

YASKAWA SINGLE PHASE CONVERTER

INSTALLATION & PRIMARY OPERATION

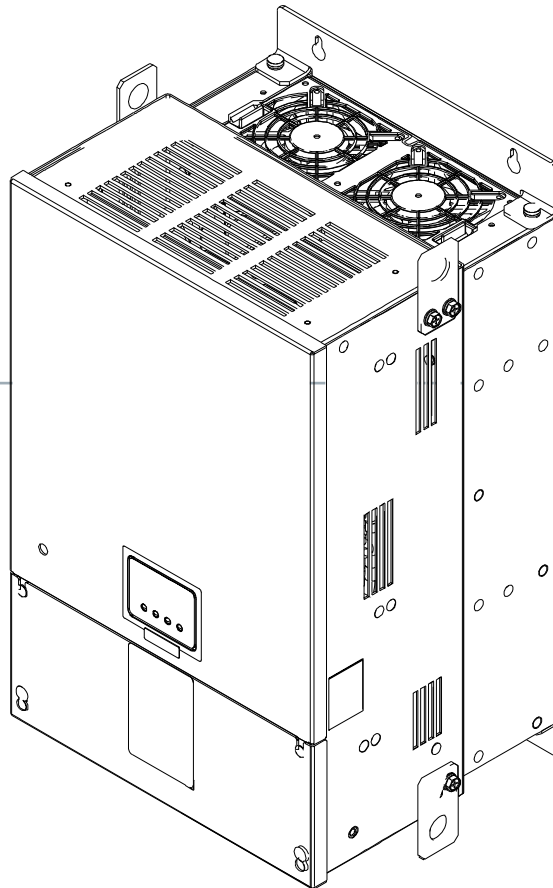
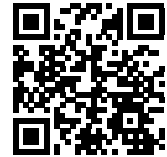
FOR INDUSTRIAL APPLICATIONS

SYSTEM NO.:

SPBC-240-xxHP
240 V: 20 to 60 HP
SPBC-480-xxHP
460 V: 30 to 125 HP

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DOCUMENT NUMBER: TOEPYAISPC01

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1 Preface and General Safety

◆ General Description

The Single Phase Converter (SPC) allows three-phase variable frequency drives to operate on a single-phase power source. The converter accepts single-phase input power and outputs a DC power supply to the drive. Additionally, the SPC eliminates the need to oversize variable frequency drives for single-phase applications. Power source distortion is reduced to less than 10% iTHD and faults are automatically reset with the SPC's factory default settings.

◆ General Safety

General Precautions

- The diagrams in this manual may be indicated without covers or safety shields to show details. Replace the covers or shields before operating the SPC and run the SPC according to the instructions described in this manual.
- Any illustrations, photographs, or examples used in this manual are provided as examples only and may not apply to all products to which this manual is applicable.
- The products and specifications described in this manual or the content and presentation of the manual may be changed without notice to improve the product and/or the manual.
- When ordering a new copy of the manual due to damage or loss, contact your Yaskawa representative or the nearest Yaskawa sales office and provide the manual number shown on the front cover.
- If nameplate becomes worn or damaged, order a replacement from your Yaskawa representative or the nearest Yaskawa sales office.

⚠ WARNING Read and understand this manual before installing, operating or servicing this converter. The converter must be installed according to this manual and local codes. The following conventions are used to indicate safety messages in this manual. Failure to heed these messages could result in serious or fatal injury or damage to the products or to related equipment and systems.

⚠ DANGER Indicates a hazardous situation, which, if not avoided, WILL result in death or serious injury.

⚠ WARNING Indicates a hazardous situation, which, if not avoided, COULD result in death or serious injury.

⚠ CAUTION Indicates a hazardous situation, which, if not avoided, COULD result in MINOR OR MODERATE injury.

NOTICE Indicates a PROPERTY DAMAGE MESSAGE.

■ Safety Messages

⚠ DANGER Heed the safety messages in this manual. The operating company is responsible for any injuries or equipment damage resulting from failure to heed the safety messages in this manual. Failure to comply will result in death or serious injury.

⚠ DANGER Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply will result in death or serious injury. Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait for at least the time specified on the warning label, once all indicators are OFF, measure for unsafe voltages to confirm the converter is safe prior to servicing. Failure to comply will result in death or serious injury.

⚠ WARNING Sudden Movement Hazard. System may start unexpectedly when the unit is energized, resulting in death or serious injury. Clear all personnel from the converter, drive, motor, and machine area before energizing. Secure covers, couplings, shaft keys, and machine loads before energizing.

⚠ WARNING Electrical Shock Hazard. Do not attempt to modify or alter the converter in any way not explained in this manual. Yaskawa is not responsible for any modification of the product made by the user. This product must not be modified. Failure to comply could result in death or serious injury.

⚠ WARNING Electrical Shock Hazard. Do not allow unqualified personnel to use equipment. Installation, maintenance, inspection, and service must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC converters. Failure to comply could result in death or serious injury.

⚠ WARNING Electrical Shock Hazard. Do not remove covers or touch circuit boards while the power is on. Failure to comply could result in death or serious injury.

⚠ WARNING Electrical Shock Hazard. Make sure the protective earthing conductor complies with technical standards and local safety regulations. Because the leakage current exceeds 3.5 mA, IEC/EN/UL 61800-5-1 states that either the power supply must be automatically disconnected in case of discontinuity of the protective earthing conductor or a protective earthing conductor with a cross-section of at least 10 mm² (Cu) or 16 mm² (Al) must be used. Failure to comply could result in death or serious injury.

⚠ WARNING Electrical Shock Hazard. Use appropriate equipment for Ground Fault Circuit Interrupters (GFCIs). The converter can cause a residual current with a DC component in the protective earthing conductor. Use a type B GFCI according to IEC/EN 60755, where a residual current operated protective or monitoring device is used for protection in case of direct or indirect contact. Failure to comply could result in death or serious injury.

⚠ WARNING *Fire Hazard. Do not use an improper voltage source. Verify that the rated voltage of the converter matches the voltage of the incoming power supply before applying power. Failure to comply could result in death or serious injury by fire.*

⚠ WARNING *Fire Hazard. Install adequate branch circuit protection according to applicable local codes and this Installation Manual. The device is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes, 240 Vac maximum (200 V class) and 480 Vac maximum (400 V class), when protected by branch circuit protection devices specified in this document. Failure to comply could result in death or serious injury by fire.*

⚠ CAUTION *Crush Hazard. Do not carry the converter by the front cover. Failure to comply may result in minor or moderate injury from the main body of the converter falling.*

NOTICE *Damage to Equipment. Observe proper electrostatic discharge procedures (ESD) when handling the converter and circuit boards. Do not perform a withstand voltage test or Megger test. Do not operate damaged equipment. Do not connect or operate any equipment with visible damage or missing parts. Failure to comply may result in damage to circuitry or damage to the sensitive devices within the converter.*

NOTICE *Damage to Equipment. Do not immediately turn on the power supply or attempt to operate the equipment if a fuse is blown or a Ground Fault Circuit Interrupter (GFCI) is tripped. Repair the cause of the problem prior to re-energizing the equipment. Check the wiring and the selection of the peripheral devices. Check for short circuits or ground faults on the secondary side of fuses and GFCIs and check the wiring and the selection of peripheral devices. Failure to comply may result in damage to circuitry or damage to the sensitive devices within the converter.*

NOTICE *Damage to Equipment. Do not expose the converter to halogen group disinfectants. Do not pack the converter in wooden materials that have been fumigated or sterilized. Do not sterilize the entire package after the product is packed. Failure to comply may result in damage to circuitry or damage to the sensitive devices within the converter.*

◆ Installation Procedure Summary

This summary gives the installer an overview of the installation procedure.

1. [Inspection on page 7](#)
2. [Converter Mounting Procedure on page 9](#)
3. [Electrical Installation Procedure on page 12](#)
4. [Test Procedure on page 19](#)

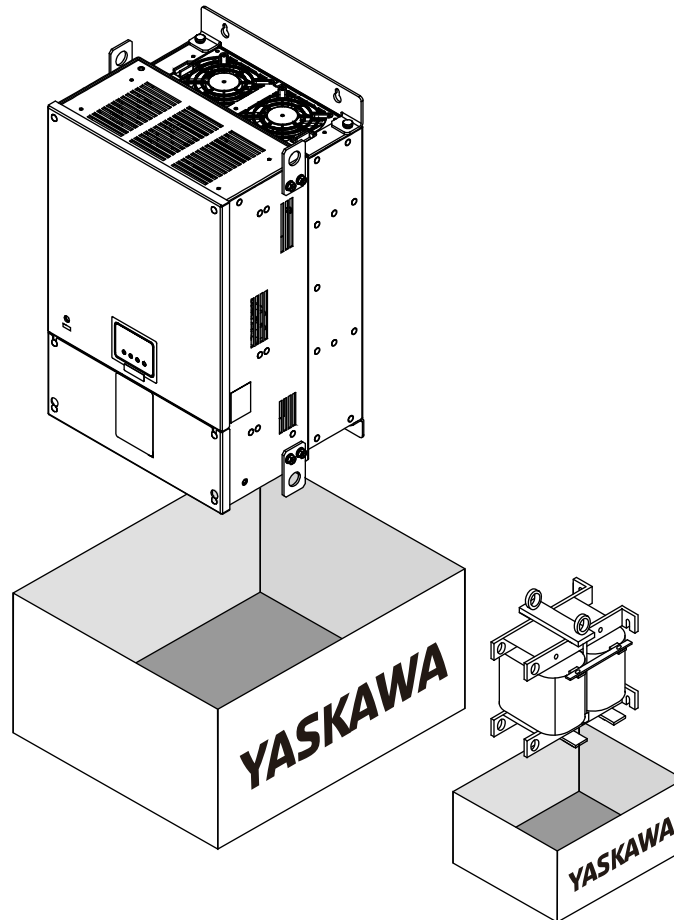
2 Receiving and Inspection

◆ Inspection

Perform the following tasks after receiving the converter:

1. Inspect the converter and DC link choke for damage.

If either unit appears damaged upon receipt, contact the shipper immediately.



2. Locate the model number on the converter nameplate and compare it to your bill of sale to confirm that you received the correct model.

If you have received the wrong model or the converter does not function properly, contact your supplier.

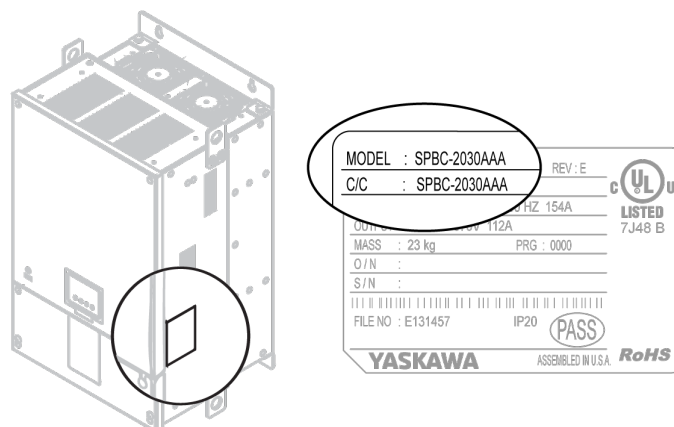


Figure 2.1 Nameplate and Location Information

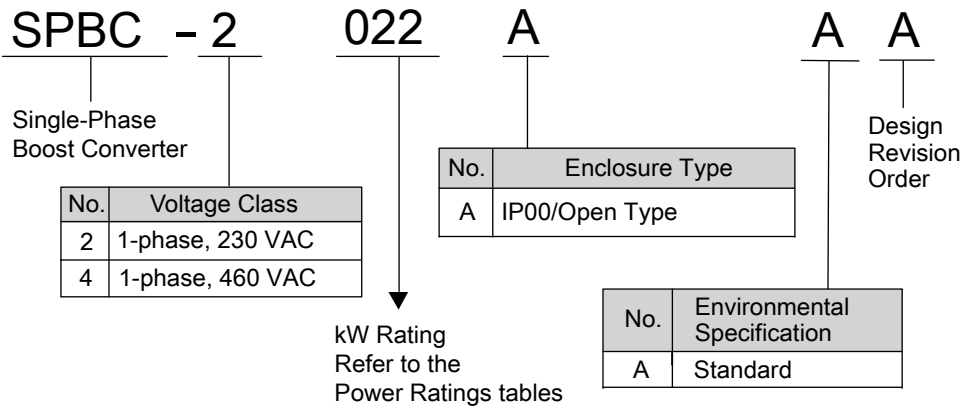


Figure 2.2 Converter Model Number

- Use the [SPC and Drive Model Compatibility on page 27](#) to verify converter compatibility for the connected AC drive.
- Use the [DC Link Choke Kits and SPC Model Compatibility on page 26](#) to confirm you have received the correct choke. Locate the model number on the DC Link Choke (DCL) nameplate as shown in [Figure 2.3](#)

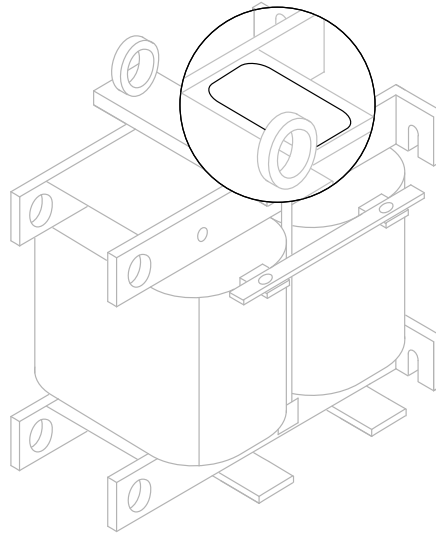


Figure 2.3 DC Link Choke

- Prior to installation, refer to [Converter Components and Locations on page 20](#) to become familiar with converter components.

3 Mechanical Installation

◆ Section Safety

⚠ DANGER *Electrical Shock Hazard. Do not connect or disconnect wiring while unit is energized. Failure to comply will result in death or serious injury.*

⚠ WARNING *Fire Hazard. Provide sufficient cooling when installing the converter inside an enclosed panel or cabinet. When multiple drives are placed inside the same enclosure panel, install proper cooling to ensure air entering the enclosure does not exceed 40°C. Failure to comply may result in overheating or fire and injury to personnel.*

⚠ CAUTION *Crush Hazard. Do not carry the converter by the front cover. Failure to comply may result in minor or moderate injury from the main body of the converter falling.*

◆ Installation Tools and Supplies

■ Mounting Tools

- Tape measure
- Level
- Drill and drill bits (bit size varies by model)
- Mounting hardware for converter (M6 or 1/4 in screws/nuts/washers/lock washers x 4)
- Mounting hardware for link choke (M6 or 1/4 in screws/nuts/washers/lock washers x 4)
- Sockets and ratchet
- Wrench
- Hoist or lift equipment (varies by model)
- Metal saw (external heatsink applications)

■ Wiring Tools

- Flathead and phillips screwdriver (size varies by model)
- Wire ferrules and crimp tool (PHOENIX is recommended)
- Wire, wire cutter, and stripper (sizes vary by model)
- Torque wrench or driver
- Electrical multimeter

◆ Converter Mounting Procedure

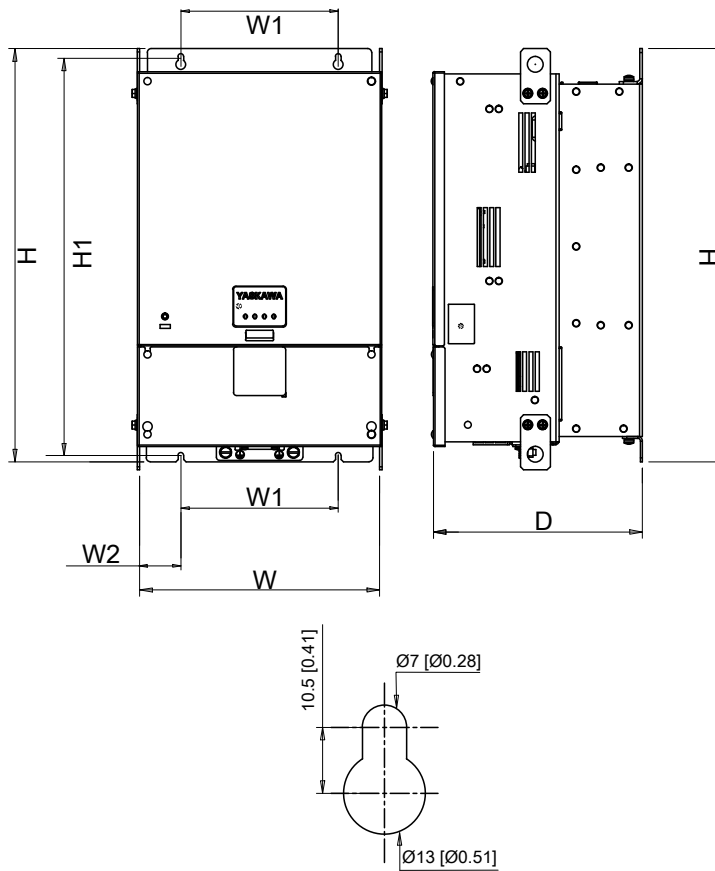
⚠ CAUTION *Crush Hazard. Use a lift or hoist to assist in lifting the converter into the proper mounting location. Failure to comply may result in minor or moderate injury from the main body of the converter falling.*

NOTICE *Foreign Objects and Debris. Place a temporary cover over the top of the converter during installation and project construction to prevent debris such as metal shavings or wire clippings from falling into the converter. Remove the temporary cover before startup, as the cover will reduce ventilation and cause the converter to overheat. Failure to comply could result in damage to the converter.*

1. Collect the necessary installation tools and materials.
2. Measure and mark the installation cabinet with mounting hole locations according to [Table 3.1](#) or [Table 3.2](#).

Use a level to mount the converter squarely in the cabinet.

Use [External Heatsink Mounting Dimensions on page 35](#) for external heatsink applications.



Top mounting hole dimensions

Figure 3.1 Mounting Dimensions

Table 3.1 200 V Class Mounting Dimensions

SPC Model	Dimensions mm (in)						
	W	W1	W2	H	H1	D	Weight kg (lb)
2015	250 (9.84)	175 (6.89)	37.5 (1.48)	423 (16.65)	405 (15.94)	254 (10)	18 (39.7)
2022							26 (57.3)
2030	305 (12.01)	200 (7.87)	52.5 (2.07)	525 (20.67)	507 (19.96)	265 (10.45)	26 (57.3)
2037	310 (12.2)		55 (2.16)	636 (25.04)	616 (24.25)	290 (11.42)	33 (72.8)
2045			55 (2.16)	636 (25.04)	616 (24.25)	290 (11.42)	33 (72.8)

Table 3.2 400 V Class Mounting Dimensions

SPC Model	Dimensions mm (in)						
	W	W1	W2	H	H1	D	Weight kg (lb)
4022	250 (9.84)	175 (6.89)	37.5 (1.48)	423 (16.65)	405 (15.94)	254 (10)	17 (37.5)
4030							26 (57.3)
4037	305 (12.01)	200 (7.87)	52.5 (2.07)	525 (20.67)	507 (19.96)	265 (10.45)	27 (59.5)
4045							33.6 (74)
4056	310 (12.2)		55 (2.16)	636 (25.04)	616 (24.25)	290 (11.42)	40.6 (89.5)
4093		375 (14.76)					

- Drill the mounting holes to accommodate either an M6 or 1/4 in diameter bolt.

4. Using hoist or lift equipment as needed, mount the converter to the mounting surface using the M6 or 1/4 in bolts and hardware. If installing multiple converters in the same cabinet, refer to [Installation Orientation & Spacing on page 33](#) for installation clearance requirements. It may be difficult to perform maintenance on the cooling fans of converters installed inside an enclosure. When mounting the converter, ensure adequate spacing at the top of the converter to perform cooling fan maintenance and replacement.
5. Mount the DC Link Choke in an acceptable position in relation to the converter. Ensure the DC link Choke installation complies with national and local electrical codes.

NOTICE *Damage to Equipment. Ensure a minimum of 12.5 mm (1/2 in) of clearance between the DC link choke terminals and other metal components. Failure to comply may result in damage to equipment.*

4 Electrical Installation Procedure

◆ Section Safety

⚠ DANGER *Electrical Shock Hazard. Do not connect or disconnect wiring while the unit is energized. Failure to comply will result in death or serious injury.*

⚠ WARNING *Electrical Shock Hazard. Do not operate equipment with covers removed. Failure to comply could result in death or serious injury.*

⚠ WARNING *Electrical Shock Hazard. The diagrams in this section may show converter without covers or safety shields to show details. Be sure to reinstall covers or shields before operating the converter and run the converter according to the instructions described in this manual. Failure to comply could result in death or serious injury.*

⚠ WARNING *Electrical Shock Hazard. Do not remove covers or touch circuit boards while the power is on. Failure to comply could result in death or serious injury.*

⚠ WARNING *Electrical Shock Hazard. Do not touch any terminals before the capacitors have fully discharged. Failure to comply could result in death or serious injury.*

⚠ WARNING *Electrical Shock Hazard. Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are off and measure the DC bus voltage level to confirm safe level. Failure to comply could result in death or serious injury.*

⚠ WARNING *Fire Hazard. Tighten all terminal screws to the specified tightening torque. Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections. Failure to comply could result in death or serious injury by fire.*

⚠ WARNING *Fire Hazard. Do not use improper combustible materials. Attach the converter to metal or other noncombustible material. Failure to comply could result in death or serious injury by fire.*

⚠ WARNING *Fire Hazard. Do not use an improper voltage source. Verify that the rated voltage of the converter matches the voltage of the incoming power supply before applying power. Failure to comply could result in death or serious injury by fire.*

NOTICE *Electrostatic Discharge (ESD). Observe proper ESD procedures when handling the converter and circuit boards. Failure to comply may result in ESD damage to the converter circuitry.*

NOTICE *Electromagnetic Interference (EMI). Do not use unshielded cable for control wiring. Use shielded, twisted-pair wires and ground the shield to the ground terminal of the converter. Failure to comply may cause electrical interference resulting in poor system performance.*

◆ **User Installation Notes**

Fill in the table below using the reference information in the [Appendix on page 20](#). This table will provide a quick reference of installation information during the electrical installation procedure. It will also serve as installation notes that can be left with the converter.

Table 4.1 User Notes

Electrical Installation Notes			
SPC Terminal	Wire Size/Fuse Model	Ring Size	Comments
R/L1 and S/L2			
+4 and +5			
- and +1			
Ground			
Branch Circuit Protection			

◆ **Electrical Installation Procedure**

1. Remove the terminal cover from both the converter and drive.

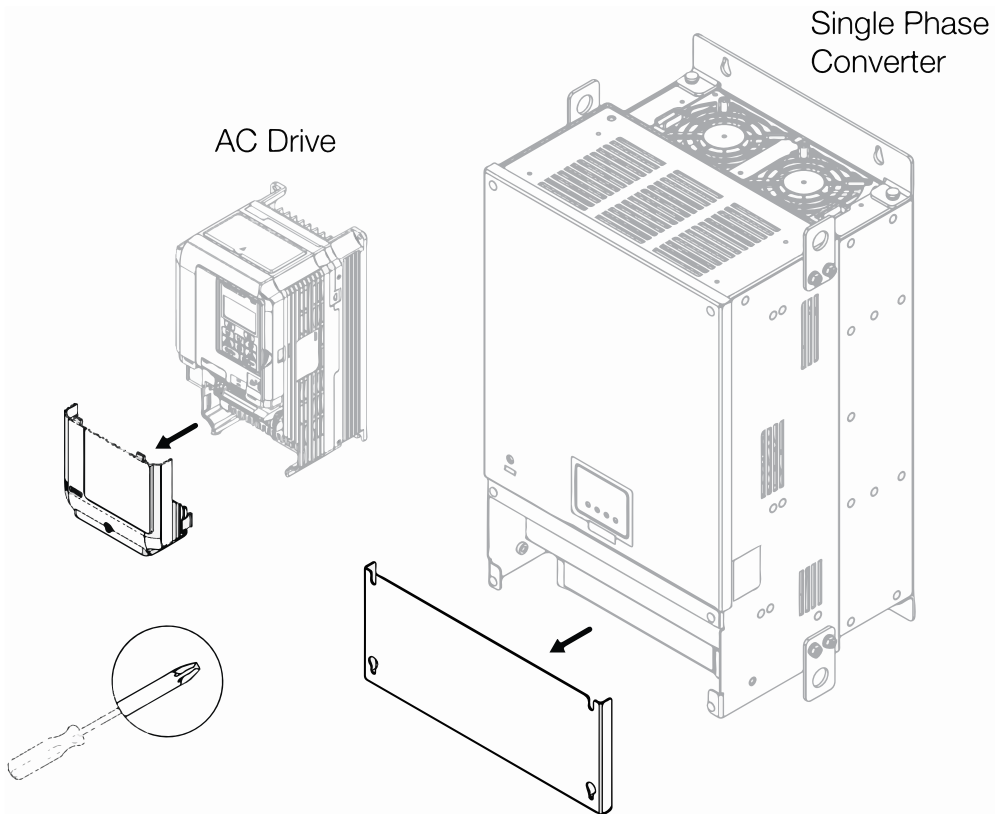


Figure 4.1 Cover Removal

2. Connect the ground wire between the converter, drive, and earth ground. Refer to [Input, Output, and Conductor Wire Sizes and Terminations on page 28](#) to select the correct wire size.

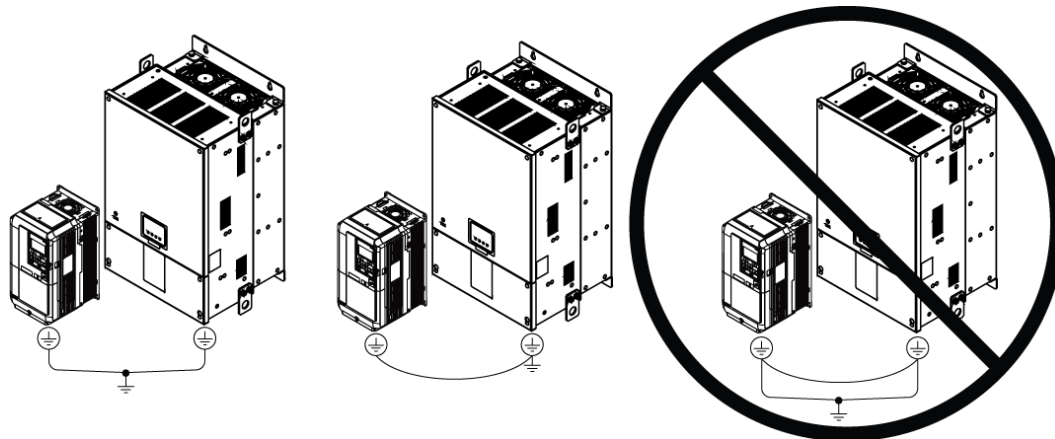


Figure 4.2 Grounding Configuration

3. Connect the DC link choke according to [Figure 4.3](#) and [Figure 4.4](#). The DC link choke terminals are not polarized and can be connected to either terminal.

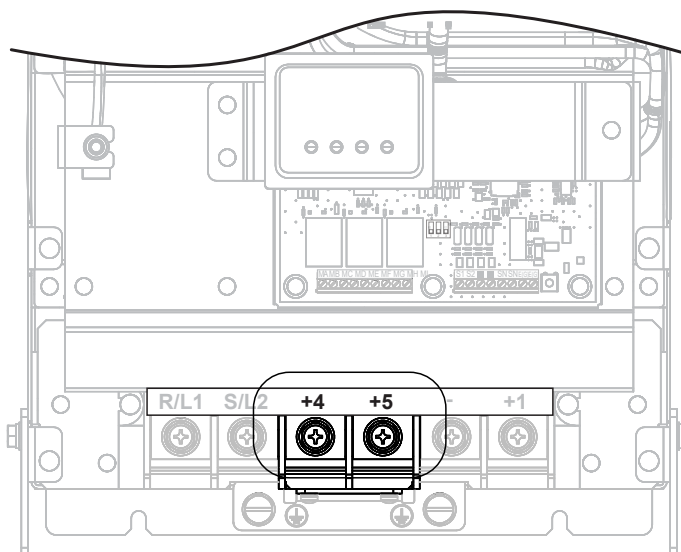


Figure 4.3 Converter Terminal 4 & 5

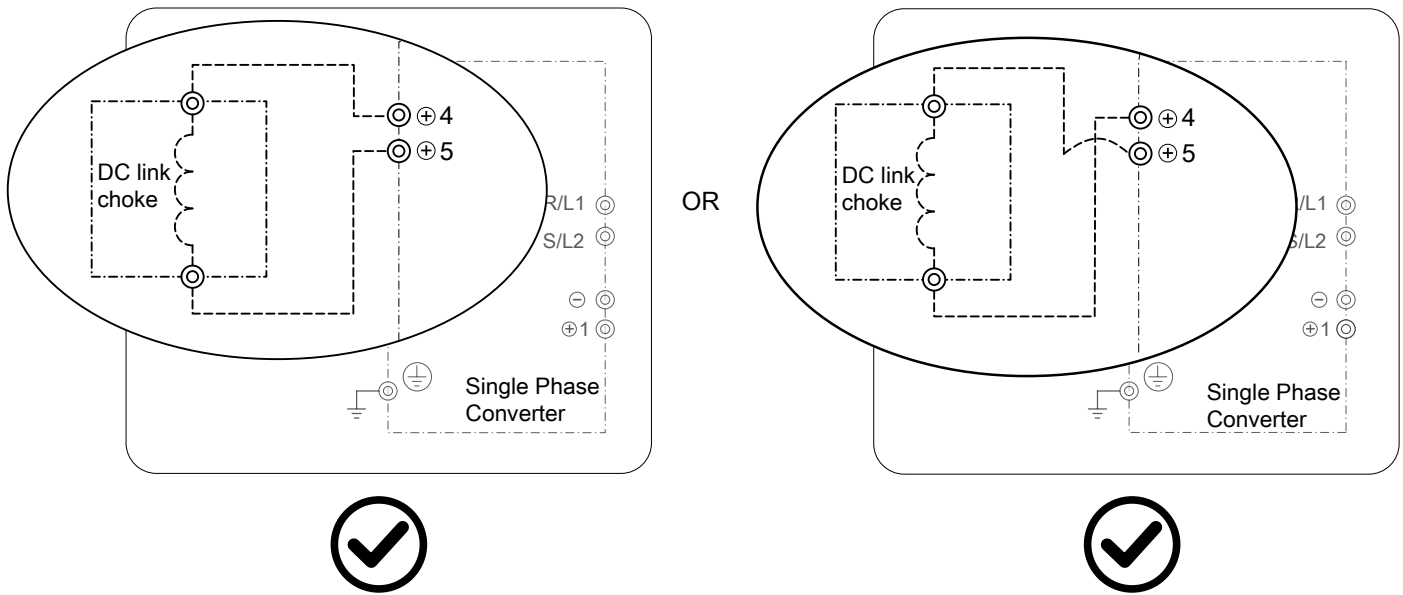


Figure 4.4 DC Link Choke Wiring

4. Make power connections between the converter and the drive according to [Figure 4.5](#) and [Figure 4.6](#). Refer to [User Installation Notes on page 12](#) or [Input, Output, and Conductor Wire Sizes and Terminations on page 28](#) to select the correct wire size.

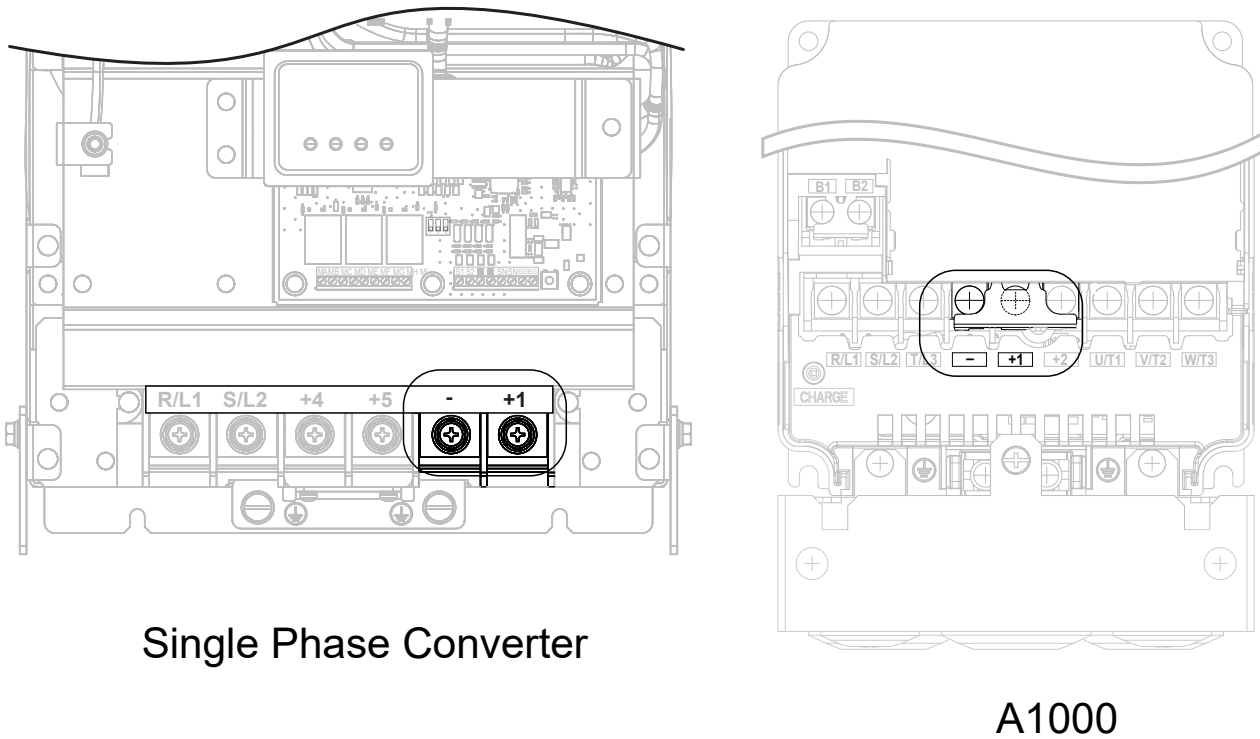


Figure 4.5 Converter and Drive Terminals

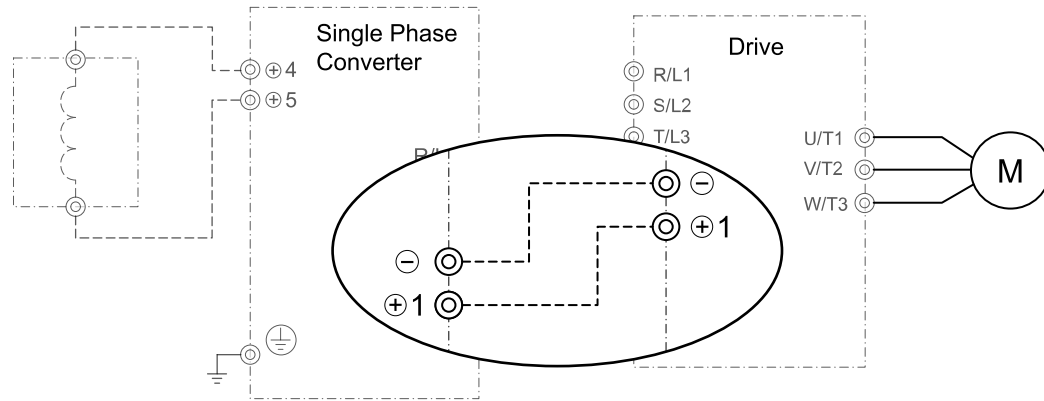


Figure 4.6 Converter to Drive Connections

5. Install branch circuit protection according to [Table 6.15 Branch Circuit Protection](#). For wiring and termination requirements, refer to [Input, Output, and Conductor Wire Sizes and Terminations on page 28](#).

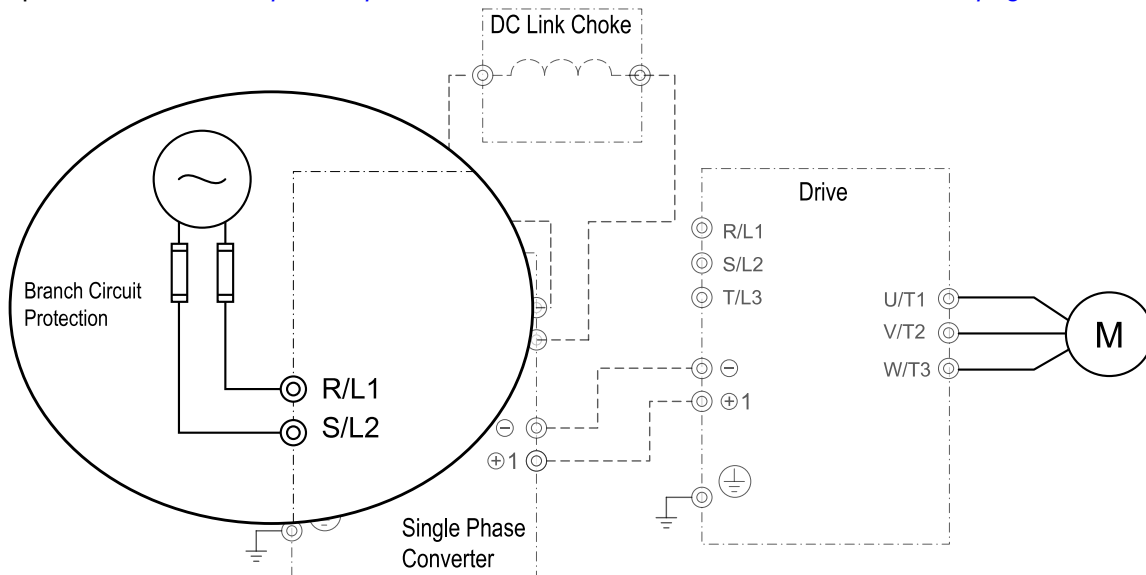


Figure 4.7 Branch Circuit Protection and Main Power Connection

6. Connect main circuit power lines to the converter (R/L1 and S/L2) according to [Figure 4.7](#). Tighten terminals according to [Table 6.11](#).

- Connect control wiring between the converter and the drive. Refer to [Connection Diagram Examples on page 22](#) for details of the converter I/O terminals, their functions, and sample configurations.

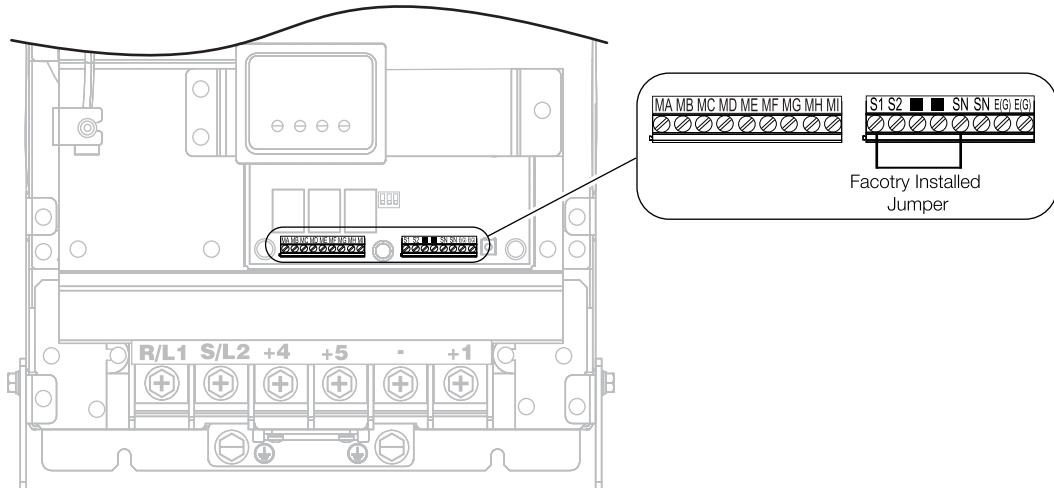


Figure 4.8 I/O Terminal Blocks

- Configure the DIP switches as required for the application per [DIP Switch Settings on page 25](#).
NOTE: The factory setting for the DIP switches (S1) is 1 and 2 in the ON position, Automatic Run Mode. This setting configures the converter to automatically provide power to the drive and reset from faults.

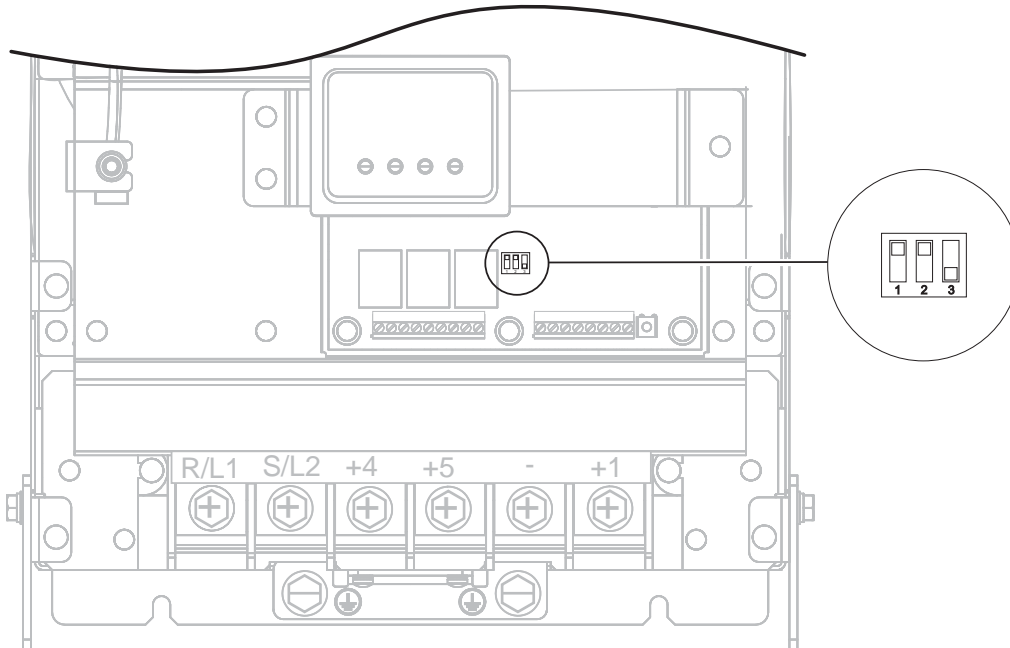


Figure 4.9 DIP Switch Location

9. Reattach terminal covers to the converter and drive.

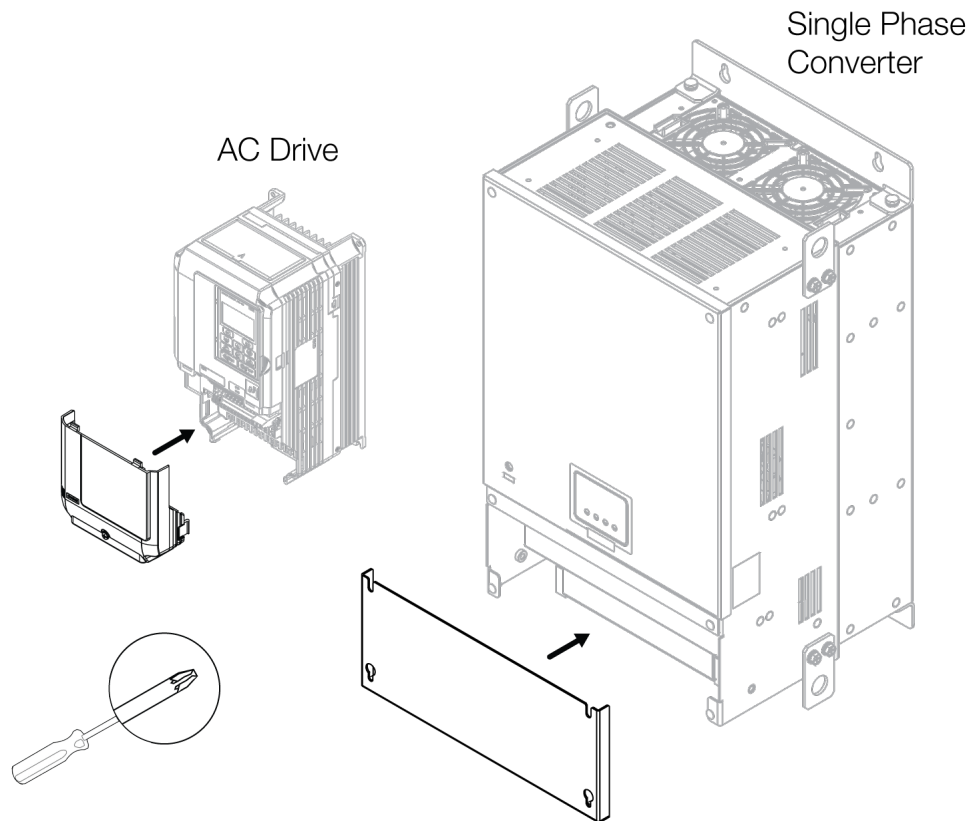


Figure 4.10 Terminal Cover Installation

10. Using the multimeter, verify that the proper voltage is present on the utility side of the branch circuit protection. If this is not possible, then measure line power at R/L1 and S/L2 after energizing the converter.

⚠ WARNING Arc Flash Hazard. Obey local codes and Arc Flash safety requirements contained in the Standard for Electrical Safety in the Workplace NFPA 70E (2009 Edition or later) and the Workplace Electrical Safety, Canadian Standards Association (CSA) Z462-12. Obey safe work procedures and use applicable personal protective equipment (PPE). If you do not obey these requirements and procedures, it can cause serious injury or death.

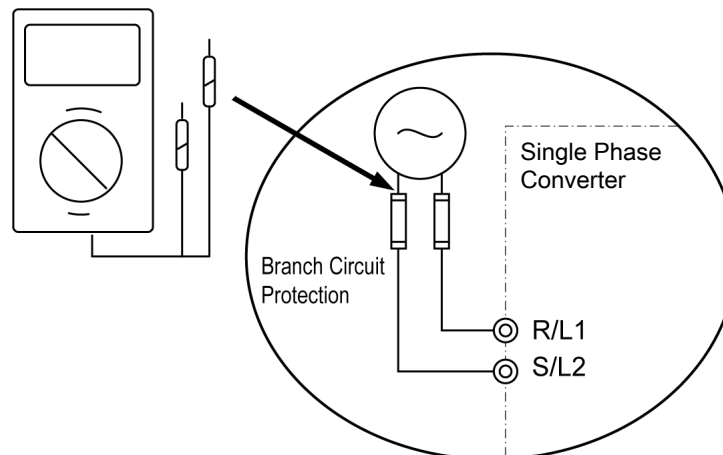


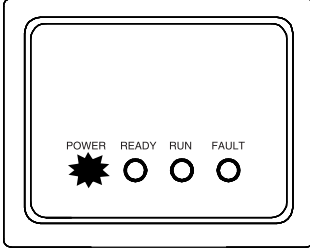
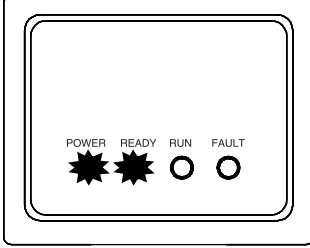
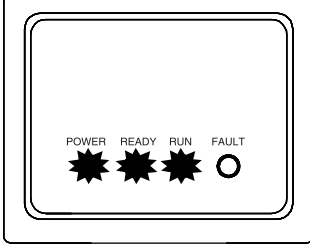
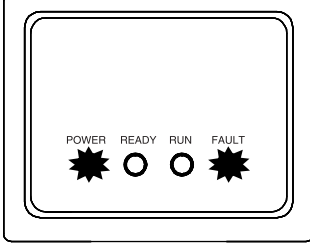
Figure 4.11 Line Power Verification

11. Energize the converter and observe the status LEDs. Use [Table 4.2](#) to understand converter status.

⚠ WARNING Electrical Shock Hazard. Do not operate equipment with covers removed. The diagrams in this section may show converter without covers or safety shields to show details. Be sure to reinstall covers or shields before operating the converter and run the converter according to the instructions described in this manual. Failure to comply could result in death or serious injury.

⚠ WARNING *Sudden Movement Hazard. Clear all personnel from the converter, drive, motor, and machine area before energizing. Secure covers, couplings, shaft keys, and machine loads before energizing. System may start unexpectedly when the unit is energized, resulting in death or serious injury.*

Table 4.2 LED Illumination States

LED States	
	<ul style="list-style-type: none"> • Power is applied to the converter • Power LED illuminates blue.
	<ul style="list-style-type: none"> • The converter is supplying voltage to the drive. • The converter is energized and is ready to supply voltage to the drive. • Power is blue. • Ready LED illuminates green.
	<ul style="list-style-type: none"> • Power is blue. • Ready is green. • Run LED illuminates green.
	<ul style="list-style-type: none"> • Converter is in a fault state. • Power is blue. • Ready is OFF. • Run is OFF. • The Fault LED is repeating a series of flashes, identifying the fault. • Refer to the LED Diagnostics on page 38.

5 Test Operation

◆ Test Procedure

Note: LED states differ between AUTOMATIC and MANUAL converter modes. In AUTOMATIC mode, the “Run” LED will illuminate when the drive requests 10% or more of the converter’s rated output. For example, >5 amps of a 50 amp rated output. In MANUAL mode, the “Run” LED will illuminate when the drive is running.

⚠ WARNING *Electrical Shock Hazard. Do not operate equipment with covers removed. The diagrams in this section may show converter without covers or safety shields to show details. Be sure to reinstall covers or shields before operating the converter and run the converter according to the instructions described in this manual. Failure to comply could result in death or serious injury.*

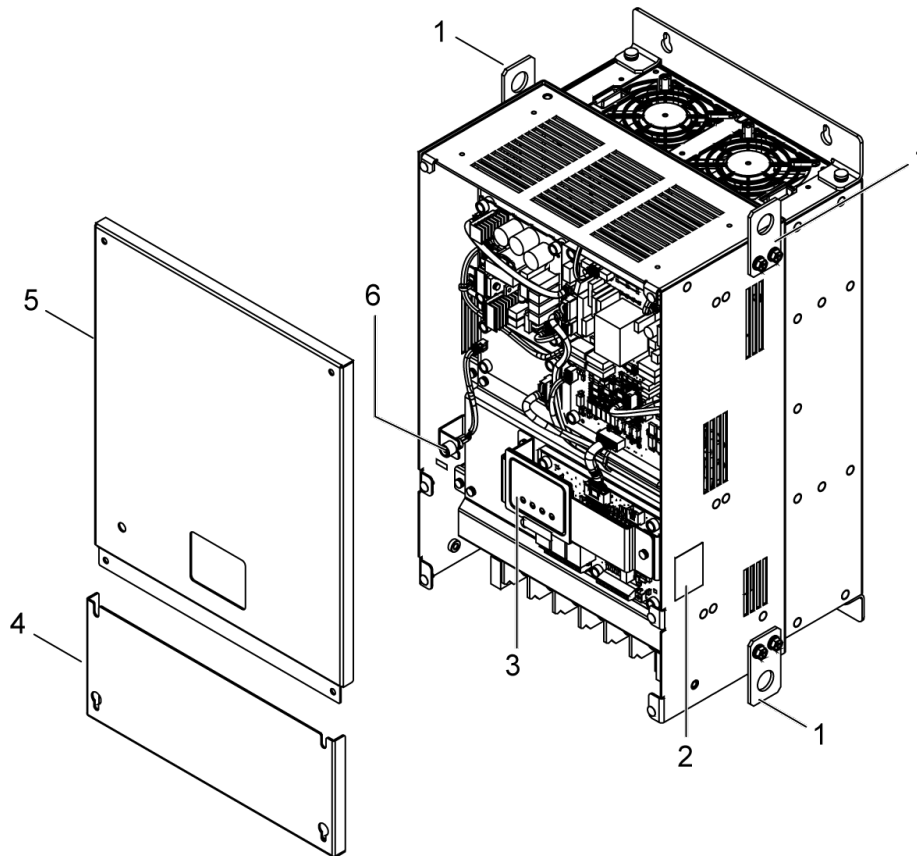
⚠ WARNING *Sudden Movement Hazard. Clear all personnel from the converter, drive, motor, and machine area before energizing. Secure covers, couplings, shaft keys, and machine loads before energizing. System may start unexpectedly when the unit is energized, resulting in death or serious injury.*

Test the installation for proper operation.

1. Energize the system if it is not already energized.
2. Verify there are no drive faults and the “Ready” LED on the converter is illuminated.
3. Run the system at a load greater than 25% if possible. This will confirm the converter can supply power to the drive under load.
4. Verify the “Run” LED on the converter is illuminated.
5. Confirm there are no faults displayed on the converter or drive.
6. Confirm drive output by observing movement of the motor and connected load.
7. Stop the drive.
8. Test operation is complete and the installation is ready for service.

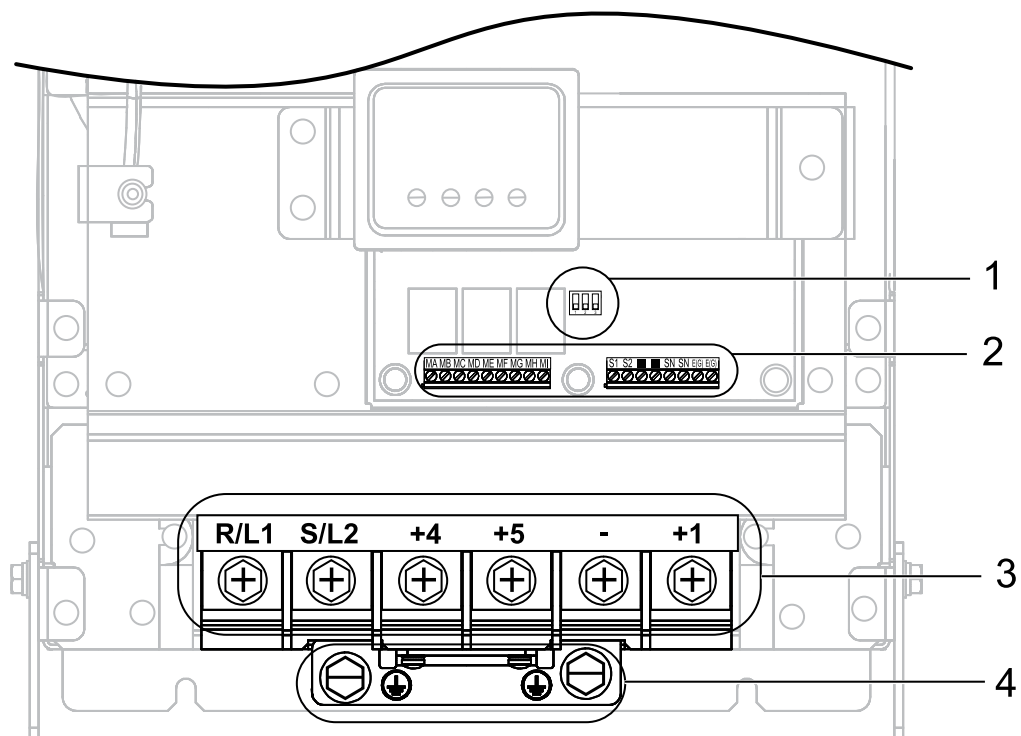
6 Appendix

◆ Converter Components and Locations



1. Removable hanging bracket
2. Nameplate
3. Status LEDs
4. Terminal cover
5. Front cover
6. Charge LED

Figure 6.1 Component Names



1. DIP switch (S1)
2. Control circuit terminals
3. Main circuit terminals
4. Ground terminals

Figure 6.2 Switch and Terminal Names

◆ Connection Diagram Examples

■ Automatic Run Mode

Figure 6.3 shows the minimum Single Phase Converter to drive wiring for proper operation in AUTO RUN mode. In AUTO RUN mode the Single Phase Converter determines when to switch from its idle power state to actively regulating DC power to the drive.

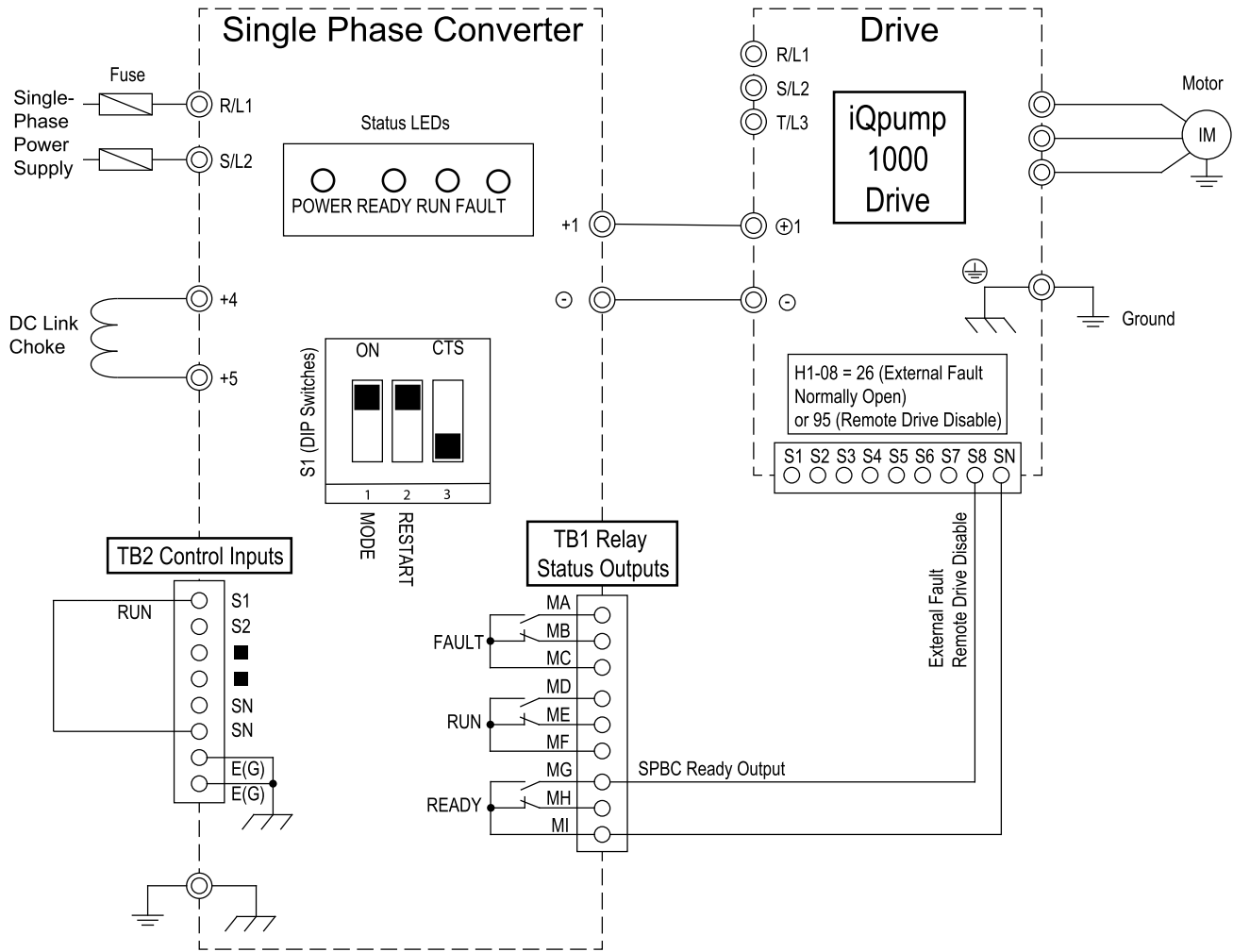


Figure 6.3 Automatic Run Mode (Default Configuration)

Manual Run Mode

Figure 6.4 shows wiring for proper operation in MANUAL RUN mode.

In MANUAL RUN mode converter states:

- S1 input is OFF = idle power state
- S1 input is ON = converter actively regulates DC power to the drive

Operation in MANUAL RUN mode may be more suitable for applications that frequently run at low power levels for extended periods of time or frequently change power needs.

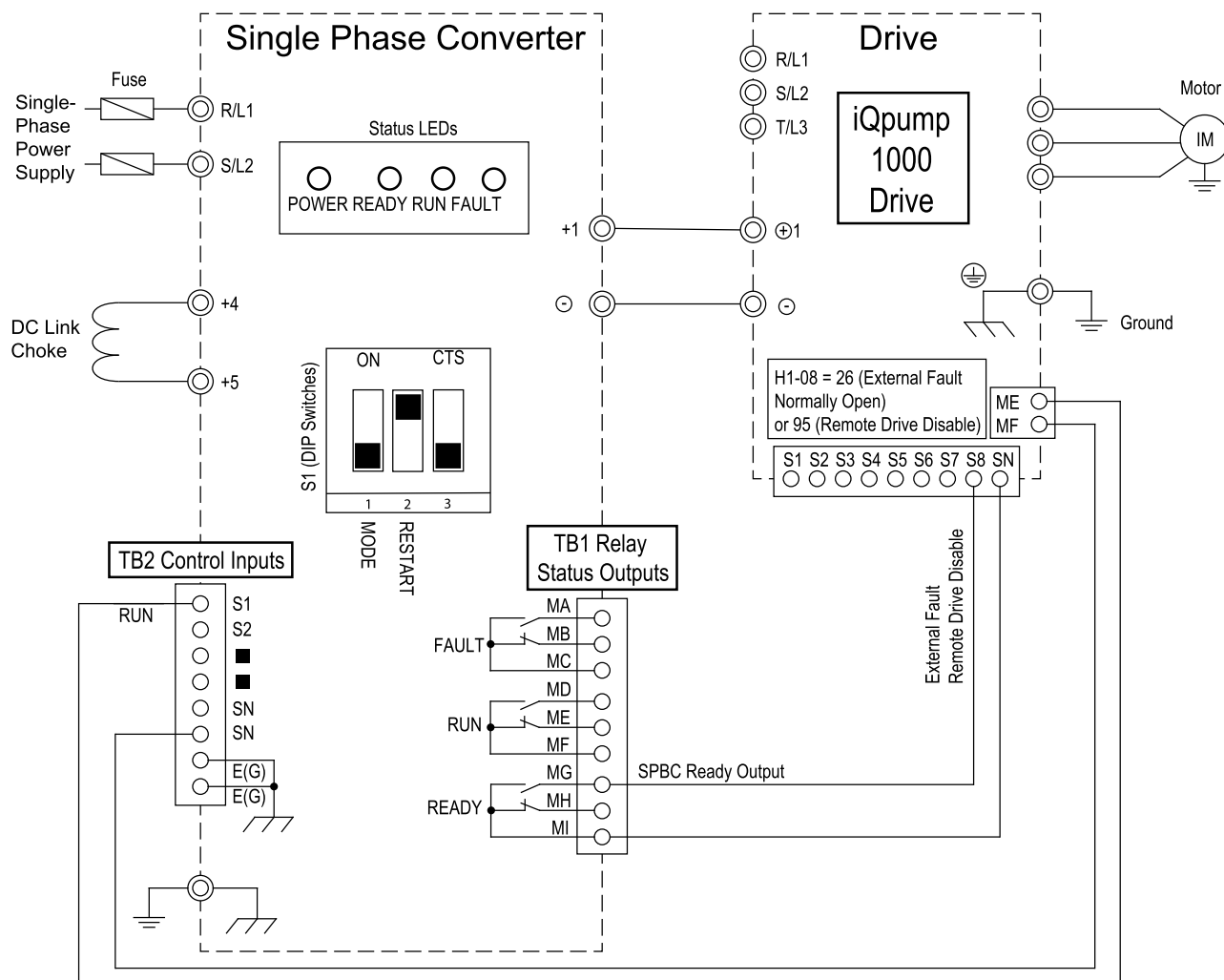


Figure 6.4 Manual Run Mode

◆ Control Circuit Input/Output Terminals



Figure 6.5 Control Circuit Input Terminals

Table 6.1 SPC Control Circuit Input Terminals

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting	Applicable Wire Gauge
Multi-Function Digital Inputs	S1	Digital input 1, isolated, Run command input	24 Vdc, 8 mA, current sinking	24 - 16 AWG
	S2	Digital input 2, isolated, Reset command input		
	■	Not used		
	■			
	SN	Isolated ground		
SN				
Analog Inputs	E(G)	Chassis ground		
	E(G)			

Note: All Control Circuit terminal screws should be tightened to 0.5 - 0.6 N·m (4.4 - 5.3 in lb)



Figure 6.6 Control Circuit Output Terminals

Table 6.2 SPC Control Circuit Output Terminals

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting	Applicable Wire Gauge
Fault Relay	MA	N.O. output (Fault)	30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA	24 - 16 AWG
	MB	N.C. output (Fault)		
	MC	Fault output common		
Run Relay	MD	N.O. output (Run)	30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA	
	ME	N.C. output (Run)		
	MF	Run output common		
Ready Relay	MG	N.O. output (Ready)	30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA	
	MH	N.C. output (Ready)		
	MI	Ready output common		

Note: All Control Circuit terminal screws should be tightened to 0.5 - 0.6 N·m (4.4 - 5.3 in lb)

◆ DIP Switch Settings

The DIP switches allow the user to configure the converter to run in either AUTOMATIC MODE or MANUAL MODE. The mode allows the user to select how the converter operates based on the application.

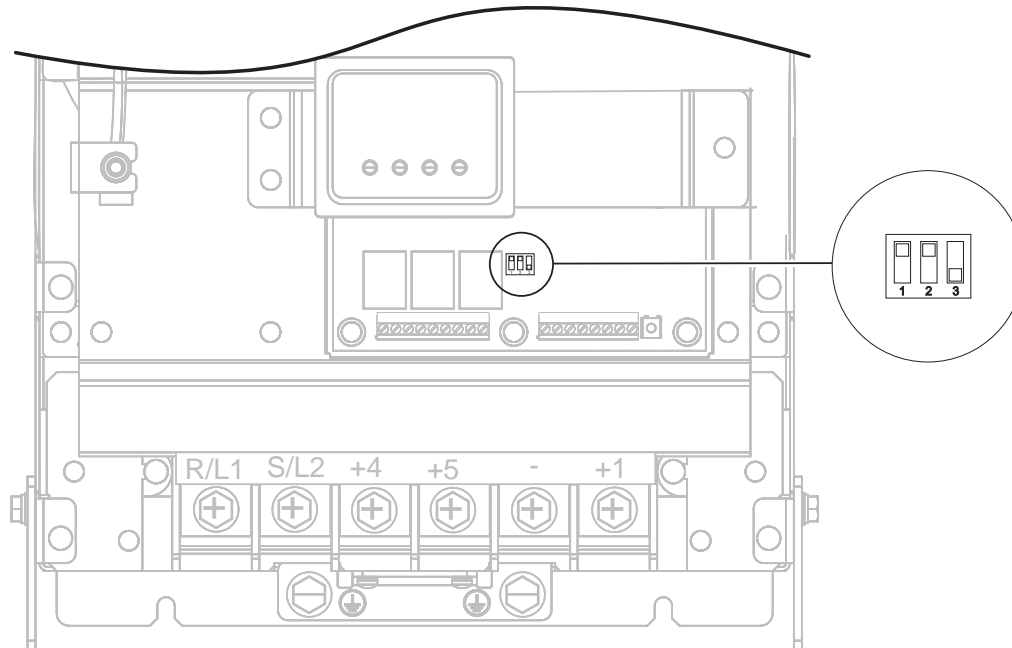
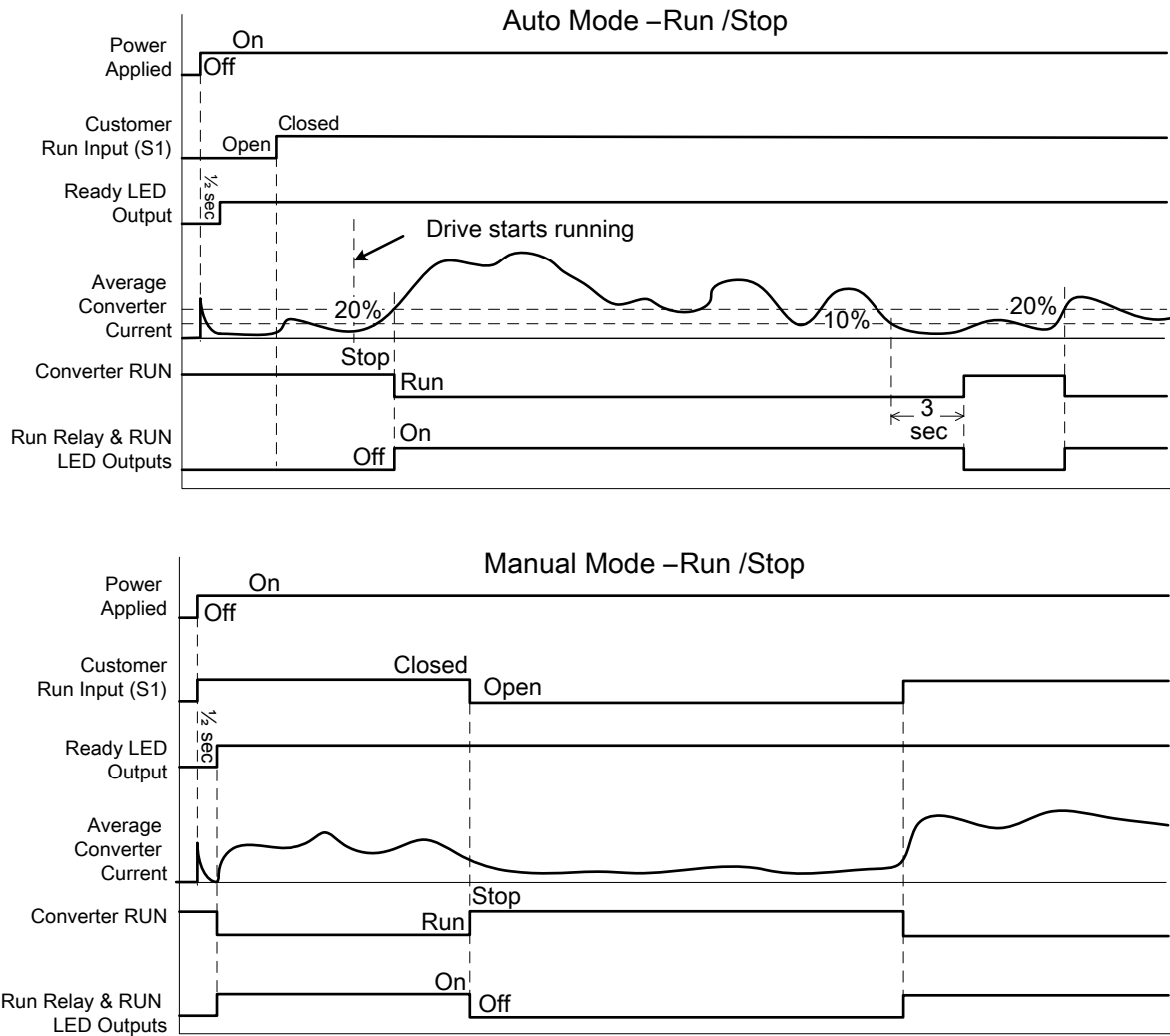


Figure 6.7 DIP Switch Location

Table 6.3 DIP Switch Position and Functions

DIP Positions (S1, S2)	Mode (-1) Manual vs Auto	Restart (-2) Manual vs Auto	Description
	Manual	Manual	The user will be required to manually start and stop the drive. If a fault occurs in the converter, the user will have to reset the converter.
	Auto	Manual	The converter will automatically provide boost when the drive starts. If a fault occurs, the user will have to manually reset the converter.
	Manual	Auto	The user will be required to manually start the drive. The converter will automatically attempt to reset in the event of a fault.
	Auto	Auto	Factory Configuration - The converter will automatically provide boost and attempt fault recovery.

Note: DIP S13 has no function.



◆ DC Link Choke Kits and SPC Model Compatibility

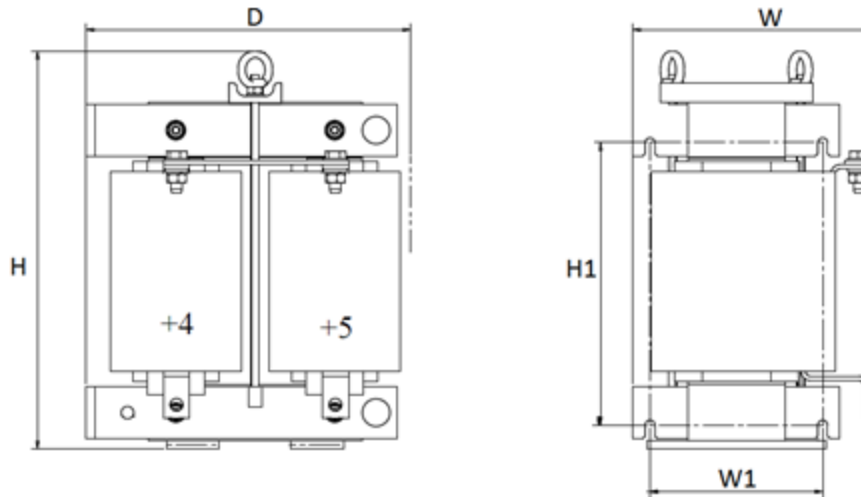


Figure 6.8 DC Link Choke Dimensions

Table 6.4 DC Link Choke Dimension Data 200 V Class

SPC Model	Part #	Dimensions mm (in)					Weight kg (lb)
		W	W1	H	H1	D	
2015	URX000530	178 (7.01)	125 (4.92)	224 (8.82)	140 (5.51)	225 (8.86)	12 (26.5)
2022	URX000531	190 (7.48)	125 (4.92)	224 (8.82)	140 (5.51)	225 (8.86)	15 (33.1)
2030	URX000532	195 (7.68)	125 (4.92)	239 (9.41)	155 (6.1)	235 (9.25)	17 (37.5)
2037	URX000520	190 (7.48)	125 (4.92)	265 (110.43)	180 (7.09)	225 (8.86)	20 (44.1)
2045	URX000521	190 (7.48)	125 (4.92)	290 (11.4)	205 (8.07)	235 (9.25)	20 (44.1)

Table 6.5 DC Link Choke Dimension Data 400 V Class

SPC Model	Part #	Dimensions mm (in)					Weight kg (lb)
		W	W1	H	H1	D	
4022	URX000534	190 (7.48)	125 (4.92)	224 (8.82)	140 (5.51)	235 (9.25)	17 (37.5)
4030	URX000535	195 (7.68)	125 (4.92)	239 (9.41)	155 (6.1)	235 (9.25)	17 (37.5)
4037	URX000536	190 (7.48)	125 (4.92)	264 (10.39)	180 (7.09)	235 (9.25)	20 (44.1)
4045	URX000537	190 (7.48)	125 (4.92)	289 (11.38)	205 (8.07)	235 (9.25)	20 (44.1)
4056	URX000527	215 (8.5)	150 (5.91)	330 (13)	240 (9.45)	230 (9.1)	27 (59.5)
4093	URX000529	220 (8.66)	150 (5.91)	330 (13)	240 (9.45)	235 (9.25)	33 (72.8)

■ SPC DC Link Chokes and Kits

Use the information in [Table 6.6](#) and [Table 6.7](#) to select the appropriate DC Link Choke Kit.

Table 6.6 SPC Kits 200 V Class

Kit P/N	SPC Model	DC Link Choke Part Number	Value (mH)	Current (A)
SPBC-240-20HP	2015	URX000530	0.81	79
SPBC-240-30HP	2022	URX000531	0.55	116
SPBC-240-40HP	2030	URX000532	0.41	154
SPBC-240-50HP	2037	URX000520	0.33	191
SPBC-240-60HP	2045	URX000521	0.28	228

Table 6.7 SPC Kits 400 V Class

Kit P/N	SPC Model	DC Link Choke Part Number	Value (mH)	Current (A)
SPBC-480-30HP	4022	URX000534	2.19	58
SPBC-480-40HP	4030	URX000535	1.65	77
SPBC-480-50HP	4037	URX000536	1.33	96
SPBC-480-60HP	4045	URX000537	1.12	114
SPBC-480-75HP	4056	URX000527	0.9	142
SPBC-480-125HP	4093	URX000529	0.54	234

◆ SPC and Drive Model Compatibility

Use the tables in this section to determine the compatibility between converter and drive models.

Table 6.8 Single Phase Converter (SPC) and Drive Compatibility 200 V Class

SPC Model	Motor HP	Rated Current Input	Rated Current Output	iQpump1000, P1000, A1000 Drives *1 *2, V1000, iQpump Micro CIMR-xx□□□□□□xxx
2015	15 - 20	79	57	2A0040 - 2A0056
2022	25 - 30	116	84	2A0069 - 2A0081
2030	40	154	112	2A0110

SPC Model	Motor HP	Rated Current Input	Rated Current Output	iQpump1000, P1000, A1000 Drives *1 *2, V1000, iQpump Micro CIMR-xx□□□□□xxx
2037	50	191	138	2A0138
2045	60	228	165	2A0169

*1 A1000 series drives can only be used in a Normal Duty application with the SPC.

*2 Consult Yaskawa when running more than one AC drive with one SPC.

Table 6.9 Single Phase Converter (SPC) and Drive Compatibility 400 V Class

SPC Model	Motor HP	Rated Current Input	Rated Current Output	iQpump1000, P1000, A1000 Drives *1 *2, V1000, iQpump Micro CIMR-xx□□□□□xxx
4022	25 - 30	58	42	4A0038 - 4A0044
4030	45	77	56	4A0058
4037	50	96	69	4A0072
4045	60	114	83	4A0088
4056	75	142	103	4A103
4093	100 - 125	234	169	4A0139 - 4A0165

*1 A1000 series drives can only be used in a Normal Duty application with the SPC.

*2 Consult Yaskawa when running more than one AC drive with one SPC.

◆ Input, Output, and Conductor Wire Sizes and Terminations

Table 6.10 Wiring Specifications 200 V Class

SPC Model	Terminal	Recomm. Gauge AWG, kcmil *1 *4	Terminal Wire Range AWG (mm ²) *2	Screw Size	Tightening Torque N·m (in-lb)
2015	R/L1, S/L2	3	22 to 2 (0.33 to 33.6)	M6	5.4 to 6.0 (47.8 to 53.1)
	+4, +5	3			
	-, +1	4			
	GND	6	N/A	M8	9 to 11 (79.7 to 97.4)
2022	R/L1, S/L2	1/0 or 4 x 2P *3	8 to 2/0 (8.4 to 67.4)	M8	9 to 11 (79.7 to 97.4)
	+4, +5	4 x 2P *3			
	-, +1	2			
	GND	4	N/A	M8	9 to 11 (79.7 to 97.4)
2030	R/L1, S/L2	3/0 or 3 x 2P *3	6 to 250 (13.3 to 126.7)	M8	9 to 11 (79.7 to 97.4)
	+4, +5	3 x 2P *3			
	-, +1	1/0			
	GND	4	N/A	M8	9 to 11 (79.7 to 97.4)
2037	R/L1, S/L2	1 x 2P *3	6 to 250 (13.3 to 126.7)	M8	9 to 11 (79.7 to 97.4)
	+4, +5	1 x 2P *3			
	-, +1	2/0			
	GND	3	N/A	M8	9 to 11 (79.7 to 97.4)
2045	R/L1, S/L2	1/0 x 2P *3	1 to 350 (42.4 to 152)	M10	9 to 11 (79.7 to 97.4)
	+4, +5	1/0 x 2P *3			
	-, +1	4/0			
	GND	3	N/A	M8	9 to 11 (79.7 to 97.4)

*1 Recommendation based on UL 61800-5-1 Table 4.3.8.8.2DV.1 for 75 °C Copper wires at 125% of rated current.

*2 Terminal wire range is the UL range of wire sizes the terminal can accommodate. Refer to local code requirements for wire size selection and keep within the range to comply with UL.

*3 For multiple wires of the same size (1/0 AWG or larger) at a terminal, the ampacity is equal to the value in Table 4.3.8.8.2DV.1 for that conductor multiplied by the number of conductors the terminal accommodates.

*4 GND wire sizing is based on Table 250.122 of NEC 2017. Please refer to local codes for wire size selection.

Table 6.11 Wiring Specifications 400 V Class

SPC Model	Terminal	Recomm. Gauge AWG, kcmil ^{*1} / _{*4}	Terminal Wire Range AWG (mm ²) ^{*2}	Screw Size	Tightening Torque N·m (in·lb)
4022	R/L1, S/L2	4	22 to 2 (0.33 to 33.6)	M6	5.4 to 6.0 (47.8 to 53.1)
	+4, +5	4			
	-, +1	6			
	GND	6	N/A	M8	9 to 11 (79.7 to 97.4)
4030	R/L1, S/L2	3	22 to 2 (0.33 to 33.6)	M6	5.4 to 6.0 (47.8 to 53.1)
	+4, +5	3			
	-, +1	4			
	GND	6	N/A	M8	9 to 11 (79.7 to 97.4)
4037	R/L1, S/L2	1	6 to 250 (13.3 to 126.7)	M8	9 to 11 (79.7 to 97.4)
	+4, +5	1			
	-, +1	3			
	GND	6	N/A	M8	9 to 11 (79.7 to 97.4)
4045	R/L1, S/L2	1/0 or 4 x 2P ^{*3}	6 to 250 (13.3 to 126.7)	M8	9 to 11 (79.7 to 97.4)
	+4, +5	4 x 2P ^{*3}			
	-, +1	2			
	GND	6	N/A	M8	9 to 11 (79.7 to 97.4)
4056	R/L1, S/L2	3/0 or 3 x 2P ^{*3}	6 to 250 (13.3 to 126.7)	M8	9 to 11 (79.7 to 97.4)
	+4, +5	3 x 2P ^{*3}			
	-, +1	1			
	GND	4	N/A	M8	9 to 11 (79.7 to 97.4)
4093	R/L1, S/L2	1/0 x 2P ^{*3}	1 to 350 (42.4 to 152)	M10	18 to 23 (159 to 204)
	+4, +5	1/0 x 2P ^{*3}			
	-, +1	4/0			
	GND	2	N/A	M8	9 to 11 (79.7 to 97.4)

*1 Recommendation based on UL 61800-5-1 Table 4.3.8.8.2DV.1 for 75 °C Copper wires at 125% of rated current.

*2 Terminal wire range is the UL range of wire sizes the terminal can accommodate. Refer to local code requirements for wire size selection and keep within the range to comply with UL.

*3 For multiple wires of the same size (1/0 AWG or larger) at a terminal, the ampacity is equal to the value in Table 4.3.8.8.2DV.1 for that conductor multiplied by the number of conductors the terminal accommodates.

*4 GND wire sizing is based on Table 250.122 of NEC 2017. Please refer to local codes for wire size selection.

To comply with UL standards, use UL Listed closed-loop crimp terminals. Use the tools recommended by the terminal manufacturer to crimp the closed-loop crimp terminals. Yaskawa recommends closed-loop crimp terminals from PANDUIT Corp. and insulation tubes from Tokyo DIP Co., Ltd.

Table 6.12 Ring Terminal Specifications 200 V Class

SPC Model	Terminal	JST Ring Terminal (non-insulated)	Insulation Cap (Tokyo DIP Co)	Panduit Ring Terminal (non-insulated) *1	Insulation Cap (Tokyo DIP Co)	Panduit Ring Terminal (insulated)
2015	R/L1, S/L2	38-S6	TP-038	P2-14R *1	TP-038	PV2-14R *1
	+4, +5	38-S6	TP-038	P2-14R *1	TP-038	PV2-14R *1
	-, +1	22-S6	TP-022	P4-14R S4-14R	TP-022	PV4-14R
	GND	14-S8	TP-014	P6-56R S6-56R	TP-014	PV6-56R
2022	R/L1, S/L2	60-8 or 22-8	TP-060 or TP-022	S1/0-56R or P4-56R S4-56R	TP-038 or TP-022	PV4-56R
	+4, +5	22-8	TP-022	P4-56R S4-56R	TP-022	PV4-56R
	-, +1	38-8	TP-038	P2-56R S2-56R	TP-038	PV2-56R
	GND	22-8	TP-022	P4-56R S4-56R	TP-022	PV4-56R
2030	R/L1, S/L2	80-8 or 38-8	TP-080 or TP-038	S3/0-56R or P2-56R *1 S2-56R *1	TP-080 or TP-038	PV2-56R *1
	+4, +5	38-8	TP-038	P2-56R *1 S2-56R *1	TP-038	PV2-56R *1
	-, +1	60-8	TP-060	S1/0-56R	TP-038	-
	GND	22-8	TP-022	P4-56R S4-56R	TP-022	PV4-56R
2037	R/L1, S/L2	38-8	TP-038	S2-56R	TP-038	-
	+4, +5	38-8	TP-038	S2-56R	TP-038	-
	-, +1	70-8	TP-080	S2/0-56R	TP-038	-
	GND	38-8	TP-038	P2-56R *1 S2-56R *1	TP-038	PV2-56R *1
2045	R/L1, S/L2	60-10	TP-060	S1/0-38R	TP-038	-
	+4, +5	60-10	TP-060	S1/0-38R	TP-038	-
	-, +1	100-10	TP-100	S4/0-38R	TP-100	-
	GND	38-8	TP-038	P2-56R *1 S2-56R *1	TP-038	PV2-56R *1

*1 When using a PANDUIT ring terminal, the wire size changes from 3 AWG to 2 AWG. When a 3 AWG is required, use JST ring terminals.

Table 6.13 Ring Terminal Specifications 400 V Class

SPC Model	Terminal	JST Ring Terminal (non-insulated)	Insulation Cap (Tokyo DIP Co)	Panduit Ring Terminal (non-insulated) *1	Insulation Cap (Tokyo DIP Co)	Panduit Ring Terminal (insulated)
4022	R/L1, S/L2	22-6	TP-022	P4-14R S4-14R	TP-022	PV4-14R
	+4, +5	22-6	TP-022	P4-14R S4-14R	TP-022	PV4-14R
	-, +1	14-6	TP-014	P6-14R S6-14R	TP-014	PV6-14R
	GND	14-8	TP-014	P6-56R S6-56R	TP-014	PV6-56R
4030	R/L1, S/L2	38-S6	TP-038	P2-14R *1	TP-038	PV2-14R *1
	+4, +5	38-S6	TP-038	P2-14R *1	TP-038	PV2-14R *1
	-, +1	22-S6	TP-022	P4-14R S4-14R	TP-022	PV4-14R
	GND	14-S8	TP-014	P6-56R S6-56R	TP-014	PV6-56R
4037	R/L1, S/L2	38-8	TP-038	S2-56R	TP-038	-
	+4, +5	38-8	TP-038	S2-56R	TP-038	-
	-, +1	38-8	TP-038	P2-56R *1 S2-56R *1	TP-038	PV2-56R *1
	GND	14-8	TP-014	P6-56R S6-56R	TP-014	PV6-56R
4045	R/L1, S/L2	60-8 or 22-8	TP-060 or TP-022	S1/0-56R or P4-56R S4-56R	TP-038 or TP-022	PV4-56R
	+4, +5	22-8	TP-022	P4-56R S4-56R	TP-022	PV4-56R
	-, +1	38-8	TP-038	P2-56R S2-56R	TP-038	PV2-56R
	GND	14-8	TP-014	P6-56R S6-56R	TP-014	PV6-56R
4056	R/L1, S/L2	80-8 or 38-8	TP-080 or TP-038	S3/0-56R or P2-56R *1 S2-56R *1	TP-080 or TP-038	PV2-56R *1
	+4, +5	38-8	TP-038	P2-56R *1 S2-56R *1	TP-038	PV2-56R *1
	-, +1	38-8	TP-038	S2-56R	TP-038	-
	GND	22-8	TP-022	P4-56R S4-56R	TP-022	PV4-56R
4093	R/L1, S/L2	60-10	TP-060	S1/0-38R	TP-038	-
	+4, +5	60-10	TP-060	S1/0-38R	TP-038	-
	-, +1	100-10	TP-100	S4/0-38R	TP-100	-
	GND	38-8	TP-038	P2-56R S2-56R	TP-038	PV2-56R

*1 When using a PANDUIT ring terminal, the wire size changes from 3 AWG to 2 AWG. When a 3 AWG is required, use JST ring terminals.

◆ Electrical Specifications

The specifications in [Table 6.14](#) apply to all converter models.

Table 6.14 Electrical Specifications

Item	Specification
Short circuit current rating (SCCR)	100,000 RMS symmetrical amperes, when protected by specified fuses
Protection	<ul style="list-style-type: none"> • Semiconductor Fuse • Class J Fuse • Class T Fuse
Output cable length	3 meters (9.8 ft) maximum

Table 6.15 Branch Circuit Protection

SPC Model	SPC Input Amps	Maximum Class J Fuse Rating (Amps) ^{*1 *2}	Bussmann Semiconductor Fuse Model ^{*2 *3}	Maximum Circuit Breaker Rating (Amps) ^{*4 *5 *6}
2015	79	100	FWH-125B	150
2022	116	150	FWH-175B	225
2030	154	200	FWH-225A	250
2037	191	250	FWH-275A	Not Qualified
2045	228	300	FWH-275A	Not Qualified
4022	58	70	FWH-90B	125
4030	77	100	FWH-125B	150
4037	96	125	FWH-150B	200
4045	114	150	FWH-175B	200
4056	142	175	FWH-200B	Not Qualified
4093	234	300	FWH-275B	Not Qualified

*1 Class J or T fuse

*2 When using semiconductor fuses, Bussmann FWH series is required for UL compliance.

*3 Suitable for use on a circuit capable of delivering not more than 100 kA RMS symmetrical amperes, 240 V (200 V class) or 480 V (400 V class) maximum when using semiconductor or time delay fuses.

*4 When using a circuit breaker, a current limiting circuit breaker is required for UL compliance.

*5 Suitable for use on a circuit capable of delivering not more than 65 kA RMS symmetrical amperes, 240 V (200 V class) or 480 V (400 V class) maximum when using a current limiting circuit breaker.

*6 Only Yaskawa manufactured panels are approved for use with circuit breakers in place of fuses (W3 enclosure minimum for frame 1/ frame 2 models).

◆ Installation Environment

Install the converter in an environment that meets the criteria in [Table 6.16](#)

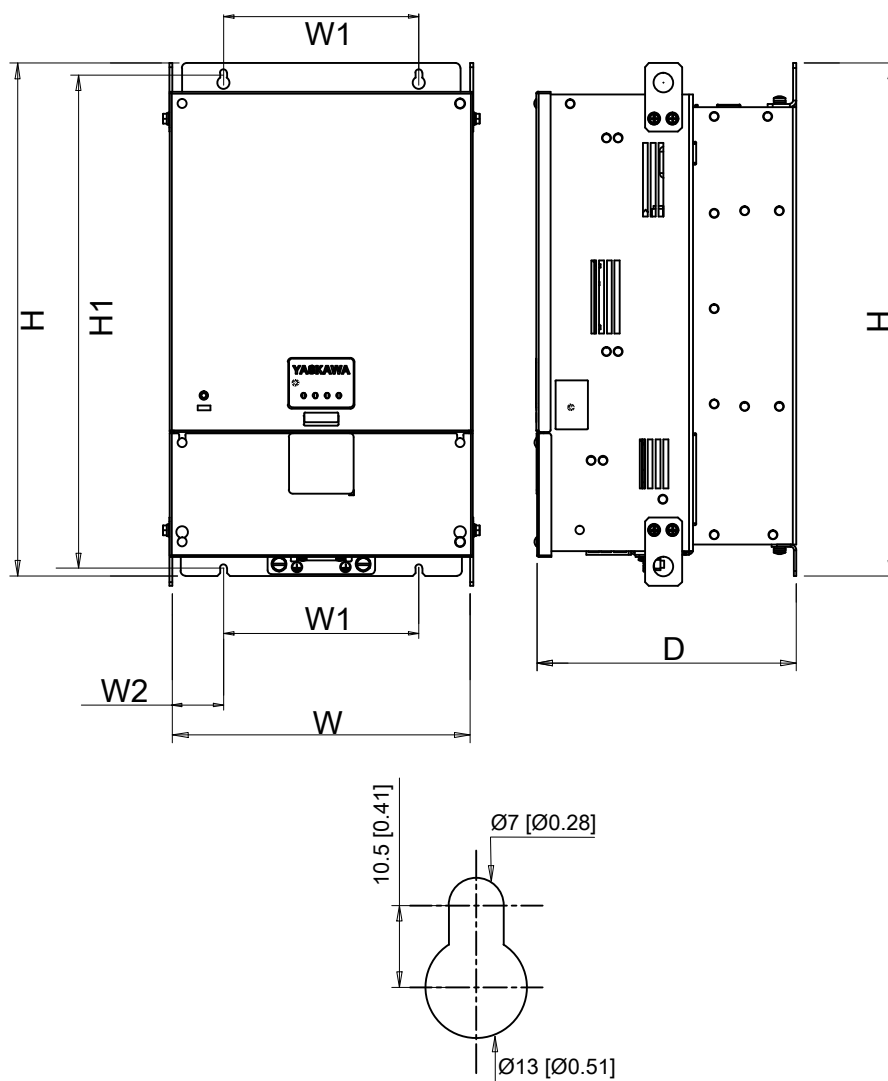
Table 6.16 Installation Environment Conditions

Environment	Condition
Installation Area	Indoors
Ambient Temperature	<ul style="list-style-type: none"> • IP00/Open chassis: -10 °C to +50° C • IP20/NEMA 1, UL Type 1: -10 °C to +40 °C
Humidity	95% RH or less without condensation
Storage Temperature	-20 °C to +70 °C
Surrounding Area	Installation area must not have: <ul style="list-style-type: none"> • Oil mist and dust • Metal shavings, oil, water or other foreign materials • Radioactive materials • Combustible materials (for example, wood) • Harmful gases or liquids • Chlorides • Direct sunlight

Environment	Condition
Altitude	Up to 1000 m, derating 1% / 1000 m up to 3000 m
Vibration	Conforms to EN60068-2-6 <ul style="list-style-type: none"> • 10-20 Hz and below, 9.8 m/s² (1G) • 20-55 Hz, m/s² (0.2G)
Orientation	Install the converter vertically to maximize cooling effects.

◆ Installation Orientation & Spacing

Figure 6.9, Table 6.17, and Table 6.18 outline the converter dimensions for mechanical installation. Refer to *External Heatsink Mounting Dimensions on page 35* for mounting information.



Top mounting hole dimensions

Figure 6.9 Mounting Dimensions

Table 6.17 200 V Class Mounting Dimensions

SPC Model	Dimensions mm (in)						
	W	W1	W2	H	H1	D	Weight kg (lb)
2015	250 (9.84)	175 (6.89)	37.5 (1.48)	423 (16.65)	405 (15.94)	254 (10)	18 (39.7)
2022							
2030	305 (12.01)	200 (7.87)	52.5 (2.07)	525 (20.67)	507 (19.96)	265 (10.45)	26 (57.3)
2037	310 (12.2)		55 (2.16)	636 (25.04)	610 (24.02)	290 (11.42)	33 (72.8)
2045							

Table 6.18 400 V Class Mounting Dimensions

SPC Model	Dimensions mm (in)						
	W	W1	W2	H	H1	D	Weight kg (lb)
4022	250 (9.84)	175 (6.89)	37.5 (1.48)	423 (16.65)	405 (15.94)	254 (10)	17 (37.5)
4030							
4037	305 (12.01)	200 (7.87)	52.5 (2.07)	525 (20.67)	507 (19.96)	265 (10.45)	26 (57.3)
4045							27 (59.5)
4056	310 (12.2)		55 (2.16)	636 (25.04)	616 (24.25)	290 (11.42)	33.6 (74)
4093		375 (14.76)	40.6 (89.5)				

Use [Figure 6.10](#) for the correct installation spacing when installing multiple converters in the same cabinet.

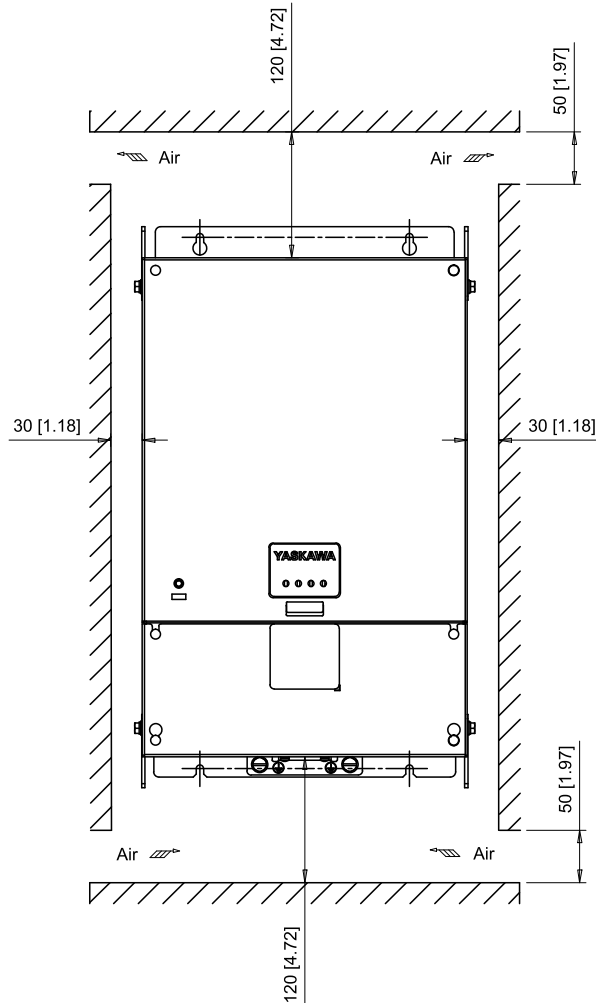


Figure 6.10 Minimum Installation Clearances

◆ SPC I/O Terminal Torque Specifications

Use [Table 6.19](#) to select the proper torque specification for terminal block connection points. Proper torque ensures terminals and terminations make solid connections for reliable function of the converter and drive.

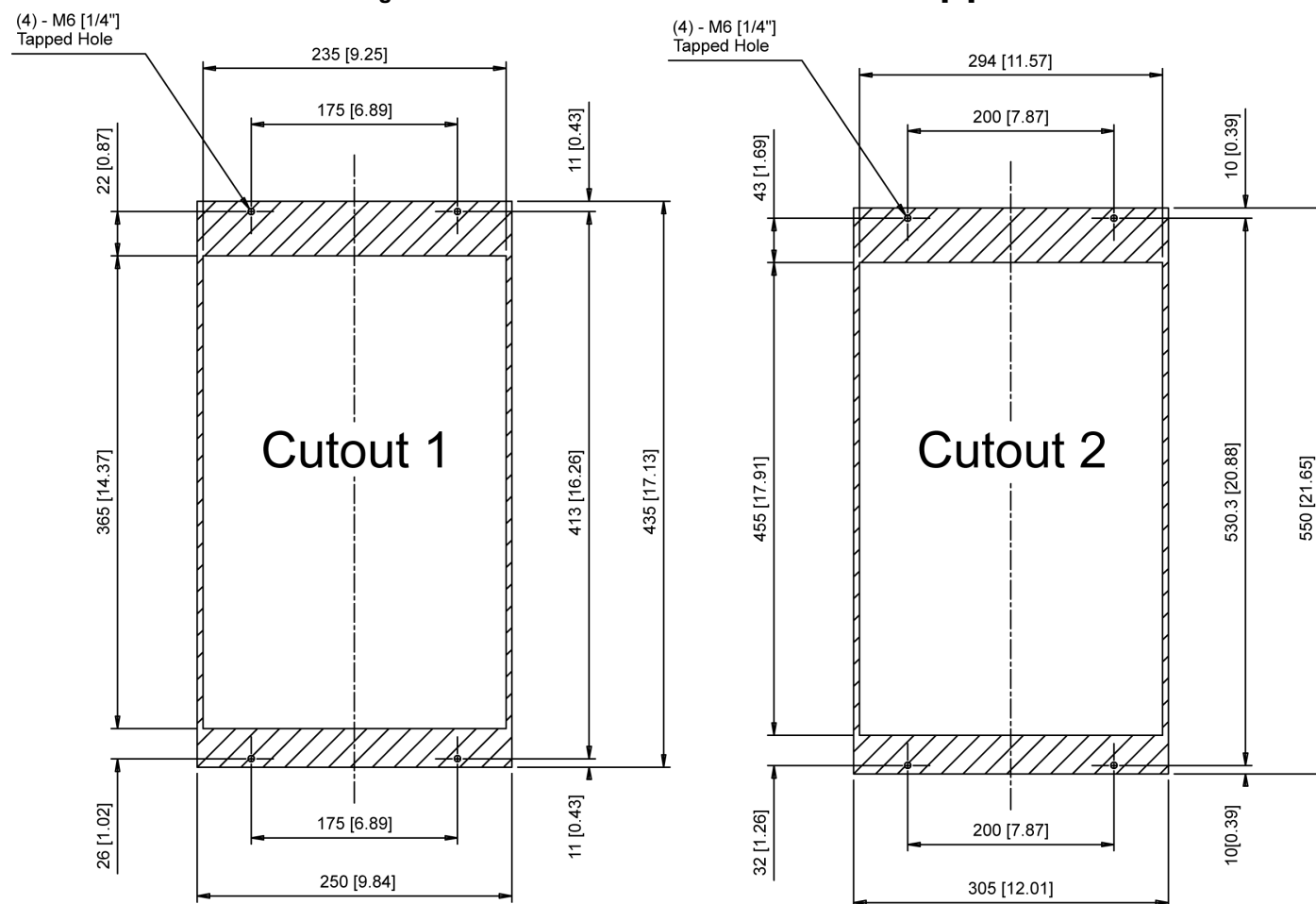
Table 6.19 TB1 and TB2 Control Terminal Block Specifications

Terminal	Screw Size	Bare Wire Terminal		Ferrule-Type Terminal		Wire Type	Clamping Torque N·m (in-lb)
		Wire Range mm ² (AWG)	Recomm. mm ² (AWG)	Applic. wire size mm ² (AWG)	Recomm. mm ² (AWG)		
TB1 and TB2	M3	Stranded: 0.25 to 1.5 mm ² (24 to 16)	0.75 (18)	0.25 to 1.0	0.5 (20)	Shielded wire, etc.	0.5 - 0.6 (4.4 - 5.3)

◆ External Heatsink Mounting Dimensions

Use [Figure 6.11](#) or [Figure 6.12](#) to select the proper cutout dimensions for an external heatsink installation.

Figure 6.11 External Heatsink Cutout Dimensions mm[in]

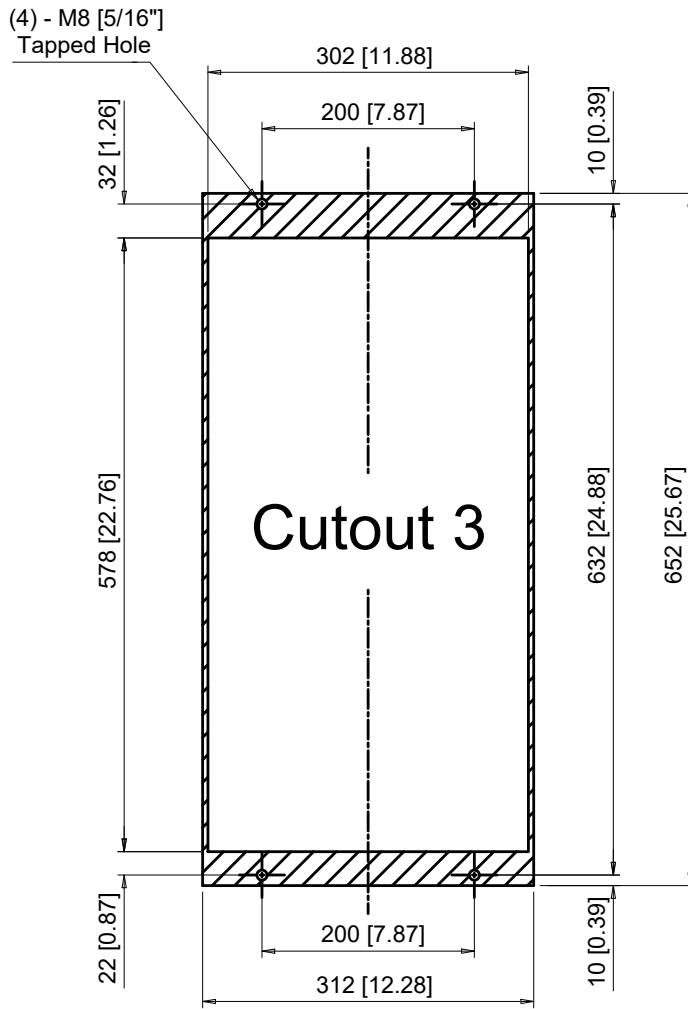


SPC Models	
Cutout 1	Cutout 2
2015	2030
2022	4037
4022	4045
4030	

Note:

1. Exposed Heatsink Minimum Clearance Depth = 111 mm (4.37 in)
2. Refer to *External Heatsink Mounting Configuration on page 37* to relocate the converter mounting brackets.

Figure 6.12 External Heatsink Cutout Dimensions mm[in]



SPC Models	
Cutout 3	
	2037
	2045
	4056
	4093

Note:

1. Models 2037, 2045, 4056 Exposed Heatsink Minimum Clearance Depth = 106 mm (4.17 in)
2. Model 4093 Exposed Heatsink Minimum Clearance Depth = 191 mm (7.51 in)
3. Refer to *External Heatsink Mounting Configuration on page 37* to relocate the converter mounting brackets.

◆ External Heatsink Mounting Configuration

Relocate the mounting brackets to mount the converter heatsink external to the enclosure.

1. Locate the new mounting bracket installation points.
2. Remove the screws and brackets.
3. Align and install brackets, tightening screws to 7.4 N·m (65 in-lb).

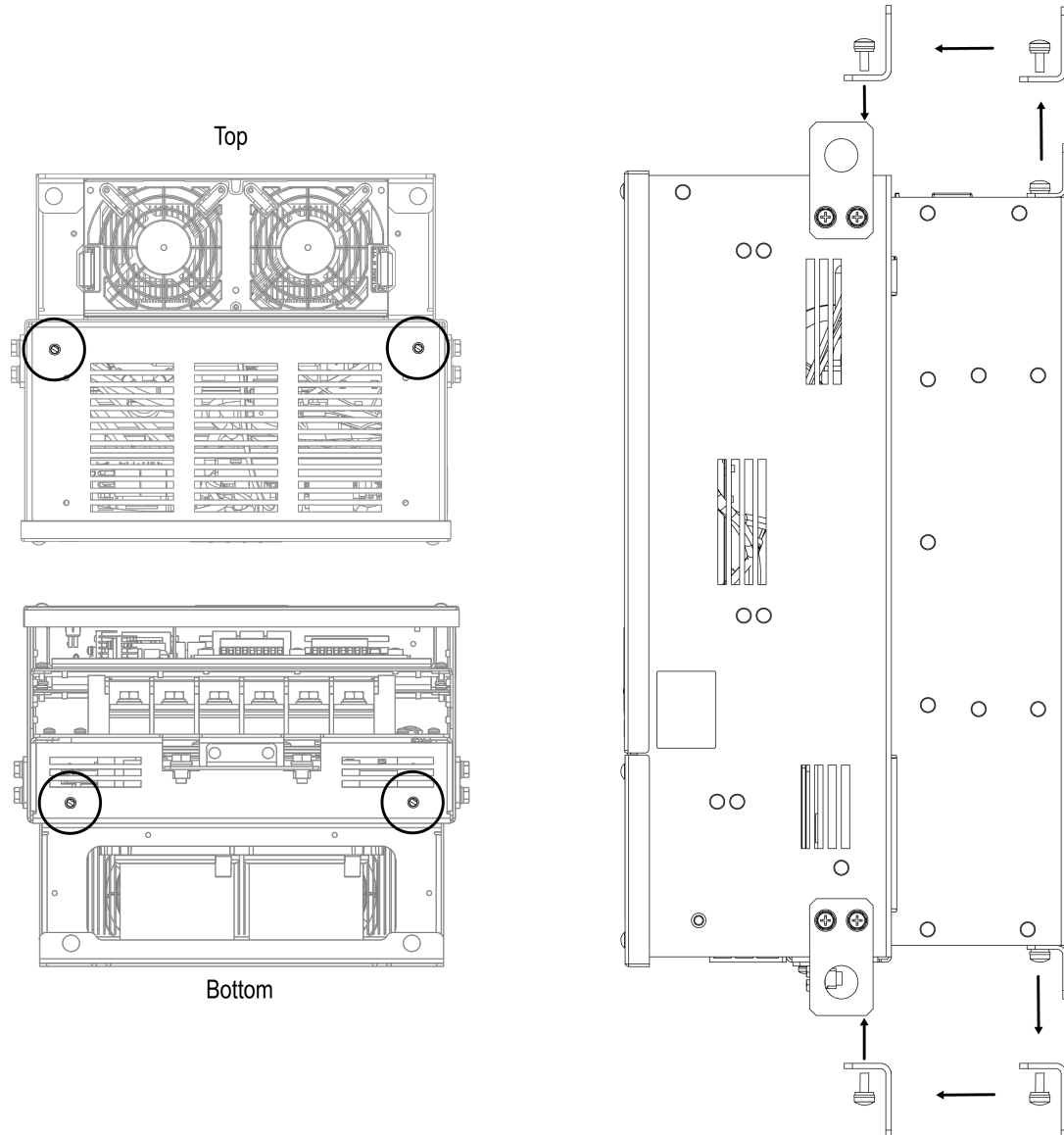


Figure 6.13 Mounting Bracket Relocation

◆ LED Diagnostics for Troubleshooting

When a fault occurs, the converter immediately stops operation, the fault relay (RLY1) closes and the “Fault” LED will flash (Figure 6.14) indicating the fault. Refer to Table 6.20 to determine the potential causes and solutions for the fault(s).

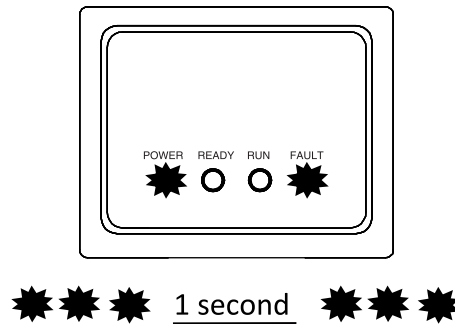


Figure 6.14 Example of an Over-Temperature Fault (3)

Table 6.20 LED Diagnostics for Troubleshooting

Fault Name	Number of Fault LED Flashes	Causes	Possible Solutions	Reset / Restart Notes
Overcurrent Condition	1	A large, instantaneous spike of current has occurred.	<ul style="list-style-type: none"> Decrease the load on the drive: <ol style="list-style-type: none"> Reduce the maximum output of the drive. Increase the acceleration time of the drive. Replace the converter with a larger capacity model. 	Auto Restart: Current must be below overcurrent trip level for 2 seconds. Manual Reset: The Reset digital input (S2) must transition from open to closed.
		Incoming line voltage is below the specified range.	<ul style="list-style-type: none"> Increase incoming line voltage. Decrease the load on the drive: <ol style="list-style-type: none"> Reduce the maximum speed of the drive. Increase the acceleration time of the drive. 	
		Incoming line voltage is unstable.	<ul style="list-style-type: none"> Minimize power line disturbances. 	
Converter Overload	2	The load is too heavy.	<ul style="list-style-type: none"> Decrease the load on the drive: <ol style="list-style-type: none"> Reduce the maximum output of the drive. Increase the acceleration time of the drive. Replace the converter with a larger capacity model. 	Auto Restart: Restart occurs when the heatsink temperature drops below overheat level. Manual Reset: Reset digital input (S2) must be closed. The reset will be accepted only after current drops below converter rated current for a short time. The reset time varies with conditions.
		Incoming line voltage is below the specified range.	<ul style="list-style-type: none"> Increase incoming line voltage. Decrease the load on the drive: <ol style="list-style-type: none"> Reduce the maximum speed of the drive. Increase the acceleration time of the drive. 	

Fault Name	Number of Fault LED Flashes	Causes	Possible Solutions	Reset / Restart Notes
Heatsink Overheat	3	The ambient temperature is too high.	<ul style="list-style-type: none"> Check for proper cabinet fan operation. Shade cabinet from direct sunlight. Check cabinet air filters. 	<p>Auto Restart: Restart occurs when the heatsink temperature drops below overheat level.</p> <p>Manual Reset: The reset digital input (S2) must be closed. The reset will be accepted only when the heatsink temperature drops below overheat level.</p>
		Heatsink clogged with dust or debris.	<ul style="list-style-type: none"> Clean heatsink 	
		Internal cooling fan malfunction.	<ul style="list-style-type: none"> Check/replace defective cooling fans. With power removed (charge light off), check the 4-pin CN6 connector. 	
		The load is too heavy.	<ul style="list-style-type: none"> Decrease the load on the drive: <ol style="list-style-type: none"> Reduce the maximum output speed of the drive. Replace the converter with a larger capacity model. 	
		Internal malfunction	Contact your Yaskawa representative or supplier for assistance.	
Main Contactor Fault	4	<p>The soft-charge bypass contactor is damaged or malfunctioning.</p> <p>Loose or disconnected CN13 or CN36 connector</p>	<ul style="list-style-type: none"> With power removed (charge light off), fully seat the 2-pin CN13 connector and the 2-pin CN36 connector. 	<p>Auto Restart: Restart occurs when the Main contactor malfunction is no longer detected.</p> <p>Manual Reset: The reset digital input (S2) must be closed. The reset will be accepted when the Main Contactor malfunction is no longer detected.</p>
Fan Power Supply	5	<p>Fan power supply malfunction</p> <p>Loose or disconnected CN49 or CN33-1 connector</p>	<ul style="list-style-type: none"> With power removed (charge light off), fully seat the 2-pin CN49 connector and the 2-pin CN33-1 connector. For other models, contact your Yaskawa representative or supplier for assistance. 	<p>Auto Restart: Restart occurs when the fan power supply is properly detected.</p> <p>Manual Reset: The reset digital input (S2) must be closed. Will reset when the fan power supply is properly detected.</p>
Short Circuit fault	6	IGBT Short Circuit	Contact your Yaskawa representative or supplier for assistance.	<p>This fault cannot be automatically restarted or manually reset. Input power must be removed to reset this fault.</p>
Converter Capacity Error	7	<p>Converter capacity or model not supported</p> <p>Loose or disconnected 22-pin CN1 connector</p>	<ul style="list-style-type: none"> With power removed (charge light off), fully seat the 22-pin CN1 connector. Software in unit does not support the converter <p>Contact your Yaskawa representative or supplier for assistance.</p>	
Short Circuit Fault 2	9	A DC Bus Short Circuit occurred	Contact your Yaskawa representative or supplier for assistance.	
Internal Failure	Solid	Control Board Failure	Contact your Yaskawa representative or supplier for assistance.	

■ Manual vs Automatic Restart

Manual Restart / Automatic Restart Configuration: Manual Restart is selected by having the RESTART dip-switch OPEN (SW2 OFF) when power is first applied to the converter. Automatic Restart is selected by having the RESTART dip-switch CLOSED (SW2 ON) when power is first applied to the converter. Changing this setting with power applied will have no effect.

■ Manual Fault Reset (Mode)

Manual Reset Operation: When a fault occurs the converter will stop, the Fault Relay (MA, MB, MC) will activate, and the FAULT LED will report which fault has occurred using a blink-code. The converter will stay stopped until a reset is commanded or power to the converter is cycled. A reset is commanded by closing the Reset Input (S2-SN) customer digital input. A reset is only accepted once the fault condition has cleared. The Reset Input (S2-SN) is level-activated for a Main Contactor Fault or Overtemperature fault. If the Reset Input (S2-SN) is closed (jumpered), either of these faults will reset as soon as the condition has cleared. The Over Current fault will only reset once the fault condition has cleared and there is a transition from Open to Closed for the Reset Input (S2-SN). Faults & Reset commands operate the same in Standby and RUN modes.

■ Automatic Fault Reset (Mode)

When a fault occurs the converter will stop, the Fault Relay (MA, MB, MC) will activate, and the FAULT LED will report which fault has occurred using a blink-code. When the fault condition clears, the converter will wait for the fault restart time (2 seconds) then automatically clear the fault.

If the converter has 10 faults in 60 seconds, it is assumed there is a persistent problem (Hard Fault) that requires manual intervention. The converter will NOT reset even if the fault condition clears. The Fault Relay (MA, MB, MC) will remain activated, and the FAULT LED will then flash the fault codes for each of the last 10 faults, from newest to oldest. When all fault codes have been displayed, there will be a 5 second delay and the faults codes will be re-played. Once the converter has had 10 faults within 60 seconds, it can be reset when the Reset Input (S2-SN) transitions from Open to Closed. At that time all fault codes will be cleared, the Fault Relay (MA MB MC) will deactivate, the FAULT LED will go off and normal operation will resume.

◆ Mechanical Specifications

The specifications in [Table 6.21](#) in apply to all converter models.

Table 6.21 Converter Chassis Specifications

Item	Specification
Protection	IP00/Open Type and IP20/NEMA 1, UL Type 1 with optional field-installed kit
Required spacing	<ul style="list-style-type: none"> • 30 mm (1.2 in) on the sides • 120 mm (4.7 in) on top and bottom
Exhaust temperature	80 °C maximum
Audible noise	72 dbA or less for all models except 4093, which may reach 76 dbA
PCB coating	Conformal coating PCB as standard, conforms to IEC 60721-3-3 Class 3C2 (chemical gas) and Class 3S2 (solid particles)
Fire proof	Conforms to UL 61800-5-1
Mounting	<ul style="list-style-type: none"> • Hole can receive metric and standard bolt equivalents • Accessible without removing front cover • Keyholes on the top of the unit • U-shaped holes on the bottom of the unit
Lifting	<ul style="list-style-type: none"> • Four points on units 11.3 kg (25 lb) and greater • Eye bolts or lifting brackets • Lifting bolt or bracket is not the same as the mounting hole or bracket
DC link choke	External to the chassis

◆ Power Ratings for 200 V Class Models

Table 6.22 200 V Specifications

Item		Specification				
SPC Model		2015	2022	2030	2037	2045
Maximum Motor Capacity kW (HP) ^{*1}		15 (20)	22 (30)	30 (40)	37 (50)	45 (60)
Inductor (mH)		0.81	0.55	0.41	0.33	0.28
Input	Rated Current (A) ^{*2}	79	116	154	191	228
	Rated Voltage ^{*3}	Single-phase 230 to 240 Vac				
	Rated Frequency	60 Hz				
	Allowable Voltage Fluctuation ^{*4}	-5 to +10% ^{*5}				
	Allowable Frequency Fluctuation	±3 Hz				
	Power (kVA) ^{*6}	21	31	41	51	60
Output	Rated Current (A)	57	84	112	139	166
	Overload Tolerance	110% of rated output current for 60 seconds				
	Carrier Frequency (kHz)	9	9	7.5	6	6
	Rated Voltage	310 to 370 Vdc				
Harmonic Current Distortion ^{*7}		<30% at full load <50% at 50% load or greater				
Input Power Factor		>0.95 at 50% load or greater				

- *1 The motor capacity (HP) refers to an NEC 4-pole motor. The rated current of the converter should be greater than or equal the DC input current required by the drive selected to operate the motor.
- *2 Assumes operation at the rated output current of the converter. Input current rating varies depending on the power supply transformer, input reactor, wiring connections, and power supply impedance.
- *3 A derate (maximum motor capacity) is applied below 208 Vac.
- *4 Based on 240 Vac input.
- *5 -10% minimum input voltage for 60 seconds at rated power.
- *6 Rated input capacity is calculated with a power line voltage of $240\text{ V} \times 1.1$.
- *7 The total harmonic voltage distortion of the source is 0% to meet these conditions.

Use the values in [Table 6.23](#) to derate the SPC when input voltage is between 208 Vac to 229 Vac.

Table 6.23 SPC Derating for Input Voltages between 208 Vac to 229 Vac

SPC Model	2015	2022	2030	2037	2045
Maximum Motor Capacity kW (HP) *1	11 (15)	18.5 (25)	22 (30)	30 (40)	37 (50)

- *1 The motor capacity (HP) refers to an NEC 4-pole motor. The rated current of the converter should be greater than or equal the DC input current required by the drive selected to operate the motor.

◆ Power Ratings for 400 V Class Models

Table 6.24 400 V Specifications

Item		Specification					
SPC Model		4022	4030	4037	4045	4056	4093
Maximum Motor Capacity kW (HP) *1		22 (30)	30 (40)	37 (50)	45 (60)	56 (75)	93 (100 - 125)
Inductor (mH)		2.19	1.65	1.33	1.12	0.9	0.54
Input	Rated Current (A) *2	58	77	96	114	142	234
	Rated Voltage *3	Single-phase 460 to 480 Vac					
	Rated Frequency	60 Hz					
	Allowable Voltage Fluctuation *4	-15 to +10%					
	Allowable Frequency Fluctuation	±3 Hz					
	Power (kVA) *5	31	41	51	60	75	124
Output	Rated Current (A)	42	56	69	83	103	170
	Overload Tolerance	110% of rated output current for 60 seconds					
	Carrier Frequency (kHz)	7.5	7.5	8.7	7.5	6	6
	Rated Voltage	630 to 720 Vdc					
Harmonic Current Distortion *6		<30% at full load <50% at 50% load or greater					
Input Power Factor		>0.95 at 50% load or greater					

- *1 The motor capacity (HP) refers to an NEC 4-pole motor. The rated current of the converter should be greater than or equal the DC input current required by the drive selected to operate the motor.
- *2 Assumes operation at the rated output current of the converter. Input current rating varies depending on the power supply transformer, input reactor, wiring connections, and power supply impedance.
- *3 A derate (maximum motor capacity) is applied below 460 Vac.
- *4 Based on 480 Vac input.
- *5 Rated input capacity is calculated with a power line voltage of $480\text{ V} \times 1.1$.
- *6 The total harmonic voltage distortion of the source is 0% to meet these conditions.

◆ Watt Loss

Table 6.25 Watt Loss 200 V Class

SPC Model	Input voltage Single-Phase (Vac)	Output Capacity (kW)	Cooling Fans	Heat Loss (W)		
				Internal	External	Total
2015	230 to 240	15	2	125	352	477
2022		22	2	156	539	695
2030		30	2	209	728	937
2037		37	2	281	878	1159
2045		45	2	339	1031	1370

Table 6.26 Watt Loss 400 V Class

SPC Model	Input voltage Single-Phase (Vac)	Output Capacity (kW)	Cooling Fans	Heat Loss (W)		
				Internal	External	Total
4022	460 to 480	22	2	115	389	504
4030		30	2	141	504	645
4037		37	2	185	724	909
4045		45	2	199	782	981
4056		56	2	248	834	1082
4093		93	2	488	1556	2044

◆ UL Standards Compliance



Figure 6.15 UL/cUL Mark

The UL/cUL Mark indicates that this product satisfies stringent safety standards. This mark appears on products in the United States and Canada. It shows UL approval, indicating that it has been determined that the product complies with safety standards after undergoing strict inspection and assessment. UL-approved parts must be used for all major components that are built into electrical appliances that obtain UL approval.

This product has been tested in accordance with UL standard UL61800-5-1, and has been verified to be in compliance with UL standards.

Machines and devices integrated with this product must satisfy the following conditions for compliance with UL standards.

■ Area of Use

Install this product in a location with overvoltage category III and pollution degree 2 or less. These definitions are specified in UL 61800-5-1.

■ Ambient Temperature

Maintain the ambient temperature within the following ranges according to the enclosure type.

- Enclosed wall-mounted type (UL Type 1): -10 °C to +40 °C (14 °F to 104 °F)
- Open chassis type (IP20): -10 °C to +50 °C (14 °F to 122 °F)

■ Main Circuit Terminal Wiring

Wire the main circuit terminal block correctly as specified by the instructions in the manual. To comply with UL standards use UL-approved closed-loop crimp terminals. Refer to *Input, Output, and Conductor Wire Sizes and Terminations on page 28* for more information about closed-loop crimp terminals (UL-compliant products).

To select the correct wire gauge and tightening torques, refer to *Input, Output, and Conductor Wire Sizes and Terminations on page 28*.

■ Recommended Branch Circuit Protection

Use branch circuit protection to protect against short circuits and to maintain compliance with UL61800-5-1. Yaskawa recommends connecting semiconductor protection fuses on the input side for branch circuit protection. Refer to *Electrical Specifications on page 32* for the recommended fuses.

- 200 V Class: Use the fuses specified in this document to prepare the drive for use on a circuit that supplies not more than 100,000 RMS symmetrical amperes and 240 Vac when there is a short circuit in the power supply.
- 400 V Class: Use the fuses specified in this document to prepare the drive for use on a circuit that supplies not more than 100,000 RMS symmetrical amperes and 480 Vac when there is a short circuit in the power supply.

The converter does not provide built-in branch circuit protection. This must be user provided as specified by National Electric Code (NEC) and local codes.

■ Low Voltage for Control Circuit Terminals

You must provide low voltage wiring as specified by the National Electric Code (NEC), Part I (CEC), and local codes. Yaskawa recommends the NEC class 1 circuit conductor.

■ Drive Short Circuit Rating

The converter is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical Amperes, 240 Vac maximum (200 V Class) and 480 Vac (400 V Class) when protected by Bussmann Type FWH or Class J fuses. Refer to *Electrical Specifications on page 32* for fusing.

Revision History

Date of Publication	Revision Number	Section	Revised Content
April 2024	1	6	Revision: HP range for model 4093
June 2019	-	-	First release



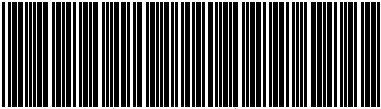
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SINGLE PHASE CONVERTER INSTALLATION & PRIMARY OPERATION

In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.
Specifications are subject to change without notice for ongoing product modifications and improvements.

Original Instructions
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