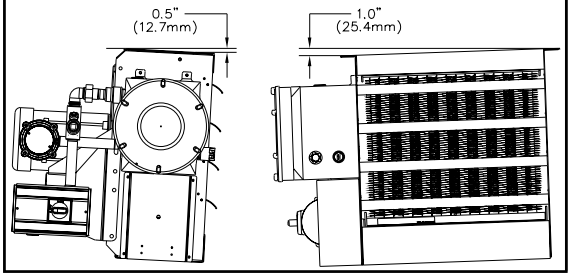
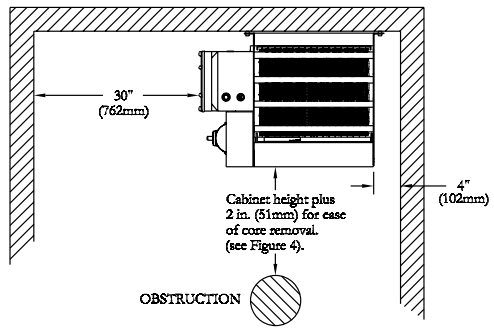
FIGURE 3 MAXIMUM TILT ANGLES (EITHER DIRECTION)



MINIMUM INSTALLATION CLEARANCES
(MUST BE MAINTAINED FOR SERVICE AND AIR FLOW)



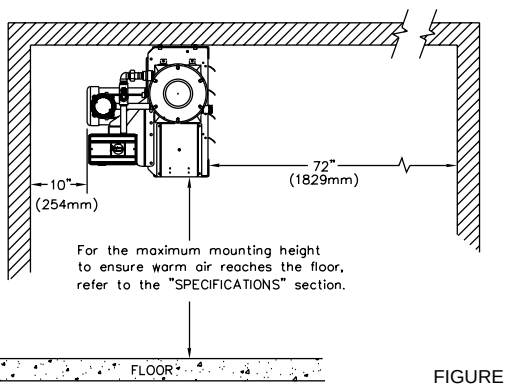


FIGURE 4

MOUNTING

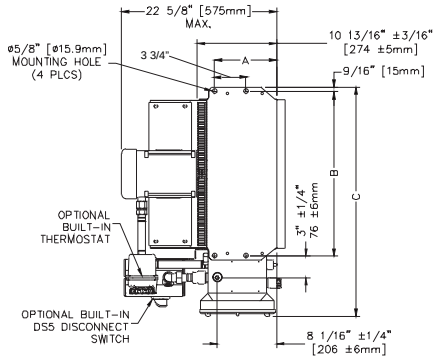
1. The heater must be permanently mounted in a level, upright position for operation. See Figures 3, 4, and 5 for maximum tilt angles, installation clearances, and physical dimensions. For ease of installation, a variety of mounting kits are available from the factory.

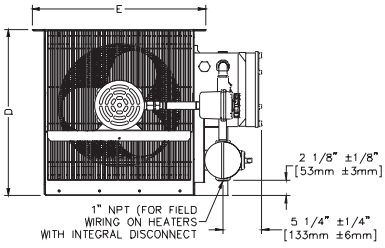
2. The mounting structure must be strong enough to:

   a. support the heater's weight, refer to the "Specifications" section,
   b. provide sufficient stiffness to prevent excessive vibration, and
   c. withstand harsh situations such as transportable installations.

DIM. \ kW		2.5–10	12.5–20	20.9–35	DIM. TOL. ±
A	in.	7.75	7.75	7.75	1/8
	mm	198	198	198	3
B	in.	18–3/16	22–5/16	26–1/4	1/8
	mm	462	566	667	3
C	in.	27	31	35	3/16
	mm	686	787	889	4
D	in.	18–1/2	22–1/2	26–1/2	1/8
	mm	470	572	674	3
E	in.	19–7/16	23–7/16	27–7/16	3/8
	mm	494	596	697	10
F	in.	17–1/2	19–1/2	21–13/16	5/16
	mm	444	495	554	8

DIMENSIONAL TOLERANCES ±1/8" [±3mm] UNLESS OTHERWISE SPECIFIED.





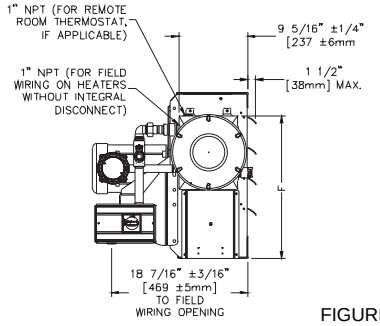


FIGURE 5

ELECTRICAL

WARNING

Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application. IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application. Installation and wiring of the heater must adhere to all application codes.

GENERAL

1. Use only copper conductors and approved explosion-proof wiring methods during installation. Refer to the "Technical Data" table and heater data plate for conductor rating.
2. External overcurrent protection is required. Refer to the "Technical Data" table and heater data plate for voltage, frequency amperage, and phase. Supply voltage is to be within 10% of the data plate voltage.
3. The heater must be installed by qualified personnel in strict compliance with electrical codes.
4. All heaters come factory prewired and ready for direct connection to the power supply leads.
5. The heater must be individually fused, preferably with Class J time-delay fuses for maximum safety. Unless stated otherwise in your local code, fuse size shall be 125% of line current or next size larger.

FIELD WIRING

1. The supply conductors, ground conductor, and room thermostat conductors (see point 2, page 5) all pass through the 1" NPT opening (see Figure 6) and are to be wired into the control enclosure (see Figure 7A).
2. Heater may be supplied with a factory installed built-in room thermostat (see Figure 8). On heaters not supplied with this option, it is recommended that a remote room thermostat be used. Connect the remote room thermostat conductors to the printed circuit board terminal block marked "TSTAT".
   Any thermostat used with this heater must:
   a. be of an explosion-proof type,
   b. be rated 125 V minimum,
   c. have a minimum 2 amp capacity, and
   d. open on temperature rise.

3. Heater may be supplied with a factory installed built-in integral disconnect. (See Figure 7B)

   Field Wiring for Integral Disconnect:

   a. Power Supply conductors and Ground conductor pass through 1"NPT opening of Disconnect Enclosure (see Figure 7B). Supply conductors to be wired to Disconnect Switch inside. Ground conductor to be wired to Ground Lug fastened to inside of Disconnect Enclosure.

   b. If applicable, Remote Room Thermostat conductors pass through 3/4"NPT opening (see Figure 7b) and are to be wired to printed circuit board terminals marked “T’STAT”.

   c. To reduce risk of ignition of hazardous atmospheres, conduit runs must have a sealing fitting connected within 18 inches (457 mm).

   Factory installed conduits require no further sealing. Integral Disconnect is sealed at factory.

4. The internal grounding terminal in the control enclosure (or in the integral disconnect enclosure when this option is provided) shall be used as the equipment grounding means. An external bonding terminal is provided for a supplementary bonding connection where local authorities permit or require such a connection.

FINAL INSPECTION

1. Before application of electrical power:

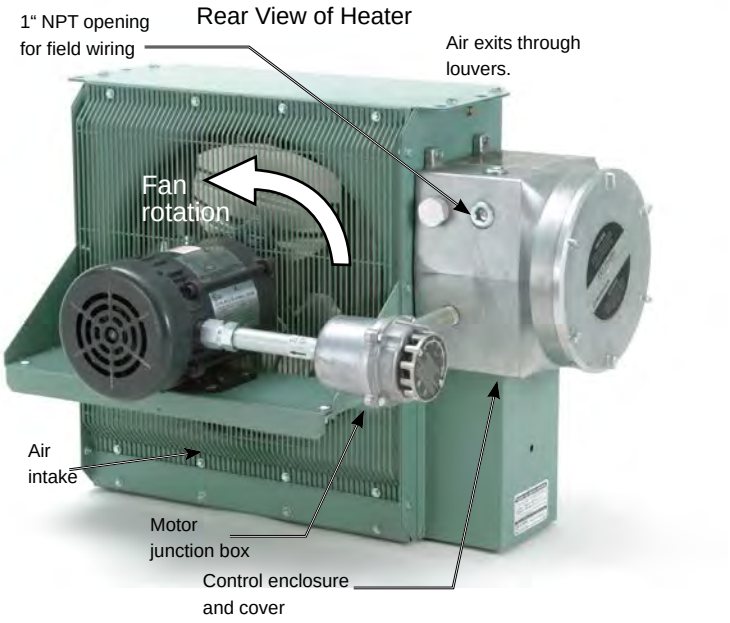
   a. Check that all connections are secured and comply with the applicable wiring diagram (see Figure 9) and code requirements,

   b. Confirm that the power supply is compatible with the data plate rating of the heater,

   c. Remove any foreign objects from the heater,

   d. Install all covers and verify that all enclosures are well secured, and

   e. Ensure that the fan rotates freely. See Figure 6 for proper direction of fan rotation.



Do not install conduit below heater (see Figure 3).

FIGURE 6

Control Enclosure & Field Wiring

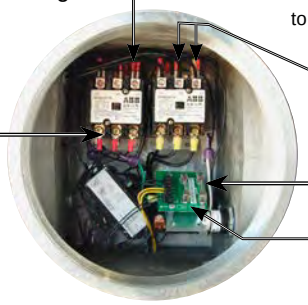


FIGURE 7A

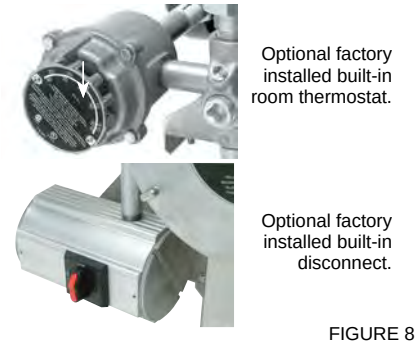


FIGURE 8

Optional Built-in Disconnect & Field Wiring

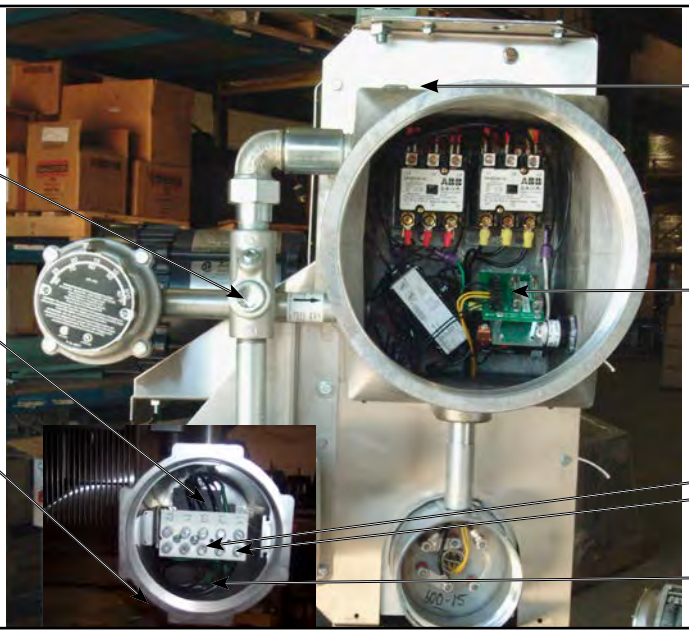
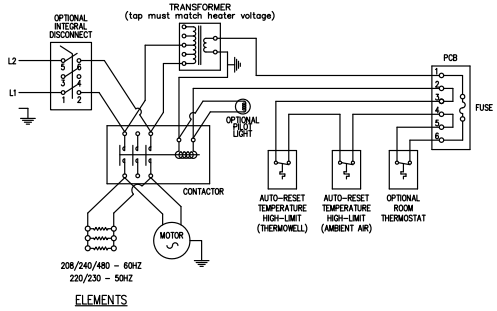
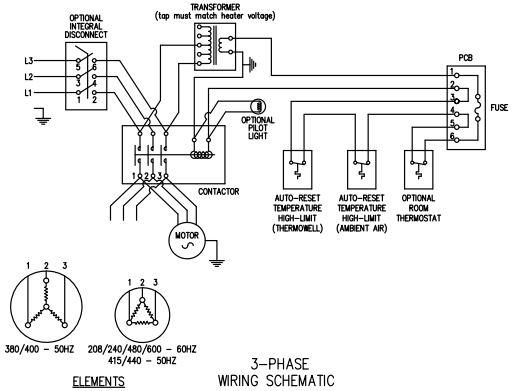


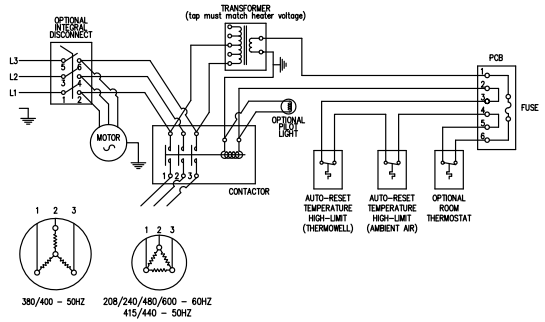
FIGURE 7B



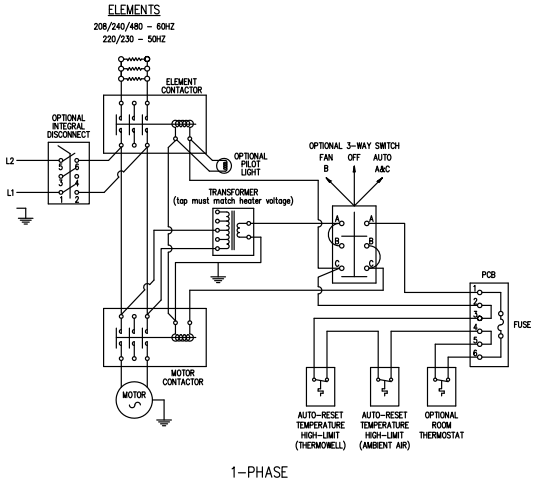
1-PHASE
WIRING SCHEMATIC



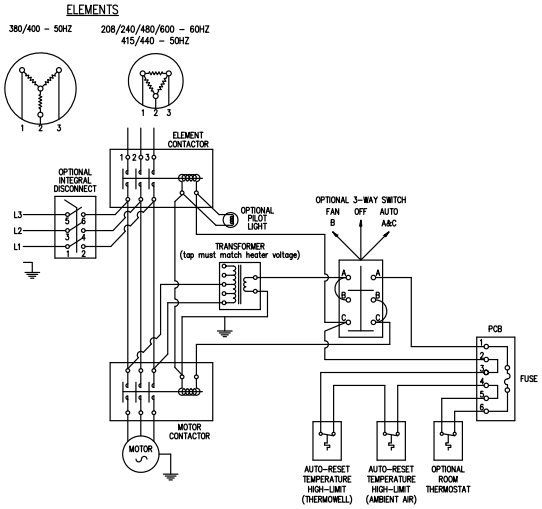
3-PHASE
WIRING SCHEMATIC



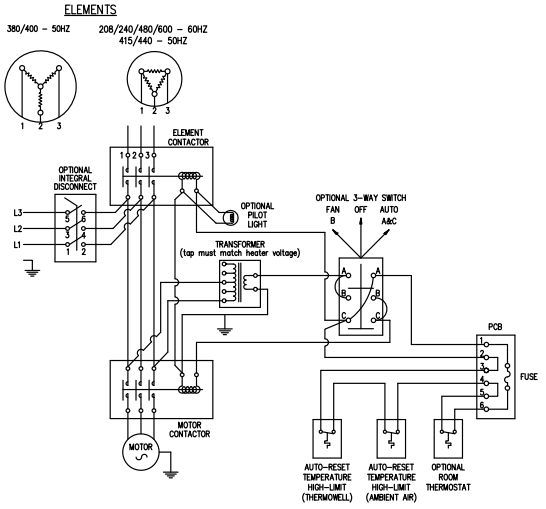
3-PHASE
WIRING SCHEMATIC
CONTINUOUS FAN OPTION



1-PHASE
WIRING SCHEMATIC
W/OPTIONAL PILOT LIGHT AND 3-WAY SWITCH



3-PHASE
WIRING SCHEMATIC
3-WAY SWITCH



3-PHASE
WIRING SCHEMATIC
3-WAY SWITCH AND CONTINUOUS FAN OPTION

FIGURE 9

FX5 TECHNICAL DATA FOR 60 HZ ELECTRIC HEATERS

Model	Note	Voltage	Nominal Wattage	Phase	Max. Motor Nameplate Current	Heater Wattage	Total Current	Minimum Circuit Ampacity	Supply Wire	Maximum Fuse Size	Temperature Rise		Core Kit Part Number	Contactor Part Number
		(V)	(kW)			(W)	(A)	(A)	(AWG)	(A)	°F	°C		
FX5-208160-030		208	3.0	1	2.7	2700	14.4	18.0	12	20	19.0	10.5	12116	10557
FX5-208160-050		208	5.0	1	2.7	4700	24.0	30.0	10	30	31.6	17.6	12117	10557
FX5-208160-075		208	7.5	1	2.7	7200	36.1	45.1	6	50	27.9	15.5	12118	10557
FX5-208160-100	*	208	10.0	1	2.7	9690	48.1	60.1	4	70	37.2	20.7	12119	10558
FX5-208360-030		208	3.0	3	1.4	2700	8.3	10.4	14	15	11.2	6.2	12116	10557
FX5-208360-050		208	5.0	3	1.4	4700	13.9	17.4	12	20	18.6	10.3	12117	10557
FX5-208360-075		208	7.5	3	1.4	7200	20.8	26.0	10	30	27.9	15.5	12118	10557
FX5-208360-100		208	10.0	3	1.4	9700	27.8	34.8	8	35	37.2	20.7	12119	10557
FX5-208360-150		208	15	3	1.4	14400	41.6	52.0	6	60	27.1	15.1	12120	10557
FX5-240160-030		240	3.0	1	2.7	2700	12.5	15.6	12	20	19.0	10.5	12122	10557
FX5-240160-050		240	5.0	1	2.7	4700	20.8	26.0	10	30	31.6	17.6	12123	10557
FX5-240160-075		240	7.5	1	2.7	7200	31.3	39.1	8	40	27.9	15.5	12124	10557
FX5-240160-100		240	10.0	1	2.7	9700	41.7	52.1	6	60	37.2	20.7	12125	10557
FX5-240160-150	*	240	15.0	1	1.4	14400	62.5	78.1	2	80	27.1	15.1	12126	10558
FX5-240360-030		240	3.0	3	1.4	2700	7.2	9.0	14	15	19.0	10.5	12122	10557
FX5-240360-050		240	5.0	3	1.4	4700	12.0	15.0	14	15	31.6	17.6	12123	10557
FX5-240360-075		240	7.5	3	1.4	7200	18.0	22.5	10	25	27.9	15.5	12124	10557
FX5-240360-100		240	10.0	3	1.4	9700	24.1	30.1	8	35	37.2	20.7	12125	10557
FX5-240360-150		240	15.0	3	1.4	14400	36.1	45.1	6	50	27.1	15.1	12126	10557
FX5-240360-200	*	240	20.0	3	1.4	19400	48.1	60.1	4	70	36.1	20.1	12127	10558
FX5-480160-030	°	480	3.0	1	1.3	2700	6.3	7.9	14	15	19.0	10.5	12129	10557
FX5-480160-050	°	480	5.0	1	1.3	4700	10.4	13.0	14	15	31.6	17.6	12130	10557
FX5-480160-075	°	480	7.5	1	1.3	7200	15.6	19.5	12	20	27.9	15.5	12131	10557
FX5-480160-100	°	480	10.0	1	1.3	9700	20.8	26.0	10	30	37.2	20.7	12132	10557
FX5-480160-150	°	480	15.0	1	1.3	14400	31.3	39.1	8	40	27.1	15.1	12133	10557
FX5-480160-200	°	480	20.0	1	1.3	19400	41.7	52.1	6	60	36.1	20.1	12134	10557
FX5-480360-030		480	3.0	3	0.7	2700	3.6	4.5	14	15	19.0	10.5	12129	10557
FX5-480360-050		480	5.0	3	0.7	4700	6.0	7.5	14	15	31.6	17.6	12130	10557
FX5-480360-075		480	7.5	3	0.7	7200	9.0	11.3	14	15	27.9	15.5	12131	10557
FX5-480360-100		480	10.0	3	0.7	9700	12.0	15.0	14	15	37.2	20.7	12134	10557
FX5-480360-150		480	15.0	3	0.7	14400	18.0	22.5	10	25	27.1	15.1	12133	10557
FX5-480360-200		480	20.0	3	0.7	19400	24.1	30.1	8	35	36.1	20.1	12134	10557
FX5-480360-250		480	25.0	3	1.0	24200	30.1	37.6	8	40	22.0	12.2	12135	10557
FX5-480360-300		480	30.0	3	1.0	29200	36.1	45.1	6	50	26.4	14.6	12136	10557
FX5-480360-350		480	35.0	3	1.0	34200	42.1	52.6	6	60	30.7	17.1	12137	10557
FX5-600360-030		600	3.0	3	0.6	2700	2.9	3.6	14	15	19.0	10.5	12138	10557
FX5-600360-050		600	5.0	3	0.6	4700	4.8	6.0	14	15	31.6	17.6	12139	10557
FX5-600360-075		600	7.5	3	0.6	7200	7.2	9.0	14	15	27.9	15.5	12140	10557
FX5-600360-100		600	10.0	3	0.6	9700	9.6	12.0	14	15	18.1	20.7	12141	10557
FX5-600360-150		600	15.0	3	0.6	14400	14.4	18.0	12	20	27.1	15.1	12142	10557
FX5-600360-200		600	20.0	3	0.6	19400	19.2	24.0	10	25	36.1	20.1	12143	10557
FX5-600360-250		600	25.0	3	0.8	24200	24.1	30.1	8	35	45.2	25.1	12144	10557
FX5-600360-300		600	30.0	3	0.8	29200	28.9	36.1	8	40	26.4	14.6	12145	10557
FX5-600360-350		600	35.0	3	0.8	34200	33.7	42.1	8	45	30.7	17.1	12126	10557

NOTES:

* Exceeds the 48 Amp Curcuit limit of NEC 424-22. DS5 not available for these units.

° 480 - 1 phase units are certified Class I, Div. 1, Group D and Class II, Div. 1 Groups F & G.

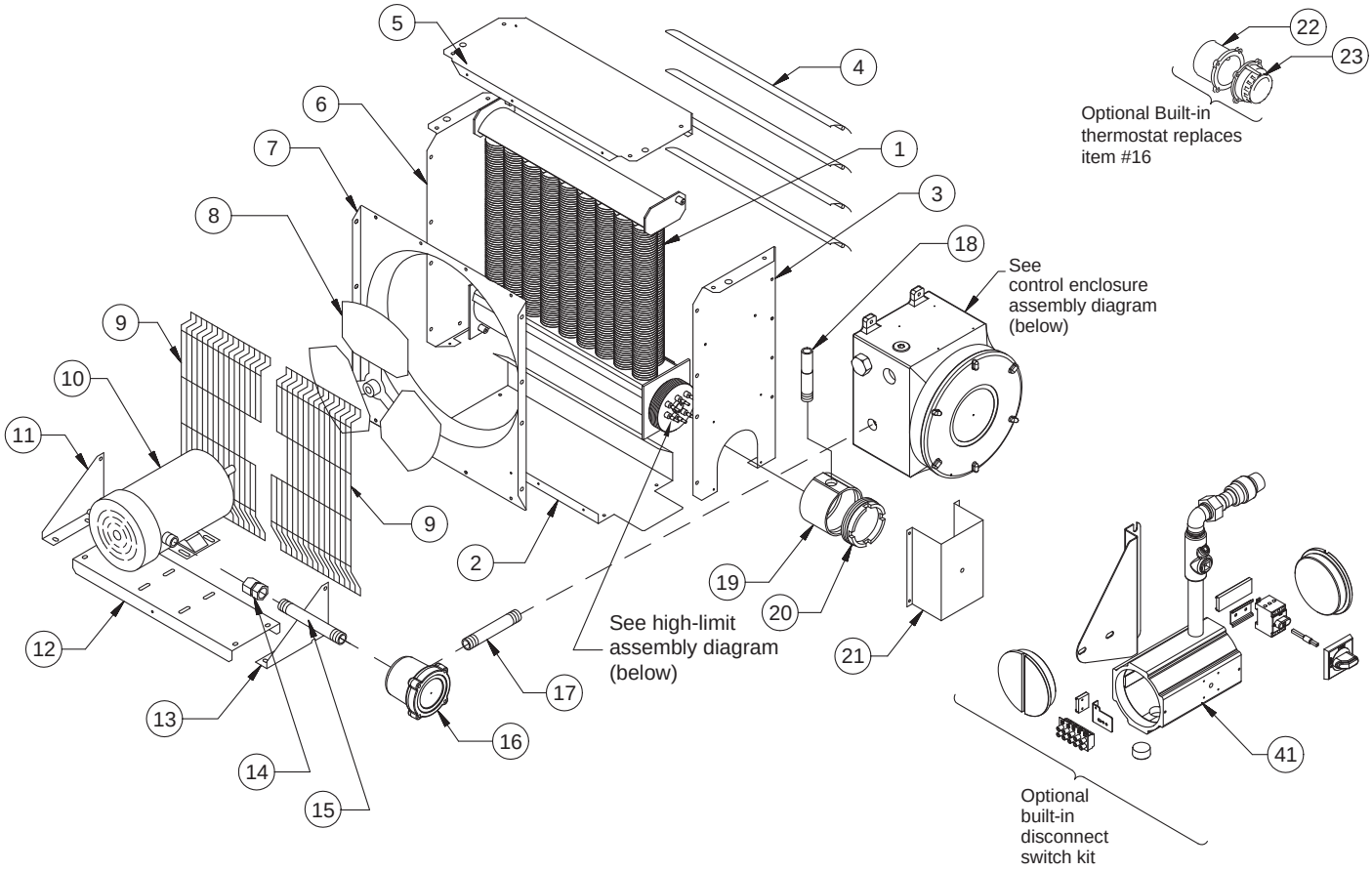
1. Minimum conductor size for 86˚F (30˚C) ambient. Derate conductor for ambient temperature. Use minimum 194˚F (90˚C) insulation.
2. Heater is functioning normally if at rated voltage the amp draw is within 10% of the value in this table.
3. Operation at lower voltages will result in reduced heat output and amp draw
4. Add "T" to model number when adding a built-in thermostat
5. Add "D" to model number when adding a built-in disconnect switch
6. Add "P" to model number when adding a built-in pilot light
7. Add "S" to model number when adding a 3-way switch
8. Add "H" to model number for units with high "off" (deenergized) ambient temperatures
9. Add "U" to model number for units with continuous fan option.
10. Add "A" to model number for units with stainless steel cabinet.

SPECIFICATIONS FOR ALL 60 HZ MODEL

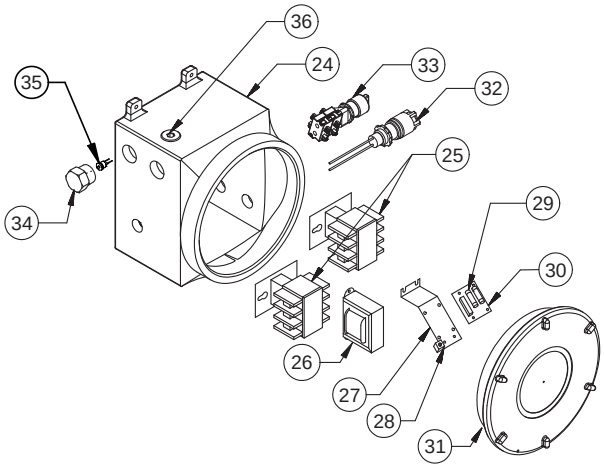
		Nominal kW	3	5	7.5	10	15	20	25	30	35
Max. Altitude		(ft.)	12,000	8,000	10,000	7,000	10,000	7,000	10,000	7,000	6,000
		(m)	3,658	2,438	3,048	2,134	3,048	2,134	3,048	2,134	1,829
Air Flow	@ 70°F	(CFM)	500		850		1750		3600		
	@ 21°C	(m^3/hr.)	850		1444		2973		6116		
Horizontal Air Throw		(ft.)	15		30		40		70		
		(m)	4.6		9.1		12.2		21.3		
Max. Mounting Height		(ft.)	7		10		10		20		
(to underside)		(m)	2.1		3.0		3.0		6.1		
Motor Power		(HP)	1/2				1/2		1/2		
(min)		(kW)	0.373				0.373		0.373		
Fan Diameter		(in.)	12				16		20		
		(mm)	305				406		508		
Net Weight	without DS5	(lbs.)	140				168		201		
		(kg)	63.5				76.2		91.2		
	with DS5	(lbs.)	152				180		213		
		(kg)	78.9				81.6		96.6		
Shipping Weight	without DS5	(lbs.)	194				218		252		
		(kg)	88				98.9		114.3		
	with DS5	(lbs.)	206				230		264		
		(kg)	93.4				104.3		119.7		

Hazardous Location Rating	Class I, Groups C and D; Class II, Groups E, F and G; Temperature Code T3B [329°F (165°C)]
Enclosures	NEMA Type 7 & 9. For dry, indoor use only. Do not immerse in water. Do not store or use in areas exposed to rain or snow
Motor Type	Explosion-proof. Thermally protected. Permanently lubricated ball bearings. 1725 RPM
Fan	Aluminum blade. Steel spider and hub with 5/8 in. (15.875 mm) bore
Fan Guard	Split design with close wire spacing. 1/4 in. (6.3 mm) dia. probe will not enter
Mounting Holes	Four 9/16 in. (14.3 mm) diameter holes at top of heater
Heating Elements	Three long-life, low watt-density, high grade metal-sheathed elements
Temperature High-Limit	Automatic reset type, snap-action bimetal, open on temperature rise. Rated 100,000 cycles at 10 amps, handles 0.128 amps
Control Circuit	120 Volts, 0.128 amps, 15VA. (Grounded)
Optional Built-in Thermostat	Explosion-proof. 36°F to 82°F (2°C to 28°C)
Optional Built-in Disconnect Switch	DS5 for use only on heaters with total current not exceeding 48-Amps. Lockout handle accepts 1/4” diameter padlock shackle
Optional Three Way Switch	Fan only, Off, Auto
Optional Pilot Light	Indicates heat-on cycle
Control Transformer	Multi-tap primary, 120 V secondary, 50 VA
Contactor	60 or 80 amp. Rated for 1,000,000 mechanical operations. 120 Volts, 15VA coil (separately fuse-protected)
Heat Transfer Fluid	Long life formulated propylene glycol and water
Cabinet Material	14 ga. (0.075 in.) (1.90 mm) steel. Epoxy coated with five-stage pretreatment, including iron phosphate. Optional stainless steel
Core	Steel with integral aluminum fins, vacuum charged and hermetically sealed
Conduit Material	Heavy walled, 0.122 in. (3.1 mm) steel
Overpressure Protection	Preset 100 psig (690 kPa) pressure relief valve, aluminum body, no field serviceable parts
Operational Temperature Limitations	-4°F to 104°F (-20°C to 40°C)
Storage Limitations	-49°F to 176°F (-45°C to 80°C), short term to 248°F (120°C). Do not immerse in water Do not expose to rain or snow

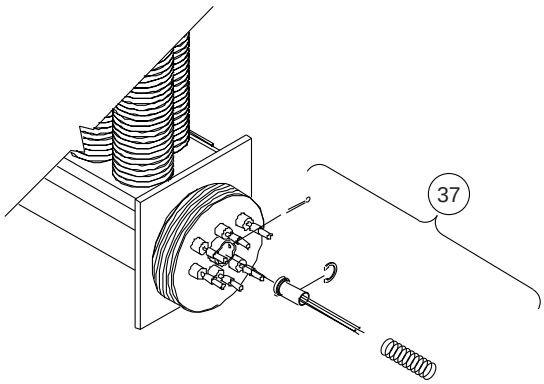
HEATER ASSEMBLY DIAGRAM



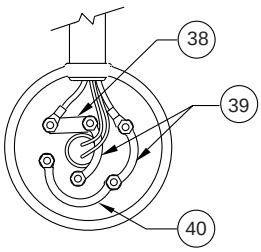
CONTROL ENCLOSURE
ASSEMBLY DIAGRAM



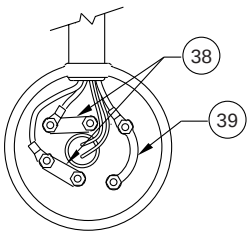
HIGH LIMIT
ASSEMBLY DIAGRAM



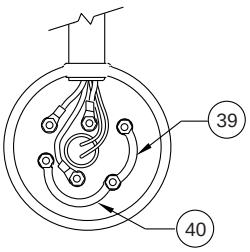
BUS-BAR CONFIGURATION
ALL 1-PHASE MODELS



BUS-BAR CONFIGURATION
FOR ALL 3-PHASE
(EXCEPT 380 50 HERTZ & 400 50 HERTZ)



BUS-BAR CONFIGURATION
FOR ALL 3-PHASE 380 V & 400 V 50 HERTZ MODELS



PARTS LIST

FORCED AIR ELECTRIC HEATERS

	PART NUMBERS			Please have model and serial number available before calling	
ITEM	**2.5 - 4.6 kW**	**6.3 - 10 kW**	**12.5 - 20 kW**	**20.9 - 35 kW**	**Description**
1	**	**	**	**	Core
2	Painted: 9203 S.S.: 9507		Painted: 9204 S.S.: 9508	Painted: 9205 S.S.: 9509	Panel, Bottom
3	Painted: 9191 S.S.: 9192		Painted: 9193 S.S.: 9194	Painted: 9195 S.S.: 9196	Panel, Left Side
4	4075		4076	4077	Louver Kit, c/w screws
5	Painted: 9200 S.S.: 9513		Painted: 9201 S.S.: 9514	Painted: 9202 S.S.: 9515	Panel, Top
6	Painted: 9197 S.S.: 9510		Painted: 9198 S.S.: 9511	Painted: 9199 S.S.: 9512	Panel, Right
7	Painted: 3782 S.S.: 9212		Painted: 3783 S.S.: 9213	Painted: 3784 S.S.:9214	Panel, Fan Shroud
8	4022	4023	4024	4025	Fan Blade
9	Painted: 4078 S.S.: 9504		Painted: 4079 S.S.: 9505	Painted: 4080 S.S.: 9506	Fan Guard Kit
10	1979 (Emerson)		10388 (Marathon)		208/240V 1PH 60HZ 220V 1PH 50HZ
	9896 (Baldor)			N/A	480V 1PH 60HZ
	1699 (Emerson)		10387 (Marathon)		208/240/480V 3PH 60HZ 380/415V 3PH 50HZ
	2433 (Emerson)		10672 (Marathon)		600V 3PH 60HZ
11	Painted: 3789 S.S.: 9112		Painted: 3789 S.S.: 9112	Painted: 3789 S.S.: 9112	Bracket, Motor Mount Right
12	Painted: 3785 S.S.: 9206		Painted: 3786 S.S.: 9207	Painted: 3787 S.S.: 9208	Channel, Motor Mount
13	Painted: 3788 S.S.: 9111		Painted: 3788 S.S.: 9111	Painted: 3788 S.S.: 9111	Bracket, Motor Mount Left
14	3737 (Emerson Motors)		4590 (Baldor & Marathon Motors)		Coupling, Motor
15	9500		3813	10389	Conduit, Motor
16	5371		5371	5371	Cover, Thermostat Enclosure
17	3813		3813	3813	Conduit, Control Enclosure
18	9314		9315	9316	Conduit, Element Enclosure
19	9679		9679	9679	Enclosure, Element
20	3510		3510	3510	Cover, Element Enclosure
21	Painted: 9354 S.S.: 9516		Painted: 9355 S.S.: 9517	Painted: 9356 S.S.: 9518	Panel, Element Enclosure Guard
22	4983		4983	4983	Enclosure, Thermostat
23	5032		5032	5032	Thermostat, Built-in-kit
24	-		-	-	Enclosure, Control
25	**		**	**	Contactor
26	10556 (60HZ)		11295 (50HZ)		Transformer
27	3809	3809	3809	3809	Bracket, Printed Circuit Board
28	1876	1876	1876	1876	Terminal, 6-14 Ga. Screw Lug
29	9357	9357	9357	9357	Fuse, Buss MDQ - 1/2 Amp
30	3514	3514	3514	3514	Assembly, Printed Circuit Board
31	9158	9158	9158	9158	Cover, Control Enclosure
32	9279	9279	9279	9279	Bulb, Pilot Light
33	9775	9775	9775	9775	Switch, Explosion Proof 3-Way
34	9267	9267	9267	9267	Thermowell, Ambient High-Limit
35	-	-	-	-	High Limit, Ambient Temperature
36	9289	9289	9289	9289	Plug, 1" NPT Explosion Proof
37	-	-	-	-	Temperature High-Limit Kit
38	Provided with Core Kits**				Bus-Bar, Straight
39					Bus-Bar, Small Curved
40					Bus-Bar, Large Curved
41	-	-	-	-	Kit, DS5 Assembly
**See technical data table for part numbers. NOTE: For items not shown, please contact factory.					

REPAIR & REPLACEMENT

WARNING
Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application. IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application. Heater surfaces may be hot.

1. After repairing any component:
   a. check that electrical connections are correct and secure (see Figure 9),
   b. remove any foreign material from enclosures,
   c. install and secure all covers,
   d. ensure that all fasteners are tight,
   e. remove all foreign objects from heater, and
   f. ensure air exits through louvers and fan rotates counterclockwise when viewed from rear of heater (see Figure 14).

CORE

The heater core is vacuum charged and not field repairable.
For core removal:

1. Remove cabinet bottom and element enclosure cover.
2. Disconnect all wires entering element enclosure (see Figure 10).
3. Slightly loosen all cabinet bolts shown in Figure 10, to prevent the core from binding.
4. With an assistant supporting the weight of the core, remove the 3 core mounting bolts. Carefully lower the core out of the cabinet (see Figure 11).
5. To return core to factory, use crate supplied with exchange core to protect the element terminals and plate threads.
6. To reinstall, lift the core up into cabinet while an assistant guides the element wires into the element enclosure conduit.
7. Position the core and tighten the 3 core mounting bolts. Tighten the remaining cabinet bolts.

TEMPERATURE HIGH-LIMIT

1. Remove temperature high-limit assembly and clean the inside of the thermowell (see Figure 12). A clean thermowell will ensure good thermal contact.
2. Use only a factory supplied temperature high-limit to ensure safe operation. (refer to the instructions that accompany the replacement Temperature High-Limit Kit).
3. Reinstall the temperature high-limit assembly with the snap ring and spring into the thermowell without damaging the insulating tube. Secure in place with the cotter pin (see Figure 13).

MOTOR, FAN & FAN GUARD

1. Remove bolts holding the motor to the motor mount. On units with a built in thermostat, remove the bolts on the back of the thermostat enclosure.
2. Remove conduit #1 located between motor junction box and control enclosure by turning it in the direction illustrated (see Figure 14). Note conduits #1 and #2 are not interchangeable and have left hand threads on one end, this end is indicated by a machined groove.
3. Remove the 2 piece fan guard assembly (see Figure 15).
4. Lift the motor assembly off the motor mount.
5. Before removing the fan, measure and record the location of the fan hub on the motor shaft (see Figure 16). If difficult to remove, use a gear puller on the fan hub.
6. To reassemble, place motor assembly onto motor mount and fasten the fan guard to cabinet.
7. Simultaneously engage and tighten both ends of conduit #1 into enclosures. Leave a 1/16" to 3/16" (1.6 to 4.8 mm) gap between the motor and fan guard (see Figure 16). Adjust conduit #2 to center the fan in the shroud.
8. To ensure a minimum 5 thread engagement, threaded ends of conduits must protrude a minimum of 1/16" (1.6mm) into enclosures. The groove on conduit #2 must not be more than 7/8" (22mm) from motor coupling (see Figure 14).
9. Bolt motor to motor mount. Manually spin the fan blade to ensure fan rotates freely.
10. Air must exit through louvers and fan must rotate counterclockwise when viewed from rear of heater (see Figure 14).

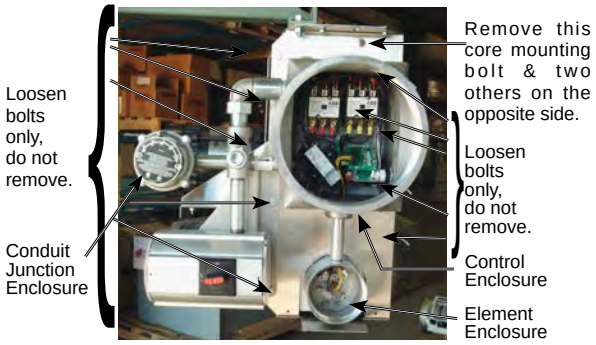


FIGURE 10

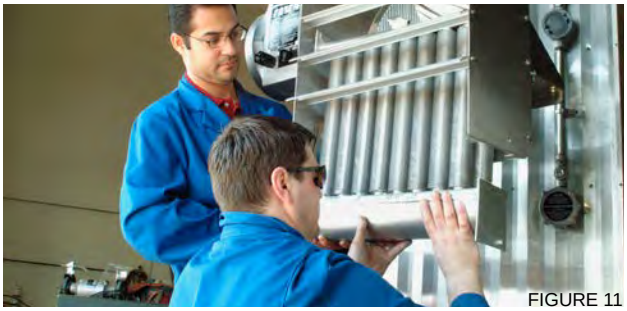


FIGURE 11

FIGURE 12


FIGURE 13

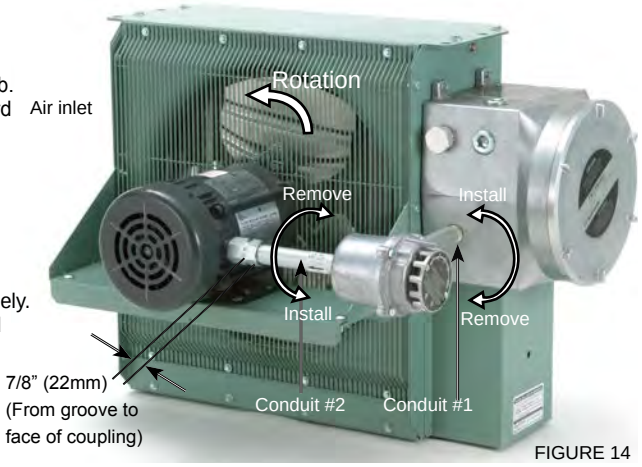


FIGURE 14


FIGURE 15


FIGURE 16

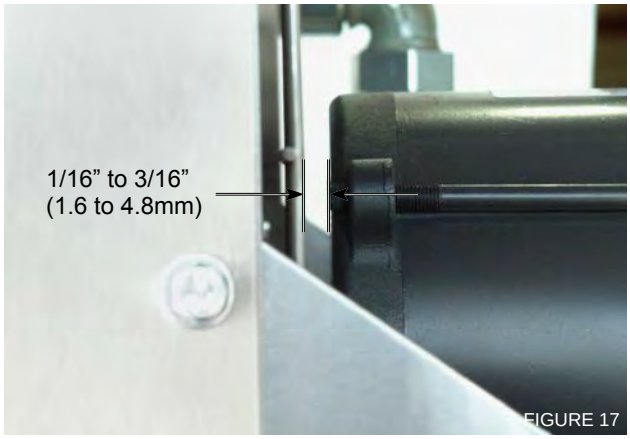


FIGURE 17

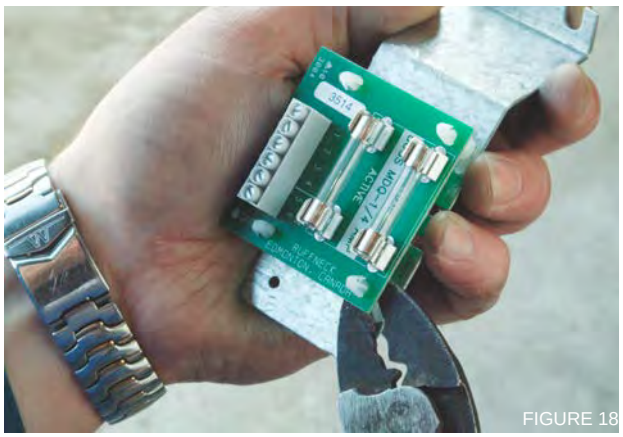


FIGURE 18

PRINTED CIRCUIT BOARD

1. After removing the printed circuit board (P.C. Board) bracket assembly from the control enclosure, separate the P.C. Board from the bracket by cutting off the plastic spacers (see Figure 18).
2. Reinstall a new factory supplied P.C. Board onto the mounting bracket using new non-conducting spacers of the same length. Spacers are supplied with a new P.C. Board. Reinstall the control circuit ground wire to the printed circuit board bracket (see Figure 9).

CONTACTOR

1. Loosen, but do not remove contactor mounting screws. Slide contactor off mounting screws.
2. Replace with a factory supplied contactor of the same rating.

TRANSFORMER

1. Replace with a factory supplied transformer of the same rating.
2. On the new transformer, select primary wires to match heater voltage. Ensure that the correct transformer secondary lead is grounded (see Figure 9). Individually terminate all unused wires using closed end connectors.

FUSE

Replace fuse with one of the same type and rating as indicated on P.C. Board or refer to parts list. An extra fuse should be stored in the clips marked “SPARE”.

HEATING ELEMENTS

Heating elements are an integral part of the vacuum charged core. A factory exchange core can be shipped immediately from stock. Refer to “Core” section for details.

CABINET PANELS

Bolt-on cabinet panels are individually replaceable.

Ruffneck™
Heaters for the Harshest Environments
5918 Roper Road, Edmonton, Alberta, Canada T6B 3E1
Phone: (780) 466-3178 Fax: (780) 468-5904

PLEASE ADHERE TO INSTRUCTIONS PUBLISHED IN THIS MANUAL.
Failure to do so may be dangerous and may void certain provisions of your warranty.
For further assistance, please call:

24 Hr. Hotline: 1-800-661-8529

(U.S.A. and Canada)

Please have model and serial numbers available before calling.

WARRANTY: Under normal use the Company warrants to the purchaser that defects in material or workmanship will be repaired or replaced without charge for a period of 36 months from date of shipment. Any claim for warranty must be reported to the sales office where the product was purchased for authorized repair or replacement within the terms of this warranty.

Subject to State or Provincial law to the contrary, the Company will not be responsible for any expense for installation, removal from service, transportation, or damages of any type whatsoever, including damages arising from lack of use, business interruptions, or incidental or consequential damages.

The Company cannot anticipate or control the conditions of product usage and therefore accepts no responsibility for the safe application and suitability of its products when used alone or in combination with other products. Tests for the safe application and suitability of the products are the sole responsibility of the user.

This warranty will be void if, in the judgment of the Company, the damage, failure or defect is the result of:

- vibration, radiation, erosion, corrosion, process contamination, abnormal process conditions, temperature and pressures, unusual surges or pulsation, fouling, ordinary wear and tear, lack of maintenance, incorrectly applied utilities such as voltage, air, gas, water, and others or any combination of the aforementioned causes not specifically allowed for in the design conditions or
- any act or omission by the Purchaser, its agents, servants or independent contractors which for greater certainty, but not so as to limit the generality of the foregoing, includes physical, chemical or mechanical abuse, accident, improper installation of the product, improper storage and handling of the product, improper application or the misalignment of parts.

No warranty applies to paint finishes except for manufacturing defects apparent within 30 days from the date of installation.

The Company neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with the product(s).

The Purchaser agrees that all warranty work required after the initial commissioning of the product will be provided only if the Company has been paid by the Purchaser in full accordance with the terms and conditions of the contract.

The Purchaser agrees that the Company makes no warranty or guarantee, express, implied or statutory, **(INCLUDING ANY WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE)** written or oral, of the Article or incidental labour, except as is expressed or contained in the agreement herein.

LIABILITY: Technical data contained in the catalog or on the website is subject to change without notice. The Company reserves the right to make dimensional and other design changes as required. The Purchaser acknowledges the Company shall not be obligated to modify those articles manufactured before the formulation of the changes in design or improvements of the products by the Company.

The Company shall not be liable to compensate or indemnify the Purchaser, end user or any other party against any actions, claims, liabilities, injury, loss, loss of use, loss of business, damages, indirect or consequential damages, demands, penalties, fines, expenses (including legal expenses), costs, obligations and causes of action of any kind arising wholly or partly from negligence or omission of the user or the misuse, incorrect application, unsafe application, incorrect storage and handling, incorrect installation, lack of maintenance, improper maintenance or improper operation of products furnished by the Company.

Edmonton	Oakville	Orillia	Greensburg	Houston	Denver
Head Office	1-800-410-3131	1-877-325-3473	1-800-473-2402	1-855-219-2101	1-855-244-3128
1-800-661-8529	(905) 829-4422	(705) 325-3473	(812) 663-4141	(281) 506-2310	(303) 979-7339
(780) 466-3178	F 905-829-4430	F 705-325-2106	F 812-663-4202	F 281-506-2316	F 303-979-7350
F 780-468-5904					

Agnico Eagle, Baker Lake
Jet-A Tank Farm
Control equipment UPS

Eaton 5110 UPS

Now featuring a 3-year warranty with product registration!

Product Snapshot

Product rating:	350–1500 VA
Voltage	120V and 230V
Frequency:	50 Hz and 60 Hz, auto-sensing
Configuration:	Plug-and-play tower or under monitor
Topology:	Line-interactive

Features

- Protect the integrity of your data and applications by shielding electronic equipment from power outages, surges, sags, brown-outs, and overvoltage conditions
- Save space with a compact design that can be deployed as a tower or under a computer monitor
- Protect loads on eight outlets—four with surge suppression and battery backup, four with surge suppression only
- Deliver consistent, clean output with automatic voltage regulation (AVR) that doesn't drain battery power
- Extend UPS service life with user-replaceable batteries
- Protect networked equipment from "back door" power surges coming through LAN or telephone lines
- Stay informed of power problems and battery conditions with audible alarms and remote alarm notification via e-mail, pager, the Web, or SNMP
- Deliver short-term mobile power with start-on-battery capability
- USB port and cables are standard
- Rest easy with a three-year limited warranty with product registration and a $150,000 load protection guarantee (US and Canada); optional multi-year Gold Plan service is available to provide repair and replacement coverage that goes beyond the provisions of the limited warranty

As much as business depends on electric power, public utility power is anything but dependable. By law, public utilities do not have to supply computer-grade power. That's bad news in an age when sensitive computer systems form the core of virtually all business functions. Advances in processing capacity and miniaturization make these systems more susceptible than ever to power fluctuations—and make system crashes and data losses more costly than ever.

According to National Power Laboratories (NPL) and the Electric Power Research Institute, the typical power customer location can experience an average of 24 power disturbances each month, costing the US economy $119 billion to $188 billion every year.

You don't have to be a part of those statistics. Effective protection is here, at a very attractive price.

The Eaton® 5110 uninterruptible power system (UPS) provides a layer of defense between your equipment and raw utility power. This line-interactive UPS constantly safeguards your systems from power outages, surges, sags, brownouts, and overvoltage conditions—and provides varying degrees of protection from other power problems as well. If utility power is interrupted, even briefly, the 5110 transfers to battery power.

Powering Business Worldwide

Introducing the Eaton 5110 UPS

Affordable protection for small to medium organizations

Incorporating more than 40 years of UPS design experience, the 5110 provides cost-effective power management, backup power, and power quality for office workstations, PBX or key telephone systems, servers, small network nodes, point-of-sale systems, and computer peripheral devices. This UPS is ideal for any small- to mid-sized business or institutional setting where reliable power must be provided at an affordable price.

Automatic voltage regulation (AVR)—clean power without draining the battery

The 5110 uses AVR to smooth out wide fluctuations in input voltage. If input voltage varies as much as 25 percent over or 23 percent under nominal voltage—which can easily happen when running on generator power or in severe environments—the 5110 accepts this inconsistent voltage and delivers clean, consistent output for protected equipment. AVR enables you to work through even the most frequent brownouts and power sags.

Unlike typical line-interactive systems, the 5110 does not switch back and forth to battery power to accomplish this voltage regulation—which would shorten battery life and increase battery replacement costs. As a result, battery power is conserved for when you really need it.

Eight outlets in a low-profile tower

The 5110 occupies a small footprint—about the size of a dictionary for low-power units (500–700 VA), or a sleek tower for higher-rated models (1000–1500 VA). This tower package fits easily under a monitor.

The cost-effective design features eight outlets, four with surge protection and battery backup and four with surge protection only. You can plug less critical equipment, such as printers or monitors, into surge-protection-only outlets that do not drain battery power.

Protection for data lines

Incoming power lines aren't the only source of damaging surges. Power also travels across network links, such as LANs and telephone lines. The 5110 uses an integral network transient protector to safeguard network-connected equipment—such as fax machines, modems, or electronic telephones—from "back door" power surges coming through network or phone wiring.

Short-term power for mobile applications

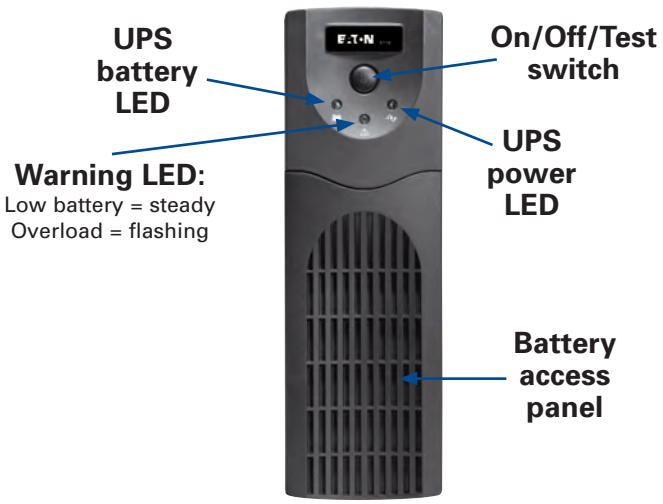
The 5110 supports start-on-battery capability, which means you can unplug the UPS from utility power, then restart and run it from battery power elsewhere. This capability offers tremendous flexibility for short-term powering needs, such as in mobile offices or service vans.

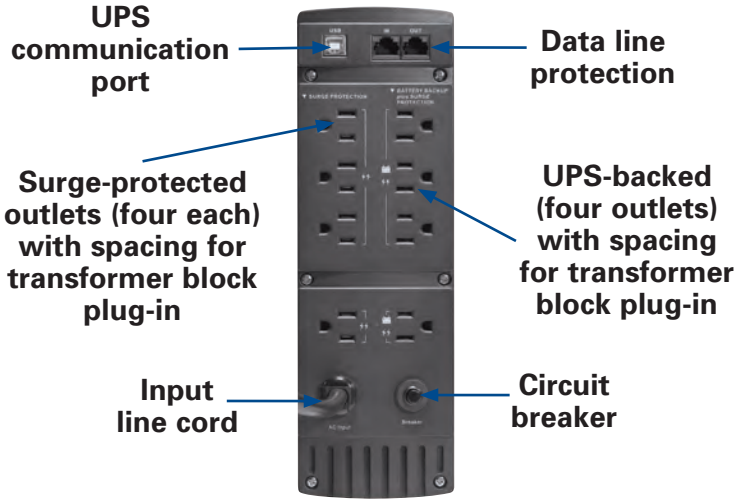
User-replaceable batteries for extended service life

Many UPS products in this range are useful only up to the service life of their batteries. When the battery fails, the unit is worthless. Not so with the 5110. You can replace the batteries yourself—a simple process that can be performed by easy access through the front panel. When the audible alarm indicates that batteries need replacing, you can safely and easily install supplied batteries and remove the old batteries for proper disposal and recycling. You can also choose to return the entire unit for repair or battery replacement under our warranty and service programs.

Easy-to-understand LEDs and audible alarms

You never have to guess about the status and condition of your 5110. Simple LED indicators and audible alarms warn of power problems and low battery conditions. The Battery LED illuminates when the UPS is operating on battery power. The Warning LED turns on when the battery is low and flashes under overload conditions.





The 5110 delivers confidence—confidence that your vital business equipment is protected and confidence that Eaton will be there with you for the long term.

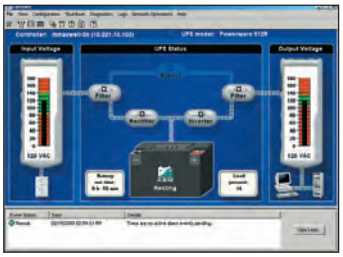
Remote UPS monitoring from anywhere

You don't have to be within sight of the UPS to stay informed. You can connect the 5110 to a network using the built-in USB port, and monitor its working status. The UPS comes with Eaton LanSafe® software, free of charge. This UPS management software gives you control and visibility over all your UPSs, using an intuitive, graphical interface.

Warranty coverage with load protection guarantee

Rest easy with industry-leading protection from Eaton. The 5110 is backed by a two-year limited warranty and a $150,000 load protection guarantee. We're that confident of the performance and reliability of the 5110.

To find out more about how the 5110 can protect your critical equipment, applications, and data:
www.eaton.com/powerquality
800-356-5794



5110 technical specifications[1]

OPERATION

Input voltage range	0–160Vac/0–300Vac
Output voltage range	Nominal -23% to +25%
On battery output voltage	Nominal -12% to +10%
Frequency	50/60 Hz auto sensing
Lighting / surge protection	120V models 320 joules; 230V models 476 joules
Safety	UL 1778, designed to meet UL497A, CAN/CSAOC22.2 No107.1/IEC 62040-1-1: CE low voltage directive
EMI	FCC Class B/IEC 62040-2, EN55022: Class B: CE EMC directive
Transfer time to battery/AC	2-6 msec. typical
Battery type	Sealed, maintenance free lead-acid battery
Typical backup time	Three minutes at full rated load
Internet / phone / fax protection	RJ11/RJ45
Short circuit protection	Circuit breaker
Communication port	USB

ENVIRONMENTAL

Operation temperature	0°C ~ 40°C
Operation relative humidity	0 to 95% non-condensing
Storage temperature	-15°C ~ 50°C

SOFTWARE

LanSafe software is included free of charge

SERVICE PLANS

PRODUCT	LENGTH OF SERVICE	GOLD PLAN PART NUMBER
5110 500-1500 VA	Three years	3XXGX5100XALLCX
5110 500-1500 VA	Five years	5XXGX5100XALLCX

REPLACEMENT BATTERIES

MODEL NUMBER	PART NUMBER	DESCRIPTION
PW5110 500 VA	106711159-001	BATT. KIT 500 VA PW5110
PW5110 700 VA	106711160-001	BATT. KIT 700 VA PW5110
PW 5110 1000 VA	106711161-001	BATT. KIT 1000 VA PW5110
PW5110 1500 VA	106711162-001	BATT. KIT 1500 VA PW5110

1. Specifications are subject to change without notice due to continuing product improvement programs.

5110 NORTH AMERICAN MODELS: 120V, 50/60 Hz

Model	Part Number	Power Out (VA/Watt)	Input Connection	Output Receptacles	Dimensions (H x W x D, inches)	Weight (lb)
PW5110 500	103004256-5591	500/300	1.8m line cord with 90 deg. 5-15P	(8) 5-15R Outlets*	10.6 x 3.4 x 10.2	12.1
PW5110 700	103004257-5591	700/420	1.8m line cord with 90 deg. 5-15P	(8) 5-15R Outlets*	10.6 x 3.4 x 10.2	15.2
PW5110 1000	103004258-5591	1000/600	1.8m line cord with 90 deg. 5-15P	(8) 5-15R Outlets*	10.6 x 3.4 x 15.1	28.0
PW5110 1500	103004259-5591	1440/900	1.8m line cord with 90 deg. 5-15P	(8) 5-15R Outlets*	10.6 x 3.4 x 15.1	29.1

5110 INTERNATIONAL MODELS: 230V, 50/60 Hz

Model	Part Number	Power Out (VA/Watt)	Input Connection	Output Receptacles	Dimensions H x W x D (inches)	Weight (lb)
PW5110 500i	103004261-5591	500/300	IEC C14 inlet, 1.8 meter line patch cord IEC to IEC	(8) IE C13 Outlets*	10.6 x 3.4 x 10.2	13.4
PW5110 700i	103004262-5591	700/420	IEC C14 inlet, 1.8 meter line patch cord IEC to IEC	(8) IE C13 Outlets*	10.6 x 3.4 x 10.2	16.5
PW5110 1000i	103004263-5591	1000/600	IEC C14 inlet, 1.8 meter line patch cord IEC to IEC	(8) IE C13 Outlets*	10.6 x 3.4 x 15.1	29.1
PW5110 1500i	103004264-5591	1500/900	IEC C14 inlet, 1.8 meter line patch cord IEC to IEC	(8) IE C13 Outlets*	10.6 x 3.4 x 15.1	30.2

* Four battery backup & surge protection; four surge protection only.

5110 BATTERY BACKUP TIMES (in minutes)

Load (VA)	30W	60W	90W	120W	150W	180W	210W	240W	270W	300W	330W	360W	390W	420W
500	52	35	22	14	11	8	6	5	4	3	-	-	-	-
700	63	46	34	23	16	12	10	8	7	6	5	4	4	3
Load (VA)	**120W**	**180W**	**240W**	**300W**	**360W**	**420W**	**480W**	**540W**	**600W**	**660W**	**720W**	**780W**	**840W**	**900W**
1000	52	35	23	17	13	10	9	7	5	-	-	-	-	-
1500	62	43	29	20	16	14	12	11	9	8	7	6	5	4.4

Note: Battery runtimes are approximate and may vary with equipment, configuration, battery age, temperature, etc.

UNITED STATES
8609 Six Forks Road
Raleigh, NC 27615 U.S.A.
Toll Free: 1.800.356.5794

www.eaton.com/powerquality

CANADA
Ontario: 416.798.0112
Toll free: 1.800.461.9166

LATIN AMERICA
Brazil: 55.11.3616.8500
Caribbean: 1.949.452.9610
México & Central America:
52.55.9000.5252
South Cone: 54.11.4343.6323

EUROPE/MIDDLE EAST/AFRICA
Denmark: 45.3686.7910
Finland: 358.94.52.661
France: 33.1.6012.7400
Germany: 49.0.7841.604.0
Italy: 39.02.66.04.05.40
Norway: 47.23.03.65.50
Sweden: 46.8.598.940.00
United Kingdom: 44.1753.608.700

ASIA PACIFIC
Australia: 61.2.9693.9366
New Zealand: 64.0.3.343.3314
China: 86.21.6361.5599
HK/Korea/Taiwan: 852.2745.6682
India: 91.11.4223.2300
Singapore/SEA: 65.6825.1668

Printed in USA
5110FXA
September 2009

EATON
Powering Business Worldwide

Powerware 5110 UPS

USER'S MANUAL

The Powerware 5110 uninterruptible power system (UPS) protects your sensitive electronic equipment from power problems such as power failures, power sags, power surges, brownouts, and line noise.

Features:

- Processor-controlled voltage regulation
- Eight outlets
  -Four with surge and backup protection
  -Four with surge protection only
- Data Line (Internet fax - modem - DSL) or telephone line surge protection jacks
- Cold start capability
- USB communication port
- User-replaceable batteries

SAFETY INSTRUCTIONS

Once you have received the Powerware 5110 UPS product, you should remove and inspect the product for shipping damage. If any damage is found, please notify the carrier and your dealer. Please keep the shipping carton and the packing foam in the event the product must be returned to the factory for service.

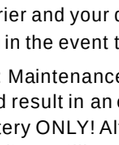
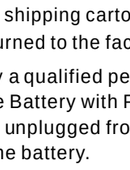
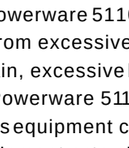
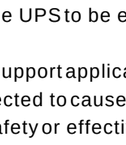
ATTENTION: Maintenance must be performed by a qualified personnel. Failure to do so could result in an electric shock. Replace Battery with Powerware supplied Battery ONLY! Although the unit may be unplugged from utility power, hazardous voltage still may be present through the battery.

1. Place the Powerware 5110 UPS indoors in an area that has adequate airflow and is free from excessive dust. Do NOT allow the UPS to be exposed to moisture, rain, excessive heat or direct sunlight.
2. Use of the Powerware 5110 UPS product in life support applications where failure of this equipment can reasonably be expected to cause failure of life support equipment or to significantly affect its safety or effectiveness is NOT recommended.
3. Always disconnect the input power cord from the wall outlet before replacing the battery.
4. When replacing the battery, use the same number and type of battery.
5. Do **NOT** dispose of the battery in a fire: the battery may explode.
6. Do **NOT** open or mutilate the battery. Batteries contain an electrolyte that is toxic and harmful to both the skin and eyes.
7. Proper disposal of the battery is required. Please refer to your local laws/regulations regarding battery disposal.
8. Use tools with insulated handles to replace the battery to avoid personal injury. Due to energy hazards, please remove wristwatches and jewelry such as rings when replacing battery.

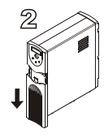
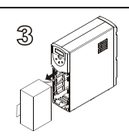
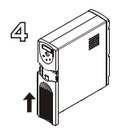
BATTERY CONNECTION REQUIRED BEFORE USE!

Connecting the Battery:

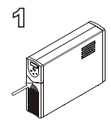
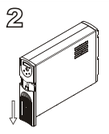
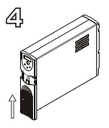
4.5 AH, 5 AH batteries (350 VA, 500 VA models)

1  Push at the top Edge to remove the battery cover	2  Slide down to remove the battery cover
3  Pull out the battery and connect the battery wire to the battery terminal	4  Reinstall the battery cover

7 AH battery (700 VA models)

1  Push at the top Edge to remove the battery cover	2  Slide down to remove the battery cover
3  Pull out the battery and connect the battery wire to the battery terminal	4  Reinstall the battery cover

7AH x 2, 9AH x 2 batteries (1000VA, 1500VA models)

1  Push at the top Edge to remove the battery cover	2  Slide down to remove the battery cover
3  Connect the battery cable	4  Reinstall the battery cover

INSTALLATION AND OPERATION:

Following steps explain how to connect and operate the Powerware 5110 UPS.

1. Connect the UPS to a grounded power outlet.

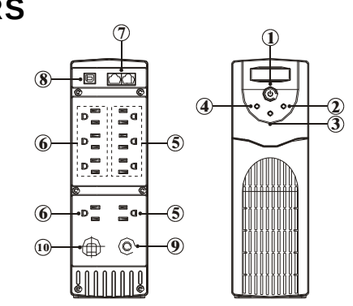
Note: It is recommended that the battery should be charged for minimum 8 hours to ensure full charge before placing the UPS in service.

2. Plug your computer, monitor or load to be protected into the "Battery Backup & Surge Protection" outlets. (These outlets will provide emergency battery backup power during power outages as well as protection from surges and spikes.)

CAUTION: Do NOT plug **LASER PRINTERS** into the "Battery Backup" outlets.
CAUTION: Do NOT plug **ACCESSORY SURGE** strips into the "Battery Backup" outlets.

3. Plug your peripheral equipment or non-critical loads (printer, scanner, fax, speaker, etc.) into the "Surge Protection" outlets. (These outlets provide surge and spike protection only, they will NOT provide battery backup power during a utility power failure).
4. Connect your computer to the UPS using USB cable provided.
5. With your equipment turned off, switch on the UPS.
6. When the "On/Off" LED light is illuminated, turn on the connected equipment.
7. Install Power management software provided with the UPS

INDICATORS



1.On/Off Push Button
Push button switch that controls power to the UPS and initiates the self-test function.
Depress the push button to turn on the UPS.
Depress the push button again to turn off the UPS.
The UPS will perform a self-test for about 5 seconds when the UPS is turned on.

2.AC mode (Green) LED
Indicates that AC utility power is present and regulated power (AVR) is applied to the connected equipment.

3.Fault / Warning (Red) LED
Indicates that a fault condition has occurred.
-Flashing Red LED indicates an overload condition or that the battery should be replaced.
-Solid On LED indicates that the output is shorted or an internal UPS fault exits.
See the Indicator Table below for further detail.

4.Backup mode (Yellow) LED
Indicates that the UPS is operating on battery and providing regulated AC power to the backup only outlets and the connected equipment.

5.Battery Backup & Surge Protection Outlets
Four 5-15R output receptacles that provide both backup and surge protection.

6.Surge Protection Outlets
Four 5-15R output receptacles that provide surge and spike protection only.

7.Data /Phone/Fax Protection Connectors

8.USB Communication Port
The built-in USB port connects to your computer. The LanSafe monitoring and shutdown software provided can automatically save your files and shut down your computer in the event of a prolonged power outage. The software also provides information regarding the status of your utility power line.

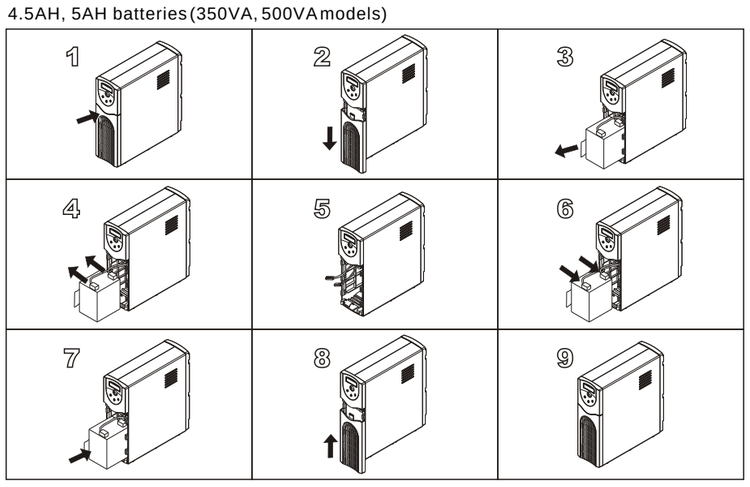
9.Circuit Breaker (resetable)
The button will protrude when the overload condition occurs. If the button protrudes, disconnect some non-essential equipment and reset the circuit breaker by pushing the button inward.

10.Power Cord
6 foot line cord

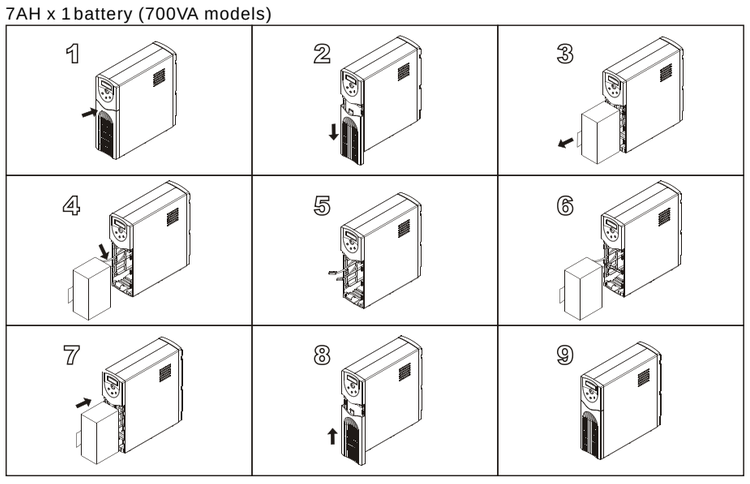
BATTERY REPLACEMENT PROCEDURE:

1.Disconnect the UPS from the power source and slide the battery door open. See pictures 1 and 2.
2.Disconnect the battery and remove as indicated below. See pictures 3 and 4
3.Insert the replacement battery and reconnect the battery cables.
See pictures 6 and 7
NOTE: It is important that the connectors be firmly attached to new batteries.
4.Reposition the battery door and slide closed. See pictures 8 and 9.
NOTE: Properly recycle used battery.

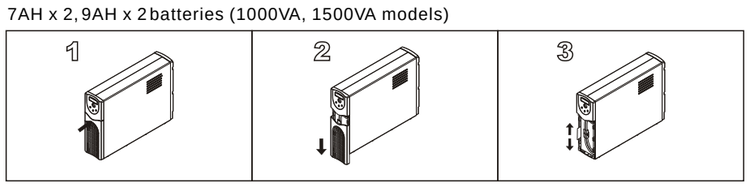
4.5AH, 5AH batteries (350VA, 500VA models)

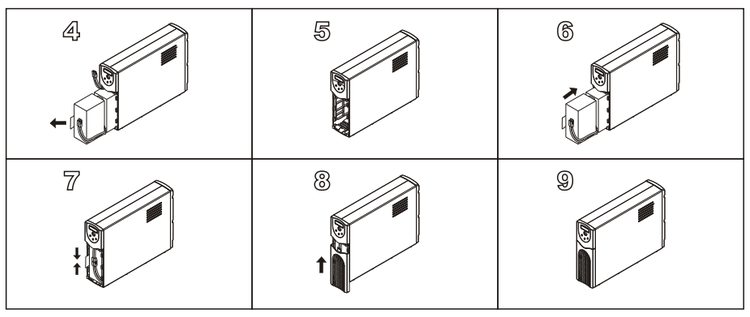


7AH x 1 battery (700VA models)



7AH x 2, 9AH x 2 batteries (1000VA, 1500VA models)





Status Indicators

The UPS provides both visual and audible status indicators. Visual indicators consist of three LEDs to represent the following conditions:

- On utility power operation
- On battery power operation
- UPS fault/alarm

LED Indicator Table

On Utility (AC mode)	Green Lighting
On Battery (Backup mode)	Yellow Lighting
Low Battery	Yellow Flashing
Fault/Output Short	Red Lighting
Overload/Check Battery	Red Flashing

LED Audible Alarm Table

Backup mode	Sounding every 5 seconds
Battery low	Sounding (two beeps) every 5 seconds
Overload	Sounding every 0.5 seconds
Replace battery	Sounding (three beeps) every 30 seconds
Fault or output short circuit	Continuous sounding
Battery over charge	Sounding (three beeps) every 5 seconds

SPECIFICATIONS

Model Numbers PW5110 350 USB PW5110 500 USB PW5110 700 USB PW5110 1000 USB PW5110 1500 USB	Capacity 350 VA / 210W 500 VA / 300W 700 VA / 420W 1000 VA / 600W 1500 VA / 900W
Nominal Input Voltage	120Vac
Nominal Output Voltage	120Vac
Automatic Voltage Regulation (AVR)	±15%
Frequency	50 / 60 Hz auto sensing
Outlets	8 Outlets (4 Battery Backup & Surge Protection; 4 Surge Protection only)
Lighting / Surge Protection	320 Joules
Transfer time to Battery/AC	6ms typical
Battery Type	Maintenance free lead-acid battery
Battery Specification	350 VA: 12V 4.5 Ah 500 VA: 12V 5 Ah 750 VA: 12V 7 Ah 1000 VA: (2) 12V 7 Ah 1500 VA: (2) 12V 9 Ah
Typical Backup Time	3 MINUTES MINIMUM AT FULL RATED LOAD
LAN / Phone / Fax Protection	RJ11/RJ45
Short Circuit Protection	Circuit Breaker
Communication Port	USB
Operation Temperature	0°C~40°C
Operation Relative Humidity	0 to 95% non-condensing
Storage Temperature	-15°C~50°C
Net Weight	350 VA: 11.9 pounds / 5.4 kg 500 VA: 12.13 pounds / 5.5 kg 700 VA: 15.21 pounds / 6.9 kg 1000 VA: 28 pounds / 12.7kg 1500 VA: 29.1 pounds / 13.2 kg
Dimensions (HxWxD)	350 / 500 / 700 VA: 10.6 x 3.4 x 10 in. 1000 / 1500 VA: 10.6 x 3.4 x 15 in.

* Due to continuing product improvement programs, specifications are subject to change without notice.

TROUBLESHOOTING

Symptom	Possible Cause	Action to Take
UPS will not turn on	The UPS is not connected to the power source.	Ensure the UPS is securely connected to an AC outlet.
	Circuit Breaker has tripped.	Reduce the amount of equipment plugged into the "Battery Backup & Surge Protection" outlets of the UPS. Reset the circuit breaker by pushing it back in. Switch the UPS back on.
UPS is making a continuous sound and the "Overload" indicator is on	The "Battery Backup & Surge Protection" outlets are overload.	Turn off the UPS and reduce the amount of equipment connected to these outlets.
UPS does not provide expected runtime	The UPS battery is discharged due to a power outage and has not recharged.	Charge the battery for 8 hours. The UPS runtime is reduced until the battery is fully charged.
	Devices plugged into Back up & surge protection receptacles exceed the rated load for the UPS run time	Unplug non-essential equipment (printers, scanners, etc) from the Battery Backup outlets and plug into 'Surge Only' outlets
UPS does not power essential equipment during an outage	The UPS circuit breaker "tripped".	Disconnect non-essential equipment from the UPS. Reset (push in) the circuit breaker and switch the UPS on. Plug equipment in one-at-a-time. If the circuit breaker trips again, disconnect the device that caused the breaker to trip.
	The battery has reached the end of its life.	Replace the battery or the battery module.
	Equipment plugged into a Surge Only outlet.	Unplug device from 'Surge Only' outlet and move to a 'Battery Backup outlet.
Red LED Indicator ON	Internal UPS fault.	Contact Technical Support (see Service and Support below).

SERVICE AND SUPPORT

For questions and/or problems, please call your local distributor or the help desk at one of the following telephone numbers and ask for a UPS technical representative.

United States:	1.800.356.5737
Europe, Middle East, and Africa:	+44.17.53.608.700
Asia:	+852.2830.3030
Australia:	+61.3.9706.5022

Please have the following information ready when you call the Help Desk:

- Model number
- Serial number
- Version number (if available)
- Date of failure or problem
- Symptoms of failure or problem
- Customer return address and contact information

If repair is required, you will be given a Returned Material Authorization (RMA) Number. This number must appear on the outside of the package and on the Bill of Lading (if applicable). Use the original packaging or request packaging from the Help Desk or distributor. Units damaged in shipment as a result of improper packaging are not covered under warranty.
A replacement unit will be shipped, freight prepaid for all units under warranty.
For additional information please visit us online: **www.powerware.com**

EATON | Powerware

MA6B411003A(2005/01/25)

SIEMENS

Agnico Eagle, Baker Lake
Jet-A Tank Farm
Motor soft starter
3RW4026-1BB15

Industrial Controls

Soft starters
SIRIUS 3RW30 / 3RW40

Manual

01/2010
535 1995-02 DS01

Legal information

Warning notice system

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

CAUTION

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

NOTICE

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

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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

⚠ WARNING

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

Trademarks

All names identified by ® are registered trademarks of the Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

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

Siemens AG
Industry Sector
Postfach 48 48
90026 NÜRNBERG
GERMANY

Ordernumber: 3ZX1012-0RW30-1AC1
®‹ 01.2010

Table of contents

Introduction 1

1.1 Important notes

Purpose of the manual

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

Target group

This manual is intended for any user involved in

- Commissioning
- Servicing and maintaining
- Planning and configuring systems

Basic knowledge required

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

Scope of validity

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

Standards and approvals

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

Disclaimer of liability

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

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

Orientation aids

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

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

Continuously updated information

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

For all technical queries, please contact:

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

Correction sheet

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

Safety information 2

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

⚠ DANGER

Hazardous voltage Will cause death or serious injury.

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

⚠ DANGER

Hazardous voltage Will cause death or serious injury.

Qualified Personnel.

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

2.2 Five safety rules for work in or on electrical systems

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

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

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

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

Explanations

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

Product description 3

3.1 Fields of application

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

SIRIUS soft starter family

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

3RW30 and 3RW40

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

3RW44

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

Download from 3RW44 manual (http://support.automation.siemens.com/WW/llisapi.dll?func=cslib.csinfo&lang=de&objid=21772518&caller=view).

3.2 Basic physical principles of a three-phase induction motor

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

3.2.1 Three-phase induction motor

Fields of application

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

Problem

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

Starting current

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

Disadvantage

This results in the following disadvantage:

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

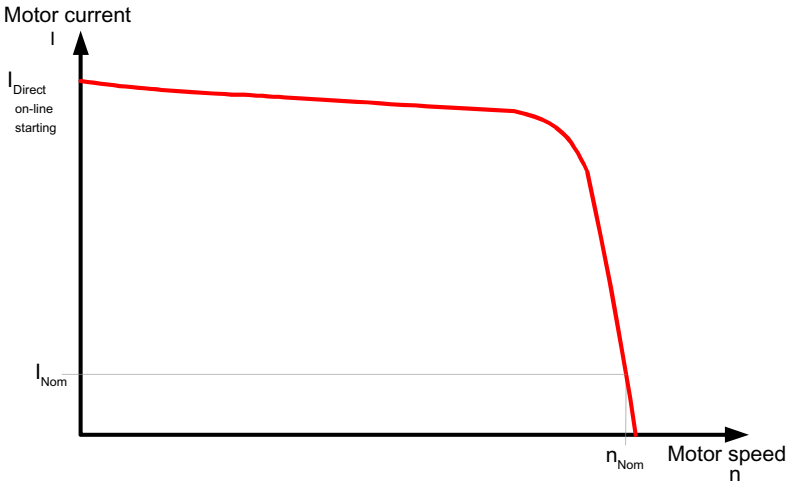


Figure 3-1 Typical starting current characteristic of a three-phase induction motor

Starting torque

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

Disadvantages

This results in the following disadvantages

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

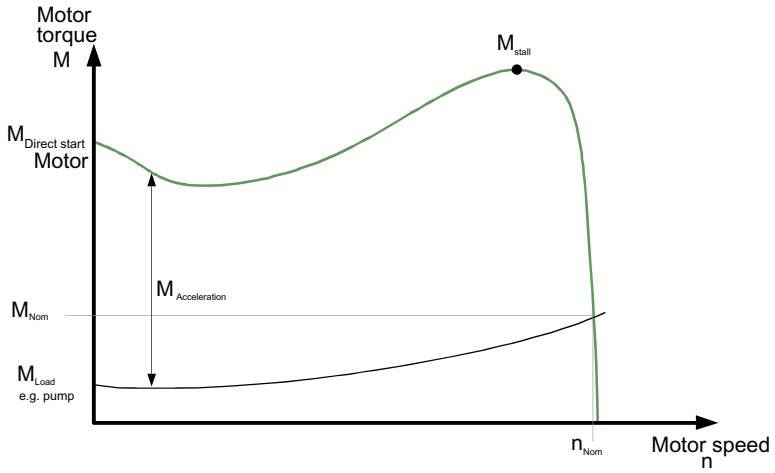


Figure 3-2 Typical starting torque characteristic of a three-phase induction motor

Remedy

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

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

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

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

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

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

Example

SIEMENS 1LG4253AA motor (55 kW)

Rated data at 400 V

P_e:	55 kW
I_e:	100 A
$I_{direct\ starting}$:	Approx. 700 A
M_e:	355 Nm ; e.g.: $M_e = 9.55 \times 55\ kW \times \frac{1000}{1480\ min^{-1}}$
n_e:	1480 rpm
$M_{direct\ starting}$:	Approx. 700 Nm
Set starting voltage:	50 % (½ of mains voltage)

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

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

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

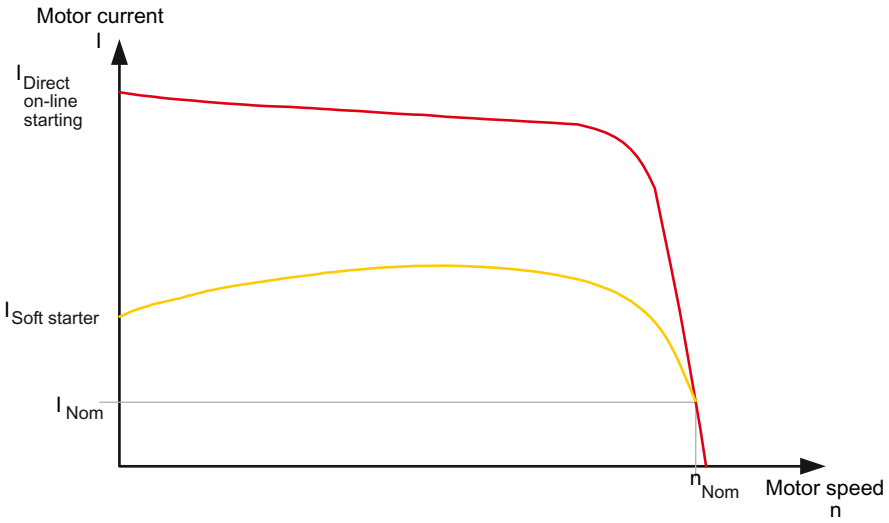


Figure 3-3 Reduced current characteristic of a three-phase induction motor during starting with a SIRIUS 3RW30 or 3RW40 soft starter

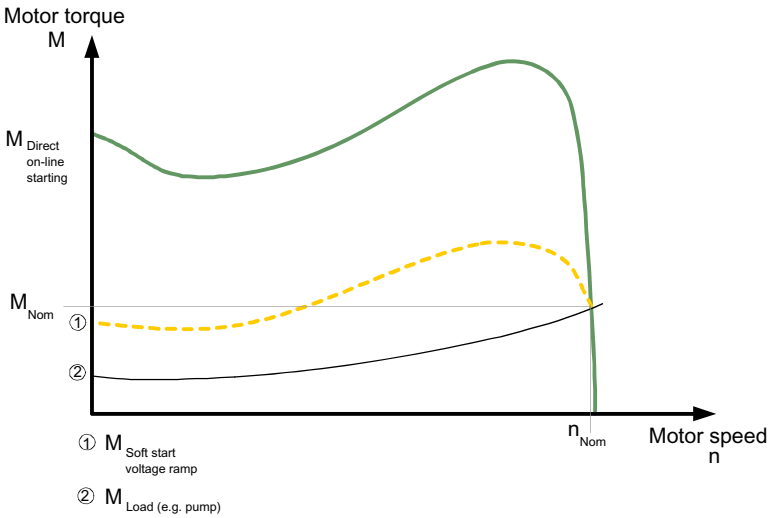


Figure 3-4 Reduced torque characteristic of a three-phase induction motor during starting with a SIRIUS 3RW30 or 3RW40 soft starter

Soft start /soft stop

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

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

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

Bypass mode

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

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

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

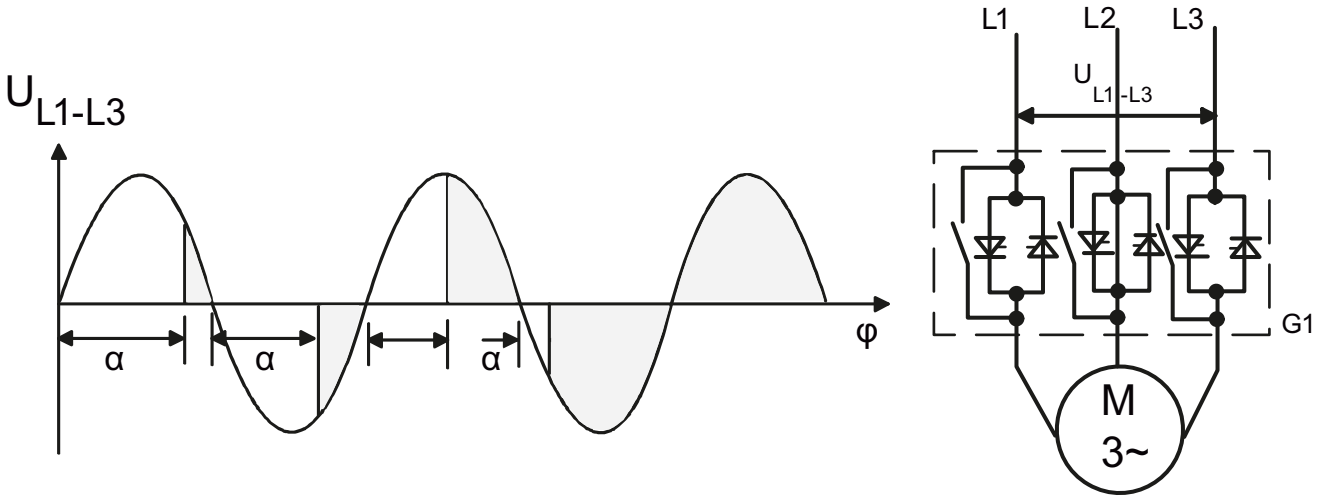


Figure 3-5 Phase angle control and schematic diagram of a two-phase controlled soft starter with integral bypass contacts

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

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

Two-phase control

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

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

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

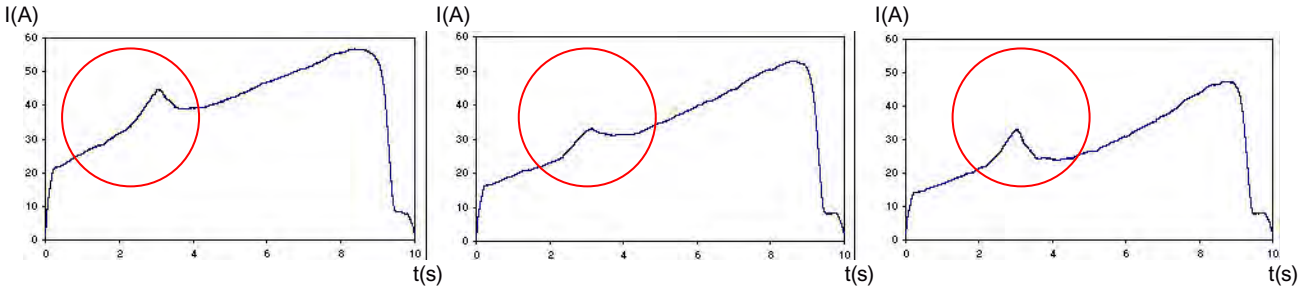


Figure 3-6 Current characteristic and occurrence of DC components in the three phases without "polarity balancing"

Polarity balancing

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

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

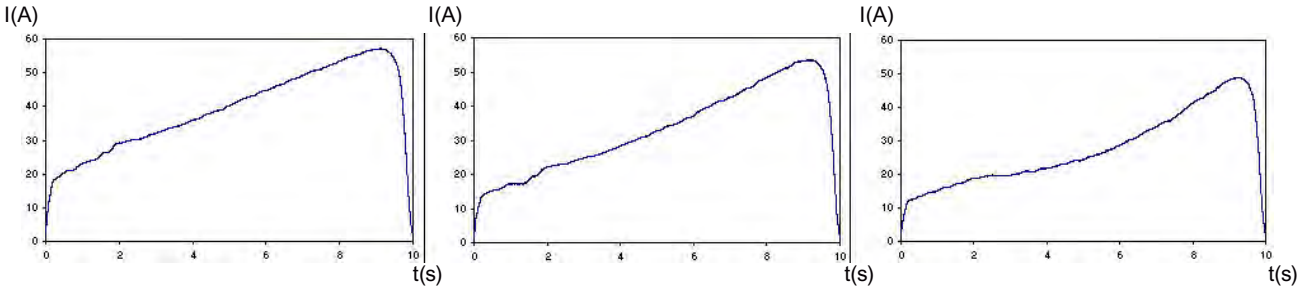


Figure 3-7 Current characteristic in the three phases without DC components thanks to "polarity balancing"

3.3.2 Starting current asymmetry

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

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

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

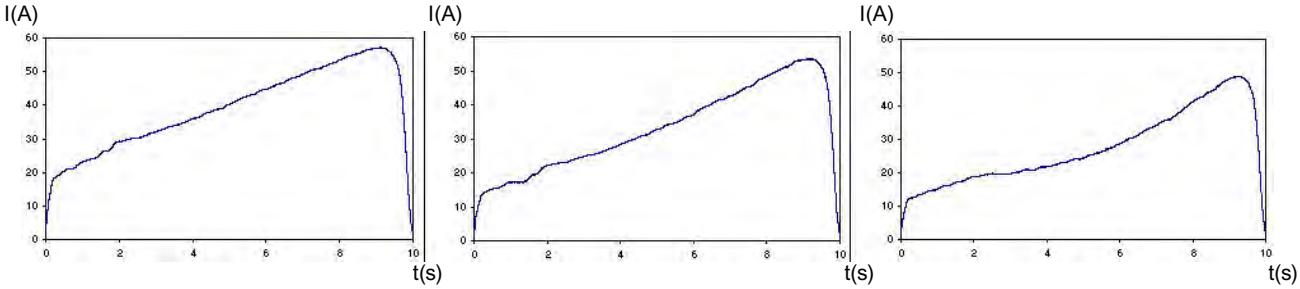


Figure 3-8 Starting current asymmetry

Note

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

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

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

3.3.3 Applications and use

Applications and selection criteria

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

The most important advantages are:

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

Applications

The typical applications include:

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

Advantages

Conveyor belts and transport systems:

- Smooth starting
- Smooth stopping

Rotary pumps and piston pumps:

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

Agitators and mixers:

- Reduced starting current

Fans:

- Protection for the gearbox and V belt

3.4 Comparison of device functions




		SIRIUS 3RW30 Standard applications	SIRIUS 3RW40 Standard applications	SIRIUS 3RW44 High Feature applications
Rated current at 40 °C / 50 °C	A	3 . . . 1 0 6 / 3 . . . 9 8	12.5...432 / 11 ... 385	29 ... 1214 / 26 ... 1076
Rated operational voltage	V	200...480	200...600	200...690
Motor rating at 400 V / 460 V •Standard connection •Inside-delta circuit	 kW /hp kW /hp	 1.5...55 / 1.5 ... 75 –	 5.5...250 / 7.5 ... 300 –	 15...710 / 15 ... 950 22...1200 / 30 ... 1700
Ambient temperature	°C	-25...+60	-25...+60	0 . . . + 6 0
Soft start/soft stop		✔[1]	✔	✔
Voltage ramp		✔	✔	✔
Starting/stopping voltage	%	40...100	40...100	20...100
Ramp-up and ramp-down time	s	0 . . . 2 0	0 . . . 2 0	1 . . . 3 6 0
Torque control		–	–	✔
Starting/stopping torque	%	–	–	20...100
Torque limiting	%	–	–	20...200
Ramp time	s	–	–	1 . . . 3 6 0
Integrated jumper contact system		✔	✔	✔
Intrinsic device protection		–	✔	✔
Motor overload protection		–	✔[7]	✔
Thermistor motor protection		–	✔[2]	✔
Integrated remote RESET		–	✔[3]	✔
Settable current limiting		–	✔	✔
Inside-delta circuit		–	–	✔
Breakaway torque		–	–	✔
Creep speed in both directions of rotation		–	–	✔
Pump stop		–	–	✔[4]
DC braking		–	–	✔[4] [5]
Combined braking		–	–	✔[4] [5]
Motor heating		–	–	✔
Communication		–	–	With PROFIBUS DP (option)
External display and operator control module		–	–	(option)
Status measured value display		–	–	✔
Error log		–	–	✔
Events list		–	–	✔
Min/max pointer function		–	–	✔
Trace function		–	–	✔[6]
Programmable control inputs and outputs		–	–	✔
Number of parameter sets		1	1	3
Parameterizing software (SoftStarterES)		–	–	✔
Power semiconductors (thyristors)		2 controlled phases	2 controlled phases	3 controlled phases
Screw terminals		✔	✔	✔
Spring-loaded terminals		✔	✔	✔
UL/CSA		✔	✔	✔
CE mark		✔	✔	✔
Soft starting under heavy-duty starting		–	–	✔[4]
Support for configuration		Win-Soft Starter, electronic selection slider, Technical Assistance ++49 9118955900		

✔ Function available; – function not available.

1) For 3RW30 only soft start.

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

3) For 3RW402. to 3RW404.; for 3RW405. and 3RW407. optional.

4) If necessary, overdimension soft starter and motor.

5) Not possible in inside-delta circuit.

6) Trace function with SoftStarterES software.

7) Acc. to ATEX

Product combinations

4

4.1 SIRIUS modular system

Switching, protecting, and starting motors

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

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

For further information on individual products, refer to System manual (http://support.automation.siemens.com/WW/llisapi.dll?aktprim=0&lang=en&referer=%2fWW%2f&func=cslib.csinfo&siteid=csius&caller=view&extranet=standard&viewreg=WW&nodeid0=20025979&objaction=csopen) "Innovations in the SIRIUS modular system", Order No. 3ZX1012-0RA01-1AB1.

SIRIUS motor starter protectors


3RV20 11 (S00)


3RV20 21 (S0)


3RV10 31 (S2)


3RV10 41 (S3)

SENTRON circuit breakers


VL250/3VL3


VL400/3VL4


VL630/3VL5

SIRIUS contactors


3RT20 1 (S00)


3RT20 2 (S0)


3RT10 3 (S2)


3RT1. 4 (S3)


3RT1. 5 (S6)


3RT1. 6 (S10)


3RT1. 7 (S12)

SIRIUS overload relays


3RB30 16 (S00)


3RB30 26 (S0)


3RB20 36 (S2)


3RB20 46 (S3)


3RB20 56 (S6)


3RB20 66 (S10/S12)

SIRIUS soft starters


3RW30 1 (S00)


3RW40 2 (S0)


3RW40 3 (S2)


3RW40 4 (S3)


3RW40 5 (S6)


3RW40 7 (S10/S12)

Figure 4-1 SIRIUS modular system

Functions

5

5.1 Start modes

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

5.1.1 Voltage ramp

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

Starting voltage

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

Ramp time

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

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

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

CAUTION
Risk of property damage When using the 3RW30: Make sure the selected ramp time is longer than the actual motor ramp-up time. If not, the SIRIUS 3RW30 may be damaged because the internal bypass contacts close when the set ramp time elapses. If the motor has not finished starting up, an AC3 current that could damage the bypass contact system will flow. When using the 3RW40: The 3RW40 has an integrated ramp-up detection function that prevents this operating state from occurring.

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

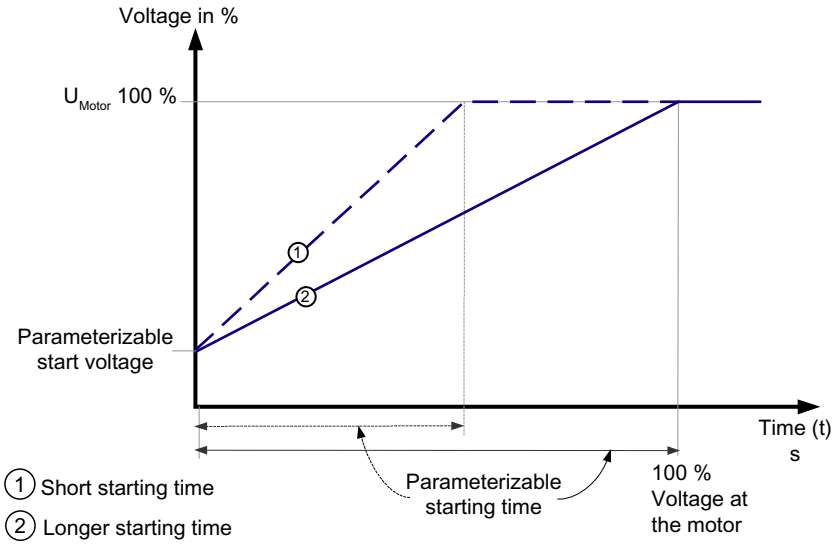


Figure 5-1 Principle of the voltage ramp

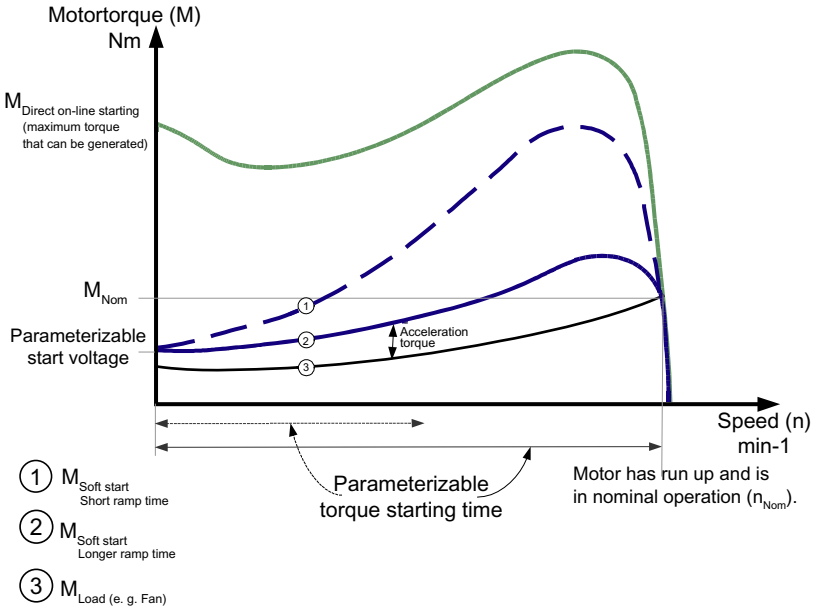


Figure 5-2 Principle of the voltage ramp for the torque characteristic

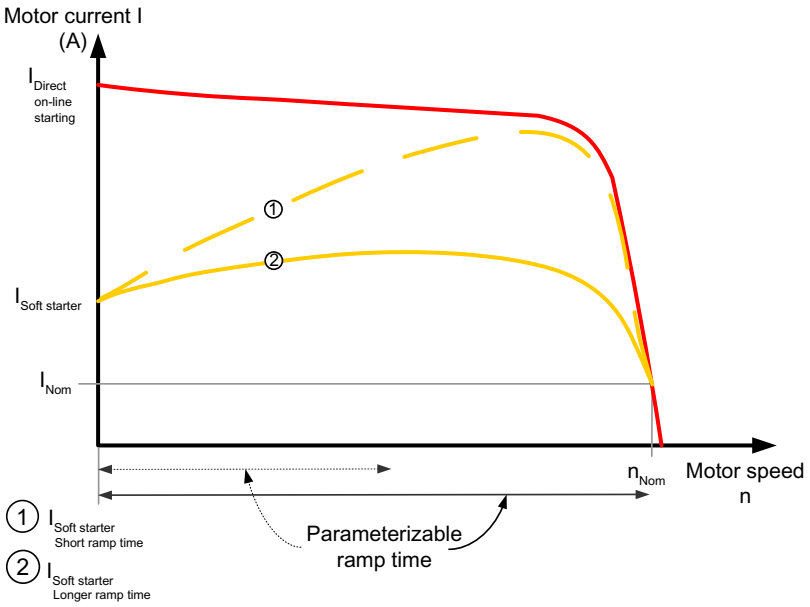


Figure 5-3 Principle of the voltage ramp for the starting current characteristic

Typical applications of the voltage ramp

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

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

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

Current limiting value

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

Example

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

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

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

Ramp-up detection (3RW40 only)

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

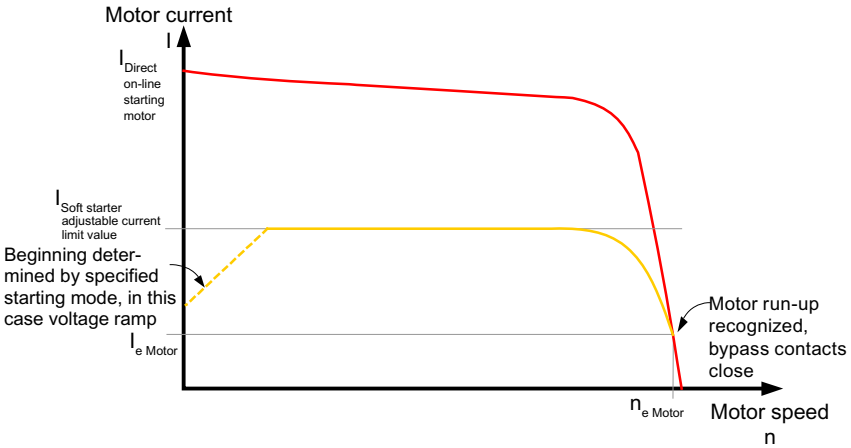


Figure 5-4 Current limiting with soft starter

Typical applications for current limiting

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

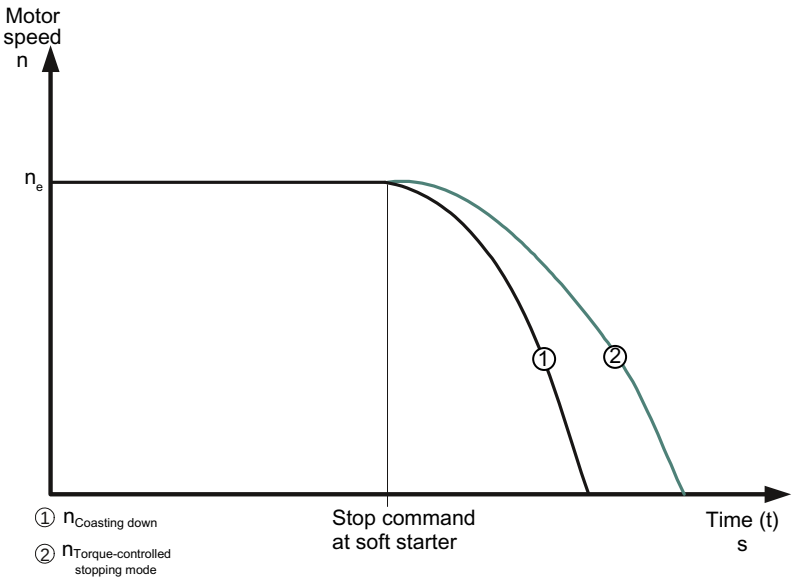
5.2 Stop modes

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

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

Note

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



5.2.1 Stop without load (3RW30 and 3RW40)

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

Typical applications for stop without load

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

5.2.2 Soft stop (3RW40 only)

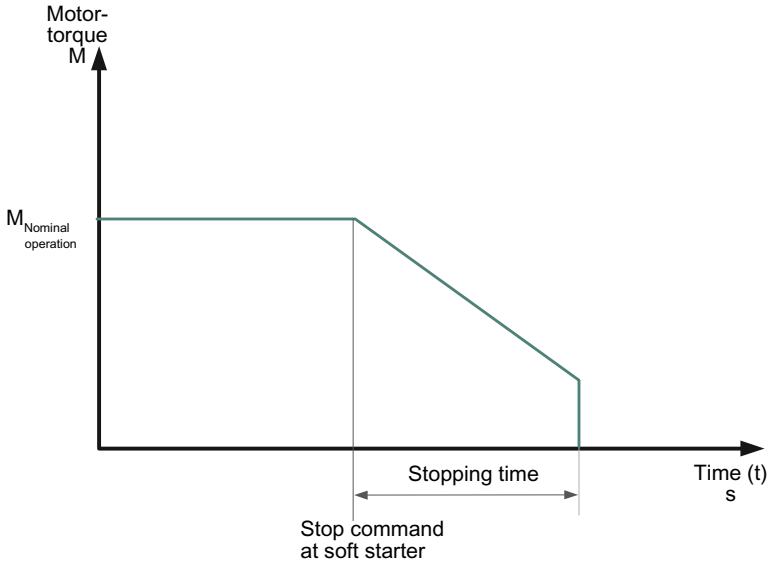
In "soft stop" mode, the natural stop process of the load is decelerated. The function is used when the load must be prevented from stopping abruptly. This is typically the case in applications with a low mass inertia or a high counter-torque.

Ramp-down time

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

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

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



Typical applications for soft stop

Use soft stop for

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

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

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

5.3.1 Motor protection function

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

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

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

Note

Thermistor motor protection evaluation

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

Motor overload protection

The current flow during motor operation is measured by measuring the current with transformers integrated in the soft starter. The temperature rise in the winding is calculated based on the rated operational current set for the motor.
A trip is generated by the soft starter when the characteristic is reached, depending on the trip class (CLASS setting).

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

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

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

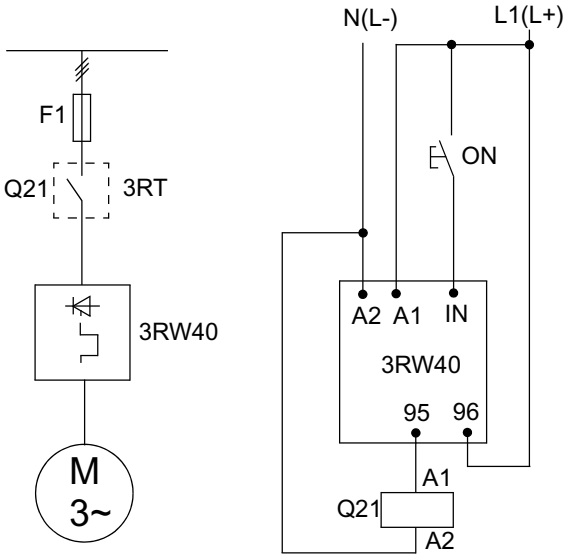


Figure 5-5 3RW40 wiring fault

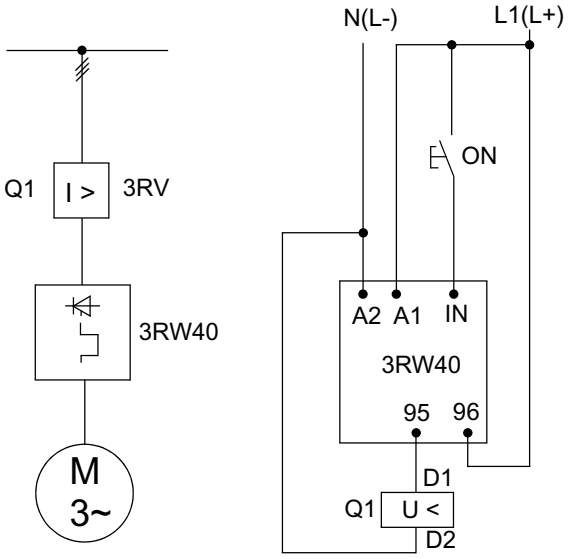


Figure 5-6 3RW40 wiring fault with 3RV

For further information, refer to the operating instructions, Order No. 3ZX1012-0RW40-1CA1 (http://support.automation.siemens.com/WW/view/de/22809303).

⚠ WARNING

Danger of death or serious injury.

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

Trip class (electronic overload protection)

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

Note

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

Recovery time (motor overload protection)

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

Protection against voltage failure in the event of a fault

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

Temperature sensor

Note

Temperature sensor

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

This motor protection function measures the motor's stator winding temperature directly with the help of a sensor installed in the motor, in other words the motor must have a sensor wound into the stator winding.
You can choose between two different sensor types for the evaluation.

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

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

Recovery time (thermistor motor protection)

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

5.3.2 Intrinsic device protection (3RW40 only)

Thyristor protection (thermal)

SIRIUS 3RW40 soft starters are equipped with integrated intrinsic device protection to prevent thermal overloading of the thyristors.
This is achieved on the one hand by means of current measuring transformers in the three phases and on the other, by measuring the temperature with temperature sensors on the thyristor's heat sink.
If the fixed, internally set trip value is exceeded, the soft starter is automatically disconnected.

Recovery time (intrinsic device protection)

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

Thyristor protection (short-circuit)

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

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

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

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

5.4 Functions of the RESET buttons

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

5.4.1.1 RESET MODE button and LED

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

Yellow = AUTO

Off = MANUAL

Green = REMOTE

Note

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

5.4.1.2 Manual RESET

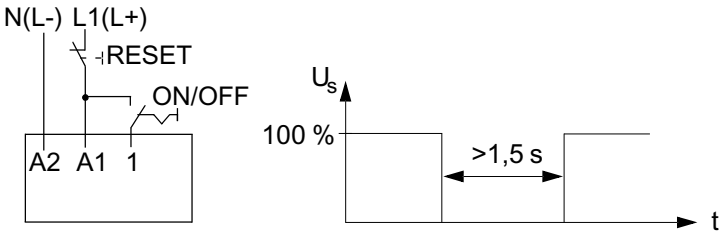
Manual RESET with the RESET / TEST button (RESET MODE LED = off)

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

5.4.1.3 Remote RESET

Remote RESET (RESET MODE LED = green)

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



5.4.1.4 AUTO RESET

AUTO RESET (RESET MODE LED = yellow)

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

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

⚠ WARNING

Automatic restart
Danger of death, serious injury, or property damage.

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

5.4.1.5 Acknowledging faults

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

5.4.2 SIRIUS 3RW40 5 and 3RW40 7 soft starters

5.4.2.1 RESET MODE button and AUTO LED

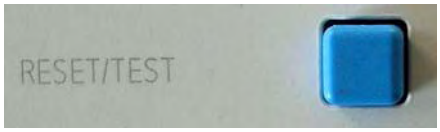
By pressing the RESET MODE button, you define the reset procedure in case of a fault. This is indicated by the AUTO LED.

Yellow = AUTO
Off = MANUAL (REMOTE)

5.4.2.2 Manual RESET

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

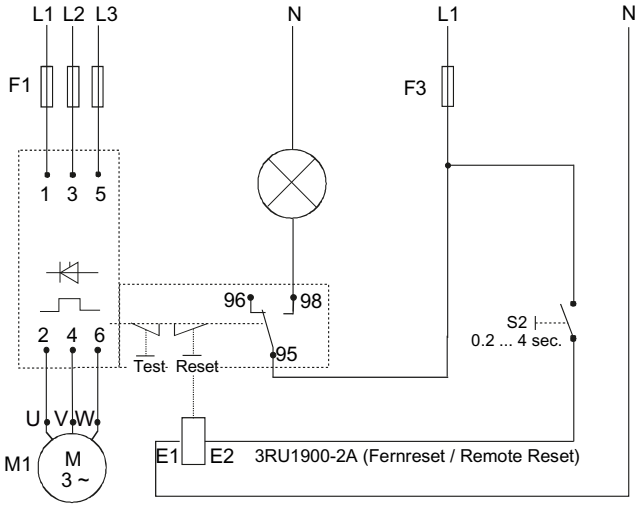
You can reset a fault by pressing the RESET / TEST button.



5.4.2.3 Remote RESET

Remote RESET (AUTO LED = green)

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



5.4.2.4 AUTO RESET

AUTO RESET (AUTO LED = yellow)

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

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

⚠ WARNING

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

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

5.4.2.5 Acknowledging faults

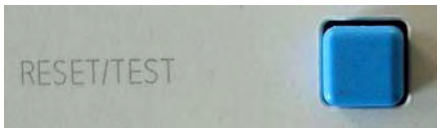
For information about whether or not faults can be acknowledged as well as the corresponding LED and output contact states, refer to chapter Diagnostics and fault signals [Page 44].

5.4.3 Other functions of the RESET button

5.4.3.1 Motor protection trip test

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

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



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

5.4.3.2 Reparameterizing the ON / RUN output contact

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

5.5 Functions of the inputs

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

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

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

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

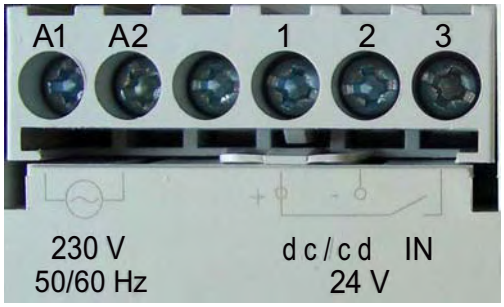
For recommended circuits, e.g. control by means of pushbuttons, contactor contacts, or a PLC, refer to chapter Typical circuit diagrams [Page 167].

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

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

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

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

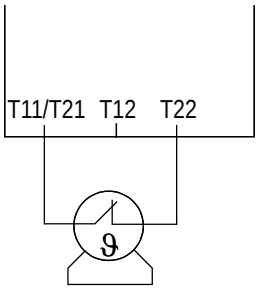


For recommended circuits, e.g. control by means of pushbuttons, contactor contacts, or a PLC, refer to chapter Typical circuit diagrams [Page 167].

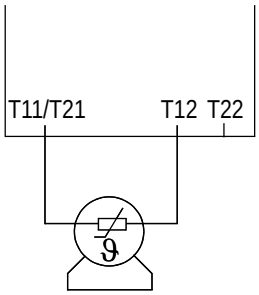
5.5.3 Thermistor input / connection on 3RW40 2 to 3RW40 4

24 V AC/DC rated control voltage

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



Klixon



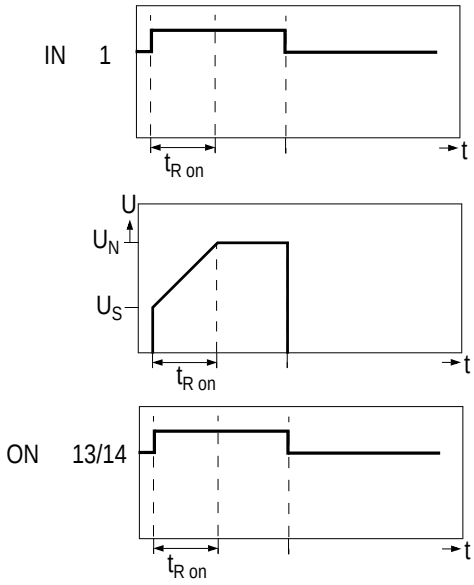
Type A PTC

5.6 Functions of the outputs

5.6.1 3RW30: Output terminal 13 / 14 ON

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

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



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

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

ON

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

Reparameterizing from ON to RUN

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

RUN

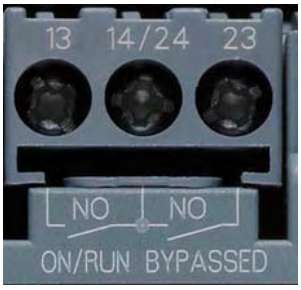
The RUN output remains closed as long as the motor is controlled by the soft starter, in other words during the startup phase, in bypass mode, and during the soft stop (if set). This output function can be used, for instance, if a line contactor connected upstream must be controlled by the soft starter,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

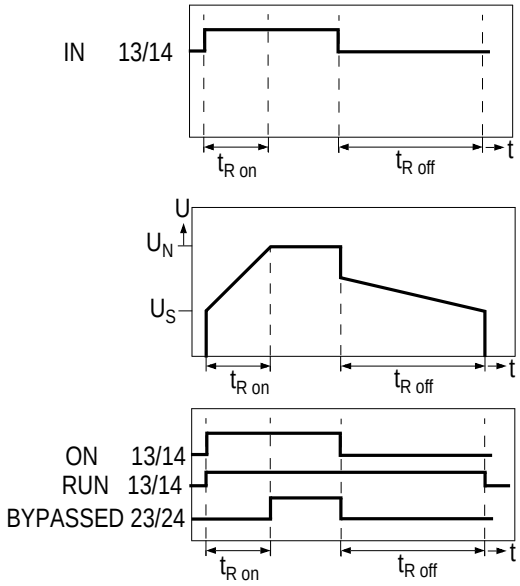
BYPASSED

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

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

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





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

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

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

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

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

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

5.7 Diagnostics and fault signals

5.7.1 3RW30: LEDs and troubleshooting

		LEDs on 3RW30		Auxiliary contact
		Soft starter		
3RW30		DEVICE (rd/gn/ylw)	STATE/BYPASSED/ FAILURE (gn/rd)	13 14/ (ON)
U_s= 0		●	●	
Operating state	IN			
Off	0	☼ gn	●	
Start	1	☼ gn	◑ gn	
Bypassed	1	☼ gn	☼ gn	
Fault				
Impermissible electronics supply voltage [1]		●	☼ rd	
Bypass overload [2]		☼ ylw	☼ rd	
- Missing load voltage [1] - Phase failure, missing load [1]		☼ gn	☼ rd	
Device fault [3]		☼ rd	☼ rd	

LEDs					
●	☼	◑	gn =	rd =	ylw =
Off	ON	Flashing	Green	Red	Yellow

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

⚠ WARNING

Automatic restart
Danger of death, serious injury, or property damage.

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

2) The fault can be acknowledged by removing the start command at the start input.

3) Switch off the control voltage, then switch it on again. If the fault is still present, contact your SIEMENS partner or Technical Assistance.

For notes on troubleshooting, refer to the table below.

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

5.7.2 3RW40: LEDs and troubleshooting

		LEDs on 3RW40				Auxiliary contacts			
		Soft starter		Motor protection					
3RW40		DEVICE (rd/gn/ylw)	STATE / BYPASSED / FAILURE (gn/rd)	OVERLOAD (rd)	RESET MODE / AUTO (ylw/gn)	13 14 (ON)	13 14 (RUN)	24 23 (BYPASSED)	96 95 98 FAILURE / OVERLOAD
U_S= 0		●	●	●	●				
Operating state	IN								
Off	0	☼ gn	●	●	●				
Start	1	☼ gn	◑ gn	●	●				
Bypassed	1	☼ gn	☼ gn	●	●				
Stop	0	☼ gn	◑ gn	●	●				
Warning									
I_e/ impermissible CLASS setting [2]		☼ gn	● ◑ ☼ gn gn	◑	●				
Start inhibited, device too hot (cooling time may vary according to thyristor temperature) [3]		◑ ylw	●	●	●				
Fault									
Impermissible electronics supply voltage [2]		●	☼ rd	●	●				
Impermissible I_e / CLASS setting and IN (0 -> 1) [2]		☼ gn	☼ rd	◑	●				
Motor protection tripping, overload relay [1] cooling time 60 s / thermistor cooling time may vary according to motor temperature		☼ gn	●	☼	●				
Thermistor motor protection Wire breakage / short-circuit [1] [3]		☼ gn	●	⋈	●				
Thermal overload on device [3] (cooling time > 30 s)		☼ ylw	☼ rd	●	●				
- Missing load voltage - Phase failure, missing load [3]		☼ gn	☼ rd	●	●				
Device fault (cannot be acknowledged, device defective) [5]		☼ rd	☼ rd	●	●				
Test function									
Press TEST t>5 s [4]		☼ gn	●	☼ rd	●				
RESET MODE (press to change)									
Manual RESET		●	●	●	●				
Auto RESET		●	●	●	☼ ylw				
Remote RESET		●	●	●	☼ gn				

LEDs							1) Optional, 3RW40 2. to 3RW40 4. in 24 V AC/DC only
●	☼	◑	⋈	gn =	ylw =	rd =	2) Automatically reset if the setting is corrected or when the system returns to normal
							3) Must be acknowledged according to the selected RESET mode 4) Motor protection trip test
Off	ON	Flashing	Flickering	Green	Yellow	Red	5) Device fault cannot be acknowledged. Contact your SIEMENS partner or Technical Assistance.

⚠ WARNING

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

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

Notes on troubleshooting

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

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

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

Application planning

6

6.1 Application examples

6.1.1 Roller conveyor application

Using the 3RW30 with roller conveyors

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

The following requirements must be met by the roller conveyor:

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

The SIRIUS 3RW30 soft starter offers the following advantages:

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

6.1.2 Hydraulic pump application

Using the 3RW40 with hydraulic pumps

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

The drives for hydraulic pumps must meet the following requirements:

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

The SIRIUS 3RW40 soft starter offers the following advantages:

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

Installation

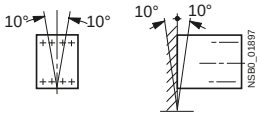
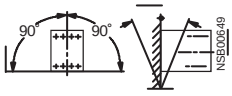
7

7.1 Installing the soft starter

7.1.1 Unpacking

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

7.1.2 Permissible mounting position

3RW30	3RW40 2 to 3RW40 4 (with optional additional fan)
3RW40	3RW40 5 to 3RW40 7
	
Vertical mounting	Horizontal mounting

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

Note

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

7.1.3 Mounting dimensions, clearances, and assembly type

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

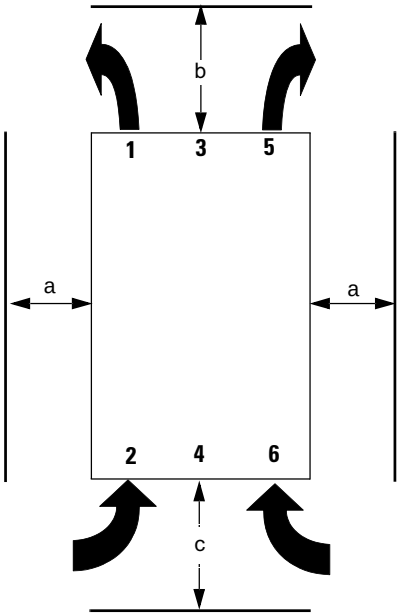


Figure 7-1 Clearances from other devices

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

NOTICE

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

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

Standalone assembly

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

Side-by-side assembly

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

Direct mounting

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

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

7.1.5 Installation requirements

Degree of protection IP00

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

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

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

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

Installation / mounting

8

8.1 General information

General information

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

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

Disconnector

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

Contact

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

⚠ DANGER

Hazardous voltage
Danger of death or serious injury.

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

Note

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

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

8.2 Five safety rules for work in or on electrical systems

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

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

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

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

Explanations

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

8.3 General feeder assembly (type of coordination 1)

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

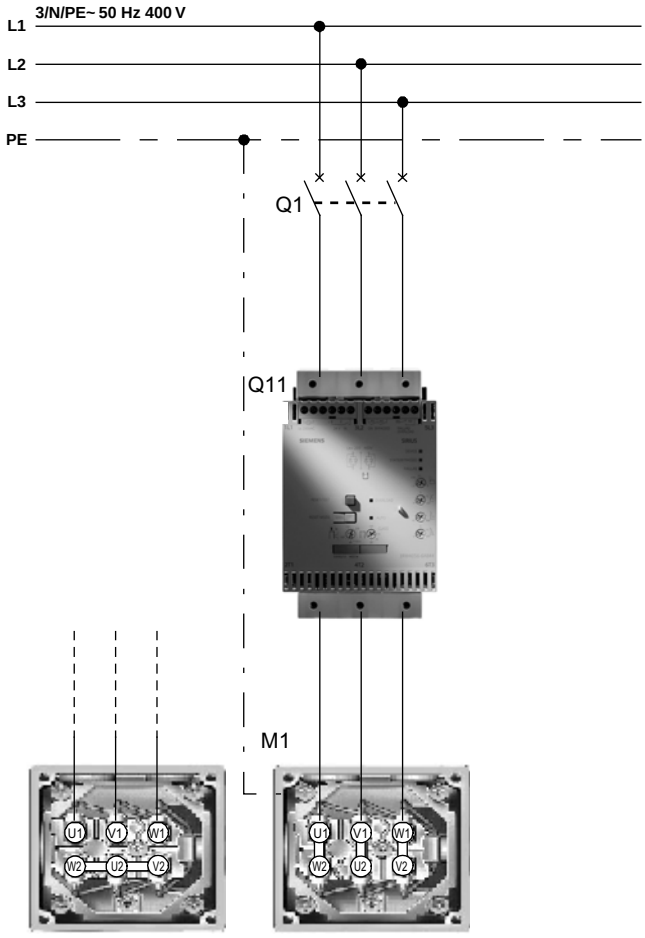


Figure 8-1 Block diagram of the SIRIUS 3RW40 soft starter

Note

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

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

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

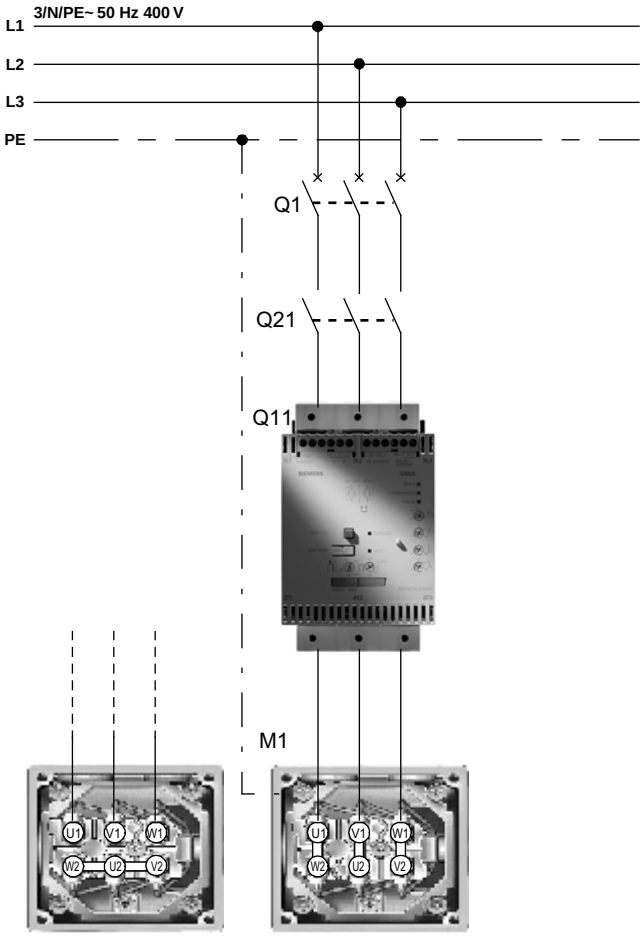


Figure 8-2 Block diagram of a feeder with an optional main / line contactor

Note

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

NOTICE

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

8.5 Soft starter assembly with type of coordination 2

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

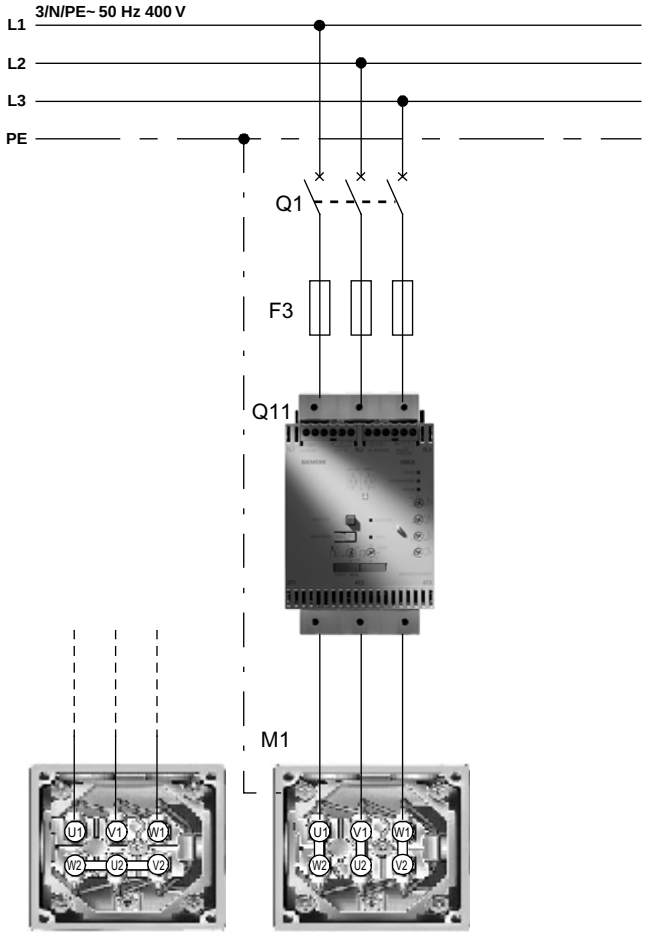


Figure 8-3 Block diagram of a feeder with semiconductor fuses

Note

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

Note

Minimum and maximum configuration of the semiconductor fuses

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

Minimum configuration: The fuse is optimized for the thyristor's I^2t value.

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

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

The maximum configuration is recommended for heavy-duty starting.

CAUTION

Risk of property damage

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

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

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

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

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

8.6 Capacitors to improve the power factor

⚠ CAUTION

No capacitors must be connected to the output terminals of the soft starter. If so, the soft starter will be damaged.
Active filters, e.g. for power factor correction, must not be operated parallel to the motor control device.

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

8.7 Maximum cable length

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

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

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

Connecting

9

9.1 Electrical connection

9.1.1 Control and auxiliary terminals

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

- Screw-type technology
- Spring-loaded technology

9.1.2 Main circuit connection

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