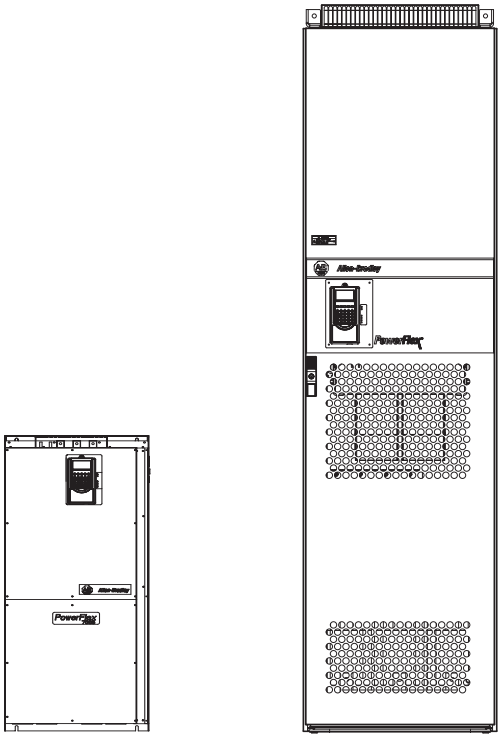
PowerFlex® 700S Drives - Phase I Control (Frame Sizes 9 & 10)



Introduction

This document is designed to guide you through the basic steps needed to install, start-up, and program PowerFlex 700S AC drives with Phase I Control and frame sizes 9 & 10. **The information provided does not replace the user manual and is intended for qualified personnel only.** For detailed PowerFlex 700S information refer to the appropriate publications:

Title	Publication	Available
User Manual - PowerFlex 700S Drive with Phase I Control	20D-UM001	www.rockwellautomation.com/literature
Installation Instructions - PowerFlex 700S and 700H High Power Drives	PFLEX-IN006	
Reference Manual - PowerFlex 700S Drive with Phase I Control	PFLEX-RM002	
Wiring and Grounding Guidelines for Pulse Width Modulated Drives	DRIVES-IN001	

Table of Contents

Step 1: Read General Information

Class 1 LED Product

ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into module ports or fiber optic cable connectors.

General Precautions

ATTENTION: This drive contains **ESD** (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference Allen-Bradley publication 8000-4.5.2, “Guarding Against Electrostatic Damage” or any other applicable ESD protection handbook.

ATTENTION: An incorrectly applied or installed drive can result in component damage or a reduction in product life. Wiring or application errors such as under sizing the motor, incorrect or inadequate AC supply, or excessive surrounding air temperatures may result in malfunction of the system.

ATTENTION: Only **qualified personnel** familiar with the PowerFlex 700S Drive and associated machinery should plan or implement the installation, start-up and subsequent maintenance of the system. Failure to comply may result in personal injury and/or equipment damage.

ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the +DC & –DC terminals of the Power Terminal Block (refer to Chapter 1 in the *PowerFlex 700S User Manual* for location). The voltage must be zero.

ATTENTION: Risk of injury or equipment damage exists. DPI or SCANport host products must not be directly connected together via 1202 cables. Unpredictable behavior can result if two or more devices are connected in this manner.

ATTENTION: Risk of injury or equipment damage exists. Parameters 365 [Encdr0 Loss Cnfg] - 394 [VoltFdbkLossCnfg] let you determine the action of the drive in response to operating anomalies. Precautions should be taken to ensure that the settings of these parameters do not create hazards of injury or equipment damage

ATTENTION: Risk of injury or equipment damage exists. Parameters 383 [SL CommLoss Data] - 392 [NetLoss DPI Cnfg] let you determine the action of the drive if communications are disrupted. You can set these parameters so the drive continues to run. Precautions should be taken to ensure the settings of these parameters do not create hazards of injury or equipment damage.

ATTENTION: The sheet metal cover and mounting screws on the ASIC Board located on the power structure are energized at (-) DC bus potential high voltage. Risk of electrical shock, injury, or death exists if someone comes in contact with the assembly.

CE Conformity

Conformity with the Low Voltage (LV) Directive and Electromagnetic Compatibility (EMC) Directive has been demonstrated using harmonized European Norm (EN) standards published in the Official Journal of the European Communities. PowerFlex Drives comply with the EN standards listed below when installed according to the User and Reference Manual.

CE Declarations of Conformity are available online at:
http://www.ab.com/certification/ce/docs.

Low Voltage Directive (73/23/EEC)

- EN50178 Electronic equipment for use in power installations.

EMC Directive (89/336/EEC)

- EN61800-3 Adjustable speed electrical power drive systems Part 3: EMC product standard including specific test methods.

General Notes

- The motor cable should be kept as short as possible in order to avoid electromagnetic emission as well as capacitive currents.
- Use of line filters in ungrounded systems is not recommended.
- PowerFlex drives may cause radio frequency interference if used in a residential or domestic environment. The user is required to take measures to prevent interference, in addition to the essential requirements for CE compliance listed below, if necessary.
- Conformity of the drive with CE EMC requirements does not guarantee an entire machine or installation complies with CE EMC requirements. Many factors can influence total machine/installation compliance.
- PowerFlex drives can generate conducted low frequency disturbances (harmonic emissions) on the AC supply system. More information regarding harmonic emissions can be found in the *Reference Manual - PowerFlex 700S Drives with Phase I Control*, PFLEX-RM002.

Essential Requirements for CE Compliance

Conditions 1-6 listed below **must be** satisfied for PowerFlex drives to meet the requirements of **EN61800-3**.

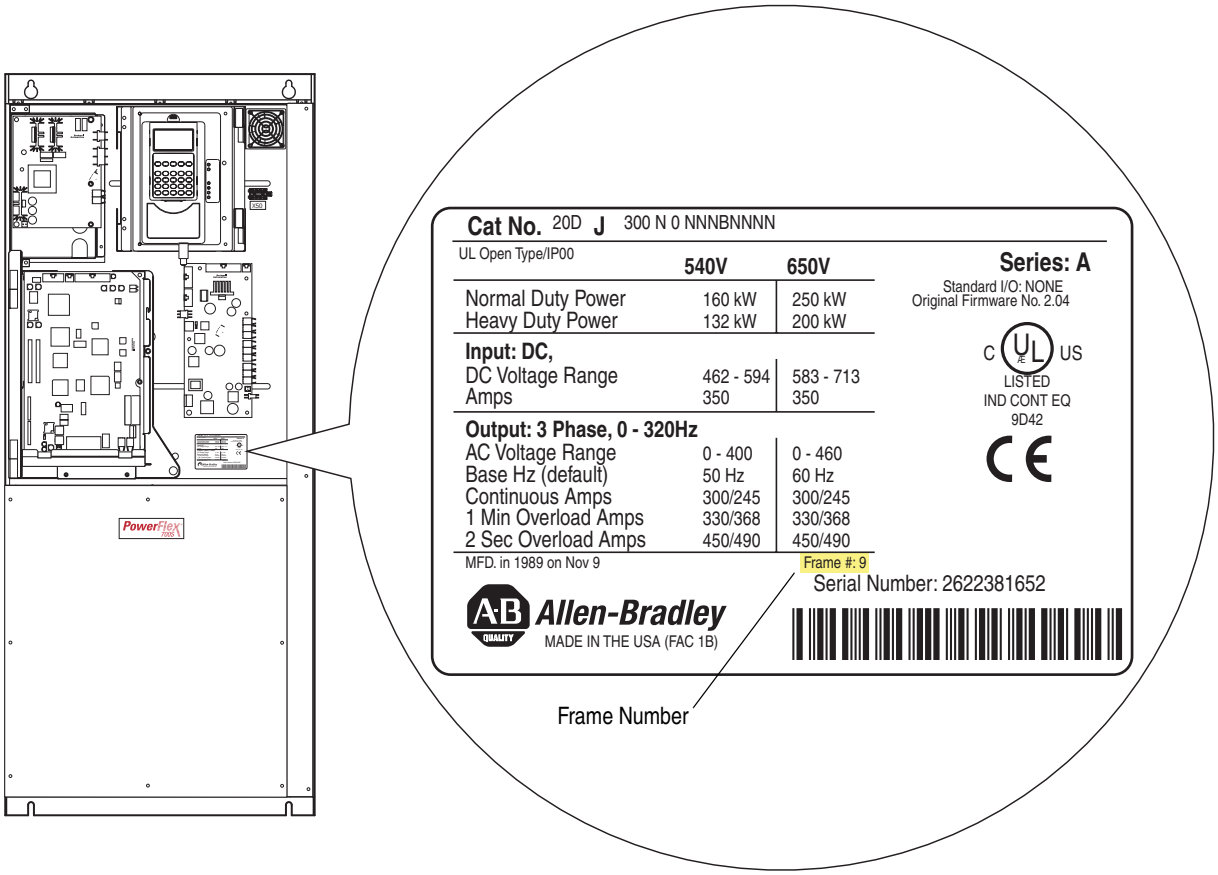
1. Standard PowerFlex High Power CE compatible Drive. For Frame 10, the drive must also be installed in a suitable Rittal TS 8 (or equivalent) enclosure.
2. Review important precautions/attention statements throughout this manual before installing the drive.
3. Grounding as described on page 25.
4. Output power, control (I/O) and signal wiring must be braided, shielded cable with a coverage of 75% or better, metal conduit or equivalent attenuation.
5. All shielded cables should terminate with the proper shielded connector.
6. Conditions in Table A.

Table A PowerFlex High Power EN61800-3 EMC Compatibility

Frame	Second Environment *Restrict Motor Cable to 30 m (98 ft.)* *Any Drive and Option*
9	✔
10	✔

Step 2: Identifying the Frame Size of the Drive

Determine the frame size of your drive by checking the data nameplate on the Control Frame. The frame number is printed just above the serial number.



Step 3: Lifting the Drive

- For lifting instructions for frame 9 size drives, see "Frame 9 Size Drives" below.
- For lifting instructions for frame 10 size drives, see Frame 10 Size Drives on page 9.

Frame 9 Size Drives

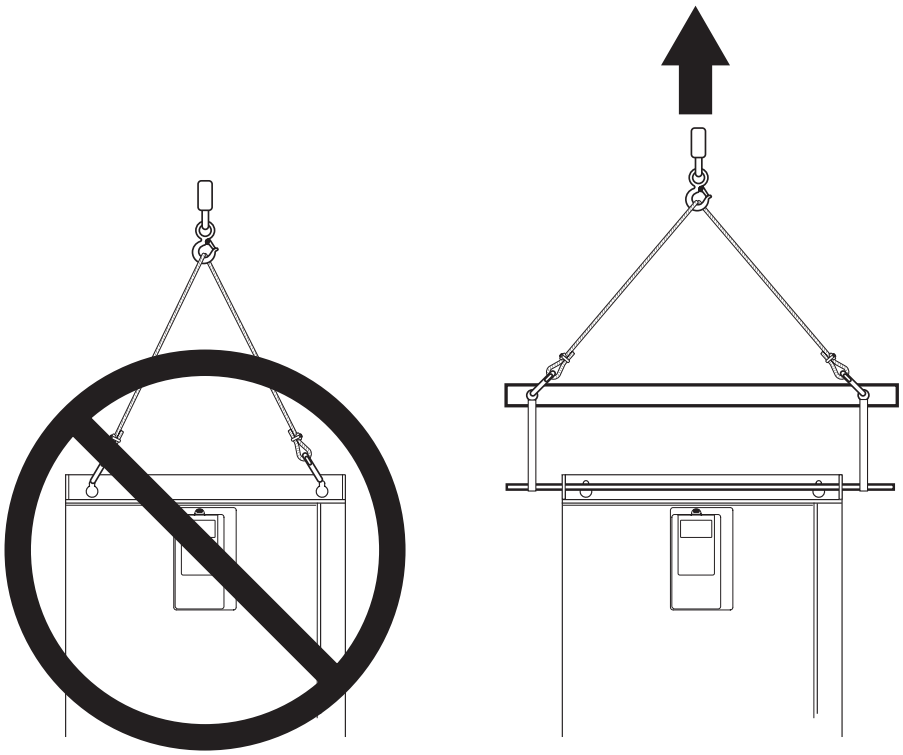
Important: When lifting a frame 9 size drive, a rod must be placed between the lifting holes as shown in Figure 1 below.

ATTENTION: To guard against possible personal injury and/or equipment damage...

- Remove any wiring access covers at the top of the drive.
- Do Not allow any part of the drive or lifting mechanism to make contact with electrically charged conductors or components.
- At no time should a person or their limbs be directly underneath the items being lifted.
- Do not subject the load to high rates of acceleration or deceleration.
- Inspect all lifting hardware for proper attachment before lifting drive unit.

Figure 1 Frame 9 Lifting

Voltage Class	Drive Rating Amps	AC Input Drive & Enclosure Weight kg (lbs.)	AC Input Drive & Packaging Weight kg (lbs.)	DC Input Drive & Enclosure Weight kg (lbs.)	DC Input Drive & Packaging Weight kg (lbs.)
400V	261	143 (315)	143 (315)	109 (240)	109 (240)
400V	300	151 (333)	151 (333)	117 (258)	117 (258)
600V	170	143 (315)	143 (315)	109 (240)	109 (240)
600V	208	143 (315)	143 (315)	109 (240)	109 (240)



Frame 10 Size Drives

When lifting frame size 10 drives you must:

- attach the lifting hardware.
- remove the skid and shipping feet.

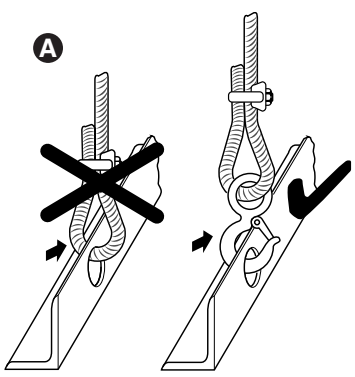
ATTENTION: To guard against possible personal injury and/or equipment damage...

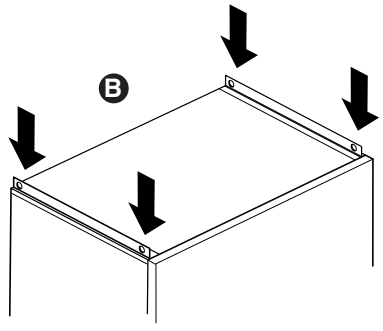
- Do Not allow any part of the drive or lifting mechanism to make contact with electrically charged conductors or components.
- At no time should a person or their limbs be directly underneath the items being lifted.
- Do not subject the load to high rates of acceleration or deceleration.
- Inspect all lifting hardware for proper attachment before lifting drive unit.

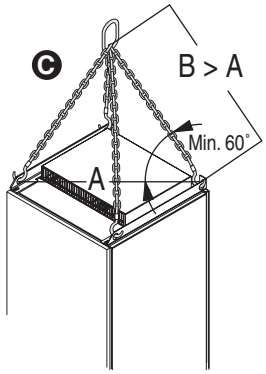
Frame 10 Approximate Weights - Enclosed Drives

Voltage Class	Drive Rating Amps	AC Input Drive & Enclosure Weight kg (lbs.)	AC Input Drive & Packaging Weight kg (lbs.)	DC Input Drive & Enclosure Weight kg (lbs.)	DC Input Drive & Packaging Weight kg (lbs.)
400	385	382 (842)	432 (952)	267 (589)	317 (699)
	460	382 (842)	432 (952)	267 (589)	317 (699)
	520	382 (842)	432 (952)	267 (589)	317 (699)
600	261	320 (705)	370 (816)	267 (589)	317 (699)
	325	351 (774)	401 (884)	267 (589)	317 (699)
	385	351 (774)	401 (884)	267 (589)	317 (699)
	416	351 (774)	401 (884)	267 (589)	317 (699)

Attaching Lifting Hardware to Frames 10 Size Drives







TIP: To ensure that this angle is greater than 60°, make the length of chain or cable between the center and the corners (B) longer than the distance between the opposite corners (A).

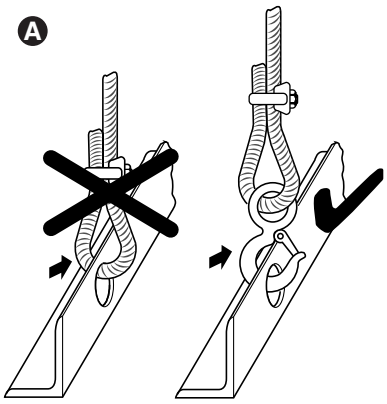
Open Type Drives - Approximate Weights

Drive Voltage Class	Drive Rating Amps	Power Structure Weight kg (lbs.)	AC Choke Weight kg (lbs.)	AC Input Drive & Packaging Weight kg (lbs.)(1)
400	385	120 (265)	115 (254)	235 (519)
	460	120 (265)	115 (254)	235 (519)
	520	120 (265)	115 (254)	235 (519)
600	261	120 (265)	53 (117)	173 (382)
	325	120 (265)	84 (185)	204 (450)
	385	120 (265)	84 (185)	204 (450)
	416	120 (265)	84 (185)	204 (450)

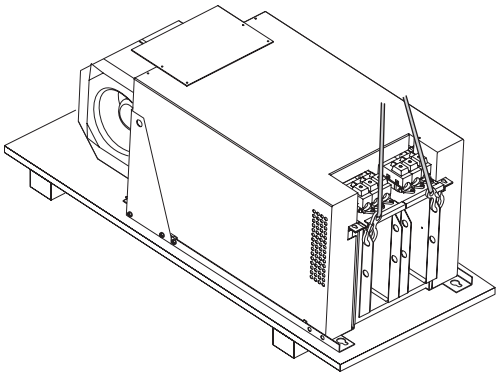
(1) DC input drive and packaging weight is equal to the weight of the power structure

Directions for Open Type Drives

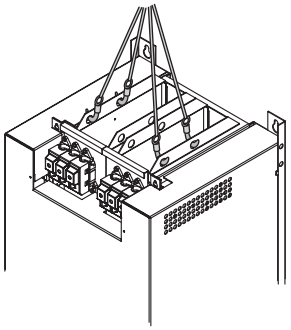
A

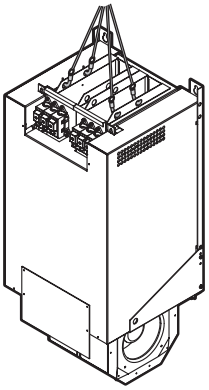


B



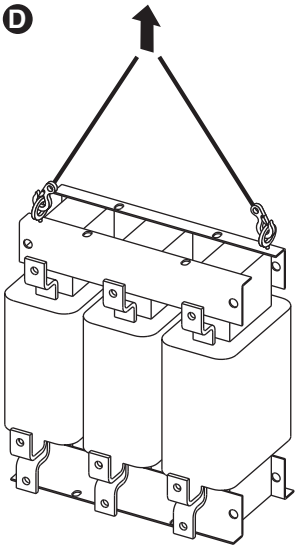
C





Fasten the module symmetrically in at least two (2) holes.

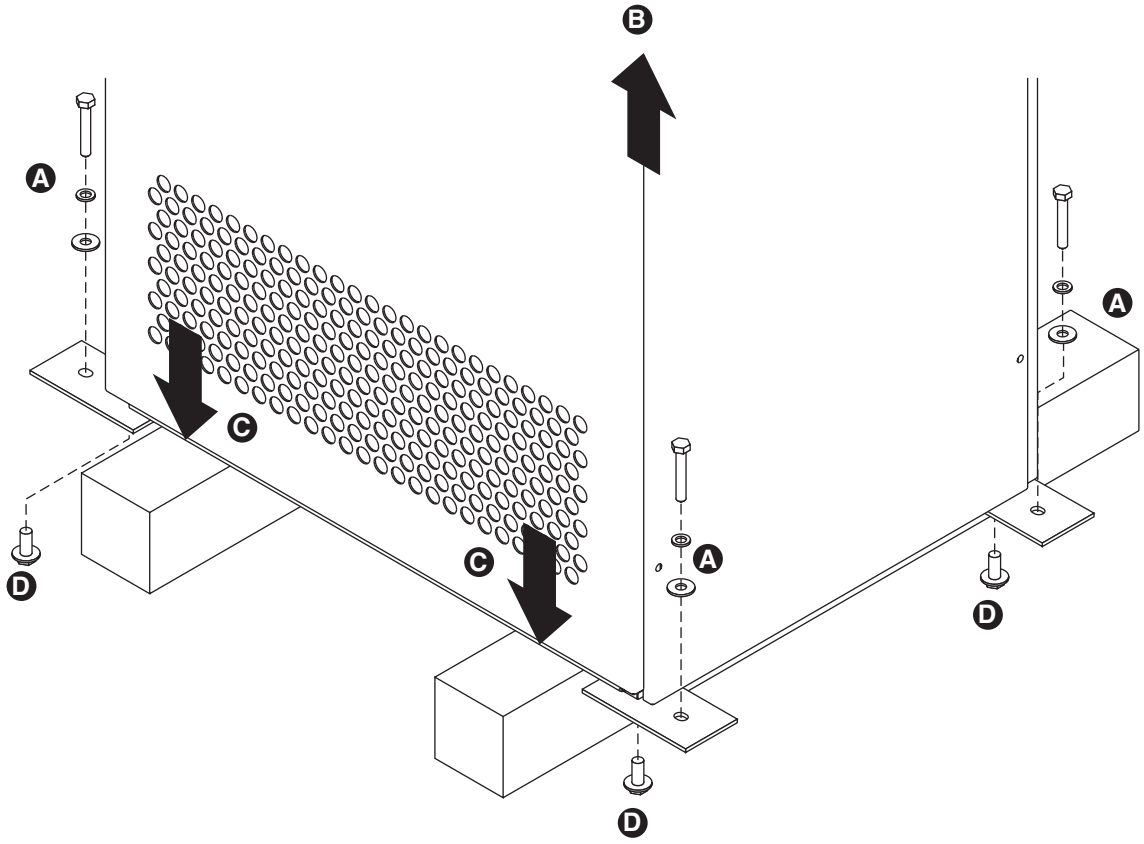
D



Removing the Skid and Shipping Feet

ATTENTION: To guard against personal injury and equipment damage, do not work under the drive unless the drive is securely mounted on appropriate blocks.

Task	Description
A	Using a 15 mm wrench, remove the hardware which secures the drive to the skid.
B	Lift the drive off the skid.
C	Place the drive on proper blocks on a hard, level surface. The blocks should be approximately 10 cm (4 inches) high.
D	Using a 17 mm wrench, remove the hardware which secures the feet to the drive and remove the feet.



Step 4: Mounting the Drive

Operating Temperatures

Frame Size	Required Airflow m^3/h (cfm)	Voltage Class	Amp Rating	Surrounding Air Temperature	
				Normal Duty	Heavy Duty
9	1300 (765)	400	261, 300	0 to 40 degrees C (32 to 104 degrees F)	0 to 40 degrees C (32 to 104 degrees F)
		600	170	0 to 40 degrees C (32 to 104 degrees F)	0 to 40 degrees C (32 to 104 degrees F)
			208	0 to 35 degrees C (32 to 95 degrees F)	0 to 40 degrees C (32 to 104 degrees F)
10	2600 (1530)	400	385, 460, 500	0 to 40 degrees C (32 to 104 degrees F)	0 to 40 degrees C (32 to 104 degrees F)
		600	261, 325, 385	0 to 40 degrees C (32 to 104 degrees F)	0 to 40 degrees C (32 to 104 degrees F)
		600	416	0 to 35 degrees C (32 to 95 degrees F)	0 to 40 degrees C (32 to 104 degrees F)

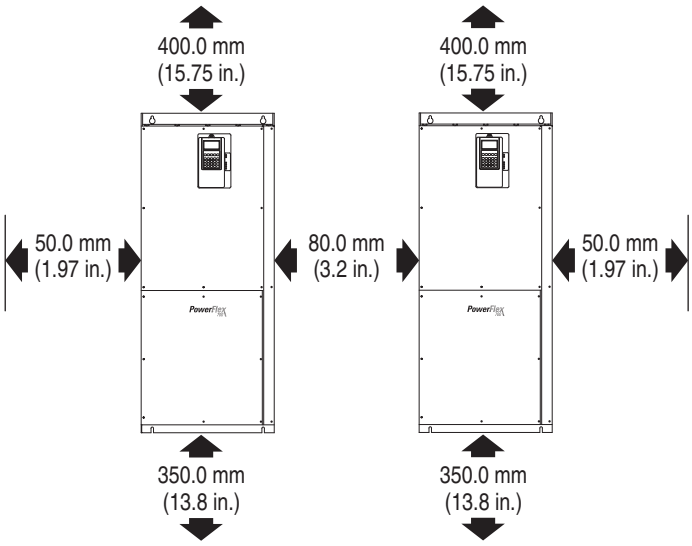
- For minimum mounting clearances and dimensions for frame 9 size drives, see "Frame 9 Size Drives Mounting Clearances" below.
- For minimum mounting clearances and dimensions for frame 10 size drives, see Frame 10 Size Drives Mounting Clearances on page 14.

Also:

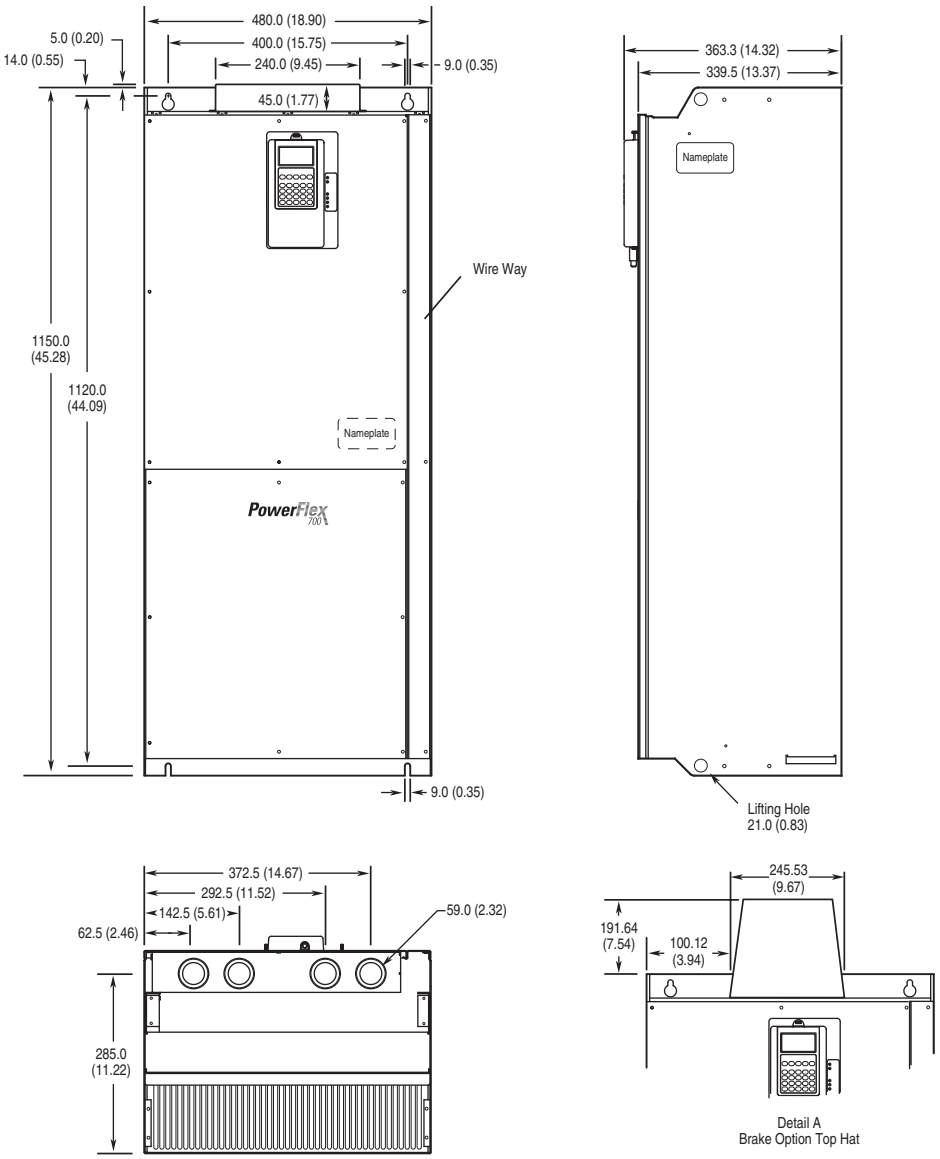
- For floor and wall mounting of frame 10 size drives, see Floor and Wall Mounting for Frame 10 Size Drives on page 16.

Minimum Mounting Clearances and Dimensions

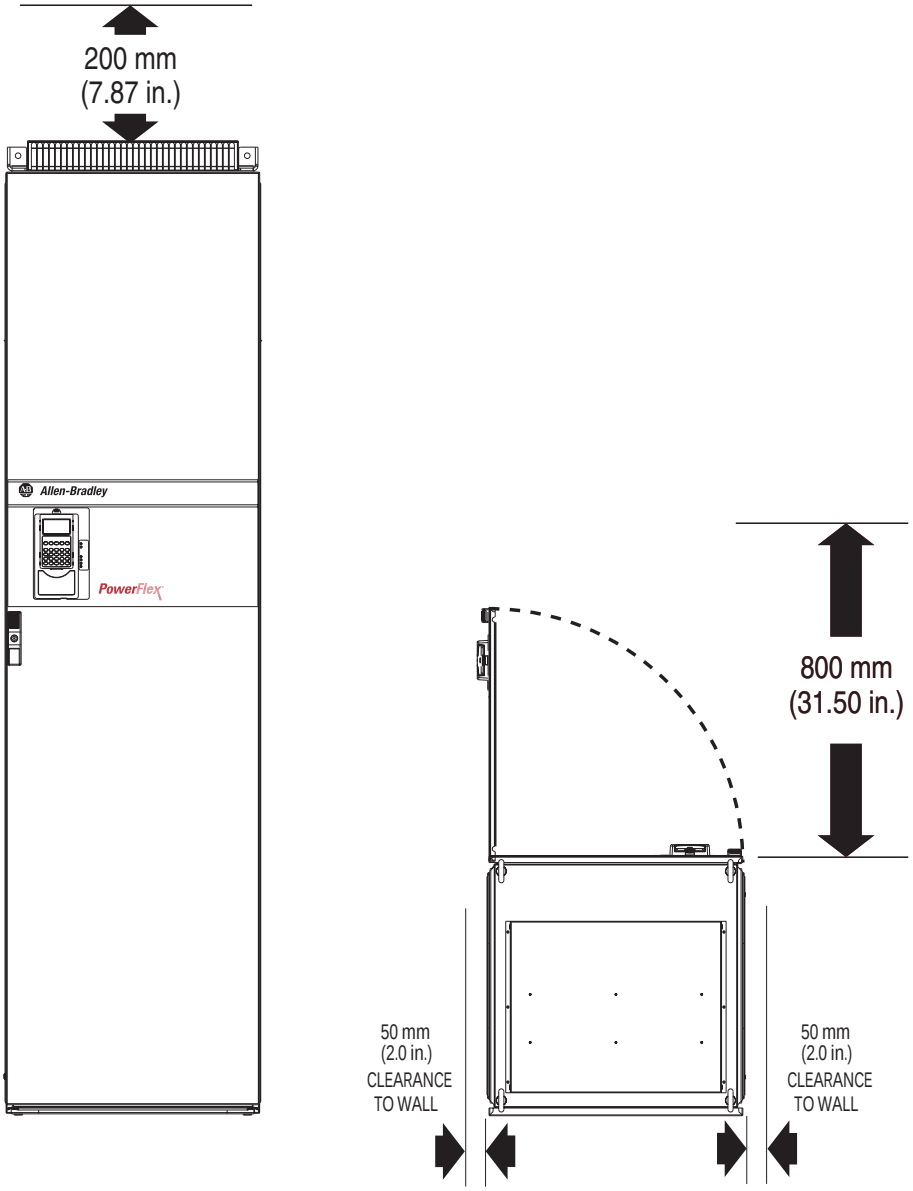
Frame 9 Size Drives Mounting Clearances



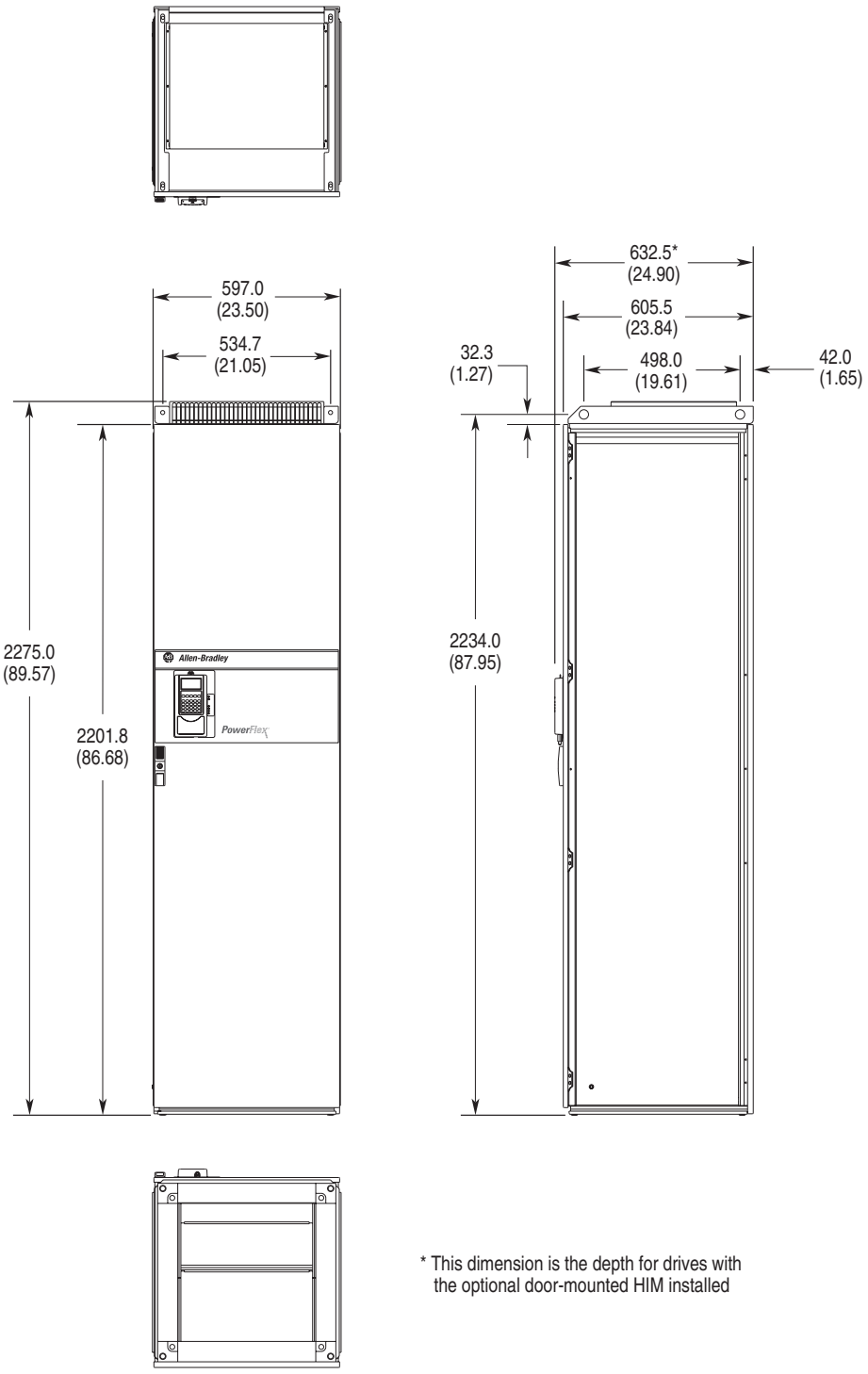
Frame 9 Dimensions



Frame 10 Size Drives Mounting Clearances



Frame 10 Dimensions

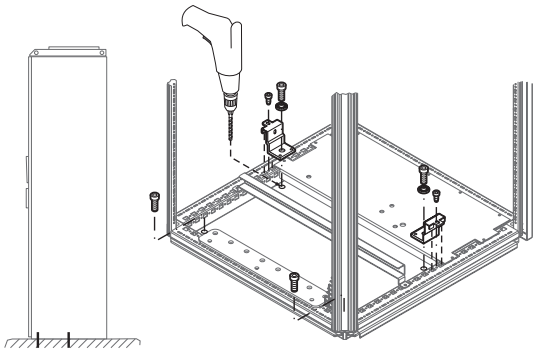


* This dimension is the depth for drives with the optional door-mounted HIM installed

Floor and Wall Mounting for Frame 10 Size Drives

Floor Only Mounting

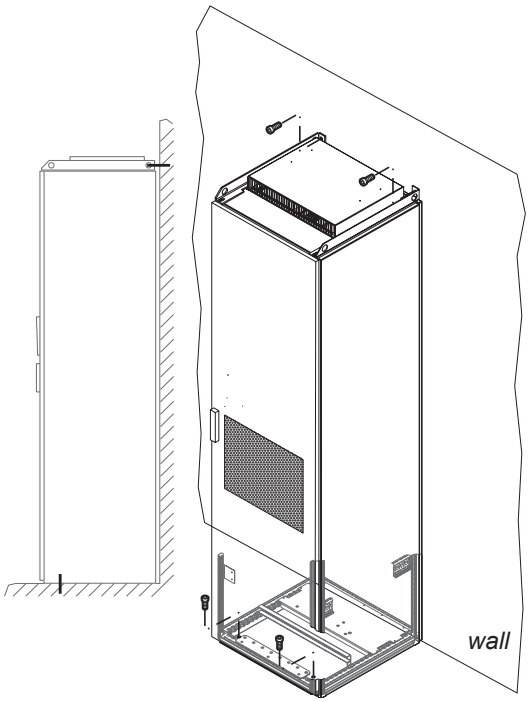
Secure drive to the floor with anchor bolts in the front corner holes of the enclosure base plate. Additionally secure the drive using the mounting plates as needed (Rittal part no. 8800-210 or equivalent). Do this as close to the choke assembly plate as possible. With this method the holes through base plate must be drilled on-site.



Important: If it is important to align the drive cabinet vertically with adjacent Rittal cabinets, you may need to place shims under the drive cabinet or use leveling feet throughout the cabinet line-up. The Allen-Bradley factory may have removed the standard plastic plugs from the bottom of the cabinet when installing the shipping feet. This reduces the height of the cabinet by 2 mm.

Wall Mounting

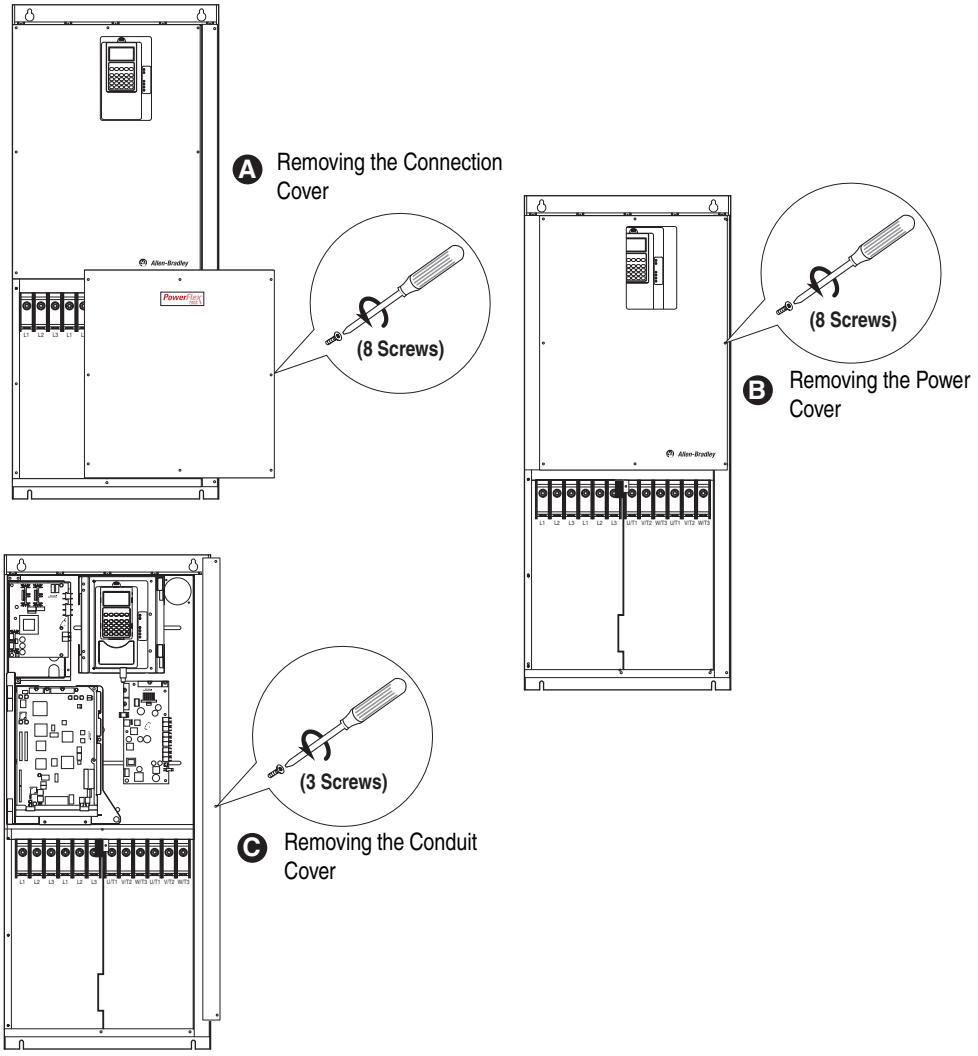
Secure drive to the floor with anchor bolts in the front corner holes of the enclosure base plate. Secure the drive by bolting the adjustable lifting rails to the rear wall or supporting structure.



Step 5: Removing Protective Covers

- For removing the protective covers from frame 9 size drives, see "Removing Covers from Frame 9 Size Drives" below.
- For removing the protective covers from frame 10 size drives, see Removing the Covers from Frame 10 Size Drives on page 18.

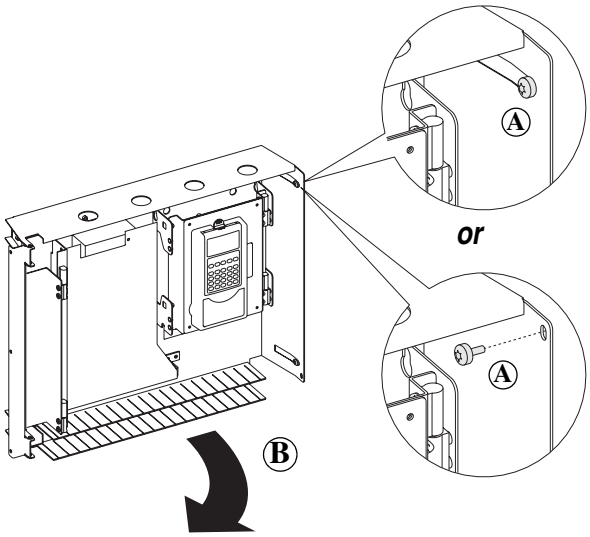
Removing the Covers from Frame 9 Size Drives



Removing the Covers from Frame 10 Size Drives

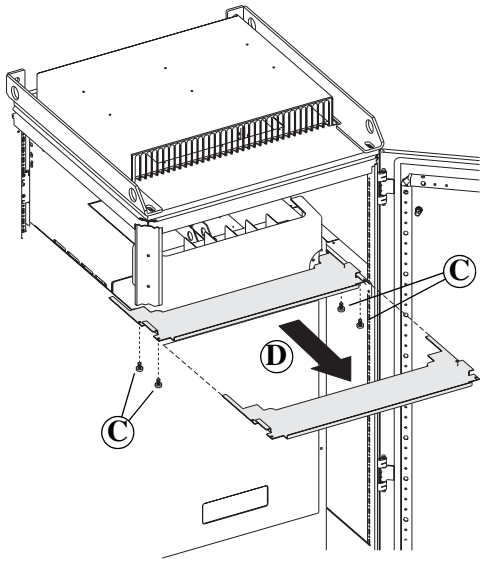
Moving Control Frame

Task	Description
Ⓐ	Loosen the two T8 Torx-head screws, which secure the Control Frame to the drive enclosure (Frame 10 drives, from early production runs, have holes instead of slots for these screws. You must completely remove the screws from these drives in order to swing-open the control frame.).
Ⓑ	Swing the Control Frame out and away from the power structure.



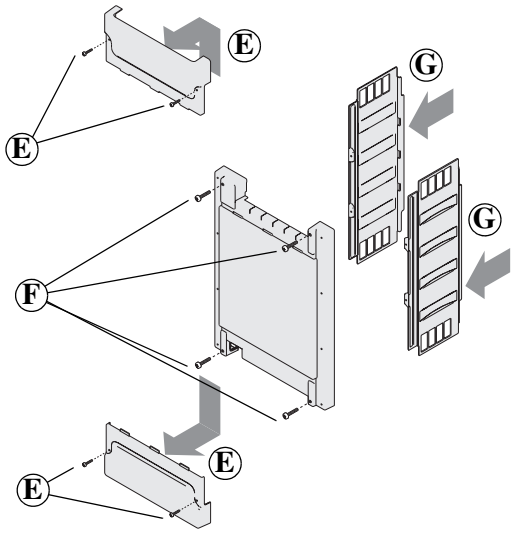
Removing the Airflow Plate

Task	Description
Ⓒ	Remove the four T8 Torx-head screws which secure the airflow plate to the drive.
Ⓓ	Slide airflow plate off of the drive.



Removing Protective Covers

Task	Description
Ⓔ	Remove the four M5 POZIDRIV screws which secure the top and bottom protective covers to the main front protective cover, then remove the top and bottom protective covers. **Note:** You only need to remove the top and bottom covers to gain access to the power terminals. You can remove the other covers without removing the top and bottom covers.
Ⓕ	Remove the four M5 POZIDRIV screws which secure the main front protective cover to the drive, then remove the protective cover.
Ⓖ	Remove side protective covers.



Step 6: Configuring Drive for Ground System

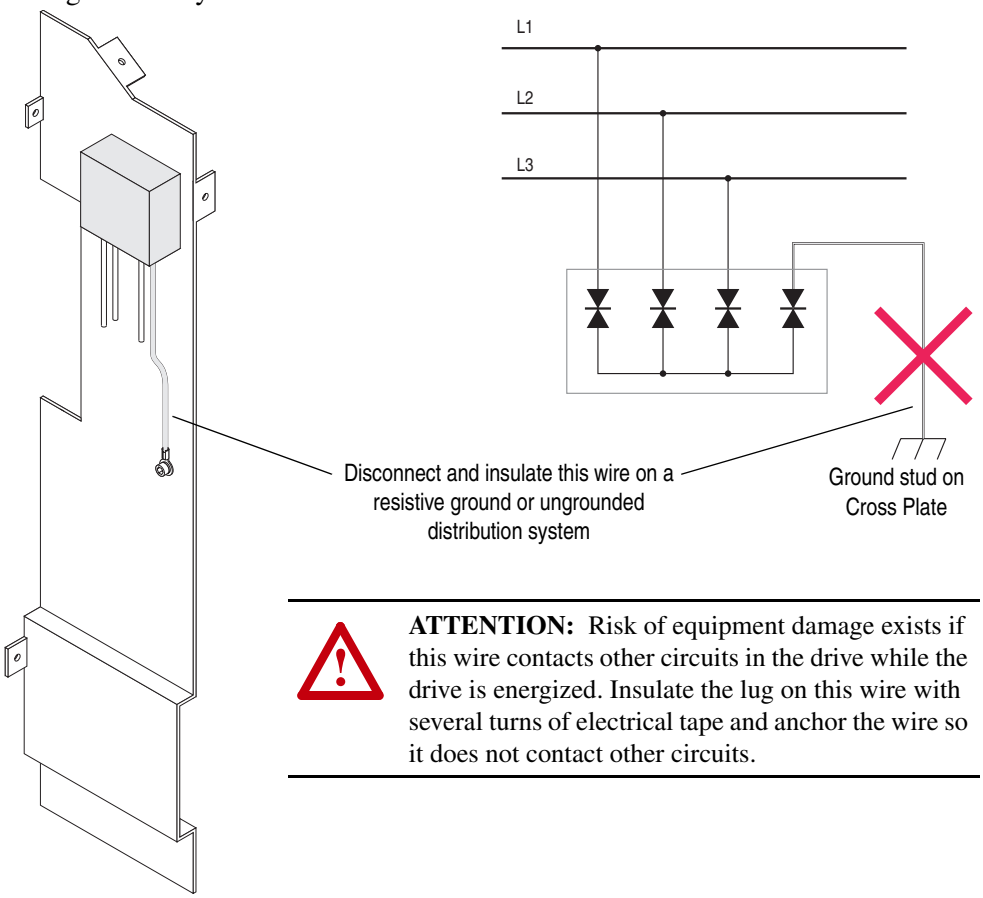
- For configuring frame 9 size drives for a grounding system, see "Frame 9 Size Drives" below.
- For configuring frame 10 size drives for a grounding system, see Frame 10 Size Drives on page 20.

Frame 9 Size Drives

CE frame 9 size drives are equipped with common mode capacitors that are referenced to ground. Operating a CE frame 9 drive on a resistive ground or ungrounded distribution system could result in drive damage.

ATTENTION: If you intend to operate a Frame 9 drive on a resistive ground or ungrounded distribution system, you must order a non-CE PowerFlex High Power drive.

All frame 9 drives (CE and non-CE) are equipped with a Metal Oxide Varistor (MOV) assembly to provide voltage surge protection. The MOV is designed for transient surge suppression only (not continuous operation). With a resistive ground or ungrounded distribution system the phase-to-ground MOV connection could become a continuous current path. Therefore, you should disconnect the MOV ground connection when installing a Frame 9 drive on a resistive ground or ungrounded distribution system. Refer to publication PFLEX-RM001, *PowerFlex® 700S with Phase I Control Reference Manual*, for information on a resistive ground or ungrounded system installation.



ATTENTION: Risk of equipment damage exists if this wire contacts other circuits in the drive while the drive is energized. Insulate the lug on this wire with several turns of electrical tape and anchor the wire so it does not contact other circuits.

Frame 10 Size Drives

Frame 10 size drives are equipped with common mode capacitors that are referenced to ground. To guard against drive damage, these capacitors should be disconnected if the drive is installed on a resistive ground or ungrounded distribution system or on a voltage distribution system greater than 400V AC. For installations on a resistive ground or ungrounded distribution system, refer to "Installation on an Ungrounded Distribution System" below. For installations on a grounded B phase delta system on a voltage distribution system greater than 400V AC, refer to Installation on a Grounded B Phase Delta System on a Voltage Distribution System Greater than 400V AC on page 21.

Note: Refer to publication PFLEX-RM002, *Reference Manual - PowerFlex® 700S with Phase I Control*, for information on a resistive ground or ungrounded distribution system installation.

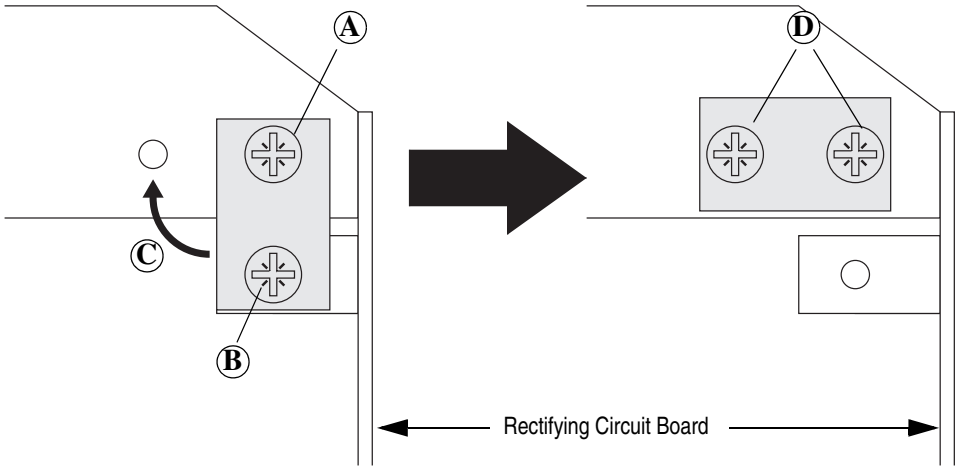
There is one jumper located on the upper-right side of the Rectifying Module.

Installation on a Resistive Ground or Ungrounded Distribution System

1. To disconnect the capacitors, move the jumper shown below.

Task	Description
Ⓐ	Loosen upper screw
Ⓑ	Remove lower screw
Ⓒ	Move jumper to horizontal position
Ⓓ	Install and tighten screws

Continue with step 2 on page 22.

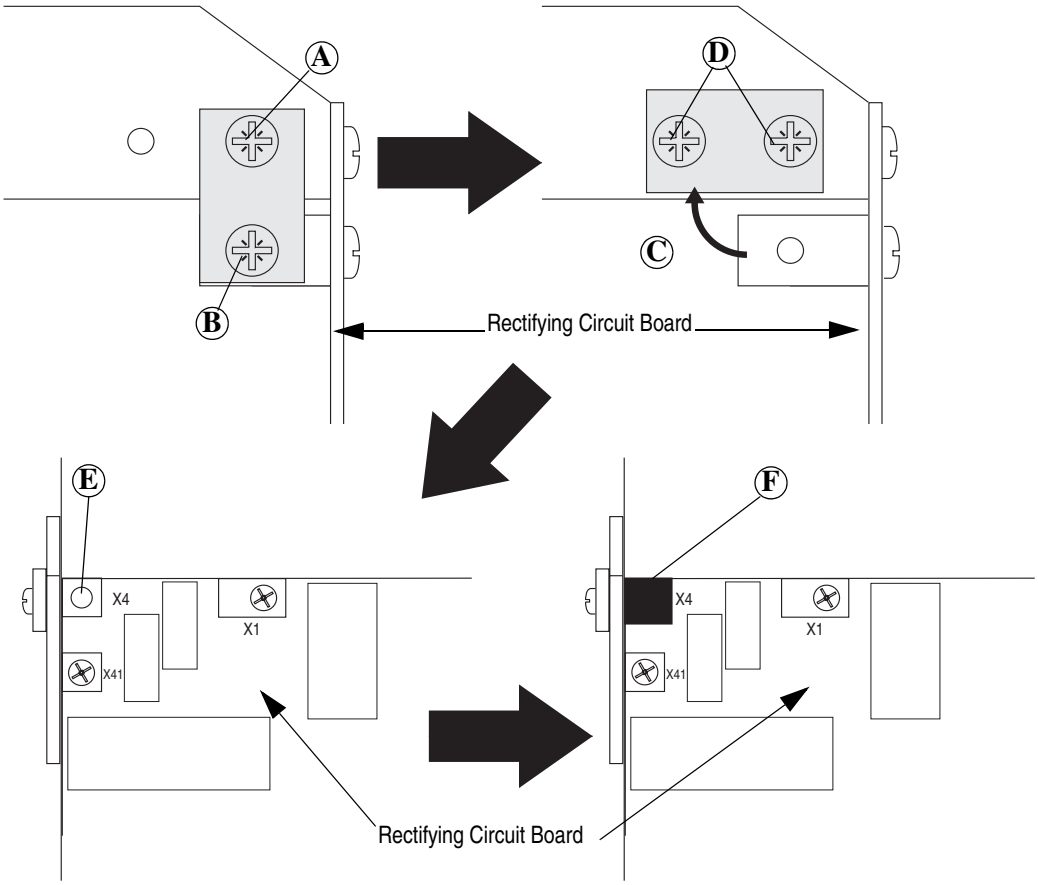


Installation on a Grounded B Phase Delta System on a Voltage Distribution System Greater than 400V AC

1. To use a grounded B phase delta system on a drive with a voltage distribution system greater than 400V AC, follow the steps below.

Task	Description
Ⓐ	Loosen upper screw on common mode capacitor jumper
Ⓑ	Remove lower screw
Ⓒ	Move jumper to horizontal position
Ⓓ	Install and tighten screws
Ⓔ	Remove screw from X4 connection on rectifying board
Ⓕ	Insulate top and bottom of X4 connection

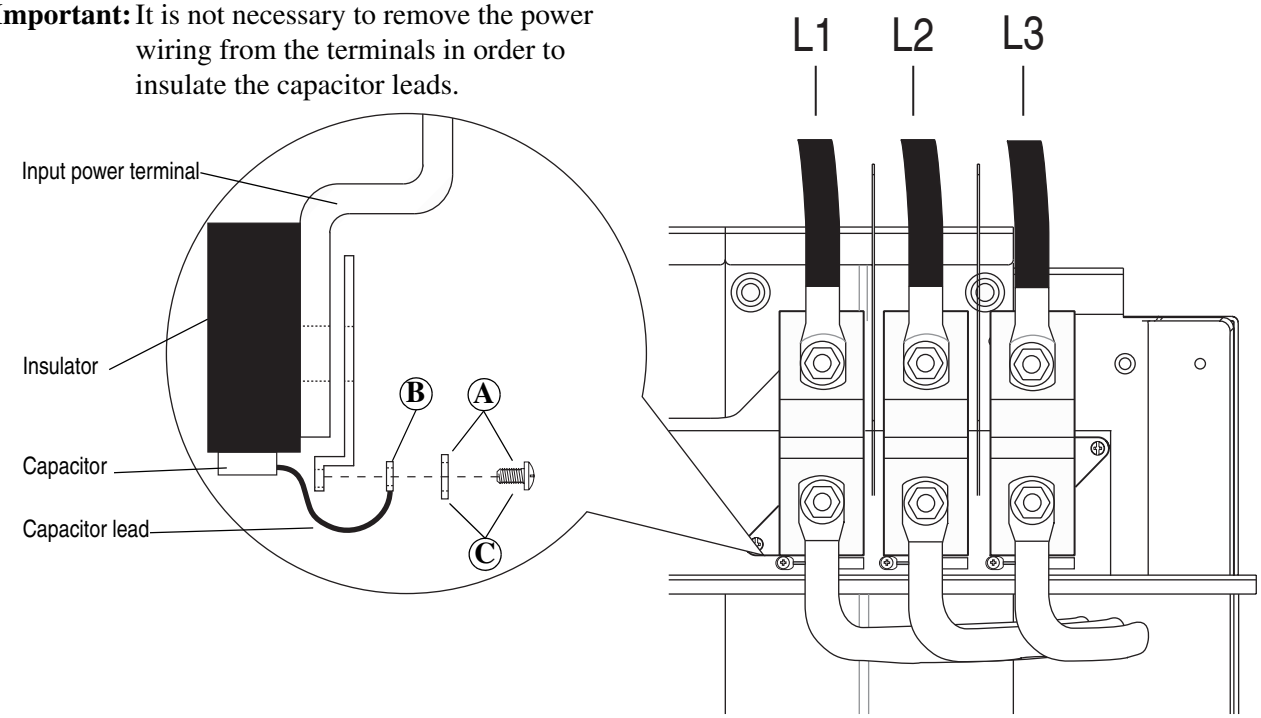
Continue with step 2 on page 22.



2. Insulate the capacitors from the drive input power terminals.

Task	Description
Ⓐ	Remove the screws and lock washers that secure each of the three capacitor supply wires to the input power terminals.
Ⓑ	Insulate the capacitor leads.
Ⓒ	Install and tighten screws and lock washers only.

Important: It is not necessary to remove the power wiring from the terminals in order to insulate the capacitor leads.



Step 7: Power Wiring

Wire Recommendations

ATTENTION: National Codes and standards (NEC, VDE, BSI etc.) and local codes outline provisions for safely installing electrical equipment. Installation must comply with specifications regarding wire types, conductor sizes, branch circuit protection and disconnect devices. Failure to do so may result in personal injury and/or equipment damage.

Cable Types Acceptable for 200-600 Volt Installations

A variety of cable types are acceptable for drive installations. For many installations, unshielded cable is adequate, provided it can be separated from sensitive circuits. As an approximate guide, allow a spacing of 0.3 meters (1 foot) for every 10 meters (32.8 feet) of length. In all cases, long parallel runs must be avoided. Do not use cable with an insulation thickness less than or equal to 15 mils (0.4 mm/0.015 in.). Use Copper wire only. Wire gauge requirements and recommendations are based on 75 degrees C. Do not reduce wire gauge when using higher temperature wire.

Unshielded Cable

THHN, THWN or similar wire is acceptable for drive installation in dry environments provided adequate free air space and/or conduit fill rates limits are provided. **Do not use THHN or similarly coated wire in wet areas**. Any wire chosen must have a minimum insulation thickness of 15 Mils and should not have large variations in insulation concentricity.

Shielded Cable

Shielded cable contains all of the general benefits of multi-conductor cable with the added benefit of a copper braided shield that can contain much of the noise generated by a typical AC Drive. Strong consideration for shielded cable should be given in installations with sensitive equipment such as weigh scales, capacitive proximity switches and other devices that may be affected by electrical noise in the distribution system. Applications with large numbers of drives in a similar location, imposed EMC regulations or a high degree of communications/ networking are also good candidates for shielded cable.

Shielded cable may also help reduce shaft voltage and induced bearing currents for some applications. In addition, the increased impedance of shielded cable may help extend the distance that the motor can be located from the drive without the addition of motor protective devices such as terminator networks. Refer to Chapter 5, “Reflected Wave” in *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives*, publication DRIVES-IN001.

Consideration should be given to all of the general specifications dictated by the environment of the installation, including temperature, flexibility, moisture characteristics and chemical resistance. In addition, a braided shield should be included and be specified by the cable manufacturer as having coverage of at least 75%. An additional foil shield can greatly improve noise containment.

A good example of recommended cable is Belden® 295xx (xx determines gauge). This cable has four (4) XLPE insulated conductors with a 100% coverage foil and an 85% coverage copper braided shield (with drain wire) surrounded by a PVC jacket.

Other types of shielded cable are available, but the selection of these types may limit the allowable cable length. Particularly, some of the newer cables twist 4 conductors of THHN wire and wrap them tightly with a foil shield. This construction can greatly increase the cable charging current required and reduce the overall drive performance. Unless specified in the individual distance tables as tested with the drive, these cables are not recommended and their performance against the lead length limits supplied is not known.

Armored Cable

Cable with continuous aluminum armor is often recommended in drive system applications or specific industries. It offers most of the advantages of standard shielded cable and also combines considerable mechanical strength and resistance to moisture. It can be installed in concealed and exposed manners and removes the requirement for conduit (EMT) in the installation. It can also be directly buried or embedded in concrete.

Because noise containment can be affected by incidental grounding of the armor to building steel (see Chapter 2. “Wire Types,” of publication DRIVES-IN001, *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives*) when the cable is mounted, it is recommended the armored cable have an overall PVC jacket.

Interlocked armor is acceptable for shorter cable runs, but continuous welded armor is preferred.

Best performance is achieved with 3 spaced ground conductors, but acceptable performance below 200 HP is provided via a single ground conductor. See Table B.

Table B Recommended Shielded / Armored Cable

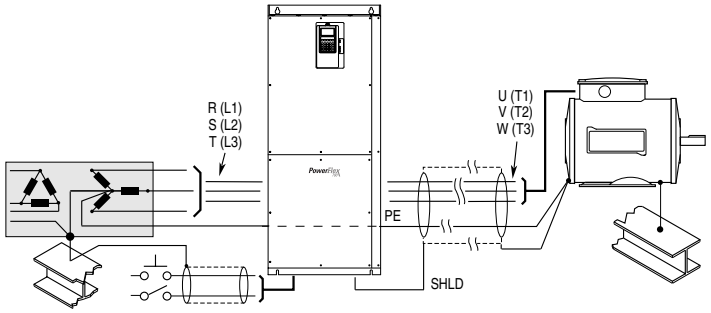
Location	Rating/Type	Description
Standard (Option 1)	600V, 90°C (194°F) XHHW2/RHW-2 Anixter B209500-B209507, Belden 29501-29507, or equivalent	• Four tinned copper conductors with XLPE insulation. • Copper braid/aluminum foil combination shield and tinned copper drain wire. • PVC jacket.
Standard (Option 2)	Tray rated 600V, 90° C (194° F) RHH/RHW-2 Anixter OLF-7xxxxx or equivalent	• Three tinned copper conductors with XLPE insulation. • 5 mil single helical copper tape (25% overlap min.) with three bare copper grounds in contact with shield. • PVC jacket.
Class I & II; Division I & II	Tray rated 600V, 90° C (194° F) RHH/RHW-2 Anixter 7V-7xxxx-3G or equivalent	• Three bare copper conductors with XLPE insulation and impervious corrugated continuously welded aluminum armor. • Black sunlight resistant PVC jacket overall. • Three copper grounds on #10 AWG and smaller.

General Grounding Requirements

The drive Safety Ground - PE must be connected to system ground. Ground impedance must conform to the requirements of national and local industrial safety regulations and/or electrical codes. The integrity of all ground connections should be periodically checked.

For installations within a cabinet, a single safety ground point or ground bus bar connected directly to building steel should be used. All circuits including the AC input ground conductor should be grounded independently and directly to this point/bar.

Table C Typical Grounding



Safety Ground - PE

This is the safety ground for the drive that is required by code. This point must be connected to adjacent building steel (girder, joist), a floor ground rod or bus bar (see above). Grounding points must comply with national and local industrial safety regulations and/or electrical codes.

Shield Termination - SHLD

The Shield terminal provides a grounding point for the motor cable shield. It must be connected to an earth ground by a separate continuous lead. The **motor cable** shield should be connected to this terminal on the drive (drive end) and the motor frame (motor end). A shield terminating cable gland may also be used.

When shielded cable is used for **control and signal wiring**, the shield should be grounded at the source end only, not at the drive end.

RFI Filter Grounding

Using an optional RFI filter may result in relatively high ground leakage currents. Therefore, the **filter must only be used in installations with grounded AC supply systems and be permanently installed and solidly grounded** (bonded) to the building power distribution ground. Ensure that the incoming supply neutral is solidly connected (bonded) to the same building power distribution ground. Grounding must not rely on flexible cables and should not include any form of plug or socket that would permit inadvertent disconnection. Some local codes may require redundant ground connections. The integrity of all connections should be periodically checked. Refer to the instructions supplied with the filter.

DC Input Precharge Control Wiring

If you are installing a DC input drive with a precharge interlock you must make the following connections on the X50 terminal block from the precharge circuit.

Important: Precharge circuitry is external to the drive.

Figure 2 Sample Precharge Wiring Diagram (Frame 9 Shown)

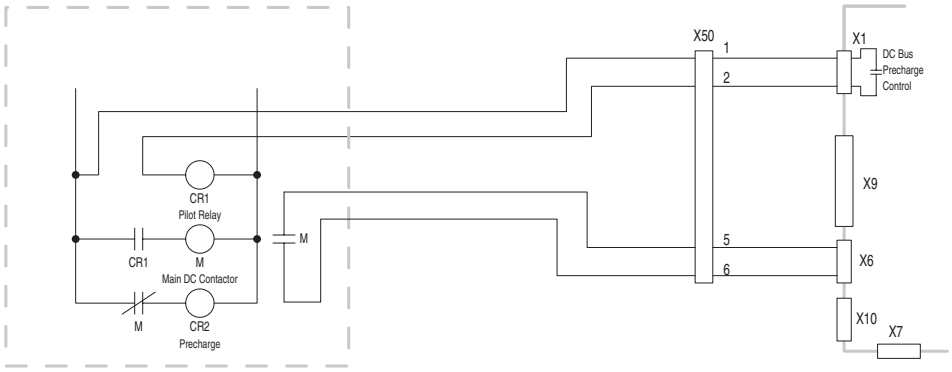
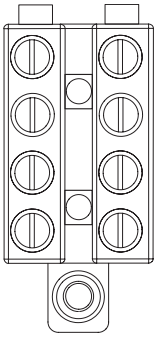


Table D X50 Terminal Block Connections



Frame	X50 Terminal	Description
9	1	Charge Relay Contact
	2	Charge Relay Contact
	3	Precharge Complete Signal (+24V DC)
	4	Precharge Complete Signal (Common)
10	21	Charge Relay Contact
	23	Charge Relay Contact
	25	Precharge Complete Signal (+24V DC)
	26	Precharge Complete Signal (Common)

Figure 3 Frame 9 - X50 Terminal Block Location

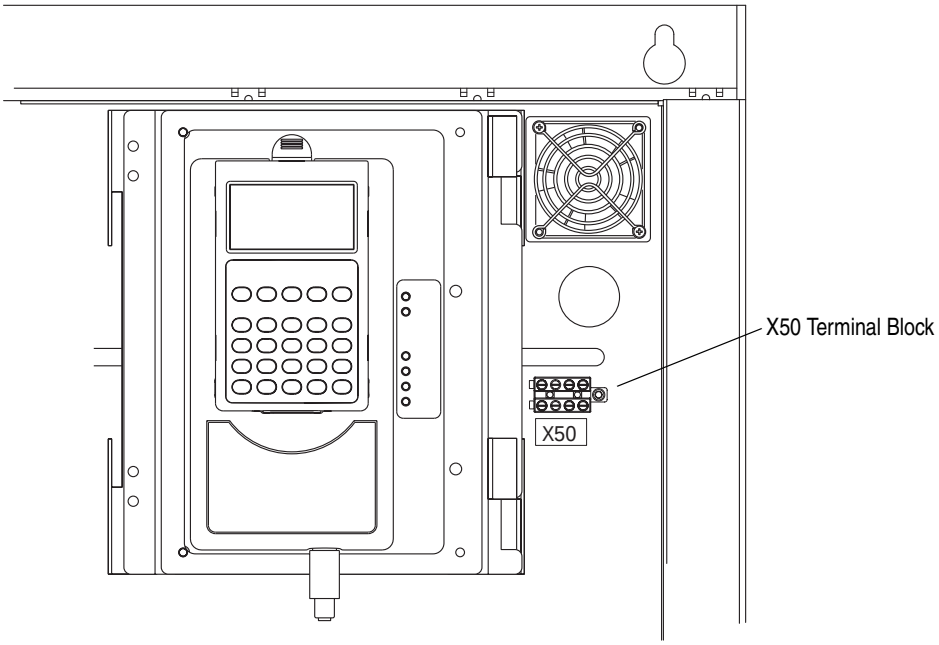
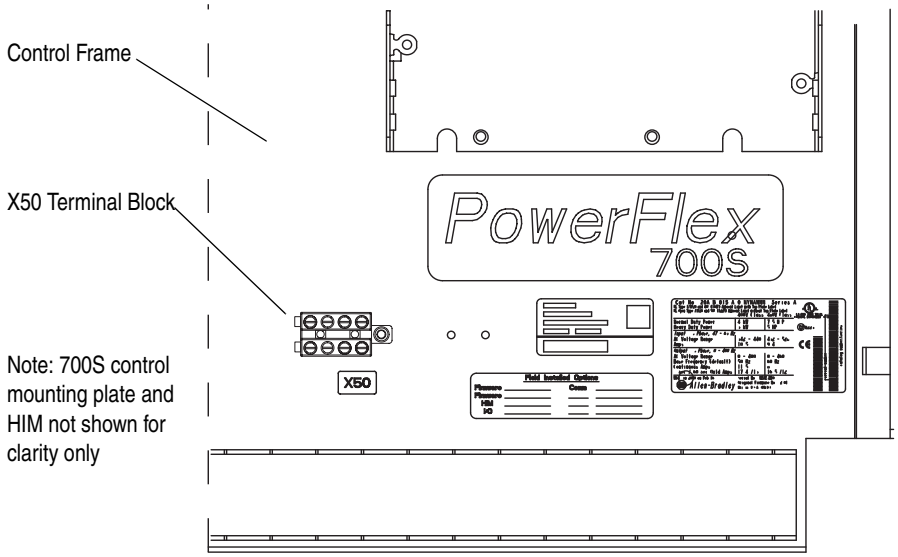


Figure 4 Frame 10 - X50 Terminal Block Location



Power Wiring Instructions

- For power wiring instructions for frame 9 size drives, see "Frame 9 Size Drives Power Terminal Specifications" below.
- For power wiring instructions for frame 10 size drives, see Frame 10 Size Drives Power Terminal Specifications on page 29.

Frame 9 Size Drives Power Terminal Specifications

No.	Name	Description	Wire Size Range[1]		Torque
			Maximum	Minimum	Recommended
❶	Input Power Terminal Block[2] L1, L2, L3	Input power	185.0 mm^2 (350 MCM)	95.0 mm^2 (4/0 AWG)	40 N-m (354 lb.-in.)
❷	Output Power Terminal Block[2] U/T1, V/T2, W/T3	Motor connections	185.0 mm^2 (350 MCM)	95.0 mm^2 (4/0 AWG)	40 N-m (354 lb.-in.)
❸	SHLD Terminal, PE, Motor Ground	Terminating point for wiring shields	95.0 mm^2 (4/0 AWG)	5.0 mm2 (10 AWG)	22 N-m (195 lb.-in.)
❹	DC Bus[3] (2 Terminals; DC–, DC+)	DC input or external brake *(Internal Brake option not ordered)*	185.0 mm^2 (350 MCM)	95.0 mm^2 (4/0 AWG)	40 N-m (354 lb.-in.)
	DC Bus w/Brake[3] (3 Terminals; DC–, DC+/R+, R–)	DC input/internal brake *(Internal Brake option is ordered)*	185.0 mm^2 (350 MCM)	95.0 mm^2 (4/0 AWG)	40 N-m (354 lb.-in.)
❺	Cable Clamp for Shield				

(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.
(2) Do Not exceed maximum wire size. Parallel connections may be required.
(3) DC terminal and brake lugs can be removed.

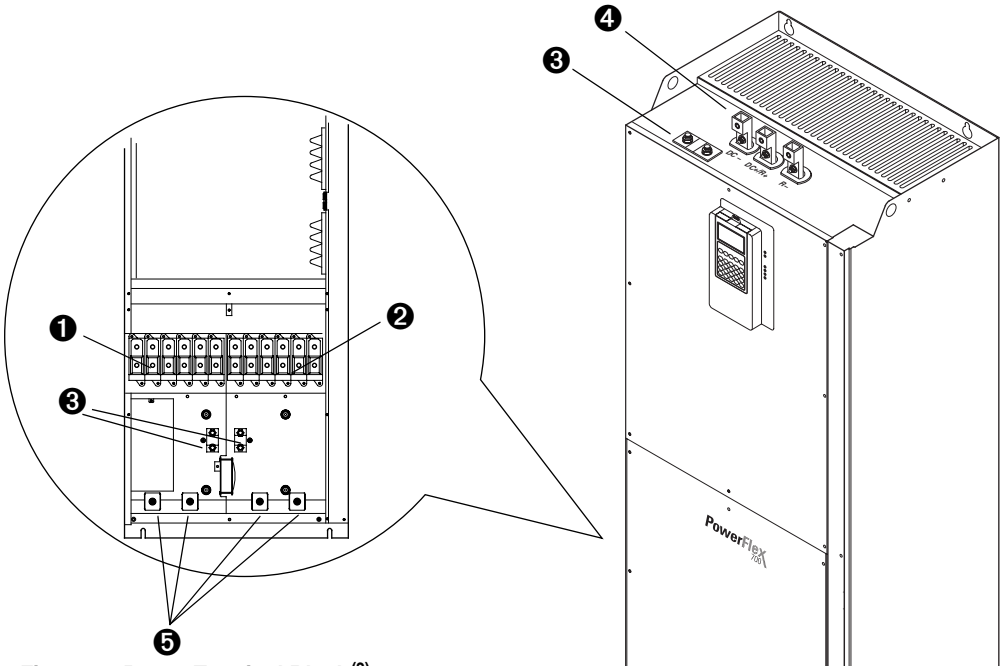
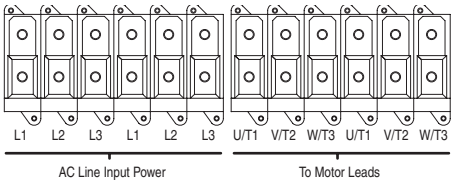


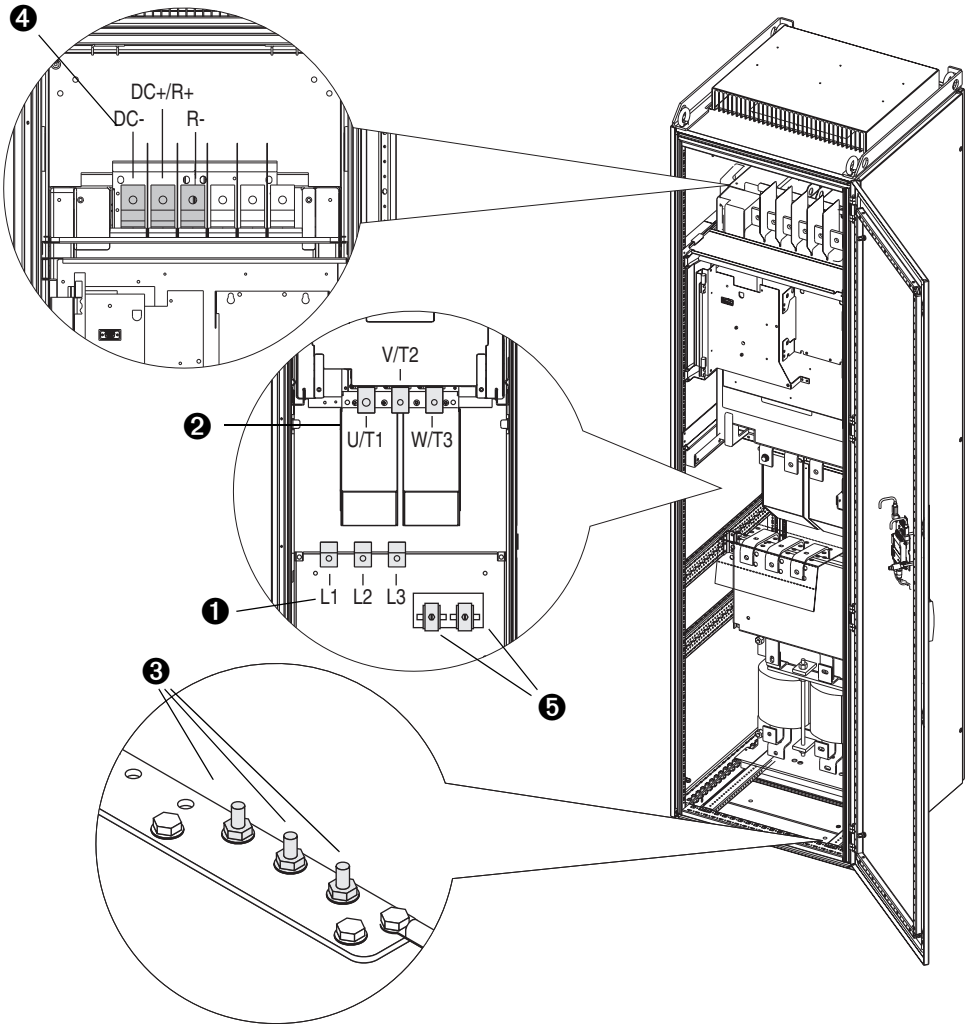
Figure 5 Power Terminal Block[2]



Frame 10 Size Drives Power Terminal Specifications

No.	Name	Description	Wire Size Range[1][2]		Torque	Terminal Bolt Size[3] [4]
			Maximum	Minimum	Recommended	
❶	Input Power Terminal Block L1, L2, L3[3]	Input power	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N-m (354 lb.-in.)	M12
❷	Output Power Terminal Block[(3)] U/T1, V/T2, W/T3	Motor connections	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N-m (354 lb.-in.)	M12
❸	SHLD Terminal, PE, Motor Ground[3]	Terminating point for wiring shields	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N-m (354 lb.-in.)	M10
❹	DC Bus[3] (2 Terminals; DC–, DC+)	DC input or external brake *(Internal Brake option not ordered)*	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N-m (354 lb.-in.)	M12
	DC Bus w/Brake[3] (3 Terminals; DC–, DC+/R+, R–)	DC input/internal brake *(Internal Brake option is ordered)*	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N-m (354 lb.-in.)	M12
❺	Cable Clamp for Shield					

(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.
(2) Do Not exceed maximum wire size. Parallel connections may be required.
(3) These connections are bus bar type terminations and require the use of lug type connectors.
(4) Apply counter torque to the nut on the other side of terminations when tightening or loosening the terminal bolt in order to avoid damage to the terminal.



Step 8: Control Wiring

Wiring Recommendations

Important points to remember about I/O wiring:

- Always use tinned copper wire.
- Wire with an insulation rating of 600V or greater is recommended.
- Control and signal wires should be separated from power wires by at least 0.3 meters (1 foot).
- 4100CCF3 Flex I/O cable for use with DriveLogix is 3 ft. maximum length.

Important: I/O terminals labeled "(–)" or "Common" are not referenced to earth ground and are designed to greatly reduce common mode interference. Grounding these terminals can cause signal noise.

ATTENTION: Hazard of personal injury or equipment damage exists when using bipolar input sources. Noise and drift in sensitive input circuits can cause unpredictable changes in motor speed and direction. Use speed command parameters to help reduce input source sensitivity.

Table E Recommended Control Wire

Type		Wire Type(s)	Description	Insulation Rating
Digital I/O	Un-shielded	Per US NEC or applicable national or local code	–	300V, 60° C (140° F), Minimum
	Shielded	Multi-conductor shielded cable such as Belden 8770 (or equiv.)	0.750 mm^2 (18 AWG), 3 conductor, shielded.	
Standard Analog I/O	Belden 8760/9460 (or equiv.)		0.750 mm^2 (18 AWG), twisted pair, 100% shield with drain (5).	300V, 75-90 °C (167-194 °F)
Remote Pot	Belden 8770 (or equiv.)		0.750 mm^2 (18 AWG), 3 cond., shielded	
Encoder/ Pulse I/O Less 30.5 m (100 ft.)	Combined:	Belden 9730 (or equivalent) (1)	0.196 mm^2 (24 AWG), individually shielded.	
Encoder/ Pulse I/O 30.5 m (100 ft.) to 152.4 m (500 ft.)	Signal:	Belden 9730/9728 (or equivalent) (1)	0.196 mm^2 (24 AWG), individually shielded.	
	Power:	Belden 8790 (2)	0.750 mm^2 (18 AWG)	
	Combined:	Belden 9892 (3)	0.330 mm^2 or 0.500 mm^2 (3)	
Encoder/ Pulse I/O 152.4 m (500 ft.) to 259.1 m (850 ft.)	Signal:	Belden 9730/9728 (or equivalent) (1)	0.196 mm^2 (24 AWG), individually shielded.	
	Power:	Belden 8790 (2)	0.750 mm^2 (18 AWG)	
	Combined:	Belden 9773/9774 (or equivalent) (4)	0.750 mm^2 (18 AWG), individually shielded pair.	
EMC Compliance	Refer to EMC Directive (89/336/EEC) on page -6 for details.			

(1) Belden 9730 is 3 individually shielded pairs (2 channel plus power). If 3 channel is required, use Belden 9728 (or equivalent).

(2) Belden 8790 is 1 shielded pair.

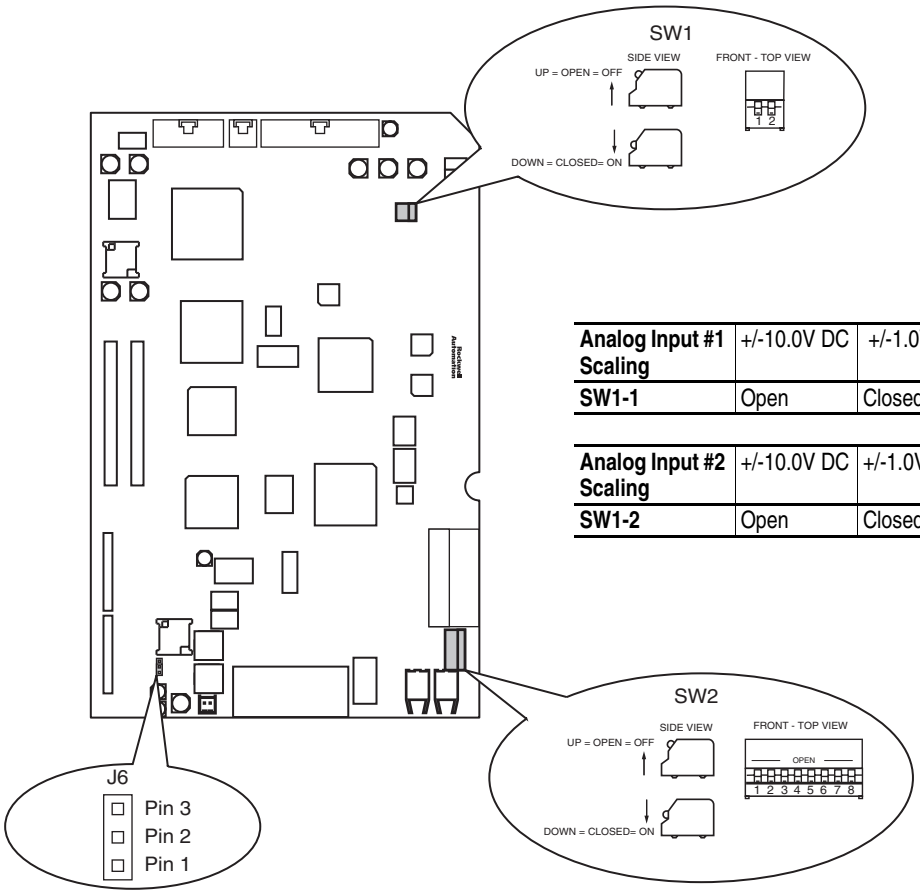
(3) Belden 9892 is 3 individually shielded pairs (3 channel), 0.33 mm^2 (22 AWG) plus 1 shielded pair 0.5 mm^2 (20 AWG) for power.

(4) Belden 9773 is 3 individually shielded pairs (2 channel plus power). If 3 channel is required, use Belden 9774 (or equivalent).

(5) If the wires are short and contained within a cabinet which has no sensitive circuits, the use of shielded wire may not be necessary, but is always recommended.

DIP Switch Settings

Figure 6 Main Control Board Dip Switches



Analog Input #1 Scaling	+/-10.0V DC	+/-1.0V DC
SW1-1	Open	Closed

Analog Input #2 Scaling	+/-10.0V DC	+/-1.0V DC
SW1-2	Open	Closed

Encoder Power Supply Voltage	Jumper Position
5V DC	2-3
12V DC	1-2

Primary Encoder	SW2-2	SW2-4	SW2-6
5V DC Operation	Closed	Closed	Closed
12V DC Operation	Open	Open	Open

Secondary Encoder	SW2-1	SW2-3	SW2-5
5V DC Operation	Closed	Closed	Closed
12V DC Operation	Open	Open	Open

Analog Input Settings

Switch SW1-1 configures the scaling of Analog Input #1. Switch SW1-2 configures the scaling of Analog Input #2. Open the switch for +/-10.0V DC operation. Close the switch for +/-1.0V DC operation.

Encoder Input Settings

Dip switch SW2 on the main control board configures the encoder inputs for 5V DC or 12V DC operation. Switches SW2-2, 4, and 6 are for the primary encoder. Set these switches to match the encoder output specifications. Open these switches for 12V DC operation, close them for 5V DC operation.

Switches SW2-1, 3, and 5 are for the secondary encoder. Set these switches to match the encoder output specifications. Open these switches for 12V DC operation, close them for 5V DC operation.

Encoder Output Settings

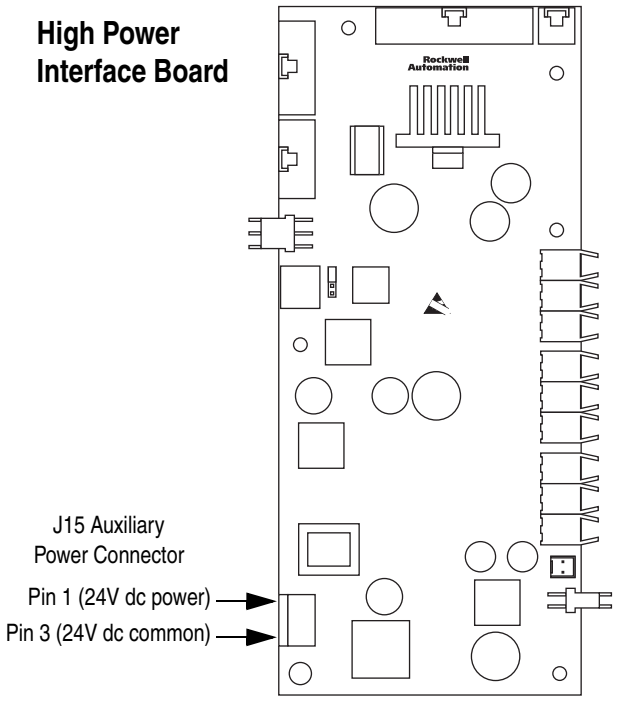
Jumper J6 on the main control board configures the encoder power supply for either 5V dc or 12V dc operation. Place the jumper on pins 1 and 2 for 12V operation. Place it on pins 2 and 3 for 5V dc operation.

Auxiliary Power Supply

You may use an auxiliary power supply to keep the 700S Control Assembly energized, when input power is de-energized. This allows the Main Control Board, DriveLogix controller and any feedback option cards to continue operation. Connect auxiliary power to J15 on the High Power Interface board. You must set parameter 153 [Control Options], bit 17 [Aux Pwr Sply] to enable this feature.

Table F Auxiliary Power Supply Specifications

Voltage	Current (Min)	Power (Min)
24V dc ± 5%	3A	75W



Connecting SynchLink

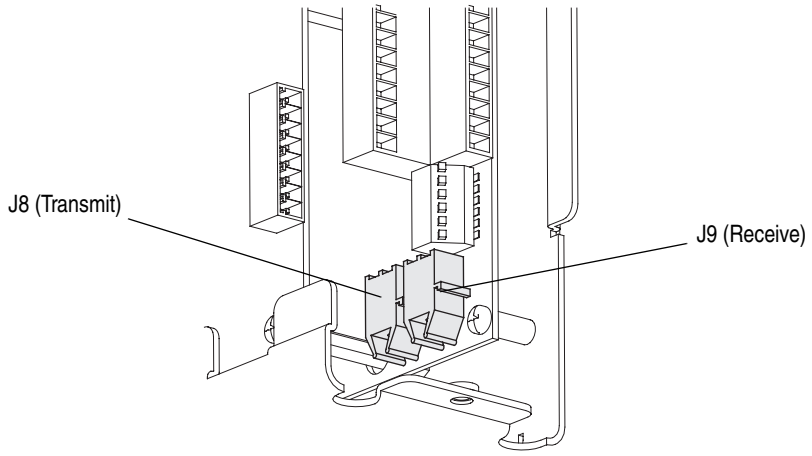
SynchLink provides high-speed synchronization and communication between multiple PowerFlex 700S drives (or other products with SynchLink capability).

Class 1 LED Product

ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into module ports or fiber optic cable connectors.

Refer to publication number 1756-TD008, *SynchLink System Design Guide,* when planning and connecting the SynchLink network.

Connect cables to J9 (receive) and J8 (transmit) connectors on the bottom of the Main Control Board. Push the plug into the socket until it produces an audible click.



Important: Do not overtighten tie-wraps.

Table G SynchLink Cables and Accessories

Description	Cat. No.
2 x 1 M Fiber Optic Link	1403-CF001
2 x 3 M Fiber Optic Link	1403-CF003
2 x 5 M Fiber Optic Link	1403-CF005
10 M Fiber Optic Link	1403-CF010
20 M Fiber Optic Link	1403-CF020
50 M Fiber Optic Link	1403-CF050
100 M Fiber Optic Link	1403-CF100
250 M Fiber Optic Link	1403-CF250
500 M Fiber Optic Bulk	1403-CFBLK
SynchLink Fiber-Hub, 1 input, Base	1751-SLBA
SynchLink Fiber-Hub, 4 output, “Star” Splitter	1751-SL4SP
SynchLink Bypass Switch	1751-SLBP/A

Table H Fiber Optic Cable Assembly

Specification	
Connecting Cables	200/230 micron HCS (Hard Clad Silica) • Versalink V-System • Lucent Technologies, • Specialty Fibers Technology Division
Maximum Cable Length	300 meters with no more than one splice or one adapter
Minimum Cable Length	1 meter

Specification	
Minimum inside bend radius	25.4mm (1 in.) Any bends with a shorter inside radius can permanently damage the fiber optic cable. Signal attention increases with decreased inside bend radius.
Operating Wavelength	650 nm (Red)
Data Rate	5 Mbps
Maximum Node Count	• 10 - Daisy Chain • 256 - Star Configuration

I/O Terminal Blocks

Wiring the Main Control Board I/O Terminals

Terminal blocks TB1 and TB2 contain connection points for all inputs, outputs and standard encoder connections. Both terminal blocks reside on the Main Control Board.

Remove the terminal block plug from the socket, and make connections.

TIP: Remember to route wires through the sliding access panel at the bottom Control Assembly.

Reinstall the plug, when wiring is complete. The terminal blocks have keys, which make it difficult to insert a terminal plug into the wrong socket.

Figure 7 Main Control Board I/O Terminal Locations

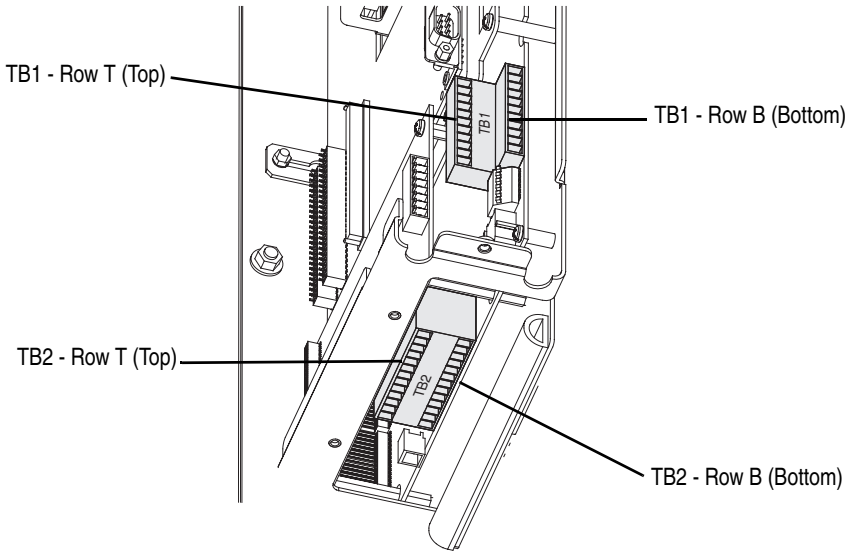
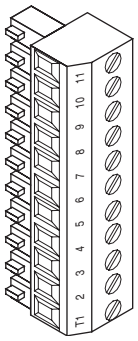


Table I Control & Encoder Terminal Block Specifications

		Wires Size Range (1)		Torque	
Name	**Description**	Maximum	Minimum	Maximum	Recommended
I/O & Encoder Blocks	Signal & Encoder power connections	1.5 mm^2 (16 AWG)	.14 mm^2 (28 AWG)	.25 N-m (2.2 lb.-in.)	.22 N-m (1.9 lb.-in.)

(1) Maximum/minimum sizes the terminal block will accept - these are not recommendations.

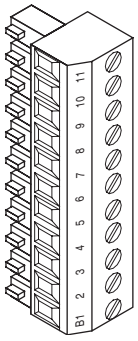
Table J TB1 - Row T (Top) Terminals



Terminal	Signal	Description	Related Parameter
T11	Power Supply 24V DC Return (-)	Power and common for pre charge and enable inputs.(1) Inputs may sink or source.(2) Rating: 100 mA maximum.	
T10	Power Supply 24V DC (+)		
T9	Logic Common		
T8	Digital Input #1 Default = Precharge	For common DC bus drives. Must be high, for drive to complete the pre charge cycle. Load: 20 mA at 24V DC.	824, 838, 829, 826, 827, 828
T7	Enable Input	Must be high for drive to run. Load: 20 mA at 24V DC.	824, 825
T6	Digital Output #1	24V DC open collector (sinking logic) output. Rating: 25 mA maximum.	843, 844, 824
T5	Digital Output #2	24V DC open collector (sinking logic) output. Rating: 25 mA maximum.	845, 846, 824
T4	Digital Output Return	Return for Digital outputs 1 and 2.	
T3	Thermistor Input	Used only in FOC2 mode with approved motor for temperature adaptation.	485
T2	Thermistor Input Return		
T1	Thermistor Shield		

(1) The drive's 24V DC power supply supports only on-board digital inputs. Do not use it to power circuits outside of the drive.
(2) Refer to wiring examples of sinking and sourcing outputs.

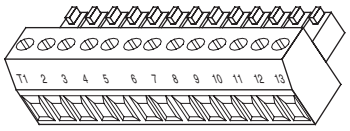
Table K TB1 - Row B (Bottom) Terminals



Terminal	Signal	Description	Related Parameter
B11	Analog Input #1 (-)	+/-10.0V DC or +/-1.0V DC bipolar, differential input. (1), 13 bit + sign, 20k ohm input impedance	800, 801, 802, 803, 804, 805
B10	Analog Input #1 (+)		
B9	Analog Input Shield	Optional connection point for analog input shield. (2)	
B8	Analog Input #2 (-)	+/-10.0V DC or +/-1.0V DC bipolar, differential input. (1), 13 bit + sign, 20k ohm input impedance	806, 807, 808, 809, 810, 811
B7	Analog Input #2 (+)		
B6	Analog Output #1 (+)	+/-10.0V DC bipolar, differential output, 11 bit + sign, 2k ohm minimum load	814, 815, 816, 817, 812, 818
B5	Analog Output #1 Return (-)		
B4	Analog Output Shield	Optional connection point for analog output shield. (2)	
B3	Analog Output #2 (+)	+/-10.0V DC bipolar, differential output, 11 bit + sign, 2k ohm minimum load	819, 820, 821, 822, 813, 823
B2	Analog Output #2 Return (-)		
B1	Analog Output Shield	Optional connection point for analog shields.	

(1) Refer to Analog Input Settings in the *User Manual - PowerFlex 700S Drives with Phase I Control*, publication 20D-UM001, for necessary dip switch settings.
(2) Analog shields should connect to common at the signal source, if possible. Shields for signals from ungrounded devices, such as analog tachometers, should connect to an analog shield terminal point at the drive.

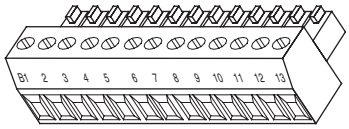
Table L TB2 - Row T (Top) Terminals



Terminal	Signal	Description	Related Parameter
T13	Encoder Signal A	Primary encoder interface. 5 or 12V DC switch selectable (1), Nominal current draw per channel @ 12V DC 45 mA, @5V DC 32 mA	222, 232, 233, 234, 231, 230, 236, 237. 238, 235
T12	Encoder Signal Not A		
T11	Encoder Signal B		
T10	Encoder Signal Not B		
T9	Encoder Signal Z		
T8	Encoder Signal Not Z		
T7	Shield	Connection point for encoder shield.	
T6	Digital Input #2	High speed 12-24V DC sinking digital input.	824, 839, 833, 830, 831, 832
T5	Digital Input #2 Return		
T4	Digital Input #3	High speed 12-24V DC sinking digital input.	824, 840, 837, 834, 835, 836
T3	Digital Input #3 Return		
T2	Power Supply +12V DC (A) (+)	12V DC power supply for primary encoder interface and high speed inputs. Rating 300 mA(2)	
T1	Power Supply +12V DC Return (A) (-)		

(1) Refer to Encoder Input Settings in the *User Manual - PowerFlex 700S Drives with Phase I Control*, publication 20D-UM001, for necessary dip switch settings.
(2) This power supply supports only the primary encoder interface and digital inputs. Do not use it to power circuits outside of the drive.

Table M TB2 - Row B (Bottom) Terminals



Terminal	Signal	Description	Related Parameter
B13	Encoder Signal A	Secondary encoder interface. 5 or 12V DC switch selectable (1), Nominal current draw per channel @ 12V DC 45 mA, @5V DC 32 mA	222, 243, 244, 242, 241, 240, 246, 247, 248, 245
B12	Encoder Signal Not A		
B11	Encoder Signal B		
B10	Encoder Signal Not B		
B9	Encoder Signal Z		
B8	Encoder Signal Not Z		
B7	Shield	Connection point for encoder shield.	
B6	Unused		
B5	Relay Output	Relay contact output. Rating: 5A @ 24V DC Resistive, 2A 24V DC Inductive	824, 841, 842
B4	Relay Output Return		
B3	Unused		
B2	Power Supply +12V DCDC (B) (+)	12V DC power supply for secondary encoder interface. Rating 300 mA(2)	
B1	Power Supply +12V DC Return (B) (-)		

(1) Refer to Encoder Input Setting in the *User Manual - PowerFlex 700S Drives with Phase I Control*, publication 20D-UM001, for necessary dip switch settings.
(2) This power supply supports only the secondary encoder interface. Do not use it to power circuits outside of the drive

I/O Wiring Examples

This section provides basic information to wire the PowerFlex 700S Drive.

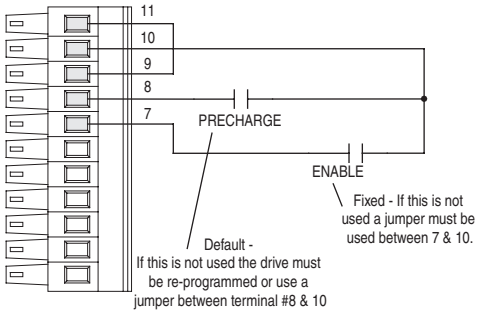
Table N Digital Wiring Examples

The following definitions are used throughout this section:

Source
- Apply positive voltage through the device to the input or output.
- Connect the input or output common (return) directly to the power supply common.

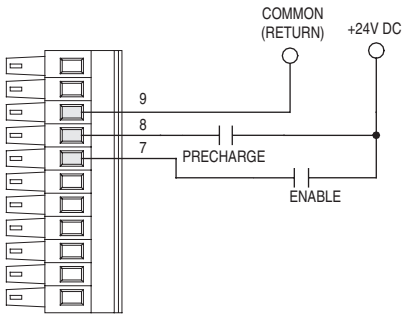
Sink
- Apply the positive voltage directly to the input or output common (return).
- Connect the input or output to the power supply common through the device

<table>
<tr><th>Input/Output</th><th>Connection Example</th><th></th></tr>
<tr><td rowspan="2">Digital Inputs used for enable and precharge control.

Note:
24V DC Supply - supports only on-board digital inputs. Do not use for circuits outside the drive.</td><td>Sourcing Input - using internal power supply
TB1 - Row T (Top)
 
</td><td>Required Parameter Changes
Enable - In sourcing configuration, this circuit must connect to 24V DC power for drive to run.

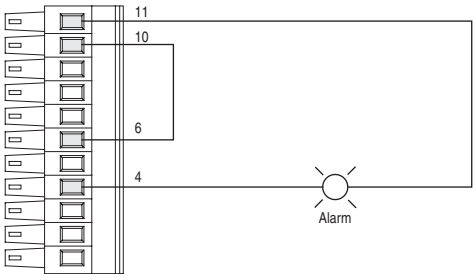
Precharge
Precharge control is used in common bus configurations and is not required for AC fed drives.

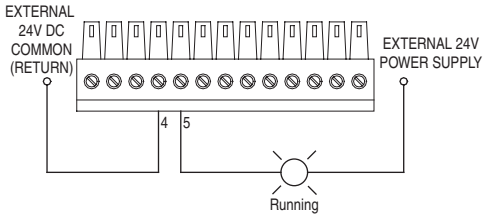
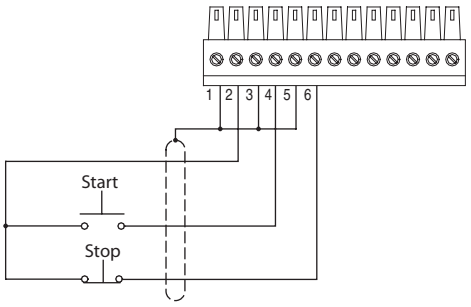
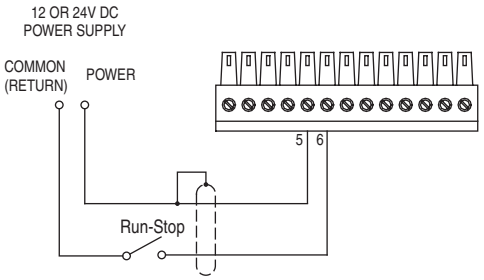
If precharge control is not required, reprogram Par 838 [DigIn 1 Sel] to a value of zero or replace the contact shown with a jumper from Terminal 8 to Terminal 10.

If precharge is needed, in sourcing configuration, this circuit must connect to 24V DC power for drive to complete the precharge cycle.</td></tr>
<tr><td>Sourcing Input - using external power supply
TB1 - Row T (Top)
 
</td><td>Enable - In sourcing configuration, must connect to 24V DC common for drive to run.

Precharge
Precharge control is used in common bus configurations and is not required for AC fed drives.

If precharge control is not required, reprogram Par 838 [DigIn1 Sel] to a value of zero

If precharge is needed, in sourcing configuration, must connect to 24V DC common for drive to enter precharge cycle.</td></tr>
<tr><td>Auxiliary Outputs - 24V DC outputs 25 mA maximum per output</td><td>Digital Output 1 Indicating Alarm and Digital Output 2 Indicating Fault - in sourcing configuration
TB1 - Row T (Top)
 
</td><td>Using Digital Output 1 to annunciate an alarm:
• Link the status word to the output control
Par 843 [DigOut 1 Data] (the destination) linked to
Par 155 [Logic Status] (the source)
• Select which bit activated the output
Par 844 [DigOut 1], Bit = 8 “Alarm”</td></tr>
</table>

Input/Output	Connection Example	
Auxiliary Output - Relay contact output	Auxiliary Output - sourcing configuration **TB2 - Row B (Bottom)** 	**Using Relay Out to annunciate "drive running:"** • Link the status word to the relay control Par 841 [Relay Out Data] (the destination) linked to Par 155 [Logic Status] (the source) • Set Par 842 [Relay Out Bit] to a value of one, so that Par 155 [Logic Status], bit 1 "Running" will control the output.
12 - 24V DC Inputs Digital Inputs used for Start/Stop 3-Wire Control	3-Wire Control, Non-Reversing - using internal power supply **TB2 - Row T (Top)** 	• Set Par 839 [DigIn2 Sel] = 1 "Normal Stop" • Set Par 840 [DigIn3 Sel] = 2 "Start" • Set Par 153 [Control Options], bit 8 "3WireControl" = 1 Use Digital Input 2 & 3 for 3-wire Start/Stop Control
Digital Inputs used for Run/Stop 2-Wire Control **Note:** +12V and +24V are also available from TB1 Top 10 & 11.	2 -Wire Control, Non-Reversing - using external power supply (1) **TB2 - Row T (Top)** 	• Par 839 [DigIn2 Sel] = 3 "Run" • Par 153 [Control Options], bit 8 "3WireControl" = 0 **AND** • Par 153 [Control Options], bit 9 "2W CoastStop" = 0 (ramp stop) **or** • Par 153 [Control Options], bit 9 "2W CoastStop" = 1 (coast stop) Use Digital Input 2 for 2-wire Run/Stop Control

(1) See "Important" statement about the HIM on page 44.

Table O Analog Wiring Examples

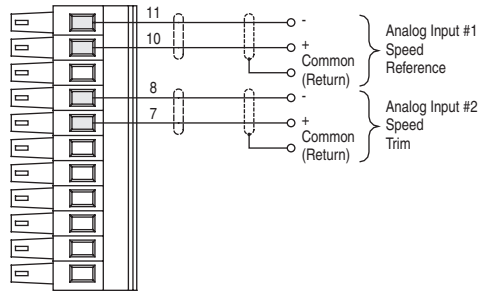
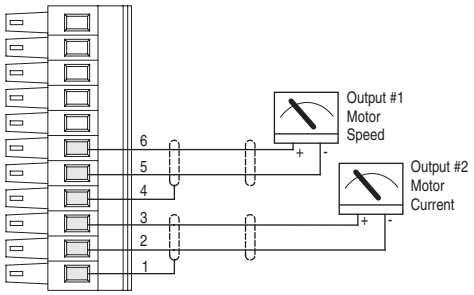
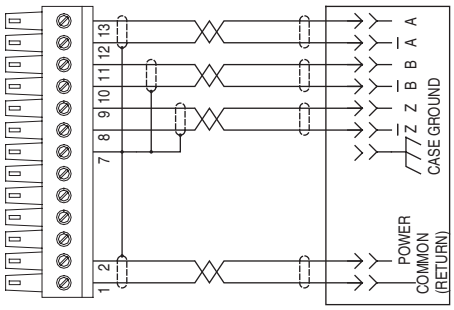
Analog I/O	Connection Example	Required Parameter Changes
Analog Inputs - +/-10V DC or +/-1.0V DC (DIP switch setable) Terminate shields at the analog source if analog common is available Used for Speed Reference and Speed Trim	Analog Inputs - shield terminated at source **TB1 - Row B (Bottom)** 	**Using Analog In1 as 0 - 10 V speed reference:** • Scale the Input to 1 V Par 802 [Anlg In1 Scale] = 0.1 • Send the data to the Speed Reference parameter Par 10 [Speed Ref 1] (the destination) linked to Par 800 [Anlg In1 Data] (the source) • Select Ref 1 as the active speed ref Par 16 [Speed Ref Sel] = 1 “Spd Ref 1” • Par 153 [Control Options], bit 0 “Bipolar SRef” = 0 (Unipolar Speed Reference) **Using Analog In2 as -10 to +10V speed trim @ 10%:** • Scale the input to 0.1V - 10% Par 808 [Anlg In2 Scale] = 0.1 • Send the data to the speed reference parameter Par 12 [Speed Ref 2] (the destination) linked to Par 806 [Anlg In2 Data] (the source) • Select Ref 1 as the active speed reference and Ref2 as trim • Set Par 16 [Speed Ref Sel] = 3 “Spd Ref 3”
Analog Outputs - +/-10V DC Used to drive analog meters displaying speed and current	**TB1 - Row B (Bottom)** 	**Using Analog Out 1, -10V to + 10V to meter Motor RPM and direction:** • Send the data to the Analog Output Par 815 [Anlg Out1 Real] (the destination) linked to Par 300 [Motor Spd Fdbk] (the source) • Scale the Output to the source parameter Par 817 [Anlg Out1 Scale] = 175 (Par 4 [Motor NP RPM] = 1750 / 10V) **Using Analog Out 2, -10V to + 10V to meter Motor Current:** • Send the data to the Analog Output Par 820 [Anlg Out2 Real] (the destination) linked to Par 308 [Output Current] (the source) • Scale the Output to the source parameter Par 822 [Anlg Out2 Scale] = xx (Par 2 [Motor NP FLA] / 10 V)

Table P Encoder Wiring Example

Input/Output	Connection Example	Required Parameter Changes
Primary Encoder Interface - Supports 12V DC differential encoders with internal power supply. 5V DC differential encoders require external power supply and special jumper settings. Used as primary closed loop speed feedback	Primary Encoder - using internal power supply **TB2 - Row T (Top)** 	**Using Encoder 0 as speed feedback:** • Par 222 [Motor Fdkbk Sel] = 0 “Encoder 0” (= default) • Par 232 [Encoder0 PPR] = Pulses/Rev for installed encoder

Step 9: Verifying the Start-up Check List

This section describes how you start-up the PowerFlex 700S drive.

ATTENTION: Power must be applied to the drive to perform the following start-up procedure. Some of the voltages present are at incoming line potential. To avoid electric shock hazard or damage to equipment, only qualified service personnel should perform the following procedure. Thoroughly read and understand the procedure before beginning. If an event does not occur while performing this procedure, **Do Not Proceed**. **Remove Power** including user supplied control voltages. User supplied voltages may exist even when main AC power is not applied to then drive. Correct the malfunction before continuing.

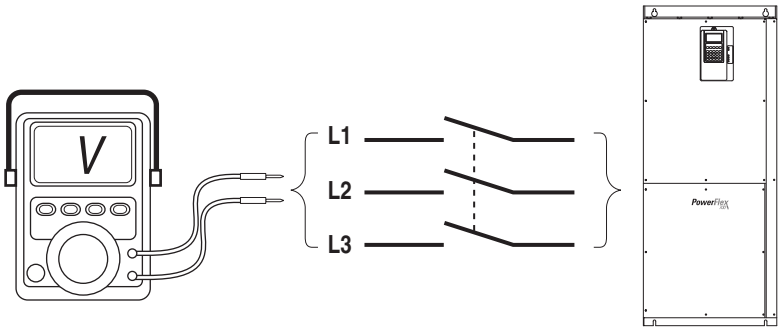
Important: If you have a DriveLogix application, you must first connect the battery before starting this section.

Before Applying Power to the Drive

1. Confirm that motor wires are connected to the correct terminals and are secure.

   Note: Refer to "Power Terminal Specifications" for the appropriate drive frame size for motor connection information.

2. Confirm that encoder wires are connected to the correct terminals and are secure.
3. Confirm that all control inputs are connected to the correct terminals and are secure.
4. Verify that AC line power at the disconnect device is within the rated value of the drive.



The remainder of this procedure requires a HIM (Human Interface Module) be installed. If an operator interface is not available, remote devices should be used to start-up the drive.

Applying Power to the Drive

The RUN LED, controller LEDs, and SynchLink LEDs are only operational when the drive is energized. These LEDs are only visible when the drive door is open.

ATTENTION: The RUN LED and the controller LEDs are only operational when the drive is energized. Servicing energized equipment can be hazardous. Severe injury or death can result from electrical shock, burn or unintended actuation of controlled equipment. Follow Safety related practices of NFPA 70E, *ELECTRICAL SAFETY FOR EMPLOYEE WORKPLACES*. DO NOT work alone on energized equipment!

5. Apply AC power and control voltages to the drive. Examine the *Power (PWR)* LED.

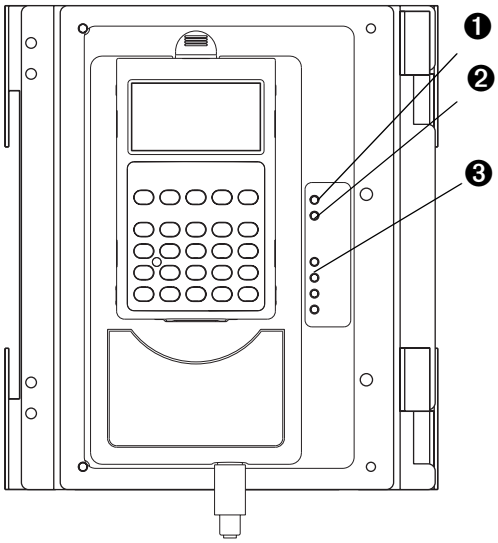


Table Q Drive Status Indicator Descriptions

			#	Name	Color	State	Description
DRIVE	Power Structure		❶	PWR (Power)	Green	Steady	Illuminates when power is applied to the drive.
			❷	STS (Status)	Green	Flashing	Drive ready, but not running & no faults are present.
						Steady	Drive running, no faults are present.
					Yellow	Flashing	When running, a type 2 (non-configurable) alarm condition exists, drive continues to run. When stopped, a start inhibit exists and the drive cannot be started.
						Steady	A type 1 (user configurable) alarm condition exists, but drive continues to run.
					Red	Flashing	A fault has occurred.
						Steady	A non-resettable fault has occurred.
					Red / Yellow	Flashing Alternately	The drive is in flash recovery mode. The only operation permitted is flash upgrade.
	Control Assembly	Communications	❸	PORT	Refer to the *Communication Adapter User Manual*		Status of DPI port internal communications (if present).
				MOD			Status of communications module (when installed).
				NET A			Status of network (if connected).
				NET B			Status of secondary network (if connected).
		Control	(1)	SYNCHLINK	Green	Steady	The module is configured as the time keeper. or The module is configured as a follower and synchronization is complete.
					Green	Flashing	The follower(s) are not synchronized with the time keeper.
					Red	Flashing	The module is configured as a time master on SynchLink and has received time information from another time master on SynchLink.
				ENABLE	Green	On	The drive's enable input is high.
					Green	Off	The drive's enable input is low.

(1) SynchLink LEDS are located on the SynchLink daughtercard on the main circuit board in the control cassette.

6. Examine the *Status (STS)* LED. Verify that it is flashing green. If it is not in this state, check the following possible causes and take the necessary corrective action.

Table R Common Causes of a Pre-Start Alarm

Examine Parameter 156 [Run Inhibit Status]		
bit	**Description**	**Action**
1	No power is present at the Enable Terminal TB1 - T7	Apply the enable
2, 3, 4	A stop command is being issued	Close all stop inputs
5	Power loss event is in progress, indicating a loss of the AC input voltage	Restore AC power
6	Data supplied by the power structure EEprom is invalid or corrupt.	Cycle power. If problem persists, replace the power structure.
7	Flash Update in Progress	Complete Flash Procedures
8	Drive is expecting a Start Edge and is receiving a continuous signal.	Open all start buttons and remove all start commands
9	Drive is expecting a Jog Edge and is receiving a continuous signal.	Open all jog buttons and remove all jog commands
10	A conflict exists between the Encoder PPR programming (Par 232 or 242) and the encoder configuration for edge counts (Par 233 or 243, bits 4 & 5).	Verify encoder data and reprogram
11	The drive cannot precharge because a precharge input is programmed and no signal is present.	Reprogram the input or close the precharge control contact.

12	Digital Configuration	Start input configured but stop not configured	Program Par 838-840 to include a stop button, rewire the drive
		Run input configured but control options do not match	Program Par 153, Bit 8 “2 wire control” to “0”
		Start input configured but control options do not match	Program Par 153, Bit 8 “3 wire control” to “1”
		Multiple inputs configured as Start or Run	Reprogram Par 838-840 so multiple starts, multiple runs or any combination do not exist
		Multiple inputs configured as Jog1	Reprogram Par 838-840 so only (1) is set to “Jog1”
		Multiple inputs configured as Jog2	Reprogram Par 838-840 so only (1) is set to “Jog2”
		Multiple inputs configured as Fwd/Rev	Reprogram Par 838-840 so only (1) is set to “Fwd/Rev”
14	Invalid Feedback Device for Permanent Magnet Motor Control		Set Par 222 to 5 “FB Opt Port0”

Table S Common Start-Up Faults

Fault	Description	Action
Encoder Loss	One of the following has occurred on an encoder: • missing encoder (broken wire) • quadrature error • phase loss	Reconnect encoder or replace encoder.
Motor Overload	A motor overload is pending.	Enter correct motor nameplate full load amps. Par 2 [Motor NP FLA] or reduce excess load.
Motor Poles Fault	The poles of the motor do not match its rating.	Enter correct motor nameplate RPM. Par 4 [Motor NP RPM]

If any digital input is configured to Stop - CF (CF=Clear Faults) verify the signal is present or the drive will not start. Refer to Chapter 4 of the *User Manual - PowerFlex 700S Drives with Phase I Control*, publication 20D-UM001, for a list of potential digital input conflicts.

If a fault code appears, refer to Fault & Alarm Clearing on page 49 for more information.

At this point, The *Status (STS)* LED should be flashing green or Bit 1 [Sts Ready] of parameter 554 [LED Status] should be set.

7. Install the Protective Covers and Control Frame (if applicable) in reverse order of removal as described in Step 5: Removing Protective Covers on page 17.
8. Proceed to Step 10: Performing Assisted Start on page 44.

Step 10: Performing Assisted Start

This routine prompts you for information that is needed to start-up a drive for most applications, such as line and motor data, commonly adjusted parameters and I/O.

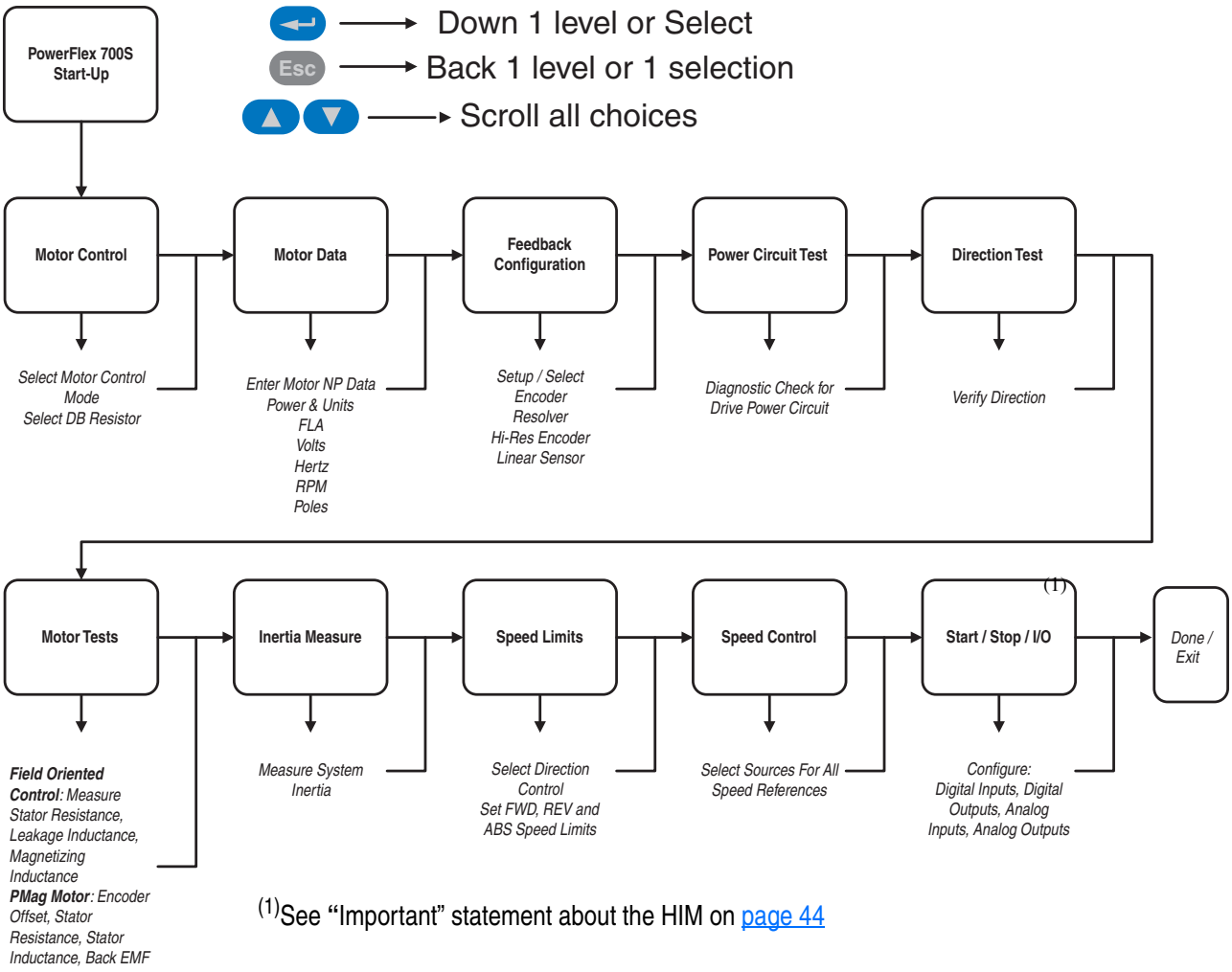
Important: This start-up routine requires a HIM. If the drive is configured for 2-wire control, the HIM installed on the drive will also act as a 2-wire device. In 2-wire mode, the drive will start when the HIM "Start" is pressed and stop when the HIM "Start" is released. The recommended mode of use for a Start-Up Routine is 3-wire control, Parameter 153 [Control Options], Bit 8 set to "1".

The assisted start-up routine asks simple yes or no questions and prompts you to input required information. Access Assisted Start-Up by selecting "Start-Up" from the Main Menu.

1. To exit the User Display screen Press Esc.	Esc	F Stopped Auto 0.0 RPM 0.0 DC Bus V 0.0 Output C
1. In the Main Menu, use the Down Arrow to scroll to "Start Up". 2. Press Enter. **TIP:** Throughout the Start-Up Routine many screens have more selections than shown. Use the arrow keys to scroll through all the menu options.	▲ ▼ Enter	F Stopped Auto 0.0 RPM Main Menu: Diagnostics Parameter Device Select
1. Follow the instructions on the screen to complete the Start-Up.	Enter	PowerFlex 700S Start-Up The Start-Up routine sets up the drive for basic operation. Push Enter.

TIP: If using a HIM the following functions are not available.

- Alt-Man
- Alt-Lang
- Alt-SMART



(1)See “Important” statement about the HIM on page 44

Important: In 2-wire mode, the drive will start when the HIM “Start” is pressed and stop when the HIM “Start” is released. The recommended mode of use for the Start-Up Routine is 3-wire control, Parameter 153 [Control Options], Bit 8 set to “1”.

Step 11: Running Drive from HIM (Optional)

Follow these instructions to run the drive in a very basic fashion from the HIM. This step is very useful when commissioning a complex system.

Using the HIM, make the following parameter settings to allow the HIM to control the drive:

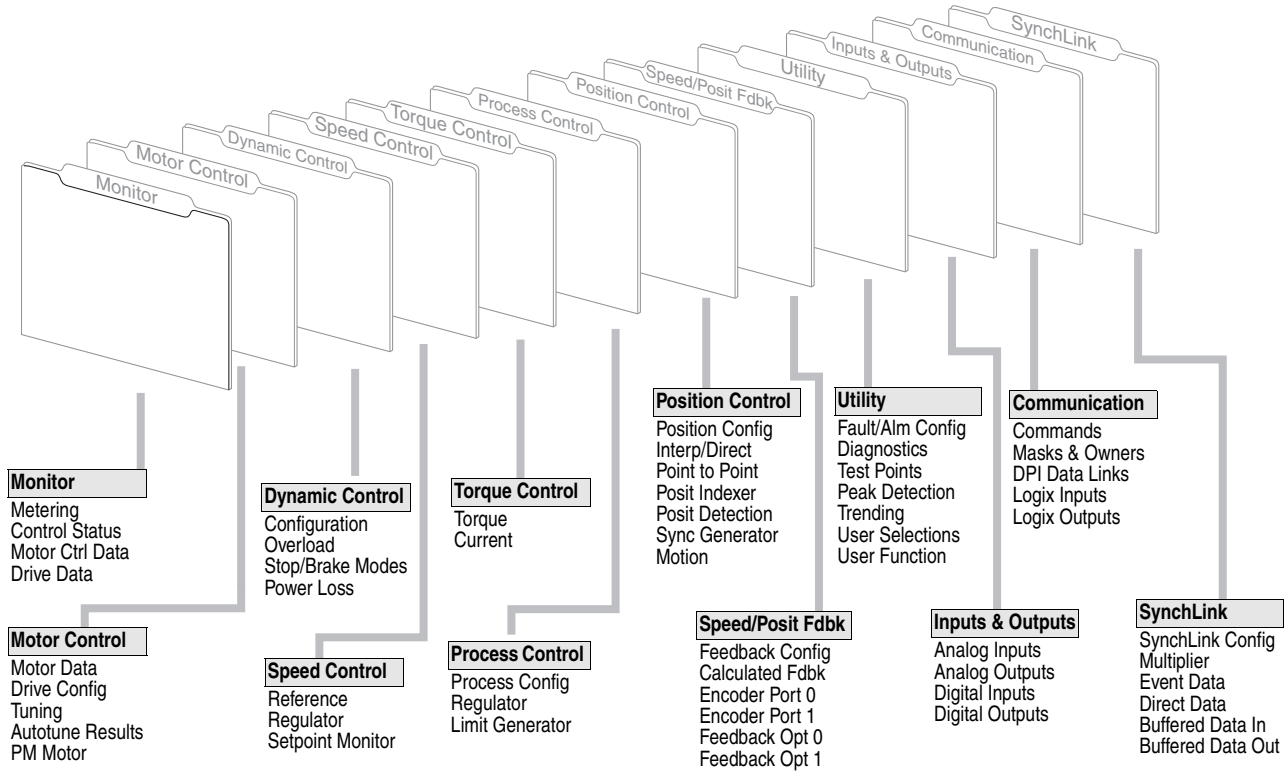
Set this parameter ...	... to this value
Parameter 16 [Speed Ref Sel]	0100 0000
Parameter 691 [DPI Ref Sel]	1 “Local HIM”
Parameter 693 [Logic Mask]	0000 0000 0000 0010
Parameter 694 [Start Mask]	0000 0000 0000 0010
Parameter 695 [Jog Mask]	0000 0000 0000 0010
Parameter 696 [Direction Mask]	0000 0000 0000 0010
Parameter 697 [Fault Clr Mask]	0000 0000 0000 0010
Parameter 222 [Motor Fdbk Sel]	2 “Sensorless”

Additional Information

This section contains additional information that may be helpful during drive start up, including:

- Frequently Used Parameters
- Fault & Alarm Clearing on page 49
- HIM Indication on page 49
- Manually Clearing Faults on page 49
- Technical Support on page 50

Parameter Files & Groups



Frequently Used Parameters

Footnote definitions are found on page 48.

No.(1)	Name Description (2)	Values (3)	Linkable	Read-Write	Data Type
1	**Motor NP Volts** Set to the motor nameplate rated volts.	Units: Volt Default: Calculated Min/Max: 75/705		RW	16-bit Integer
2	**Motor NP FLA** Set to the motor nameplate rated full load amps. Range limited by three-second inverter rating.	Units: Amps Default: Calculated Min/Max: Calculated/Calculated		RW	Real
3	**Motor NP Hertz** Set to the motor nameplate rated frequency.	Units: Hz Default: Calculated Min/Max: 2.0000/500.0000		RW	Real
4	**Motor NP RPM** Set to the motor nameplate rated RPM.	Units: RPM Default: Calculated Min/Max: 1/30000		RW	16-bit Integer
5	**Motor NP Power** Set to the motor nameplate rated power.	Units: Hp Default: Calculated Min/Max: 0.2500/3500.0000		RW	Real
6	**Mtr NP Pwr Units** The power units shown on the motor nameplate.	Default: 0 Hp Options: 0 Hp 1 W			
10	**Speed Ref 1** Sets the speed reference that the drive should use when selected by Parameter 16 [Speed Ref Sel]. A value of 1.0 represents base speed of the motor.	Default: 0.0000 Min/Max: -/+2200000000.0000	✓	RW	Real
16	**Speed Ref Sel** Selects the source of the speed reference to the drive.	Default: 1 "Spd Ref DPI" Options: 0 "Zero Speed" 4 "Spd Ref 4" 1 "Spd Ref 1" 5 "Spd Ref 5" 2 "Spd Ref 2" 6 "Spd Ref DPI" 3 "Spd Ref 3"			
30	**Rev Speed Limit** Sets a limit on the speed reference in the negative direction. This value can be entered as a negative value or zero.	Units: RPM Default: -2205.0000 Min/Max: -14112.0000/0.0000 Comm Scale: Parameter 4 [Motor NP RPM] = 1.0		RW	Real
31	**Fwd Speed Limit** Sets a limit on the speed reference in the positive direction. This value can be entered as a positive value or zero.	Units: RPM Default: 2205.0000 Min/Max: 0.0000/14112.0000 Comm Scale: Parameter 4 [Motor NP RPM] = 1.0		RW	Real
32	**Accel Time** Sets the rate of acceleration for all speed increases, with time in seconds to base speed. Accel Rate = Parameter 4 [Motor NP RPM] / Parameter 32 [Accel Time]	Units: Sec Default: 10.0000 Min/Max: 0.0100/6553.5000	✓	RW	Real
33	**Decel Time** Sets the rate of deceleration for all speed decreases, with time in seconds to base speed. Decel Rate = Parameter 4 [Motor NP RPM] / Parameter 33 [Decel Time]	Units: Sec Default: 10.0000 Min/Max: 0.0100/6553.5000	✓	RW	Real
34	**S Curve Time** Sets the S time (Round In and Round Out) in seconds. Half of the time specified is added to the beginning and half to the end of the applied ramp. The S time is independent of speed and results in a trapezoidal torque profile.	Units: Sec Default: 0.5000 Min/Max: 0.0000/4.0000	✓	RW	Real
90	**Spd Reg BW** Sets the bandwidth of the speed regulator in rad/sec. Bandwidth is also referred to as the crossover frequency. Small signal time response is approximately 1/BW and is the time to reach 63% of set point. A change to this parameter will cause an automatic update of Parameters 81 [Spd Reg P Gain] and 82 [Spd Reg I Gain]. To disable the automatic gain calculation, set this parameter to a value of zero. Adjustments to Parameters 474 [Freq Reg We BW] and 475 Freq Reg Wr BW] may be necessary when using sensorless feedback.	Units: R/S Default: 10.0000 Min/Max: 0.0000/500.0000	✓	RW	Real
153	**Control Options** Set bits to configure the options for operating the drive.				

Options	Reserved	Reserved	Reserved	Reserved	Reserved	Trq Trim En	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Aux Pwr Sply	Auto Tach Sw	Reserved	Reserved	OL ClsLpDsbl	Jog -NoInteg	Iq Delay	Motor Dir	2W CoastStop	3WireControl	Stop Cndt Tq	Stop in Torq	Jog - NoRamp	Jog in Torq	2WCurrLimStp	Sreg LPF 1	SRef Filt En	Bipolar SRef
Default	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

0 = False
1 = True

No.(1)	Name Description (2)	Values (3)					Linkable	Read-Write	Data Type
222	**Motor Fdbk Sel** Enter or write a value to select the primary motor speed feedback device.	Default: Options:	0 0 1 2 3	"Encoder 0" "Encoder 0" "Encoder 1" "Sensorless" "Reserved"	4 5 6	"Motor Sim" "FB Opt Port0" "FB Opt Port1"			
800	**Anlg In1 Data** Displays the value of Analog Input 1. This is the final value (after conversion, offsetting, scaling and filtering).	Default: Min/Max:	0.0000 -/+2200000000.0000						Real
802	**Anlg In1 Scale** Scales the range of Analog Input 1 to the range of Parameter 800 [Anlg In1 Data]. Parameter 801 [Anlg In1 Volts] is multiplied by this number to produce the input to the lead lag filter function. *Par 802* = 1, *Par 800* = 10 when 10V is applied.	Units: Default: Min/Max:	/1v 0.0000 -/+2200000000.0000				✓	RW	Real
803	**Anlg In1 Offset** Applies an offset to Analog Input 1. The output of the analog to digital conversion is summed with this number to produce Parameter 801 [Anlg In1 Volts]. This is used to zero out the analog input.	Units: Default: Min/Max:	Volt 0.0000 -/+20.0000				✓	RW	Real
806	**Anlg In2 Data** Displays the value of Analog Input 2. This is the final value (after conversion, offsetting, scaling and filtering).	Units: Default: Min/Max:	 0.0000 -/+2200000000.0000						Real
808	**Anlg In2 Scale** Scales the range of Analog Input 1 to the range of Parameter 806 [Anlg In2 Data]. Parameter 807 [Anlg In2 Volts] is multiplied by this number to produce the input to the lead lag filter function.	Units: Default: Min/Max:	/1v 0.0000 -/+2200000000.0000				✓	RW	Real
809	**Anlg In2 Offset** Applies an offset to Analog Input 1. The output of the analog to digital conversion is summed with this number to produce Parameter 807 [Anlg In2 Volts].	Units: Default: Min/Max:	Volt 0.0000 -/+20.0000				✓	RW	Real
838	**DigIn1 Sel** Enter or write a value to select the function of digital input 1.	Default: Options:	0 0 1 2 3 4 5 6 7	"Not Used" "Not Used" "Normal Stop" "Start" "Run" "Clear Faults" "Stop - CF" "Jog 1" "Jog 2"	8 9 10 11 12 13 14	"Fwd/Reverse" "CurLim Stop" "Coast Stop" "Aux Fault" "AuxFault Inv" "User Select" "PreChrg/Disc"			
839	**DigIn2 Sel** Enter or write a value to select the function of digital input 2.	Default: Options:	4 0 1 2 3 4 5 6 7 8 9 10 11 12 13	"Norm Stop-CF" "Not Used" "Normal Stop"" "Start" "Run" "Clear Faults" "Stop-CF" "Jog 1" "Jog 2" "Fwd/Reverse" "CurLim Stop" "Coast Stop" "Aux Fault" "AuxFault Inv" "User Select"	14 15 16 17 18 19 21 22 23 24 25	"Reserved" "Reserved" "Reserved" "Reserved" "Reserved" "Reserved" "Reserved" "Reserved" "Logix Motion" "+Hrd OvrTrvl" "-Hrd OvrTrvl"			
840	**DigIn3 Sel** Enter or write a value to select the function of digital input 3.	Default: Options:	0 0 1 2 3 4 5 6 7 8 9 10 11 12	"Not Used" "Not Used" "Normal Stop" "Start" "Run" "Clear Faults" "Stop-CF" "Jog 1" "Jog 2" "Fwd/Reverse" "CurLim Stop" "Coast Stop" "Aux Fault" "AuxFault Inv"	13 14 15 16 17 18 19 21 22 23 24 25	"User Select" "Reserved" "Reserved" "Reserved" "Reserved" "Reserved" "Reserved" "Reserved" "Reserved" "Logix Motion" "+Hrd OvrTrvl" "-Hrd OvrTrvl"			

(1) No. - Parameter Number. = parameter value cannot be changed until the drive is stopped.

(2) Name - Parameter name as it appears in DriveExecutive™ software.
Description - Brief description of parameter function.

(3) Values - Define the various operating characteristics of the parameter. There are 3 types of Values: ENUM, Bit and Numeric.

Fault & Alarm Clearing

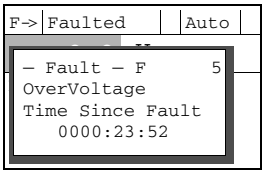
For a complete listing of Faults and Alarms, refer to the *User Manual - PowerFlex 700S Drives with Phase I Control*, publication 20D-UM001.

A fault is a condition that stops the drive. There are two fault types.

Type	Fault Description	
①	Non-Resettable	This type of fault normally requires drive or motor repair. The cause of the fault must be corrected before the fault can be cleared. The fault will be reset on power up after repair.
②	User Configurable	Programming and commissioning personnel can configure the drive's response to these exception events. Responses include: • Ignore • Alarm • Fault Coast Stop • Fault Ramp Stop • Fault Current Limit Stop

HIM Indication

The HIM also provides visual notification of a fault or alarm condition.

Condition	Display
Drive is indicating a fault. The LCD HIM immediately reports the fault condition by displaying the following: "Faulted" appears in the status line Fault number Fault name Time that has passed since fault occurred Press **Esc** to regain HIM control.	

Manually Clearing Faults

The following table contains the HIM keystrokes necessary to clear faults.

Step	Key(s)
1. Press **Esc** to acknowledge the fault. The fault information will be removed so that you can use the HIM.	
2. Address the condition that caused the fault. The cause must be corrected before the fault can be cleared.	
3. After corrective action has been taken, clear the fault by one of these methods. • Press **Stop** • Cycle drive power • Select **Clear Faults** from "Diagnostic - Faults" menu	

Technical Support

You can access the *PowerFlex® 700S with Phase I Control User Manual*, publication 20D-UM001 online at:

http://www.rockwellautomation.com/literature

PowerFlex 700S and DriveLogix™ Technical Support is available online by following these simple steps:

1. Open your Internet Browser, this may be: Microsoft® Internet Explorer, Netscape®, or Opera®.
2. With your browser open, type the following URL in your Address bar.

   http://www.ab.com/support/abdrives/powerflex700s/

3. Press the **Enter** key or click the **Go** button.

Drives Technical Forum

The *Drives Technical Forum* for all Allen-Bradley® drive products can help you solve issues in areas such as *Application*s, *Communication*s, *Hardware* and *Software*. You can visit us at the following URL address...

http://www.ab.com/support/abdrives/registered.html

Telephone

Drives Technical Support Hotline

Monday through Friday, 7:00 a.m. to 7:00 p.m. Central Standard Time
Call **1-262-512-8176**

Notes:

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