"—>"SITOR"

Soft starters		All-range fuses			Line contactors
ToC 2	Rated current		Rated current	Size	(optional)
Q11 Type	A	F'1 Type	A		Q21
Type of coordination "2"[1]: I_q = 65 kA at 600 V +5 %					
3RW40 24	12.5	3NE1 814-0	20	000	3RT10 24
3RW40 26	25	3NE1 803-0	35	000	3RT10 26
3RW40 27	32	3NE1 020-2	80	00	3RT10 34
3RW40 28	38	3NE1 020-2	80	00	3RT10 35
3RW40 36	45	3NE1 020-2	80	00	3RT10 36
3RW40 37	63	3NE1 820-0	80	000	3RT10 44
3RW40 38	72	3NE1 820-0	80	000	3RT10 45
3RW40 46	80	3NE1 021-0	100	00	3RT10 45
3RW40 47	106	3NE1 022-0	125	00	3RT10 46
3RW40 55	134	3NE1 227-2	250	1	3RT10 55-6A.36
3RW40 56	162	3NE1 227-2	250	1	3RT10 56-6A.36
3RW40 73	230	3NE1 331-2	350	2	3RT10 65-6A.36
3RW40 74	280	3NE1 333-2	450	2	3RT10 66-6A.36
3RW40 75	356	3NE1 334-2	500	2	3RT10 75-6A.36
3RW40 76	432	3NE1 435-2	560	3	3RT10 76-6A.36

1) The types of coordination are explained in more detail under "3RA1 Fuseless Load Feeders".
The type of coordination "2" refers only to soft starters in combination with the stipulated protective device (circuit breaker/fuse), not to any additional components in the feeder.

ToC 1 Type of coordination "1"

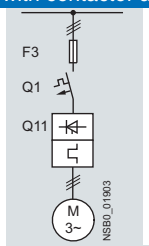
ToC 2 Type of coordination "2"

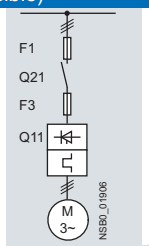
The types of coordination are explained in more detail under "3RA1 Fuseless Load Feeders".

These types of coordination are indicated in the Technical specifications by orange backgrounds.

3RW40 for standard applications

Fused version with 3NE3 SITOR fuses (semiconductor protection by fuse, line and overload protection by motor starter protector; alternatively, installation with contactor and overload relay possible)





For matching fuse bases see Catalog LV 1 under "SENTRON Switching and Protection Devices for Power Distribution" —> "Switch Disconnectors", and Catalog ET B1 under "BETA Protecting" —> "SITOR Semiconductor Fuses" or go to rwww.siemens.com/sitor —>"Products" —>"BETA Protecting" —>"SITOR"

Soft starters		Semiconductor fuses, minimum			Semiconductor fuses, maximum			Semiconductor fuses, minimum		
ToC 2	Rated current		Rated current	Size		Rated current	Size		Rated current	Size
Q11 Type	A	F3 Type	A		F3 Type	A		F3 Type	A	
Type of coordination "2"[1]: I_q = 65 kA at 600 V +5 %										
3RW40 24	12.5	--	--	--	--	--	--	3NE4 101	32	0
3RW40 26	25	--	--	--	3NE3 221	100	1	3NE4 102	40	0
3RW40 27	32	--	--	--	3NE3 224	160	1	3NE4 118	63	0
3RW40 28	38	--	--	--	3NE3 224	160	1	3NE4 118	63	0
3RW40 36	45	--	--	--	3NE3 224	160	1	3NE4 120	80	0
3RW40 37	63	--	--	--	3NE3 225	200	1	3NE4 121	100	0
3RW40 38	72	3NE3 221	100	1	3NE3 227	250	1	--	--	--
3RW40 46	80	3NE3 222	125	1	3NE3 225	200	1	--	--	--
3RW40 47	106	3NE3 224	160	1	3NE3 231	350	1	--	--	--
3RW40 55	134	3NE3 227	250	1	3NE3 335	560	2	--	--	--
3RW40 56	162	3NE3 227	250	1	3NE3 335	560	2	--	--	--
3RW40 73	230	3NE3 232-0B	400	1	3NE3 333	450	2	--	--	--
3RW40 74	280	3NE3 233	450	1	3NE3 336	630	2	--	--	--
3RW40 75	356	3NE3 335	560	2	3NE3 336	630	2	--	--	--
3RW40 76	432	3NE3 337-8	710	2	3NE3 340-8	900	2	--	--	--

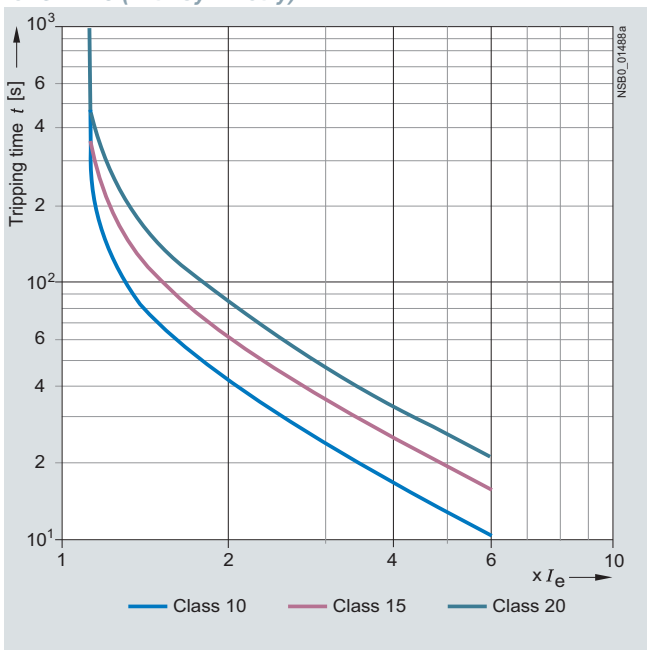
Soft starters		Semiconductor fuses max.			Semiconductor fuses min.			Semiconductor fuses max.			Cylindrical fuses	
ToC 2	Rated current		Rated current	Size		Rated current	Size		Rated current	Size		Rated current
Q11 Type	A	F3 Type	A		F3 Type	A		F3 Type	A		F3 Type	A
Type of coordination "2"[1]: I_q = 65 kA at 600 V +5 %												
3RW40 24	12.5	3NE4 117	50	0	3NE8 015-1	25	00	3NE8 017-1	50	00	3NC2 240	40
3RW40 26	25	3NE4 117	50	0	3NE8 017-1	50	00	3NE8 021-1	100	00	3NC2 263	63
3RW40 27	32	3NE4 118	63	0	3NE8 018-1	63	00	3NE8 022-1	125	00	3NC2 280	80
3RW40 28	38	3NE4 118	63	0	3NE8 020-1	80	00	3NE8 024-1	160	00	3NC2 280	80
3RW40 36	45	3NE4 120	80	0	3NE8 020-1	80	00	3NE8 024-1	160	00	3NC2 280	80
3RW40 37	63	3NE4 121	100	0	3NE8 021-1	100	00	3NE8 024-1	160	00	--	--
3RW40 38	72	--	--	--	3NE8 022-1	125	00	3NE8 024-1	160	00	--	--
3RW40 46	80	--	--	--	3NE8 022-1	125	00	3NE8 024-1	160	00	--	--
3RW40 47	106	--	--	--	3NE8 024-1	160	00	3NE8 024-1	160	00	--	--
3RW40 55	134	--	--	--	--	--	--	--	--	--	--	--
3RW40 56	162	--	--	--	--	--	--	--	--	--	--	--
3RW40 73	230	--	--	--	--	--	--	--	--	--	--	--
3RW40 74	280	--	--	--	--	--	--	--	--	--	--	--
3RW40 75	356	--	--	--	--	--	--	--	--	--	--	--
3RW40 76	432	--	--	--	--	--	--	--	--	--	--	--

Soft starters		Line contactors	Motor starter protectors/circuit breakers				Line protection, maximum		
ToC 2	Rated current	(optional)	400 V +10 %	Rated current	575 V +10 %	Rated current		Rated current	Size
Q11 Type	A	Q21	Q1 Type	A	Q1 Type	A	F1 Type	A	
Type of coordination "2"[1]: I_q = 65 kA at 600 V +5 %									
3RW40 24	12.5	3RT10 24	3RV1 021-4KA10	55	--	--	3NA3 820-6	50	00
3RW40 26	25	3RT10 26	3RV1 021-4DA10	55	--	--	3NA3 822-6	63	00
3RW40 27	32	3RT10 34	3RV1 031-4EA10	55	--	--	3NA3 824-6	80	00
3RW40 28	38	3RT10 35	3RV1 031-4FA10	55	--	--	3NA3 824-6	80	00
3RW40 36	45	3RT10 36	3RV1 031-4GA10	20	--	--	3NA3 130-6	100	1
3RW40 37	63	3RT10 44	3RV1 041-4JA10	20	--	--	3NA3 132-6	125	1
3RW40 38	72	3RT10 45	3RV1 041-4KA10	20	--	--	3NA3 132-6	125	1
3RW40 46	80	3RT10 45	3RV1 041-4LA10	11	--	--	3NA3 136-6	160	1
3RW40 47	106	3RT10 46	3RV1 041-4MA10	11	--	--	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	280	3RT10 66-6A.36	3VL4 731	315	3VL5 731	315	2 x 3NA3 354-6	2 x 355	3
3RW40 75	356	3RT10 75-6A.36	3VL4 740	400	3VL5 740	400	2 x 3NA3 365-6	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	3

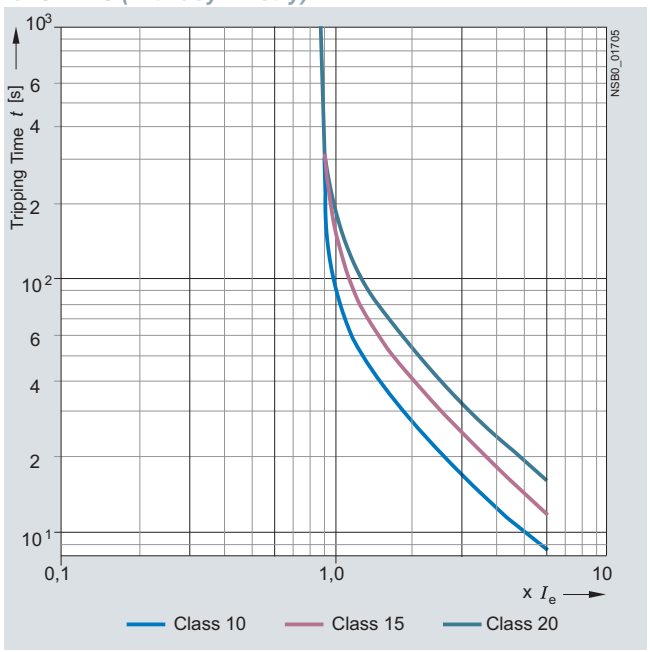
[1] The types of coordination are explained under "3RA1 Fuseless Load Feeders". The type of coordination "2" refers only to soft starters in combination with the stipulated protective device (motor starter protector/circuit breaker/fuse), not to any additional components in the feeder.

Characteristic curves

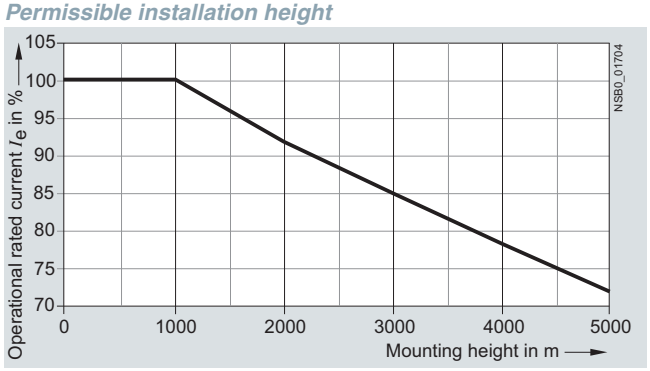
Motor protection tripping characteristics for 3RW40 (with symmetry)



Motor protection tripping characteristics for 3RW40 (with asymmetry)



Permissible installation height



At an installation height above 2000 m, the max. permissible operational voltage is reduced to 460 V.

More information

Application examples for normal starting (Class 10)

Normal starting Class 10 (up to 20 s with 350 % $I_{n\ motor}$),
The soft starter rating can be selected to be as high as the rating of the motor used.

Application		Conveyor belt	Roller conveyor	Compressor	Small fan	Pump	Hydraulic pump
Starting parameters							
• Voltage ramp and current limiting							
- Starting voltage	%	70	60	50	40	40	40
- Starting time	s	10	10	10	10	10	10
- Current limit value		5 x I_M	5 x I_M	4 x I_M	4 x I_M	4 x I_M	4 x I_M
Ramp-down time	s	5	5	0	0	10	0

Application examples for heavy starting (Class 20)

Heavy starting Class 20 (up to 40 s with 350 % $I_{n\ motor}$),
The soft starter has to be selected at least one performance class higher than the motor used.

Application		Stirrer	Centrifuge
Starting parameters			
• Voltage ramp and current limiting			
- Starting voltage	%	40	40
- Starting time	s	20	20
- Current limit value		4 x I_M	4 x I_M
Ramp-down time		0	0

Note:
These tables present sample set values and device sizes. They are intended only for the purposes of information and are not binding. The set values depend on the application in question and must be optimized during commissioning.
The soft starter dimensions should be checked where necessary with the Win-Soft Starter software or with the help of Technical Assistance.

Configuration

The 3RW solid-state soft starters are designed for easy starting conditions. In the event of deviating conditions or increased switching frequency, it may be necessary to choose a larger device. For accurate dimensioning, use the Win-Soft Starter selection and simulation program.

Where long starting times are involved, the integrated solid-state overload relay for heavy starting should not be disconnected. PTC sensors are recommended. This also applies for the smooth ramp-down because during the ramp-down time an additional current loading applies in contrast to free ramp-down.

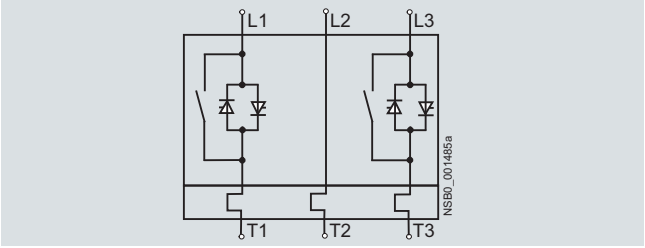
In the case of high switching frequencies in S4 mode, Siemens recommends the use of PTC sensors. For corresponding device versions with integrated thermistor motor protection or separate thermistor evaluation devices see Catalog LV 1.

In the motor feeder between the SIRIUS 3RW soft starter and the motor, no capacitive elements are permitted (e. g. no reactive-power compensation equipment). In addition, neither static systems for reactive-power compensation nor dynamic PFC (Power Factor Correction) must be operated in parallel during starting and ramp-down of the soft starter. This is important to prevent faults arising on the compensation equipment and/or the soft starter.

All elements of the main circuit (such as fuses and controls) should be dimensioned for direct starting, following the local short-circuit conditions. Fuses, controls and overload relays must be ordered separately. Please observe the maximum switching frequencies specified in the technical specifications.

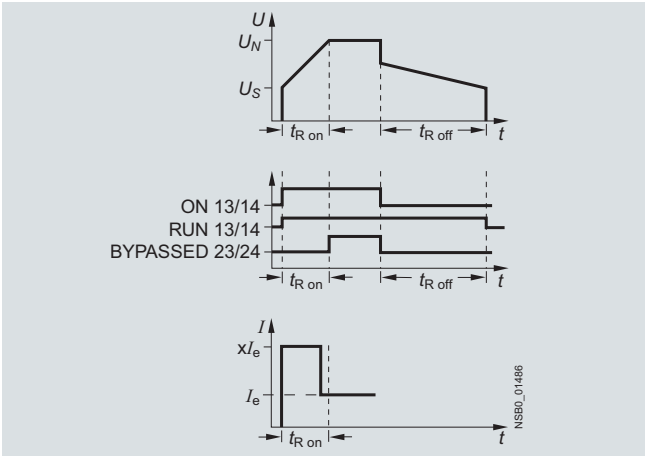
Note:
When induction motors are switched on, voltage drops occur as a rule on starters of all types (direct starters, wye-delta starters, soft starters). The infeed transformer must always be dimensioned such that the voltage dip when starting the motor remains within the permissible tolerance. If the infeed transformer is dimensioned with only a small margin, it is best for the control voltage to be supplied from a separate circuit (independently of the main voltage) in order to avoid the potential switching off of the soft starter.

Schematic circuit diagram



A bypass contact system and solid-state overload relay are already integrated in the 3RW40 soft starter and therefore do not have to be ordered separately.

Status graphs



Win-Soft Starter selection and simulation program

With this software, you can simulate and select all Siemens soft starters, taking into account various parameters such as mains properties, motor and load data, and special application requirements.

The software is a valuable tool, which makes complicated, lengthy manual calculations for determining the required soft starters superfluous.

The Win-Soft Starter selection and simulation program can be downloaded from:
http://www.siemens.com/softstarter > Software

More information can be found on the Internet at:
http://www.siemens.com/softstarter

3RW44 for high-feature applications

Overview

In addition to soft starting and soft ramp-down, the solid-state SIRIUS 3RW44 soft starters provide numerous functions for higher-level requirements. They cover a performance range up to 710 kW (at 400 V) in the inline circuit and up to 1200 kW (at 400 V) in the inside-delta circuit.

The SIRIUS 3RW44 soft starters are characterized by a compact design for space-saving and clearly arranged control cabinet layouts. For optimized motor starting and stopping the innovative SIRIUS 3RW44 soft starters are an attractive alternative with considerable savings potential compared to applications with a frequency converter. The new torque control and adjustable current limiting enable the High-Feature soft starters to be used in nearly every conceivable task. They guarantee the reliable avoidance of sudden torque applications and current peaks during motor starting and stopping. This creates savings potential when calculating the size of the switchgear and when servicing the machinery installed. Be it for inline circuits or inside-delta circuits – the SIRIUS 3RW44 soft starter offers savings especially in terms of size and equipment costs.

The bypass contacts already integrated in the soft starter bypass the thyristors after a motor ramp-up is detected. This results in a further great reduction in the heat loss occuring during operation of the soft starter at rated value.

Combinations of various starting, operating and ramp-down possibilities ensure an optimum adaptation to the application-specific requirements. Operation and commissioning can be performed with the menu-controlled keypad and a menu-prompted, multi-line graphic display with background lighting. The optimized motor ramp-up and ramp-down can be effected quickly, easily and reliably by means of just a few settings with a previously selected language. Four-key operation and plain-text displays for each menu point guarantee full clarity at every moment of the parameterization and operation.

Applicable standards

- IEC 60947-4-2
- UL/CSA

Soft Starter ES parameterization software

Soft Starter ES software is used for the parameterization, monitoring and service diagnostics of SIRIUS 3RW44 High Feature soft starters.
See Catalog LV 1, Chapter 12 "Planning and Configuration with SIRIUS".

Function

Equipped with modern, ergonomic user prompting the SIRIUS 3RW44 soft starters can be commissioned quickly and easily using a keypad and a menu-prompted, multi-line graphic display with background lighting. The optimized motor ramp-up and ramp-down can be effected quickly, easily and reliably by means of just a few settings with a selectable language. Four-key operation and plain-text displays for each menu point guarantee full clarity at every moment of the parameterization and operation. During operation and when control voltage is applied, the display field continuously presents measured values and operating values as well as warnings and fault messages. An external display and operator module can be connected by means of a connection cable to the soft starter, thus enabling active indications and the like to be read directly from the control cabinet door.

The SIRIUS 3RW44 soft starters are equipped with optimum functionality. An integral bypass contact system reduces the power loss of the soft starter during operation.
This reliably prevents heating of the switchgear environment. The SIRIUS 3RW44 soft starters have internal intrinsic device protection. This prevents thermal overloading of the power section's thyristors, e. g. due to unacceptably high closing operations.

Wiring outlay for installing an additional motor overload relay is no longer needed as the SIRIUS 3RW44 soft starters perform this function too. In addition they offer adjustable trip classes and a thermistor motor protection function. As an option the thyristors can also be protected by SITOR semiconductor fuses from short-circuiting so that the soft starter is still functional after a short-circuit (type of coordination 2). And even inrush current peaks are reliably avoided thanks to adjustable current limiting.

As a further option the SIRIUS 3RW44 soft starters can be upgraded with a PROFIBUS DP module. Thanks to their communication capability and their programmable control inputs and relay outputs the SIRIUS 3RW44 soft starters can be very easily and quickly integrated in higher-level controllers.

In addition a creep speed function is available for positioning and setting jobs. With this function the motor can be controlled in both directions of rotation with reduced torque and an adjustable, low speed.

On the other hand the SIRIUS 3RW44 soft starters offer a new, combined DC braking function for the fast stopping of driving loads.

Highlights

- Soft starting with breakaway pulse, torque control or voltage ramp, adjustable torque or current limiting as well as any combination of these, depending on load type
- Integrated bypass contact system to minimize power loss
- Various setting options for the starting parameters such as starting torque, starting voltage, ramp-up and ramp-down time, and much more in three separate parameter sets
- Start-up detection
- Inside-delta circuit for savings in terms of size and equipment costs
- Various ramp-down modes selectable: free ramp-down, torque-controlled pump ramp-down, combined DC braking
- Solid-state motor overload and intrinsic device protection
- Thermistor motor protection
- Keypad with a menu-prompted, multi-line graphic display with background lighting
- Interface for communication with the PC for more accurate setting of the parameters as well as for control and monitoring
- Simple adaptation to the motor feeder
- Simple mounting and commissioning
- Display of operating states and fault messages
- Connection to PROFIBUS with optional PROFIBUS DP module
- External display and operator module
- Mains voltages from 200 to 690 V, 50 to 60 Hz
- Applicable up to 60 °C (derating from 40 °C)

Technical specifications

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

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

3RW44 for high-feature applications

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

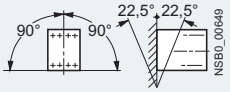
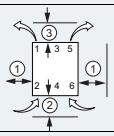
[1] Max. current limit value for 3RW44 53 ... 3RW44 57: 500 % and for 3RW44 58 ... 3RW44 66: 450 %.

[2] Reference variable depends on the motor used but is always smaller than the rated torque of the motor.

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

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

3RW44 for high-feature applications

Type		3RW44 ..-.BC.4	3RW44 ..-.BC.5	3RW44 ..-.BC.6
Power electronics				
Rated operational voltage for inline circuit	V AC	200 ... 460	400 ... 600	400 ... 690
Tolerance	%	-15/+10	-15/+10	-15/+10
Maximum blocking voltage (thyristor)	V AC	1400	1800	1800
Rated operational voltage for inside-delta circuit	V AC	200 ... 460	400 ... 600	400 ... 600
Tolerance	%	-15/+10	-15/+10	-15/+10
Rated frequency	Hz	50 ... 60		
Tolerance	%	±10		
Uninterrupted duty at 40 °C (% of I_e)	%	115		
Minimum load (% of set motor current I_M)	%	8		
Maximum cable length between soft starter and motor	m	500[1]		
Permissible installation height	m	5000 (derating from 1000, see characteristic curves); higher on request		
Permissible mounting position				
Installation type		Stand-alone installation  ① ≥ 5 mm (≥ 0.2 in) ② ≥ 75 mm (≥ 3 in) ③ ≥ 100 mm (≥ 4 in)		
Permissible ambient temperature				
Operation	°C	0 ... +60; (derating from +40)		
Storage	°C	-25 ... +80		
Degree of protection		IP00		

[1] At the project configuration stage, it is important to make allowance for the voltage drop on the motor cable up to the motor connection. If necessary, higher values for the rated operational voltage or current must be calculated accordingly for the soft starter.

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

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

[2] Current limit on soft starter set to 350 % I_M.

[3] For intermittent duty S4 with ON period = 70 %, T_u = 40 °C, stand-alone installation vertical. The quoted switching frequencies do not apply for automatic mode.

[4] Maximum adjustable rated motor current I_M, dependent on CLASS setting.

Type		3RW44 34	3RW44 35	3RW44 36
Power electronics				
Rated operational current I_e		113	134	162
Load rating with rated operational current I_e				
• Acc. to IEC and UL/CSA[1], for individual mounting, AC-53a				
- At 40 °C	A	113	134	162
- At 50 °C	A	100	117	145
- At 60 °C	A	88	100	125
Smallest adjustable rated motor current I_M For the motor overload protection	A	22	26	32
Power loss				
• In operation after completed starting with uninterrupted rated operational current (40 °C) approx.	W	64	76	95
• During starting with current limit set to 350 % I_M (40 °C)	W	1350	1700	2460
Permissible rated motor current and starts per hour				
• **Normal starting (Class 5)**				
- Rated motor current I_M[2], starting time 5 s	A	113	134	162
- Starts per hour[3]	1/h	41	39	41
- Rated motor current I_M[2)4)], starting time 10 s	A	113	134	162
- Starts per hour[3]	1/h	20	15	20
• **Normal starting (Class 10)**				
- Rated motor current I_M[2], starting time 10 s	A	113	134	162
- Starts per hour[3]	1/h	20	15	20
- Rated motor current I_M[2)4)], starting time 20 s	A	113	134	162
- Starts per hour[3]	1/h	9	6	7
• **Normal starting (Class 15)**				
- Rated motor current I_M[2], starting time 15 s	A	113	134	162
- Starts per hour[3]	1/h	13	9	12
- Rated motor current I_M[2)4)], starting time 30 s	A	113	134	162
- Starts per hour[3]	1/h	6	6	1
• **For heavy starting (Class 20)**				
- Rated motor current I_M[2], starting time 20 s	A	106	125	147
- Starts per hour[3]	1/h	9	9	10
- Rated motor current I_M[2)4)], starting time 40 s	A	106	125	147
- Starts per hour[3]	1/h	1.5	2	1
• **For very heavy starting (Class 30)**				
- Rated motor current I_M[2], starting time 30 s	A	91	110	120
- Starts per hour[3]	1/h	6	6	6
- Rated motor current I_M[2)4)], starting time 60 s	A	91	110	120
- Starts per hour[3]	1/h	2	2	2

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

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

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

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

3RW44 for high-feature applications

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

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

[2] Current limit on soft starter set to 350 % I_M.

[3] For intermittent duty S4 with ON period = 70 %, T_u = 40 °C, stand-alone installation vertical. The quoted switching frequencies do not apply for automatic mode.

[4] Maximum adjustable rated motor current I_M, dependent on CLASS setting.

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

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

[2] Current limit on soft starter set to 350 % I_M.

[3] For intermittent duty S4 with ON period = 70 %, T_u = 40 °C, stand-alone installation vertical. The quoted switching frequencies do not apply for automatic mode.

[4] Maximum adjustable rated motor current I_M, dependent on CLASS setting.

3RW44 for high-feature applications

Type		3RW44 65	3RW44 66
Power electronics			
Rated operational current I_e		1076	1214
Load rating with rated operational current I_e			
• Acc. to IEC and UL/CSA[1], for individual mounting, AC-53a			
- At 40 °C	A	1076	1214
- At 50 °C	A	970	1076
- At 60 °C	A	880	970
Smallest adjustable rated motor current I_M For the motor overload protection	A	215	242
Power loss			
• In operation after completed starting with uninterrupted rated operational current (40 °C) approx.	W	510	630
• During starting with current limit set to 350 % I_M (40 °C)	W	15000	17500
Permissible rated motor current and starts per hour			
• **Normal starting (Class 5)**			
- Rated motor current I_M[2], starting time 5 s	A	1076	1214
- Starts per hour[3]	1/h	30	20
- Rated motor current I_M[2][4], starting time 10 s	A	1076	1214
- Starts per hour[3]	1/h	10	6
• **Normal starting (Class 10)**			
- Rated motor current I_M[2], starting time 10 s	A	1076	1214
- Starts per hour[3]	1/h	11	6
- Rated motor current I_M[2][4], starting time 20 s	A	1076	1214
- Starts per hour[3]	1/h	3	0.5
• **Normal starting (Class 15)**			
- Rated motor current I_M[2], starting time 15 s	A	1020	1090
- Starts per hour[3]	1/h	7	5
- Rated motor current I_M[2][4], starting time 30 s	A	1020	1090
- Starts per hour[3]	1/h	1	1
• **For heavy starting (Class 20)**			
- Rated motor current I_M[2], starting time 20 s	A	970	1030
- Starts per hour[3]	1/h	7	5
- Rated motor current I_M[2][4], starting time 40 s	A	970	1030
- Starts per hour[3]	1/h	1	1
• **For very heavy starting (Class 30)**			
- Rated motor current I_M[2], starting time 30 s	A	880	920
- Starts per hour[3]	1/h	6	6
- Rated motor current I_M[2][4], starting time 60 s	A	880	920
- Starts per hour[3]	1/h	1	1

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

[2] Current limit on soft starter set to 350 % I_M.

[3] For intermittent duty S4 with ON period = 70 %, T_u = 40 °C, stand-alone installation vertical. The quoted switching frequencies do not apply for automatic mode.

[4] Maximum adjustable rated motor current I_M, dependent on CLASS setting.

Type			3RW44 2.	3RW44 3.	3RW44 4.	3RW44 5. 3RW44 6.
Conductor cross-sections						
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	2.5 ... 35	16 ... 70	70 ... 240	--
	• Finely stranded without end sleeve	mm^2	4 ... 50	16 ... 70	70 ... 240	--
	• Solid	mm^2	2.5 ... 16	--	--	--
	• Stranded	mm^2	4 ... 70	16 ... 70	95 ... 300	--
	• Ribbon cable conductors (number x width x thickness)	mm	6 x 9 x 0.8	Min. 3 x 9 x 0.8 Max. 6 x 15.5 x 0.8	Min. 6 x 9 x 0.8 Max. 20 x 24 x 0.5	--
	• AWG cables, solid or stranded	AWG	10 ... 2/0	6 ... 2/0	3/0 ... 600 kcmil	--
Rear clamping point connected	• Finely stranded with end sleeve	mm^2	2.5 ... 50	16 ... 70	120 ... 185	--
	• Finely stranded without end sleeve	mm^2	10 ... 50	16 ... 70	120 ... 185	--
	• Solid	mm^2	2.5 ... 16	--	--	--
	• Stranded	mm^2	10 ... 70	16 ... 70	120 ... 240	--
	• Ribbon cable conductors (number x width x thickness)	mm	6 x 9 x 0.8	Min. 3 x 9 x 0.8 Max. 6 x 15.5 x 0.8	Min. 6 x 9 x 0.8 Max. 20 x 24 x 0.5	--
	• AWG cables, solid or stranded	AWG	10 ... 2/0	6 ... 2/0	250 ... 500 kcmil	--
Both clamping points connected	• Finely stranded with end sleeve	mm^2	2 x (2.5 ... 35)	Max. 1 x 50, 1 x 70	Min. 2 x 50 Max. 2 x 185	--
	• Finely stranded without end sleeve	mm^2	2 x (4 ... 35)	Max. 1 x 50, 1 x 70	Min. 2 x 50 Max. 2 x 185	--
	• Solid	mm^2	2 x (2.5 ... 16)	--	--	--
	• Stranded	mm^2	2 x (4 ... 50)	Max. 2 x 70	Max. 2 x 70 Max. 2 x 240	--
	• Ribbon cable conductors (number x width x thickness)	mm	2 x (6 x 9 x 0.8)	Max. 2 x (6 x 15.5 x 0.8)	Max. 2 x (20 x 24 x 0.5)	--
	• AWG cables, solid or stranded	AWG	2 x (10 ... 1/0)	Max. 2 x 1/0	Min. 2 x 2/0 Max. 2 x 500 kcmil	--
	• Terminal screws		M6 (hexagon socket, A/F4)	M10 (hexagon socket, A/F4)	M12 (hexagon socket, A/F5)	--
	- Tightening torque	NM lb.in	4 ... 6 36 ... 53	10 ... 12 90 ... 110	20 ... 22 180 ... 195	-- --
Screw terminals	**Main conductors**					
With box terminal			--	3RT19 56-4G	--	--
Front or rear clamping point connected	• Finely stranded with end sleeve	mm^2	--	16 ... 120	--	--
	• Finely stranded without end sleeve	mm^2	--	16 ... 120	--	--
	• Stranded	mm^2	--	16 ... 120	--	--
	• Ribbon cable conductors (number x width x thickness)	mm	--	Min. 3 x 9 x 0.8 Max. 6 x 15.5 x 0.8	--	--
	• AWG cables, solid or stranded	AWG	--	6 ... 250 kcmil	--	--
Both clamping points connected	• Finely stranded with end sleeve	mm^2	--	Max. 1 x 95, 1 x 120	--	--
	• Finely stranded without end sleeve	mm^2	--	Max. 1 x 95, 1 x 120	--	--
	• Stranded	mm^2	--	Max. 2 x 120	--	--
	• Ribbon cable conductors (number x width x thickness)	mm	--	Max. 2 x (10 x 15.5 x 0.8)	--	--
	• AWG cables, solid or stranded	AWG	--	Max. 2 x 3/0	--	--
Screw terminals	**Main conductors**					
	Without box terminal/busbar connection					
	• Finely stranded with cable lug	mm^2	--	16 ... 95[1]	50 ... 240[2]	50 ... 240[2]
	• Stranded with cable lug	mm^2	--	25 ... 120[1]	70 ... 240[2]	70 ... 240[2]
	• AWG cables, solid or stranded	AWG	--	4 ... 250 kcmil	2/0 ... 500 kcmil	2/0 ... 500 kcmil
	• Connecting bar (max. width)	mm	--	17	25	60
	• Terminal screws		--	M8 x 25 (A/F13)	M10 x 30 (A/F17)	M12 x 40
	- Tightening torque	NM lb.in	-- --	10 ... 14 89 ... 124	14 ... 24 124 ... 210	20 ... 35 177 ... 310

[1] When connecting cable lugs to DIN 46235, use 3RT19 56-4EA1 terminal cover for conductor cross-sections from 95 mm^2 to ensure phase spacing.

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

3RW44 for high-feature applications

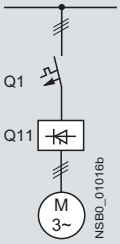
Soft starters	Type		3RW44..
Conductor cross-sections			
Auxiliary conductors (1 or 2 conductors can be connected):			
	Screw terminals		
	• Solid	mm^2	2 x (0.5 ... 2.5)
	• Finely stranded with end sleeve	mm^2	2 x (0.5 ... 1.5)
	• AWG cables		
	- Solid or stranded	AWG	2 x (20 ... 14)
	- Finely stranded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

	Standard	Parameters
Electromagnetic compatibility acc. to EN 60947-4-2		
EMC interference immunity		
Electrostatic discharge (ESD)	EN 61000-4-2	±4 kV contact discharge, ±8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Frequency range: 80 ... 1000 MHz with 80 % at 1 kHz Degree of severity 3, 10 V/m
Conducted RF interference	EN 61000-4-6	Frequency range: 150 kHz ... 80 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 30 ... 1000 MHz
Radio interference voltage	EN 55011	Limit value of Class A at 0.15 ... 30 MHz
Is an RI suppression filter necessary?		
Degree of noise suppression A (industrial applications)	No	

Fuse assignment

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

Inline circuit fuseless version



Soft starters		Motor starter protectors/circuit breakers[1]	
ToC 1	Rated current	440 V +10 %	Rated current
Q11 Type	A	Q1 Type	A
Type of coordination "1"[2]: 3RW44 22 ... 3RW44 27: I_q = 32 kA; 3RW44 34 and 3RW44 35: I_q = 16 kA; 3RW44 36 ... 3RW44 66: I_q = 65 kA			
3RW44 22	29	3RV10 42-4HA10	50
3RW44 23	36	3RV10 42-4JA10	63
3RW44 24	47	3RV10 42-4KA10	75
3RW44 25	57	3RV10 42-4LA10	90
3RW44 26	77	3RV10 42-4MA10	100
3RW44 27	93	3RV10 42-4MA10	100
3RW44 34	113	3VL17 16-2DD36	160
3RW44 35	134	3VL17 16-2DD36	160
3RW44 36	162	3VL37 25-2DC36	250
3RW44 43	203	3VL47 31-3DC36	315
3RW44 44	250	3VL47 31-3DC36	315
3RW44 45	313	3VL47 40-3DC36	400
3RW44 46	356	3VL47 40-3DC36	400
3RW44 47	432	3VL57 50-3DC36	500
3RW44 53	551	3VL67 80-3AB36	800
3RW44 54	615	3VL67 80-3AB36	800
3RW44 55	693	3VL67 80-3AB36	800
3RW44 56	780	3VL77 10-3AB36	1000
3RW44 57	880	3VL77 10-3AB36	1000
3RW44 58	970	3VL77 12-3AB36	1250
3RW44 65	1076	3VL77 12-3AB36	1250
3RW44 66	1214	3VL77 12-3AB36	1250

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

[2] The types of coordination are explained under "3RA1 Fuseless Load Feeders".

ToC 1 Type of coordination "1"

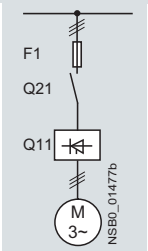
ToC 2 Type of coordination "2"

The types of coordination are explained in more detail under "3RA1 Fuseless Load Feeders".

These types of coordination are indicated in the Technical specifications by orange backgrounds.

3RW44 for high-feature applications

Inline circuit fused version (line protection only)



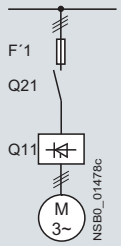
Soft starters ToC 1 Q11 Type	Rated current A	Line protection, maximum 690 V +5 % F1 Type	Rated current A	Size	Line contactors up to 400 V (optional) Q21 Type	Braking contactors[1)2)] (for example circuit see page 6/61) Q91 Type	Q92 Type
Type of coordination "1"[3)]: I_q = 65 kA							
3RW44 22	29	3NA3 820-6	50	00	3RT10 34	3RT15 26	--
3RW44 23	36	3NA3 822-6	63	00	3RT10 35	3RT15 26	--
3RW44 24	47	3NA3 824-6	80	00	3RT10 36	3RT15 35	--
3RW44 25	57	3NA3 830-6	100	00	3RT10 44	3RT15 35	--
3RW44 26	77	3NA3 132-6	125	1	3RT10 45	3RT10 24	3RT10 35
3RW44 27	93	3NA3 136-6	160	1	3RT10 46	3RT10 25	3RT10 36
3RW44 34	113	3NA3 244-6	250	2	3RT10 54	3RT10 34	3RT10 44
3RW44 35	134	3NA3 244-6	250	2	3RT10 55	3RT10 36	3RT10 45
3RW44 36	162	3NA3 365-6	500	3	3RT10 56	3RT10 44	3RT10 45
3RW44 43	203	2 x 3NA3 354-6	2 x 355	3	3RT10 64	3RT10 44	3RT10 54
3RW44 44	250	2 x 3NA3 354-6	2 x 355	3	3RT10 65	3RT10 44	3RT10 55
3RW44 45	313	2 x 3NA3 365-6	2 x 500	3	3RT10 75	3RT10 54	3RT10 56
3RW44 46	356	2 x 3NA3 365-6	2 x 500	3	3RT10 75	3RT10 54	3RT10 56
3RW44 47	432	2 x 3NA3 365-6	2 x 500	3	3RT10 76	3RT10 55	3RT10 64
3RW44 53	551	2 x 3NA3 365-6	2 x 500	3	3TF68	3RT10 64	3RT10 66
3RW44 54	615	2 x 3NA3 365-6	2 x 500	3	3TF68	3RT10 64	3RT10 75
3RW44 55	693	2 x 3NA3 365-6	2 x 500	3	3TF69	3RT10 65	3RT10 75
3RW44 56	780	2 x 3NA3 365-6	2 x 500	3	3TF69	3RT10 65	3RT10 75
3RW44 57	880	2 x 3NA3 365-6	2 x 500	3		3RT10 75	3RT10 76
3RW44 58	970	3 x 3NA3 365-6	3 x 500	3		3RT10 75	3RT10 76
3RW44 65	1076	3 x 3NA3 365-6	3 x 500	3		3RT10 75	3TF68
3RW44 66	1214	3 x 3NA3 365-6	3 x 500	3		3RT10 76	3TF68

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

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

3) The type of coordination "1" refers only to soft starters in combination with the stipulated protective device (motor starter protector/circuit breaker/fuse), not to any additional components in the feeder.
The types of coordination are explained under "3RA1 Fuseless Load Feeders".

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



For matching fuse bases see Catalog LV 1 under "SENTRON Switching and Protection Devices for Power Distribution" —> "Switch Disconnectors", and Catalog ET B1 under "BETA Protecting" —> "SITOR Semiconductor Fuses" or go to www.siemens.com/sitor —>"Products" —>"BETA Protecting"—>"SITOR"

Soft starters		All-range fuses				Line contactors up to 400 V	Braking contactors[1)2)]	
ToC 2	Rated current		Rated current	Voltage	Size	(optional)	(for example circuit see page 6/61)	
Q11 Type	A	F'1 Type	A	V		Q21 Type	Q91 Type	Q92 Type
Type of coordination "2"[3)]: I_q = 65 kA								
3RW44 22	29	3NE1 020-2	80	690 +5 %	00	3RT10 34	3RT15 26	--
3RW44 23	36	3NE1 020-2	80	690 +5 %	00	3RT10 35	3RT15 26	--
3RW44 24	47	3NE1 021-2	100	690 +5 %	00	3RT10 36	3RT15 35	--
3RW44 25	57	3NE1 022-2	125	690 +5 %	00	3RT10 44	3RT15 35	--
3RW44 26	77	3NE1 022-2	125	690 +5 %	00	3RT10 45	3RT10 24	3RT10 35
3RW44 27	93	3NE1 024-2	160	690 +5 %	1	3RT10 46	3RT10 25	3RT10 36
3RW44 34	113	3NE1 225-2	200	690 +5 %	1	3RT10 54	3RT10 34	3RT10 44
3RW44 35	134	3NE1 227-2	250	690 +5 %	1	3RT10 55	3RT10 36	3RT10 45
3RW44 36	162	3NE1 227-2	250	690 +5 %	1	3RT10 56	3RT10 44	3RT10 45
3RW44 43	203	3NE1 230-2	315	600 +10 %	1	3RT10 64	3RT10 44	3RT10 54
3RW44 44	250	3NE1 331-2	350	460 +10 %	2	3RT10 65	3RT10 44	3RT10 55
3RW44 45	313	3NE1 333-2	450	690 +5 %	2	3RT10 75	3RT10 54	3RT10 56
3RW44 46	356	3NE1 334-2	500	690 +5 %	2	3RT10 75	3RT10 54	3RT10 56
3RW44 47	432	3NE1 435-2	560	690 +5 %	3	3RT10 76	3RT10 55	3RT10 64
3RW44 53	551	2 x 3NE1 334-2	500	690 +10 %	2	3TF68	3RT10 64	3RT10 66
3RW44 54	615	2 x 3NE1 334-2	500	690 +10 %	2	3TF68	3RT10 64	3RT10 75
3RW44 55	693	2 x 3NE1 334-2	500	690 +10 %	2	3TF69	3RT10 65	3RT10 75
3RW44 56	780	2 x 3NE1 435-2	560	690 +10 %	3	3TF69	3RT10 65	3RT10 75
3RW44 57	880	2 x 3NE1 435-2	560	690 +10 %	3		3RT10 75	3RT10 76
3RW44 58	970	2 x 3NE1 435-2	560	690 +10 %	3		3RT10 75	3RT10 76
3RW44 65	1076	3 x 3NE1 334-2	500	690 +10 %	2		3RT10 75	3TF68
3RW44 66	1214	3 x 3NE1 435-2	560	690 +10 %	3		3RT10 76	3TF68

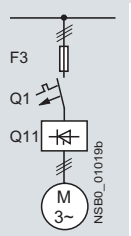
1) If the ramp-down function "Combined braking" is selected, no braking contactor is required.
If the ramp-down function "DC braking" is selected, a braking contactor must be used in addition (see table for type).
For applications with large centrifugal masses ($J_{Load} > J_{Motor}$) we recommend the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

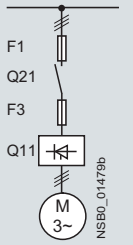
2) Additional auxiliary relay K4:
LZX:RT4A4T30
(3RW44 soft starter with rated control supply voltage 230 V AC),
LZX:RT4A4S15
(3RW44 soft starter with rated control supply voltage 115 V AC).

3) The type of coordination "2" refers only to soft starters in combination with the stipulated protective device (motor starter protector/circuit breaker/fuse), not to any additional components in the feeder.
The types of coordination are explained under "3RA1 Fuseless Load Feeders".

3RW44 for high-feature applications

Inline circuit fused version with 3NE or 3NC SITOR semiconductor fuse
(semiconductor protection by fuse, line and overload protection by motor starter protector/circuit breaker)





For matching fuse bases see Catalog LV 1 under "SENTRON Switching and Protection Devices for Power Distribution" —> "Switch Disconnectors", and Catalog ET B1 under "BETA Protecting" —> "SITOR Semiconductor Fuses" or go to rwww.siemens.com/sitor —>"Products" —>"BETA Protecting" —>"SITOR"

Soft starters		Semiconductor fuses, minimum			Semiconductor fuses, maximum			Semiconductor fuses (cylinder)		
ToC 2	Rated current	690 V +10 %	Rated current	Size	690 V +10 %	Rated current	Size		Rated current	Size
Q11 Type	A	F3 Type	A		F3 Type	A		F3 Type	A	
Type of coordination "2"[3]: I_q = 65 kA										
3RW44 22	29	3NE4 120	80	0	3NE4 121	100	0	3NC2 280	80	22 x 58
3RW44 23	36	3NE4 121	100	0	3NE4 121	100	0	3NC2 200	100	22 x 58
3RW44 24	47	3NE4 121	100	0	3NE4 122	125	0	3NC2 200	100	22 x 58
3RW44 25	57	3NE4 122	125	0	3NE4 124	160	0			
3RW44 26	77	3NE4 124	160	0	3NE4 124	160	0			
3RW44 27	93	3NE3 224	160	1	3NE3 332-0B	400	2			
3RW44 34	113	3NE3 225	200	1	3NE3 335	560	2			
3RW44 35	134	3NE3 225	200	1	3NE3 335	560	2			
3RW44 36	162	3NE3 227	250	1	3NE3 333	450	2			
3RW44 43	203	3NE3 230-0B	315	1	3NE3 333	450	2			
3RW44 44	250	3NE3 230-0B	315	1	3NE3 333	450	2			
3RW44 45	313	3NE3 233	450	1	3NE3 336	630	2			
3RW44 46	356	3NE3 333	450	2	3NE3 336	630	2			
3RW44 47	432	3NE3 335	560	2	3NE3 338-8	800	2			
3RW44 53	551	2 x 3NE3 335	560	2	3 x 3NE3 334-0B	500	2			
3RW44 54	615	2 x 3NE3 335	560	2	3 x 3NE3 334-0B	500	2			
3RW44 55	693	2 x 3NE3 335	560	2	3 x 3NE3 334-0B	500	2			
3RW44 56	780	2 x 3NE3 336	630	2	2 x 3NE3 340-8	900	2			
3RW44 57	880	2 x 3NE3 336	630	2	2 x 3NE3 340-8	900	2			
3RW44 58	970	2 x 3NE3 336	630	2	2 x 3NE3 340-8	900	2			
3RW44 65	1076	2 x 3NE3 340-8	900	2	3 x 3NE3 338-8	800	2			
3RW44 66	1214	2 x 3NE3 340-8	900	2	3 x 3NE3 338-8	800	2			

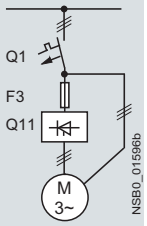
Soft starters		Line contactors up to 400 V	Braking contactors[1][2]		Motor starter protectors/ circuit breakers		Line protection, maximum		
ToC 2	Rated current	(optional)	(for example circuit see page 6/61)		440 V +10 %	Rated current	690 V +5 %	Rated current	Size
Q11 Type	A	Q21 Type	Q91 Type	Q92 Type	Q1 Type	A	F1 Type	A	
Type of coordination "2"[3]: I_q = 65 kA									
3RW44 22	29	3RT10 34	3RT15 26	--	3RV10 41-4HA10	50	3NA3 820-6	50	00
3RW44 23	36	3RT10 35	3RT15 26	--	3RV10 41-4JA10	63	3NA3 822-6	63	00
3RW44 24	47	3RT10 36	3RT15 35	--	3RV10 41-4KA10	75	3NA3 824-6	80	00
3RW44 25	57	3RT10 44	3RT15 35	--	3RV10 41-4LA10	90	3NA3 830-6	100	00
3RW44 26	77	3RT10 45	3RT10 24	3RT10 35	3RV10 41-4MA10	100	3NA3 132-6	125	1
3RW44 27	93	3RT10 46	3RT10 25	3RT10 36	3RV10 41-4MA10	100	3NA3 136-6	160	1
3RW44 34	113	3RT10 54	3RT10 34	3RT10 44	3VL17 16	160	3NA3 244-6	250	2
3RW44 35	134	3RT10 55	3RT10 36	3RT10 45	3VL17 16	160	3NA3 244-6	250	2
3RW44 36	162	3RT10 56	3RT10 44	3RT10 45	3VL37 25	250	3NA3 365-6	500	3
3RW44 43	203	3RT10 64	3RT10 44	3RT10 54	3VL47 31	315	2 x 3NA3 354-6	2 x 355	3
3RW44 44	250	3RT10 65	3RT10 44	3RT10 55	3VL47 31	315	2 x 3NA3 354-6	2 x 355	3
3RW44 45	313	3RT10 75	3RT10 54	3RT10 56	3VL47 40	400	2 x 3NA3 365-6	2 x 500	3
3RW44 46	356	3RT10 75	3RT10 54	3RT10 56	3VL47 40	400	2 x 3NA3 365-6	2 x 500	3
3RW44 47	432	3RT10 76	3RT10 55	3RT10 64	3VL57 50	500	2 x 3NA3 365-6	2 x 500	3
3RW44 53	551	3TF68	3RT10 64	3RT10 66	3VL67 80	800	2 x 3NA3 365-6	2 x 500	3
3RW44 54	615	3TF68	3RT10 64	3RT10 75	3VL67 80	800	2 x 3NA3 365-6	2 x 500	3
3RW44 55	693	3TF69	3RT10 65	3RT10 75	3VL67 80	800	2 x 3NA3 365-6	2 x 500	3
3RW44 56	780	3TF69	3RT10 65	3RT10 75	3VL77 10	1000	2 x 3NA3 365-6	2 x 500	3
3RW44 57	880		3RT10 75	3RT10 76	3VL77 10	1000	2 x 3NA3 365-6	2 x 500	3
3RW44 58	970		3RT10 75	3RT10 76	3VL77 12	1250	3 x 3NA3 365-6	3 x 500	3
3RW44 65	1076		3RT10 75	3TF68	3VL77 12	1250	3 x 3NA3 365-6	3 x 500	3
3RW44 66	1214		3RT10 76	3TF68	3VL77 12	1250	3 x 3NA3 365-6	3 x 500	3

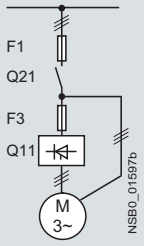
[1] If the ramp-down function "Combined braking" is selected, no braking contactor is required. If the ramp-down function "DC braking" is selected, a braking contactor must be used in addition (see table for type).
For applications with large centrifugal masses ($J_{Load} > J_{Motor}$) we recommend the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

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

[3] The type of coordination "2" refers only to soft starters in combination with the stipulated protective device (motor starter protector/circuit breaker/fuse), not to any additional components in the feeder. The types of coordination are explained under "3RA1 Fuseless Load Feeders".

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





For matching fuse bases see Catalog LV 1 under "SENTRON Switching and Protection Devices for Power Distribution" —> "Switch Disconnectors", and Catalog ET B1 under "BETA Protecting" —> "SITOR Semiconductor Fuses" or go to www.siemens.com/sitor —>"Products" —>"BETA Protecting" —>"SITOR"

Soft starters		Semiconductor fuses, minimum			Semiconductor fuses, maximum			Semiconductor fuses (cylinder)		
ToC 2	Rated current	690 V +10 %	Rated current	Size	690 V +10 %	Rated current	Size		Rated current	Size
Q11 Type	A	F3 Type	A		F3 Type	A		F3 Type	A	
Type of coordination "2" [1]										
3RW44 22	50	3NE4 120	80	0	3NE4 121	100	0	3NC2 280	80	22 x 58
3RW44 23	62	3NE4 121	100	0	3NE4 121	100	0	3NC2 200	100	22 x 58
3RW44 24	81	3NE4 121	100	0	3NE4 122	125	0	3NC2 200	100	22 x 58
3RW44 25	99	3NE4 122	125	0	3NE4 124	160	0			
3RW44 26	133	3NE4 124	160	0	3NE4 124	160	0			
3RW44 27	161	3NE3 224	160	1	3NE3 332-0B	400	2			
3RW44 34	196	3NE3 225	200	1	3NE3 335	560	2			
3RW44 35	232	3NE3 225	200	1	3NE3 335	560	2			
3RW44 36	281	3NE3 227	250	1	3NE3 333	450	2			
3RW44 43	352	3NE3 230-0B	315	1	3NE3 333	450	2			
3RW44 44	433	3NE3 230-0B	315	1	3NE3 333	450	2			
3RW44 45	542	3NE3 233	450	1	3NE3 336	630	2			
3RW44 46	617	3NE3 333	450	2	3NE3 336	630	2			
3RW44 47	748	3NE3 335	560	2	3NE3 338-8	800	2			
3RW44 53	954	2 x 3NE3 335	560	2	3 x 3NE3 334-0B	500	2			
3RW44 54	1065	2 x 3NE3 335	560	2	3 x 3NE3 334-0B	500	2			
3RW44 55	1200	2 x 3NE3 335	560	2	3 x 3NE3 334-0B	500	2			
3RW44 56	1351	2 x 3NE3 336	630	2	2 x 3NE3 340-8	900	2			
3RW44 57	1524	2 x 3NE3 336	630	2	3 x 3NE3 340-8	900	2			
3RW44 58	1680	2 x 3NE3 336	630	2	3 x 3NE3 340-8	900	2			
3RW44 65	1864	2 x 3NE3 340-8	900	2	3 x 3NE3 338-8	800	2			
3RW44 66	2103	2 x 3NE3 340-8	900	2	3 x 3NE3 338-8	800	2			

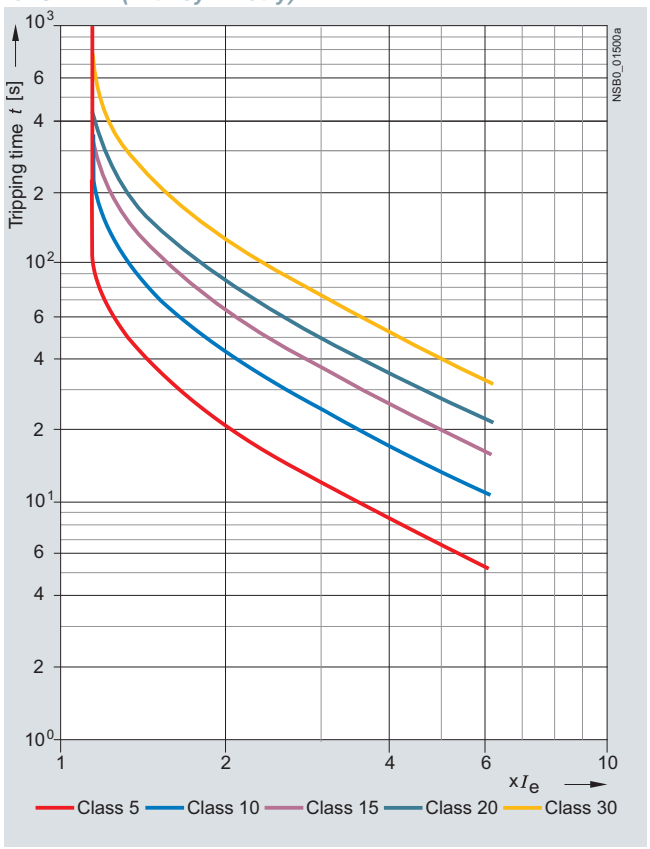
Soft starters		Line contactors up to 400 V	Motor starter protectors/ circuit breakers		Line protection, maximum		
ToC 2	Rated current	(optional)	440 V +10 %	Rated current	690 V +5 %	Rated current	Size
Q11 Type	A	Q21 Type	Q1 Type	A	F1 Type	A	
Type of coordination "2" [1]							
3RW44 22	50	3RT10 36-1AP04	3RV10 42-4KA10	75	3NA3 824-6	80	00
3RW44 23	62	3RT10 44-1AP04	3RV10 42-4LA10	90	3NA3 830-6	100	00
3RW44 24	81	3RT10 46-1AP04	3RV10 42-4MA10	100	3NA3 132-6	125	1
3RW44 25	99	3RT10 54-1AP36	3VL27 16	160	3NA3 136-6	160	1
3RW44 26	133	3RT10 55-6AP36	3VL27 16	160	3NA3 240-6	200	2
3RW44 27	161	3RT10 56-6AP36	3VL37 20	200	3NA3 244-6	250	2
3RW44 34	196	3RT10 64-6AP36	3VL37 25	250	3NA3 360-6	400	3
3RW44 35	232	3RT10 65-6AP36	3VL47 31	315	3NA3 360-6	400	3
3RW44 36	281	3RT10 66-6AP36	3VL47 40	400	2 x 3NA3 360-6	2 x 400	3
3RW44 43	352	3RT10 75-6AP36	3VL47 40	400	2 x 3NA3 365-6	2 x 500	3
3RW44 44	433	3RT10 76-6AP36	3VL57 50	500	2 x 3NA3 365-6	2 x 500	3
3RW44 45	542	3TF68 44-0CM7	3VL57 63	800	3 x 3NA3 365-6	3 x 500	3
3RW44 46	617	3TF68 44-0CM7	3VL67 80	800	3 x 3NA3 365-6	3 x 500	3
3RW44 47	748	3TF69	3VL67 80	800	3 x 3NA3 365-6	3 x 500	3
3RW44 53	954		3VL77 10	1000	3 x 3NA3 365-6	3 x 500	3
3RW44 54	1065		3VL77 12	1250	3 x 3NA3 365-6	3 x 500	3
3RW44 55	1200		3VL87 16	1600	3 x 3NA3 365-6	3 x 500	3
3RW44 56	1351		3VL87 16	1600	3 x 3NA3 372	3 x 630	3
3RW44 57	1524		3VL87 16	1600	3 x 3NA3 372	3 x 630	3
3RW44 58	1680		3WL12 20	2000	2 x 3NA3 480	2 x 1000	4
3RW44 65	1864		3WL12 25	2500	2 x 3NA3 482	2 x 1250	4
3RW44 66	2103		3WL12 25	2500	2 x 3NA3 482	2 x 1250	4

[1] The type of coordination "2" refers only to soft starters in combination with the stipulated protective device (motor starter protector/circuit breaker/fuse), not to any additional components in the feeder.

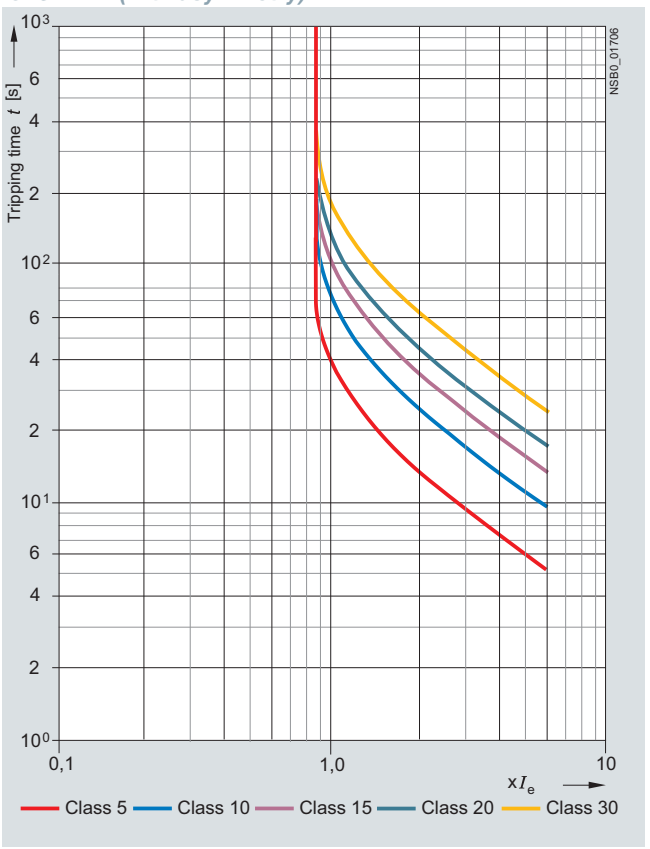
The types of coordination are explained under "3RA1 Fuseless Load Feeders".

Characteristic curves

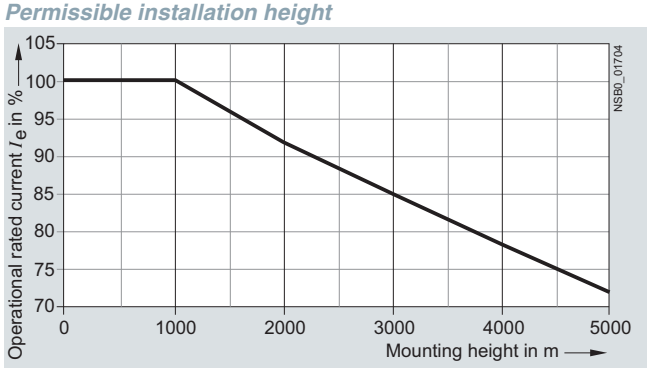
Motor protection tripping characteristics for 3RW44 (with symmetry)



Motor protection tripping characteristics for 3RW44 (with asymmetry)



Permissible installation height



At an installation height above 2000 m, the max. permissible operational voltage is reduced to 460 V.

More information

Application examples for normal starting (Class 10)

Normal starting Class 10 (up to 20 s with 350 % $I_{n\ motor}$),
The soft starter rating can be selected to be as high as the rating of the motor used

Application		Conveyor belt	Roller conveyor	Compressor	Small fan	Pump	Hydraulic pump
Starting parameters							
• Voltage ramp and current limiting							
- Starting voltage	%	70	60	50	30	30	30
- Starting time	s	10	10	10	10	10	10
- Current limit value		Deactivated	Deactivated	4 x I_M	4 x I_M	Deactivated	Deactivated
• Torque ramp							
- Starting torque		60	50	40	20	10	10
- End torque		150	150	150	150	150	150
- Starting time		10	10	10	10	10	10
• Breakaway pulse		Deactivated (0 ms)	Deactivated (0 ms)	Deactivated (0 ms)	Deactivated (0 ms)	Deactivated (0 ms)	Deactivated (0 ms)
Ramp-down mode		Smooth ramp-down	Smooth ramp-down	Free ramp-down	Free ramp-down	Pump ramp-down	Free ramp-down

Application examples for heavy starting (Class 20)

Heavy starting Class 20 (up to 40 s with 350 % $I_{n\ motor}$),
The soft starter has to be selected one performance class higher than the motor used

Application		Stirrer	Centrifuge	Milling machine
Starting parameters				
• Voltage ramp and current limiting				
- Starting voltage	%	30	30	30
- Starting time	s	30	30	30
- Current limit value		4 x I_M	4 x I_M	4 x I_M
• Torque ramp				
- Starting torque		30	30	30
- End torque		150	150	150
- Starting time		30	30	30
• Breakaway pulse		Deactivated (0 ms)	Deactivated (0 ms)	Deactivated (0 ms)
Ramp-down mode		Free ramp-down	Free ramp-down	Free ramp-down or DC braking

Application examples for very heavy starting (Class 30)

Very heavy starting Class 30 (up to 60 s with 350 % $I_{n\ motor}$),
The soft starter has to be selected two performance classes higher than the motor used

Application		Large fan	Mill	Breaker	Circular saw/bandsaw
Starting parameters					
• Voltage ramp and current limiting					
- Starting voltage	%	30	50	50	30
- Starting time	s	60	60	60	60
- Current limit value		4 x I_M	4 x I_M	4 x I_M	4 x I_M
• Torque ramp					
- Starting torque		20	50	50	20
- End torque		150	150	150	150
- Starting time		60	60	60	60
• Breakaway pulse		Deactivated (0 ms)	80 %, 300 ms	80 %, 300 ms	Deactivated (0 ms)
Ramp-down mode		Free ramp-down	Free ramp-down	Free ramp-down	Free ramp-down

Note:
These tables present sample set values and device sizes. They are intended only for the purposes of information and are not binding. The set values depend on the application in question and must be optimized during commissioning.
The soft starter dimensions should be checked where necessary with the Win-Soft Starter software or with the help of Technical Assistance.

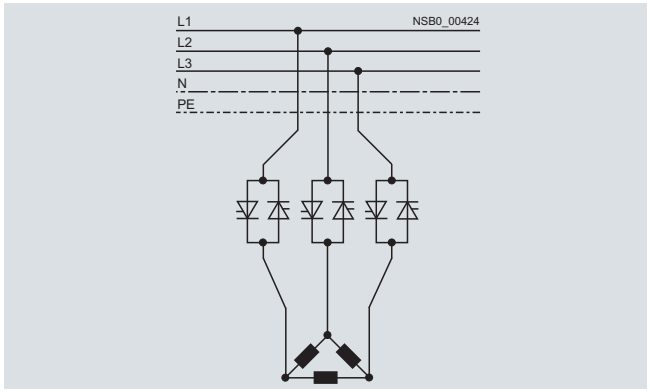
3RW44 for high-feature applications

Circuit concept

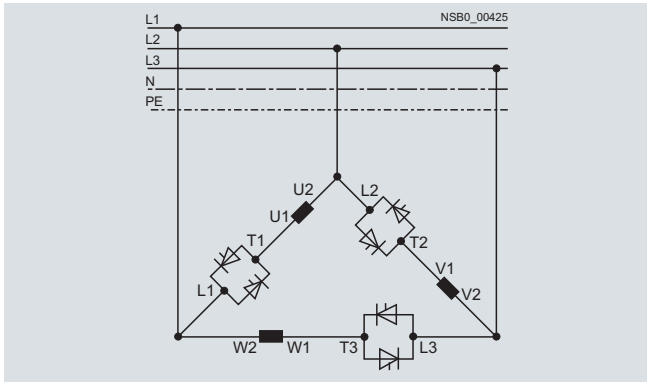
The SIRIUS 3RW44 soft starters can be operated in two different types of circuit.

- Inline circuit
  The controls for isolating and protecting the motor are simply connected in series with the soft starter. The motor is connected to the soft starter with three cables.
- Inside-delta circuit
  The wiring is similar to that of wye-delta starters. The phases of the soft starter are connected in series with the individual motor windings. The soft starter then only has to carry the phase current, amounting to about 58 % of the rated motor current (conductor current).

Comparison of the types of circuit



Inline circuit:
Rated current I_e corresponds to the rated motor current I_n,
3 cables to the motor



Inside-delta circuit:
Rated current I_e corresponds to approx. 58 % of the rated motor current I_n, 6 cables to the motor (as with wye-delta starters)

Which circuit?

Using the inline circuit involves the lowest wiring outlay. If the soft starter to motor connections are long, this circuit is preferable. With the inside-delta circuit there is double the wiring complexity but a smaller size of device can be used at the same rating.

Thanks to the choice of operating mode between the inline circuit and inside-delta circuit, it is always possible to select the most favorable solution.

The braking function is possible only in the inline circuit.

Configuration

The 3RW44 solid-state soft starters are designed for normal starting. In case of heavy starting or increased starting frequency, a larger device must be selected.

For long starting times it is recommended to have a PTC sensor in the motor. This also applies for the ramp-down modes smooth ramp-down, pump ramp-down and DC braking, because during the ramp-down time in these modes, an additional current loading applies in contrast to free ramp-down.

In the motor feeder between the SIRIUS 3RW soft starter and the motor, no capacitive elements are permitted (e. g. no reactive-power compensation equipment). In addition, neither static systems for reactive-power compensation nor dynamic PFC (Power Factor Correction) must be operated in parallel during starting and ramp-down of the soft starter. This is important to prevent faults arising on the compensation equipment and/or the soft starter.

All elements of the main circuit (such as fuses and controls) should be dimensioned for direct starting, following the local short-circuit conditions. Fuses, controls and overload relays must be ordered separately.

A bypass contact system and solid-state overload relay are already integrated in the 3RW44 soft starter and therefore do not have to be ordered separately.

The harmonic component load for starting currents must be taken into consideration for the selection of motor starter protectors (selection of release).

Note:
When induction motors are switched on, voltage drops occur as a rule on starters of all types (direct starters, wye-delta starters, soft starters). The infeed transformer must always be dimensioned such that the voltage dip when starting the motor remains within the permissible tolerance. If the infeed transformer is dimensioned with only a small margin, it is best for the control voltage to be supplied from a separate circuit (independently of the main voltage) in order to avoid the potential switching off of the soft starter.

Device interface, PROFIBUS DP communication module, Soft Starter ES parameterizing and operating software

The 3RW44 electronic soft starters have a PC interface for communicating with the Soft Starter ES software or for connecting the external display and operator module. If the optional PROFIBUS communication module is used, the 3RW44 soft starter can be integrated in the PROFIBUS network and communicate using the GSD file or Soft Starter ES Premium software.

The Soft Starter ES parameterizing and operating software can be downloaded from
http://www.siemens.com/softstarter > Software
with a 14-day trial license.

More information about Soft Starter ES can be found in Chapter 12 of Catalog LV 1.

Manual for SIRIUS 3RW44

Besides containing all important information on configuring, commissioning and servicing, the manual also contains example circuits and the technical specifications for all devices.

Win-Soft Starter selection and simulation program

With this software, you can simulate and select all Siemens soft starters, taking into account various parameters such as mains properties, motor and load data, and special application requirements.

The software is a valuable tool, which makes complicated, lengthy manual calculations for determining the required soft starters superfluous.

The Win-Soft Starter selection and simulation program can be downloaded from:
http://www.siemens.com/softstarter > Software

More information can be found on the Internet at:
http://www.siemens.com/softstarter

SIRIUS soft starter training course (SD-SIRIUSO)

Siemens offers a 2-day training course on the SIRIUS solid-state soft starters to keep customers and own personnel up-to-date on configuring, commissioning and servicing issues.

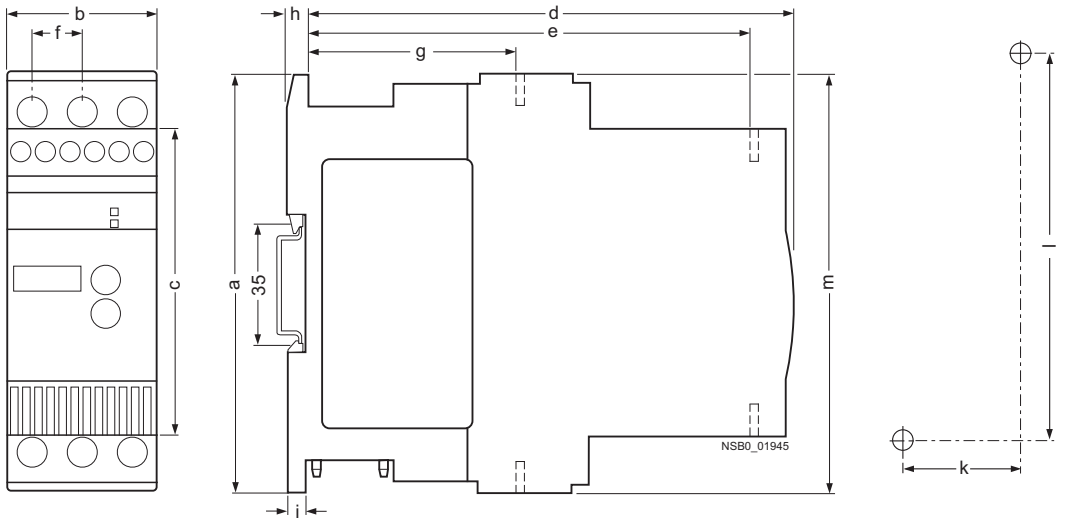
Please direct enquiries and applications to:

Siemens AG
Training Center for Automation and Industrial Solution
Gleiwitzer Strasse 555
90475 Nürnberg
GERMANY
Tel.: +49 (0) 911 895 3202
Fax: +49 (0) 911 895 3275
E-mail: ingeborg.hoier@siemens.com
http://www.siemens.com/sitrain-cd

Dimensional drawings

3RW30 for standard applications

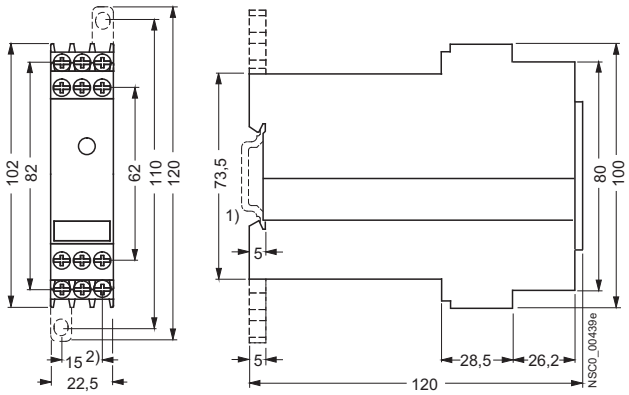
3RW30 1. ... 3RW30 4.



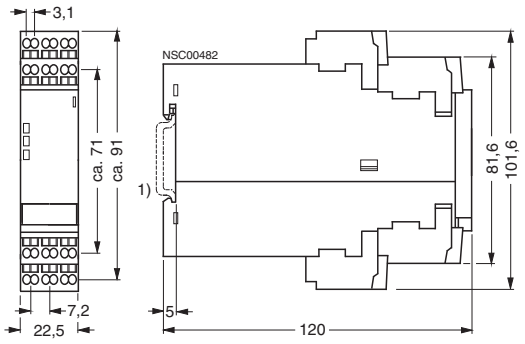
Type/Dimension (mm)	a	b	c	d	e	f	g	h	i	k	l	m
3RW30 1.-1.	95	45	62	146	126	14.4	63	5	6.5	35	85	95
3RW30 1.-2.	95	45	62	146	126	14.4	63	5	6.5	35	85	117.2
3RW30 2.-1.	125	45	92	146	126	14.4	63	5	6.5	35	115	125
3RW30 2.-2.	125	45	92	146	126	14.4	63	5	6.5	35	115	150
3RW30 3.	160	55	110	163	140	18	63	5	6.5	30	150	144
3RW30 4.	170	70	110	181	158	22.5	85	5	10	60	160	160

Clearances to grounded parts (mm)	Lateral	Top	Bottom	Fixing screws	Tightening torques (Nm)
3RW30 1.	5	60	40	M4	1
3RW30 2.	5	60	40	M4	1
3RW30 3.	30	60	40	M4	1
3RW30 4.	30	60	40	M4	2

3RW30 03-1. (screw terminals)



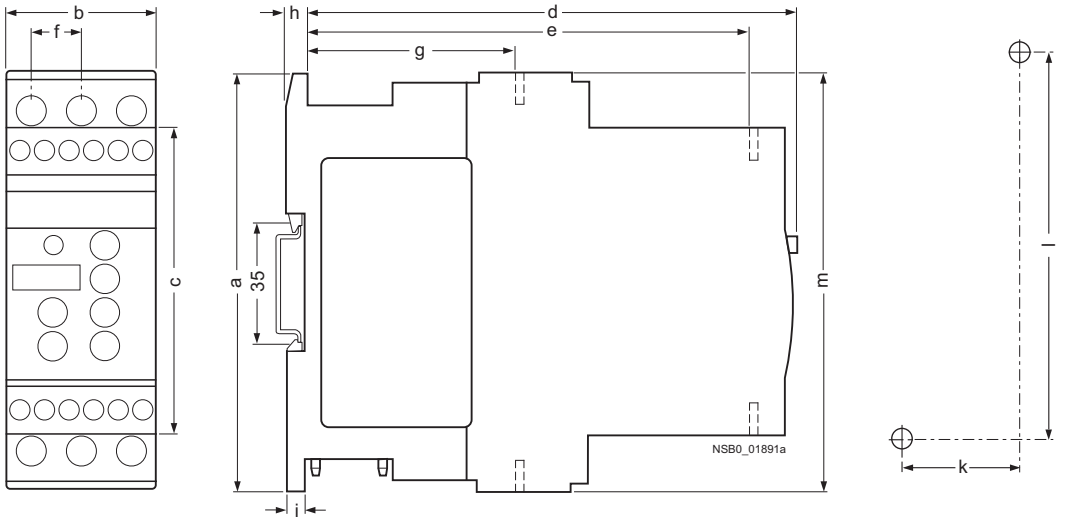
3RW30 03-2. (spring-type terminals)



1) For mounting onto standard mounting rail TH 35 according to EN 60715.

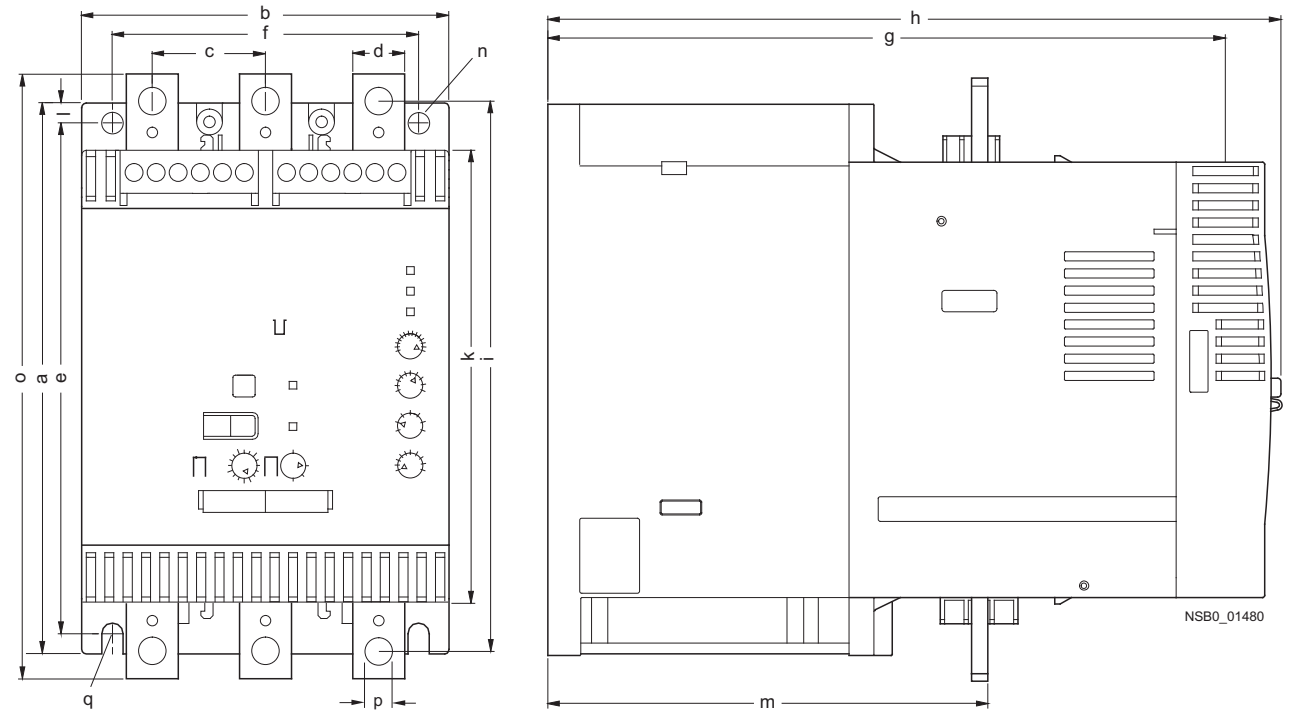
2) Dimension for screw fixing.
Screw fixing with two 3RP1 903 push-in lugs per 3RW30 03 device.

3RW40 for standard applications



Type/Dimension (mm)	a	b	c	d	e	f	g	h	i	k	l	m
3RW40 2.-1.	125	45	92	149	126	14.4	63	5	6.5	35	115	125
3RW40 2.-2.	125	45	92	149	126	14.4	63	5	6.5	35	115	150
3RW40 3.	170	55	110	165	140	18	63	5	6.5	30	150	144
3RW40 4.	170	70	110	183	158	22.5	85	5	10	60	160	160

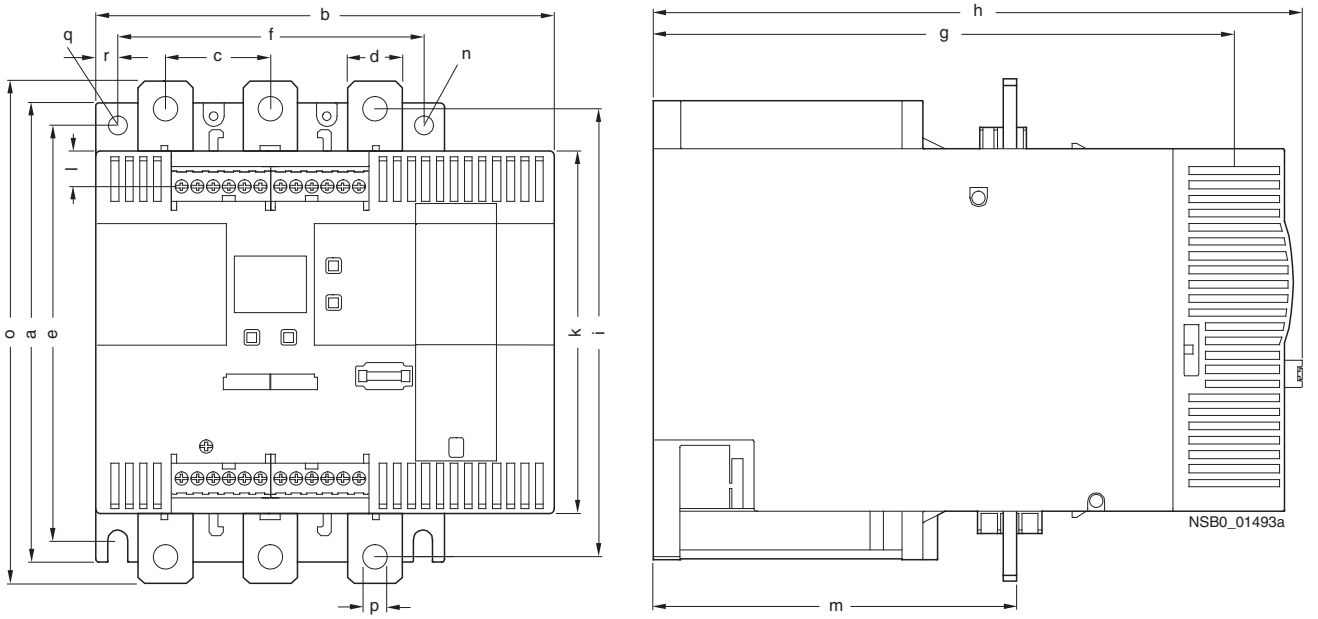
Clearances to grounded parts (mm)	Lateral	Top	Bottom	Fixing screws	Tightening torques (Nm)
3RW40 2.	5	60	40	M4	1
3RW40 3.	30	60	40	M4	1
3RW40 4.	30	60	40	M4	2



Type/Dimension (mm)	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q
3RW40 5.	180	120	37	17	167	100	223	250	180	148	6.5	153	7	198	9	M6, 10 Nm
3RW40 7.	210	160	48	25	190	140	240	278	205	166	10	166	9	230	11	M8, 15 Nm

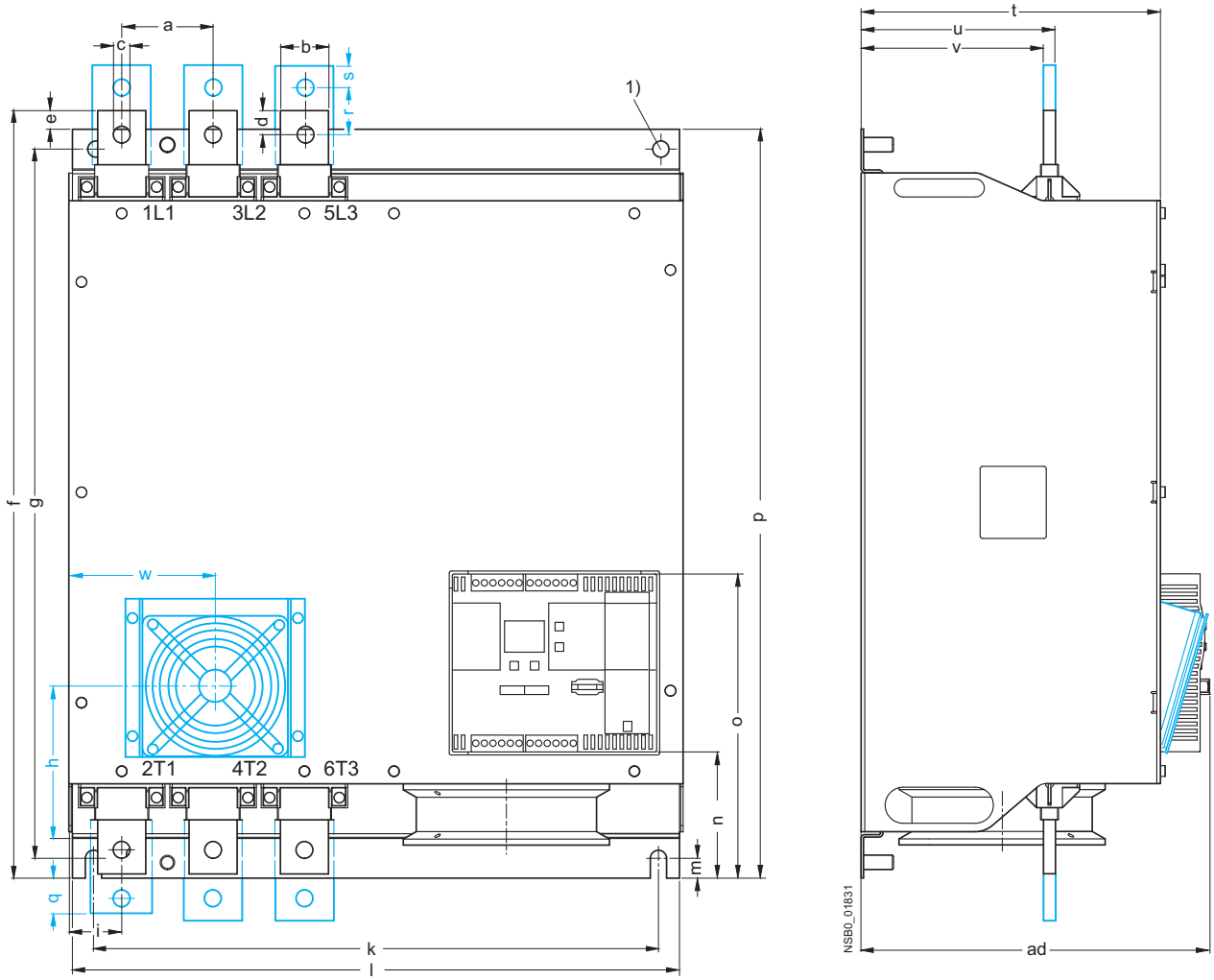
Project planning aids

3RW44 2., 3RW44 3. and 3RW44 4. for High-Feature applications



Type/Dimension (mm)	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r
3RW44 2.	180	170	37	11	167	100	240	270	174	148	7.5	153	7	184	6.6	M6, 10 Nm	10
3RW44 3.	180	170	37	17	167	100	240	270	174	148	7.5	153	7	198	9	M6, 10 Nm	10
3RW44 4.	210	210	48	25	190	140	269	298	205	166	16	166	9	230	11	M8, 15 Nm	10

3RW44 5. and 3RW44 6. for High-Feature applications

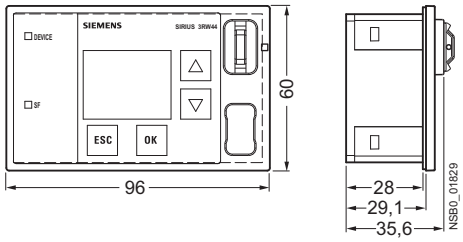


1) For M12 screw, tightening torque max. 35 Nm (310 lb.in).

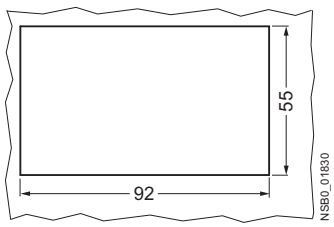
Type/Dimension (mm)	a	b	c	d	e	f	g	h	i	k	l	m
3RW44 5.	76	40	14	20	15.5	638.5	590	--	44	470	510	16.5
3RW44 6.	85	50	14	--	--	667	660	160	37.5	535	576	16.5

Type/Dimension (mm)	n	o	p	q	r	s	t	u	v	W	ad
3RW44 5.	105	253	623	--	--	--	249	162	152	--	290
3RW44 6.	103	251	693	43.5	40	20	249	162	151.4	123	290

3RW49 00-0AC00 external display and operator module



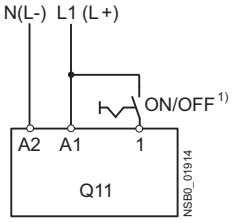
Installation cutout for 3RW49 00-0AC00 external display and operator module



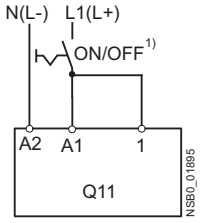
Schematics

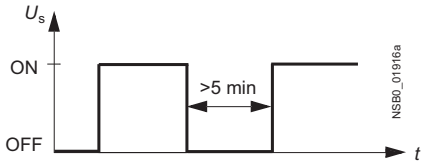
3RW30 . . connection examples for control circuit

Control using switches

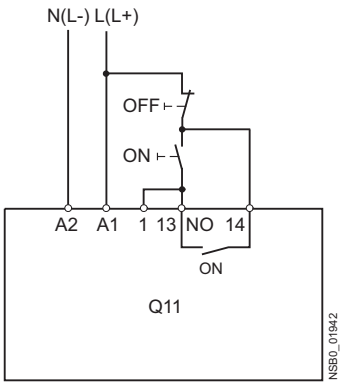


Automatic mode

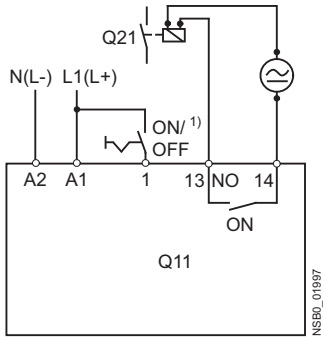




Control by pushbutton

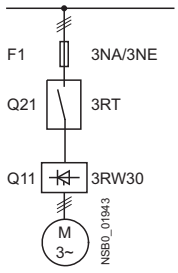


Control of a main contactor

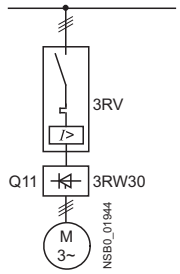


3RW30 connection examples for main circuit[2)]

3RW30 – 3-phase motor with 3NA/3NE fuse



3RV motor starter protector

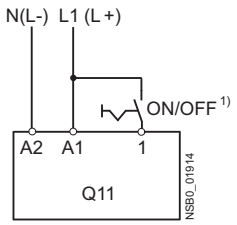


1) **Caution: Risk of restarting!**
When operating with a switch (ON/OFF) a new, automatic restart will take place automatically if the start command is still active at terminal 1.

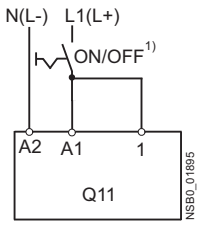
2) As an alternative, the motor feeder can also be installed as a fuseless or as a fused version. For fuse and switching device coordination, see "Technical specifications".
The wiring diagrams are provided only as examples.

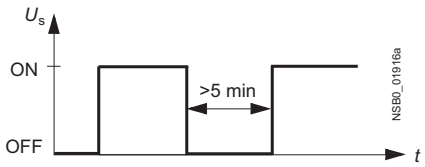
3RW40 2. ... 3RW40 4. connection examples for control circuit

Control using switches

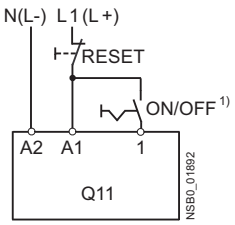


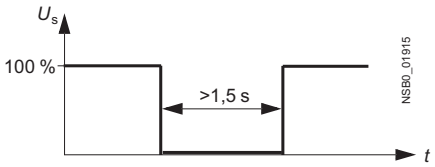
Automatic mode



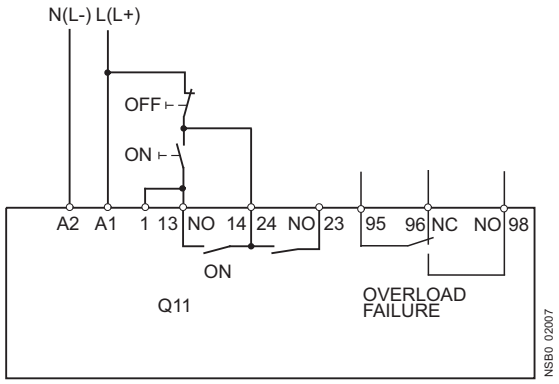


Control with remote reset

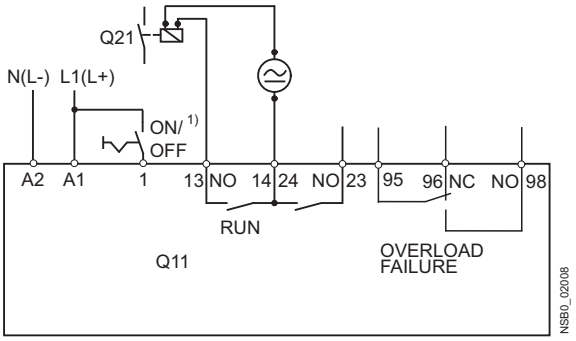




Control of 3RW40 2. ... 3RW40 4. by pushbutton

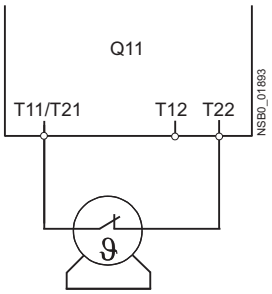


Control of a main contactor

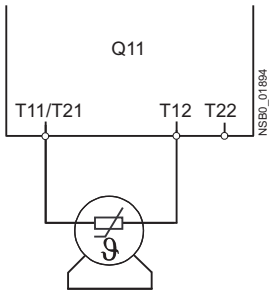


Connection example of 3RW40 2. ... 3RW40 4. for PTC sensors (thermistor motor protection)

Thermoclick



PTC type A

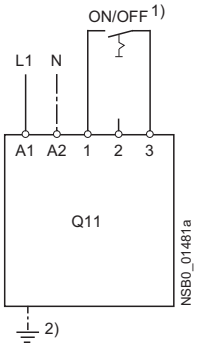


1) **Caution: Risk of restarting!**
When operating with a switch (ON/OFF) a new, automatic restart will take place automatically if the start command is still active at terminal 1.

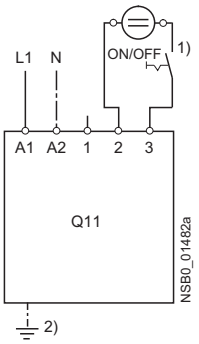
Project planning aids

3RW40 5. and 3RW40 7. connection examples for control circuit

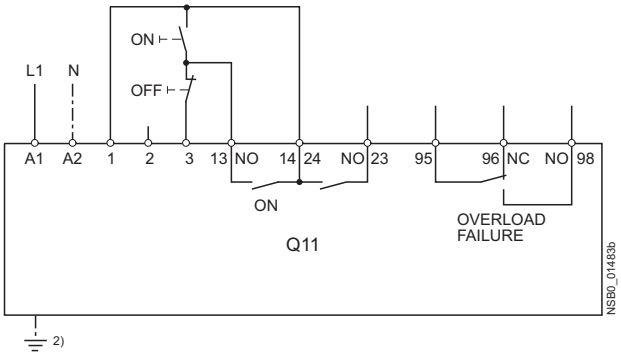
Control by switch using internal 24 V DC supply



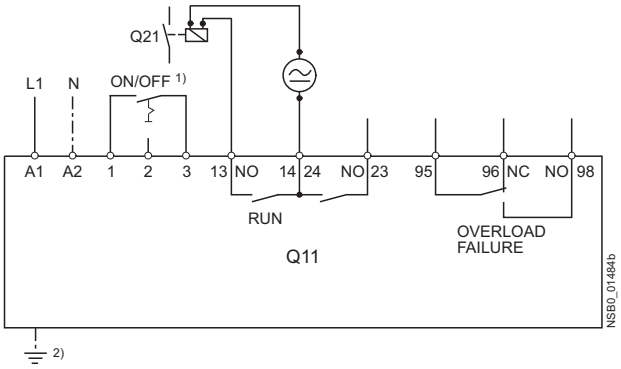
external power supply



Control by pushbutton

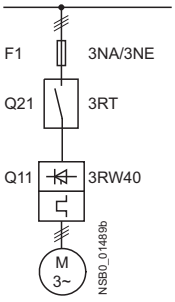


Control of a main contactor

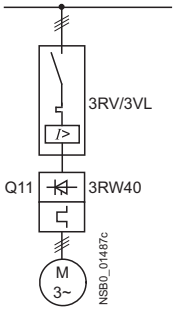


3RW40 connection examples for main circuit[3)]

3RW40 – 3-phase motor with 3NA/3NE fuse



3RV motor starter protector/ 3VL circuit breaker



1) **Caution: Risk of restarting!**
When operating with a switch (ON/OFF) a new, automatic restart will take place automatically if the start command is still active at terminal 3.

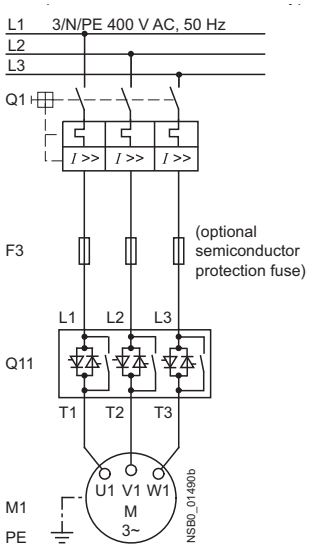
2) Grounding necessary for fan connection to 3RW40 5...

3) As an alternative, the motor feeder can also be installed as a fuseless or as a fused version. For fuse and switching device coordination, see "Technical specifications".
The wiring diagrams are provided only as examples.

3RW44 connection examples for main and control circuits

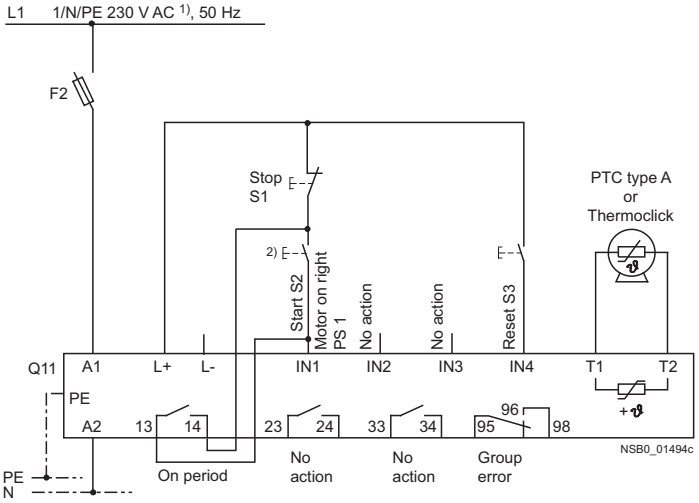
Main circuit

Possibility 1a:
Inline circuit with motor starter protector and SITOR fuse
(semiconductor protection only)



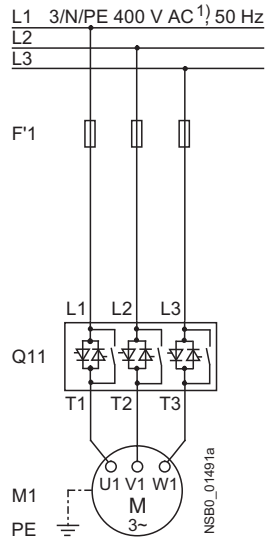
Control circuit

Possibility 1:
Control by pushbutton

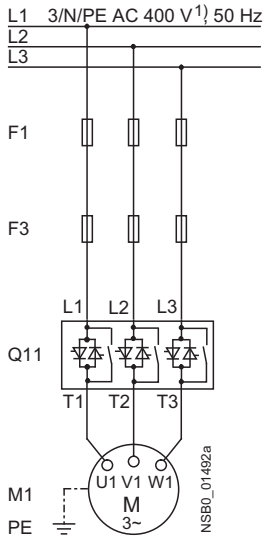


Main circuit

Possibility 1b:
Inline circuit with all-range protection
(line and semiconductor protection)



Possibility 1c:
Inline circuit with line and SITOR fuse
(semiconductor protection only)



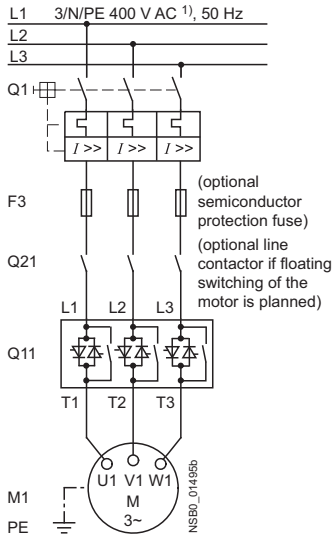
1) Permissible values for main and control voltage, see "Technical specifications".

2) **Caution: Risk of restarting!**
Because the output is parameterized to "Motor ON", the start command is automatically active after the reset command and a new, automatic restart will take place. This applies especially in case of motor protection tripping. For safety reasons we recommend connecting the group error output (terminals 95/96) in series with the output parameterized to "Motor ON".

Project planning aids

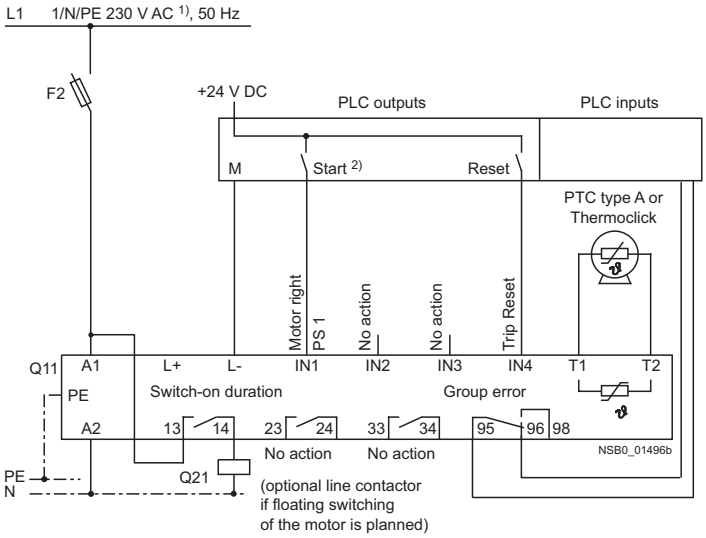
Main circuit

Possibility 2:
Inline circuit with main contactor



Control circuit

Possibility 2:
Control of a main contactor and control by means of PLC

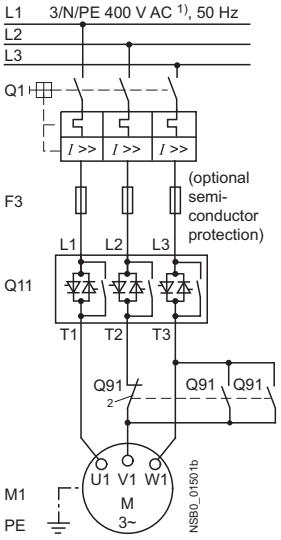


1) Permissible values for main and control voltage, see "Technical specifications".

2) **Caution: Risk of restarting!**
The start command (e. g. from the PLC) must be reset prior to a reset command because a new, automatic restart will take place automatically if a start command is active after the reset command. This applies especially in case of motor protection tripping.
For safety reasons we recommend incorporating the group error output (terminals 95 and 96) in the controller.

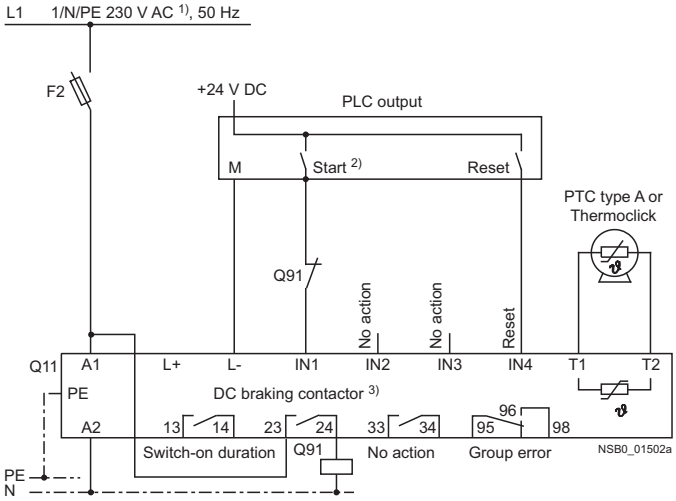
Main circuit

Possibility 3a:
Inline circuit with ramp-down function DC braking[3)]
(for device types 3RW44 22 to 3RW44 25)



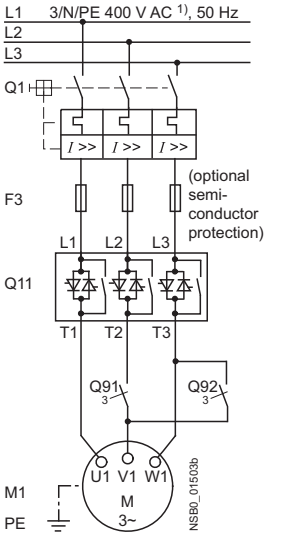
Control circuit

Possibility 3a:
Control of the DC braking contactor[3)]



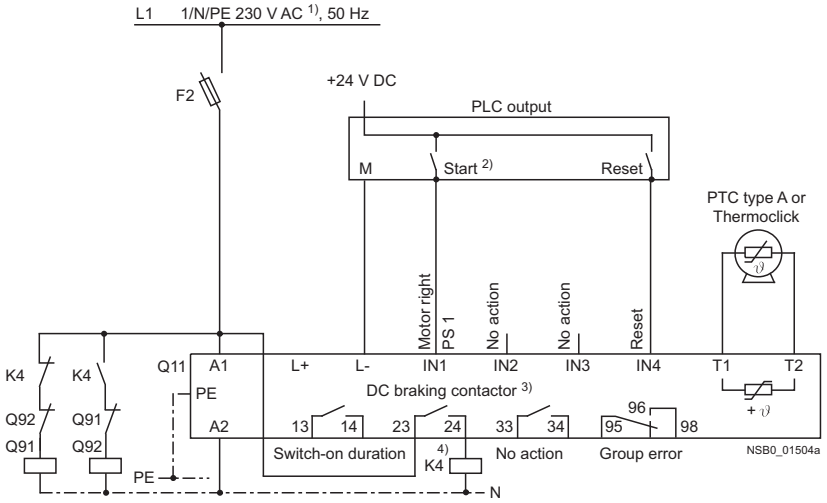
Main circuit

Possibility 3b:
Inline circuit with ramp-down function DC braking[3)]
(for device types 3RW44 26 to 3RW44 47)



Control circuit

Possibility 3b:
Control of the DC braking contactor[3)]



1) Permissible values for main and control voltage, see "Technical specifications".

2) **Caution: Risk of restarting!**
The start command (e. g. from the PLC) must be reset prior to a reset command because a new, automatic restart will take place automatically if a start command is active after the reset command. This applies especially in case of motor protection tripping.
For safety reasons we recommend incorporating the group error output (terminals 95 and 96) in the controller.

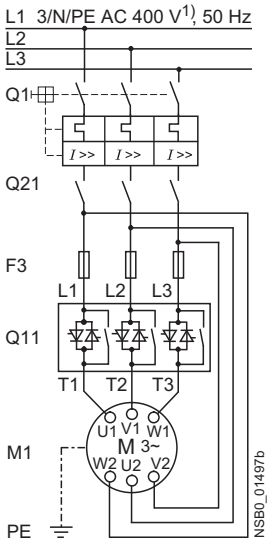
3) If the ramp-down function "Combined braking" is selected, no braking contactor is required.
If the ramp-down function "DC braking" is selected, a braking contactor must be used in addition. For type see "Fuse Assignment (Inline Circuit)" on pages 6/44 to 6/46.
For applications with large centrifugal masses ($J_{Load} > J_{Motor}$) we recommend the function "DC braking".
The output 2 must be switched over to "DC braking contactor".

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

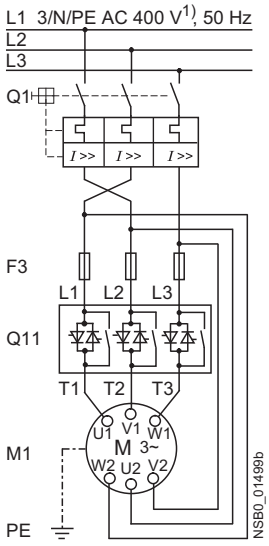
Project planning aids

Main circuit

Possibility 4a:
Inside-delta circuit

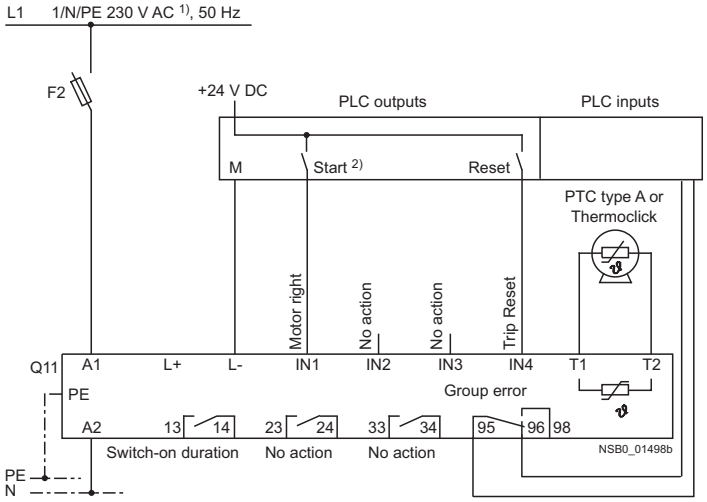


Possibility 4b:
Change of direction of rotation for inside-delta circuit



Control circuit

Possibility 4:
Control by means of PLC



1) Permissible values for main and control voltage, see "Technical specifications".

2) **Caution: Risk of restarting!**
The start command (e. g. from the PLC) must be reset prior to a reset command because a new, automatic restart will take place automatically if a start command is active after the reset command. This applies especially in case of motor protection tripping.
For safety reasons we recommend incorporating the group error output (terminals 95 and 96) in the controller.

Overview

3RA1 fuseless load feeders

The 3RA1 fuseless load feeders consist of the 3RV1 motor starter protector and the 3RT1 contactor. Motor starter protectors and contactors are electrically and mechanically connected using pre-assembled assembly kits (link modules, wiring kits and standard mounting rail or busbar adapters).

As the 3RA1 fuseless load feeders are constructed from 3RV1 motor starter protectors and 3RT1 contactors, the same accessories can be used for the 3RA fuseless load feeders as for these motor starter protectors and contactors.

Pre-assembled assembly kits are available as accessories for the power spectrum up to 45 kW. The desired fuseless load feeder can thus be assembled quickly and economically by the customer. A time saving is also achieved in connection with switchgear acceptances, as – unlike with conventional wiring systems – there is no need to rectify possible wiring errors.

The 3RV1 motor starter protector is responsible for overload and short-circuit protection in the fuseless load feeder. Back-up protective devices, such as melting fuses or limiters, are superfluous here, as the motor starter protector is capable of withstanding short-circuits of up to 50 or 100 kA at 400 V.

The 3RT1 contactor is particularly suitable for extremely complex switching tasks requiring the greatest endurance.

The permissible ambient temperature is 60 °C with butt-mounting and without derating (70 °C possible subject to certain restrictions).

3RA1 fuseless load feeders are available for motors up to 45 kW at AC-3 and 400 V (grounded network) and setting ranges from 0.14 A to 100 A.

3RA1 fuseless load feeders are supplied in four different sizes:

Size	Width mm	Max. rated current I_n max A	For induction motors up to kW
S00	45	12	5.5
S0	45	25	11
S2	55	50	22
S3	70	100	45

The SENTRON 3VL circuit breakers and the SIRIUS 3RT contactors can be used for fuseless load feeders >100 A. The corresponding clearances from grounded or live parts, as detailed in the technical specifications, must be observed.

Operating conditions

3RA1 load feeders are climate-proof. They are intended for use in enclosed rooms in which no severe operating conditions (such as dust, caustic vapors, hazardous gases) prevail. Suitable covers must be provided for installation in dusty and damp locations.

Overload tripping times

All 3RA1 fuseless load feeders described here are designed for normal starting, in other words for overload tripping times of less than 10 s (CLASS 10). At rated-load operating temperature the tripping times are shorter, depending on the particular equipment and the setting range. The exact values can be derived from the tripping characteristics of the motor starter protectors.

Types of coordination

EN 60947-4-1 and IEC 60947-4-1 make a distinction between two different types of coordination, which are designated type of coordination "1" and type of coordination "2". Any short-circuits that occur are cleared safely by both types of coordination. The only differences concern the extent of the damage caused to the device by a short-circuit.

ToC 1 Type of coordination "1"
The fuseless load feeder may be non-operational after a short-circuit has been cleared. Damage to the contactor or to the overload release is permissible. For 3RA1 load feeders, the motor starter protector itself always achieves type of coordination "2".

ToC 2 Type of coordination "2"
There must be no damage to the overload release or to any other components after a short-circuit has been cleared. The 3RA1 fuseless load feeder can resume operation without needing to be renewed. At most, welding of the contactor contacts is permissible if they can be disconnected easily without any significant deformation.

These types of coordination are indicated in the Technical specifications by orange backgrounds.

General data

Design

Complete units

The 3RA1 fuseless load feeders can be ordered as complete units for direct start or for reversing duty. Control supply voltages of AC 50 Hz 230 V or 24 V DC and assembly on a 35 mm standard mounting rail or in a 40 or 60 mm busbar system are possible.
Single devices for self-assembly can be ordered if other rated control supply voltages are required. The assembly kits simplify customer assembly of the load feeders.
The corresponding clearances from grounded or live parts, as detailed in the technical specifications, must be observed.

Customer assembly

The standard devices can be combined optimally – in terms of both technical specifications and dimensions, thanks to the modular system of the SIRIUS series.

The fuseless load feeders can thus be assembled easily by the customer. It is simply necessary to assemble the standard 3RV1 motor starter protector and 3RT1 contactor and the appropriate assembly kit together.

For the order numbers for single devices and assembly kits, see the selection and ordering data "3RA11 Direct-On-Line Starters and 3RA12 Reversing Starters for Standard Mounting Rail, Screw Fixing or Busbar Systems".

For assembly kits for direct start or reversing duty for mounting on standard mounting rails or busbars, see ordering data "Accessories for Direct-On-Line Starters and Reversing Starters".

If a motor starter protector with a rotary operating mechanism is required for the lower setting ranges up to 12 A, the S0 motor starter protector can also be assembled with an S00 contactor. A special link module is available for this purpose.

For the installation of feeders, it is imperative to use standard mounting rail adapters, as from size S2 for direct start and as from size S0 for reversing duty, to ensure the necessary mechanical strength. A standard mounting rail adapter is not necessary if a busbar adapter is used.

Accessories

The accessories for the single devices, such as auxiliary switches and undervoltage trip units, can also be used for the 3RA1 fuseless load feeders.

In addition, certain accessories have been optimized for the fuseless load feeders. They include the top-connected, transverse auxiliary switch on the motor starter protector with one changeover contact or one NO contact + one NC contact. Special auxiliary switch blocks that can be snapped on from below are available for the contactor. These two accessories enable the fuseless load feeders to be wired simply without having to route cables through the device.

The special accessories for 3RA fuseless load feeders take the form of assembly kits for 3RV1 motor starter protectors and 3RT1 contactors.

Mounting

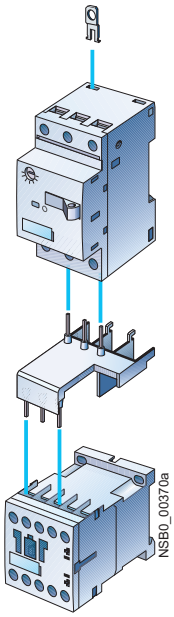
3RA1 fuseless load feeders are available for assembly on TH 35 standard mounting rails according to EN 60715 (depth 15 mm) or on busbar adapters with a busbar center-to-center clearance of 40 or 60 mm and a busbar thickness of 5 or 10 mm with chamfered edges.

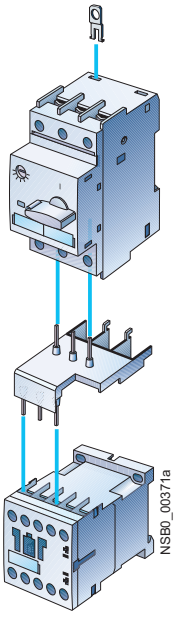
The fuseless load feeders are also suitable for screw fixing.

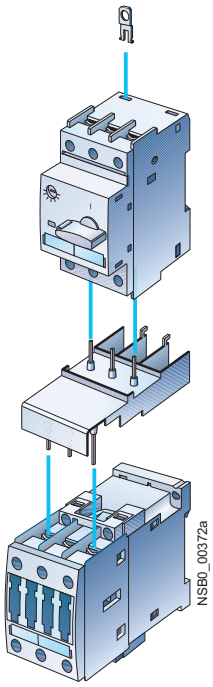
Up to size S0 the 3RA11 fuseless load feeders can also be configured with the 3RV19 infeed system (see 3RV19 Infeed System).

Size S00 and S0 can be screwed on with the aid of push-in lugs (see Accessories for Direct-On-Line and Reversing Starters).

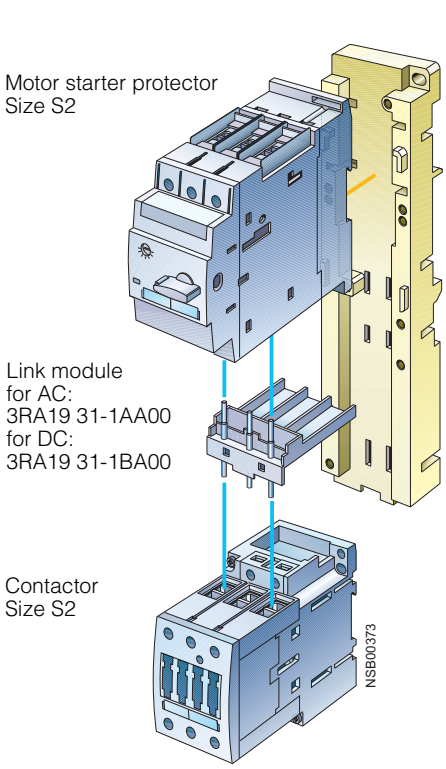
Direct start • For standard rail mounting • Size S00 and S0

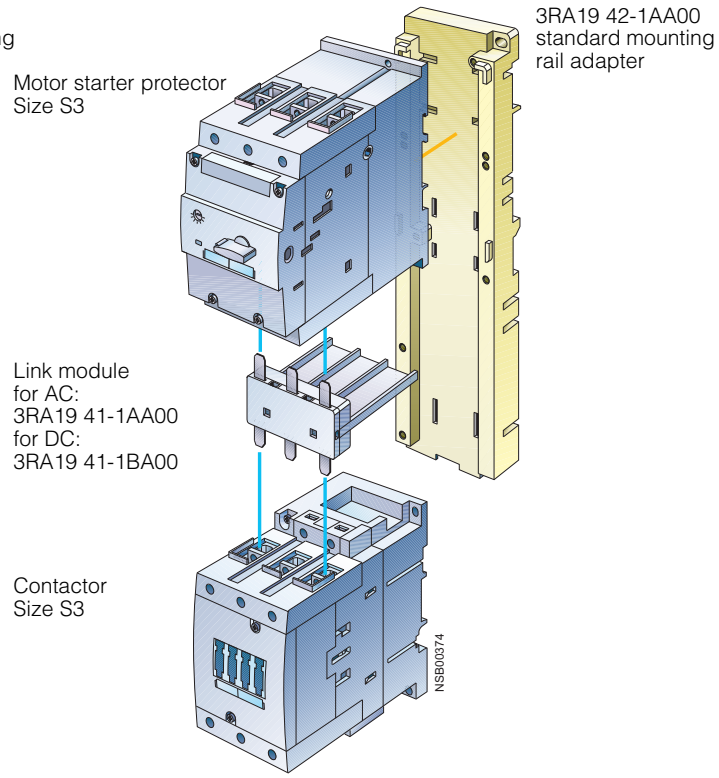






Direct start • For standard rail mounting • Size S2 and S3

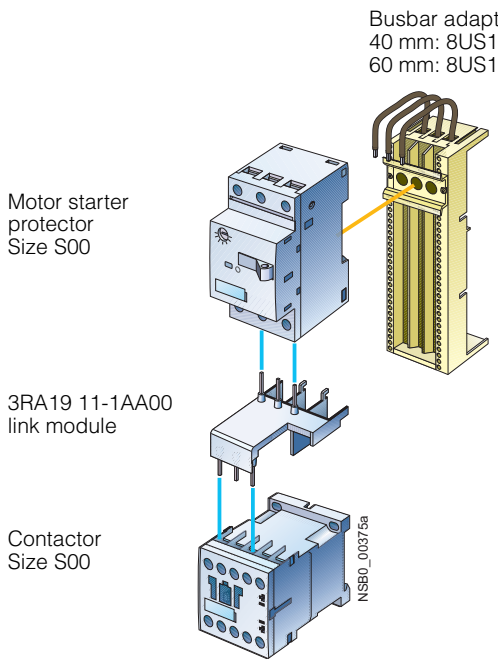


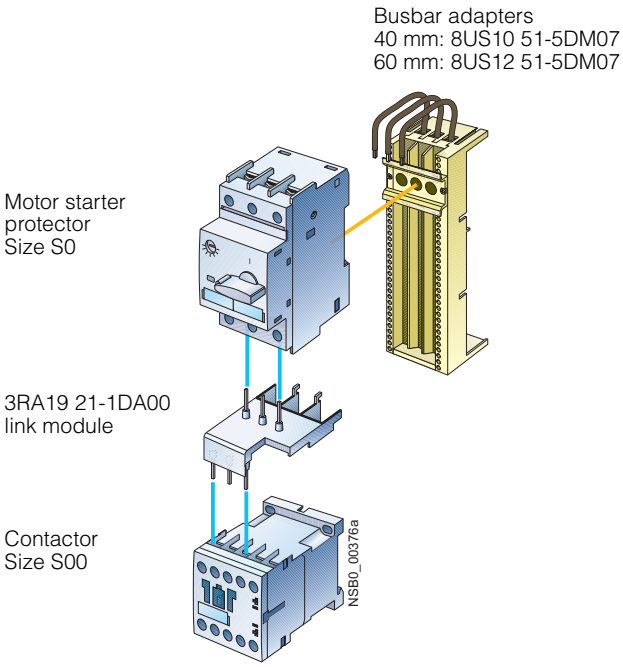


These graphical overviews are shown without small mounting parts (screws etc.).

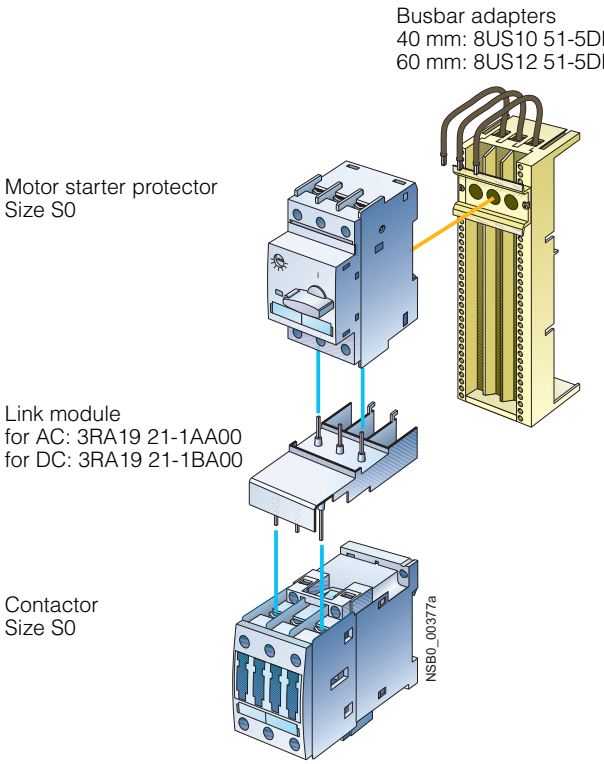
General data

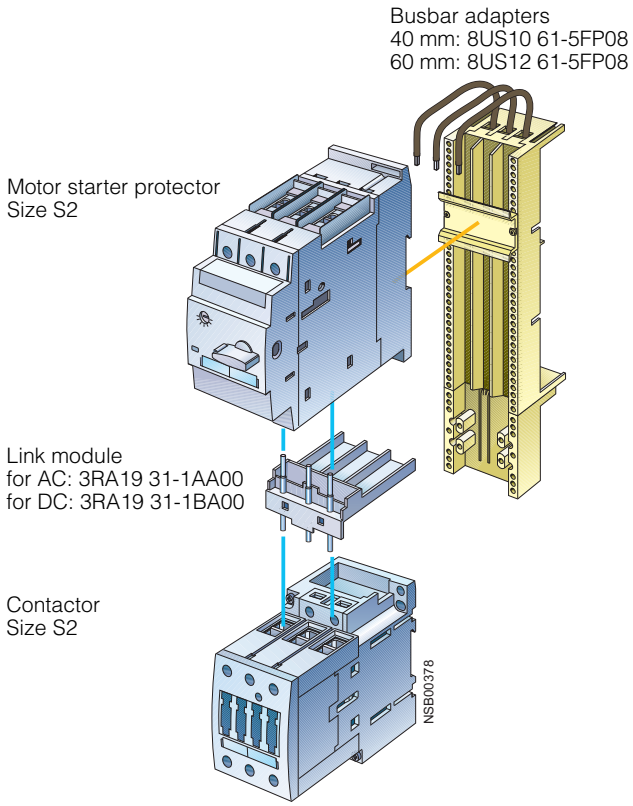
Direct start • For 40 mm and 60 mm busbar systems • Size S00 and S0





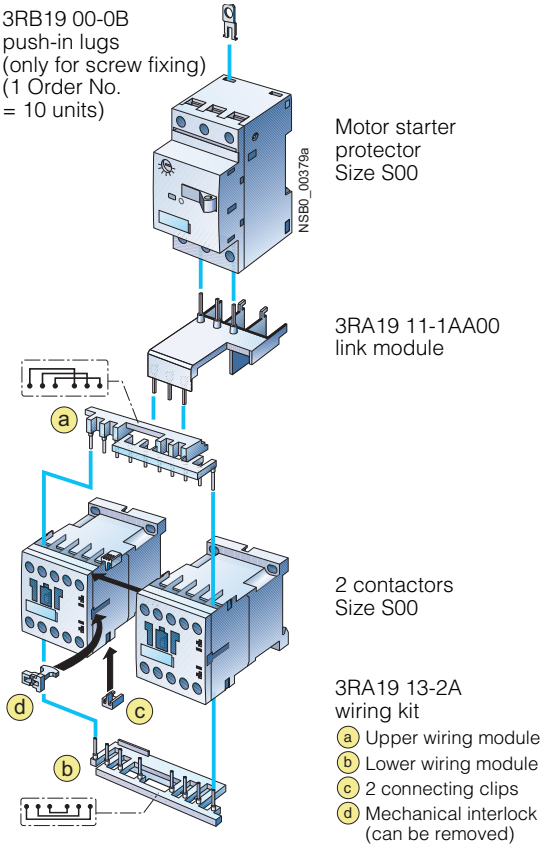
Direct start • For 40 mm and 60 mm busbar systems • Size S0 and S2

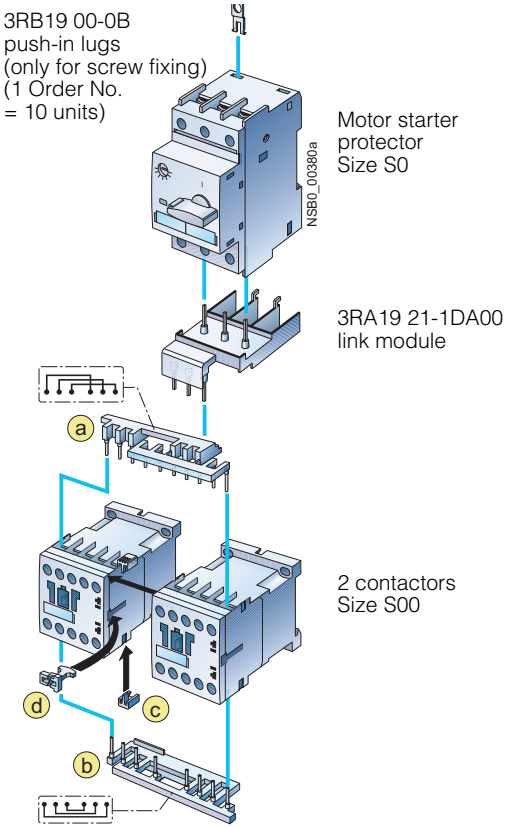




These graphical overviews are shown without small mounting parts (screws etc.).

Reversing duty • For standard rail mounting • Size S00 and S0





Reversing duty • For standard rail mounting • Size S0

3RA19 23-1B
assembly kits (RH)
for reversing duty
for standard rail mounting
Consisting of:
1 wiring kit
2 standard mounting rail adapters ①
2 side modules ②
4 connecting plates ③

① 3RA19 22-1AA00
standard mounting rail adapter

② 3RA19 02-1B
side modules
for standard mounting rail adapter
(1 Order No. = 10 units)

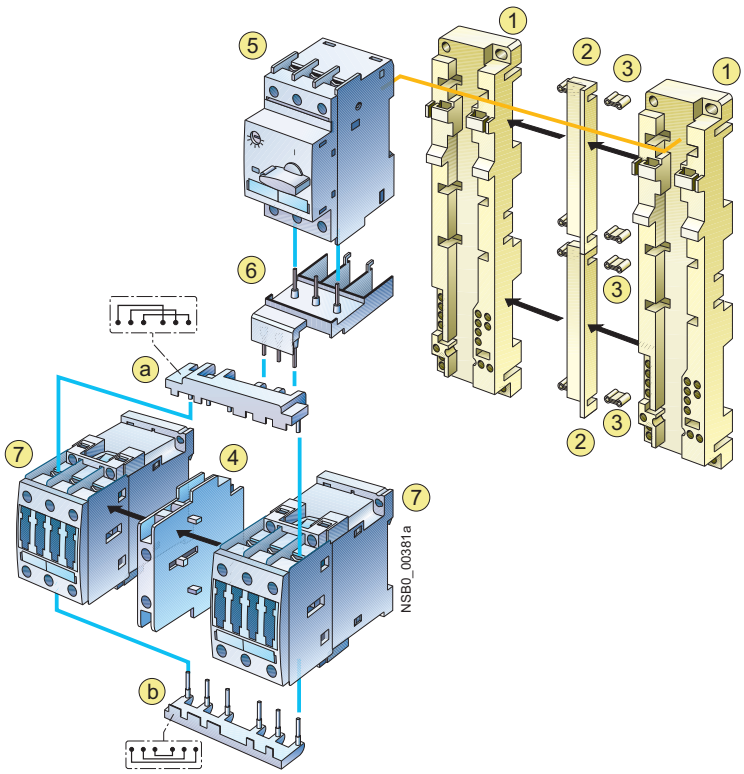
③ 8US19 98-1AA00
connecting plates
(1 Order No. = 100 units)

④ 3RA19 24-2B
mechanical interlock

⑤ Motor starter protector
Size S0

⑥ Link module
for AC: 3RA19 21-1AA00
for DC: 3RA19 21-1BA00

⑦ 2 contactors
Size S0



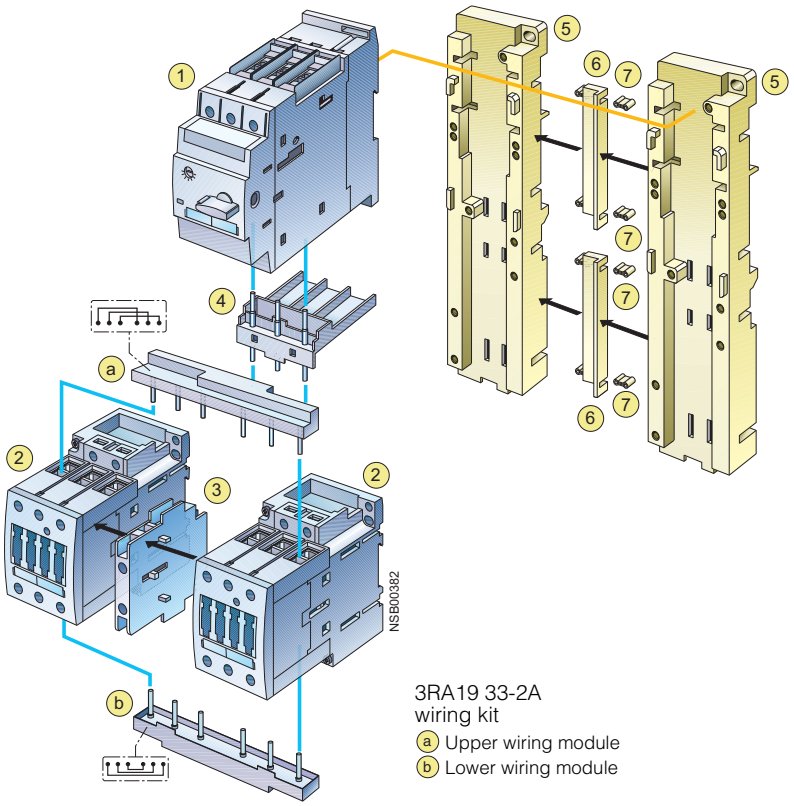
These graphical overviews are shown without small mounting parts (screws etc.).

General data

Reversing duty • For standard rail mounting • Size S2

3RA19 33-1B
assembly kit (RH)
for reversing duty
for standard rail mounting
Consisting of:
1 wiring kit
2 standard mounting rail adapters (5)
2 side modules (6)
4 connecting plates (7)

(1) Motor starter protector size S2
(2) 2 contactors size S2
(3) 3RA19 24-2B mechanical interlock
(4) Link module
for AC: 3RA19 31-1AA00
for DC: 3RA19 31-1BA00
(5) 3RA19 32-1AA00 standard mounting rail adapter
(6) 3RA19 02-1B side modules for standard mounting rail adapter
(1 Order No. = 10 units)
(7) 8US19 98-1AA00 connecting plates
(1 Order No. = 100 units)

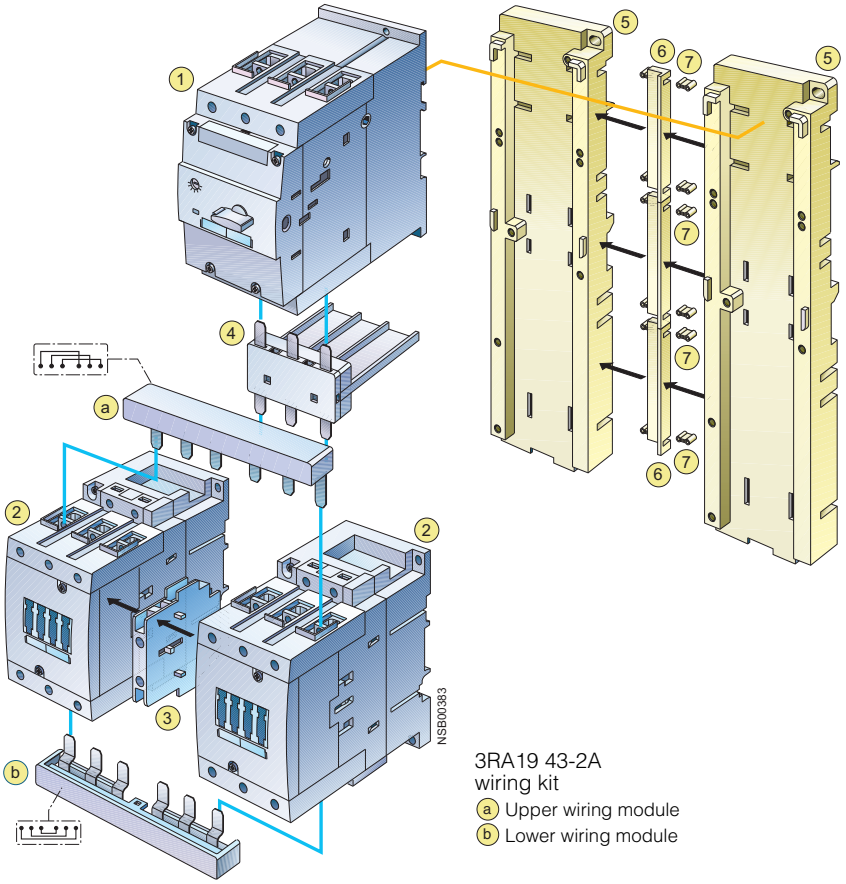


3RA19 33-2A
wiring kit
(a) Upper wiring module
(b) Lower wiring module

Reversing duty • For standard rail mounting • Size S3

3RA19 43-1B
assembly kit (RH)
for reversing duty
for standard rail mounting
Consisting of:
1 wiring kit
2 standard mounting rail adapters (5)
2 side modules (6)
4 connecting plates (7)

(1) Motor starter protector size S3
(2) 2 contactors size S3
(3) 3RA19 24-2B mechanical interlock
(4) Link module
for AC: 3RA19 41-1AA00
for DC: 3RA19 41-1BA00
(5) 3RA19 42-1AA00 standard mounting rail adapter
(6) 3RA19 02-1B side modules for standard mounting rail adapter
(1 Order No. = 10 units)
(7) 8US19 98-1AA00 connecting plates
(1 Order No. = 100 units)

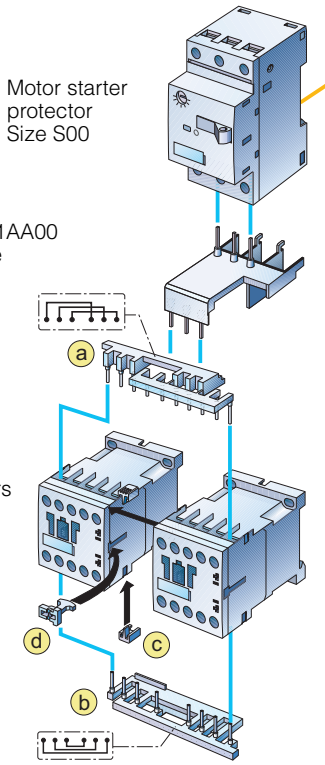


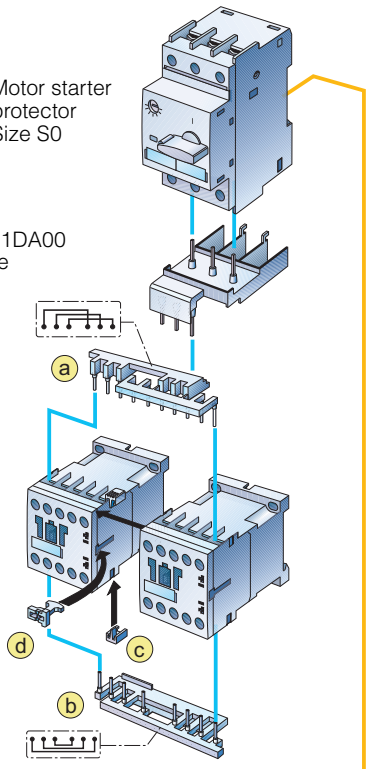
3RA19 43-2A
wiring kit
(a) Upper wiring module
(b) Lower wiring module

These graphical overviews are shown without small mounting parts (screws etc.).

Reversing duty • For 40 mm and 60 mm busbar systems • Size S00 and S0

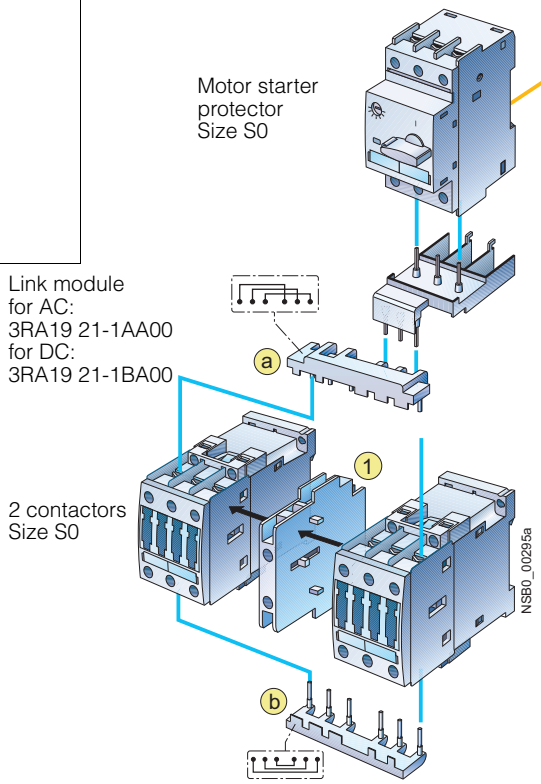
Assembly kit (RH)
for reversing duty
for busbar mounting
40 mm: 3RA19 13-1C
60 mm: 3RA19 13-1D
Consisting of:
1 wiring kit
2 busbar adapters
1 device holder
2 connecting plates





3RA19 13-2A
wiring kit
(a) Upper wiring module
(b) Lower wiring module
(c) 2 connecting clips
(d) Mechanical interlock (can be removed)

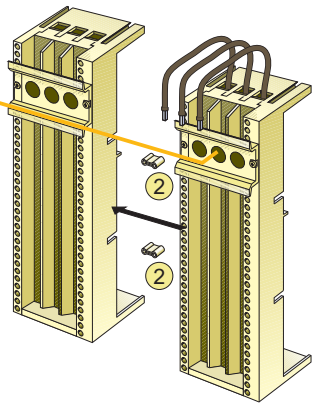
Assembly kit (RS)
for reversing duty
for busbar mounting
40 mm: 3RA19 23-1C
60 mm: 3RA19 23-1D
Consisting of:
1 wiring kit
2 busbar adapters
1 device holder
1 side module
2 connecting plates



Device holders
for size S00
40 mm: 8US10 50-5AM00
60 mm: 8US12 50-5AM00

Device holders
for size S0
40 mm: 8US10 60-5AM00
60 mm: 8US12 60-5AM00

Busbar adapters
40 mm:
8US10 51-5DM07
60 mm:
8US12 51-5DM07



3RA19 23-2A
wiring kit
(a) Upper wiring module
(b) Lower wiring module

(1) 3RA19 24-2B mechanical interlock
(2) 8US19 98-1AA00 connecting plates (1 Order No. = 100 units)

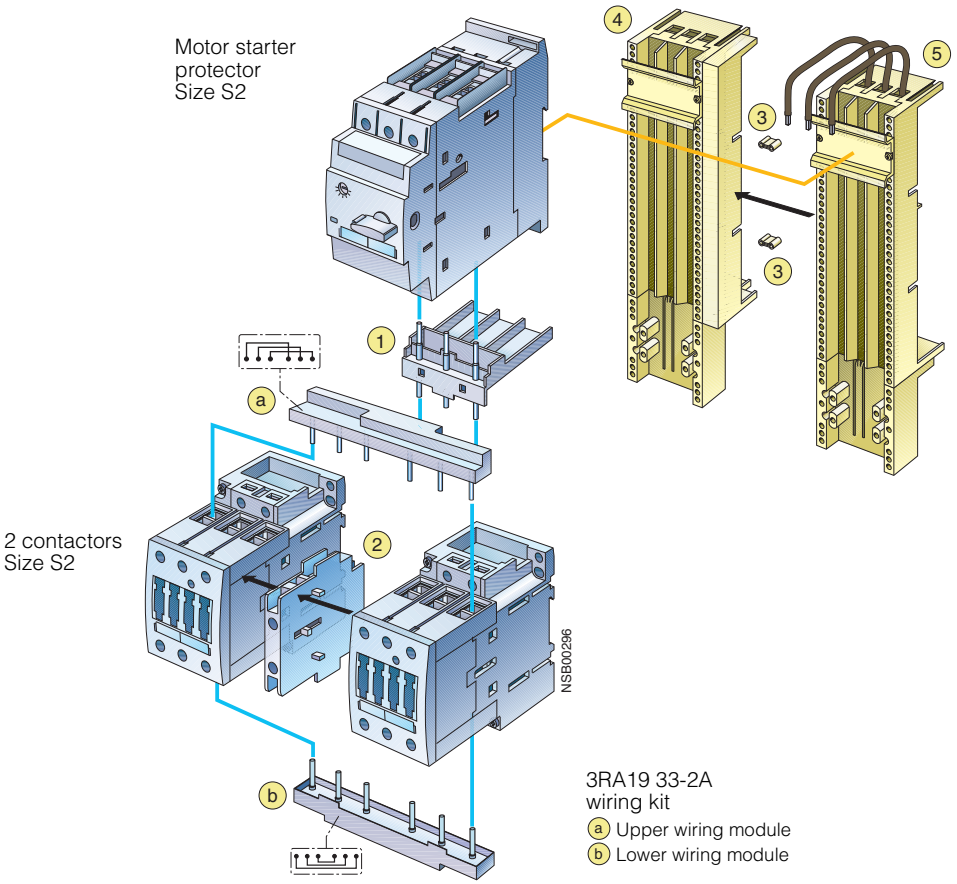
These graphical overviews are shown without small mounting parts (screws etc.).

General data

Reversing duty • for 60 mm busbar systems • size S2

Assembly kit (RS)
for reversing duty
for busbar mounting
60 mm: 3RA19 33-1D
Consisting of:
1 wiring kit
2 busbar adapters
1 device holder
1 side module
2 connecting plates ③

① Link module
for AC: 3RA19 31-1AA00
for DC: 3RA19 31-1BA00
② 3RA19 24-2B
mechanical interlock
③ 8US19 98-1AA00
connecting plates
(1 Order No. = 100 units)
④ Device holders
60 mm: 8US12 60-5AP00
with 8US19 98-2BM00
side module
for busbar adapter
⑤ Busbar adapter
60 mm: 8US12 61-5FP08

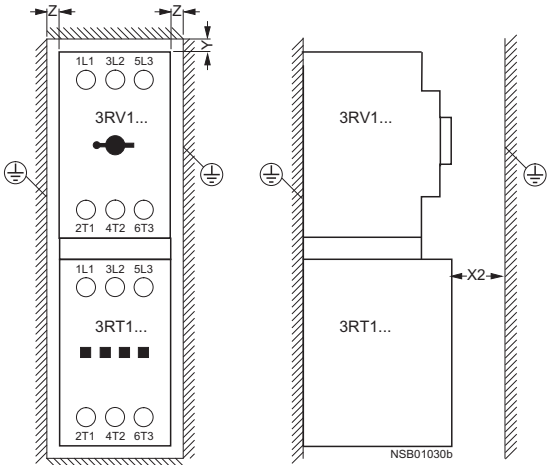


These graphical overviews are shown without small mounting parts (screws etc.).

Installation guidelines for 400/500 V AC

The following clearances from grounded components must be observed when installing combinations:

Motor starter protectors in combination with contactors			Clearance to grounded or live parts acc. to IEC 60947-4		
Motor starter protector	Contac-tors	Rated operational voltage	Y mm	X2[1] mm	Z mm
3RV1. 1 with	3RT10 1	400/500 V	20	10	9
3RV1. 2 with	3RT10 1	400/500 V	30	10	9
	3RT1. 2	400/500 V	30	10	9
	3RT1. 3	400/500 V	30	10	9
3RV1. 3 with	3RT10 2	400/500 V	50	10	10
	3RT1. 3	400/500 V	50	10	10
	3RT10 4	400/500 V	50	10	10
3RV1. 4 with	3RT10 4	400 V	90	10	12
	3RT10 4	500 V	220	10	20



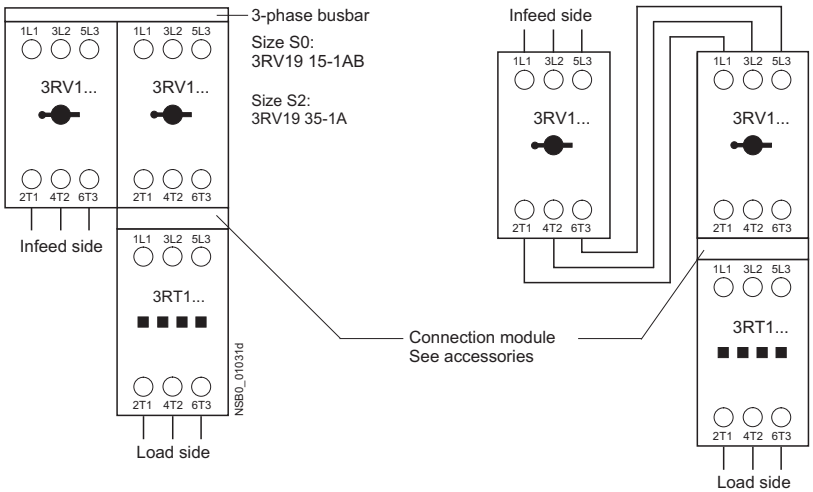
[1] Minimum clearance to contactor at front. For the motor starter protector, no minimum clearance at the front must be maintained.

Installation guidelines for 690 V AC

For assembling fuseless load feeders for 690 V, one upstream and one downstream motor starter protector are required. If the sum of the set currents does not exceed the rated or set current of the upstream motor starter protector, several downstream motor starter protectors can also be used in parallel. The motor starter protectors must be placed adjacent to each other and can be connected with the wiring modules specified below.

The contactor can be fitted with a link module under the downstream motor starter protector. If contactor assemblies are used for reversing duty, the assembly must be mounted so that the space beneath the upstream motor starter protector (infeed side) remains free.

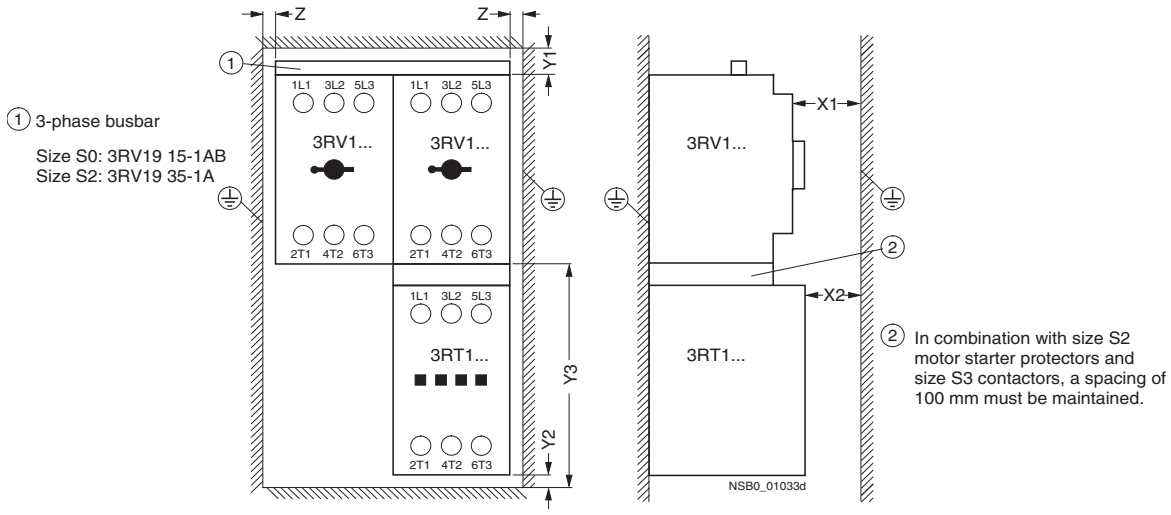
Size	Mounting methods	Standard mounting for size S0 ... 5.5 kW, S2 and S3	Mounting for size S0 from 7.5 ... 11 kW
S0	Mounting on an insulated base plate. If screws are used for mounting, the screws must not be grounded. Alternatively, the standard mounting rail adapter can be used without restriction.		
S2/S3	Mounting on an insulated base plate. Alternatively, the standard mounting rail adapter can also be used.		



General data

The following clearances from grounded components must be observed when installing combinations:

Two motor starter protectors in combination with contactors			Clearance to grounded or live parts acc. to IEC 60947-4					
Motor starter protector	Contactors	Rated operational voltage	Y1 mm	Y2 mm	Y3 mm	X1 mm	X2 mm	Z mm
3RV1. 2 with	**3RT10 2**	690 V	80	10	95	20	14	20
3RV1. 3 with	**3RT10 3**	690 V	50	10	120	10	32	10
	3RT10 4	690 V	50	10	120	10	40	10



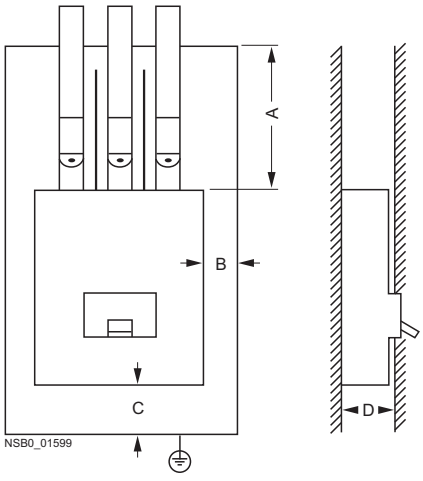
1 3-phase busbar

Size S0: 3RV19 15-1AB
Size S2: 3RV19 35-1A

2 In combination with size S2 motor starter protectors and size S3 contactors, a spacing of 100 mm must be maintained.

Clearances to grounded parts for 3VL circuit breakers

Circuit breakers	Rated operational voltage U_e	Clearance from grounded parts			
	V	A	B	C	D
3VL2/3VL3[1)]	max. 400	100	25	30	87
3VL2/3VL3[2)]	400 ... 525	100	25	30	87
3VL4/3VL5[1)]	max. 525	100	35	30	106.5

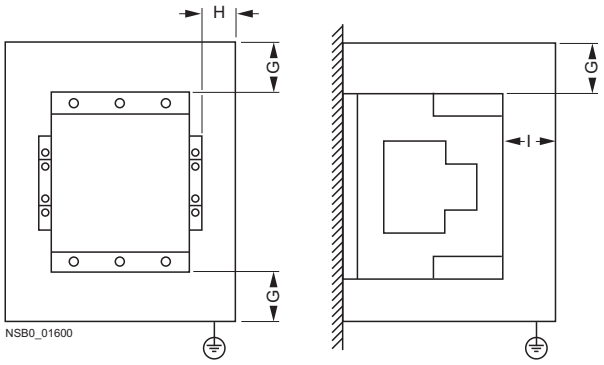


1) The 3VL9 300-8CE00 phase barriers (for 3VL2/3VL3) or 3VL9 600-8CE00 phase barriers (for 3VL4/3VL5) must be used.

2) The 3VL9 300-8C..0 terminal cover must be used.

Clearances from grounded parts for 3RT10 5./ 3RT10 6./3RT10 7. and 3RT12 6./3RT12 7. contactors

Contactors	Clearance from grounded parts, rated operational voltage up to 690 V		
	G	H	I
3RT10 5.	40	10	20
3RT10 6./3RT12 6.	20	10	20
3RT10 7./3RT12 7.	20	10	20



G = Clearance from box terminal.

In applications with cable lugs or busbar connection the 3RT19 56-4EA1 (3RT10 5) or 3RT19 66-4EA1 (3RT10 6., 3RT12 6., 3RT10 7. or 3RT12 7.) terminal cover must be used!

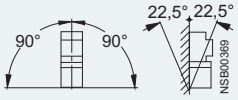
General data

Technical specifications

Type Size Number of poles			3RA1. 1 S00 3	3RA1. 2 S0 3	3RA1. 3 S2 3	3RA1. 4 S3 3
General data						
Standards			IEC 60947-1, EN 60947-1 IEC 60947-2, EN 60947-2 IEC 60947-4-1, EN 60947-4-1			
Max. rated current $I_{n\ max}$ (= max. rated operational current I_e)		A	12	25	50	100
Permissible ambient temperature		°C °C	-20 ... +70 for operation (up to +60 °C without restriction) -55 ... +80 during storage/transport			
Rated operational voltage U_e		V	690			
Rated frequency		Hz	50/60			
Rated insulation voltage U_i (degree of pollution 3)		V	690			
Rated impulse withstand voltage U_{imp}		kV	6			
Trip class (CLASS)	Acc. to IEC 60947-4-1, EN 60947-4-1		10			
Rated short-circuit current I_q **at AC 50/60 Hz 400 V acc. to IEC 60947-4-1, EN 60947-4-1**		kA	50			
Types of coordination acc. to IEC 60947-4-1, EN 60947-4-1			1)			
Power loss $P_{v\ max}$ **of all main current paths** Dependent on the rated current I_n (upper setting range)	Up to 1.25 A 1.6 ... 6.3 A 8 ... 12 A 2 ... 6.3 A 8 ... 16 A 20 ... 25 A 25 ... 32 A 40 A 45 ... 50 A 63 A 75 ... 90 A 100 A	W W W W W W W W W W W W	6 7 10.5	 7 9.5 13	 19 28 35	 29 45 60
Power consumption of the magnetic coils in the case of contactors (for cold coil and U_s, 50 Hz)						
• AC operation	Closing P.f. Closed P.f.	VA VA 	27 0.8 4.6 0.27	61 0.82 7.8 0.24	127 0.82 13.5 0.34	270 0.68 22 0.27
• DC operation	Closing = Closed	W	3.2	5.4	11.5	15
Magnetic coil operating range for contactors			0.8 ... 1.1 x U_s			
	Low limit at 55 °C at 60°C		0.8 x U_s 0.85 x U_s	-- --		
Endurance of the motor starter protector						
• Mechanical endurance	Operating cycles		100 000		50 000	
• Electrical endurance	Operating cycles		100 000		50 000	
• Max. switching frequency per hour (motor starts)		1/h	15		15	
Endurance of contactor						
• Mechanical endurance	Operating cycles		30 million	10 million		
• Electrical endurance	Operating cycles		2)			
Shock resistance (sine-wave pulse)	Acc. to IEC 60086 Part 2-27	*g*	Up to 9.8	Up to 12.5	Up to 8	Up to 6
Degree of protection	Acc. to IEC 60947-1		IP20			
Touch protection	Acc. to EN 50274		Finger-safe			
Phase failure sensitivity of the motor starter protector	Acc. to IEC 60947-1, EN 60947-1		Yes			
Isolating features of the motor starter protector	Acc. to IEC 60947-2, EN 60947-2		Yes			
Main control and EMERGENCY-STOP switch characteristics of the motor starter protector and accessories	Acc. to IEC 60204-1, EN 60204-1		Yes, (with overvoltage releases of category 1 under conditions of proper use)			
Protective separation between main and auxiliary circuits	Acc. to EN 60947-1, Appendix N	V	Up to 400			
Positively-driven operation at contactors			Yes	Yes, from main contact to auxiliary NC contact		

1) See "Selection and ordering data".

2) See endurance characteristics of the contactors under "Controls: Contactors and Contactor Assemblies".

Type		3RA1. 1	3RA1. 2	3RA1. 3	3RA1. 4
Size		S00	S0	S2	S3
Number of poles		3	3	3	3
Conductor cross-sections of main circuit					
Standards		IEC 60947-1, EN 60947-1 IEC 60947-2, EN 60947-2 IEC 60947-4-1, EN 60947-4-1			
Connection type		Screw terminals	Screw terminals	Box terminal	Box terminal
Terminal screw		Pozidriv size 2	Pozidriv size 2	Pozidriv size 2	Allen screw
Minimum/maximum conductor cross-sections					
Finely stranded with end sleeve					
• 1 conductor	mm^2	0.5/2.5	1/6	0.75/25	2.5/50 [1]
• 2 conductors	mm^2	0.5/2.5	1 ... 2.5/2.5 ... 6	0.75/16	2.5/35
Solid or stranded					
• 1 conductor	mm^2	0.5/4	1/6	0.7/35	2.5/70
• 2 conductors	mm^2	0.75/2.5	1 ... 2.5/2.5 ... 6	0.75/25	2.5/50
Connection, main contacts, ribbon cable conductors				Yes	Yes
Busbar connections					Yes
• Solid or stranded	AWG	2 x (18 ... 14)	2 x (14 ... 10)	2 x (30 ... 2)	--
• Stranded	AWG	--	--	--	2 x (10 ... 1/0)
Connection type		Cage Clamp terminals			
	mm^2	2 x (0.5 ... 2.5)	--		
	AWG	2 x (18 ... 14)	--		
Permissible mounting positions					
		Important: acc. to DIN 43602 Start command "I" at the right or top			

More information

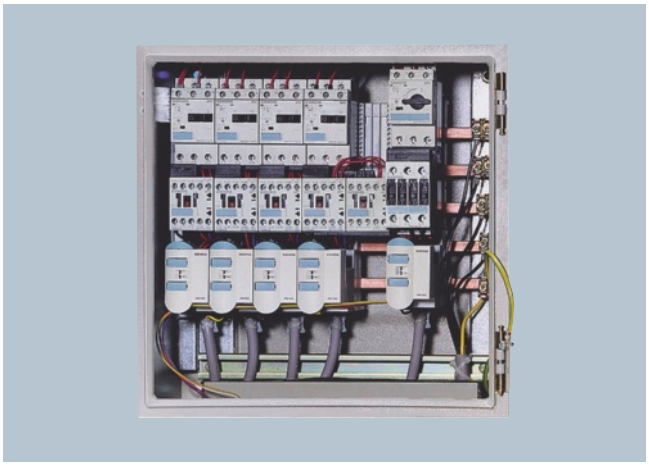
Brochure "SIRIUS Configuration"

More information and assignment tables for self-assembly combinations for 400 V, 440 V, 480 V, 500 V, 550 V and 690 V can be found in the brochure "SIRIUS Configuration: Selection Data for Load Feeders in Fuseless Designs",
Order No. E86060-T1815-A101-A2

or as a PDF file on the Internet at
http://www.siemens.com/lowvoltage/infomaterial
under the tab "Brochures".

AS-Interface load feeder modules

Overview



The AS-Interface load feeder module adds an input/output module to the conventional busbar and standard mounting rail adapters. With this module the control circuit of a load feeder is available completely factory-wired. The series has been optimized for operation in conjunction with the SIRIUS load feeders size S00 and S0. Connection to the higher-level automation system is made through the AS-Interface interface of the load feeder module. A non-shielded standard litz wire can be used as data line and for the auxiliary current supply. Connection to the AS-Interface load feeder module is made using two connectors with the insulation displacement connection.

Four different AS-Interface load feeder modules are available: Differences exist in the number of inputs and outputs and in the type of outputs. The units with solid-stated outputs are designed for 24 V DC, those with relay outputs are suitable for voltages of max. 230 AC. Direct-on-line and reversing starters as well as double direct-on-line starters and starter combinations can be wired therefore for pole reversal. The inputs can be used to separately scan the feedbacks from motor starter protectors and contactors. The outputs can be used for direct control of the contactor coils.

As the outputs already have overvoltage protection integrated, no additional measures for the contactors are required.

The outputs are supplied with separate auxiliary voltage – a selectively configured EMERGENCY-STOP concept is possible therefore. The inputs are supplied from the AS-Interface data line. Inputs and outputs have to be wired using integrated, spring-type terminals, each connected to a common potential.

3RA5 fuseless load feeder with connection to AS-Interface

The 3RA5 fuseless load feeder, comprised of the AS-Interface load feeder module, motor starter protector, contactor and all necessary connectors (AS-Interface, auxiliary power and 5-pole power connector), is delivered completely assembled, factory-wired and tested. The user can thus save valuable time when mounting, wiring and servicing.

Direct-on-line starters as well as reversing starters are available with SIRIUS switchgear size S00 up to 10 A and size S0 – on account of the power connector – up to 16 A. The complete feeders are available with AS-Interface load feeder modules with solid-state outputs for 24 V DC auxiliary voltage.

Load feeders with this type of configuration are used to control standard induction motors for example. The load feeders can be installed in central control cabinets as well as in local control boxes. They are particularly suitable for highly automated machines and plants that place high demands on availability.

Design

The AS-Interface load feeder module is snapped onto the matching support. As an option, a 5-pole power connector can be installed between the load feeder module and the support.

When this power connector is used, all connections of the load feeder can be plugged in. Should it become necessary to replace the unit, this can be done in a minimum of time. When this power connector is used, the current is limited to 16 A.

The support is available in different versions and must be selected to fit the width of the controlgear combination (45 mm or 54 mm) and the busbar system used (busbar center-to-center spacing 40 mm or 60 mm). Depending on the version, the N conductor and/or the PE conductor or neither are brought out as well. It is thus possible for pre-assembled connecting cables of the loads to be routed right up to the AS-Interface load feeder module and for them to be fitted there without any additional wiring outlay. Hence it is extremely easy to replace the loads, e. g. a standard induction motor.

A unique address must be assigned to each AS-Interface station at the latest for start-up. For the AS-Interface load feeder module this can be done either by using the master and successively plugging on the connectors which are connected to the data line (only one station in the network is allowed to log on with the default address 0) or by the individual addressing method using an addressing unit and an addressing cable. This type of addressing is also possible with the load feeder module fully wired, as the module is separated from the AS-Interface network when the addressing plug is connected.

The addressing socket is positioned underneath the equipment label on the front of the load feeder module. The indicator lamps (LEDs) for the diagnostics of the AS-Interface load feeder module are fitted in the same place. The following states are indicated:

- 24 V DC auxiliary voltage applied or output/outputs activated (version 230 V AC)
- AS-Interface communication OK
- AS-Interface communication faulty
- Station address equals 0 (module not addressed)

Technical specifications

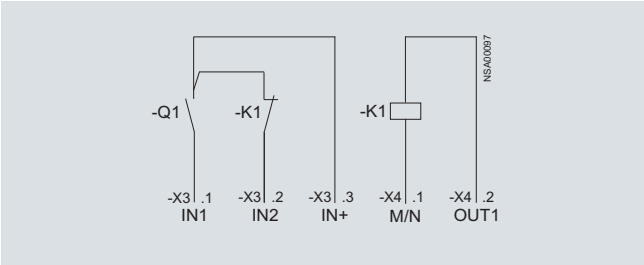
		Load feeder modules IP20			
		2I/1O	4I/2O	2I/1AR	3I/2AR
		3RK1 400-1KG01-0AA1	**3RK1 400-1MG01-0AA1**	**3RK1 402-3KG02-0AA1**	**3RK1 402-3LG02-0AA1**
I/O configuration	Hex	3	7	3	7
ID code	Hex	F			
Power supply for electronics and inputs (feedback of switchgear auxiliary contacts) **using AS-Interface data line**	V	26.5 ... 31.6 (acc. to AS-Interface specification)			
AS-Interface power consumption	mA	8 ... 12			
Temperature range					
• Operating temperature T_u	°C	0 ... +55			
• Storage temperature	°C	-40 ... +85			
Degree of protection		IP20			
Inputs					
• Reverse polarity protection		Built-in			
• Max. input current	mA	6			
• Max. permissible cable length between IN + and an input	m	0.4			
Outputs					
• External power supply for outputs (control of the contactor coils) using auxiliary power	V	24 DC		Max. 230 AC	
• Current carrying capacity I_e	A	0.5 (DC-13/DC-14)		3 (AC-15); 0.1 (DC-13 at 220 V)	
• Summation current (thermal) I_{th}	A	2		3	
• Reverse polarity protection		Built-in		Not required	
• Short-circuit protection		Built-in		No	
• Induction protection		Built-in		Not required	
• Watchdog function (disconnects outputs in the event of AS-Interface fault)		Built-in			
Diagnostics					
• Through LED on the enclosure		Auxiliary voltage applied		Output actuated	
		AS-Interface communication OK			
		AS-Interface communication faulty			
		Station address = 0 (module not addressed)			
Conductor cross-sections					
• Connectors for AS-Interface and auxiliary power	mm^2	0.5 ... 0.75 (flexible)			
• Cage Clamp for I/O wiring	mm^2	0.8 ... 2.5 (flexible, without end sleeve)			
• Power connector, 5-pole	mm^2	0.5 ... 2.5 AWG 28 ... 12			
• PE/N conductor wiring on the support	mm^2	2.5 flexible AWG 13			
Addressing		After the 15th addressing procedure, the module retains the last address			

Note:
The same technical data apply for the load feeders as for the single devices. For example, the high short-circuit strength of I_q = 50 kA also applies.

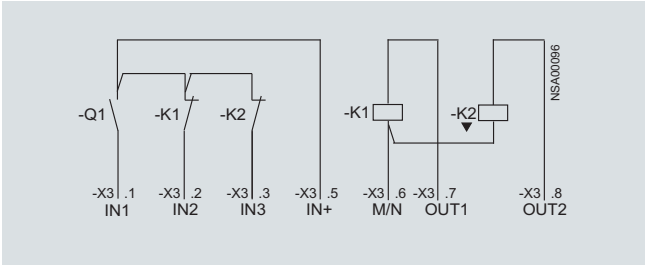
AS-Interface load feeder modules

Schematics

Typical circuits for the control circuit

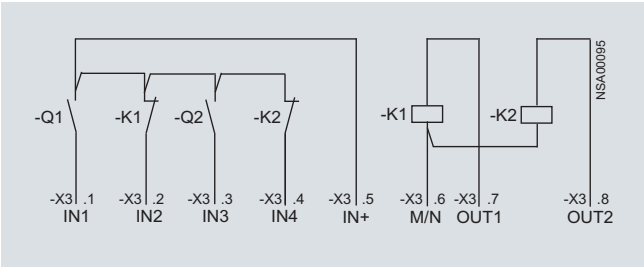


AS-Interface load feeder module with 2 inputs and 1 output as direct-on-line starter



AS-Interface load feeder module with 4 inputs and 2 outputs or 3 inputs and 2 outputs as reversing starter

Note:
When using SIRIUS contactors we recommend wiring the positively driven auxiliary NC contacts for feedback of the switching state.



AS-Interface load feeder module with 4 inputs and 2 outputs as double direct-on-line starter

Overview

The 3RV19 infeed system is a convenient means of energy supply and distribution for a group of several motor starter protectors or complete load feeders with a screw or spring-type connection up to size S0.

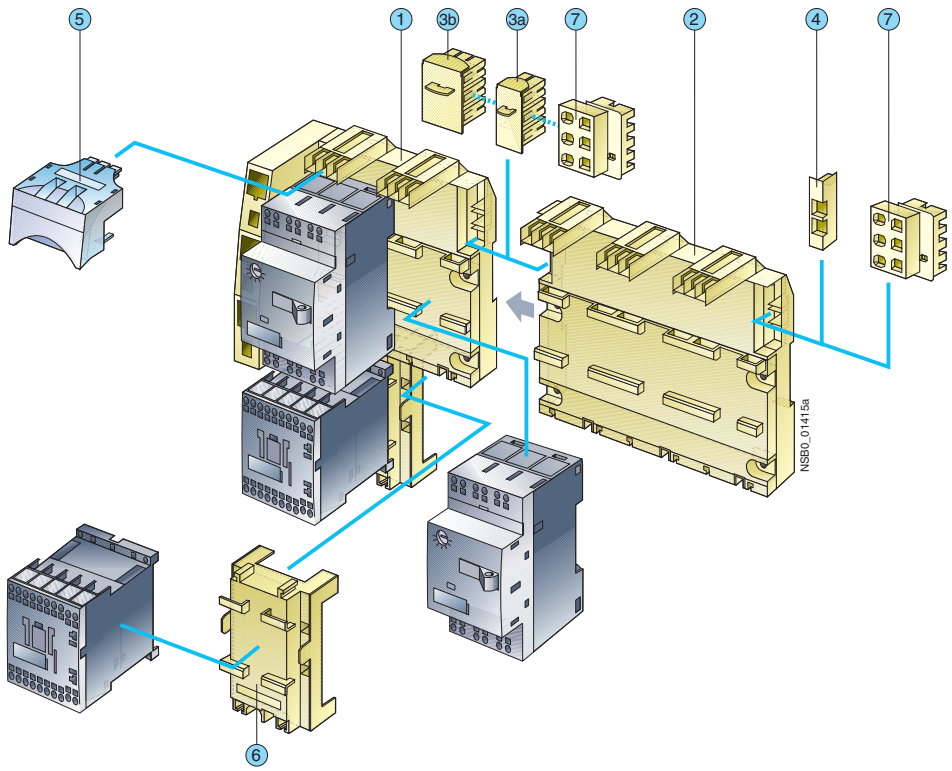
The devices with spring-type connections are available in the SIRIUS modular system up to 5.5 kW at 400 V AC. The motor starter protectors and load feeders with screw terminals for sizes S00 and S0 can also be integrated in the system at the same time.

The system is based on a basic module complete with a lateral incoming unit (three-phase busbar with infeed). This infeed with spring-type terminals is mounted on the right or left depending on the version and can be supplied with a maximum conductor cross-section of 25 mm^2 (with end sleeve). A basic module has two sockets onto each of which a motor starter protector can be snapped.

Expansion modules are available for extending the system (3-phase busbars for system expansion). The individual modules are connected through an expansion plug.

The electrical connection between the 3-phase busbars and the motor starter protectors is implemented through plug-in connectors. The complete system can be mounted on a TH 35 standard mounting rail to EN 60715 and can be expanded as required up to a maximum current carrying capacity of 80 A.

The system is mounted extremely quickly and easily thanks to the simple plug-in technique. Thanks to the lateral infeed, the system also saves space in the control cabinet. The additional overall height required for the infeed unit is only 30 mm. The alternative infeed possibilities on each side offer a high degree of flexibility for configuring the control cabinet: Infeed on left-hand or right-hand side, ring infeed or infeed on one side and outfeed on the other side to supply further loads are all possible. A terminal block with spring-type connection in combination with a standard mounting rail enables the integration of not only SIRIUS motor starter protectors but also single-phase, two-phase and three-phase components such as 5SY miniature circuit breakers or SIRIUS relay components.



1 3-phase busbar with infeed
2 3-phase busbar for system expansion
3a Expansion plug
3b Extra-wide expansion plug
4 End cover
5 Plug-in connector
6 Contactor base
7 Terminal block

3RV19 infeed system

① *3-phase busbars with infeed*

A 3-phase busbar with infeed unit is required for connecting the incoming supply. This module comprises one infeed module and 2 sockets which each accept one motor starter protector. A choice of two versions with infeed on the left or right is available. The infeed is connected using spring-type terminals. The Cage Clamp springs permit conductor cross-sections of up to 25 mm^2 with end sleeves. An end cover is supplied with each module.

② *3-phase busbars for system expansion*

The 3-phase busbars for system expansion support expansion of the system. There is a choice of modules with 2 or 3 sockets. The system can be expanded as required up to a maximum current carrying capacity of 63 A. An expansion plug is supplied with each module.

③a *Expansion plug*

The expansion plug is used for electrical connection of adjacent 3-phase busbars. The current carrying capacity of this plug equals 63 A. One expansion plug is supplied with each 3-phase busbar for system expansion. Additional expansion plugs are therefore only required as spare parts.

③b *Extra-wide expansion plug*

The extra-wide expansion plug makes the electrical connection between two 3-phase busbars, thus performing the same function as the 3RV19 17-5BA00 expansion plug; the electrical characteristics (e. g. a current carrying capacity of 63 A) are identical.

The 3RV19 17-5E expansion plug is 10 mm wider than the 3RV19 17-5BA00 expansion plug, hence in the plugged state there is a distance of 10 mm between the connected 3-phase busbars. This distance can be used to lay the auxiliary current and control current wiring ("wiring duct"). The motor starter protector and contactor can be wired from underneath, which means that the complete cable duct above the system can be omitted.

④ *End cover*

The end cover is used to cover the 3-phase busbar at the open end of the system. This cover is therefore only required once for each system. An end cover is supplied with each 3-phase busbar system with infeed. Further end covers are therefore only required as spare parts.

⑤ *Plug-in connector*

The plug-in connector is used for the electrical connection between the 3-phase busbar and the motor starter protector. There are three different versions:

- One version for 3RV motor starter protectors size S00 with screw terminals
- One version for 3RV motor starter protectors size S0 with screw terminals
- One version for 3RV motor starter protectors size S00 with spring-type terminals

⑥ *Contactor base*

Load feeders can be assembled in the system using the contactor base. The contactor bases are suitable for contactors of size S00 with spring-type terminals and are simply snapped onto the 3-phase busbars. Direct-on-line starters and reversing starters are possible. One contactor base is required for direct-on-line starters and two are required for reversing starters. To assemble load feeders for reversing starters, the contactor bases can be arranged either below each other (45 mm overall width) or alongside each other (90 mm overall width). It is important to note that mechanical interlocking of the contactors is only possible when they are arranged vertically.

The infeed system is designed for mounting on a 35 mm standard mounting rail with 7.5 mm overall depth. This standard mounting rail gives the contactor base a stable mounting surface to sit on. If standard mounting rails with a depth of 15 mm are used, the spacer connected to the bottom of the contactor base must be knocked out and plugged into the mating piece that is also on the underside. Then the contactor base also has a stable mounting surface. When standard mounting rails with a depth of 7.5 mm are used, the spacer has no function and can be removed.

As an alternative to using a contactor base, the 3RA19 11-2E electrical link modules can also be used for direct start load feeders of size S00. Motor starter protector and contactor assemblies can then be directly snapped onto the sockets of the 3-phase busbars. For feeders of size S00 and S0, the corresponding 3RA19 11-1.... or 3RA19 21-1... link modules should generally be used. For size S0, it is only possible integrate direct start load feeders and they must be integrated in the system as complete assemblies.

⑦ *Terminal block*

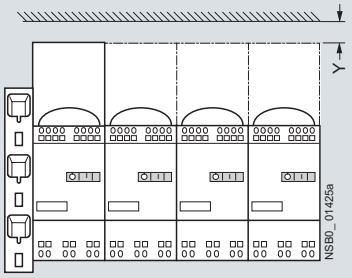
The 3RV19 17-5D terminal block enables the integration of not only SIRIUS motor starter protectors but also single-phase, two-phase and three-phase components in addition. Using the terminal block the 3 phases can be fed out of the system; single-phase loads can also be integrated in the system as the result. The terminal block is plugged into the slot of the expansion plug and thus enables outfeeding from the middle or end of the infeed system. The terminal block can be rotated through 180 ° and be locked to the support modules of the infeed system. The 3RV19 17-7B 45 mm standard mounting rail for screwing onto the support plate is available in addition in order to be able to plug the single-phase, two-phase and three-phase components onto the infeed system.

Design

Installation guidelines

Distance in Y direction from live, earthed or insulated parts according to IEC 60947-4: 10 mm.

In addition, the installation guidelines for motor starter protectors or fuseless load feeders including the clearances must be complied with.



Installation guidelines for 3RV19 17-5D terminal block

The short-circuit device which is connected upstream from the infeed system must be configured in accordance with the conductor cross-section on the infeed block.

Conductor cross-section on 3RV19 17-1A/-1E infeed block	**Upstream short-circuit device**		
	Recommendation (for 400 V)	$I_{d\,max}$	I^2t
mm²		kA	kA²s
4	3RV10 21-4DA10	< 9.5	85
6	3RV10 31-4EA10	< 12.5	140
10	3RV10 31-4HA10	< 15	180
16/25	3RV10 42-4JA10	19	440

The short-circuit device which is connected downstream from the terminal block must be configured in accordance with the conductor cross-section on the terminal block as per the following table.

Conductor cross-section on 3RV19 17-5D terminal block	**Downstream short-circuit device, e. g. 5SY**	
	$I_{d\,max}$	
mm²	kA	
1.5	< 7.5	To prevent short-circuits, the cables on the terminal block must be installed so that they are short-circuit resistant acc. to EN 60439-1 Section 7.5.5.1.2.
2.5	< 9.5	
4	< 9.5	
6	< 12.5	

Technical specifications

Type		**3RV19 .7**
Rated operational voltage U_e		
• IEC		
- 10 % overvoltage	V	500
- 5 % overvoltage	V	525
• UL/CSA	V	600
Rated frequency	Hz	50/60
Rated current I_n	A	63
Permissible ambient temperature		
• During storage/transport	°C	-50 ... +80
• During operation	°C	-20 ... +60
Permissible rated current of the 3RV10 11 motor starter protectors (size S00) at control cabinet internal temperature		
• +60 °C	%	100
Permissible rated current of the 3RV10 21 motor starter protectors (size S0) up to 16 A at control cabinet internal temperature		
• +60 °C	%	100
Permissible rated current for 3RV1. 21 motor starter protectors (size S0) from 16 A at control cabinet internal temperature		
• +40 °C	%	100
• +60 °C	%	87
Degree of protection acc. to IEC 60529		IP20[1)]
Touch protection acc. to IEC 61140		Finger-safe
Conductor cross-sections for main circuit infeed		
• Solid, stranded:	mm²	4 ... 25
• Finely stranded with end sleeve	mm²	4 ... 25
• Finely stranded without end sleeve	mm²	6 ... 25
• AWG cables, solid or stranded	AWG	10 ... 3
Conductor cross-sections of terminal block		
• Solid	mm²	1.5 ... 6
• Finely stranded with end sleeve	mm²	1.5 ... 4
• Finely stranded without end sleeve	mm²	1.5 ... 6
• AWG cables, solid or stranded	AWG	15 ... 10

1) In infeed terminal compartment without a conductor connected: IP00.

Project planning aids

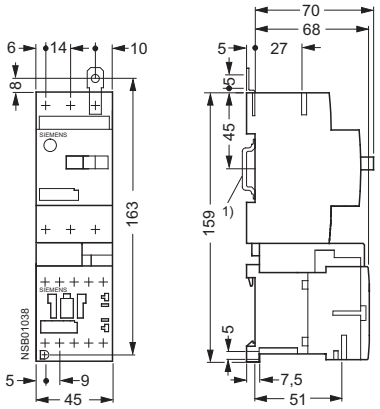
Dimensional drawings

3RA fuseless load feeders

Size S00 · For standard rail mounting

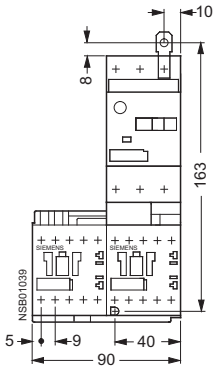
3RA11 10-. . A . .

Direct-on-line start



3RA12 10-. . A . .

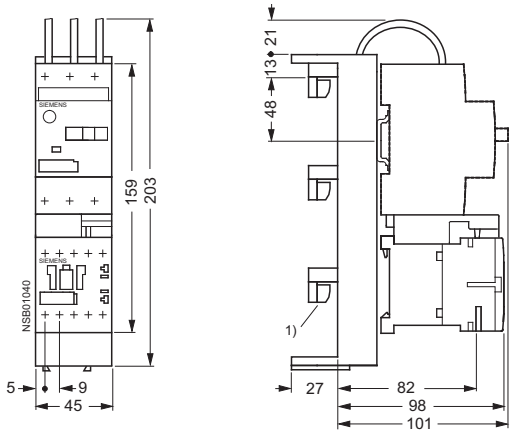
Reversing duty



Size S00 · For 40 mm and 60 mm busbar systems

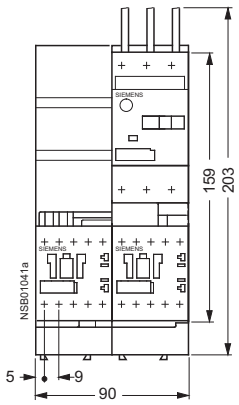
3RA11 10-. . C . .
3RA11 10-. . D . .

Direct-on-line start



3RA12 10-. . C . .
3RA12 10-. . D . .

Reversing duty

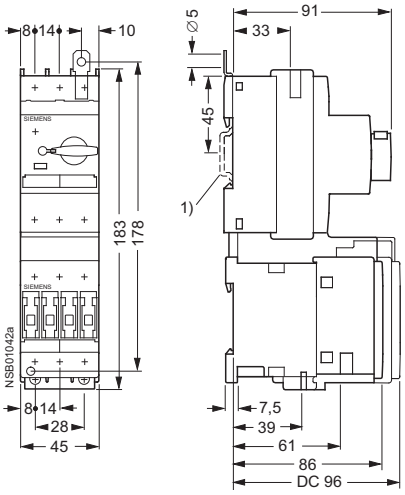


[1] Busbar adapters suitable for a busbar thickness of 5 and 10 mm with chamfered edges.

Size S0 · For standard rail mounting

3RA11 20-. . A . .

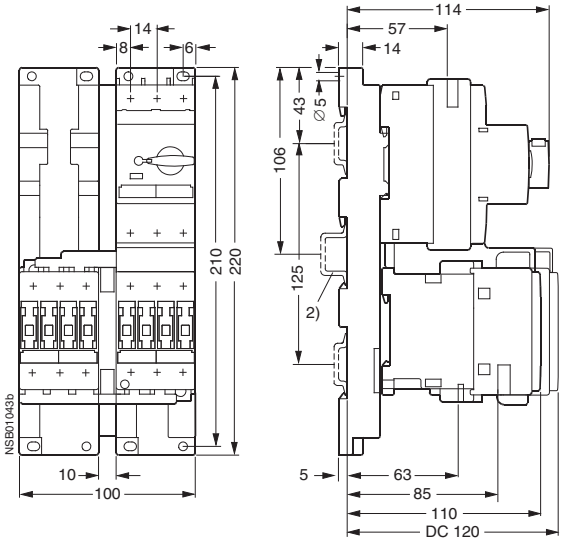
Direct-on-line start



1) Mounting with one TH 35 standard mounting rail according to EN 60715
Depth: 7.5 or 15 mm.

3RA12 20-. . A . .

Reversing duty

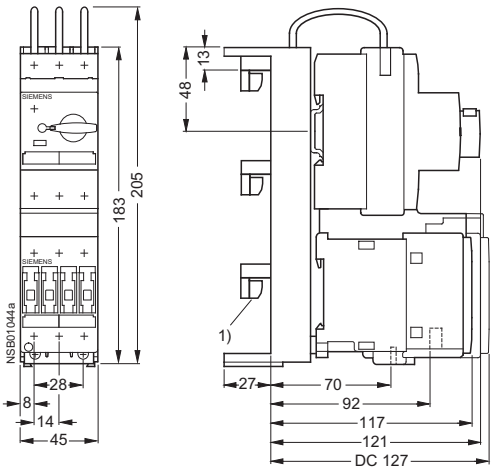


2) Alternative mounting methods
a)
Two TH 35 standard mounting rails according to EN 60715
Distance: 125 mm
Depth: 7.5 or 15 mm.
b)
One TH 35 standard mounting rail according to EN 60715
Depth: 15 mm.

Size S0 · For 40 mm and 60 mm busbar systems

3RA11 20-. . C . .
3RA11 20-. . D . .

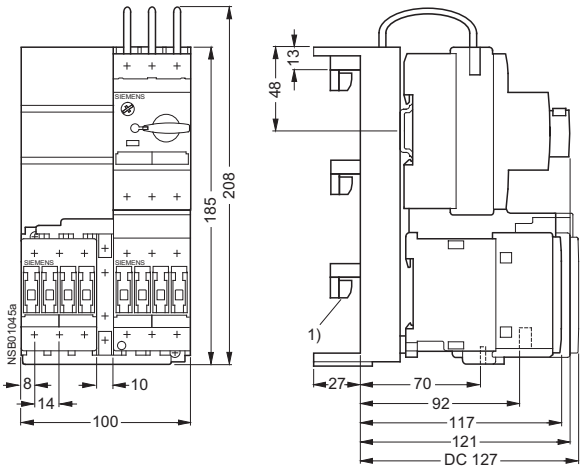
Direct-on-line start



1) Busbar adapters suitable for a busbar thickness of
5 and 10 mm with chamfered edges.

3RA12 20-. . C . .
3RA12 20-. . D . .

Reversing duty

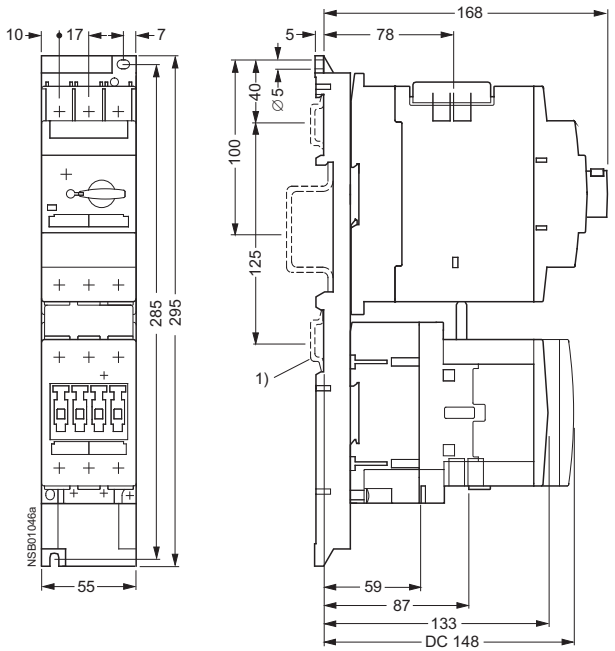


6

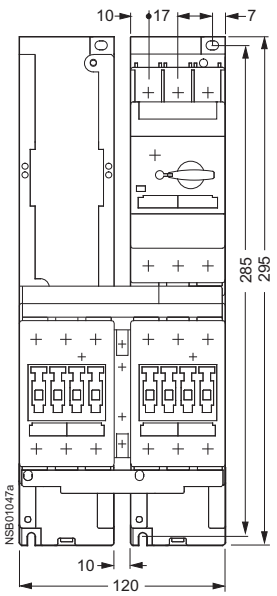
Project planning aids

Size S2 · For standard rail mounting

Direct-on-line start



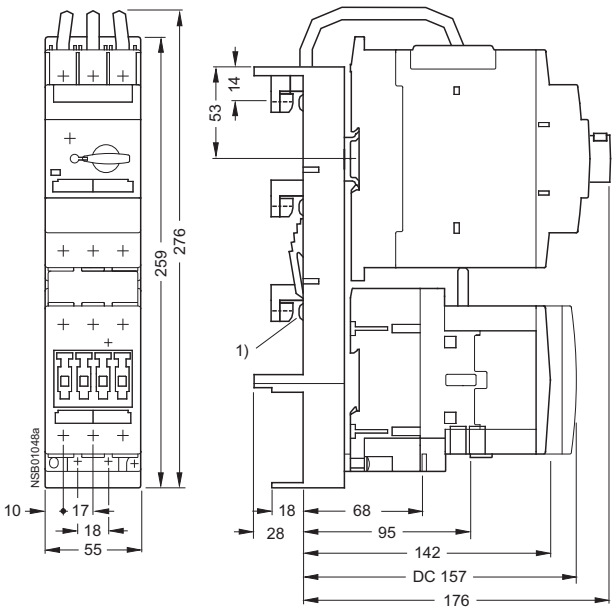
Reversing duty



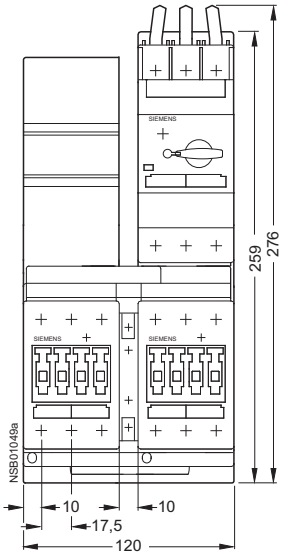
1) Alternative mounting methods
a)
Two TH 35 standard mounting rails according to EN 60715
Distance: 125 mm
Depth: 7.5 or 15 mm.
b)
One TH 75 standard mounting rail according to EN 60715
Depth: 15 mm.

Size S2 · For 40 mm and 60 mm busbar systems

Direct-on-line start



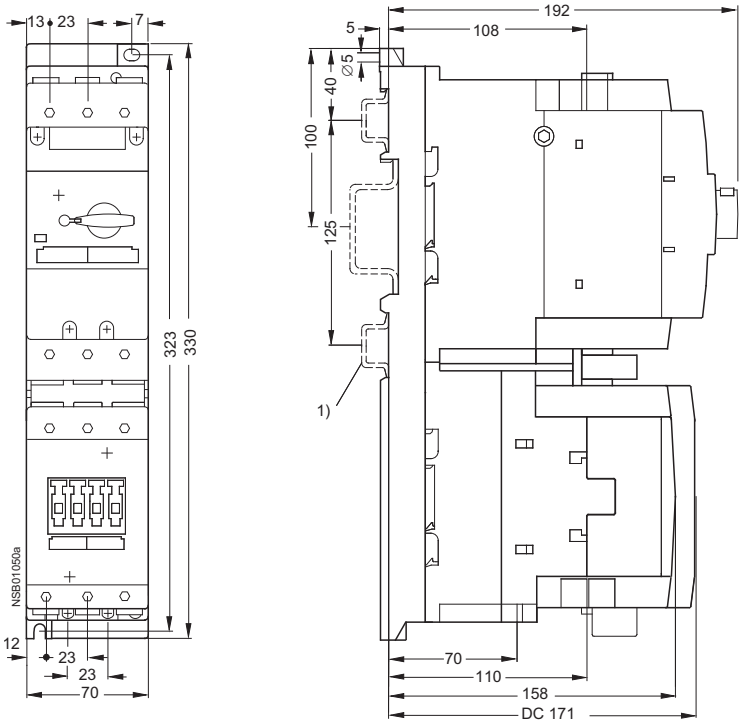
Reversing duty



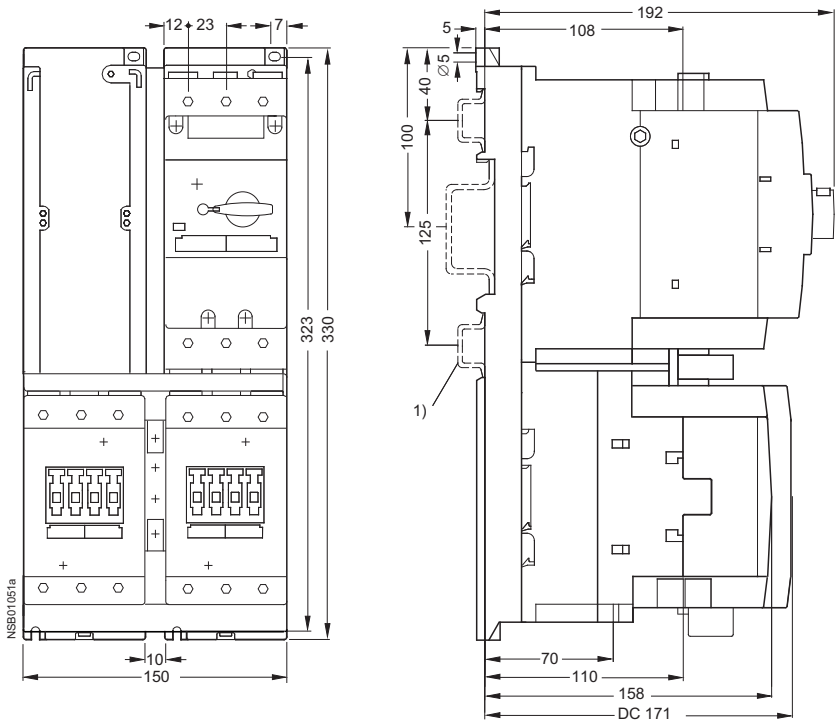
1) Busbar adapters suitable for a busbar thickness of 5 and 10 mm with chamfered edges.

Size S3 · For standard rail mounting

Direct-on-line start



Reversing duty



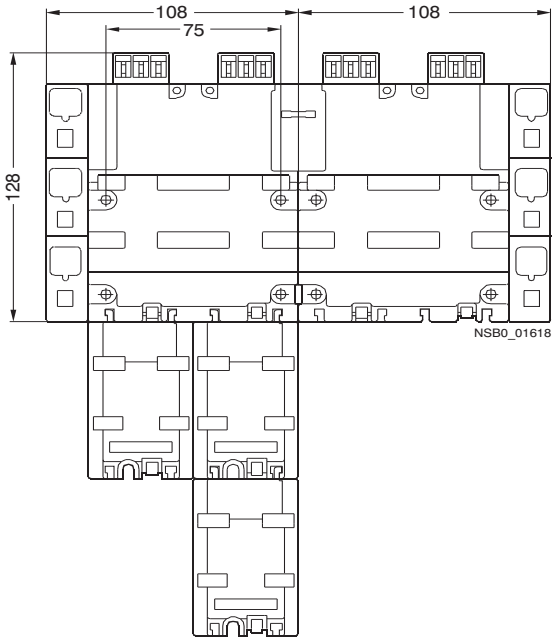
1) Alternative mounting methods
a)
Two TH 35 standard mounting rails according to EN 60715
Distance: 125 mm
Depth: 7.5 or 15 mm.
b)
One TH 75 standard mounting rail according to EN 60715
Depth: 15 mm.

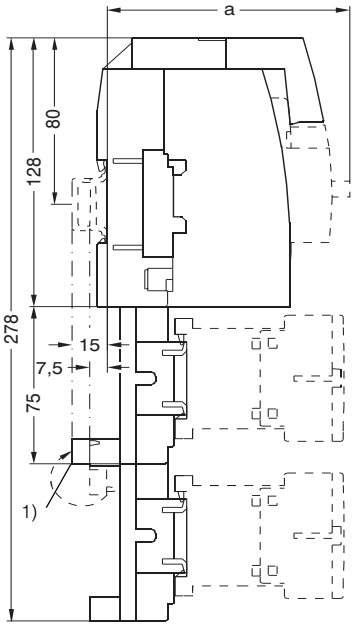
Project planning aids

3RV19 infeed system

3-phase busbars with infeed

For 2 motor starter protectors size S00 and S0, with 3RV19 17-1. + 3RV19 17-5BA00 expansion plug

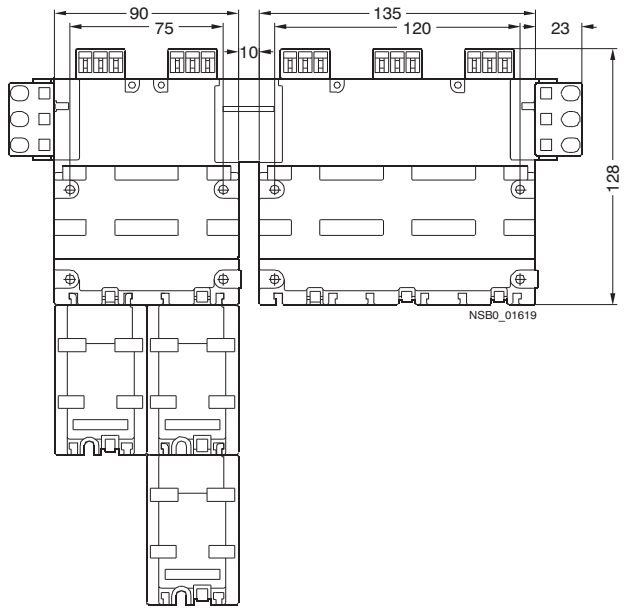


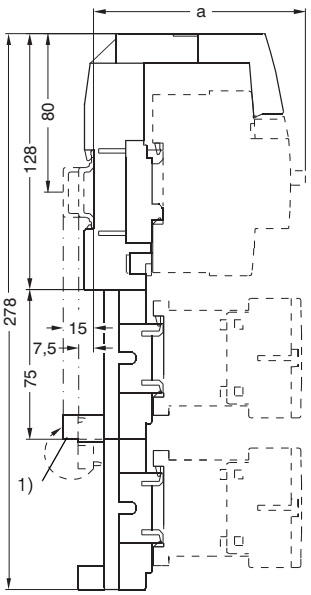


	S00	S0
a	104	125

3-phase busbars for system expansion

For 2 and 3 motor starter protectors size S00 and S0 with 3RV19 17-4. + 3RV19 17-5E extra-wide expansion plug and 3RV19 17-5D terminal block





	S00	S0
a	104	125

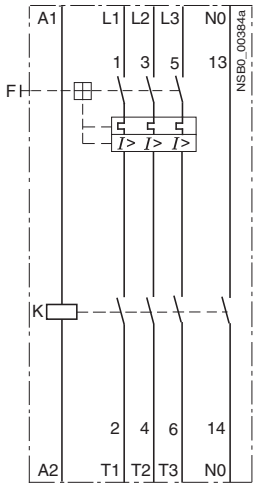
1) Alternative mounting methods (see 3RV19 Infeed System, Design)
a)
One TH 35 standard mounting rail according to EN 60715
Depth: 7.5 mm
Spacer not used.
b)
One TH 35 standard mounting rail according to EN 60715
Depth: 15 mm
Spacer plugged into mating piece.

Schematics

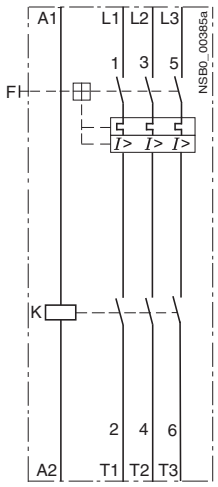
3RA fuseless load feeders

Direct-on-line start

Size S00
3RA11 1

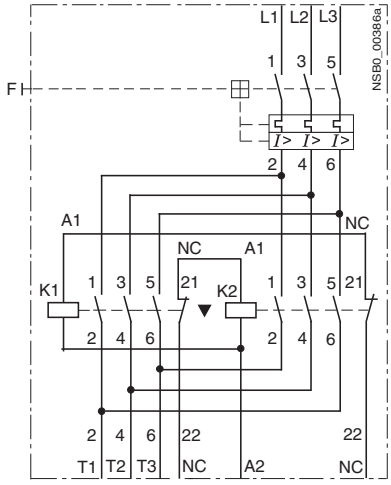


Size S0, S2 and S3
3RA11 2,
3RA11 3

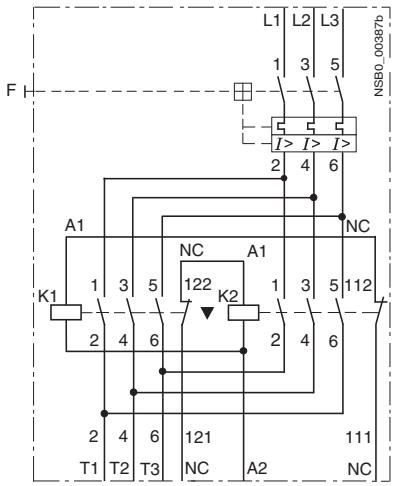


Reversing duty

Size S00
3RA12



Size S0
3RA12



6

General data

Overview

3RA6 fuseless compact feeders and infeed system for 3RA6

Integrated functionality

The SIRIUS 3RA6 compact feeders are a generation of innovative load feeders with the integrated functionality of a circuit breaker, contactor and solid-state overload relay. In addition, various functions of optional mountable accessories (e. g. auxiliary switches, surge suppressors) are already integrated in the SIRIUS compact feeder.

Application

The SIRIUS compact feeders can be used wherever standard induction motors up to 32 A (approx. 15 kW/400 V) are directly started.

Low equipment variance

Thanks to wide setting ranges for the rated current and wide voltage ranges, the equipment variance is greatly reduced compared to conventional load feeders.

Very high operational safety

No welding after a short-circuit release and defined shut-down when the end of service life is reached means that the SIRIUS compact feeder achieves a very high level of operational safety otherwise possible only with considerable additional outlay. This sets it apart from devices with similar functionality.

Safe disconnection

The auxiliary switches of the 3RA6 compact feeders are designed as mirror contacts. It is thus possible to use the devices for safe disconnection, e. g. emergency-stops, up to Category 2 (EN 954-1) and together with other redundancy switching devices up to Category 3 or 4.

Communications integration through AS-Interface

To enable communications integration through AS-Interface there is an AS-i add-on module (also available as a version with two local inputs for safe disconnection) which can be mounted instead of the control circuit terminals on the SIRIUS compact feeder.

The design of the AS-i add-on module permits a group of up to 62 feeders with a total of four cables to be connected to the control system. This reduces wiring work considerably compared to the parallel wiring method.

Permanent wiring / easy replacement

Using the SIRIUS infeed system for 3RA6 it is possible to carry out the wiring in advance without a compact feeder needing to be connected.

A compact feeder is very easily replaced simply by pulling it out of the device without disconnecting the wiring.

Even with screw connections or mounting on a standard mounting rail there is no need to disconnect any wiring (on account of the removable main and control circuit terminals) in order to replace a compact feeder.

Consistent solution from the infeed to the motor feeder

The SIRIUS infeed system for 3RA6 with integrated PE bar is offered as a user-friendly possibility of feeding in summation currents up to 100 A with a maximum conductor cross-section of 70 mm^2 and connecting the motor cable directly without additional intermediate terminals.

Screw and spring-type connections

The SIRIUS compact feeders and the SIRIUS infeed system for 3RA6 are available with screw and spring-type connections.

	Screw connection
	Spring-type connection
	These connections are indicated in the Technical specifications by orange backgrounds.

System configurator for engineering

A free system configurator is available to reduce further the amount of engineering work for selecting the required compact feeders and matching infeed.

Types of infeed for the 3RA6 fuseless compact feeders

On the whole four different infeed possibilities are available:

- Parallel wiring
- Use of 3-phase busbars (combination with SIRIUS motor starter protectors and SIRIUS contactors possible)
- 8US busbar adapters
- SIRIUS infeed system for 3RA6

To comply with the clearance and creepage distances demanded according to UL 508 there are the following infeed possibilities:

Type of infeed	Feeder terminal (acc. to UL 508, type E)	Order No.
Parallel wiring	Terminal for "Self-Protected Combination Motor Controller (Type E)"	**3RV19 28-1H**
3-phase busbars	3-phase infeed terminal for constructing "Type E Starters", UL 508	**3RV19 25-5EB**
Infeed systems for 3RA6	Infeed on left, 50/70 mm^2, screw terminal with 3 sockets, outgoing terminal with screw/spring-type connections, including PE bar	**3RA68 13-8AB** (screw terminals), **3RA68 13-8AC** (spring-type terminals)

SIRIUS 3RA6 compact feeders

The SIRIUS 3RA6 compact feeders are universal motor feeders according to IEC/EN 60947-6-2. As control and protective switching devices (CPS) they can connect, convey and disconnect the thermal, dynamic and electrical loads from short-circuit currents up to I_q = 53 kA, i. e. they are practically weld-free. They combine the functions of a motor starter protector, a contactor and a solid-state overload relay in a single enclosure and can be used wherever standard induction motors up to 32 A (up to approx. 15 kW at 400 V AC) are started directly. Direct-on-line and reversing starters are available as variants.

The reversing starter version comes with not only an internal electrical interlock but also with a mechanical interlock to prevent simultaneous actuation of both directions of rotation.

3RA6 fuseless compact feeders are available with 5 current setting ranges and 3 control voltage ranges:

Overall width of direct-on-line starter	Overall width of reversing starter	Current setting range	At 400 V AC for induction motors up to
mm	mm	A	kW
45	90	0.1 ... 0.4	0.09
45	90	0.32 ... 1.25	0.37
45	90	1 ... 4	1.5
45	90	3 ... 12	5.5
45	90	8 ... 32	15

The 3 control voltage ranges are:
- 24 V AC/DC
- 42 ... 70 V AC/DC
- 110 ... 240 V AC/DC

Note:

The 3RA1 load feeders can be used for fuseless load feeders > 32 A up to 100 A.

The SENTRON 3VL circuit breakers and the SIRIUS 3RT contactors can be used for fuseless load feeders >100 A.

You will find related information in Chapter 16, Chapter 3 and Catalog LV 1.

Operating conditions

The SIRIUS 3RA6 compact feeders are suitable for use in any climate. They are intended for use in enclosed rooms in which no severe operating conditions (such as dust, caustic vapors, hazardous gases) prevail. Suitable covers must be provided for installation in dusty and damp locations.

The SIRIUS compact feeders are generally designed to degree of protection IP20. The permissible ambient temperature during operation is -20 ... +60 °C.

The operating short-circuit current is 53 kA at 400 V.

Note:

More technical specifications can be found in the system manual at

http://www.siemens.com/compactstarter

Overload tripping times

The overload tripping time can be set on the device to less than 10 s (CLASS 10) and less than 20 s (CLASS 20 for heavy starting). As the breaker mechanism still remains closed after an overload, resetting is possible by either local manual reset or autoreset after 3 minutes cooling time.

With autoreset there is no need to open the control cabinet.

Diagnostics options

The compact feeder provides the following diagnostics options:
- With LEDs:
  - Connection to the control voltage
  - Position of the main contacts
- With mechanical indication:
  - Tripping due to overload
  - Tripping due to short-circuit
  - Tripping due to malfunction (end of service life reached because of worn switching contacts or a worn switching mechanism or faults in the control electronics)

These states can be evaluated in addition in the higher-level control system by means of the integrated auxiliary switches and signal switches of the compact feeder.

Four complement variants for 3RA6 compact feeders

- For standard mounting rail or screw fixing:
  basic version including 1 pair of main circuit terminals and 1 pair of control circuit terminals
- For standard mounting rail or screw fixing when using the AS-i add-on module:
  without control circuit terminals because the AS-i add-on module is plugged on instead
- For use with the infeed system for 3RA6:
  without main circuit terminals because they are supplied with the infeed system and the expansion modules
- For use with the infeed system for 3RA6 and AS-i add-on module:
  without terminal complement (also for reordering when replacing the compact feeder)

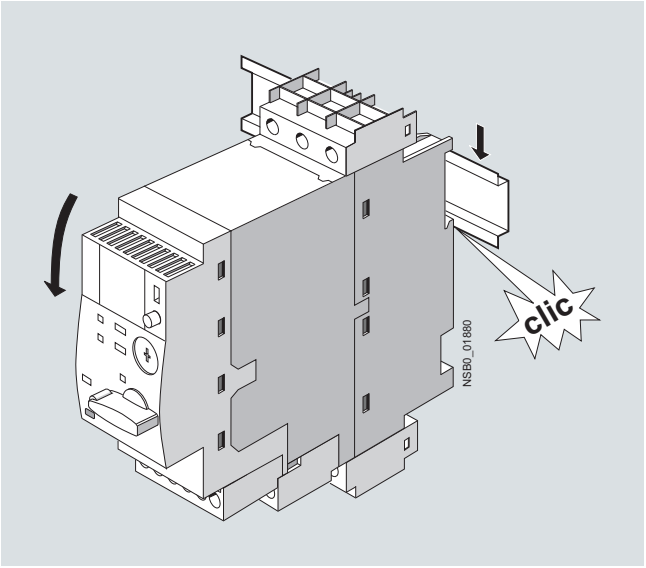
Design

Mounting

The 3RA6 compact feeders can be fastened in 4 ways:

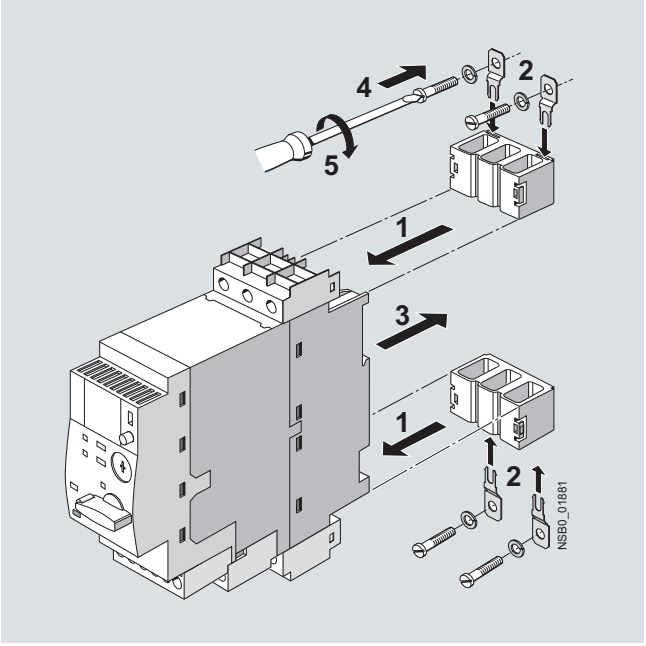
1) By snapping onto a TH 35 standard mounting rail

The SIRIUS compact feeders can be snapped onto a standard mounting rail according to EN 60715 with a width of 35 mm.



2) By screw fixing to a flat surface

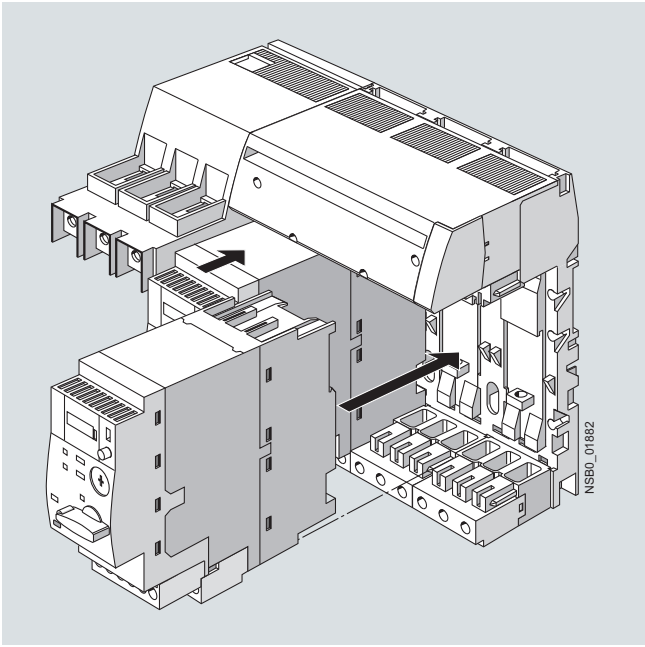
The SIRIUS compact feeders are suitable for screw fixing to a flat surface. One set of 3RA69 40-0A adapters for screw connection (including push-in lugs) is required per direct-on-line starter, two sets are required per reversing starter.



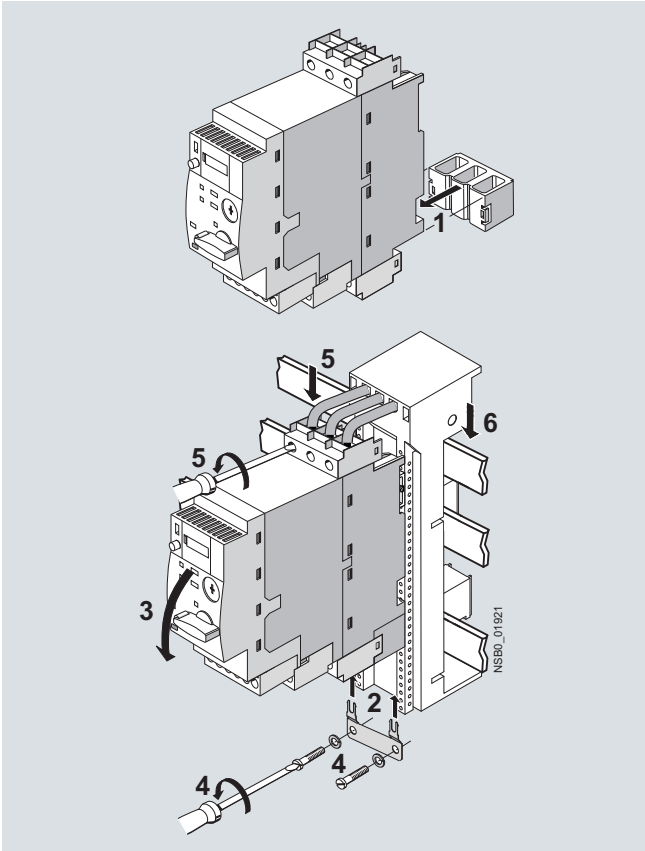
1 ... 5: order of mounting steps

3) By integrating in the infeed system for 3RA6

The SIRIUS compact feeders can be assembled with the infeed system for 3RA6 (see "Infeed system for 3RA6").



4) By using the 8US busbar adapter on busbar systems with 60 mm busbar center-to-center clearance

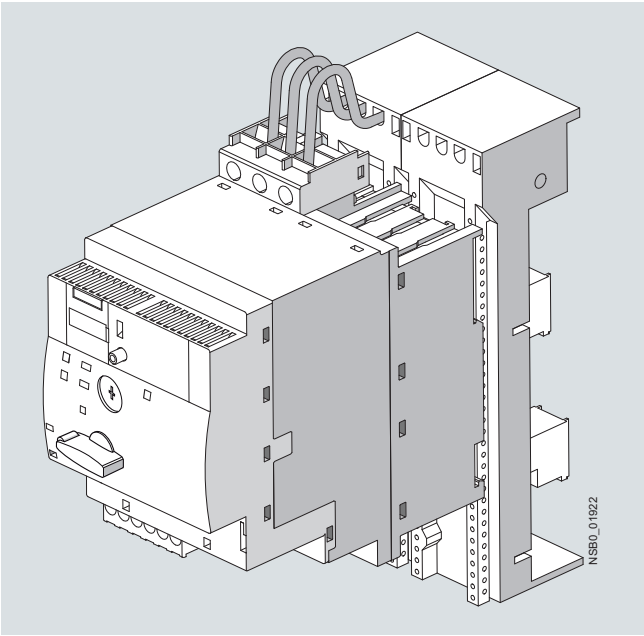


1 ... 6: order of mounting steps

4a) By using an additional device holder in the case of reversing starters

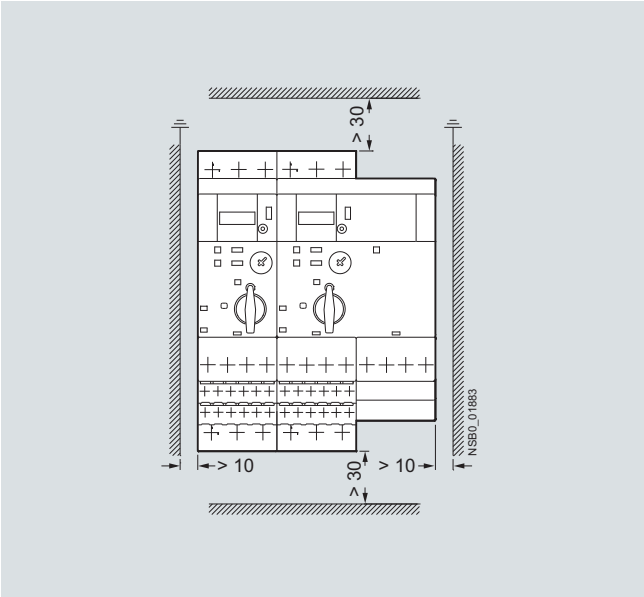
When the 8US busbar adapter is used on busbar systems with 60 mm busbar center-to-center clearance, a device holder is needed in addition for a reversing starter on account of its double width.

The reversing starter is mounted in the same way as the direct-on-line starter on the busbar adapter. Then the device holder is snapped on alongside the busbar adapter.



Mounting regulations

The module can be installed horizontally or vertically. For the different installations attention must be paid however to limit values for protective separation according to IEC/EN 60947-2 of the compact feeders (for details see the "Technical specifications").



The following distances must be observed when mounting the compact feeders:
- Lateral clearance to grounded components: 10 mm
- Arcing space at top and bottom: 30 mm

Function

Trip units

The SIRIUS 3RA6 compact feeders are equipped with the following trip units:
- Inverse-time delayed solid-state overload release
- Instantaneous electronic trip unit (electromagnetic short-circuit release)

The overload releases can be adjusted in accordance with the load current.

The electronic trip units are permanently set to a value 13 times the maximum rated current of the 4 A, 12 A and 32 A feeder and thus enable trouble-free starting of motors.

Trip classes

The trip classes of electronically delayed trip units are based on the tripping time (t_A) at 7.2 times the set current in the cold state (excerpt from IEC 60947-4):

CLASS 10: 4s < t_A < 10 s

CLASS 20: 6s < t_A < 20 s (for heavy starting)

The compact feeder must trip within this time.

Disconnection due to malfunction

The following malfunctions can be detected:
- End of service life
  - Worn switching contacts (for electrical endurance see "Technical specifications")
  - Worn switching mechanisms (for mechanical endurance see "Technical specifications")
- Faults in the control electronics

Short-circuit protection

If a short-circuit occurs, the short-circuit releases of the SIRIUS 3RA6 compact feeders isolate the faulty load feeder from the network and thus prevent further damage. The short-circuit releases are factory-set to 14 times the value of the maximum rated current I_n of the device.

The SIRIUS compact feeders have a short-circuit breaking capacity of 53 kA at a voltage of 400 V AC. Higher short-circuit currents are not to be expected in practice.

Overload relay function

In the event of an overload, the compact feeder switches off without the breaker mechanism being opened.

The overload trip can be signaled to the higher-level control system through an integrated signal switch (1 W).

The overload signal can be reset automatically or by means of a manual reset.

Control through AS-Interface

For control through AS-Interface, the AS-i add-on module is mounted instead of the two control circuit terminals on the SIRIUS 3RA6 compact feeders (direct-on-line starters and reversing starters).

The AS-i auxiliary voltage and the AS-i data line are installed on the AS-i add-on module easily and quickly without tools by means of two plug-in connector blocks with insulation displacement connection.

The AS-i add-on module is equipped with the latest A/B technology and has an addressing socket onboard.

An addressing unit can be ordered for addressing the AS-i add-on module.

Bit assignment (see below) is similar to that for the SIRIUS motor starters, which means that the same programming can be used here.

DI 0.0 ready
DI 0.1 motor on
DI 0.2 group fault
DI 0.3 group warning

DO 0.0 motor on or motor clockwise
DO 0.1 motor counterclockwise

A 24 V DC PELV power supply unit according to EN 61140 safety class III is required for the auxiliary voltage.

The AS-i data line is supplied with voltage by means of an AS-i power supply unit and is controlled by means of the AS-i master.

The AS-i add-on modules are available in the following two versions:
- AS-i add-on modules for compact feeders
- AS-i add-on modules for compact feeders with two local inputs for safe disconnection of the "clockwise rotation" or "counterclockwise rotation" outputs

The AS-i add-on module can be combined only with compact feeders with a control voltage of 24 V AC/DC.

Integrated auxiliary switches

The control circuit terminals of the SIRIUS 3RA6 compact feeders have the following connections:
- A1/A2 for the control voltage for 3RA61,
  A1/A2 and B1/B2 for the control voltage for 3RA62
- "Overload" signal switch
- "Fault" signal switch, e. g. "short-circuit"
- Internal auxiliary switch for position of the main contacts (in case of direct-on-line starters: 1 NO + 1 NC with mirror contact to the main contact; in case of reversing starters: 2 NO)

Technical specifications

Type			**3RA61**	**3RA62**
Size			**S0**	
Number of poles			**3**	
General data				
Device standard			IEC/EN 60947-6-2	
Max. rated current $I_{n\ max}$	0.1 ... 0.4 A	A	0.4	
(= max. rated operational current I_e)	0.32 ...1.25 A	A	1.25	
for the respective setting range	1 ... 4 A	A	4	
	4 ... 12 A	A	12	
	8 ... 32 A	A	32	
Permissible ambient temperature				
• During operation	Acc. to IEC/EN 60721-3-3	°C	-20 ... +60, with restriction up to +70	
• For installation in SIRIUS infeed system for 3RA6		°C	-20 ... +40	
• During storage	IEC/EN 60732-3-1	°C	-55 ... +80	
• During transport	IEC/EN 60721-3-2	°C	-55 ... +80	
Permissible rated current of the compact feeder, when several compact feeders are mounted side-by-side on a vertical standard mounting rail or in the infeed system for 3RA6				
• For a control cabinet inside temperature of	+40 °C	%	100	
• For a control cabinet inside temperature of	+60 °C	%	80	
Relative air humidity		%	10 ... 90	
Installation altitude		m	Up to 2000 above sea level without restriction	
Rated frequency		Hz	50/60	
Rated insulation voltage U_i (degree of pollution 3)		V	690	
Rated impulse withstand voltage U_{imp}		kV	6	
Trip class (CLASS)	Acc. to IEC 60947-4-1, EN 60947-4-1		10/20	
Rated short-circuit current I_q at AC 50/60 Hz 400 V	Acc. to IEC 60947-4-1, EN 60947-4-1	kA	53 kA	
Types of coordination	Acc. to IEC 60947-6-2, EN 60947-6-2		Continuously	
Power loss $P_{V\ max}$ of all main current paths	Up to 0.4 A	mW	2	
Dependent on the rated current I_n	0.32 ... 1.25 A	mW	19.1	
(upper setting range)	1 ... 4 A	W	0.2	
	3 ... 12 A	W	0.7	
	8 ... 32 A	W	2.3	
Compact feeder endurance				
• Mechanical endurance		Operating cycles	10 000 000	
• Electrical endurance	At I_e = 0.9 I_n	Operating cycles	1 520 000	
Max. switching frequency	AC-41	1/h	750	
	AC-43	1/h	250	
	AC-44	1/h	15	
Drive losses				
Active power	At 24 V			
	• Up to 12 A	W	2.7	
	• 8 ... 32 A	W	2.95	
	At 42 ... 70 V			
	• Up to 12 A	W	2.5	
	• 8 ... 32 A	W	3.0	
	At 110 ... 240 V			
	• Up to 12 A	W	3.4	
	• 8 ... 32 A	W	3.8	
Overload function				
Ratio of lower to upper current mark			1:4	
Shock resistance (sine-wave pulse)			a = 60 m/s² = 6g with 10 ms; for every 3 shocks in all axes	
Vibratory load			f =1 ... 6 Hz; d =15 mm 10 cycles f =150 Hz; a = 2 g	
Degree of protection	Acc. to IEC 60947-1		IP20	
Touch protection	Acc. to IEC/EN 61140		Finger-safe	
Isolating features of the compact feeder	Acc. to IEC/EN 60947-3		Yes	
Main and EMERGENCY-STOP switch characteristics of the compact feeder and accessories	Acc. to IEC/EN 60204		Yes	

3RA61 direct-on-line starters, 3RA62 reversing starters, general data

Type			3RA61	3RA62
Size			S0	
Number of poles			3	
General data				
Protective separation	Acc. to IEC 60947-2			
Control circuit to auxiliary circuit				
• Horizontal standard mounting rail		V	Up to 400	
• Other mounting position		V	Up to 250	
Auxiliary circuit to auxiliary circuit				
• Horizontal standard mounting rail		V	Up to 400	
• Other mounting position		V	Up to 250	
Main circuit to auxiliary circuit				
• Any mounting position		V	Up to 400	
EMC interference immunity	Acc. to IEC 60947-1		Corresponds to degree of severity 3	
Conductor-related interference	BURST acc. to IEC 61000-4-4	kV	4	
Conductor-related interference	SURGE acc. to IEC 61000-4-5			
• Conductor - Ground		kV	4	
• Conductor - Conductor		kV	1	
Electrostatic discharge	Acc. to IEC 61000-4-2	kV	8	
ESD		kV	6	
Field-related interference	Acc. to IEC 61000-4-3	V/m	10	
Auxiliary switches				
• Integrated			2 NO, 1 NC, 1 CO	3 NO, 1 CO
• Expandable			1 x auxiliary switch	1 x auxiliary switch per direction of rotation
			2 NO, 2 NC, 1 NO + 1 NC	2 NO, 2 NC, 1 NO + 1 NC
Surge suppressors			Integrated (Varistor)	
Degree of pollution			3	
Depth from standard mounting rail		mm	160	
Electromagnetic operating mechanism				
Control voltage		V	24 AC/DC	
		V	42 ... 70 AC/DC	
		V	110 ... 240 AC/DC	
Frequency	At AC	Hz	50/60 (±5%)	
Operating range			0.7 ... 1.25 U_s	
No-load switching frequency		1/h	3600	
Make-time		ms	Max. 70	
Break-time		ms	Max. 120	
Max. pick-up current at 24 V DC	At 12 A	mA	250	
	At 32 A	mA	350	
Max. hold current at 24 V DC	At 12 A	mA	100	
	At 32 A	mA	150	
Max. pick-up power at 24 V DC	At 12 A	W	6.0	
	At 32 A	W	8.4	
Max. hold power at 24 V DC	At 12 A	W	2.4	
	At 32 A	W	3.6	
Hold current and hold power valid for 24 V operating range				
	24 V, AC operation			
	• Up to 12 A			
Hold current		mA	132	
Active power		W	2.7	
Apparent power		VA	3.15	
P.f.			0.86	
	• 8 ... 32 A			
Hold current		mA	144	
Active power		W	3.0	
Apparent power		VA	3.45	
P.f.			0.86	
	24 V, DC operation			
	• Up to 12 A			
Hold current		mA	100	
Active power		W	2.45	
Apparent power		VA	2.75	
P.f.			0.88	
	• 8 ... 32 A			
Hold current		mA	116	
Active power		W	2.8	
Apparent power		VA	3.3	
P.f.			0.85	

Type			3RA61	3RA62
Size			S0	
Number of poles			3	
Electromagnetic operating mechanism				
Hold current and hold power valid for operating range 42 V ... 70 V				
	42 V, AC operation			
	• Up to 12 A			
Hold current		mA	75	
Active power		W	2.35	
Apparent power		VA	3.2	
P.f.			0.734	
	• 8 ... 32 A			
Hold current		mA	84	
Active power		W	2.7	
Apparent power		VA	3.6	
P.f.			0.73	
	42 V, DC operation			
	• Up to 12 A			
Hold current		mA	55	
Active power		W	2.3	
Apparent power		VA	2.7	
P.f.			0.853	
	• 8 ... 32 A			
Hold current		mA	63	
Active power		W	2.7	
Apparent power		VA	3.35	
P.f.			0.85	
	70 V, AC operation			
	• Up to 12 A			
Hold current		mA	54	
Active power		W	2.5	
Apparent power		VA	3.8	
P.f.			0.654	
	• 8 ... 32 A			
Hold current		mA	58.5	
Active power		W	2.7	
Apparent power		VA	4	
P.f.			0.65	
	70 V, DC operation			
	• Up to 12 A			
Hold current		mA	33	
Active power		W	2.35	
Apparent power		VA	2.9	
P.f.			0.813	
	• 8 ... 32 A			
Hold current		mA	37	
Active power		W	2.6	
Apparent power		VA	3.0	
P.f.			0.81	
Hold current and hold power valid for operating range 110 V ... 240 V				
	110 V, AC operation			
	• Up to 12 A			
Hold current		mA	38	
Active power		W	2.8	
Apparent power		VA	4.2	
P.f.			0.67	
	• 8 ... 32 A			
Hold current		mA	42.5	
Active power		W	3.2	
Apparent power		VA	4.7	
P.f.			0.68	
	110 V, DC operation			
	• Up to 12 A			
Hold current		mA	22.5	
Active power		W	2.5	
Apparent power		VA	3.75	
P.f.			0.67	
	• 8 ... 32 A			
Hold current		mA	25.5	
Active power		W	2.9	
Apparent power		VA	4.65	
P.f.			0.62	
	240 V, AC operation			
	• Up to 12 A			
Hold current		mA	36	
Active power		W	3.6	
Apparent power		VA	8.8	
P.f.			0.41	
	• 8 ... 32 A			
Hold current		mA	39	
Active power		W	3.9	
Apparent power		VA	9.3	
P.f.			0.42	

3RA61 direct-on-line starters, 3RA62 reversing starters, general data

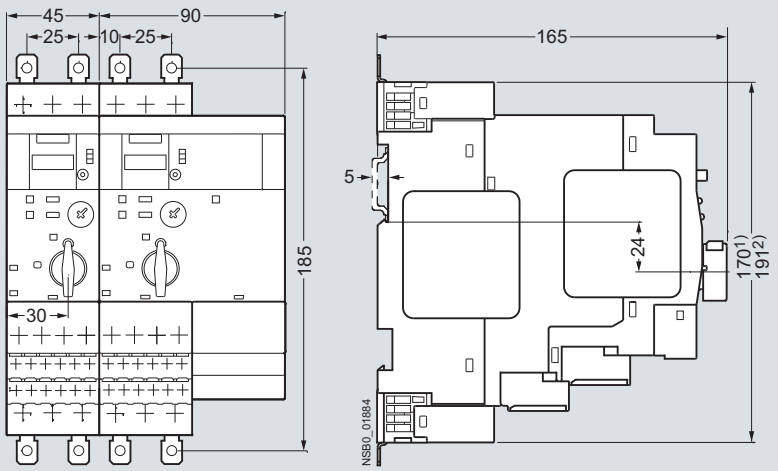
Type			3RA61	3RA62
Size			S0	
Number of poles			3	
Electromagnetic operating mechanism				
Hold current and hold power valid for operating range 110 V ... 240 V				
	240 V, DC operation			
	• Up to 12 A			
Hold current		mA	12.5	
Active power		W	3.0	
Apparent power		VA	6.35	
P.f.			0.47	
	• 8 ... 32 A			
Hold current		mA	14	
Active power		W	3.35	
Apparent power		VA	6.55	
P.f.			0.51	
Switching capacity at 400 V		kA	53	
Switching capacity at 690 V		kA	3	
Line protection	At 10 kA	mm^2	2.5	
	At 50 kA	mm^2	4	
Shock resistance				
• Breaker mechanism OFF		*g*	25	
• Breaker mechanism ON		*g*	15	
Normal switching duty				
Making capacity			12 x I_n	
Breaking capacity			10 x I_n	
Switching capacity dependent on rated current	Up to 12 A	kW	5.5	
	Up to 32 A	kW	15	
Endurance in operating cycles				
• Mechanical endurance			10 000 000	
• Electrical endurance	At I_e = 0.9 x I_n		1 520 000	

Type			3RA61	3RA62
Size			S0	
Number of poles			3	
Control circuit				
Rated operational voltage				
• External auxiliary switch block		V	400/690	
• Internal auxiliary switch		V	400/690	
• Short-circuit signal switch		V	400	
• Overload signal switch		V	400	
Switching capacity				
• External auxiliary switch block	AC-15			
	• At U_e = 230 V	A	6	
	• At U_e = 400 V	A	3	
	• At U_e = 289/500 V	A	2	
	• At U_e = 400/690 V	A	1	
	DC-13			
	• At U_e = 24 V	A	6	
	• At U_e = 60 V	A	0.9	
	• At U_e = 125 V	A	0.55	
	• At U_e = 250 V	A	0.27	
• Internal auxiliary switch	AC-15			
	• At U_e = 230 V	A	6	
	• At U_e = 400 V	A	3	
	• At U_e = 289/500 V	A	2	
	• At U_e = 400/690 V	A	1	
	DC-13			
	• At U_e = 24 V	A	10	
	• At U_e = 60 V	A	2	
	• At U_e = 125 V	A	1	
	• At U_e = 250 V	A	0.27	
	• At U_e = 480 V	A	0.1	
• Signal switch	AC-15			
	• At U_e = 230 V	A	3	
	• At U_e = 400 V	A	1	
	DC-13			
	• At U_e = 24 V	A	2	
	• At U_e = 250 V	A	0.11	

Type			**3RA61**	**3RA62**
Size			**S0**	
Number of poles			**3**	
External auxiliary switch block, internal auxiliary switch				
Endurance in operating cycles				
• Mechanical endurance			10 000 000	
• Electrical endurance	AC-15, 230 V			
	• At 6 A		200 000	
	• At 3 A		500 000	
	• At 1A		2 000 000	
	• At 0.3 A		10 000 000	
	DC-13, 24 V			
	• At 6 A		30 000	
	• At 3 A		100 000	
	• At 0.5A		2 000 000	
	• At 0.2 A		10 000 000	
	DC-13, 110 V			
	• At 1 A		40 000	
	• At 0.55 A		100 000	
	• At 0.3 A		300 000	
	• At 0.1 A		2 000 000	
	• At 0.04 A		10 000 000	
	DC-13, 220 V			
	• At 0.3 A		110 000	
	• At 0.1 A		650 000	
	• At 0.05 A		2 000 000	
	• At 0.018 A		10 000 000	
Contact stability	At 17 V and 5 mA	Operating cycles	1 incorrect switching operation per 100 000 000	
Short-circuit protection				
• Short-circuit current $I_K \leq 1.1$ kA	Fuse links gL/gG NEOZED 5SE, DIAZED 5SB, LV HRC 3NA	A	10	
• Short-circuit current $I_K < 400$ A	Miniature circuit breaker up to 230 V with C characteristic	A	10	
Signal switches				
Endurance in operating cycles				
• Mechanical endurance			20 000	
• Electrical endurance AC-15	At 230 V and 3 A		6050	
Contact stability	At 17 V and 5 mA	Operating cycles	1 incorrect switching operation per 100 000 000	
Short-circuit protection				
• Short-circuit current $I_K \leq 1.1$ kA	Fuse links gL/gG NEOZED 5SE, DIAZED 5SB, LV HRC 3NA	A	6	
• Short-circuit current $I_K < 400$ A	Miniature circuit breaker up to 230 V with C characteristic	A	6	
Overload (short-circuit current $I_K \leq 1.1$ kA)	Fuse links gL/gG NEOZED 5SE, DIAZED 5SB, LV HRC 3NA	A	4	

Dimensional drawings

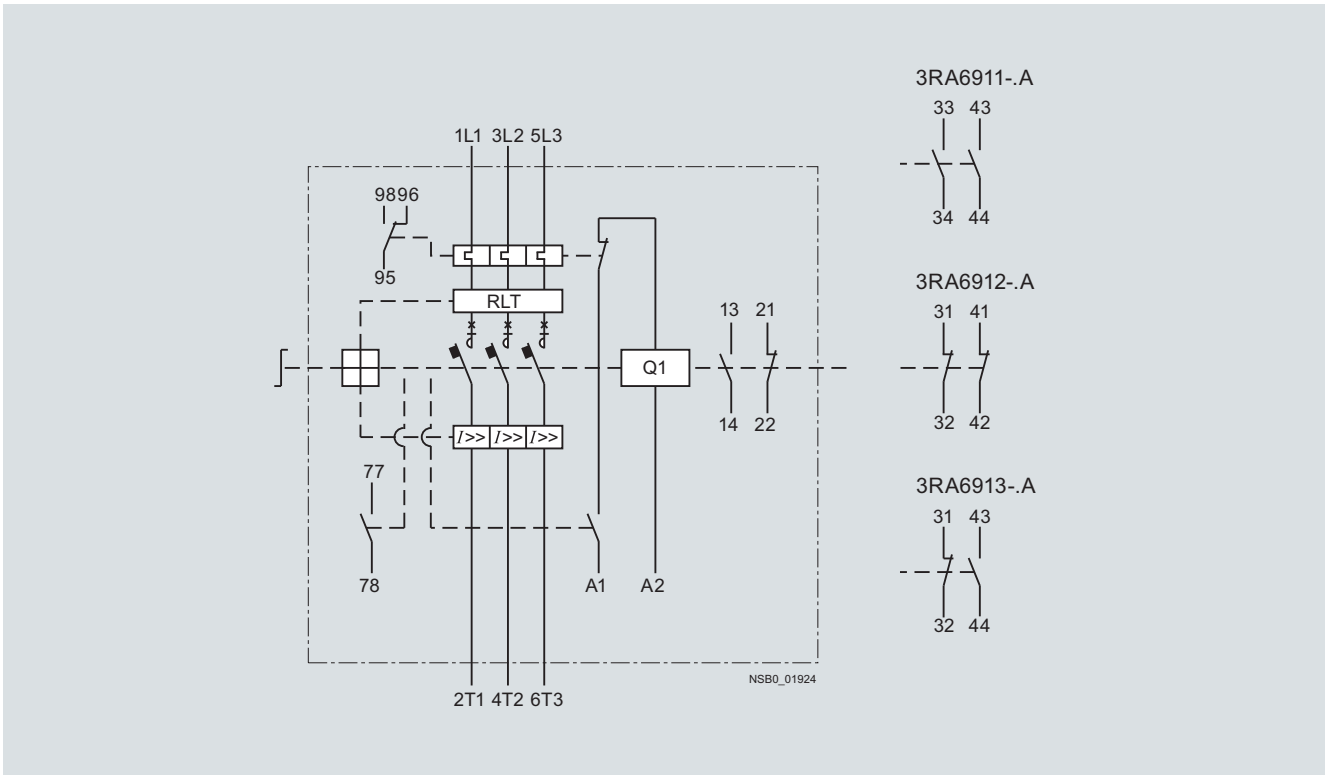
Direct-on-line starters and reversing starters



1) Screw connection
2) Spring-loaded connection

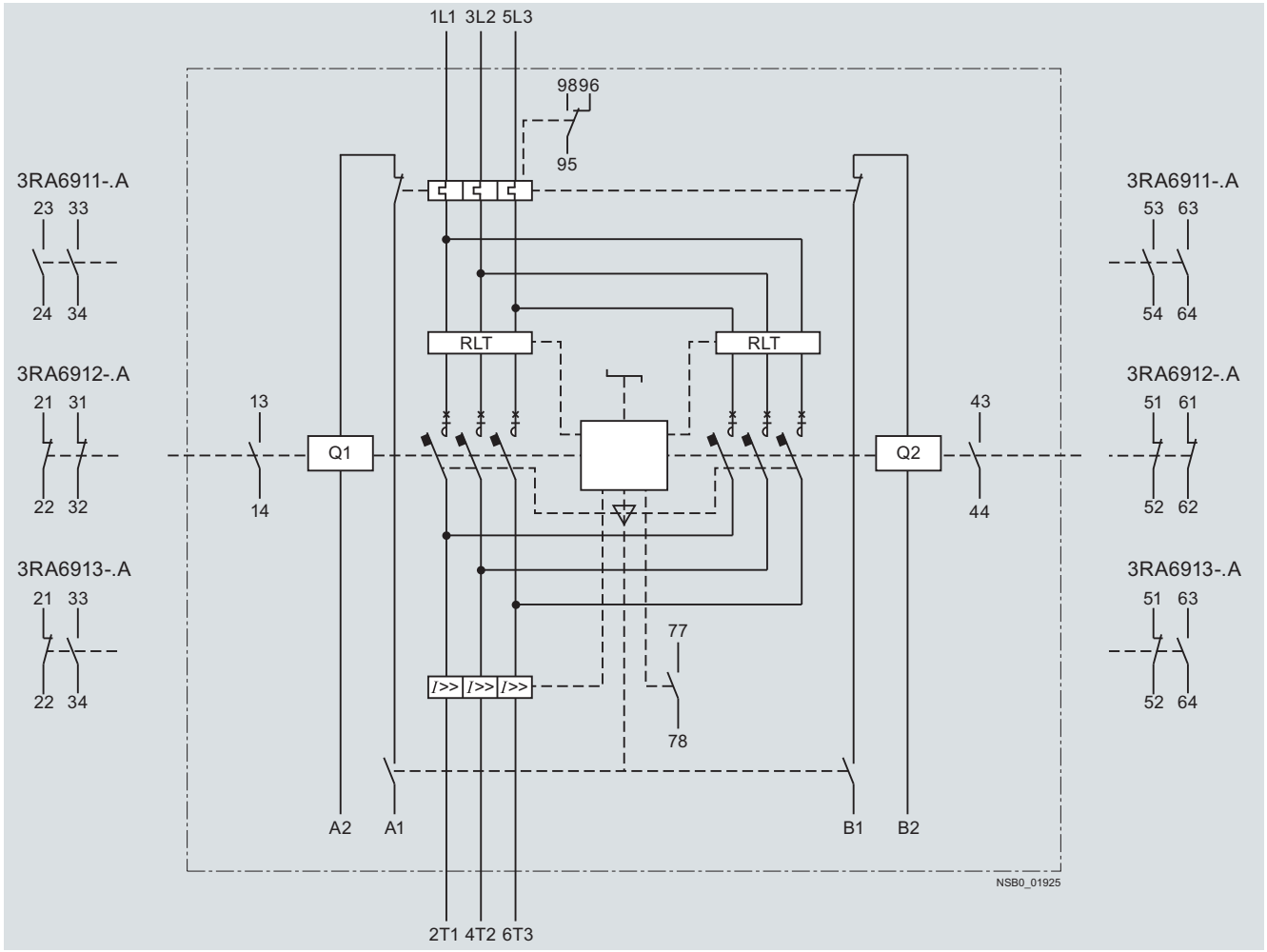
Schematics

3RA61 direct-on-line starters



Schematic for 3RA61 direct-on-line starters (main circuit)

3RA62 reversing starters



Schematic for 3RA62 reversing starters (main circuit)

Accessories for 3RA6 direct-on-line and reversing starters

Overview

Accessories for SIRIUS 3RA6 compact feeders

The following accessories are available specially for the 3RA6 compact feeders:

- AS-i add-on module: For communication of the compact feeder with the control system using AS-Interface; also available as a version with two local inputs for safe disconnection. The AS-i add-on module can be combined only in connection with compact feeders with a rated control supply voltage of 24 V AC/DC.
- Addressing unit for addressing the AS-i add-on module
- External auxiliary switch blocks: Snap-on auxiliary switch as versions 2 NO, 2 NC and 1 NO + 1 NC with screw or spring-type connections; the contacts of the auxiliary switch block open and close jointly with the main contacts of the compact feeder. The NC contacts are designed as mirror contacts.
- Control kit: aid for manually closing the main contacts in order to check the wiring and motor direction under conditions of short-circuit protection
- Adapter for screw fixing the compact feeder, including push-in lugs
- Main conductor terminal: available with screw and spring-type connection

Accessories for parallel wiring

The terminal block for "Self-Protected Combination Motor Controller", type E is available for complying with the clearance and creepage distances demanded according to UL 508.

Accessories for infeed using 3-phase busbar systems

The 3-phase busbars can be used as an easy, time-saving and clearly arranged means of feeding SIRIUS 3RA6 compact feeders with screw connection. Motor starter protector sizes S00 and S0 can also be integrated.

The busbars are suitable for between 2 and 5 devices. However, any kind of extension up to a maximum summation current of 63 A is possible by clamping the tags of an additional busbar (rotated by 180°) underneath the terminals of the respective last circuit breaker.

A connecting piece is required for the combination with motor starter protector size S00. The motor starter protectors are supplied by appropriate feeder terminals. Special feeder terminals are required for constructing "Type E Starters" according to UL/CSA.

The 3-phase busbar systems are finger-safe but empty connection tags must be fitted with covers. They are designed for any short-circuit stress which can occur at the output side of connected SIRIUS 3RA6 compact feeders or motor starter protectors.

Busbar adapters for 60 mm systems

The compact feeders are mounted directly with the aid of busbar adapters on busbar systems with 60 mm center-to-center clearance in order to save space and to reduce infeed times and costs. These feeders are suitable for copper busbars with a width from 12 to 30 mm. The busbars can be 4 to 5 mm or 10 mm thick.

The 8US busbar system can be loaded with a maximum summation current of 630 A.

The "reversing starter" version requires a device holder along side the busbar adapter for lateral mounting.

The compact feeders are snapped onto the adapter and connected on the line side. This prepared unit is then plugged directly onto the busbar system, and is thus connected both mechanically and electrically at the same time.

For more accessories such as incoming and outgoing terminals, flat copper profiles etc., see LV1, Chapter 14, "8US Busbar Systems, 60 mm Busbar System".

Accessories for operation with closed control cabinet doors

Door-coupling rotary operating mechanisms for standard and emergency-stop applications are available for operating the compact feeder with closed control cabinet doors.

Technical specifications

Connection type		Screw connection		Spring-type connection	
Max. rated current I_{max}		**12 A**	**32 A**	**12 A**	**32 A**
Conductor cross-sections of main circuit terminals					
Tools		Pozidriv size 2		(3.5 x 0.5) mm, 8WA2 803	
Prescribed tightening torque	NM	2 ... 2.5		--	
Minimum/maximum conductor cross-sections					
• Solid	mm^2 mm^2 mm^2	2 x (1.5 ... 2.5) 2 x (2.5 ... 6) Max. 1 x 10	2 x (2.5 ... 6) Max. 1 x 10	2 x (1.5 ... 6) Max. 1 x 10	2 x (2.5 ... 6) Max. 1 x 10
• Finely stranded without end sleeve	mm^2	--	--	2 x (1.5 ... 6)	2 x (2.5 ... 6)
• Finely stranded with end sleeve	mm^2 mm^2	2 x (1.5 ... 2.5) 2 x (2.5 ... 6)	2 x (2.5 ... 6)	2 x (1.5 ... 6)	2 x (2.5 ... 6)
• AWG cables	AWG AWG AWG	2 x (16 ...14) 2 x (14 ...10) 1 x 8	2 x (14 ...10) 1 x 8	2 x (16 ...10) 1 x 8	2 x (14 ...10) 1 x 8

Connection type		Screw connection	Spring-type connection
Conductor cross-sections of control circuit terminals			
Tools		Pozidriv size 2	(3.0 x 0.5) mm, DIN ISO 2380-1A
Prescribed tightening torque	NM	0.8 ... 1.2	--
Minimum/maximum conductor cross-sections			
• Solid	mm^2 mm^2	1 x (0.5 ... 4) 2 x (0.5 ... 2.5)	2 x (0.25 ... 1.5)
• Finely stranded without end sleeve	mm^2	--	2 x (0.25 ... 1.5)
• Finely stranded with end sleeve	mm^2 mm^2	1 x (0.5 ... 2.5) 2 x (0.5 ... 1.5)	2 x (0.25 ... 1.5)
• AWG cables	AWG	2 x (20 ... 14)	2 x (24 ... 16)
Conductor cross-sections of the auxiliary switch for compact feeders			
Order No.		**3RA69 1.-1A**	**3RA69 1.-2A**
Tools		Pozidriv size 2	(2.5 x 0.4) mm, 8WA2 807
Prescribed tightening torque	NM	0.8 ... 1.2	--
Conductor cross-sections			
• Solid	mm^2 mm^2 mm^2	2 x (0.5 ...1.5) 2 x (0.75 ... 2.5) 2 x (1 ... 4)	2 x (0.25 ... 2.5)
• Finely stranded without end sleeve	mm^2	--	2 x (0.25 ... 2.5)
• Finely stranded with end sleeve	mm^2 mm^2	2 x (0.5 ... 1.5) 2 x (0.75 ... 2.5)	2 x (0.25 ... 1.5)
• AWG cables	AWG AWG AWG	2 x (20 ... 16) 2 x (18 ... 14) 1 x 12	2 x (24 ... 14)

Accessories for 3RA6 direct-on-line and reversing starters

Order No.			3RA6970-3A, 3RA6970-3B,
General data of the AS-i add-on module			
Permissible ambient temperature			
• Storage	Acc. to IEC/EN 60721-3-1	°C	-25 ... +70
• Transport	Acc. to IEC/EN 60721-3-2	°C	-25 ... +70
Degree of protection	Acc. to IEC/EN 60947-1		IP20
EMC interference immunity	Acc. to EN 50295		
Conductor-related interference	BURST acc. to IEC/EN 61000-4-4	kV	1/2
Electrostatic discharge	Acc. to IEC/EN 61000-4-2	kV	6/8
Field-related interference	Acc. to IEC/EN 61000-4-3	V/m	10 (80 MHz ... 2.7 GHz)
Maximum pick-up current		mA	400
Maximum hold current		mA	200
Power consumption, max.		mA	30
IO code			7
ID code			A
ID2 code			E

Order No.			3RA6970-3B
Connection type			**Screw connection**
Conductor cross-sections of the AS-i add-on module			
Tools			Pozidriv size 1
Prescribed tightening torque		NM	0.5 ... 0.6
Conductor cross-sections			
• Solid		mm^2	1 x (0.5 ... 2.5)
		mm^2	2 x (0.5 ... 1.0)
• Finely stranded with end sleeve		mm^2	1 x (0.5 ... 2.5)
		mm^2	2 x (0.5 ... 1.0)
• AWG cables		AWG	1 x (20 ... 12)

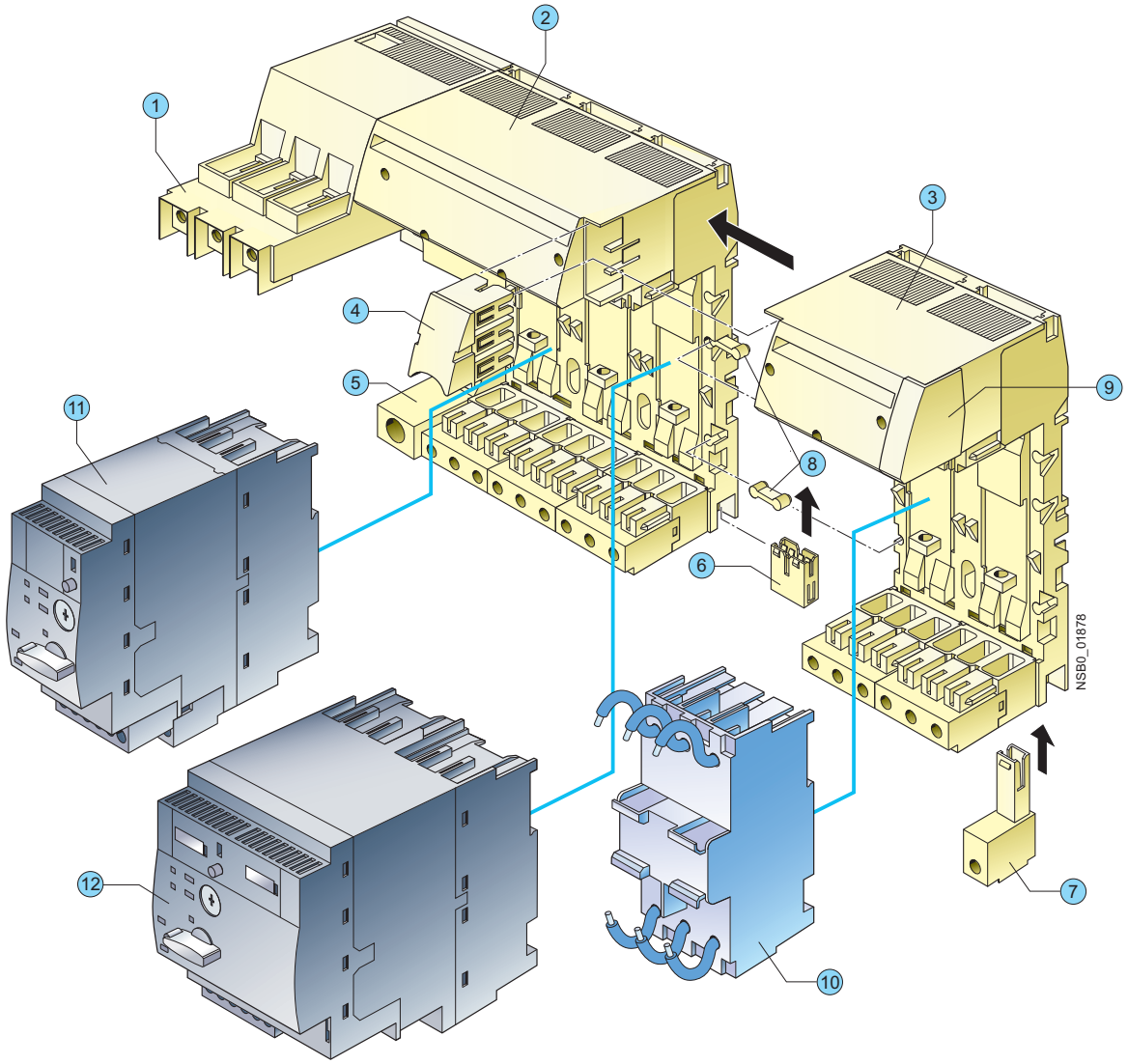
Overview

The infeed system for 3RA6 compact feeders enables far less wiring in the main circuit and, thanks to the easy exchangeability of the compact feeders, reduces the usual downtimes for maintenance work during the plant's operating phase.

The infeed system provides the possibility of completely prewiring the main circuit without a compact feeder needing to be connected at the same time. As the result of the removable terminals in the main circuit, compact feeders can be integrated in an infeed system in easy manner (without the use of tools).

In addition, the integrated PE bar means it is optionally possible to connect the motor cable directly to the infeed system without additional intermediate terminals. The infeed system for 3RA6 compact feeders is designed for summation currents up to 100 A with a maximum conductor cross-section of max. 70 mm^2 on the feeder terminal block.

The infeed system can be mounted on a standard mounting rail or flat surfaces.



① Feeder terminal
② Three-socket expansion module
③ Two-socket expansion module
④ Expansion plug
⑤ PE infeed
⑥ PE expansion plug
⑦ PE pick-off
⑧ Connecting plate
⑨ End cover
⑩ 45 mm adapter for SIRIUS motor starter protector size S0
⑪ 3RA61 direct-on-line starter
⑫ 3RA62 reversing starter

Infeed systems for 3RA6

① Infeed

The 3-phase infeed is available with screw connection (25/35 mm² up to 63 A or 50/70 mm² up to 100 A) and spring-type connection (25/35 mm² up to 63 A).

The infeed with spring-type terminal can be fitted on the left as well on as the right to an expansion module.

The infeed with screw terminal is supplied only with a 3-socket expansion module and permanently fitted on the left side.

The infeeds with screw connection enable connection of the main conductors (L1, L2, L3) either from above or from below.

The infeed with screw connection is supplied complete with 1 end cover, the infeed with spring-type connection complete with 2 end covers.

② Three-socket expansion modules

The expansion module with 3 sockets for compact feeders is available with screw connection and with spring-type connection.

Expansion modules enable the infeed system to be expanded and can be fitted to each other in any number.

Two expansion modules are held together with the help of 2 connecting plates and 1 expansion plug. These assembly parts are included in the scope of supply of the respective expansion module.

When the infeed system for 3RA6 is used, the compact feeders (plug-in modules) are easily mounted and removed even when live.

Optional possibilities:
- PE connection on motor outgoing side
- Outfeed for external auxiliary devices
- Connection to 3RV19 infeed system
- Integration of SIRIUS motor starter protectors size S00 and S0 (using 3RA68 90-0BA adapter)

③ Two-socket expansion modules

If only 2 instead of 3 additional sockets are required, then the 2-socket expansion module is the right choice. It has the same functionality as the 3-socket expansion module.

④ Expansion plug

Two expansion modules can be connected together using the expansion plug. Flexible expansion of the infeed system is thus possible.

⑤ PE infeeds

This module enables a PE cable to be connected.

The PE infeed can be ordered with screw connection and spring-type connection (35 mm²) and can be fitted on the right or left to the expansion block.

⑥ PE expansion plug

The PE expansion plug is inserted from below and enables two PE bars to be connected.

⑦ PE pick-off

The PE pick-off is available with screw connection and spring-type connection (6/10 mm²). It is snapped into the infeed system from below.

⑧ Connecting plates

Two connecting plates are used to hold together 2 expansion modules.

⑨ End covers

On the last expansion module of a row, the socket provided for the expansion plug can be covered by inserting the end cover.

⑩ 45 mm adapters for SIRIUS motor starter protectors

SIRIUS motor starter protectors size S0 with screw connection can be fitted to the adapter, enabling them to be plugged into the infeed system.

Terminal blocks

Using the terminal block the 3 phases can be fed out of the system; this means that single-phase, 2-phase and 3-phase components can also be integrated in the system.

After the end cover is pulled out, the terminal block can be plugged onto an expansion module.

Expansion plug for SIRIUS 3RV19 infeed systems

After the end cover is pulled out, the expansion plug for the SIRIUS 3RV19 infeed system can be plugged onto an expansion module. It connects the infeed system for 3RA6 with the SIRIUS 3RV19 infeed system.

Maximum rated operational current

The following maximum rated operational currents apply for the components of the infeed system for 3RA6:

Component	Maximum rated operational current A
Infeed with screw connection 50/70 mm²	100
Infeed with screw connection 25/35 mm²	63
Infeed with spring-type connection 25/35 mm²	63
Expansion plug	63

In a row of several expansion modules, the maximum rated operational current from the 2nd expansion module to the end of the row is 63 A.

Proposal for upstream short-circuit protection devices

The following short-circuit data apply for the components of the infeed system for 3RA6:

Conductor cross-section mm²	Inscriptions	Proposal for upstream short-circuit protection device
Short-circuit protection for infeed block (25 mm²/35 mm²) with screw connection		
2.5 ... 35	$I_{d,max}$ = 19 kA, I^2t = 440 kA²s	**3RV10 41-4JA10**
Short-circuit protection for infeed block (50 mm²/70 mm²) with screw connection		
2.5 ... 70	$I_{d,max}$ = approx. 22 kA	**3RV10 41-4MA10**
Short-circuit protection for infeed block with spring-type connection		
4	$I_{d,max}$ = 9.5 kA, I^2t = 85 kA²s	**3RV10 21-4DA10**
6	$I_{d,max}$ = 12.5 kA, I^2t = 140 kA²s	**3RV10 31-4EA10**
10	$I_{d,max}$ = 15 kA, I^2t = 180 kA²s	**3RV10 31-4HA10**
16 / 25	$I_{d,max}$ = 19 kA, I^2t = 440 kA²s	**3RV10 41-4JA10**
Short-circuit protection for terminal block		
1.5	$I_{d,max}$ = 7.5 kA	**5SY...** [1]
2.5	$I_{d,max}$ = 9.5 kA	
4	$I_{d,max}$ = 9.5 kA	
6	$I_{d,max}$ = 12.5 kA	

[1] To prevent the possibility of short-circuits, the cables on the terminal block must be installed so that they are short-circuit resistant according to EN 60439-1 Section 7.5.5.1.2.

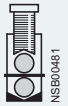
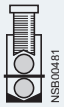
Technical specifications

Type			3RA6.	
General data				
Max. rated operational current				
• Infeed with screw connection 50/70 mm²		A	100	
• Infeed with screw connection 25/35 mm²		A	63	
• Infeed with spring-type connection 25/35 mm²		A	63	
• Expansion plug		A	63	
Permissible ambient temperature				
• During operation		°C	-20 ... +60 (over +40 current reduction is required)	
- Permissible rated current at control cabinet inside temperature: +40 °C		%	100	
+60 °C		%	80	
• During storage/transport		°C	-55 ... +80	
Relative air humidity		%	10 ... 90	
Installation altitude		m	Up to 2000 above sea level without restriction	
Rated operational voltage U_e		V	690 AC	
Rated frequency		Hz	50/60	
Shock resistance			a = 60 m/s² = 6g with 10 ms; for every 3 shocks in all axes	
Vibratory load			f =1 ... 6 Hz; d =15 mm 10 cycles f =150 Hz; a = 2 g	
Degree of protection	Acc. to IEC 60947-1		IP20 (IP 00 terminal compartment)	
Touch protection	Acc. to EN 50274		Finger-safe	
Degree of pollution			3	
Short-circuit protection for				Recommendation for upstream short-circuit protection device
infeed with screw connection (25/35 mm²) and infeed with screw connection (50/70 mm²)				3RV1041-4JA10 3RV1041-4MA10
	$I_{d,max}$	kA	< 21	
	I^2t	kA²s	530	LV HRC gL/gG 3NA3, 315 A
Short-circuit protection for infeed with spring-type connection				Recommendation for upstream short-circuit protection device
• Conductor cross-section 4 mm²	$I_{d,max}$	kA	< 9.5	3RV1021-4DA10
	I^2t	kA²s	85	
• Conductor cross-section 6 mm²	$I_{d,max}$	kA	< 12.5	3RV1031-4EA10
	I^2t	kA²s	140	
• Conductor cross-section 10 mm²	$I_{d,max}$	kA	< 15	3RV1031-4HA10
	I^2t	kA²s	180	
• Conductor cross-section 16/25 mm²	$I_{d,max}$	kA	< 19	3RV1041-4JA10
	I^2t	kA²s	440	
Short-circuit protection for terminal block				Recommendation for upstream short-circuit protection device
• Conductor cross-section 1.5 mm²	$I_{d,max}$	kA	7.5	5SY... [1]
• Conductor cross-section 2.5 mm²	$I_{d,max}$	kA	9.5	
• Conductor cross-section 4 mm²	$I_{d,max}$	kA	9.5	
• Conductor cross-section 6 mm²	$I_{d,max}$	kA	12.5	

1) To prevent the possibility of short-circuits, the cables on the terminal block must be installed so that they are short-circuit resistant according to EN 60439-1 Section 7.5.5.1.2.

Type			3RV19.	
Connection type			**Spring-type connection**	
Conductor cross-sections of terminal block				
Order No.			**3RV19 17-5D**	
Conductor cross-sections				
• Solid		mm²	1.5 ... 6	
• Finely stranded with end sleeve		mm²	1.5 ... 4	
• Finely stranded without end sleeve		mm²	1.5 ... 6	
• AWG cables, solid or stranded		AWG	15 ... 10	

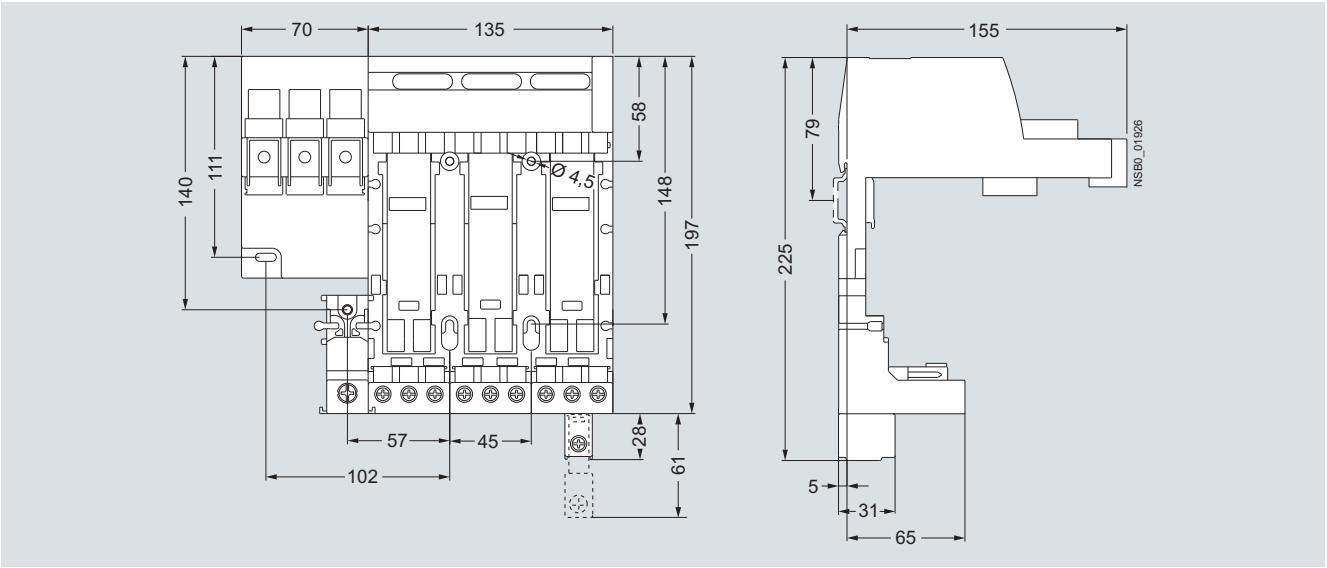
Infeed systems for 3RA6

Type			**3RA6.**		
Connection type			**Screw connection**		
Conductor cross-sections of infeed with screw connection 25/35 mm² (L1, L2, L3)[1] and PE infeed 25/35 mm²					
Order No.			**3RA68 12-8AB, 3RA68 12-8AC, 3RA68 60-6AB**		
Tools		Pozidriv	Size 2		
Specified tightening torque		NM	3 ... 4.5		
			 NSB00479	 NSB00480	 NSB00481
Conductor cross-sections					
• Solid		mm^2	2.6 ... 16	2.6 ... 16	max. 2 x 16
• Stranded		mm^2	2.5 ... 35	2.5 ... 35	max. 2 x 25
• Finely stranded with end sleeve		mm^2	2.5 ... 25	2.5 ... 25	max. 2 x 16
• Finely stranded without end sleeve		mm^2	2.5 ... 25	2.5 ... 25	max. 2 x 16
• AWG cables		AWG	12 ... 2	12 ... 2	max. 2 x (18 ... 2)
Connection type			**Screw connection**		
Conductor cross-sections of infeed with screw connection 50/70 mm² (L1, L2, L3)[1]					
Order No.			**3RA68 13-8AB, 3RA68 13-8AC**		
Tools		SW	4		
Specified tightening torque		NM	6 ... 8		
			 NSB00479	 NSR00480	 NSB00481
Conductor cross-sections					
• Solid		mm^2	2.5 ... 16	2.5 ... 16	max. 2 x 16
• Stranded		mm^2	4 ... 70	10 ... 70	max. 2 x 50
• Finely stranded with end sleeve		mm^2	2.5 ... 35	2.5 ... 50	max. 2 x 35
• Finely stranded without end sleeve		mm^2	4 ... 50	10 ... 50	max. 2 x 35
• AWG cables		AWG	10 ... 2/0	10 ... 2/0	max. 2 x (10 ... 1/0)
Connection type			**Spring-type connection**		
Conductor cross-sections of infeed with spring-type connection 25/35 mm² (L1, L2, L3)[1] and PE infeed 25/35 mm²					
Order No.			**3RA68 30-5AC, 3RA68 60-5AC**		
Tools	8WA2 806	mm	5.5 x 0.8		
Conductor cross-sections					
• Solid		mm^2	4 ... 16		
• Stranded		mm^2	4 ... 35		
• Finely stranded with end sleeve		mm^2	4 ... 25		
• Finely stranded without end sleeve		mm^2	6 ... 25		
• AWG cables		AWG	10 ... 3		
Connection type			**Screw connection**		**Spring-type connection**
Conductor cross-sections of infeed with screw connection 25/35 mm² (T1, T2, T3)[2], infeed with screw connection 50/70 mm² (T1, T2, T3)[2], 2-socket and 3-socket expansion modules (T1,T2,T3)[2] and PE pick-off 6/10 mm²					
Order No.			**3RA68 12-8AB, 3RA68 13-8AB, 3RA68 22-0AB, 3RA68 23-0AB, 3RA68 70-4AB**		**3RA68 12-8AC, 3RA68 13-8AC, 3RA68 22-0AC, 3RA68 23-0AC, 3RA68 70-3AC**
Tools			Pozidriv size 2		(3.5 x 0.5) mm, 8WA2 803
Specified tightening torque		NM	2 ... 2.5		--
Maximum rated current		A	**12**	**32**	**12**	**32**
Conductor cross-sections						
• Solid		mm^2	2 x (1 ... 2.5)	2 x (2.5 ... 6)	2 x (1.5 ... 6)	2 x (2.5 ... 6)
		mm^2	2 x (2.5 ... 6)			
		mm^2	max. 1 x 10	max. 1 x 10	max. 1 x 10	max. 1 x 10
• Finely stranded with end sleeve		mm^2	--	--	2 x (1.5 ... 6)	2 x (2.5 ... 6)
• Finely stranded without end sleeve		mm^2	2 x (1 ... 2.5)	2 x (2.5 ... 6)	2 x (1.5 ... 6)	2 x (2.5 ... 6)
		mm^2	2 x (2.5 ... 6)			
• AWG cables		AWG	2 x (16 ... 14)	2 x (14 ... 10)	2 x (16 ... 10)	2 x (14 ... 10)
		AWG	2 x (14 ... 10)			
		AWG	1 x 8	1 x 8	1 x 8	1 x 8

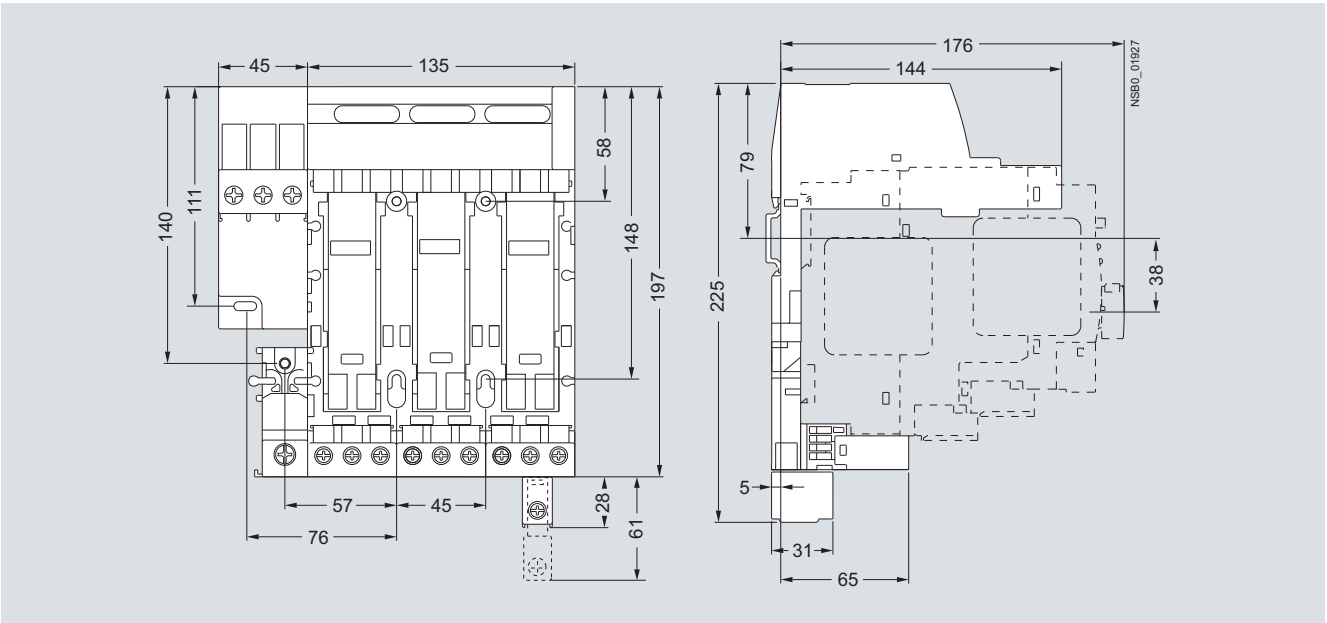
[1] L1, L2, L3 main conductors on input side.

[2] T1, T2, T3 main conductors on output side.

Dimensional drawings

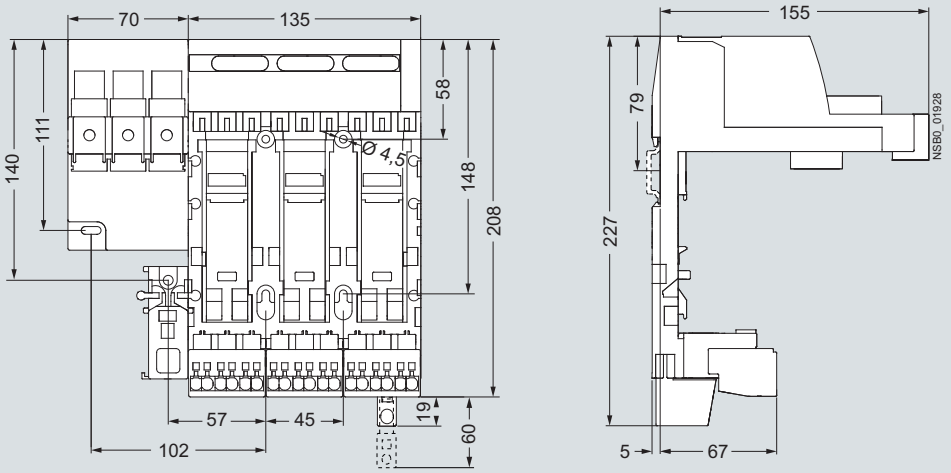


Infeed with screw connection 50/70 mm^2 on left with fixed 3-socket expansion module with outgoing screw terminals

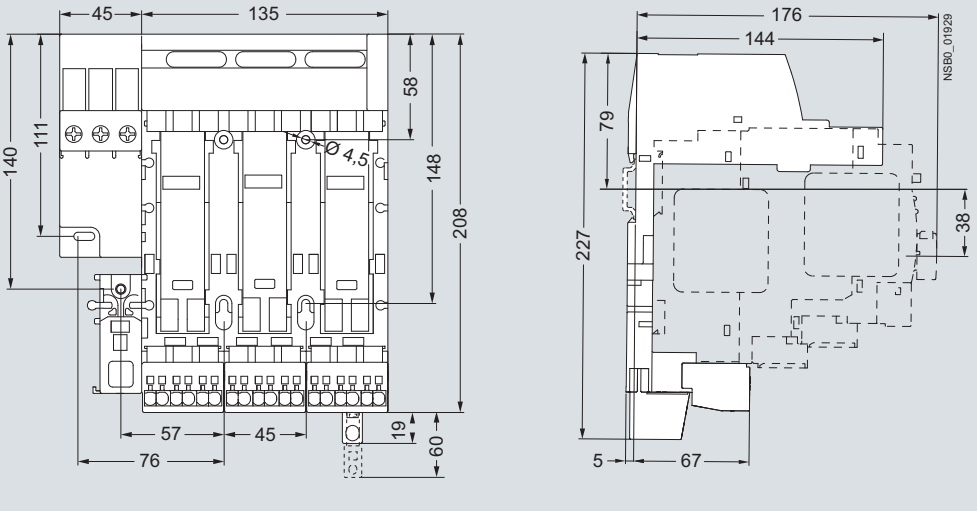


Infeed with screw connection 25/35 mm^2 on left with fixed 3-socket expansion module with outgoing screw terminals

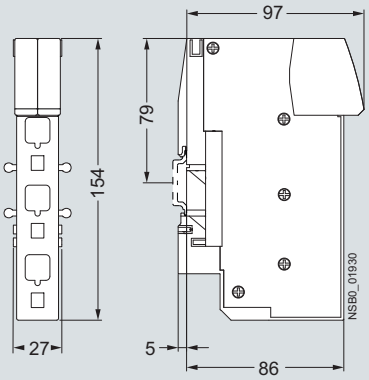
Infeed systems for 3RA6



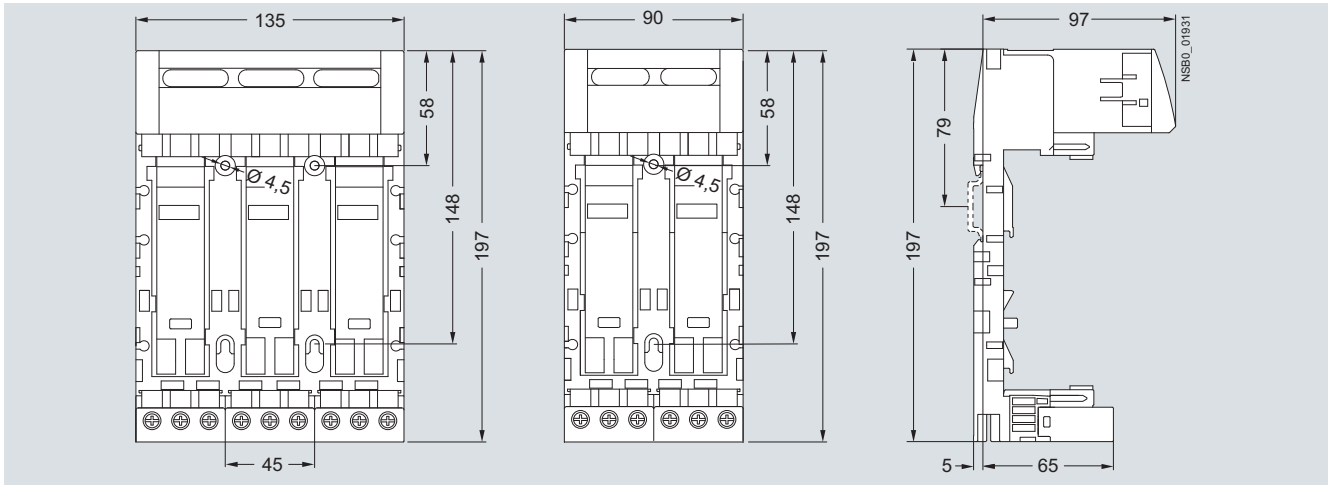
Infeed with screw connection 50/70 mm^2 on left with fixed 3-socket expansion module with outgoing spring-type terminals



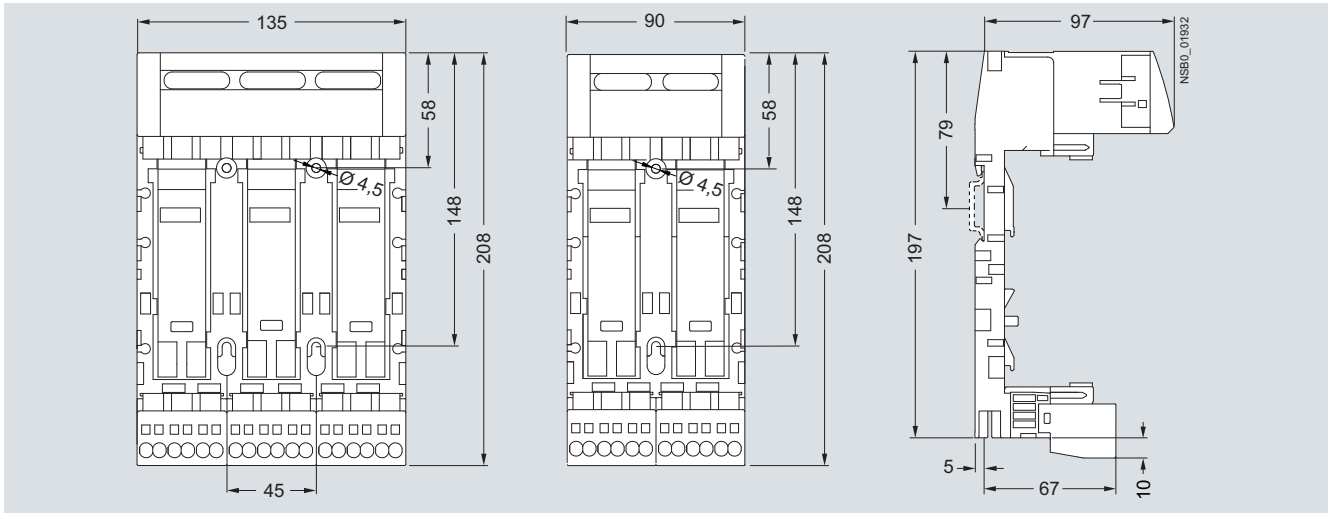
Infeed with screw connection 25/35 mm^2 on left with fixed 3-socket expansion module with outgoing spring-type terminals



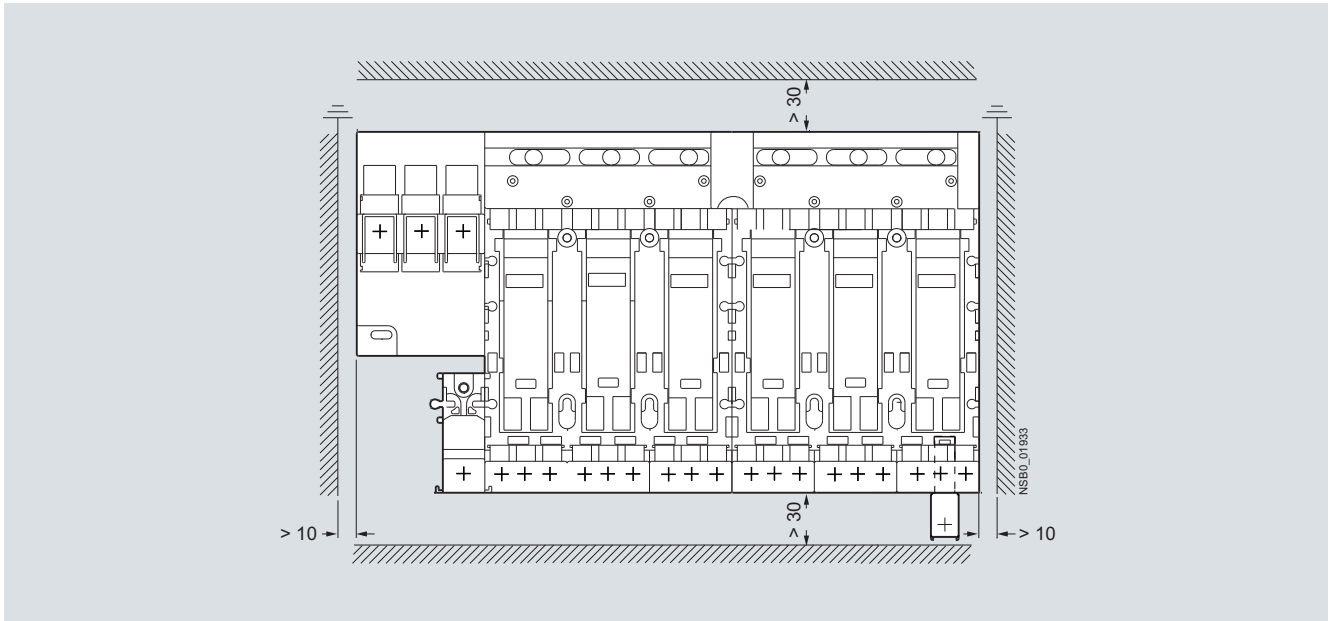
Infeed with spring-type terminals



3-socket expansion module and 2-socket expansion module with outgoing screw terminals



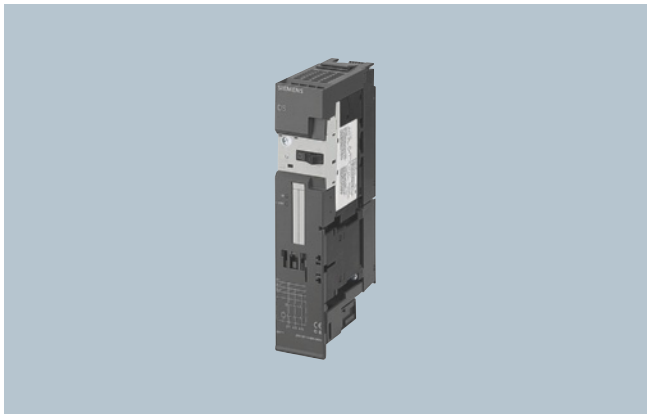
3-socket expansion module and 2-socket expansion module with outgoing spring-type terminals



Minimum clearances to adjacent components when using infeed system for 3RA6

ET 200S motor starters

Overview



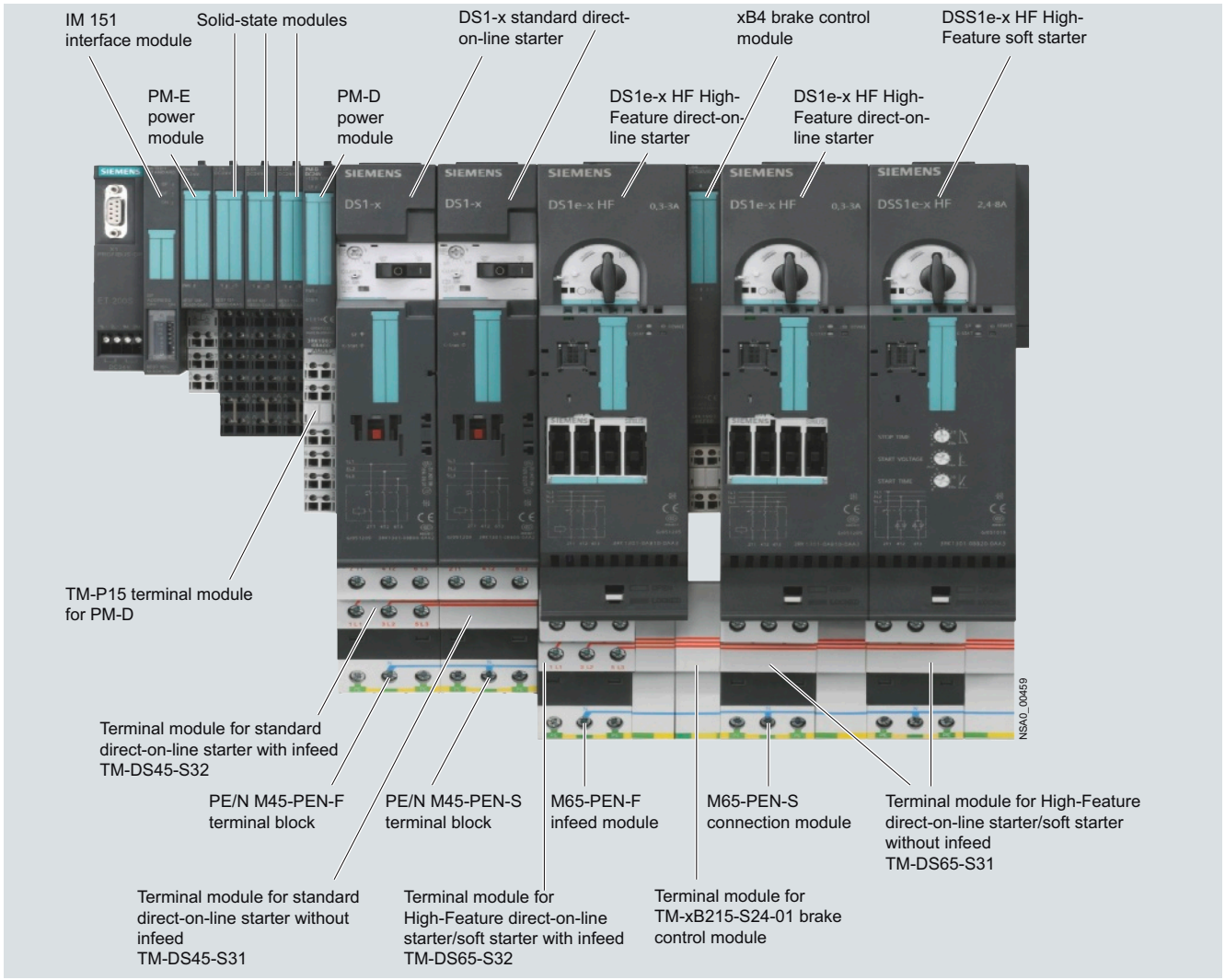
Motor starter, Standard, DS1-x direct-on-line starter

Motor starter, High-Feature, DS1e-x direct-on-line starter

- Completely factory-wired motor starters for switching and protecting any AC loads
- Can be used as a direct-on-line, reversing or soft starter
- Standard motor starter with motor starter protector and contactor assembly up to 5.5 kW
- High-feature motor starter with a combination comprising a starter protector, solid-state overload protection and contactor or soft starter up to 7.5 kW
- With self-assembling 40/50 A power bus, i. e. the load voltage is only supplied once for a group of motor starters
- Hot swapping is permissible
- Inputs and outputs for activating and signaling the statistics have been integrated
- Diagnostics capability for active monitoring of the switching and protection functions
- Can be combined with expansion modules: Brake control module for controlling electromechanical brakes in induction motors and with two optional inputs for special functions (for quick stop with the Standard motor starter and for parameterizable special functions with the High-Feature motor starter)
- For combining with safety technology (see ET 200S Solutions Local/PROFIsafe Safety Motor Starters, page 6/121 onwards) for use in safety-related system components (EN 954-1).

Motor Starter ES software

The Motor Starter ES software is used for the parameterization, monitoring, diagnostics and testing of motor starters.
See Catalog LV 1, Chapter 12 "Planning and Configuration with SIRIUS".



Interplay of ET 200S motor starter components

Design

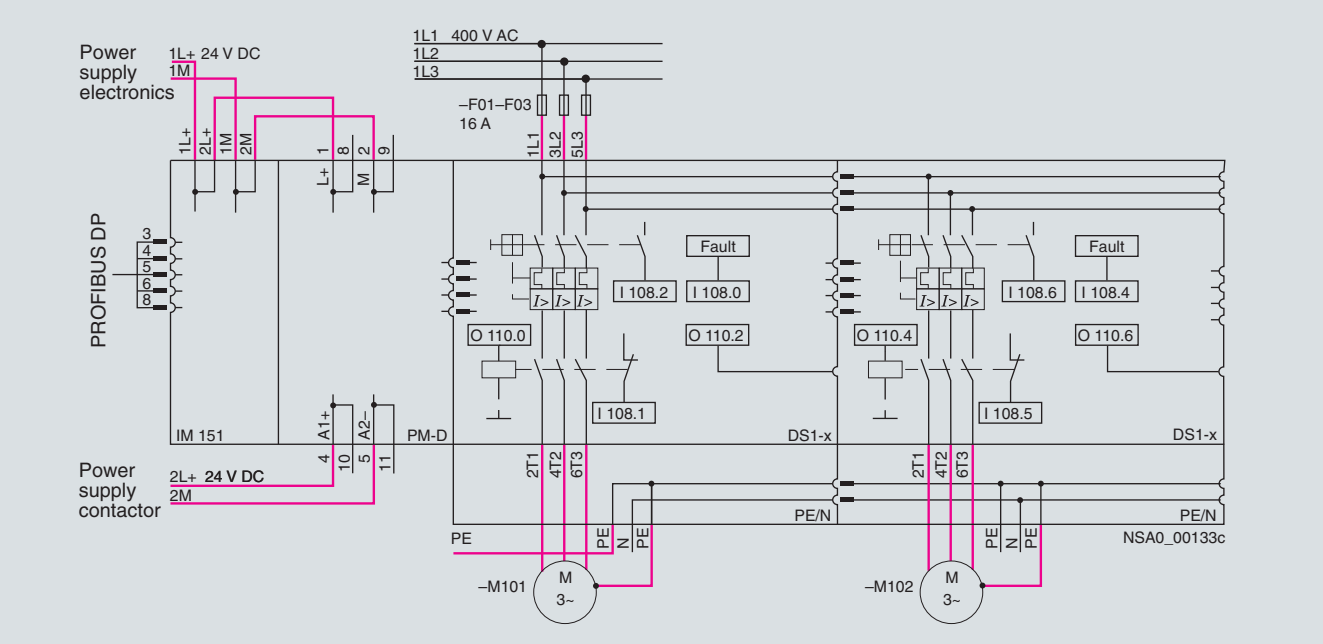
Power is supplied through the terminal modules for motor starters. While the auxiliary voltages must be fed in once through the PM-D or PM-DFx power module, which is to be plugged in on the left side of the first motor starter, the load voltage must be fed in at the first TM-xxxxS32 terminal module (on the left) of a motor starter. The other TM-xxxxS31 terminal modules are automatically supplied as well through the integrated power bus when they are mounted side by side.

If the power bus is utilized to its full capacity of 40 A (Standard motor starters) or 50 A (High-Feature motor starters), a new supply is fed in through an additional TM-xxxxS32 terminal module. This also applies when transferring from a Standard motor starter to a High-Feature motor starter and vice versa. In this case, however, no PM-D power module must be placed in between.

Note:
Soft starters as well as frequency converters are both suitable for taking special care of mechanical systems. Soft starters are often used for loads with a square curve (pumps, compressors, fans).
Frequency converters are often used for varying loads and when constant starting times are required (conveying systems).

It should be noted that during starting with soft starters the torque is reduced by approx. 20 % (compared to operation with direct-on-line starters/frequency converters). The motor must be dimensioned accordingly. Soft starters can be used typically with switching frequencies of up to 20 operations/h.

ET 200S motor starters



Sample illustration of an ET 200S station with PM-D power module and two standard motor starters

Accessories for motor starters, Standard

Control unit

With the control unit the contactor coils of the Standard motor starter can be directly controlled using 24 V DC. The motor starter can thus be started as normal using a local control point without PLC or bus.

Note:
The control unit cannot be used in combination with the safety technology or a brake control module.

Control kit

The control kit for the standard motor starter provides the possibility of testing the motor during start-up or service by actuating the motor starter protector. Using the control kit with the motor starter protector tripped, the contactor is mechanically locked in ON position.

Accessories for High-Feature motor starters

2DI 24 V DC COM control module

The 2DI 24 V DC COM control module is plugged onto the interface on the front of the motor starter. The module provides two inputs which can receive signals from the process and be assigned directly to the starter.

The functionality can be selected from a list of various control functions as part of the PROFIBUS parameterization. Local control point, emergency start and quick stop, for example, are available as functions. The signal levels can also be parameterized (NO/NC). For more extensive control functions the two inputs of a xB3 or x4 brake control module, which is plugged in alongside on the right, can be integrated in addition. The signal states of all inputs are transmitted in parallel with the internal use to the higher-level control system.

When a motor starter is replaced, the parameterization is automatically transmitted by download to the new starter. The inputs on the motor starter ensure autonomous operation, e. g. in the event of PLC failure, on the one hand and short response times through direct processing in the starter on the other hand. Another advantage results from the direct assignment of functions to modular machine concepts.

The 2DI 24 V DC COM control module has in addition a PC interface for connecting the Switch ES Motor Starter parameterization and diagnostics software (Version 2.0 and higher). The module works solely on High-Feature motor starters with ES Motor Starter interface. The Logo!-PC cable is used as connecting cable between the 2DI 24 V DC COM control module and the High-Feature motor starter.

DM-V15

- Significant only in conjunction with a Standard motor starter
- Passive module without bus connection and terminals
- Does not need a separate terminal module
- Follows a TM-DS45 or TM-RS90 or TM-xB if required
- Does not need to be taken into account when configuring the GSD file

Function

All ET 200S motor starters are set up without fuses. Contactors and soft starters are activated through the integrated outputs. If a brake control module is arranged next to a motor starter, its solid-state brake switch is operated by an output of the motor starter. This module must always be arranged next to the motor starter on the right-hand side. The inputs of the motor starters evaluate the signal states of the protective devices (short-circuit or overload), the switching states of contactor(s) or soft starters, and system faults.

The motor starter protector signaling is freely programmable with regard to group fault signals (group fault at motor starter protector "Off"/group fault signal at motor starter protector "Off" only in case of "On" command from the motor starter).

Technical specifications

		Motor starters Standard DS1-x, RS1-x	Motor starters High-Feature DS1e-x, RS1e-x	Motor starters High-Feature DSS1e-x
Motor starters for connection to ET 200S, max.[1)]		42	17	17
Mounting dimensions (W x H x D)				
• Direct-on-line starter	mm	45 x (265 + 45) x (120 + 27); (45: PE/N module; 27: Aux. switch contactor from F-Kit)	65 x (290 + 45) x (150 + 23); (45: PE/N module; 23: Control module)	
• Reversing starters	mm	90 x (265 + 45) x (120 + 27); (45: PE/N module; 27: Aux. switch contactor from F-Kit)	130 x (290 + 45) x (150 + 23); (45: PE/N module; 23: Control module)	
Permissible ambient temperature				
• During operation	°C	0 ... +60, from +40 with derating	0 ... +60 With horizontal mounting up to +40	
• During storage	°C	-40 ... +70	-40 ... +70	
• Permissible mounting position	°C	Vertical, horizontal With derating	Vertical, horizontal	
Vibration resistance acc. to IEC 60068, Part 2-6	g	2		
Shock resistance acc. to IEC 60068, Part 2-27	g/ms	Square 5/11		
Power consumption				
• From auxiliary circuit L+/M (U_1)	mA	Approx. 20	Approx. 40	Approx. 40
• From auxiliary circuit A1/A2 (U_2)	mA	Approx. 100	Approx. 1700 (80 ms long) Approx. 350 (after 80 ms)	Approx. 30
Rated operational current for TM-D terminal modules I_e	A	40	50	50
Rated operational voltage U_e	V	400		
Approval to EN 61140	V	Yes, up to 500	Yes, up to 500	Yes, up to 480
CSA approval and U_L	V	Yes, up to 600	Yes, up to 600	Yes, up to 480
Conductor cross-section				
• Solid	mm^2	2 x (1 ... 2.5)[2)]; 2 x (2.5 ... 6)[2)], acc. to IEC 60947: max. 1 x 10		
• Finely stranded with end sleeve	mm^2	2 x (1 ... 2.5)[2)]; 2 x (2.5 ... 6)[2)]		
• AWG cables, solid or stranded	AWG	2 x (14 ...10)		
Degree of protection		IP20		
Touch protection		Finger-safe (this also applies to terminal modules on a dismounted motor starter)		
Degree of pollution				
• At 400 V		3, IEC 60664 (IEC 61131)		
• At 500 V		2, IEC 60664 (IEC 61131)		
Rated impulse withstand voltage U_{imp}	kV	6		
Rated insulation voltage U_i	V	500		
Rated operational current I_e for motor starters				
• AC-1/2/3 at 60 °C				
- At 400 V	A	12	16	3 / 8 / 16
- At 500 V	A	9	11	--
• AC-4 at 60 °C				
- At 400 V	A	4.1	9	--
Rated short-circuit breaking capacity	kA	50 at 400 V		
Power of induction motors at 500 V	kW	5.5	7.5	
Utilization categories		AC-1, AC-2, AC-3, AC-4		
Protective separation between main and auxiliary circuits	V	400, acc. to EN 61140		
Positively-driven operation of contactor relay (NC)		Yes	Yes	--
Trip class		Class 10	Class 10/20, can be parameterized	0.3 ... 3 A: Class 10/10A, can be parameterized 2.4 ... 8 A: Class 10A 2.4 ... 16 A: Class 10A
Stall protection		No	Yes, 8 x I_e / 1 s	
Motor starter protector signaling		Yes	Parameterizable: always / only in case of "On" commands	
Overload warning		No, only tripping	Yes	
Emergency start function		No	Yes	
Type of coordination		Up to 1.6 A: 2 Up to 12 A: 1	Up to 16 A: 2	Up to 16 A: 1
Mechanical endurance				
• Motor starter protector	Oper-	100 000		
• Contactors	ating	30 million	10 million	--
• Contactor with safety functionality (F-Kit)	cycles	10 million	--	--

1) Additional limits: process image, max. design width 2 m.

2) If two different conductor cross-sections are connected to one clamping point, both cross-sections must lie in the range specified. If identical cross-sections are used, this restriction does not apply.

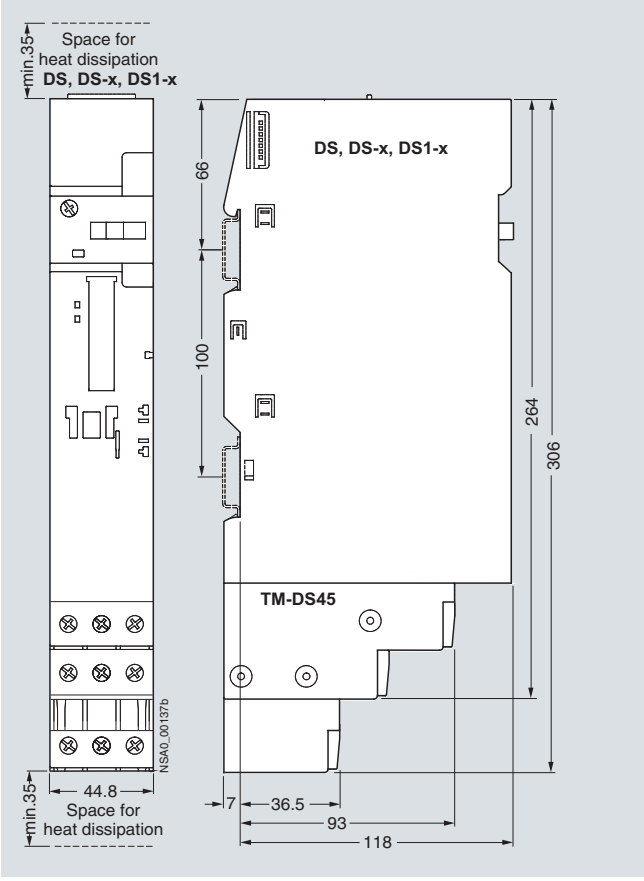
ET 200S motor starters

		Motor starters Standard DS1-x, RS1-x	Motor starters High-Feature DS1e-x, RS1e-x	Motor starters High-Feature DSS1e-x
Electrical endurance				
• Motor starter protector	h	100 000		
• Contactors		See manual	See manual	--
Permissible switching frequency with a starting time t_A = 0.1 s and a relative ON period t_{OP} = 50 %	1/h	< 80	See manual	
Induction protection		Already installed		
Operating times (Total break time = Opening delay + Arcing time)				
• Operating times at 0.85 ... 1.1 x U_e				
- Closing time	ms	25 ... 100	25 ... 100	--
- Opening time	ms	7 ... 10	20 ... 50	--
• Operating times at 1.0 x U_e				
- Closing time	ms	30 ... 50	Typ. 25	--
- Opening time	ms	7 ... 9	Typ. 20	--
Arcing time	ms	10 ... 15	10 ... 15	--
Number of outputs		4	16	16
Number of inputs		4	16	16
Address area required per module				
• With summary	bit	4	--	--
• Without summary	byte	1	2	2
Diagnostics functions				
• Group fault "SF"		Red LED		
• Switching state "C-STAT"		Red/green/yellow LED		
• Device state "DEVICE"		--	Red/green/yellow LED	
Configurable through PROFIBUS DP		Yes		
Auxiliary switch for enabling circuit of the ET 200S safety technology already integrated (up to max. category 4 EN 954-1)		No, F-Kit required	Yes	No (max. Category 1 attainable)
Setting options for soft starters (locally on the device)				
• Starting time	s	--	--	0 ... 20
• Starting voltage	%	--	--	30 ... 100 of U_e
• Ramp-down time	s	--	--	0 ... 20
Input/output bit				
• DO 0		Motor on (clockwise)		
• DO 1		Motor on (counterclockwise)		
• DO 2		Control of brake (1 = tripped, motor without being braked)		
• DO 3		Reserved	Remote reset (e. g. in case of overload)	
• DO 4		Reserved	Emergency start	
• DO 5-8		Reserved		
• DI 0		Ready		
• DI 1		Motor on (feedback from contactor)	Motor on (feedback current is flowing)	
• DI 2		Motor starter protector tripped	Actuator shutdown (short-circuit, overload)/Device fault	
• DI 3		Reserved	Overload group warning	
• DI 4		Reserved	Input 1 (from brake control module)	
• DI 5		Reserved	Input 2 (from brake control module)	
• DI 6		Reserved	Input 3 (from brake control module 2DI)	
• DI 7		Reserved	Input 4 (from brake control module 2DI)	
• DI 8 ... DI 13		n/a	Motor current I_{actual}	
• DI 14		n/a	Reserved	
• DI 15		n/a	--	Ramp mode
Fault type (PROFIBUS diagnostics)				
• 00001: Short-circuit		--	Starter motor starter protector has tripped	
• 00100: Overload		--	Thermal motor model overload	
• 00111: Upper limit overshot		--	I_e limit value overshoot	
• 01000: Lower limit value undershot		--	I_e limit value undershoot	
• 01001: Fault		Internal fault/Device fault/Fault during self-test		
• 10000: Parameterizing fault		--	Wrong parameter value	
• 11000: Actuator shutdown		All designated faults/Unbalance/motor blocking (possibly with an additional fault entry describing the fault in more detail)		
• 11010: External fault		--	Input disconnection/Input disconnection limit/ Process image fault	

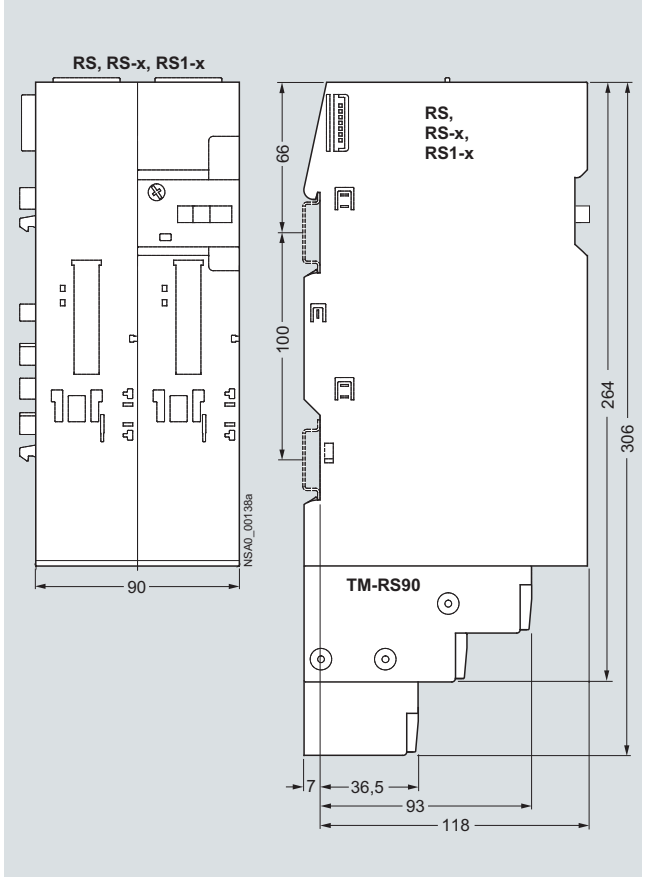
Accessories

		Brake control module XB1	Brake control module XB3	Brake control module XB2	Brake control module XB4
Dimensions (W x H x D)	mm	15 x 196.5 x 125.5 including terminal module on 7.5 mm standard mounting rail			
Number of assigned outputs for the (left-hand) motor starter		1			
Rated operational voltage	V	24 DC		500 DC (min. 100)	
Power supply		Externally through terminal module		From brake rectifier through terminal module	
Rated operational current	A	4		0.7	
Reverse polarity protection		No, in the event of polarity reversal the brake is released and the overload/short-circuit protection is not effective			
Overload/short-circuit protection		Yes, solid-state			
Conductor cross-section of the terminal module for the brake control module	mm^2	1 x 2.5 without end sleeve 1 x 1.5 with end sleeve			
Number of outputs		0	1 (used internally)	0	1 (used internally)
Number of inputs		0	2	0	2
Address area required per module					
• With summary		0	2 bits	0	2 bits
• Without summary		0	1 byte	0	1 byte
Diagnostics functions					
• Group fault "SF"		Red LED			
• Switching state for brake "STAT"		Yellow LED			
• Inputs 1 and 5		--	Green LED	--	Green LED
Parameters (default values underlined)					
• Brake overload diagnostics		--	Disable/Enable	--	Disable/Enable
• Input delay	ms	--	0/0.1/0.5/3/15	--	0/0.1/0.5/3/15
Module width	mm	15			

Dimensional drawings

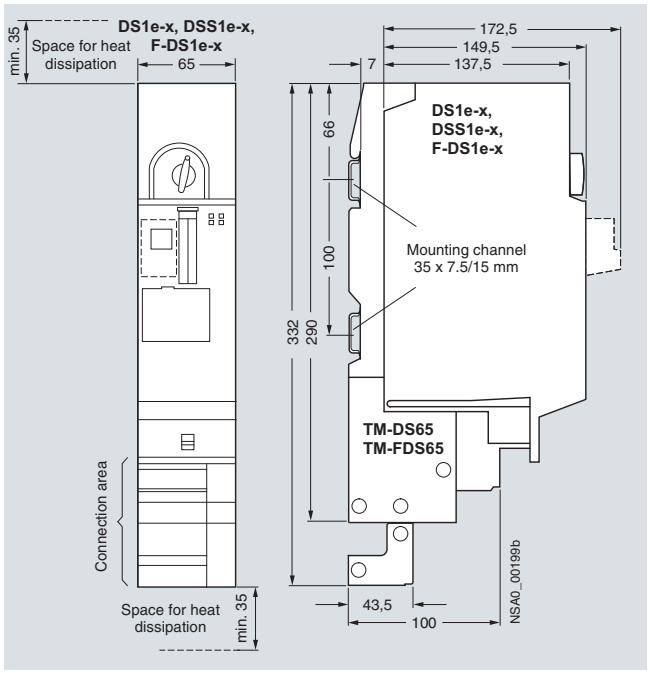


DS1-x direct-on-line starter with TM-DS 45 terminal module

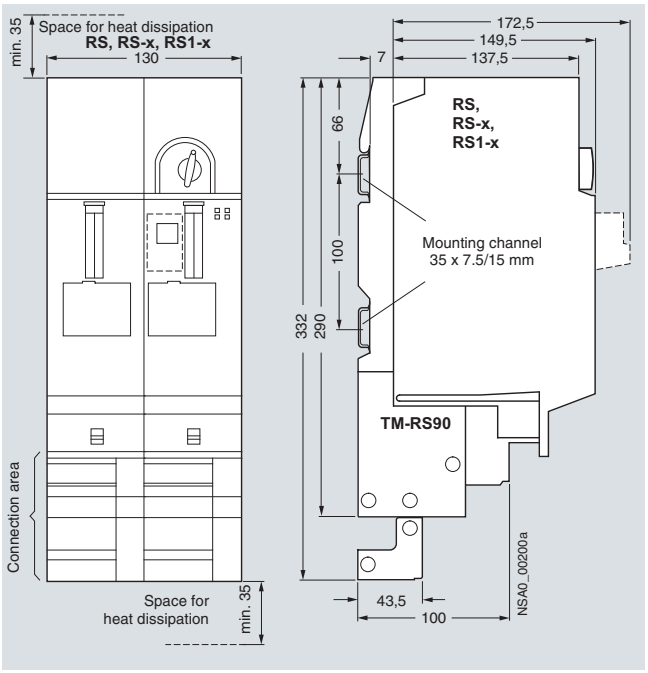


RS1-x reversing starter with TM-RS 90 terminal module

ET 200S motor starters

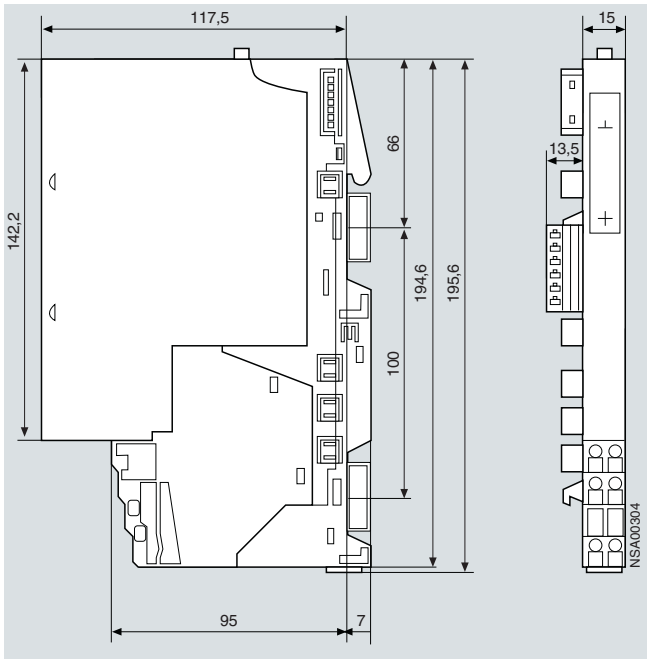


DS1e-x direct-on-line starter, DSS1e-x soft starter and TM-DS65 terminal module



RS1e-x reversing starters and TM-RS130 terminal module

Accessories



xB1 ... 4 brake control module with TM-xB215 terminal module

Power modules for ET 200S motor starters

Overview

- For supplying and monitoring the auxiliary voltages for motor starters
- Disconnection of a complete group of motor starters is possible without any additional outlay (safety category 1 according to EN 954-1)
- For plugging onto TM-P15 terminal module
- For supplying and monitoring the power supply for the ET 200S FC frequency converter

Design

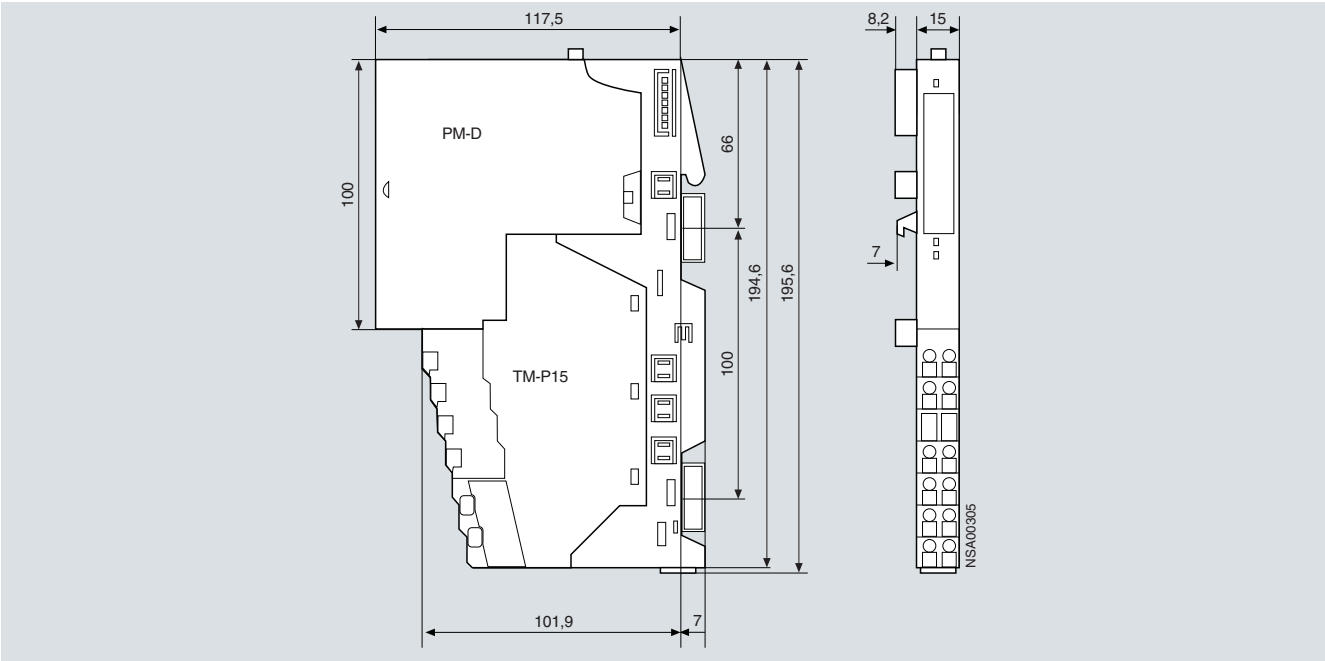
PM-D power modules are plugged onto the TM-P15 terminal modules.

A PM-D power module must be followed by at least one motor starter or one frequency converter.

Technical specifications

		PM-D power module 3RK1 903-0BA00
Rated control supply voltage U_s Up to 60 °C	V	20.4 ... 28
Rated operational current I_e		
• Recommended short-circuit protection	A	10
• Melting fuse	A	10
• Miniature circuit breaker	A	10, Tripping characteristic B
Power consumption from the backplane bus	mA	≤ 10
Supplying		
• Motor starters		Yes
• Frequency converters		Yes
• Motor starters for safety technology		No
• Solid-state modules		No
• Ex(i) modules		No
Alarms		None
Diagnostics functions		Yes
• System fault/device fault		Red "SF" LED
• Monitoring the supply voltage for solid-state modules U_1		Green "PWR" LED
• Monitoring the supply voltage for contactors U_2		Green "CON" LED
• Diagnostics information can be read out		Yes
Conductor cross-sections		
• Flexible with end sleeve	mm^2	1.5
• Rigid	mm^2	2.5
Mounting dimensions (W x H x D)	mm	15 x 195.5 x 117.5

Dimensional drawings



PM-D power module and TM-P15 terminal module

Terminal modules for ET 200S motor starters

Overview

Terminal modules for motor starters

- Mechanical modules in which the motor starter and expansion modules are inserted
- For constructing the permanent wiring and self-assembling voltage bus
- For connecting the motor connection cables
- Positive-locking connection to ensure enhanced vibration resistance

Terminal modules for frequency converters

- Mechanical modules in which the components of the frequency converter are inserted
- For constructing the permanent wiring and self-assembling voltage bus
- For connecting the motor cables
- Integrated shield attachments for receiving the busbar 3 x 10 mm

Terminal module for power module

- Connection by means of screw terminals
- Light colored enclosure for visual distinction
- Always before the first TM-DS/TM-RS

Design

TM-DS, TM-RS

- "–S32" version with supply terminals: 2 x 3 x 10 mm^2 screw terminals for power bus and motor feeder
- "–S31" version without supply terminals: 1 x 3 x 10 mm^2 screw terminals for motor feeder
- Optionally expandable with PE/N modules (see Accessories)
- Applies only to Standard motor starters: For applications with high motor currents (> 6.3 A) or high ambient temperatures (> 40 °C) it is recommended to use the DM-V15 distance module (See Accessories) between two DS1-x motor starters

TM-ICU

- For ICU24/ICU24F control modules of the frequency converter

TM-IPM

- "TM-IPM65" version for IPM25 power section of the frequency converter with 0.75 kW
- "TM-IPM130" version for IPM25 power section of the frequency converter with 2.2 or 4.0 kW
- "–S32" version with supply terminals: 2 x 3 x 10 mm^2 screw terminals for power bus and motor feeder
- "–S31" version without supply terminals: 1 x 3 x 10 mm^2 screw terminals for motor feeder
- All TM-IPM units have an integrated shield attachment
- Optionally expandable with PE/N modules (see Accessories)

TM-xB

- Can be combined with Standard motor starters as well as High-Feature motor starters and frequency converters
- Connection by means of screw terminals
- Always next to the TM-DS/TM-RS on the right-hand side

Terminal module for power module

For supplying load and sensor voltage to the self-assembling potential bars of the Standard motor starters, High-Feature motor starters and frequency converters. Power modules for voltage monitoring are plugged onto TM-P modules. TM-P modules can be used any number of times within the ET 200S. A power module must always be plugged upstream from the first motor starter/frequency converter.

Technical specifications

TM-P15 S27-01 terminal module

Dimensions		
• Mounting dimensions (W x H x D)	mm	15 x 196.5 x 102
• Depth with power module	mm	117.5
Rated voltages and rated currents		
• Rated insulation voltage	V	500
• Rated operational voltage	V	24 DC
• Rated operational current	A	10
Conductor cross-sections		
• Solid	mm^2	1 x (0.14 ... 2.5), acc. to IEC 60947 1 x 2.5
• Finely stranded with end sleeve	mm^2	1 x (0.14 ... 1.5), acc. to IEC 60947
• AWG cables, solid or stranded	AWG	1 x (18 ... 22)
Wiring		
• Required tool		Standard screwdriver size 1
• Tightening torque	NM	0.4 ... 0.7

TM-DS45 and TM-DS65/TM-FDS65 terminal module

		TM-DS45	TM-DS65/TM-FDS65
Dimensions			
• Mounting dimensions (W x H x D)	mm	45 x 264 x 100	65 x 290 x 100
• Height with PE/N terminal block	mm	306	332
• Depth with motor starter	mm	127	150
• Depth with motor starter and F-Kit (safety technology)	mm	152	--
• Depth with motor starter and 2DI control module	mm	--	173
Rated voltages, currents and frequencies for the power bus			
• Rated insulation voltage U_i	V	690	
• Rated operational voltage U_e	V	500 AC	
• Rated impulse withstand voltage U_{imp}	kV	6	
• Rated operational current I_e	A	40	50
• Rated frequency	Hz	50/60	
Conductor cross-sections			
• Solid	mm^2	2 x (1 ... 2.5)[1] or 2 x (2.5 ... 6)[1]	
• Finely stranded with end sleeve	mm^2	1 x 10 or 2 x (1 ... 2.5)[1] or 2 x (2.5 ... 6)[1] acc. to IEC 60947	
• AWG cables, solid or stranded	AWG	2 x (14 ... 10)	
• With additional 3-phase feeder terminal if required			
- Solid or stranded	mm^2	1 x 2.5 ... 25	
- Finely stranded with end sleeve	mm^2	1 x 2.5 ... 25	
- AWG cables, solid or stranded	AWG	1 x 12 ... 4	
Wiring			
• Required tool		Standard screwdriver size 2 and Pozidriv 2	
• Tightening torque	NM	2.0 ... 2.5	

[1] If two different conductor cross-sections are connected to one clamping point, both cross-sections must lie in the range specified. If identical cross-sections are used, this restriction does not apply.

Terminal modules for ET 200S motor starters

TM-RS90 and TM-RS130/TM-FRS130 terminal module

		TM-RS90	TM-RS130/TM-FRS130
Dimensions			
• Mounting dimensions (W x H x D)	mm	90 x 264 x 100	130 x 290 x 100
• Height with PE/N	mm	306	332
• Depth with motor starter	mm	127	150
• Depth with motor starter and F-Kit (safety technology)	mm	152	--
• Depth with motor starter and 2DI control module	mm	--	173
Rated voltages, currents and frequencies for the power bus			
• Rated insulation voltage U_i	V	690	
• Rated operational voltage U_e	V	500 AC	
• Rated impulse withstand voltage U_{imp}	kV	6	
• Rated operational current I_e	A	40	50
• Rated frequency	Hz	50/60	
Conductor cross-sections			
• Solid	mm^2	2 x (1 ... 2.5)[1] or 2 x (2.5 ... 6)[1]	
• Finely stranded with end sleeve	mm^2	1 x 10 or 2 x (1 ... 2.5)[1] or 2 x (2.5 ... 6)[1] Acc. to IEC 60947	
• AWG cables, solid or stranded	AWG	2 x (14 ... 10)	
• With additional 3-phase feeder terminal if required			
- Solid or stranded	mm^2	1 x 2.5 ... 25	
- Finely stranded with end sleeve	mm^2	1 x 2.5 ... 25	
- AWG cables, solid or stranded	AWG	1 x 12 ... 4	
Wiring			
• Required tool		Standard screwdriver size 2 and Pozidriv 2	
• Tightening torque	NM	2.0 ... 2.5	

[1] If two different conductor cross-sections are connected to one clamping point, both cross-sections must lie in the range specified. If identical cross-sections are used, this restriction does not apply.

TM-ICU15 terminal module

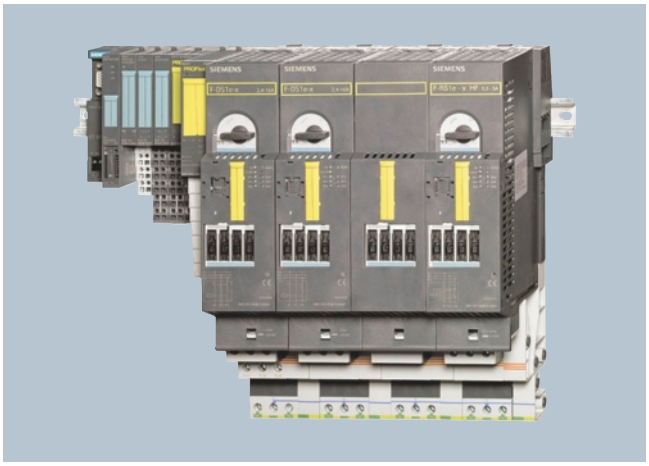
Dimensions		
• Mounting dimensions (W x H x D)	mm	15 x 195 x 52 (depth with control module 154)
Rated voltages and currents		
• Rated insulation voltage U_i	V	500 AC
• Rated operational voltage U_e	V	24 DC
• Rated operational current I_e	A	10

TM-IPM65 and TM-IPM130 terminal module

		TM-IPM65 terminal module	TM-IPM130 terminal module
Dimensions			
• Mounting dimensions (W x H x D)	mm	65 x 290 x 100	130 x 290 x 100
• Height with PE/N terminal block	mm	332	
• Depth with frequency converter power section	mm	150	
Rated voltages, currents and frequencies for the power bus			
• Rated insulation voltage U_i	V	690	
• Rated operational voltage U_e	V	500 AC	
• Rated impulse withstand voltage U_{imp}	kV	6	
• Rated operational current I_e	A	50	
• Rated frequency	Hz	50/60	
Conductor cross-sections			
• Solid	mm^2	2 x (1 ... 2.5) or 2 x (2.5 ... 6)	
• Finely stranded with end sleeve	mm^2	1 x 10 or 2 x (1 ... 2.5)[1] or 2 x (2.5 ... 6)[1] Acc. to IEC 60947	
• AWG cables, solid or stranded	AWG	2 x (14 ... 10)	
• With additional 3-phase feeder terminal if required			
- Solid or stranded	mm^2	1 x 2.5 ... 25	
- Finely stranded with end sleeve	mm^2	1 x 2.5 ... 25	
- AWG cables, solid or stranded	AWG	1 x 12 ... 4	
Wiring			
• Required tool		Standard screwdriver size 2 and Pozidriv 2	
• Tightening torque	NM	2.0 ... 2.5	

[1] If two different conductor cross-sections are connected to one clamping point, both cross-sections must lie in the range specified. If identical cross-sections are used, this restriction does not apply.

Overview



The ET 200S Safety motor starters Solutions comprise:

- Safety modules
- Standard motor starters
- High-Feature motor starters
- Failsafe motor starters

With the ET 200S Safety motor starters Solutions there is no complicated and hence cost-intensive configuring and wiring outlay compared to the conventional safety technology. The ET 200S Safety motor starter Solutions are designed for Category 4 according to EN 954-1 or SIL 3 to IEC 61508.

They enable the use of safety-oriented direct-on-line starters or reversing starters in the SIMATIC ET 200S distributed peripherals system on PROFINET or PROFIBUS. The fine modular architecture of the system permits optimum imaging of machine or plant applications.

Within an ET 200S station the Safety motor starters Solutions can also be combined with Standard motor starters or High-Feature motor starters without safety functions or the SIMATIC ET 200S FC frequency converter up to max. 4 kW up to Category 3 according to EN 954-1 or SIL 2 according to IEC 61508.

Standard and High-Feature ET 200S motor starters can be found on page 6/110 onwards.

The "SIMATIC ET 200 Configurator" software can be found in Catalog CA 01 on CD or DVD. You can also download the "SIMATIC ET 200 Configurator" software from the Internet:

http://www.siemens.com/sirius-starting

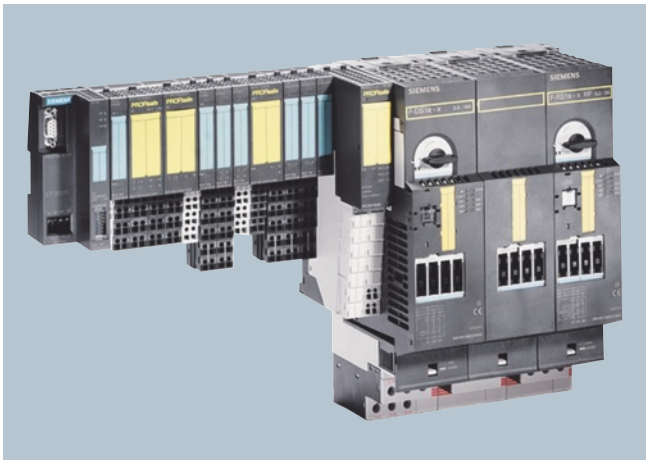
http://www.siemens.com/ET200S

Motor Starter ES software

The Motor Starter ES software is used the for parameterization, monitoring, diagnostics and testing of motor starters.
See Catalog LV 1, Chapter 12 "Planning and Configuration with SIRIUS".

ET 200S Failsafe motor starters

Overview



The Failsafe motor starter has been developed on the basis of the High-Feature motor starter. It differs in that, in addition to a motor starter protector and contactor assembly, a safe solid-state evaluation circuit is installed for error detection purposes which makes the motor starter failsafe.

If the contactor to be switched fails in an EMERGENCY-STOP case, the evaluation electronics detects a fault and opens the motor starter protector in the motor starter through a shunt trip unit in a failsafe manner. The second redundant shutdown component is therefore no longer a main contactor, as is generally the case, but the motor starter protector installed in the motor.

All functions of the High-Feature starter are already integrated

The new failsafe motor starters are characterized by easy, space-saving assembly as well as minimal wiring outlay. Like the High-Feature starters, the Failsafe motor starters have a switching capacity of up to 7.5 kW (16 A) which is achieved with just two motor starter versions. Another important feature is the high availability due to the high short-circuit strength (type of coordination "2").

Design

High degree of flexibility with safety technology

Solution PROFIsafe

In EMERGENCY-STOP applications, the Failsafe motor starters are selectively switched off through the upstream PM-D F PROFIsafe safety module. For each safety module, six switch-off groups can be formed. In the first delivery stage, the failsafe freely-programmable logic of the SIMATIC controller is used to interface with the relevant Failsafe sensor technology. The interface between PROFIsafe and installations that use conventional safety technologies is implemented through the F-CM Failsafe contact multiplier with four floating contacts.

Solution local

Failsafe motor starter with safety relay (Version 1) or ASIsafe (Version 2, see example 2, page 6/125):
Signals with relevance for safety can be input to ET 200S through a PM-D F X1 infeed terminal module through the enabling circuits of the AS-i Safety Monitor or the safety relay to control the Failsafe motor starters which then selectively switch off the downstream motors.

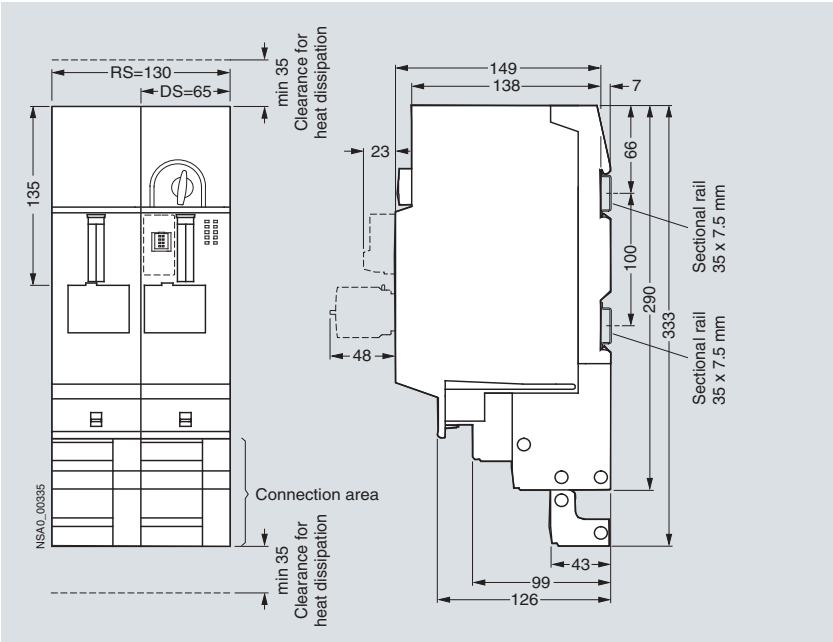
Technical specifications

F-DS1e-x direct-on-line starters/
F-RS1e-x reversing starters

			Direct-on-line starters	Reversing starters
Dimensions				
Dimensions (W x H x D)		mm	65 x 290 x 150 (incl. terminal module)	130 x 290 x 150 (incl. terminal module)
Height with PE/N module		mm	332	
Depth with 2DI control module (not safe)		mm	173	
Module-specific specifications				
Type of coordination			Type 2 up to $I_e \leq 16$ A at 400 V	
Internal power supply			U1 (from PM-D F/PM-DF X1)	
Maximum achievable safety class				
• Acc. to IEC 61508			SIL 3	
• Acc. to EN 954-1			Category 4	
Safety characteristics				
Low demand	PFD_{AVG} (10a)			
• Test interval 3 months			3.5×10^{-5}	
• Test interval 6 months			8.0×10^{-5}	
High demand/continuous mode	PFH			
• Test interval 3 months		1/h	8.1×10^{-10}	
• Test interval 6 months		1/h	1.8×10^{-9}	
Proof-test interval		Years	10	
Voltages, currents, potentials				
Switching capacity			Up to 7.5 kW at 400 V AC in three setting ranges:	
		A	0.3 ... 3	
		A	2.4 ... 8	
		A	2.4 ... 16	
Status, alarms, diagnostics				
Status display			SF, DEVICE and C-STAT, SG1 ... SG6	
Diagnostics functions				
Group fault display			Red LED (SF)	
Diagnostics information can be read out			Available	

		Direct-on-line starters	Reversing starters
Control circuit			
Rated operational voltage for electronics U_1	V	24 DC (20.4 ... 28.8 DC)	24 (21.6 ... 26.4 DC)
Reverse polarity protection for electronics U_1		Yes	
Rated operational voltage for contactor U_2	V	24 DC (20.4 ... 28.8 V DC)	
Reverse polarity protection for contactor U_2		Yes	
Power consumption			
• From electronics supply U_1	mA	Approx. 40	Approx. 100
• From contactor supply U_2			
- Pickup	A	1.7 (for 80 ms)	--
- Hold	mA	Max. 350	--
• From SG1 up to 6			
- Pickup	mA	250 (for 200 ms)	
- Hold	mA	Max. 55	
• Test function of the shunt trip unit/starter protector (50 ms) from U_1	A	Approx. 1.5	
• From the backplane bus	mA	Approx. 20	
Main circuit			
Rated operational voltage U_e			
• Acc. to IEC 60947-1, EN 60947-1	V	500 AC	
• Protective separation between main and auxiliary circuits	V	400	
• UL, CSA	V	600 AC	
Rated insulation voltage U_i	V	500 AC	
Rated impulse withstand voltage U_{imp}	kV	6	
Rated frequency	Hz	50/60	

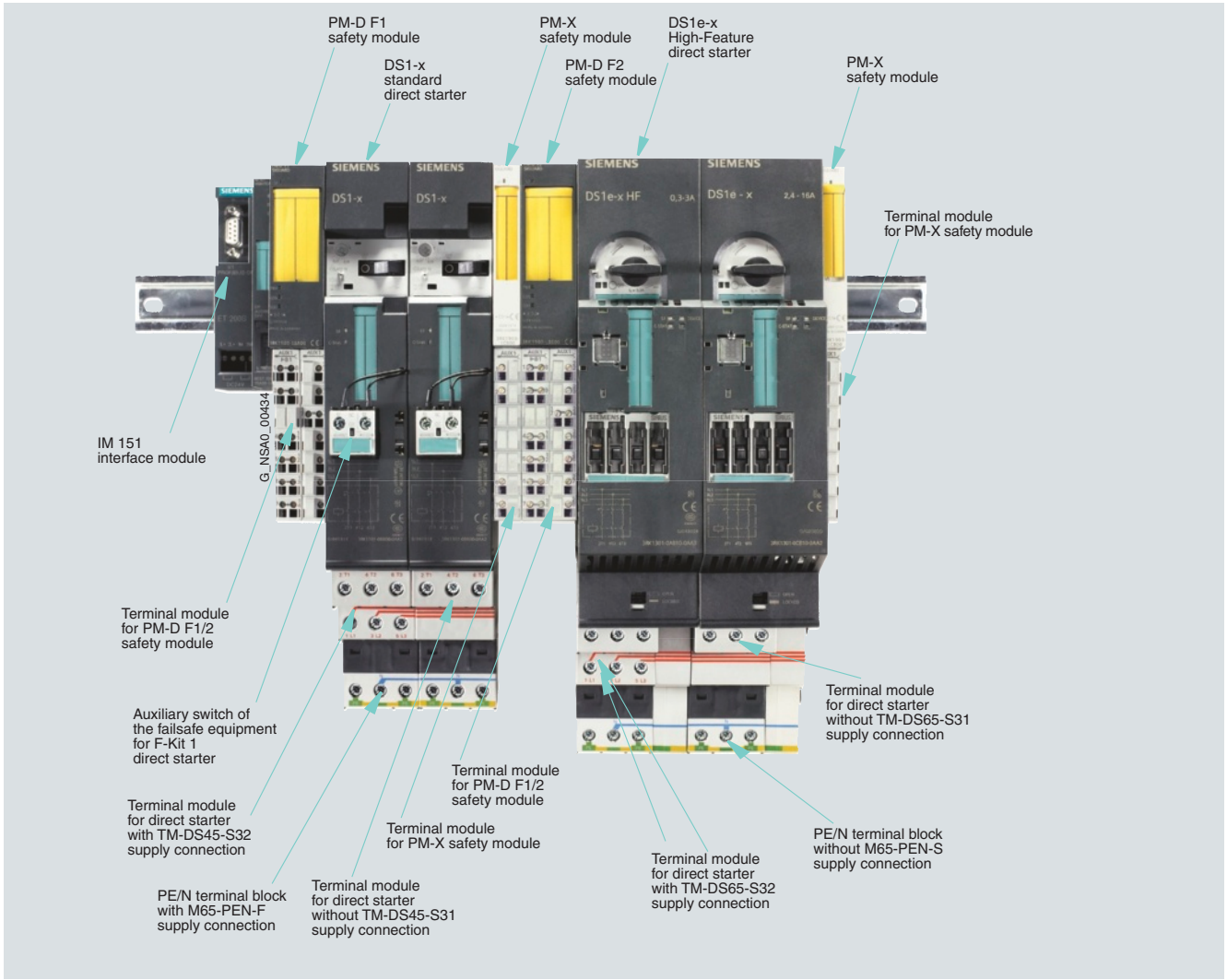
Dimensional drawings



F-DS1e-x direct-on-line starter/F-RS1e-x reversing starter

Safety modules local

Overview



Interplay of ET 200S Safety motor starters Solutions local components

PM-D F1 safety module

Safety motor starters Solutions local

- For use of Standard, High-Feature or Failsafe motor starters in systems with safety categories 2 to 4 (according to EN 954-1)
- No complex wiring for conventional safety technology
- Can also be used in combination with external safety relays
- Can also be used to activate external safety systems
- Safety module available for function-monitored and automatic starting
- Safety module available for stop category 0 and 1
- Safety module for monitoring the auxiliary voltages for motor starters
- Safety modules can be plugged into the TM-PF30 terminal modules

PM-D F1/F2/F3/F4/F5 safety modules

- PM-D F1/F2/F3/F4 safety modules monitor auxiliary voltages and contain the complete functionality of a safety relay:
  - PM-D F1
    For evaluation of EMERGENCY-STOP circuits with the function "monitored start".
  - PM-D F2
    For monitoring of protective doors with the function "automatic start".
  - PM-D F3
    Expansion to PM-D F1/F2 for time-delayed disconnection.
  - PM-D F4
    For expansion of safety circuits with other ET 200S motor starters, e. g. in a different line.
  - PM-D F5
    Transmits the status from PM-D F1 ... 4 through four floating enabling circuits to external safety equipment (contact multiplier)
- The PM-D F1 and PM-D F2 modules can be combined with the PM-D F3 or PM-D F4 modules.
- A PM-D F5 can be positioned at any point between a PM-D F1 ... 4 and a PM-X.
- Safety modules monitor the U1 and U2 auxiliary voltages. A voltage failure is relayed as a diagnostic signal over the bus.
- No additional PM-D safety module is required when the safety modules are used.
- Each safety circuit, beginning with a PM-D F1 ... 4, must be terminated with one PM-X each.

Failsafe Kit

The Failsafe Kit (F-Kit) must be added to each Standard motor starter in a safety segment in order to monitor the switching function.

F-Kit 1 supplements the DS1-x direct-on-line starter, F-Kit 2 the RS1-x reversing starter.

The F-Kits are comprised of:

- Contact supports for the terminal modules
- One or two auxiliary switch blocks for the contactor/contactors of the motor starter
- Connecting cables

High-Feature motor starters and their terminal modules come as standard with the functionality of the F-Kits integrated.

Examples

The diverse possible uses of the Safety motor starters Solutions local are presented in the manual SIMATIC ET 200S motor starters in the context of typical sample applications.

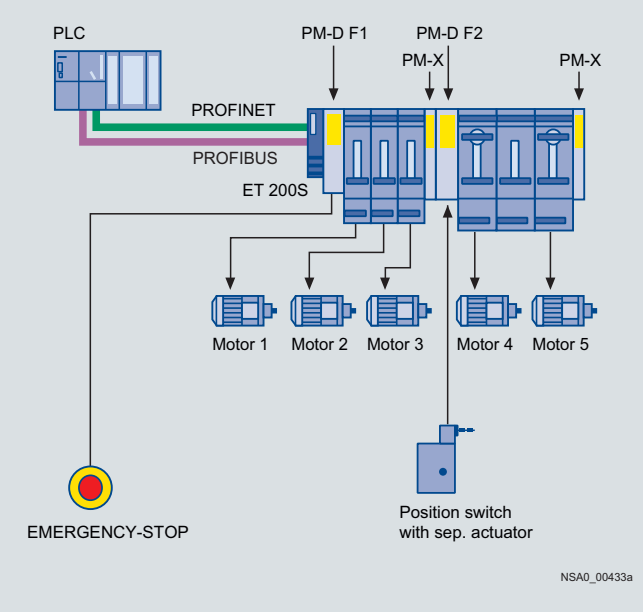
Safety functional examples for easy, quick and low-cost implementations of applications with Safety motor starters Solutions local are available on the Internet:

You can find more information on the Internet at:

http://www.siemens.com/sirius-starting

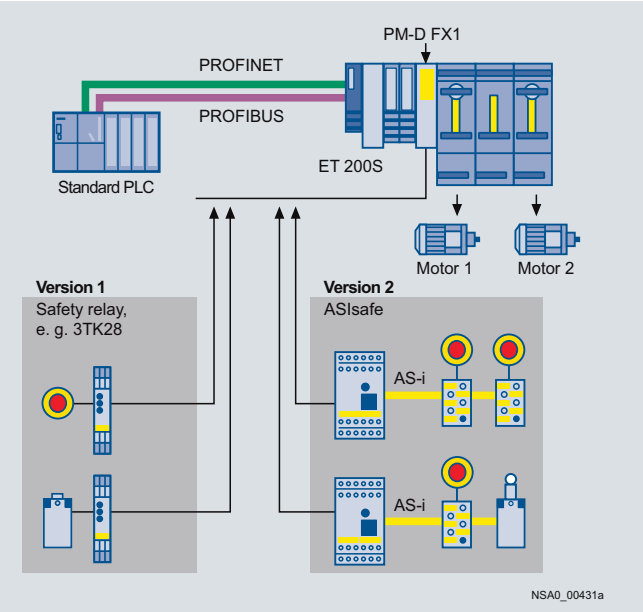
http://www.siemens.com/ET200S

Example 1:



ET 200S Safety motor starters Solutions local with 2 safety circuits (= switch-off groups), standard motor starters and High Feature motor starters.

Example 2:



ET 200S Safety motor starters Solutions local with 2 external safety combinations (= safety relays or ASIsafe monitors) and with Failsafe motor starters (PM-DFX1 application). 2 of the 6 available safe switch-off groups are used.

Signals with relevance for safety can be input to ET 200S through a PM-DFX1 infeed terminal module through the enabling circuits of the ASIsafe monitor or the safety relay to control the Failsafe motor starters which then selectively switch off the downstream motors.

Safety modules local

Design

Components needed for applications with safety requirement

Components needed	Safety category acc. to EN 954-1			
	1	2	3	4
PM-D	X	--	--	--
PM-D F1/-F2/-F4	--	X	X	X
PM-D F3	--	X	X	--
F-Kit 1/2	--	X[1)]	X[1)]	X[1)]
PM-X	--	X	X	X
PM-DFX1	--	X	X	X
External infeed contactor	--	--	X	X

1) F-Kit needed only for Standard motor starter; already integrated in High-Feature motor starter.

Possible combinations of safety and terminal modules

Terminal module	PM-D F1	PM-D F2	PM-D F3	PM-D F4	PM-D F5	PM-X	PM-DFX1	FCM
TM-PF30 S47-B0	X	X	--	--	--	--	--	--
TM-PF30 S47-B1	X	X	--	--	--	--	--	--
TM-PF30 S47-C0	--	--	X	X	--	--	--	--
TM-PF30 S47-C1	--	--	X	X	--	--	--	--
TM-PF30 S47-D0	--	--	--	--	X	--	--	--
TM-X15 S27-01	--	--	--	--	--	X	--	--
TM-PFX30 S47-G0	--	--	--	--	--	--	X	--
TM-PFX30 S47-G1	--	--	--	--	--	--	X	--
TM-FCM30 S47	--	--	--	--	--	--	--	X

Terminal modules for safety modules

For supplying load and sensor voltage to the self-assembling potential bars of the Standard motor starters, High-Feature motor starters and frequency converters. Safety modules for voltage monitoring are plugged onto TM-P modules. TM-P modules can be used any number of times within the ET 200S. A safety module must always be plugged upstream from the first motor starter.

Different safety circuits can be functionally separated or else cascaded using different terminal modules. Each group in such a case must be terminated with a PM-X connection module.

TM-PF30 S47-B1

The terminal module is always positioned at the beginning of a safety segment and accommodates the PM-DF1 safety module for EMERGENCY-STOP applications or the PM-DF2 safety module for protective door monitorings. The 24 V supply voltages for the electronics (U1) and those for supplying the contactors (U2) of the motor starters must be connected along with the 2-channel connection of the safety sensors (e. g. EMERGENCY-STOP pushbuttons) to this terminal module. Connections for the ON button (enabling) and safe output of the safety module are available in addition.

TM-PF30 S47-B0

The terminal module is used to cascade lower level safety segments and accommodates the PM-DF1 safety module for EMERGENCY-STOP applications or the PM-DF2 safety module for protective door monitorings. No other auxiliary voltage has to be connected to this terminal module. The supply comes from the preceding PM-DF1 or PM-DF2 module over the potential bars of the terminal modules. Once the potential of the preceding safety module is disconnected, this sub-potential also has no voltage.

TM-PF30 S47-C1

The terminal module is always positioned at the beginning of a safety segment expansion in a new station, e. g. at an interlace point. It accommodates the PM-D F3 safety module for time-delayed shutdown or the PM-D F4 safety module for direct shutdown in separately located ET 200S stations. The 24 V supply voltages for the electronics (U1) and those for supplying the contactors (U2) are fed in new.
The shutdown command from an upstream ET 200S station is received through a safe input. Separate terminals are available to connect the feedback circuit to the upstream ET 200S station. No safety sensors can be connected to this terminal module.

TM-PF30 S47-C0

The terminal module is used to cascade lower level safety segments and accommodates the PM-D F3 safety module for time-delayed shutdown or the PM-D F4 safety module. Only the U2 supply voltage for the contactors must be connected to this terminal module. The U1 supply comes from the preceding safety module (sub-potential group) over the potential bars of the terminal modules. No safety sensors can be connected to this terminal module.

TM-PF30 S47-D0

The terminal module is used to accommodate the PM-D F5 safety module. On this terminal module, safe signals can be relayed to external systems through four groups, each with two safety relay contacts configured with redundancy. The terminal module must always be positioned between one of the above mentioned terminal modules and a terminal module for the TM-X connection module. No safety sensors can be connected to this terminal module.

Terminal modules for connection modules (TM-X)

For connection of an external infeed contactor (second shutdown option) for category 3 and 4. The connection module is plugged on the right alongside the last motor starter of a safety segment. On the TM-X terminal module there are the terminals for connecting the positively driven NC contact of the contactors as well as the terminals for connecting the contactor coil. If no contactor with redundant switching is required, e. g. for category 2 (EN 954-1), the feedback circuit has to be closed at these terminals with a jumper. In applications with external safety relays it is also used instead of the safety module as interface to the external safety relay.

Function

Safety motor starters Solutions local

The safety module evaluates the signal state of the connected safety sensors and, using the integrated safety relays, shuts down the group(s) of downstream motor starters. The shutdown function is monitored by the module, and the auxiliary voltages likewise.

Safety-relevant system signals, e. g. due to an actuated EMERGENCY-STOP switch or a missing auxiliary voltage, are automatically generated and notified to the interface module. The latter assigns an unambiguous ID to the fault. Using the PROFIBUS DP diagnostics module, faults of this type can be identified and localized without a great deal of programming work.

The PM-D F X1 safety module is used for feeding in 1 to 6 switch-off groups. The infeed voltage can be switched using 1 to 6 external safety shutdown devices (either ASIsafe monitors or 3TK28 safety shutdown devices). This safety module is used in applications with external safety shutdown devices where there is a need for the selective safety shutdown of failsafe motor starters (see example 2, page 6/125).

Terminal modules

Terminal modules for expansion modules (TM-xB)

The TM-xB terminal modules are used to accommodate the xB1, xB2, xB3 and xB4 brake control modules. The TM-terminal module must always follow directly after a terminal module for Standard motor starters, High-Feature motor starters or frequency converters as control of the solid-state braking switch is provided through an output of the motor starter/frequency converter. The xB215 terminal modules for the brake control modules have not only the terminals for connecting the cable for the motor brake but also the terminals of the two local acting inputs. These local inputs are not evaluated by a frequency converter; for this reason the xB215 terminal module may be plugged in only downstream from a motor starter.

Terminal modules for (TM-PF30) safety module

For supplying load and sensor voltage to the potential bars of the motor starters, and for connection of the 2-channel sensor circuit (e. g. EMERGENCY-STOP pushbutton) and a reset button. Different terminal modules are available for the configuring of separate safety circuits or for the cascading of safety circuits, and for applications with time-delayed disconnection.

Terminal module for (TM-X) connection safety module

For connection of an external infeed contactor (2nd shutdown possibility). With terminals for contactor coil and feedback contact. Is always required to terminate a group of safety-oriented motor starters.

Technical specifications

PM-D F1, F2, F3, F4 and F5 safety modules		
Mechanical endurance	Operating cycles	10 x 10^6
Electrical endurance		200 000 with I_e
Utilization categories		DC-13
Control times		
• Minimum command duration	ms	200
• Recovery time	s	< 1
• Off-delay	ms	30
Control circuit U_1		
• Rated control supply voltage U_S	V	24 DC
• Operating range DC up to 60 °C		0.85 ... 1.2 x U_s
• Power consumption	W	2.4
• Recommended short-circuit protection		(gG) gL 2 A
• Output OUT+/OUT- for control of expansion modules		24 V DC/< 50 mA (PTC fuse)
Switched auxiliary circuit U_2		
• Rated control supply voltage U_S	V	24 DC
• Operating range DC up to 60 °C		0.85 ... 1.2 x U_s
• Rated operational current I_e (DC 13 ... 24 V)	A	4
• Conventional thermal current I_{th}	A	5
Recommended short-circuit protection for enabling and signaling circuits		Fuse links: LV HRC type 3NA DIAZED type 5SB NEOZED type 5SE gL (gG) operational class 6 A
Supplying		
• Motor starters		Yes
• Solid-state modules		No
• Ex(i) modules		No
• BG certification		Yes
• UL-, CSA certification		Yes
Cable length for EMERGENCY-STOP and ON pushbuttons	m	Max. 1000
Mounting dimensions (W x H x D)	mm	30 x 196.5 x 117.5 (incl. terminal module)
Enabling circuits with PM-D F5		4 (floating)

Safety modules local

PM-X safety modules		
Control circuit U_1		
• Rated control supply voltage U_S	V	24 DC
Mounting dimensions (W x H x D)	mm	15 x 196.5 x 117.5 (incl. terminal module)

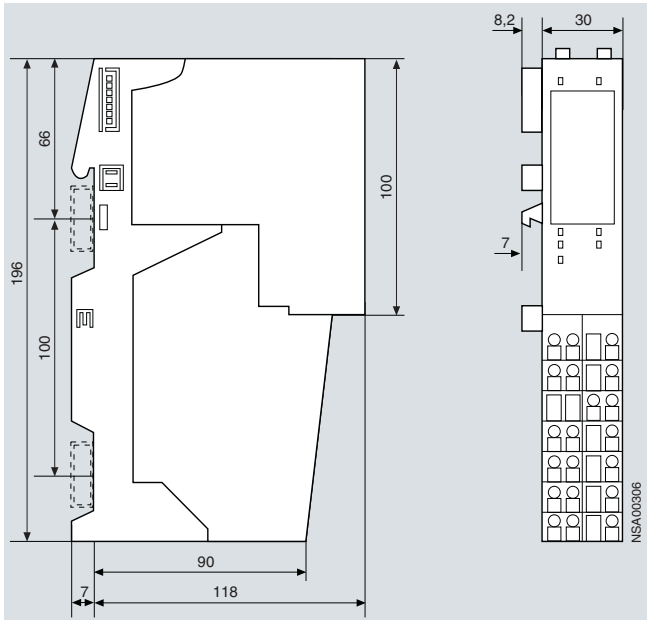
Diagnostic signals with safety modules

Fault type	Meaning	PM-D power modules				
		F1	F2	F3	F4	F5
01001: Fault	A module fault has occurred	X	X	X	X	X
10001: Sensor or load voltage missing	U_1 or U_2 not available or too low	X	X	X	X	X
11000: Actuator shutdown	Safety relay has dropped	X	X	X	X	X
11001: Safety-oriented disconnection	EMERGENCY-STOP has been actuated; crossover between the EMERGENCY-STOP cables has occurred	X	X	--	--	--

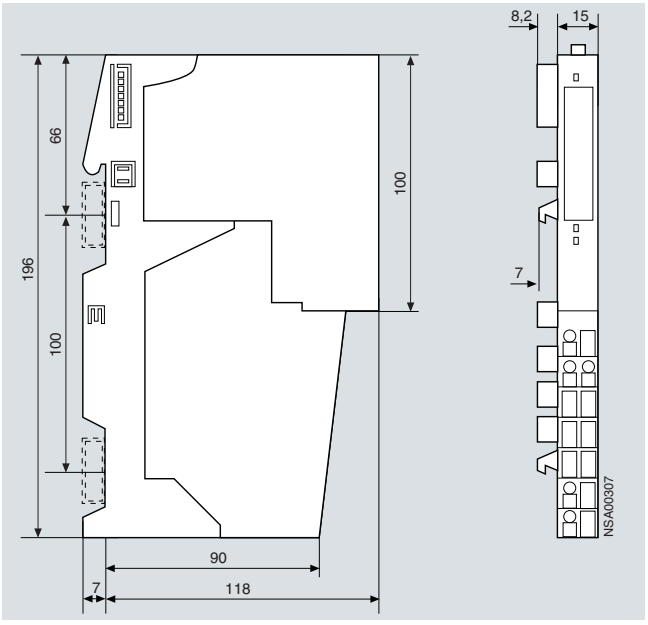
TM-PFX30 S47/TM-PF30 S47 terminal modules		
Dimensions		
Mounting dimensions (W x H x D)	mm	30 x 196.5 x 102
Depth with power module	mm	117.5
Insulation voltages and rated currents		
Insulation voltage	V	500
Rated operational voltage	V	24 DC
Rated operational current	A	10
Conductor cross-sections		
Solid	mm^2	1 x (0.14 ... 2.5) acc. to IEC 60947 1 x (2.5
Finely stranded with end sleeve	mm^2	1 x (0.14 ... 1.5) acc. to IEC 60947
AWG cables, solid or stranded	AWG	1 x (18 ... 22)
Wiring		
Required tool		Standard screwdriver size 1
Tightening torque	NM	0.4 ... 0.7
PM-D FX1 safety modules (infeed terminal modules)		
Dimensions		
Mounting dimensions (W x H x D)	mm	30 x 196.5 x 117.5 (incl. terminal module)
Module-specific specifications		
Ambient temperature	°C	0 ... +60
Degree of protection		IP20
Maximum achievable safety classes		
• IEC 61508		SIL 3
• EN 954-1		Category 4
Safety characteristics		
Proof-test interval		10 years
Voltages, currents, potentials		
Rated control supply voltage U_s	V	21.6 ... 26.4 DC up to 60 °C
Rated operational current I_e	A	6 Internal protection with 7 A melting fuse (quick)
Recommended upstream short-circuit protection	A	Melting fuse gL/gG 6.3
Supplying		
• Failsafe motor starters		Yes
• Failsafe frequency converters		Yes
• Solid-state modules		No
• Ex[i] modules		No
Power consumption		
• From the backplane bus	mA	≤ 10
• From U_1	mA	≤ 35
• From SGx	mA	≤ 15
Status, alarms, diagnostics		
Alarms		None
Diagnostics functions		
• Group fault/device fault		Red "SF" LED
• Monitoring the supply voltage for solid-state modules U1 (PWR)		Green PWR LED
• Monitoring of six switch-off groups		Green LED SG1 ... SG6
• Diagnostics information can be read out		Yes
Standards, approvals		
• TÜV		Yes
• UL, CSA certification		Yes

F-CM contact multipliers		
Dimensions		
Dimensions (W x H x D)	mm	30 x 196.5 x 117.5 (incl. terminal module)
Module-specific specifications		
Number of relay outputs		4 (4 x 1-channel or 2 x 2-channel safe coupling/contact multiplication)
Internal power supply for bar		U1 (from PM-D F/PM-D FX1)
Maximum achievable safety class		
• Acc. to IEC 61508		SIL3
• Acc. to EN 954		Cat. 4
Voltages, currents, potentials		
Switching capacity of the relay outputs		Utilization category DC-13 (I_e/U_e): 1.5 A/24 V
Electrical separation		
• Between outputs and backplane bus		Yes
• Between outputs and power supply		Yes
• Between outputs		Yes
• Between outputs/power supply and shield		Yes
Status, alarms, diagnostics		
Status display		PWR and STAT
Alarms: Diagnostics alarm		None
Diagnostics functions		Yes
• Group fault display		Red LED (SF)
• Diagnostics information can be read out		Available
• Monitoring the supply voltage for solid-state modules U_1 (PWR)		Green PWR LED
• Monitoring the switching state of the enabling circuit		Red/green STAT LED

Dimensional drawings

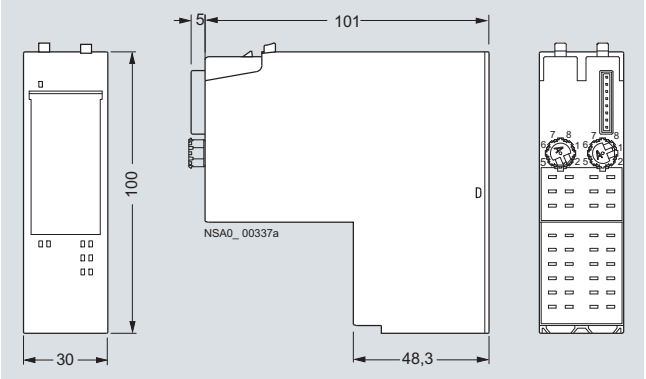


PM-D F1 ... 4 safety module and TM-PF30 terminal module



PM-X safety module and TM-X15 terminal module

Safety modules local



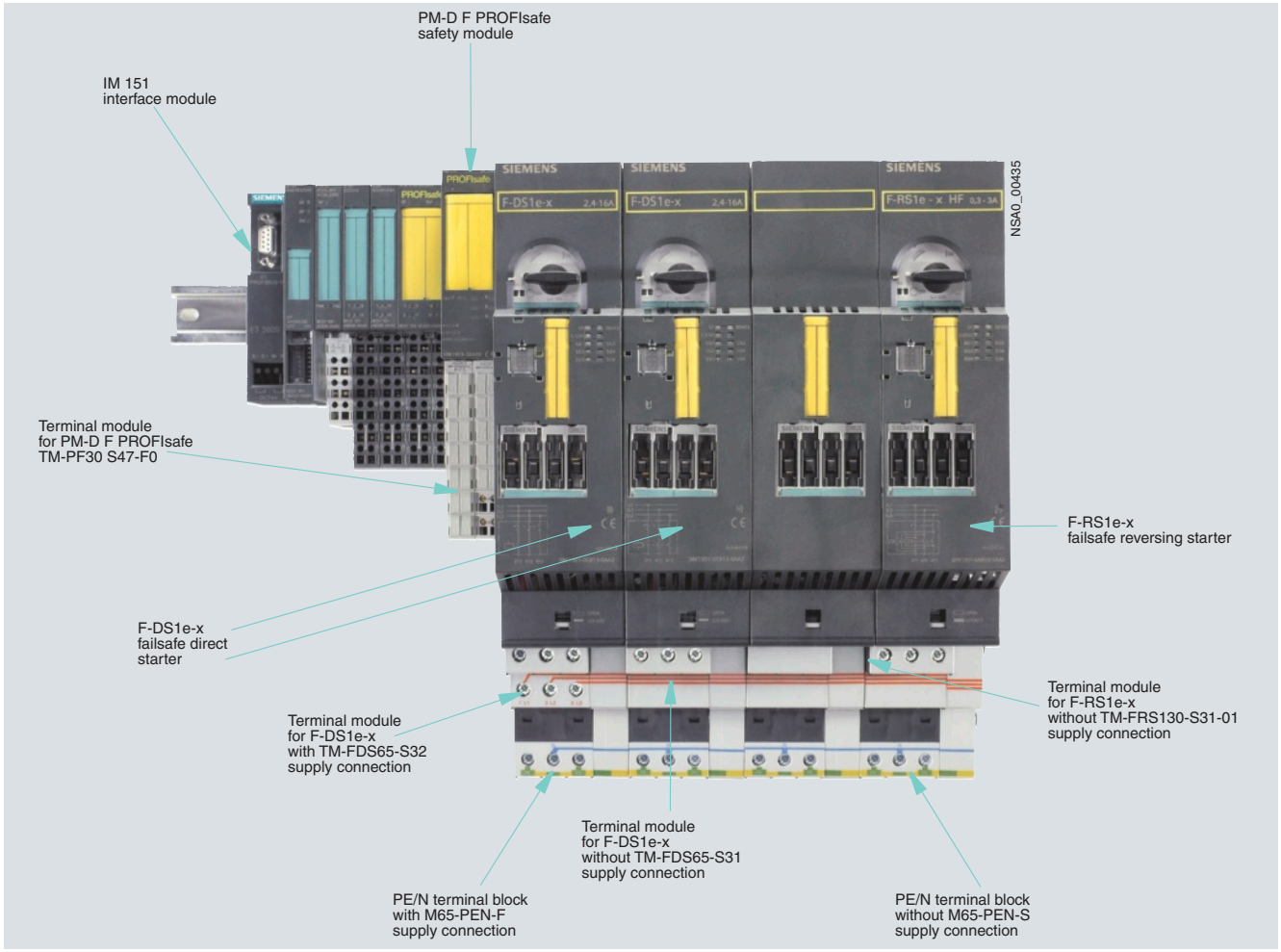
PM-D F X1 safety module (infeed terminal module)

Schematics

Terminal assignment
TM-PFX30 S47-G0/G1 terminal modules (for PM-D F X1)

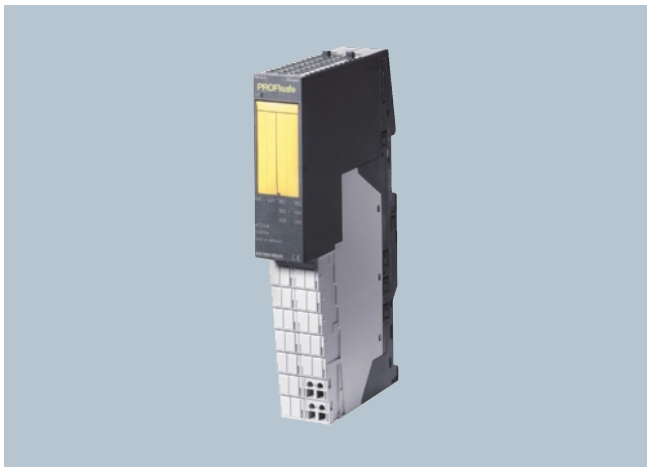
Terminal	Short designation	Meaning
1, 8	+ IN/OUT	U_1: fused 24 V DC, limited to SIMATIC range
2, 9	M IN/OUT	
3, 10	--	Not assigned
4, 11	--	Not assigned
5, 12	--	Not assigned
6, 13	L+	U_{in}: for connecting an external power supply
7, 14	M	24 V DC SELP/PELV
--	AUX1	Is passed through without a terminal
15, 22	SG1	
16, 23	SG2	
17, 24	--	Not assigned
18, 25	SG3	
19, 26	SG4	
20, 27	SG5	
21, 28	SG6	

Overview



Interplay of ET 200S Safety motor starter Solutions PROFIsafe components

Safety motor starters Solutions PROFIsafe



PM-D F PROFIsafe with TM-PF30 S47-F0 terminal module

Sensor and actuator assignment are freely configurable within the framework of the distributed safety concept:

The logic of the safety functions is implemented by software. Safety-oriented PROFIsafe communication and the use of a safety-oriented control system are required. Integration of the safety technology in the standard automation is realized through a single bus system (see Advantages of PROFIsafe), using PROFIBUS as well as PROFINET.

- For the use of Failsafe motor starters in plants with safety category 2 to 4 according to EN 954-1 and SIL 2 and 3 according to IEC 61508. The use of Standard or High-Feature motor starters is also possible with certain assemblies
- High flexibility (any assignment of sensors to motor starters using the PLC)
- Full selectivity of disconnection of the Failsafe motor starters
- No complex wiring for conventional safety technology, e. g. no infeed contactors even in the highest safety category
- Can also be used to activate external safety systems through F-CM contact multiplier
- Safety module available for any safety function
- Safety module available for stop category 0 and 1
- Safety module for monitoring the auxiliary voltages for motor starters
- Safety modules can be plugged into the TM-PF30 terminal modules

Safety module PROFIsafe

High degree of flexibility with safety technology
Failsafe motor starters for PROFIsafe:

In EMERGENCY-STOP applications, the Failsafe motor starters are selectively switched off through the upstream PM-D F PROFIsafe safety module. For each safety module, six switch-off groups can be formed. In the first delivery stage, the failsafe freely-programmable logic of the SIMATIC controller is used to interface with the relevant Failsafe sensor technology. The interface between PROFIsafe and installations that use conventional safety technologies is implemented through the F-CM Failsafe contact multiplier with four floating contacts.

Example:

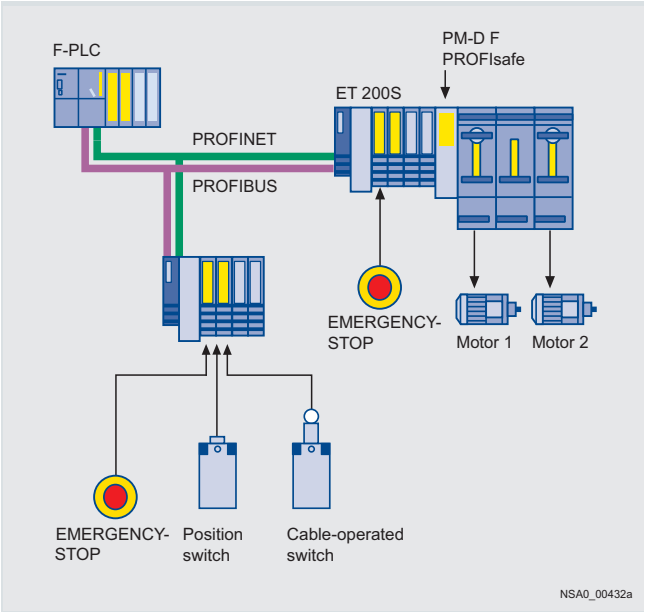
The diverse possible uses of the Safety motor starter Solutions PROFIsafe are presented in the manual SIMATIC ET 200S Motor Starters in the context of typical sample applications.

Safety functional examples for easy, quick and low-cost implementations of applications with safety motor starters Solution PROFIsafe are available on the Internet:

You can find more information on the Internet at:

http://www.siemens.com/sirius-starting

http://www.siemens.com/ET200S



ET 200S Safety motor starters Solutions PROFIsafe with Failsafe motor starters and fully selective disconnection (PM-DF PROFIsafe application)

Within an ET 200S station the Failsafe motor starters are assigned to one of 6 safety segments. For plants with distributed configuration the shutdown signals of these safety segments are preferably issued by a higher-level, safety-oriented control system through PROFIsafe. This permits the greatest flexibility for assigning the motor starters to different safety circuits.

Alternatively, an ET 200S F-CPU can also be used for control purposes.

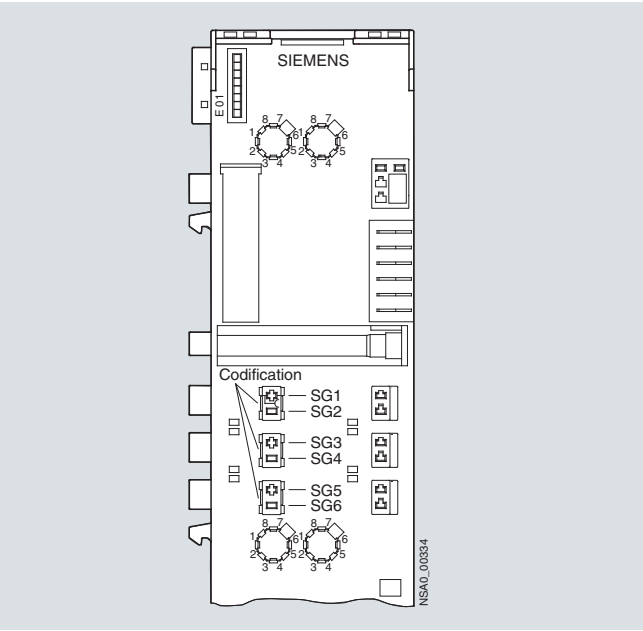
Function

Each safety module switches up to 6 switch-off groups for Failsafe motor starters/frequency converters.

The PM-D F PROFIsafe safety module receives the shutdown signal from the interface module of the ET 200S and safely switches off 1 to 6 switch-off groups. This safety module is used in PROFIsafe applications where there is a need for the selective safety shutdown of Failsafe motor starters/frequency converters.

The terminal assignment of the terminal modules for safe motor starters corresponds to the terminal assignment of the 45 and 65 mm terminal modules. The terminal modules for safe motor starters have a coding module in addition. This enables the safe motor starter to be assigned to one of the six switch-off groups.

The terminal module contains three coding elements which fully cover the three coding openings in the terminal module. The labeled coding element contains (in the chamber marked with the dash) the busbar tap; the non-labeled coding elements are used only to cover the coding openings. Switch-off group 1 (AG1 or SG1) is coded in the as-delivered state. The coding can be changed to switch-off group 2 by releasing the coding element and turning it through 180°. Changing the coding to switch-off group 3 is possible by exchanging the labeled and blank coding elements. In this case the dash on the labeled coding element must correlate with the dash of the required switch-off group (symbolized busbar).

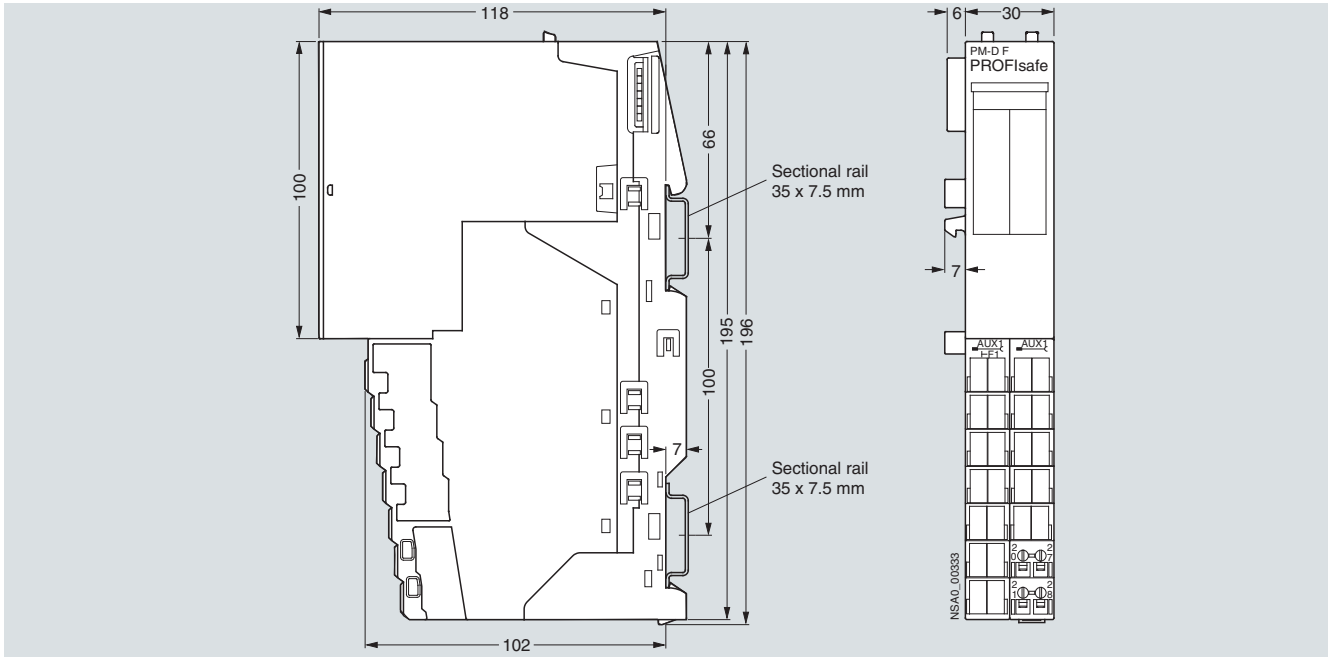


The Failsafe motor starters are assigned to one of the six possible switch-off groups.

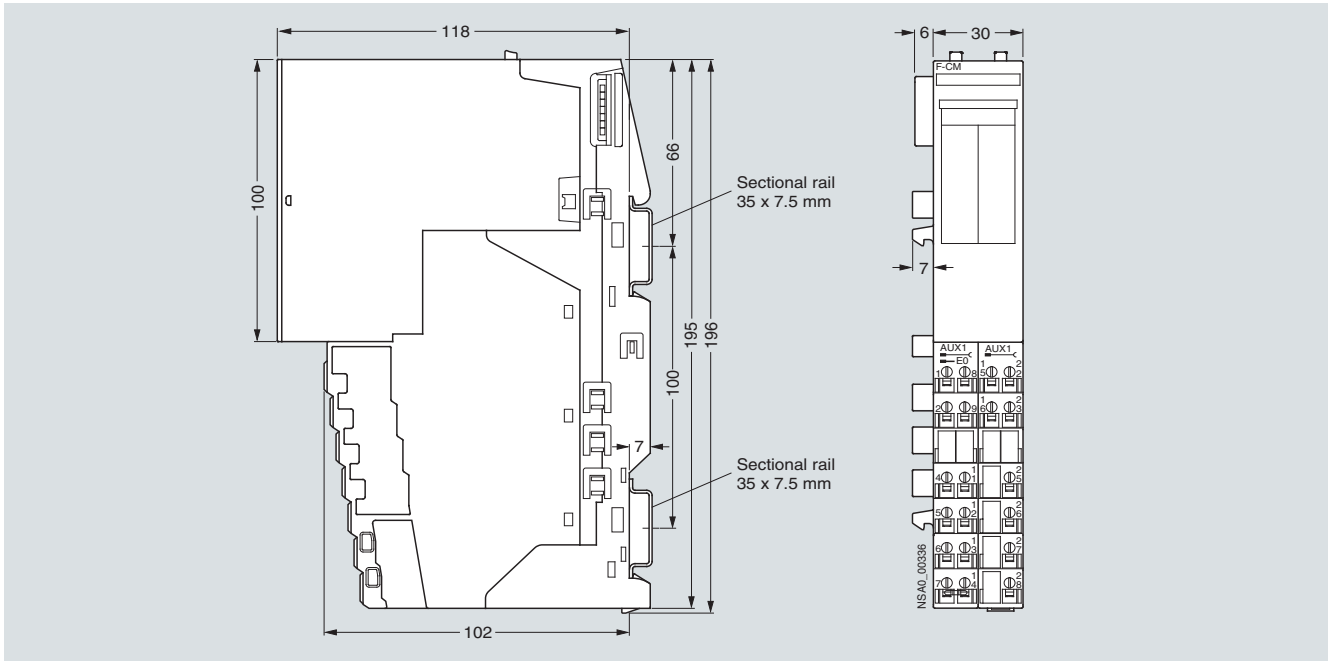
Technical specifications

PM-D F PROFIsafe safety modules		
Dimensions		
Dimensions (W x H x D)	mm	30 x 196.5 x 117.5 (incl. terminal module)
Module-specific specifications		
Number of outputs, source input		6 switch-off groups (safety group 1 ... 6)
Internal power supply for bar		U1
Assigned address range		
• In PAE	byte	5
• In PAA	byte	5
Maximum achievable safety class		
• Acc. to IEC 61508		SIL3
• Acc. to EN 954		Cat. 4
Voltages, currents, potentials		
Supply voltage	V	24 DC
Electrical separation		
• Between outputs and backplane bus		Yes
• Between outputs and power supply		No
• Between outputs		No
• Between outputs/power supply and shield		Yes
Status, alarms, diagnostics		
Status display		Green LED per SG Green LED for electronics supply Green LED for load voltage
Alarms: Diagnostics alarm		"TO"
Diagnostics functions		
• Group fault display		Red LED (SF)
• Diagnostics information can be read out		available
Settings		
Module address		Diverse: 1. Using a safety-oriented parameter in the parameterization message frame over the backplane bus 2. Using the 10-pole DIL switch (binary-coded) on the left side of the module The received address is then compared with the DIL switch setting
F-CM contact multipliers		
Dimensions		
Dimensions (W x H x D)	mm	30 x 196.5 x 117.5 (incl. terminal module)
Module-specific specifications		
Number of relay outputs		4 (4 x 1-channel or 2 x 2-channel safe coupling/contact multiplication)
Internal power supply for bar		U1 (from PM-D F/PM-D FX1)
Maximum achievable safety class		
• Acc. to IEC 61508		SIL3
• Acc. to EN 954		Cat. 4
Voltages, currents, potentials		
Switching capacity of the relay outputs		Utilization category DC-13 (I_e/U_e): 1.5 A/24 V
Electrical separation		
• Between outputs and backplane bus		Yes
• Between outputs and power supply		Yes
• Between outputs		Yes
• Between outputs/power supply and shield		Yes
Status, alarms, diagnostics		
Status display		PWR and STAT
Alarms: Diagnostics alarm		None
Diagnostics functions		Yes
• Group fault display		Red LED (SF)
• Diagnostics information can be read out		Available
• Monitoring the supply voltage for solid-state modules U_1 (PWR)		Green PWR LED
• Monitoring the switching state of the enabling circuit		Red/green STAT LED

Dimensional drawings



PM-D F PROFIsafe safety module with TM-PF30 terminal module



F-CM contact multiplier with TM-FCM30 terminal module

Schematics

Terminal assignment of TM-PF30 S47-F0 terminal module (for PM-DF PROFIsafe)

Terminal	Short designation	Meaning
20, 27	24 V DC	24 V DC infeed (terminals internally bridged)
21, 28	M	Infeed ground (terminals internally bridged)

Terminal assignment of TM-FCM30 S47-F01 terminal module (for F-CM)

The table shows the terminal assignment of the TM-FCM30 S47-F01 terminal module for the F-CM contact multiplier. The left half of the terminal module is used to assign the contact multiplier outputs to the desired switch-off group (safety group). It can be coded for only one safety group. The PM-D F treats multiple coding as crossover. The F-CM can also be configured in connection with the PM-D F X1 power module.

Terminal	Short designation	Meaning
1, 8	SG1	Jumper for coding to safety group 1
2, 9	SG2	Jumper for coding to safety group 2
4, 11	SG3	Jumper for coding to safety group 3
5, 12	SG4	Jumper for coding to safety group 4
6, 13	SG5	Jumper for coding to safety group 5
7, 14	SG6	Jumper for coding to safety group 6
15	OUT1.1	Floating relay output 1.1
16	OUT1.2	Floating relay output 1.2
22	OUT2.1	Floating relay output 2.1
23	OUT2.2	Floating relay output 2.2
25	OUT3.1	Floating relay output 3.1
26	OUT3.2	Floating relay output 3.2
27	OUT4.1	Floating relay output 4.1
28	OUT4.2	Floating relay output 4.2

Standard and High-Feature

Overview

Motor starters

- Only two versions up to 5.5 kW
- All settings can be parameterized by bus
- Comprehensive diagnostic signals
- Overload can be acknowledged by remote reset
- Current unbalance monitoring
- Stall protection
- Emergency start function in the event of overload
- Current value transmission by bus
- Current limit monitoring
- Direct-on-line or reversing starters
- Power bus can be plugged in using the new HAN Q4/2 plug-in connectors
- Conductor cross-sections up to 6 x 4 mm^2
- 25 A per segment
  (power looped through using jumper plug)
- In the Standard and High Feature versions
  (with 4 DI onBoard)
- Electromechanical switching and electronic switching
- Electronic starter for direct activation or with integrated smooth-starter function
- Supplied with 400 V AC brake contact as an option

Isolator modules

The isolator module with switch disconnector function is used for safe disconnection of the 400 V operational voltage during repair work in the plant and provides an integrated group fusing function (i. e. additional group short-circuit protection for all subsequently supplied motor starters).

Depending on the power distribution concept, all stations can be equipped with an isolator module as an option.

Safety applications

Safety local isolator module

With the Safety local modules
- Safety local isolator module and
- 400 V disconnecting module

it is possible to achieve safety category 4/SIL 3 with an appropriate connection.

Safety Solution PROFIsafe

With the Safety PROFIsafe modules
- F-Switch and
- 400 V disconnecting modules

it is also possible to achieve safety category 4/SIL 3 with an appropriate connection.

Motor Starter ES software

The Motor Starter ES software is used the for parameterization, monitoring, diagnostics and testing of motor starters.
See Catalog LV 1, Chapter 12 "Planning and Configuration with SIRIUS".

Technical specifications

		Standard motor starters	High-Feature motor starters	
		DSe, RSe	DSe, RSe	sDSSte, sDSte, sRSSte, sRSte
General data				
Motor starters that can be connected to ET 200pro or modules with width of 110 mm		Max. 8		
Mounting dimensions (W x H x D) • Direct-on-line starter and reversing starter	mm	110 x 230 x 150		110 x 230 x 160
Permissible ambient temperature • During operation • During storage	 °C °C	 -25 ... +55, from +40 with derating -40 ... +70		
Permissible mounting positions		Vertical, horizontal		
Vibration resistance acc. to IEC 60068, Part 2-6		2 *g*		
Shock resistance to IEC 60068 Part 2-27		Half-sine 15 *g*/11 ms		
Power consumption • From auxiliary circuit L+/M (U1) • From auxiliary circuit A1/A2 (U2)	V DC mA mA	24 Approx. 40 Approx. 200		
Rated operational current for power bus I_e	A	25		
Rated operational voltage U_e • Approval acc. to EN 60947-1, Appendix N • Approval acc. to CSA and UL	V AC V AC V AC	400 Up to 400 Up to 600		 Up to 400 Up to 480
Approval to EN 61140	V	Up to 400		Up to 480
CSA and UL approval	V	Up to 600		Up to 480
Conductor cross-sections • Incoming energy supply	 mm^2	 Max. 6 x 4		
Degree of protection		IP65		
Touch protection		Finger-safe		
Degree of pollution		3, IEC 60664 (IEC 61131)		
Rated impulse withstand voltage U_{imp}	kV	6		
Rated insulation voltage U_i	V	400		
Rated operational current for starter I_e				
• AC-1/2/3 at 40 °C - At 400 V - At 500 V	 A A	 0.15 ... 2.0/1.5 ... 12.0 0.15 ... 2.0/1.5 ... 9.0		 0.15 ... 2.0/1.5 ... 12.0[1]
• AC-4 at 40 °C - At 400 V	 A	 0.15 ... 2.0/1.5 ... 4.0		
Rated short-circuit breaking capacity	kA	100 at 400 V		
Type of coordination to IEC 60947-4-1		1		
Power of induction motors at 400 V	kW	Max. 5.5		Max. 5.5/4[2]
Utilization categories		AC-1, AC-2, AC-3, AC-4		AC-53a[3] (max. 9 A with deactivated soft star function up to CLASS 10)
Protective separation between main and auxiliary circuits	V	400, acc. to EN 60947-1, Appendix N		
Endurance of contactor • Mechanical • Electrical		 30 million operating cycles Up to 10 million operating cycles; dependent on the current loading (see Manual)		 -- --
Reliable switching frequency		Dependent on the current loading, motor starting time and relative ON period (see Manual)		
Operating times at 0.85 ... 1.1 x U_e • Closing time • Opening delay	 ms ms	 11 ... 50 5 ... 45		 -- --

1) **Caution!**
With deactivated soft starter control function the the permissible rated operational current is reduced to 9 A up to CLASS 10.

2) With parameterization as electronic starter max. 4 kW.

3) 8-hour operation.

Standard and High-Feature

		Standard motor starters	High-Feature motor starters	
		DSe, RSe	DSe, RSe	sDSSte, sDSte, sRSSte, sRSte
Device functions				
Parameterizable rated operational current		Yes		
Parameterizable current limit values		No	Yes, 2 limit values	
Parameterizable response in case of current limit violation		No	Yes	
Zero current monitoring		Yes		
Parameterizable response in case of zero current violation		Yes		
Parameterizable current unbalance limit		No, fixed limit value (30 % x I_e)	Yes, 30 % ... 60 % x I_e	
Parameterizable response in case of unbalance limit violation		Yes		
Motor blocking monitoring		No	Yes	
Parameterizable blocking current limit		No	Yes, 150 % ... 1000 % x I_e	
Parameterizable blocking time limit	s	No	Yes, 1 ... 5	
Current value transmission		Yes		
Group warning diagnostics		No	Yes, parameterizable	
Group diagnostics		Yes, parameterizable		
Emergency start		Yes		
Digital inputs		No	Yes, 4 inputs	
• Parameterizable input signal		No	Yes, latching/ non-latching	
• Parameterizable input level		No	Yes, NC contacts/NO contacts	
• Parameterizable input signal delay	ms	No	Yes, 10 ... 80	
• Parameterizable input signal extension	ms	No	Yes, 0 ... 200	
• Parameterizable input control actions		No	Yes, 12 different actions	
400 V brake output		Yes, ordering option		
Parameterizable brake enabling delay	s	Yes, -2.5 ... 2.5		
Parameterizable holding time of the brake during stopping	s	Yes, 0 ... 25		
Parameterizable start-up type		No		Yes
Parameterizable ramp-down time		No		Yes
Parameterizable starting voltage		No		Yes
Parameterizable stopping voltage		No		Yes
Local device interface		Yes		
Firmware update		Yes, by trained personnel		
Thermal motor model		Yes		
Parameterizable trip class		No, CLASS 10 fixed	Yes, CLASS 5, 10, 15, 20	
Parameterizable response in case of overload of thermal motor model		No	Yes, 3 possible states	
Advance warning limit for motor heating	%	No	Yes, parameterizable 0 ... 95	
Advance warning limit time-related trip reserve	s	No	Yes, parameterizable 0 ... 500	
Parameterizable recovery time	min	No	Yes, 1 ... 30	
Parameterizable protection against voltage failure		No, permanently integrated	Yes	
Reversing start function		Yes, ordering option		
Parameterizable interlock time for reversing starters		No, 150 ms fixed	Yes, 0 ... 60 s	
Integrated logbook functions		Yes, 3 device logbooks		
Integrated statistics data memory		Yes		
Parameterizable response in case of CPU/master stop		Yes		
Device indications				
• Group fault		SF LED (red)		
• Switching state		STATE LED (red, yellow, green)		
• Device status		DEVICE LED (red, yellow, green)		
• Digital inputs		No	IN 1 ... IN 4, LED	

Overview

The isolator module with integrated group fusing function (i. e. additional group short-circuit protection for all subsequently supplied motor starters) and switch disconnector function is used for safe disconnection of the 400 V operational voltage in the plant.

Depending on the power distribution concept, all stations can be equipped with an isolator module as an option.

The isolator module is available in addition in a safety version. See Safety local Isolator Modules.

Function

The following properties apply to the isolator module:

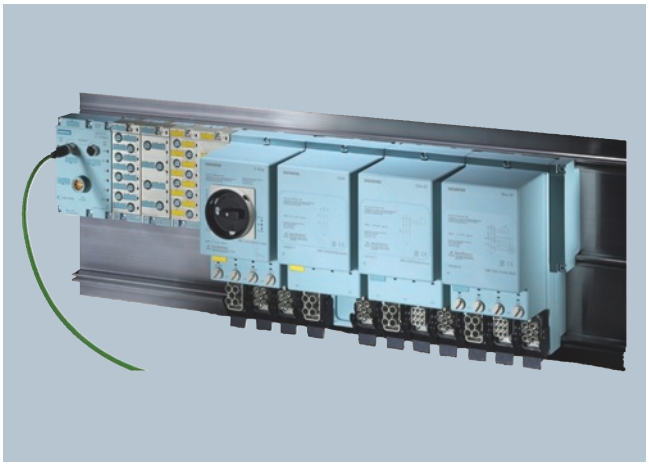
- Increase of plant availability through fast replacement of units (easy mounting and plug-in technology)
- Cabinet-free construction thanks to high degree of protection IP65.

Technical specifications

		Isolator modules
General data		
Mounting dimensions (W x H x D) • Direct-on-line starter and reversing starter	mm	110 x 230 x 170
Permissible ambient temperature • During operation • During storage	°C °C	-25 ... +55 -40 ... +70
Permissible mounting positions		Any
Vibration resistance acc. to IEC 60068, Part 2-6		2 *g*
Shock resistance acc. to IEC 60068, Part 2-27		Half-sine 15 *g*/11 ms
Power consumption • From auxiliary circuit L+/M (U1) • From auxiliary circuit A1/A2 (U2)	mA	Approx. 20 --
Rated operational current for power bus I_e	A	25
Rated operational voltage U_e	V	400
Approvals acc. to • EN 61140 • CSA and UL	 V V	 Up to 500 Up to 600
Conductor cross-sections • Incoming energy supply	 mm^2	 Max. 6 x 4
Degree of protection		IP65
Touch protection		Finger-safe
Degree of pollution		3, IEC 60664 (IEC 61131)
Rated impulse withstand voltage U_{imp}	kV	6
Rated insulation voltage U_i	V	400
Rated operational current for starters I_e • AC-1/2/3 at 40 °C - At 400 V - At 500 V	 A A	 25 25
Rated short-circuit breaking capacity	kA	50 at 400 V
Type of coordination to IEC 60947-4-1		2
Protective separation between main and auxiliary circuits	V	400, acc. to IEC 61140
Device functions • Group diagnostics		 Yes, parameterizable
Device indications • Group fault		 SF LED (red)

Safety modules

Overview



Safety local isolator module

The Safety local isolator module is a repair switch with integrated safety evaluation functions that can be parameterized using DIP switches.

It is used for:
- Connection of a 1 or 2-channel EMERGENCY-STOP circuit up to category 3-4/SIL 3 (protective door or EMERGENCY-STOP pushbuttons) and parameterizable start behavior
- Control of the 400 V disconnecting module by means of a safety rail signal

400 V disconnecting modules

The 400 V disconnecting module enables the safe disconnection of the operational voltage of 400 V up to Category 3-4/SIL 3. For operation in a Safety Solution local application it functions only in combination with the Safety local isolator module.

For operation in a Safety PROFIsafe application it functions only in combination with the F-Switch.

F-Switch

Fail-safe digital inputs/outputs in degree of protection IP65/66/67 for near-machine, cabinet-free use.

Fail-safe digital inputs

- For the failsafe reading in of sensor information (1-/2-channel)
- Including integrated evaluation for 2v2 signals
- Internal sensor supplies (incl. testing) available

Fail-safe digital outputs

- 3 failsafe PP-switching outputs for safe switching of the backplane bus bars

The F-Switch is certified up to Cat. 4 (EN 954-1) and up to SIL 3 (IEC 61508) and has detailed diagnostics.

It supports PROFIsafe in PROFIBUS configurations as well as in PROFINET configurations.

Function

Safety local isolator module

The module with local safety function is designed for the following individual functions:
- Functions as for the isolator module, plus:
- 2 safe inputs for:
  - EMERGENCY-STOP or protective door contacts, 2-channel
  - Monitored start
- 2 slide switches for adjusting the basic functions
  - 1-/2-channel
  - Autostart/monitored start.

400 V disconnecting modules

The 400 V disconnecting module is designed for the following individual functions:
- Double disconnection of the main circuit supply (Cat. 4/SIL 3)
- Feedback of the module's functional state over bus.

Technical specifications

		Safety local isolator modules	400 V disconnecting modules
General data			
Mounting dimensions (W x H x D) in mm • Direct-on-line starter and reversing starter	mm	110 x 230 x 170	110 x 230 x 150
Permissible ambient temperature • During operation • During storage	 °C °C	 -25 ... +55 -40 ... +70	
Permissible mounting positions		Any	
Vibration resistance to IEC 60068, Part 2-6		2 *g*	
Shock resistance to IEC 60068 Part 2-27		Half-sine 15 *g*/11 ms	
Power consumption • From auxiliary circuit L+/M (U1) • From auxiliary circuit A1/A2 (U2)	 mA	 Approx. 20 --	
Rated operational current for power bus I_e	A	25	
Rated operational voltage U_e	V	400	
Approval to EN 61140	V	Up to 500	
CSA and UL approval	V	Up to 600	
Conductor cross-sections Incoming energy supply	 mm^2	 Max. 6 x 4	
Degree of protection		IP65	
Touch protection		Finger-safe	
Degree of pollution		3, IEC 60664 (IEC 61131)	
Rated impulse withstand voltage U_{imp}	kV	6	
Rated insulation voltage U_i	V	400	
Rated operational current for starter I_e • AC-1/2/3 at 40 °C - At 400 V - At 500 V	 A A	 16 16	 25 25
Rated short-circuit breaking capacity	kA	50 at 400 V	
Type of coordination to IEC 60947-4-1		2	
Protective separation between main and auxiliary circuits	V	400, acc. to EN 61140	
Operating times at 0.85 ... 1.1 x U_e • Closing time • Opening delay	 ms ms	 -- --	 25 ... 100 7 ... 10
Device functions • Group diagnostics		 Yes, parameterizable	
Device indications • Group fault		 SF LED (red)	

General data

Overview

The AS-Interface compact starter is a load feeder with degree of protection IP65, which is fully prewired inside, for switching and protecting any AC loads up to 5.5 kW at 400/500 V AC (electromechanical compact starter) or up to 2.2 kW (solid-state compact starter) – mostly standard induction motors in direct start and reversing duty. It consists either of an electromechanical controlgear combination or a solid-state overload protection and switching unit. The overload or short-circuit protection is located below a sealable, transparent cover and is therefore available for diagnostics. Two LEDs are provided to the left of the cover for diagnostics purposes for the AS-Interface and the auxiliary power.

It is not possible for live parts to be touched even when the cover is open. The contacts are activated through the integrated outputs. The status of the device is scanned through the inputs, e. g. feedbacks from the auxiliary contacts of the motor starter protector and contactor(s). A further input is used to detect the operating mode of the optional hand-held device. The three power connectors are used to feed and loop through to the load supply voltage (power bus) and to connect to the load itself. Prefabricated power supply cables can be used to connect compact starters which are directly adjacent to each other. Prefabricated power supply lines can be used to connect compact starters which are directly adjacent to each other. The maximum number of starters that can be supplied with one power supply cable is limited by the maximum permissible summation current (up to max. 4 mm^2 corresponds to ~ 35 A).

DS/RS compact starters (electromechanical)

The electromechanical compact starters consist of a conventional controlgear combination with a SIRIUS motor starter protector for protection against short-circuits and overloading and SIRIUS contactor(s) for normal switching. The advantages of the electromechanical starters are the reliable isolation during disconnection and tripping, the integrated fuseless protection against short-circuits and the favorable price. What is more, direct currents can also be switched with the electromechanical starters.

Configuring note:
In the case of temperature-critical applications, we recommend operation in the lower setting range of the motor starter protector.

EDS/ERS compact starters (solid-state)

The solid-state compact starters EDS (direct-on-line starter) and ERS (reversing starter) consist of a solid-state overload relay and a solid-state motor starter protector unit.

The advantages of these solid-state compact starters are the broad limits within which the overload protection can be adjusted (the performance range up to 2.2 kW at 400/500 V AC is covered with just 2 versions), the fact that the switching units are non-wearing, current measurement (used for monitoring the energy connector), emergency operation in the event of an overload as well as remote resetting via the AS-Interface after overload tripping.

The ERS compact starter is designed for direct start in reversing duty. The solid-state overload protection and the shutdown response in the event of overload can be adjusted directly at the device.

Version with brake contact

All compact starters are available optionally with a separately activated brake contact for electrically operated motor brakes. For externally fed motor brakes, 24 V DC is supplied jointly with the load voltage through the power connector on -X1. It is looped through via -X3 for supplying the next compact starter on -X1. The 24 V DC supply for the brakes is only linked in those devices equipped with a brake contact. At the project configuration stage, it is important to ensure that these starters are located alongside each other.

All compact starters with a brake contact for 500 V DC can be equipped with an 400 AC brake contact.

Hand-held device

The hand-held device enables the compact starter to be operated locally and autonomously, providing that the auxiliary voltage supply is connected. Thus, assuming that the automation level is functioning correctly, local switching operations can be carried out in addition to normal manual operations in the event of a programmable controller / bus system failure (emergency mode) or during test runs before commissioning, e. g. for testing the direction of rotation of the motor. The hand-held device can be connected to the compact starter by means of a connecting cable through a socket underneath the transparent cover.

Spare inputs

The compact starters are also equipped with two spare inputs.

The M12 socket is a "Y" connector. The signal inputs are applied to PIN 2 and 4. In this manner, it is possible, for example, to connect an optical proximity switch that supplies a signal and the "contamination" alarm.

A "T" adapter can be used to split the signal inputs onto two M12 sockets. Compact starters modified in this way offer additional advantages. At no extra cost, it is possible to save AS-Interface addresses, reduce the space requirement and to build up logical groupings.

Design

Wiring and mounting

All terminals are for plugging in or designed for the user-friendly insulation piercing method.

The shaped flat cable for the 24 V load voltage to actuate the contactors must simply be inserted (like the AS-Interface data line) in a mounting plate. Then the compact starter is hung in the mounting plate and screwed tight. Compact starters and mounting plates must be ordered separately. The energy for the main circuit is supplied through power connectors which must also be ordered separately (see "Accessories" in "Selection and ordering data").

The load itself and other compact starters are supplied with the help of the same connector system. This enables all supply and data lines to be routed like a bus through the installation. While the switching devices are switched by the load voltage through the outputs, the inputs are supplied through the AS-Interface data line. With this separate auxiliary voltage supply it is easy to implement selective Emergency-Stop concepts.

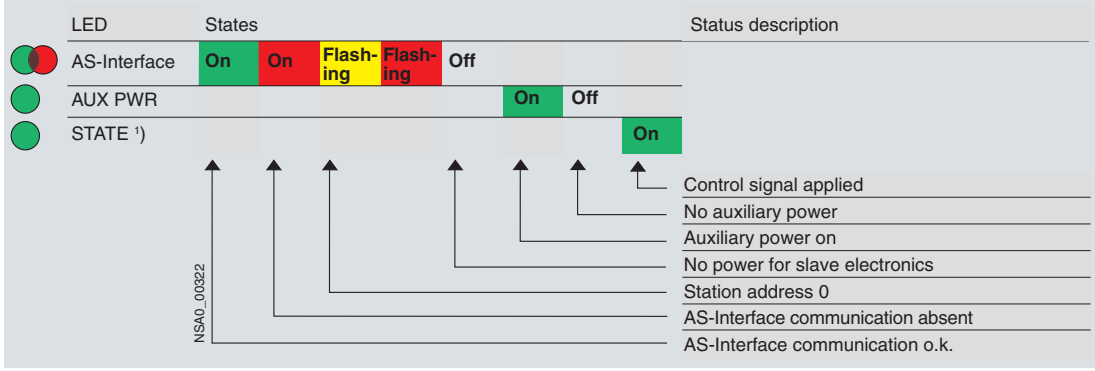
Addressing

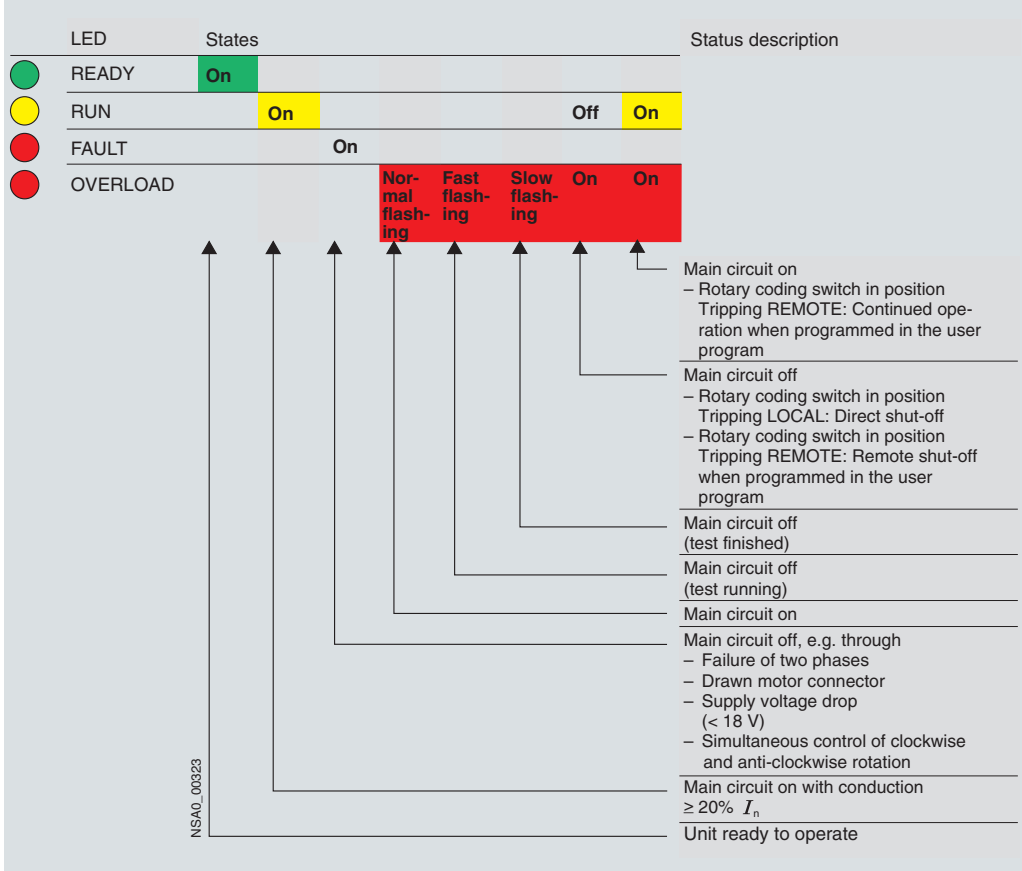
The addressing of the AS-Interface compact starter is also possible in the fully wired state. When the addressing cable is plugged into the addressing socket, the starter is separated from the AS-Interface network.

Function

Indication behavior

During operation, the LEDs on the compact starter indicate the following device states:





General data

Diagnostics of the electromechanical compact starters via the user program

The input and output signals of the electromechanical compact starters DS2E and RS2E can be evaluated in the user program.

Output DO2 is actuated only in the case of versions with brake contact.

The I/O assignment corresponds to the AS-Interface motor starter profile 7D.

Note:
The brake contact is controlled through the bus separately to the main circuit. The non-synchronous switching of motor and brake is thus possible. Therefore, steps must be taken in the user program to ensure that no dangerous plant states can arise, e. g. unwanted freewheeling or blocking of the motor. This also applies to local disconnections, e. g. by overload tripping. The DI0 input signal can be used to check the device state.

Inputs

Input signals			Device status	Meaning
DI0	"Ready"	0	Device not ready/error	**Manual operation** Device was switched locally to manual operation (use the hand-held device to switch back to automatic mode). **Overload and short-circuit release** Reclosing of the motor starter protector after a cooling phase. **FAULT signal** • Coil defective. • Contacts welded. • Output driver defective (contactor must be tested). • Simultaneous switching of clockwise and counterclockwise operation (user program must be checked).
		1	Device ready/automatic mode	--
DI1	"Running"	0	Contactor off	--
		1	Contactor on	--
DI2	"Special information 1"	0	No input signal IN1	--
		1	Input signal IN1	--
DI3	"Special information 2"	0	No input signal IN2	--
		1	Input signal IN2	--

Outputs

Output signals			Device status	Meaning
DO0	"Run forward"	0	Clockwise off	--
		1	Clockwise on	--
DO1	"Run reserve"	0	Counterclockwise off	--
		1	Counterclockwise on	--
DO2	"Special command 1"	0	Open brake contact	--
		1	Close brake contact	--
DI3	"Special command 2"	0	--	--
		1	--	--

Diagnostics of the solid-state compact starters via the user program

The input and output signals of the solid-state compact starters EDS2E and ERS2E can be evaluated in the user program.

Output DO2 is actuated only in the case of versions with brake contact.

The I/O assignment corresponds to the AS-Interface motor starter profile 7E.

Note:
The brake contact is controlled through the bus separately to the main circuit. The non-synchronous switching of motor and brake is thus possible. Therefore, steps must be taken in the user program to ensure that no dangerous plant states can arise, e. g. unwanted freewheeling or blocking of the motor. This also applies to local disconnections, e. g. by overload tripping. The DI0 input signal can be used to check the device state.

Inputs

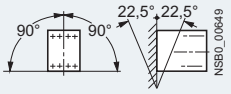
Input signals			Device status	Meaning
DI0	"Ready"	0	Device not ready/error	**Manual operation** Device was switched locally to manual operation (use the hand-held device to switch back to automatic mode). **Tripped signal** Rotary coding switch in position • Tripping LOCAL: direct switching off • Tripping REMOTE: remote switching off or continued operation when programmed accordingly in the user program **FAULT signal** • No current flow due to - Failure of two phases - Disconnected motor connector - Supply voltage dip (< 18 V) - Current unbalance limit exceeded - Fault in main circuit of the device • Device fault (reset after elimination of fault)
		1	Device ready/automatic mode	--
DI1	"Running"	0	No current flow	--
		1	Current flow exists	--
DI2	"Special information 1"	0	No input signal IN1	--
		1	Input signal IN1	--
DI3	"Special information 2"	0	No input signal IN2	--
		1	Input signal IN2	--

Outputs

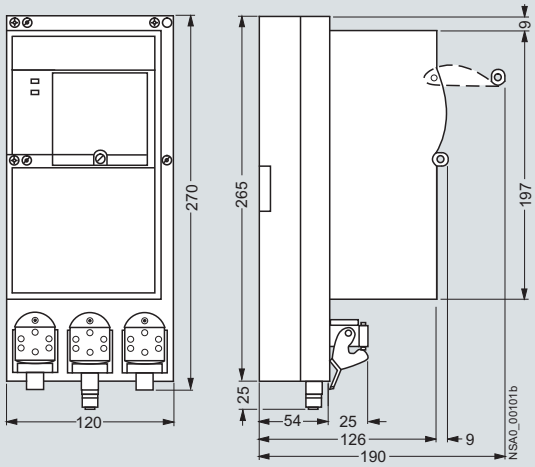
Output signals			Device status	Meaning
DO0	"Run forward"	0	Clockwise off	--
		1	Clockwise on	--
DO1	"Run reserve"	0	Counterclockwise off	--
		1	Counterclockwise on	--
DO2	"Special command 1"	0	Open brake contact	--
		1	Close brake contact	--
DI3	"Special command 2"	0	Remote RESET off	--
		1	Remote RESET on	--

General data

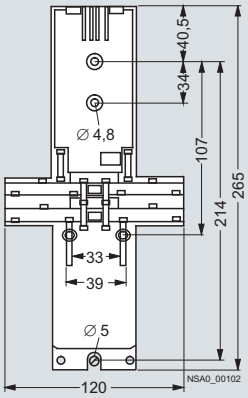
Technical specifications

		DS/RS	EDS/ERS
Degree of protection		IP65 (with closed connection elements and cover)	
Material		Thermoplast (glass-fiber reinforced)	
Color		Anthracite RAL 7016	
Cover		Latching, sealable	
Dimensions (W x H x D)	mm	120 × 265 × 134	
Temperature range			
• Operating temperature	°C	-25 ... +55; (note derating: see manual)	
• Storage temperature	°C	-40 ... +70	
Permissible mounting positions		 Important: acc. to DIN 43602 Start command "I" at the right or top	
Shock resistance			
Rectangular pulse	g/ms g/ms	2/unlimited, 10/5 or 5/10	
Sine pulse	g/ms g/ms	2/unlimited, 8/10 or 5/15	
External power supply			
For output supply (contactor control) **Rated operational voltage U_e**	V DC	24 (PELV – must be grounded)	
For electronics and inputs (feedback of controlgear states) **using AS-Interface data line**	V DC	26.5 ... 31.6 (acc. to AS-Interface Specification)	
I/O configuration	Hex	7	
ID code	Hex	D	E
AS-Interface power consumption	mA	Max. 100	
Power consumption U_{aux}	mA	Approx. 170	
Watchdog function (disconnects outputs in the event of AS-Interface fault)		Built-in	
Diagnostics			
Using AS-Interface		Feedback from motor starter protectors and contactor(s) through positively driven auxiliary contacts and separate inputs	
Through LED on the enclosure		Auxiliary voltage applied AS-Interface communication OK AS-Interface communication faulty Station address = 0 (module not addressed)	
Through LED on the hand-held device		On or Clockwise or Counterclockwise	
Main circuit			
Rated operational voltage	V AC	500 acc. to EN 61140, 600 acc. to CSA and UL	
Protective separation between main and auxiliary circuits (acc. to EN 61140)	V	Up to 400	--
Rated power	kW	5.5	2.2
Permissible operating modes		Uninterrupted duty, temporary duty, periodic duty, periodic intermittent duty (50 % relative ON period at 80 1/h at 5.5 A)	
Permissible switching frequency with a starting time t_A = 0.1 s and a relative ON period t_{OP} = 50 %	1/h	≤ 80	≤ 600
Trip class		Class 10	
Conductor cross-sections of power connector for infeed/feeder/9-pole loop	mm^2	≤ 4, AWG (15 ... 11)	
Max. permissible current through power connector (dependent on cable cross-section)			
• T_u = 60 °C	A A A	30 (4 mm^2), AWG (11); 20 (2.5 mm^2), AWG (15); 12 (1.5 mm^2), AWG (13)	
• T_u = 40 °C	A A A	35 (4 mm^2), AWG (11); 25 (2.5 mm^2), AWG (15); 15 (1.5 mm^2), AWG (13)	
Short-circuit strength of the starter combination	kA	65 (acc. to type of coordination "1")	100
Electrical endurance of the motor starter protector element under load I_a (AC-3)	Operating cycles	See endurance characteristic curves of the 3RT10 contactors	≥ 10 million

Dimensional drawings



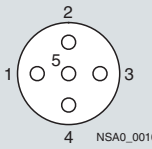
3RK1 322-..S.-.AA



3RK1 902-0AP00

Schematics

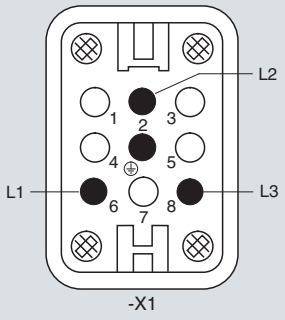
Connector assignment for digital inputs (Y assignment)



Pin 1: Supply L+
Pin 2: Signal input
Pin 3: Supply L–
Pin 4: Signal input
Pin 5: PE

Connector assignment for power connectors

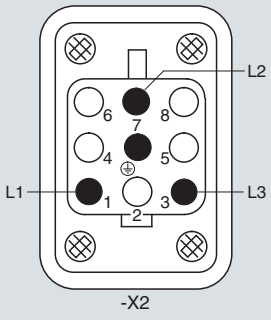
X1: Power infeed
(plug of the starter)



-X1

Pin 1: Not assigned
Pin 2: Phase L2
Pin 3: Spare
Pin 4: GND for brake[1] optional
Pin 5: + DC 24 V for brake[1] optional
Pin 6: Phase L1
Pin 7: Not assigned
Pin 8: Phase L3
Center: PE

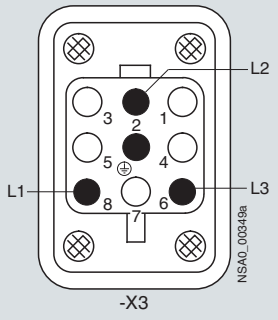
X2: Load feeder
(socket of the starter)



-X2

Pin 1: Phase L1
Pin 2: Not assigned
Pin 3: Phase L3
Pin 4: Brake output
Pin 5: Brake input
Pin 6: Not assigned
Pin 7: Phase L2
Pin 8: Not assigned
Center: PE

X3: Power loop-through connection
(socket of the starter)



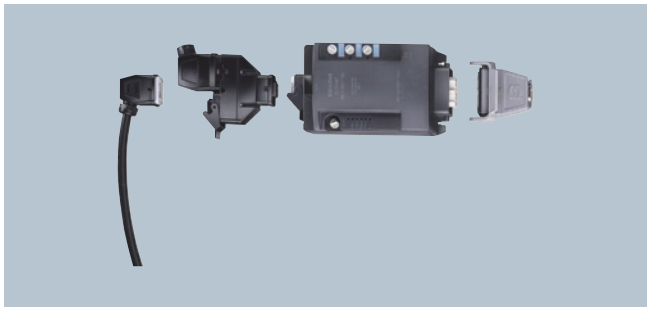
-X3

Pin 1: Not assigned
Pin 2: Phase L2
Pin 3: Spare
Pin 4: + DC 24 V for brake[1]
Pin 5: GND for brake[1]
Pin 6: Phase L3
Pin 7: Not assigned
Pin 8: Pin 1: Phase L1
Center: PE

1) Only for AS-Interface compact starters with DC 24 V brake contact (3RK1 322-..S..-.AA1).

3RK1 3 ECOFAST motor starters and soft starters

Overview



Distributed motor starters are used for switching and protecting loads locally. Versions with graded functional scope and with different installation possibilities ensure that both the functional requirements of the process and the constructional boundary conditions of the machine or installation are taken into account. Distributed motor starters are available for PROFIBUS DP and AS-Interface.

The starters can be installed close to the motor or mounted on the motor.

The following are available
- Single devices for geographically distributed motors and
- Isolated solutions (ET 200pro) for operating mechanisms installed close together.

The functionality in the ECOFAST system ranges from direct-online starters, to reversing starters and soft starters through to frequency converters.

Brake contacts are available as an option for the starters. Two or four integrated digital inputs enable sensors to be scanned locally.

All starters are equipped throughout with standardized interfaces for data and energy according to the ECOFAST specification:
- HanBrid for PROFIBUS DP and insulation piercing method for AS-Interface
- Han Q4 for the power supply
- Han 10e for motor connection

The starters can be connected using T pieces for data and T terminal connectors for power to prevent interruption.

The 3RK1 922-3BA00 hand-held device is also available for local operation (see Catalog LV 1, ET 200S Motor Starters).

Motor Starter ES software

The Motor Starter ES software is used the for parameterization, monitoring, diagnostics and testing of motor starters.
See Catalog LV 1, Chapter 12 "Planning and Configuration with SIRIUS".

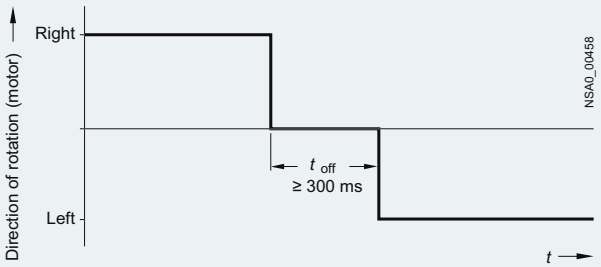
Technical specifications

		3RK1 3 ECOFAST motor starters
General data		
Location • Wall mounting • Mounting directly on the motor		On the plant Near the motor Motor plugged on
Mounting position		Any
Degree of protection		IP65
Safety class Acc. to IEC 61140		1, supply with protective extra-low voltage
Cooling		Convection, no addition cooling necessary
Weight • Reversing starters • Reversing soft starters	 kg kg	 1.4 1.9
Permissible ambient temperature • Operation - Reversing and reversing soft starters up to max. +55 °C • Storage/transport	 °C °C	 -20 ... +40; condensation not permitted! Over 40 °C: Reduction of I_e by 1.5 %/K -40 ... +80
Relative air humidity	%	5 ... 95; condensation not permitted!
Installation altitude, max.		2000 m; above 1000 m: Reduction of I_e by 1 %/100 m
Vibratory load		f = 5 ... 26 Hz; d = 0.75 mm: 10 cycles f = 26 ... 150 Hz; a = 2 *g*
Shock		a = 150 m/s^2 (15 *g*) with 11 ms, for every 3 shocks in all axes (=18)
ESD • Air discharge, acc. to IEC 61000-4-2, degree of severity 3 • Contact discharge	 kV kV	 8 6
Electromagnetic fields IEC 61000-4-3, degree of severity 3	V/m	10
BURST • Supply voltage, IEC 61000-4-4, degree of severity 3 • Data lines • Process lines	 kV/kHz kV/kHz kV/kHz	 2/5 1/5 2/5
Emitted interference, acc. to EN 55011		Limit value class A

		Unswitched voltage 24 V DC (AS-i)	Switched voltage 24 V DC (AUX PWR)
Auxiliary power			
External auxiliary power			
• PROFIBUS DP	V DC	20.4 ... 28.8 standard power supply unit acc. to DIN 19240	
• AS-Interface	V DC	23.0 ... 31.5 (AS-i)	20.4 ... 28.8 standard power supply unit acc. to DIN 19240 (PELV must be grounded)
Power consumption			
• Typical, inputs not connected	mA	80 (PROFIBUS DP)	--
	mA	60 (AS-Interface)	--
• Typical, switching element (contactor) activated	mA	--	75
• Typical, switching element (contactor) deactivated	mA	--	15
• Typical, with Duo reversing soft starters	mA	--	110
Pole reversal protection		Yes	
Short-circuit protection/overload protection		Yes Multifuse 0.5 A, self-restoring fuse Reset by Power-OFF	
Undervoltage detection (USP)	V DC	< 17	
Voltage failure bridging	ms	≤ 20, (device is not affected)	
Insulation voltage	V DC	500 between the auxiliary voltages and PE	

		3RK1 3 ECOFAST motor starters
Digital inputs		
Input voltage	V DC	20.4 ... 28.8
Power consumption		
• Typical, per input	mA	7
Sensor supply		
From AS-i, sensor supply is short-circuit resistant	mA	Max. 200
Brake output 400 V AC		
Voltage range	V AC	200 ... 460
• Tolerance	%	± 10
Current carrying capacity		
• AC-15	mA	500
Short-circuit protection		
Melting fuse, I_{Cu} = 1 kA	A	aM 1/500 V AC
Primary power		
Rated operational voltage	V AC	400
Tripping times acc. to IEC 60947-4-1 at 7.2 times I_e		
• Class 10	s	8, acc. to standard 4 ... 10
• Class 20	s	16
• Class 30	s	24
Rated insulation voltage acc. to IEC 60947-1	V AC	500
Rated impulse voltage acc. to IEC 60947-1	kV	4
Protective separation between auxiliary and primary power	V AC	300
Frequency	Hz	50 ... 60
• Tolerance	%	± 10
ON period	%	100
Utilization categories		1 (device destroyed after short-circuit)
Current measurement		
Measuring accuracy	%	± 7.5 of parameterized rated operational current
Measuring range		10 times the parameterized rated operational current

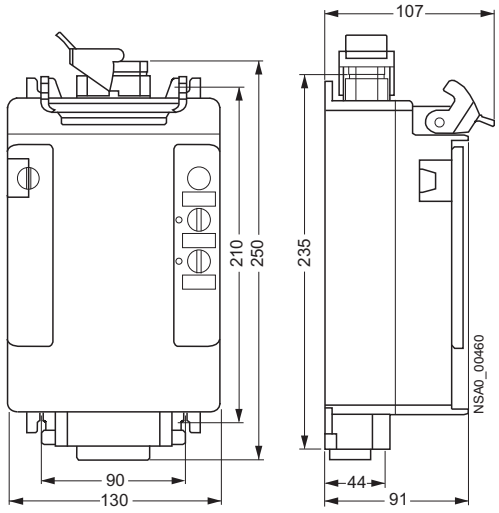
3RK1 3 ECOFAST motor starters and soft starters

		3RK1 3 ECOFAST motor starters		
		Mechanical switching	Solid-state switching of reversing soft starters	
Operational voltage	V AC	200 ... 460; 3-phase	200 ... 460; 3-phase	
• Tolerance	%	±10	±10	
Operational current			**Performance class**	
			3	**6**
• Class 10	A	0.3 ... 9	0.3 ... 3	2.4 ... 12
• Class 20	A	0.3 ... 7.3	0.3 ... 3	2.4 ... 7.3
• Class 30	A	0.3 ... 6.7	0.3 ... 3	2.4 ... 6.7
Operating mode				
Output				
• Voltage	V AC	--	--	
• Current	A	--	--	
• Frequency	Hz	--	--	
• Apparent power	kVA	--	--	
Pulse frequency		--	--	
Current limiting				
• Motorized/regenerative		--	--	
Braking resistance		--	--	
Switching capacity				
• AC-3	A	9.0	--	
• AC-53	A	--	3 (0.3 ... 3)	12 (2.4 ... 12)[1]
• AC-4	A	6.5	3 (0.3 ... 3)	12 (2.4 ... 12)[1]
Switching load		3-phase with contactor	2-phase with thyristors	
Max. heat sink temperature	°C	--	+80[2]	
Short-circuit protection		I_{Cu} = 120 kA	I_{Cu} = 120 kA	
Melting fuse	A	aM 16/500 V AC	aM 16/500 V AC	
Endurance of the switching element				
Per direction of rotation at 500 V AC				
•	Operating cycles	--	8×10^6	
• At I_e = 9.0 A	Operating cycles	0.4×10^6	--	
• At I_e = 4.5 A	Operating cycles	1.1×10^6	--	
• At I_e = 3.0 A	Operating cycles	2.5×10^6	--	
• At I_e = 1.5 A	Operating cycles	7.0×10^6	--	
Waiting time t_{off}	ms	≥300	≥500	
Time between opening command and the next closing command at a change of direction				

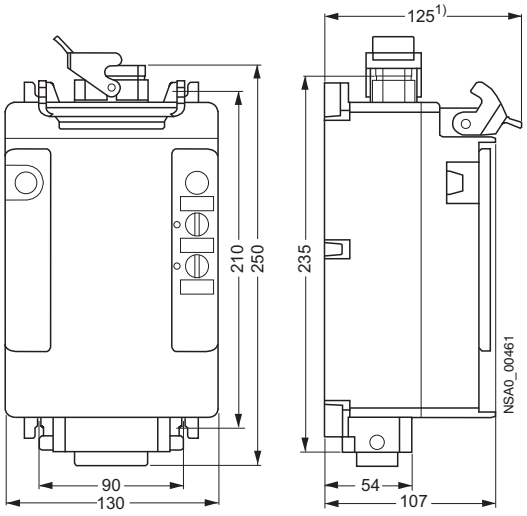
1) Max. 9 A when soft starter control function is deactivated.

2) The heat sink temperature is monitored; switch-off occurs if the maximum value is exceeded.

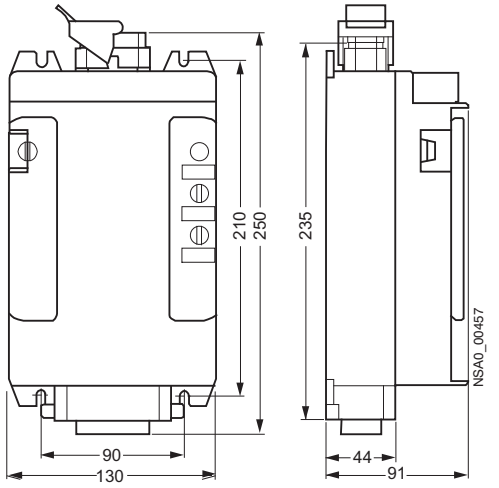
Dimensional drawings



Reversing starter PROFIBUS DP with plastic base



Reversing soft starter with metal base



Reversing starter AS-Interface with plastic base

1) This dimension does not apply for motor starters with AS-Interface.

General data

Overview

The 3RE1 encapsulated starters are available as direct-on-line starters and as reversing starters.

Direct-on-line starter

The direct-on-line starters are available in three sizes:

- Size **S00** is suitable for induction motors up to 5.5 kW with 400 V AC and a maximum rated motor current of 12 A. The starters are available in the following two versions:
  - Molded-plastic enclosure for direct-on-line starters including contactor – in this case the overload relay must be selected and ordered according to the rated motor current.
  - Molded-plastic enclosure for direct-on-line starters (without contactor) – in this case the contactor and overload relay must be selected and ordered separately.
- Size **S0** is suitable for induction motors up to 11 kW with 400 V AC and a maximum rated motor current of 25 A. The starters are available in the following two versions:
  - Molded-plastic enclosure for direct-on-line starters including contactor – in this case the overload relay must be selected and ordered according to the rated motor current.
  - Molded-plastic enclosure for direct-on-line starters (without contactor) – in this case the contactor, auxiliary switch and overload relay must be selected and ordered separately.
- Size **S2** is suitable for induction motors up to 22 kW with 400 V AC and a maximum rated motor current of 50 A. The starters are available in the following versions:
  - Molded-plastic enclosure for direct-on-line starters (without contactor) – in this case the contactor, auxiliary switch and overload relay must be selected and ordered separately.

Reversing starter

The reversing starters are available in two sizes:

- Size **S00** is suitable for induction motors up to 5.5 kW with 400 V AC and a maximum rated motor current of 12 A. The starters are available in the following two versions:
  - Molded-plastic enclosure for reversing starters including contactor assembly – in this case the overload relay must be selected and ordered according to the rated motor current.
  - Molded-plastic enclosure for reversing starters (without contactor assembly) – in this case the contactor assembly, auxiliary switch and overload relay must be selected and ordered separately.
- Size **S0** is suitable for induction motors up to 11 kW with 400 V AC and a maximum rated motor current of 25 A. The starters are available in the following versions:
  - Molded-plastic enclosure for direct-on-line starters (without contactor assembly) – in this case the contactor assembly, auxiliary switch and overload relay must be selected and ordered separately.

Design

Components

The 3RE1 encapsulated starters consist of a 3RT10 contactor or 3RA13 contactor assembly (fully mounted) for switching, a 3RU11 thermal overload relay for inverse-time delayed protection, auxiliary switch(es) and molded-plastic enclosure including the necessary actuators.

Mounting options

There are two options for mounting the 3RE1 encapsulated starters:

- The first option is to use a 3RE10 direct-on-line starter or a 3RE13 reversing starter consisting of a molded-plastic enclosure with actuators, integrated contactor or integrated contactor assembly and auxiliary switches. Only the overload relay (to be ordered separately) needs to be mounted on the contactor or contactor assembly. Wiring is carried out quickly and easily according to the schematics thanks to prefabricated cabling.
- The second option is to use a 3RE19 molded-plastic enclosure with integrated actuators. The contactor or contactor assembly, which is available fully mounted or in the form of individual components for self-assembly, the auxiliary switches (in the case of the size S00 direct-on-line starter these are already integrated in the contactor) and the overload relay must be ordered separately. In this case, too, the overload relay is mounted directly on the contactor or contactor assembly and wired up. The complete assembly is snapped onto the standard mounting rail in the molded-plastic enclosure.

In the case of the second mounting option, the following components must be ordered:

	Components for mounting	Size	Order No.	Number	Alternative components for mounting	Size	Order No.	Number
Direct-on-line starters Size S00	Molded-plastic enclosure	S00	3RE19 13-1CB1	1				
	Contactor with integrated auxiliary switch 1 NO	S00	3RT10 1.-....1	1				
	Thermal overload relay	S00	3RU11 16	1				
Direct-on-line starters Size S0	Molded-plastic enclosure	S0	3RE19 23-1CB2	1				
	Contactors	S0	3RT10 2	1				
	Thermal overload relay	S0	3RU11 26	1				
	Lateral auxiliary switches 1 NO/1 NC	--	3RH19 21-1DA11	1				
Direct-on-line starters Size S2	Molded-plastic enclosure	S2	3RE19 33-1CB3	1				
	Contactors	S2	3RT10 3	1				
	Thermal overload relay	S2	3RU11 36	1				
	Lateral auxiliary switches 1 NO/1 NC	--	3RH19 21-1DA11	1				
Reversing starters Size S00	Molded-plastic enclosure	S00/S0	3RE19 13-2CB3	1				
	Contactors	S00	3RT10 1	2	Reversing contactor assembly	S00	3RA13 17-8XC17-0..	1
	Wiring kit for reversing contactor assemblies	S00	3RH19 13-2A	1				
	Thermal overload relay	S00	3RU11 16	1				
	Front auxiliary switches 1 NO	--	3RH19 11-1BA10	2				
Reversing starters Size S0	Molded-plastic enclosure	S00/S0	3RE19 13-2CB3	1				
	Contactors	S0	3RT10 2	2	Reversing contactor assembly	S0	3RA13 2.-8XB30-0..	1
	Wiring kit for reversing contactor assemblies	S0	3RH19 23-2A	1				
	Mechanical interlock	--	3RH19 24-2B	1				
	Thermal overload relay	S00	3RU11 26	1				
	Front auxiliary switches 1 NO	--	3RH19 21-1CA10	2				

Function

The 3RE1 encapsulated starters, which are available as direct-on-line starters and reversing starters, are used for the switching and inverse-time delayed protection of loads. The switching of loads is taken care of by 3RT10 contactors. Inverse-time delayed protection is achieved with 3RU11 thermal overload relays.

These starter combinations consisting of a contactor or contactors and overload relay(s) are contained in a molded-plastic enclosure that provides effective protection against dust and splashwater with its high degree of protection IP65. This high degree of protection also applies to the actuators, which are used for manual switching on and off locally.

Control circuit

The encapsulated starters including contactor or contactor assembly are available with the following rated control supply voltages:

- Size S00: 230 V, 50/60 Hz and 400 V, 50/60 Hz
- Size S0: 230 V, 50 Hz and 400 V, 50 Hz

Short-circuit protection

Fuses (fused construction) or motor starter protectors (fuseless construction) are to be used for short-circuit protection.

Details of the assignment of appropriate short-circuit devices for the combinations of 3RT contactor with 3RU11 thermal overload relay are given in the technical specifications.

When the load feeders are selected from the table, the types of coordination must also be taken into account.

Overload protection

Detailed information about the 3RU11 thermal overload relays (e. g. about recovery time, trip classes, tripping characteristics and phase failure protection) is given in the corresponding sections relating to Protection Equipment: Overload relays -> 3RU1 thermal overload relays.

Manual/automatic resetting

In the case of the size S00 and S0 direct-on-line starters, a choice can be made between automatic and manual resetting on the overload relay. If manual resetting is chosen, the black button (O) is also the reset button. This button must be actuated after an overload trip before the load can be restarted.

The only type of resetting possible with the other starters is an automatic reset.

Details about setting the overload relays to automatic/manual resetting are given in the corresponding section describing the overload relays.

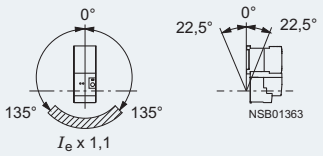
Switching on and off

With the direct-on-line starters, the load is switched on using the white button (I). The black button (O) is used for switching the load off.

With the reversing starters, the load can be started in the relevant direction of rotation by turning the upper switch clockwise or anticlockwise, as appropriate. The direction of rotation can be changed by pressing the black button (O).

General data

Technical specifications

		3RE1. 10 3RE19 13	3RE1. 20 3RE19 23	3RE1. 30 3RE19 33
General data				
Standards • IEC 60947-1, EN 60947-1 • IEC 60947-5, EN 60947-5 • IEC 60947-2, EN 60947-2		 Yes Yes Yes		
Size		S00	S0	S0
Max. rated current $I_{n\ max}$ = (Max. rated operational current I_e)	A	12	25	50
Rated insulation voltage U_i (degree of pollution 3)	V	400		
Rated impulse withstand voltage U_{imp}	kV	4		
Ambient temperature • Operation • Storage	 °C °C	 -20 ... +35 (current reduction is necessary above +35 °C) -55 ... +80		
Degree of protection acc. to IEC 60947-1		IP65		
Touch protection acc. to EN 50274		Finger-safe		
Installation altitude	m	Up to 2000 above sea level; above this, please enquire		
Permissible rated current I_n • Overload relay for ambient temperature: +35 °C • Overload relay for ambient temperature: +45 °C	 % %	 100 87		
Mounting position		For installation in the hatched area, a setting correction of 10 % must be implemented.  Contactor + overload relay		
Conductor cross-sections		1)		
Short-circuit protection				
Main circuit		2)		
Auxiliary circuit		1)		

1) See Chapter 5, "Protection Equipment" –> "Overload Relays" –> "3RU1 Thermal Overload Relays".

2) When using the 3RU11 thermal overload relays, see "Selection of Overload Relays and Short-Circuit Protection", pages 6/155 and 6/156.

Selection of overload relays and short-circuit protection

With short-circuit currents up to 50 kA at 400 V, 50/60 Hz
Permissible short-circuit protection for encapsulated motor starters comprising contactor/contactor assembly and overload relay

Size S00

Setting range	3RU11 thermal overload relay	Fuses for type of coordination "1"[1] ToC 1		Fuses for type of coordination "2"[1] ToC 2		Motor starter protectors for type of coordination "2"[1] ToC 2
		5.5 kW = 3RE1. 10-8XC17 (3RT10 17 contactor) $I_{e\ max}$ = 12 A (at 400 V, 50/60 Hz)		5.5 kW = 3RE1. 10-8XC17 (3RT10 17 contactor) $I_{e\ max}$ = 12 A (at 400 V, 50/60 Hz)		at I_q = 50 kA/400 V, 50/60 Hz
		gL/gG	BS88	gL/gG	BS88	
A		A	A	A	A	
0.11 ... 0.16	3RU11 16-0AB0	25	25	0.5	--	--
0.14 ... 0.2	3RU11 16-0BB0	25	25	1	--	3RV13 21-0BC10
0.18 ... 0.25	3RU11 16-0CB0	25	25	1	--	3RV13 21-0CC10
0.22 ... 0.32	3RU11 16-0DB0	25	25	1.6	2	3RV13 21-0DC10
0.28 ... 0.4	3RU11 16-0EB0	25	25	2	2	3RV13 21-0EC10
0.35 ... 0.5	3RU11 16-0FB0	25	25	2	2	3RV13 21-0FC10
0.45 ... 0.63	3RU11 16-0GB0	25	25	2	4	3RV13 21-0GC10
0.55 ... 0.8	3RU11 16-0HB0	25	25	4	4	3RV13 21-0HC10
0.7 ... 1	3RU11 16-0JB0	25	25	4	6	3RV13 21-0JC10
0.9 ... 1.25	3RU11 16-0KB0	25	25	4	6	3RV13 21-0KC10
1.1 ... 1.6	3RU11 16-1AB0	35	35	6	10	3RV13 21-1AC10
1.4 ... 2	3RU11 16-1BB0	35	35	6	10	3RV13 21-1BC10
1.8 ... 2.5	3RU11 16-1CB0	35	35	10	10	--
2.2 ... 3.2	3RU11 16-1DB0	35	35	10	16	--
2.8 ... 4	3RU11 16-1EB0	35	35	16	16	--
3.5 ... 5	3RU11 16-1FB0	35	35	20	20	--
4.5 ... 6.3	3RU11 16-1GB0	35	35	20	20	--
5.5 ... 8	3RU11 16-1HB0	35	35	20	20	--
7 ... 10	3RU11 16-1JB0	35	35	20	20	--
9 ... 12	3RU11 16-1KB0	35	35	--	--	--

Size S0

Setting range	3RU11 thermal overload relay	Fuses for type of coordination "1"[1] ToC 1				Fuses for type of coordination "2"[1] ToC 2				Motor starter protectors for type of coordination "2"[1] ToC 2
		7.5 kW = 3RE1. 20-8XC25 (3RT10 25 contactor) $I_{e\ max}$ = 17 A (at 400 V, 50/60 Hz)		11 kW = 3RE1. 20-8XC26 (3RT10 26 contactor) $I_{e\ max}$ = 25 A		7.5 kW = 3RE1. 20-8XC25 (3RT10 25 contactor) $I_{e\ max}$ = 17 A (at 400 V, 50/60 Hz)		11 kW = 3RE1. 20-8XC26 (3RT10 26 contactor) $I_{e\ max}$ = 25 A		at I_q = 50 kA/400 V, 50/60 Hz
		gL/gG	BS88	gL/gG	BS88	gL/gG	BS88	gL/gG	BS88	
A		A	A	A	A	A	A	A	A	
1.8 ... 2.5	3RU11 26-1CB0	63	63	63	63	10	10	10	10	3RV13 21-1CC10
2.2 ... 3.2	3RU11 26-1DB0	63	63	63	63	10	16	10	16	3RV13 21-1DC10
2.8 ... 4	3RU11 26-1EB0	63	63	63	63	16	16	16	16	3RV13 21-1EC10
3.5 ... 5	3RU11 26-1FB0	63	63	63	63	20	20	20	20	3RV13 21-1FC10
4.5 ... 6.3	3RU11 26-1GB0	63	63	63	63	20	25	20	25	3RV13 21-1GC10
5.5 ... 8	3RU11 26-1HB0	63	63	63	63	25	32	25	32	3RV13 21-1HC10
7 ... 10	3RU11 26-1JB0	63	63	63	63	25	32	32	35	3RV13 21-1JC10
9 ... 12.5	3RU11 26-1KB0	63	63	63	63	25	32	35	35	3RV13 21-1KC10
11 ... 16	3RU11 26-4AB0	63	63	63	63	25	32	35	35	3RV13 21-4AC10
14 ... 20	3RU11 26-4BB0	63	63	63	63	25	32	35	35	3RV13 21-4BC10
17 ... 22	3RU11 26-4CB0	--	--	100	100	--	--	35	35	3RV13 21-4CC10
20 ... 25	3RU11 26-4DB0	--	--	100	100	--	--	35	35	--

[1] Coordination and short-circuit equipment according to EN 60947-4-1:
Type of coordination "1": In the short-circuit case, the contactor or starter must not put equipment or personnel at risk. They do not have to be suitable for further operation (without repair and the replacement of parts).

Type of coordination "2": In the short-circuit case, the contactor or starter must not put equipment or personnel at risk. They must be capable of further operation. There is a risk of contact welding.

General data

Size S2

Setting range	3RU11 thermal overload relay	Fuses for type of coordination "1"[1] ToC 1						Fuses for type of coordination "2"[1] ToC 2						Motor starter protectors for type of coordination "2"[1] ToC 2
		15 kW = 3RT10 34 $I_{e\ max}$ = 32 A (at 400 V, 50/60 Hz)		18.5 kW = 3RT10 35 $I_{e\ max}$ = 40 A (at 400 V, 50/60 Hz)		22 kW = 3RT10 36 $I_{e\ max}$ = 50 A (at 400 V, 50/60 Hz)		15 kW = 3RT10 34 $I_{e\ max}$ = 32 A (at 400 V, 50/60 Hz)		18.5 kW = 3RT10 35 $I_{e\ max}$ = 40 A (at 400 V, 50/60 Hz)		22 kW = 3RT10 36 $I_{e\ max}$ = 50 A (at 400 V, 50/60 Hz)		at I_q = 50 kA/ 400 V, 50/60 Hz
		gL/gG	BS88	gL/gG	BS88	gL/gG	BS88	gL/gG	BS88	gL/gG	BS88	gL/gG	BS88	
A		A	A	A	A	A	A	A	A	A	A	A	A	
5.5 ... 8	3RU11 36-1HB0	125	125	125	125	125	125	25	25	25	25	25	25	--
7 ... 10	3RU11 36-1JB0	125	125	125	125	125	125	32	32	32	32	32	32	--
9 ... 12.5	3RU11 36-1KB0	125	125	125	125	125	125	35	35	35	35	35	35	--
11 ... 16	3RU11 36-4AB0	125	125	125	125	125	125	40	40	40	40	40	40	--
14 ... 20	3RU11 36-4BB0	125	125	125	125	125	125	50	50	50	50	50	50	--
18 ... 25	3RU11 36-4DB0	125	125	125	125	125	125	63	63	63	63	63	63	3RV13 31-4DC10
22 ... 32	3RU11 36-4EB0	125	125	125	125	125	125	63	63	63	63	80	80	3RV13 31-4EC10
28 ... 40	3RU11 36-4FB0	125	125	125	125	125	125	63	63	63	63	80	80	3RV13 31-4FC10
36 ... 45	3RU11 36-4GB0	--	--	125	125	125	125	--	--	63	80	80	80	3RV13 31-4GC10
40 ... 50	3RU11 36-4HB0	--	--	--	--	160	160	--	--	--	--	80	80	3RV13 31-4HC10

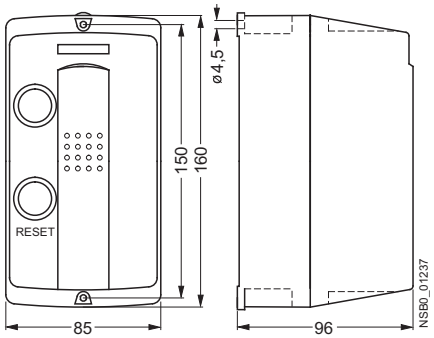
[1] Coordination and short-circuit equipment according to EN 60947-4-1:
Type of coordination "1": In the short-circuit case, the contactor or starter must not put equipment or personnel at risk. They do not have to be suitable for further operation (without repair and the replacement of parts).

Type of coordination "2": In the short-circuit case, the contactor or starter must not put equipment or personnel at risk. They must be capable of further operation. There is a risk of contact welding.

Dimensional drawings

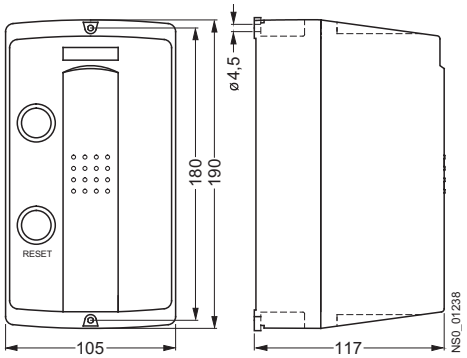
Direct-on-line starter, size S00

3RE10 10
3RE19 13-1CB1
Metric cable gland M25



Direct-on-line starter, size S0

3RE10 20
3RE19 23-1CB2
Metric cable gland M25

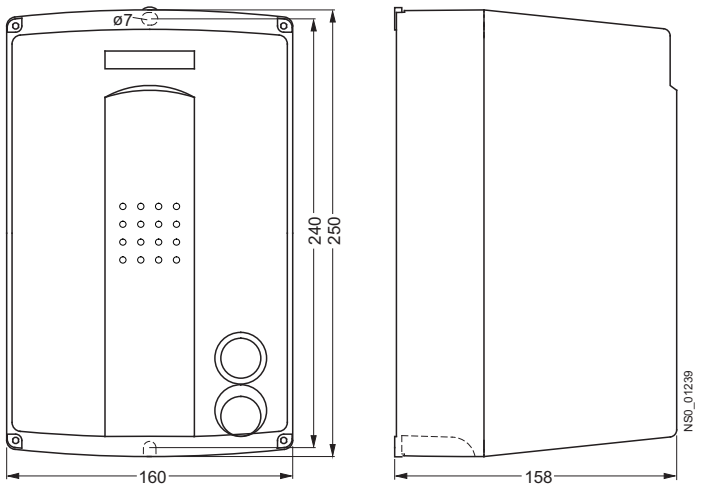


Direct-on-line starter, size S2

3RE19 33-1CB3

Reversing starter, size S00/S0

3RE13 10, 3RE19 23-2CB3
Metric cable gland M32

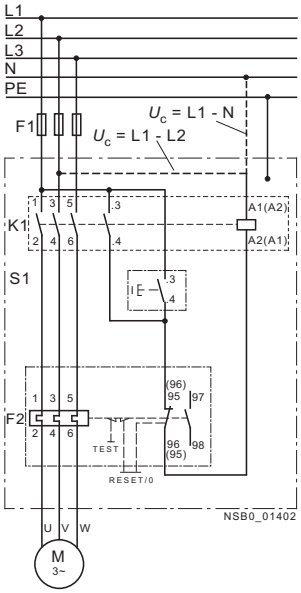


Schematics

Direct-on-line starter, size S00/S0

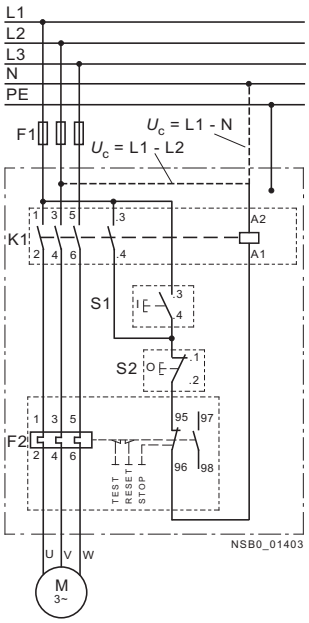
3RE10 10

3RE10 20
3RE19 13-1CB1 (see Accessories)
3RE19 23-1CB2 (see Accessories)



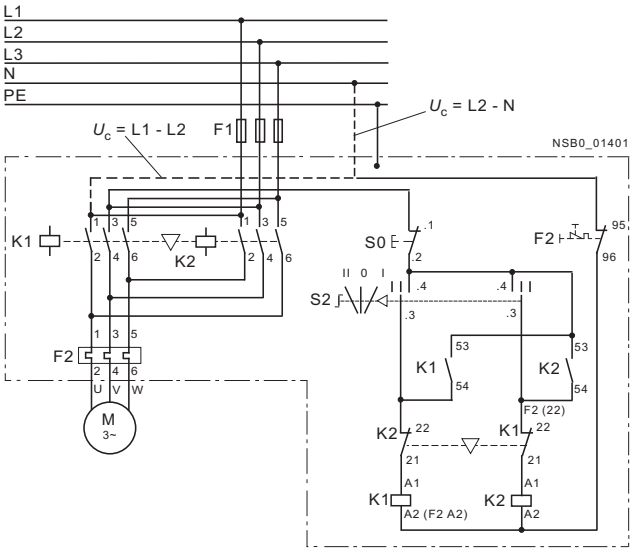
Direct-on-line starter, size S2

3RE19 33-1CB3 (see Accessories)



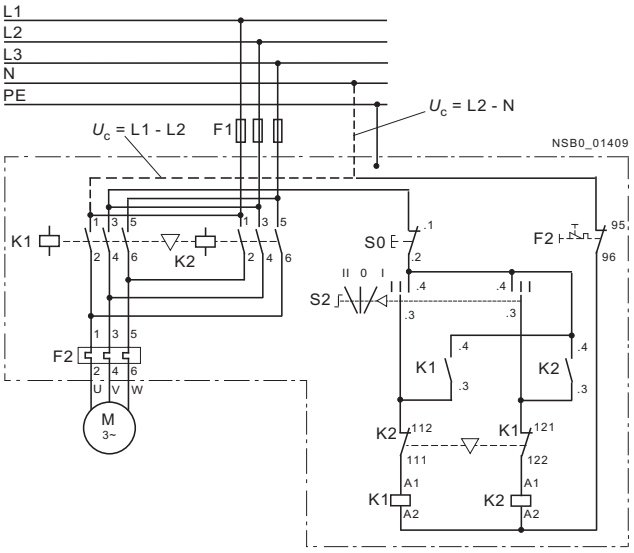
Reversing starter, size S00

3RE13 10
3RE19 13-2CB3 (see Accessories)

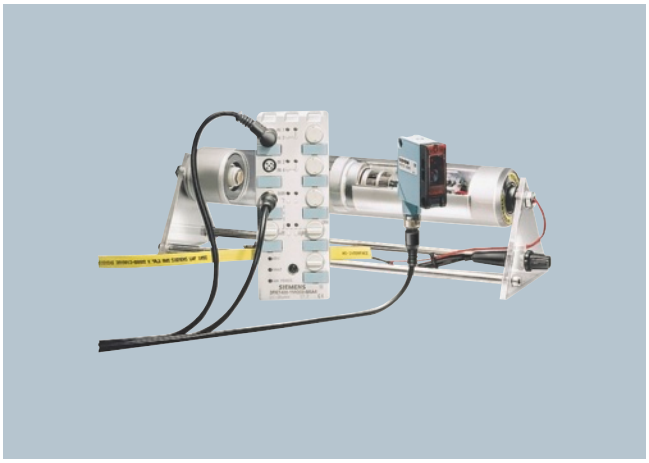


Reversing starter, size S0

3RE19 13-2CB3



Overview



Connection of an actuator roller with integrated DC motor to an AS-Interface 24 V DC motor starter

With the K60 AS-Interface 24 V DC motor starters for the low-end performance range up to 70 W, it is now possible to connect 24 V DC motors and the associated sensors directly to the AS-Interface quickly and easily.

Three different versions are available:

- Single direct-on-line starters (without brake and reversible quick-stop function)
- Double direct-on-line starters (with brake and reversible quick-stop function)
- Reversing starters (with brake and reversible quick-stop function)

DC motors are connected to the module using M12 plug-in connections. The sensors and the module electronics can be supplied from the yellow AS-Interface cable. An auxiliary voltage (24 V DC) is only required for supplying the outputs, which can be provided via the black AS-Interface cable.

Quick-stop function

All AS-Interface 24 V DC motor starters feature a quick-stop function which can be switched on and off as required using a switch integrated into the module. The quick-stop function allows a connected motor to be disconnected immediately using an applied sensor signal (High). The switch for the quick-stop function is located alongside the input sockets and is protected by an M12 sealing cap.

Brake

The double direct-on-line starter and the single reversing starter versions feature an integrated permanently set brake function, i. e. as soon as the output signal is set to "0", the motor is braked.

Start-up using integrated buttons

Buttons integrated into the module (below the output sockets) can be used to set the motor used. The buttons are protected by an M12 sealing cap.

Note:
Concerning double and reversing starters: *If an input with the quick-stop function receives a "High" signal, the corresponding output (e. g. quick-stop input 1 → output 1) is switched off within the device (the motor is braked). The manual key function (Key 1/2) for local operation is only permitted to be used during "CPU Stop" in the higher-level PLC.*

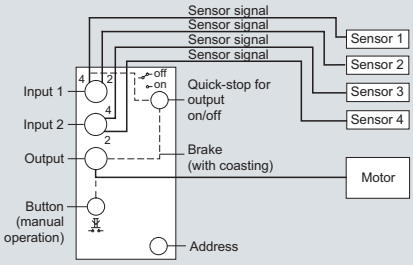
Note:
Concerning single direct-on-line starters: *If an input with the quick-stop function receives a "High" signal, the corresponding output (e. g. quick-stop input 1 → output 1) is switched off within the device (the motor runs down without being braked) The manual key function (Key 1) for local operation is only permitted to be used during "CPU Stop" in the higher-level PLC.*

Motor starters, 24 V DC

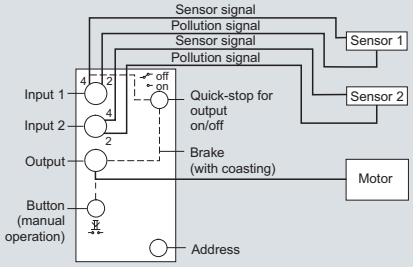
Applications

Single direct starter without brake
(with adjustable quick-stop function)

1st possibility: Connection to a maximum of four sensors without pollution indication

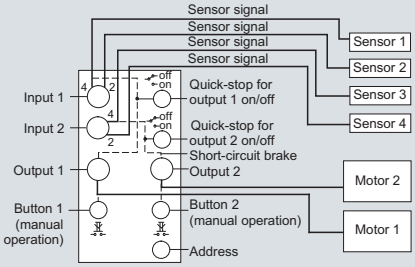


2nd possibility: Connection to a maximum of two sensors with pollution indication

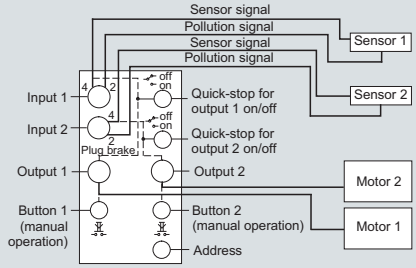


Double direct starter with brake
(with adjustable quick-stop function)

1st possibility: Connection to a maximum of four sensors without pollution indication

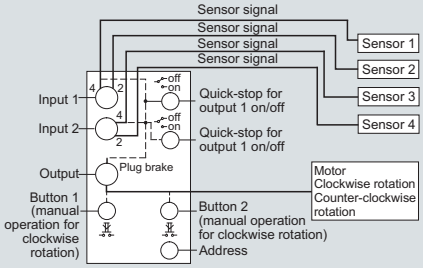


2nd possibility: Connection to a maximum of two sensors with pollution indication

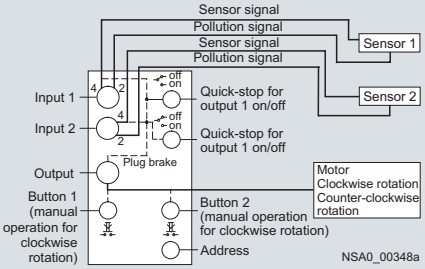


Single reversing starter with brake
(with adjustable quick-stop function)

1st possibility: Connection to a maximum of four sensors without pollution indication



2nd possibility: Connection to a maximum of two sensors with pollution indication

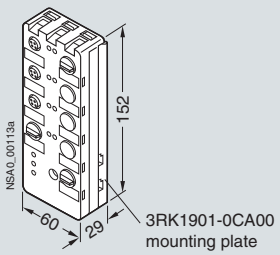


Technical specifications

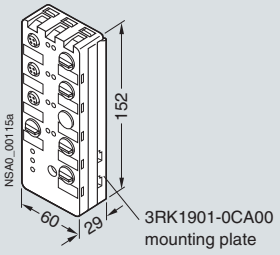
		Single direct-on-line starters 4 inputs 1 output Quick-stop function	Double direct-on-line starters 4 inputs 2 outputs Quick-stop function	Single reversing starters 4 inputs 1 output Quick-stop function
		3RK1 400-1NQ01-0AA4	**3RK1 400-1MQ01-0AA4**	**3RK1 400-1MQ03-0AA4**
Slave type		Standard slave		
Operational voltage acc. to AS-Interface specification	V	26.5 ... 31.5		
Total current input from AS-Interface	mA	≤ 270		
Input circuit		PNP		
Inputs				
• Sensor supply using AS-Interface		Short-circuit and overload resistant		
• Sensors		3-wire		
• Voltage range	V	20 ... 30		
• Current carrying capacity for sensor supply	mA	200 (T_u ≤ 40 °C)/150 (T_u ≤ 55 °C)		
• Switching level High	V	≥10		
• Switching level Low	V	≤ 5		
• Socket assignment		1 = Sensor supply L+ 2 = Data input 3 = Sensor supply L- 4 = Data input/quick-stop function 5 = Ground terminal		
• External power supply 24 V DC		Using black AS-Interface flat cable		
• Max. starting ramp time for DC motors	ms	80		
• Max. motor starting current (limited in the module)	A	4.5		
Outputs				
• Type of output		Solid-state		
• Rated current carrying capacity per output typical	A	3 (T_u ≤ 55 °C)	1 x 3 (T_u ≤ 55 °C)	2.5 (T_u ≤ 55 °C)
		--	2 x 2 (T_u ≤ 55 °C)	--
• Maximum summation current per module	A	--	4	--
• Voltage drop (without feeder cable)	V	0,6		1,2
• Short-circuit protection		Built-in		
• Induction protection		Built-in		
• Watchdog		Built-in		
I/O configuration	Hex	7		
ID code	Hex	F		
Assignment of data bits				
• Socket 1		PIN 4 = IN1 (D0/quick-stop1)PIN 2 = IN2 (D1)		
• Socket 2		PIN 4 = IN3(D2) PIN 2 = IN4(D3)	PIN 4 = IN3 (D2/quick-stop2) PIN 2 = IN4 (D3)	
• Socket 3		PIN 4 = OUT1 (D0)	PIN 4 = OUT1 (D0)	PIN2,4 = OUT1 (D0, D1)
• Socket 4		--	PIN 4 = OUT2(D1)	--
AS-Interface certificate		Yes		
Approvals		UL, CSA		
Degree of protection		IP67		
Ground terminal		Yes		
Ambient temperature	°C	-25 ... +55		
Storage temperature	°C	-40 ... +85		
Number of I/O sockets		3	4	3
Note		Max. switching frequency when activating e. g. a 10 W DC motor (U_{aux} = 28,8 V/duty cycle = 50 %): • Tu_{max}/°C: 55 • Max. switching frequency/h: 1500		• Max. switching frequency/h: 1000

Motor starters, 24 V DC

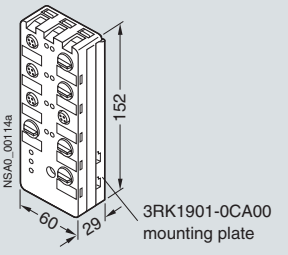
Dimensional drawings



3RK1 400-1NQ01-0AA4



3RK1 400-1MQ03-0AA4



3RK1 400-1MQ01-0AA4