LISTEN.
THINK.
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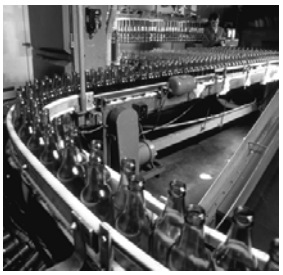
# PowerFlex® 700H Adjustable Frequency AC Drive / PowerFlex® 700S High Performance AC Drive



**INSTALLATION MANUAL**

**Frames 9 - 14**

ALLEN-BRADLEY • ROCKWELL SOFTWARE

Rockwell Automation

## Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at **http://www.rockwellautomation.com/literature**) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary we use notes to make you aware of safety considerations.

WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

Important: Identifies information that is critical for successful application and understanding of the product.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequences.

**Shock Hazard** labels may be located on or inside the equipment (e.g., drive or motor) to alert people that dangerous voltage may be present.

**Burn Hazard** labels may be located on or inside the equipment (e.g., drive or motor) to alert people that surfaces may be at dangerous temperatures.

## Manual Updates

The information below summarizes the changes to the *PowerFlex 700H and 700S Installation Instructions*, publication PFLEX-IN006, since the March 2006 release.

| Change | Page |
|---|---|
| Updated the Normal Duty power ratings | Preface-1 |
| Updated the Reference Materials List | Preface-1 |
| Added information on installations using single-phase input power | 1-2 |
| Updated the Common Bus/Precharge information | 1-9 |
| Added a description for the use of output reactors on frame 14 drives | 1-2 |
| Updated the 700H I/O board options chart | 2-2 |
| Updated the “Auto/Manual Notes” section to include information on enabling manual mode to allow starts and jogs from the HIM in 2-wire mode | 2-12 |
| Added a note to the analog inputs on the 700S Phase II control | 4-4 |
| Added terminal wiring illustration for external brake resistor and external brake IGBT and resistor connections on frame 9 drives | 6-6 |
| Updated all Frame 10 dimension drawings to include cable routing information. | 7-1 - 7-5 |
| Added a dimension drawing for the frame 10 Motor Control Center (MCC), Enclosure Codes “B” and “K” | 7-4 |
| Updated the instructions for frame 10 Ungrounded, High Resistive Ground or Grounded B Phase Delta installations | 7-9 |
| Updated the Power Terminal Block designations for frame 10 (removed brake option terminals) | 7-14 |
| Updated all Frame 11 dimension drawings to include cable routing information. | 8-1 - 8-5 |
| Added a dimension drawing for the frame 11 Motor Control Center (MCC), Enclosure Codes “B” and “K” | 8-4 |
| Updated the instructions for frame 11 Ungrounded, High Resistive Ground or Grounded B Phase Delta installations | 8-9 |
| Updated all Frame 12 dimension drawings to include cable routing information. | 9-1 - 9-5 |
| Added a dimension drawing for the frame 12 Motor Control Center (MCC), Enclosure Codes “B” and “K” | 9-4 |
| Updated the instructions for frame 12 Ungrounded, High Resistive Ground or Grounded B Phase Delta installations | 9-9 |
| Updated all Frame 13 dimension drawings to include cable routing information. | 10-3 - 10-4 |
| Updated the frame 13 dimensions for the NEMA/UL Type 12 - IP54 Enclosures | 10-4 |
| Updated the instructions for frame 13 Ungrounded, High Resistive Ground or Grounded B Phase Delta installations | 10-5 |
| Added Chapter 11 - Frame 14 Installation | 11-1 |
| Updated the Agency Certification information for drives with 700H control | A-1 |
| Separated the drive ratings information from the drive protection devices - now in separate tables | A-5, A-13 |
| Updated the drive rating, fusing and circuit breaker specifications | A-13 |
| Added new Appendix B to consolidate the common lifting and mounting instructions | B-1 |
| Added the Allen-Bradley 842HR rotary encoder to the list of compatible encoders | C-1 |
| Updated wiring diagrams for the Hi-Resolution Encoder | C-2 |
| Updated wiring diagrams for Resolvers | D-3 |
| Updated wiring diagrams for the MDI board | E-3 |
| Added Appendix E on ATEX Approved PowerFlex 700H Drives in Group II Category (2) Applications with ATEX Approved Motors | F-1 |

The information below summarizes the changes to the *PowerFlex 700H and 700S Installation Instructions*, publication PFLEX-IN006, since the October, 2004 release.

| Change | Page |
|---|---|
| Updated the drive ratings for PowerFlex 700H and 700S | Preface-1 |
| Updated the information on installing unbalanced, ungrounded or resistive grounded distribution systems | 1-1 |
| Added information on DC input precharge control wiring | 1-10 |
| Updated the “Control Board Slot Designations” table for the new 20C-DG1 digital I/O option board | 2-2 |
| Added drive catalog numbers for 700H control I/O board options | 2-2 |
| Updated the “Analog Input, PTC 0-10V Input” wiring example | 2-8 |
| Added Chapter 4, “Control Wiring for PowerFlex 700S Drives with Series II Control” | 4-1 |
| Updated information on frame 9 operating temperatures | 6-2 |
| Updated frame 9 installation instructions for unbalanced, ungrounded or resistive grounded distribution systems | 6-4 |
| Updated frame 10 minimum mounting clearances | 7-1 |
| Updated frame 10 operating temperatures | 7-2 |
| Added dimensions drawing for frame 10 NEMA/UL Type 12 - IP54 Enclosure | 7-5 |
| Updated frame 10 “Moving Control Frame” to show slotted holes in Control Frame | 7-6 |
| Updated frame 10 “Removing Protective Covers” to omit screws that were not present. | 7-8 |
| Updated frame 10 installation instructions for unbalanced, ungrounded or resistive grounded distribution systems | 7-9 |
| Updated frame 11 minimum mounting clearances | 8-1 |
| Updated frame 11 operating temperatures | 8-2 |
| Added dimensions drawing for frame 11 NEMA/UL Type 12 - IP54 Enclosure | 8-5 |
| Updated frame 11 installation instructions for unbalanced, ungrounded or resistive grounded distribution systems | 8-9 |
| Added Chapter 9, “Frame 12 Installation” | 9-1 |
| Added Chapter 10, “Frame 13 Installation” | 10-1 |
| Updated the agency certifications | A-1 |
| Updated the drive protection specifications | A-1 |
| Updated the fusing and circuit breaker specifications | A-13, A-13 |
| Added specifications and wiring diagram for using the Stahltronic linear encoder | E-3 |

# Overview

## Drive Description

Frame 9 - 14 PowerFlex® 700H and 700S AC drives are available in the following normal duty power ratings.

| Drive | AC Input Range | HP Range | kW Range |
|---|---|---|---|
| 700H | 380-500V | 200-2300 | 132-1600 |
| | 525-690V | 150-2400 | 160-2000 |
| 700S | 380-500V | 200-1250 | 132-800 |
| | 525-690V | 150-1600 | 160-1500 |

The 700H features a parameter set modeled after the PowerFlex 700 AC drive. Standard I/O includes either 24V or 115V digital I/O plus analog I/O NetLinx™ communication options, including DeviceNet™, ControlNet™ and EtherNet/IP networks.

The PowerFlex 700S offers optimized integration for the most demanding drive control and drive system applications. Available with embedded high-performance Logix engine (DriveLogix) to produce a highly functional, cost-effective drive and control solution.

## Enclosure Options

The following enclosure types are available for PowerFlex 700H and 700S drives:

| Drive | Enclosure Code | Enclosure Type | NEMA/UL Rating | Description |
|---|---|---|---|---|
| 700H | A | Rittal TS 8 Modular | IP21, NEMA/UL Type 1 | Single Door - Freestanding, Light Grey (RAL 7035) |
| | B | MCC Style | IP20, NEMA/UL Type 1 | Single Door - Freestanding, Roll-in, Roll-out power structure |
| | H | Rittal TS 8 Modular | IP54, NEMA/UL Type 12(1) | Single Door - Freestanding, Filters in Door and Roof Vent |
| | J | No enclosure | IP00, NEMA/UL Type Open | With Conformal Coated Circuit Boards |
| | K | MCC Style | IP20, NEMA/UL Type 1 | Single Door - Freestanding, Roll-in, Roll-out power structure, with Conformal Coated Circuit Boards |
| | M | Rittal TS 8 Modular | IP21, NEMA/UL Type 1 | Single Door - Freestanding, Light Grey (RAL 7035), with Conformal Coated Circuit Boards |
| | N | No enclosure | IP00, NEMA/UL Type Open | – |
| | W | Rittal TS 8 Modular w/ Conformal Coat | IP54, NEMA/UL Type 12 | Single Door - Freestanding, Filters in Door and Roof Vent |

| Drive | Enclosure Code | Enclosure Type | NEMA/UL Rating | Description |
|---|---|---|---|---|
| 700S | A | Rittal TS 8 Modular | IP21, NEMA/UL Type 1 | Single Door - Freestanding, Light Grey (RAL 7035) |
| | B | MCC Style | IP20, NEMA/UL Type 1 | Single Door - Freestanding, Roll-in, Roll-out power structure |
| | N | No enclosure | IP00, NEMA/UL Type Open | – |

(1) For replacement filters, refer to the PowerFlex Architecture Class Spare Parts & Options list available at: http://www.ab.com/support/abdrives/powerflex70/PF7ReleasedParts.pdf

## Who Should Use this Manual?

This manual is intended for qualified personnel. You must be able to mount and wire Adjustable Frequency AC Drive devices.

## What Is Not in this Manual

This manual is designed to provide drive mounting and wiring information. For start-up, programming and troubleshooting information, refer to the appropriate manual listed below.

## Reference Materials

Allen-Bradley publications are available on the internet at *www.rockwellautomation.com/literature*.

The following manuals are recommended for general drive information:

| Title | Publication |
|---|---|
| Industrial Automation Wiring and Grounding Guidelines | 1770-4.1 |
| Wiring and Grounding Guidelines for pulse Width Modulated AC Drives | DRIVES-IN001… |
| Preventive Maintenance of Industrial Control and Drive System Equipment | DRIVES-TD001… |
| Safety Guidelines for the Application, Installation and Maintenance of Solid State Control | SGI-1.1 |
| A Global Reference Guide for Reading Schematic Diagrams | 100-2.10 |
| Guarding Against Electrostatic Damage | 8000-4.5.2 |

The following manuals are recommended for detailed PowerFlex 700H information:

| Title | Publication |
|---|---|
| PowerFlex Reference Manual | PFLEX-RM001… |
| PowerFlex 700H Programming Manual | 20C-PM001… |

The following manuals are recommended for detailed PowerFlex 700S information:

| Title | Publication |
|---|---|
| PowerFlex 700S with Phase I Control Reference Manual | PFLEX-RM002… |
| PowerFlex 700S with Phase II Control Reference Manual | PFLEX-RM003… |
| PowerFlex 700S with Phase I Control User Manual | 20D-UM001… |
| PowerFlex 700S with Phase II Control User Manual | 20D-UM006… |

The following manuals are recommended for detailed installation and service information for PowerFlex 700H and 700S drives:

| Title | Publication |
|---|---|
| Installation Instructions - PowerFlex 700H/S IP00 Open Pwr Structure - Frm 10-13 | PFLEX-IN020... |
| Hardware Service Manual - PowerFlex 700S and 700H Drives (Frame 9) | PFLEX-TG001... |
| Hardware Service Manual - PowerFlex 700S and 700H Drives (Frame 10) | PFLEX-TG002... |
| Hardware Service Manual - PowerFlex 700S and 700H Drives (Frame 11) | PFLEX-TG003... |
| Hardware Service Manual - PowerFlex 700S and 700H Drives (Frame 12) | PFLEX-TG004... |
| Hardware Service Manual - PowerFlex 700S and 700H Drives (Frame 13) | PFLEX-TG005... |
| Hardware Service Manual - PowerFlex 700S and 700H Drives (Frame 14) | (not yet available) |

For Allen-Bradley Drives Technical Support:

| Title | Online at . . . |
|---|---|
| Allen-Bradley Drives Technical Support | **www.ab.com/support/abdrives** |

## Manual Conventions

- In this manual we refer to the PowerFlex 700H or 700S Adjustable Frequency AC Drive as:
  - drive
  - PowerFlex 700H
  - 700H
  - PowerFlex 700S
  - 700S
- To help differentiate parameter names and LCD display text from other text, the following conventions will be used:
  - Parameter Names will appear in [brackets].
    For example: [DC Bus Voltage].
  - Display Text will appear in “quotes.” For example: “Enabled.”
- The following words are used throughout the manual to describe an action:

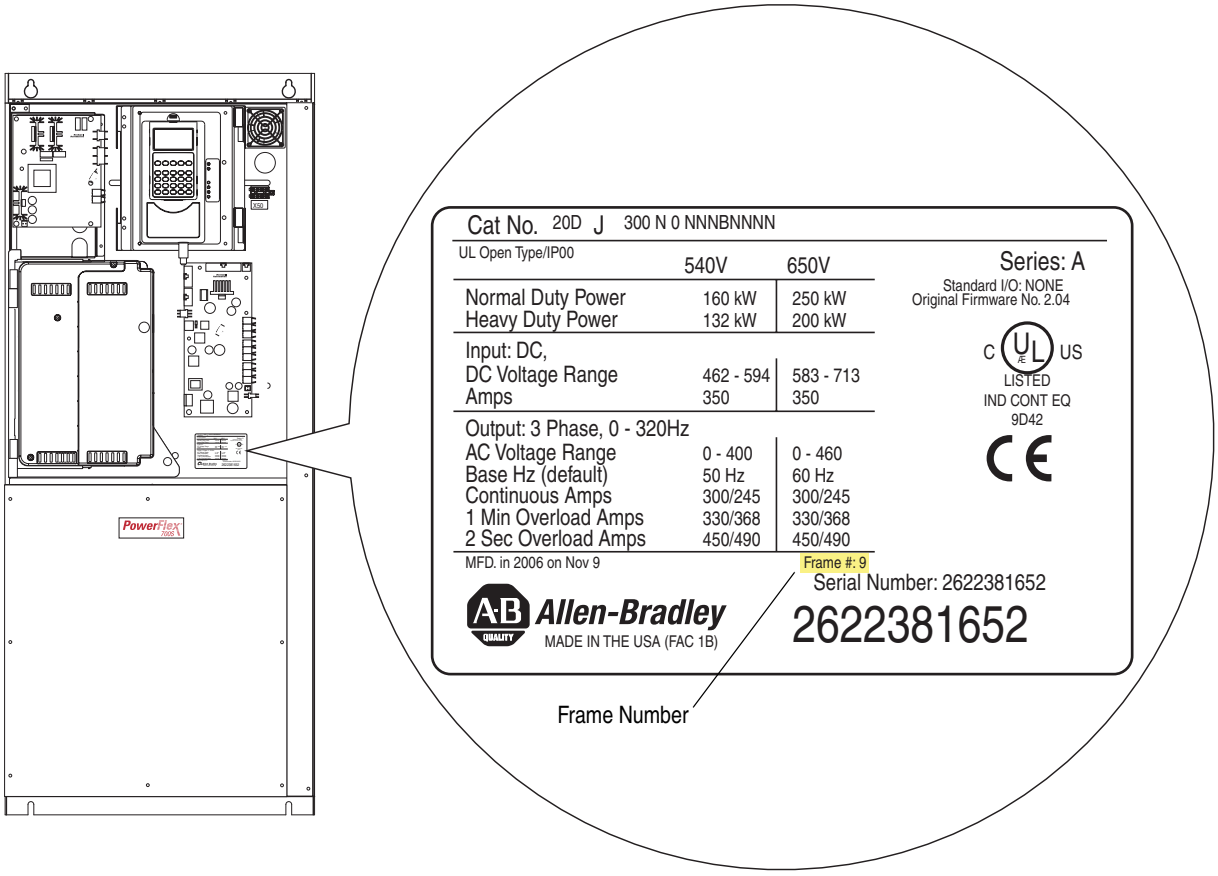
| Word | Meaning |
|---|---|
| Can | Possible, able to do something |
| Cannot | Not possible, not able to do something |
| May | Permitted, allowed |
| Must | Unavoidable, you must do this |
| Shall | Required and necessary |
| Should | Recommended |
| Should Not | Not recommended |

## Drive Frame Sizes

Similar PowerFlex 700H and 700S drive sizes are grouped into frame sizes to simplify spare parts ordering, dimensioning, etc. A cross reference of drive catalog numbers and their respective frame size is provided in Appendix A.

### 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.



## 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 A-B 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, undersizing the motor, incorrect or inadequate AC supply, or excessive ambient temperatures may result in malfunction of the system.

**ATTENTION:** Only qualified personnel familiar with adjustable frequency AC drives 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 completely before servicing. Check the DC bus voltage at the Power Terminal Block by measuring between the +DC and -DC terminals, between the +DC terminal and the chassis, and between the -DC terminal and the chassis. The voltage must be zero for all three measurements.

**ATTENTION:** Risk of injury or equipment damage exists. DPI 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:** 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.

**ATTENTION:** The “adjust freq” portion of the bus regulator function is extremely useful for preventing nuisance overvoltage faults resulting from aggressive decelerations, overhauling loads, and eccentric loads. It forces the output frequency to be greater than commanded frequency while the drive's bus voltage is increasing towards levels that would otherwise cause a fault. However, it can also cause either of the following two conditions to occur.

1. Fast positive changes in input voltage can cause uncommanded positive speed changes.

   **A.** *PowerFlex 700H* An “OverSpeed Limit” fault will occur if the speed reaches [Maximum Speed] + [Overspeed Limit]. If this condition is unacceptable, action should be taken to 1) limit supply voltages within the specification of the drive and, 2) limit fast positive input voltage changes to less than 10%. Without taking such actions, if this operation is unacceptable, the “adjust freq” portion of the bus regulator function must be disabled (see parameters 161 and 162).

   **B.** *PowerFlex 700S* An “Abs Overspd Det” fault will occur if the speed reaches [Rev Speed Limit] - [Abs OverSpd Lim] or [Fwd Speed Limit] + [Abs OverSpd Lim]. If this condition is unacceptable, action should be taken to 1) limit supply voltages within the specification of the drive and, 2) limit fast positive input voltage changes. Without taking such actions, if this operation is unacceptable, disable the bus regulator by setting parameter 414 [Brake/ Bus Cnfg], bit 3 “Bus Reg En” to zero (0).

2. Actual deceleration times can be longer than commanded deceleration times.

   **A.** *PowerFlex 700H* A “Decel Inhibit” fault is generated if the drive stops decelerating altogether. If this condition is unacceptable, the “adjust freq” portion of the bus regulator must be disabled (see parameters 161 and 162). The “Decel Inhibit” fault can be disabled by setting parameter 238 [Fault Config 1] bit 6 “Decel Inhib” to zero (0).

   **B.** *PowerFlex 700S* A “Vref Decel Fail” fault is generated if the drive stops decelerating altogether. If this operation is unacceptable, disable the bus regulator by setting parameter 414 [Brake/Bus Cnfg], bit 3 “Bus Reg En” to zero (0). This fault cannot be disabled in the PowerFlex 700S.

**Note:** For both drives, installing a properly sized dynamic brake resistor or external dynamic brake will provide equal or better performance in most cases.

**Important:** These faults are not instantaneous. Test results show they can take 2-12 seconds to occur.

# General Installation Information

## AC Supply Source Considerations

Frame 9 - 14 PowerFlex 700H and 700S drives are suitable for use on a circuit capable of delivering up to a maximum of 200,000 rms symmetrical amperes, and a maximum of 690 volts.

**ATTENTION:** To guard against personal injury and/or equipment damage caused by improper fusing or circuit breaker selection, use only the recommended line fuses/circuit breakers specified in Appendix A.

If a system ground fault monitor (RCD) is to be used, only Type B (adjustable) devices should be used to avoid nuisance tripping.

### Unbalanced, Ungrounded or Resistive Grounded Distribution Systems

If phase to ground voltage will exceed 125% of normal or the supply system is ungrounded, refer to *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives,* publication DRIVES-IN001…, for more information.

**ATTENTION:** PowerFlex 700H and 700S drives contain protective MOVs and common mode capacitors that are referenced to ground. These devices must be disconnected if the drive is installed on a resistive grounded distribution system or an ungrounded distribution system.

| If you are installing a... | refer to: |
|---|---|
| Frame 9 drive | Ungrounded, Unbalanced or High Resistive Ground Installations on page 6-4 |
| Frame 10 drive | Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations on page 7-9 |
| Frame 11 drive | Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations on page 8-9 |
| Frame 12 drive | Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations on page 9-9 |
| Frame 13 drive | Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations on page 10-5 |
| Frame 14 drive | Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations on page 11-9 |

## Single-Phase Input Power

The PowerFlex 700H and 700S drives are typically used with a three-phase input supply. The drives have been listed by UL to operate on single-phase input power with the requirement that the output current is derated by 80% of the three-phase ratings identified on pages A-5 to A-13.

## Input Power Conditioning

All AC input drives include an internal line reactor.

Certain events on the power system supplying a drive can cause component damage or shortened product life. These conditions are:

- The power system has power factor correction capacitors switched in and out of the system, either by the user or by the power company.
- The power source has intermittent voltage spikes in excess of 6000 volts. These spikes could be caused by other equipment on the line or by events such as lightning strikes.
- The power source has frequent interruptions.

If any or all of these conditions exist, it is recommended that the user install a minimum amount of impedance between the drive and the source. This impedance could come from the supply transformer itself, the cable between the transformer and drive or an additional transformer or reactor. The impedance can be calculated using the information supplied in the *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives*, publication DRIVES-IN001…

## Output Power Conditioning

Frame 14 drives can be ordered with or without output reactors (du/dt filters). The du/dt filter limits the rate of change of output voltage and the rate of change in the IGBT or output transistor switching event.

Refer to the *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives*, publication DRIVES-IN001…, for minimum inductance on installations where du/dt filters are not installed.

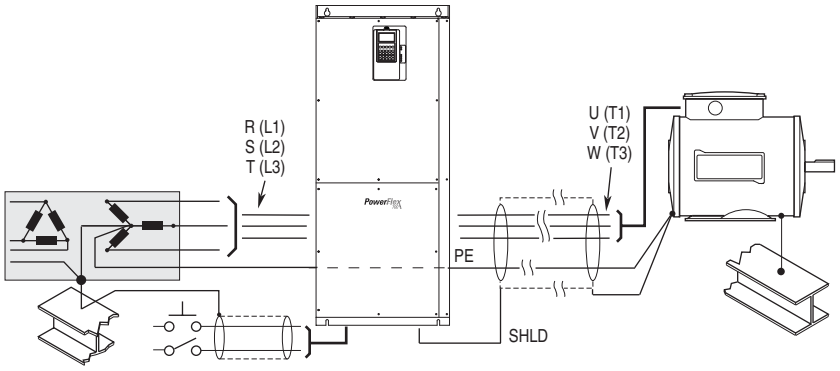
## General Grounding Requirements

### Safety Ground - PE

**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 1.A Typical Grounding**




### 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.

## Fuses and Circuit Breakers

Frame 9 - 14 drives can be installed with either input fuses or an input circuit breaker. National and local industrial safety regulations and/or electrical codes may determine additional requirements for these installations. Refer to Appendix A for recommended fuses/circuit breakers.

**ATTENTION:** Frame 9 - 14 PowerFlex drives do not provide branch short circuit protection. Specifications for recommended fuses to provide protection against short circuits are provided in Appendix A.

## Power Wiring

**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.

| If you are installing... | refer to: |
|---|---|
| a Frame 9 drive | Power Wiring on page 6-5 |
| a Frame 10 drive | Power Wiring on page 7-14 |
| a Frame 11 drive | Power Wiring on page 8-13 |
| a Frame 12 drive | Power Wiring on page 9-14 |
| a Frame 13 drive | Power Wiring on page 10-12 |
| a Frame 14 drive | Power Wiring on page 11-16 |

### Cable Types Acceptable for 200-690 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 (0.4mm/0.015 in.). Use Copper wire only. Wire gauge requirements and recommendations are based on 75° 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 PWM AC Drives*, publication DRIVES-IN001… for more information.

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 when the cable is mounted, it is recommended the armored cable have an overall PVC jacket (see Chapter 2, "Wire Types," of

*Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives*, publication DRIVES-IN001…).

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

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

**Table 1.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.<br>• Copper braid/aluminum foil combination shield and tinned copper drain wire.<br>• 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.<br>• 5 mil single helical copper tape (25% overlap min.) with three bare copper grounds in contact with shield.<br>• 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.<br>• Black sunlight resistant PVC jacket overall.<br>• Three copper grounds on #10 AWG and smaller. |

## EMC Compliance

Refer to EMC Instructions for details.

## Cable Trays and Conduit

If cable trays or large conduits are to be used, refer to guidelines presented in publication DRIVES-IN001… , *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives*.

**ATTENTION:** To avoid a possible shock hazard caused by induced voltages, unused wires in the conduit must be grounded at both ends. For the same reason, if a drive sharing a conduit is being serviced or installed, all drives using this conduit should be disabled. This will help minimize the possible shock hazard from “cross coupled” motor leads.

## EMC Instructions

### 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 this 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.

## 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 700H or 700S CE compatible Drive. For Frames 10 and up, 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 1-3.
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 1.C.

**Table 1.C PowerFlex EN61800-3 EMC Compatibility**

| Frame | Second Environment<br>*Restrict Motor Cable to 30 m (98 ft.)*<br>*Any Drive and Option* |
|---|---|
| 9 | ✔ |
| 10 | ✔ |
| 11 | ✔ |
| 12 | ✔ |
| 13 | ✔ |
| 14 | ✔ |

## Using Input/Output Contactors

### Input Contactor Precautions

**ATTENTION:** A contactor or other device that routinely disconnects and reapplies the AC line to the drive to start and stop the motor can cause drive hardware damage. The drive is designed to use control input signals that will start and stop the motor. If an input device is used, operation must not exceed one cycle per minute or drive damage will occur.

**ATTENTION:** The drive start/stop/enable control circuitry includes solid state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional hardwired stop circuit may be required to remove the AC line to the drive. An auxiliary braking method may be required.

### Output Contactor Precaution

**ATTENTION:** To guard against drive damage when using output contactors, the following information must be read and understood. One or more output contactors may be installed between the drive and motor(s) for the purpose of disconnecting or isolating certain motors/loads. If a contactor is opened while the drive is operating, power will be removed from the respective motor, but the drive will continue to produce voltage at the output terminals. In addition, reconnecting a motor to an active drive (by closing the contactor) could produce excessive current that may cause the drive to fault. If any of these conditions are determined to be undesirable or unsafe, an auxiliary contact on the output contactor should be wired to a drive digital input that is programmed as "Enable." This will cause the drive to execute a coast-to-stop (cease output) whenever an output contactor is opened.

## Common Bus/Precharge

The following information must be read and understood:

- DC input drives do not have an internal precharge. Therefore:
  - Precharge capability must be provided in the system to guard against possible damage, and
  - disconnect switches must not be used between the input of the drive and a common DC bus without the use of an external precharge device.

**Important:** Precharge circuitry is external to the drive.

### 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. Refer to Figure 1.1 on page 1-11 for additional information.

**Table 1.D X50 Terminal Block Connections**

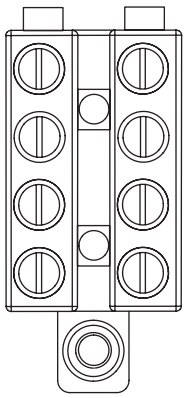
| X50 Terminal Block | Frame | Terminal | Description |
|---|---|---|---|
|  | 9 | 1 | Charge Relay Contact |
| | | 2 | Charge Relay Contact |
| | | 5 | Precharge Complete Signal (+24V DC) |
| | | 6 | Precharge Complete Signal (Common) |
| | 10, 11 & 13 | 3 | Charge Relay Contact |
| | | 4 | Charge Relay Contact |
| | | 1 | Precharge Complete Signal (+24V DC) |
| | | 2 | Precharge Complete Signal (Common) |
| | 12 & 14 | Power Module 1 | |
| | | 3 | Charge Relay Contact (Jumper to Power Module 2 Terminal 4) |
| | | 4 | Charge Relay Contact |
| | | 1 | Precharge Complete Signal (+24V DC) |
| | | 2 | Precharge Complete Signal (Common) |
| | | Power Module 2 | |
| | | 3 | Charge Relay Contact |
| | | 4 | Charge Relay Contact (Jumper to Power Module 1 Terminal 21) |
| | | 1 | Precharge Complete Signal (+24V DC) |
| | | 2 | Precharge Complete Signal (Common) |

**Table 1.E X50 Terminal Block Specifications**

| Wire Size Range[1] | | Torque |
|---|---|---|
| **Maximum** | **Minimum** | **Recommended** |
| 6.0 $mm^2$ (10 AWG) | 1.0 $mm^2$ (18 AWG) | 0.8 N•m (7.0 lb•in) |

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

**Table 1.F External Relay Contact Ratings**

| | |
|---|---|
| **Load** | Resistance load (cos $\phi$ = 1) |
| **Rated load** | 8 A at 250 VAC: 5 A at 30 VDC |
| **Rated carry current** | 8 A |
| **Max. switching voltage** | 250 VAC; 30 VDC, (400 VAC)[1] |
| **Max. switching current** | AC 8 A; DC 5 A |
| **Max. switching power** | 2,000 VA; 150 W |
| **Failure rate (reference value)** | 5 VDC 10 mA (for gold plating 0.35 µ min.) |

(1) P level: $\lambda 60 = 0.1 \times 10^{-6}$ operations

**Figure 1.1 Frame 9 Sample Precharge Wiring Diagram**

External precharge circuitry is shown as dashed lines.

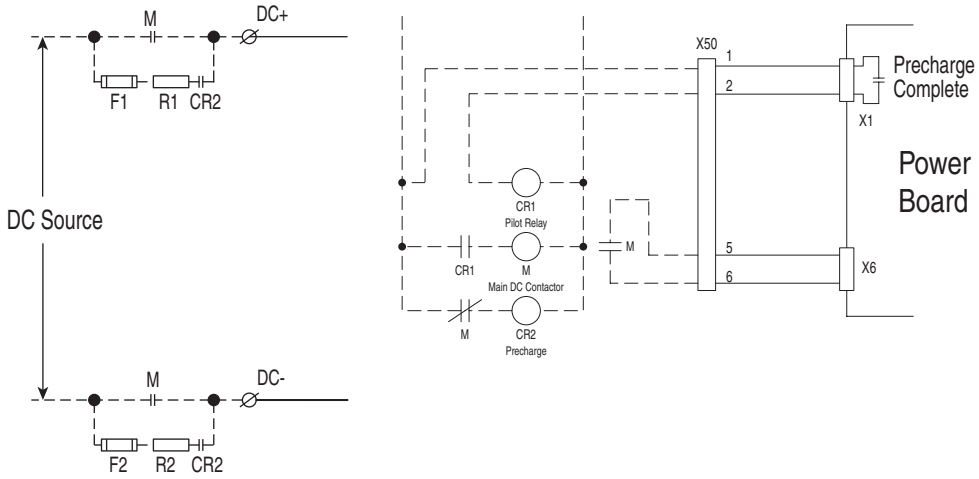



**Figure 1.2 Frames 10, 11 and 13 Sample Precharge Wiring Diagram**

External precharge circuitry is shown as dashed lines.

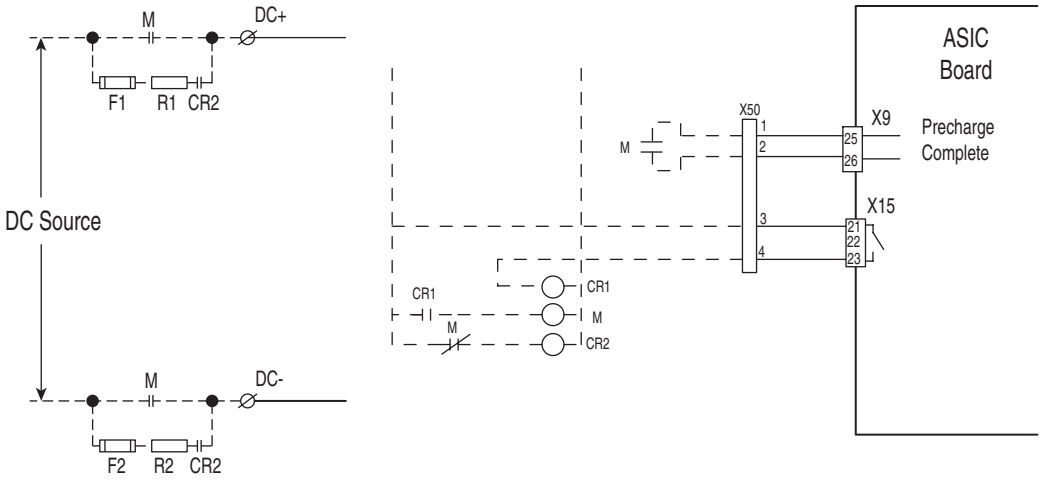


**Figure 1.3 Frames 12 and 14 Sample Precharge Wiring Diagram**

External precharge circuitry is shown as dashed lines.

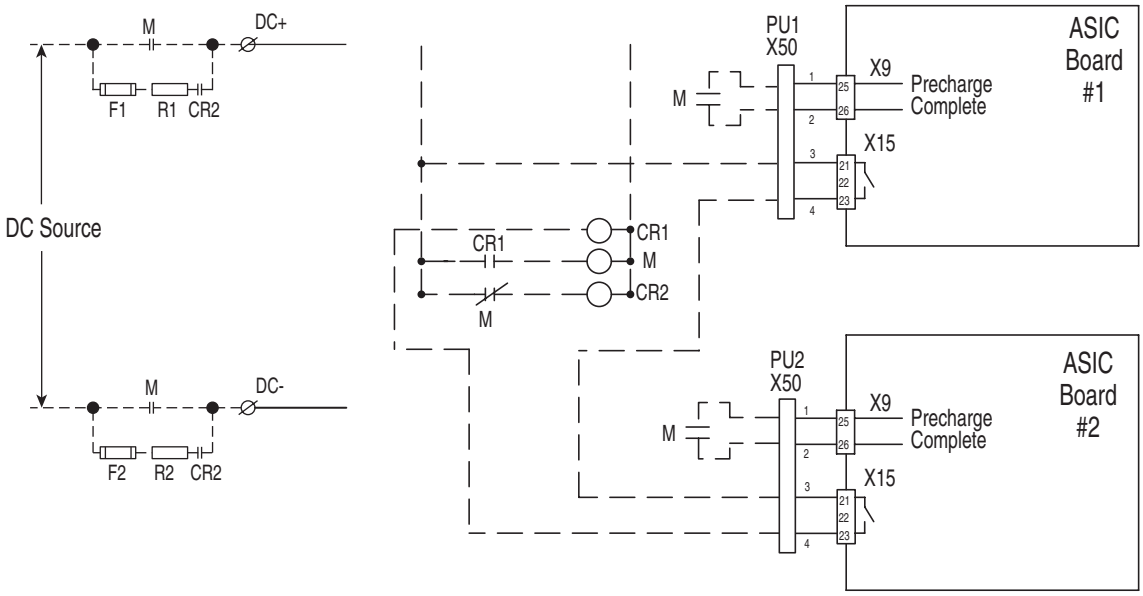
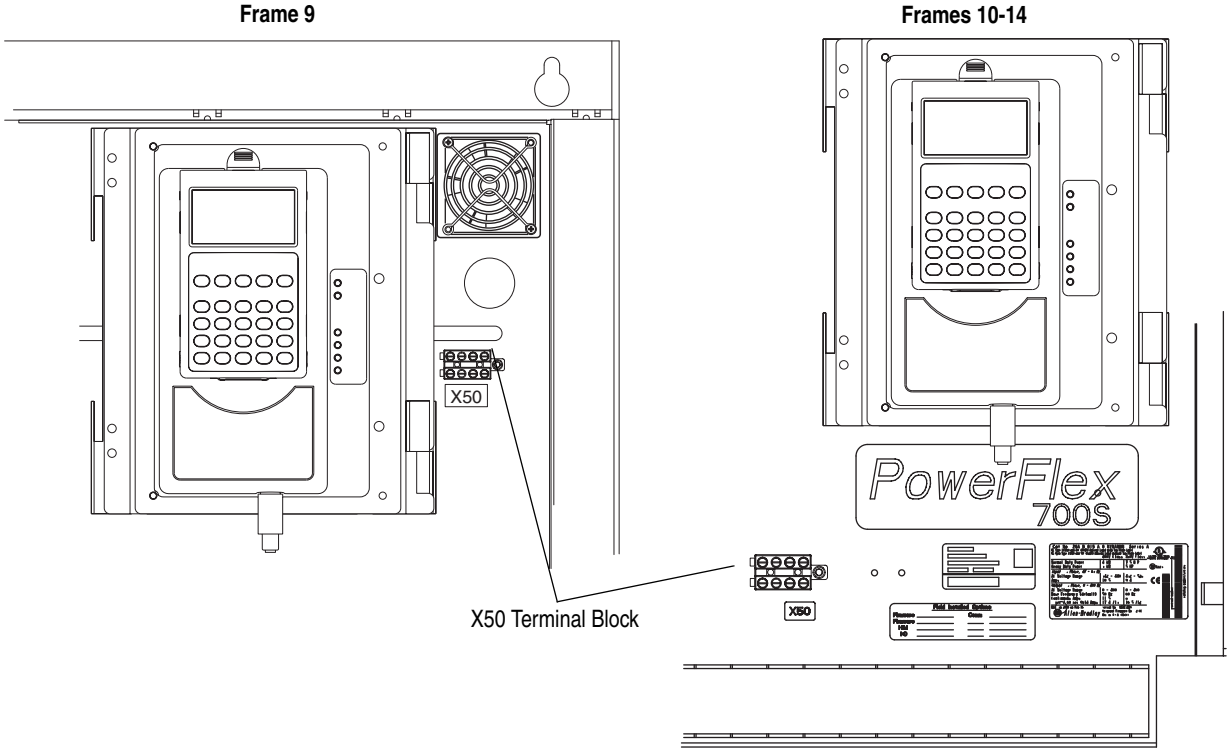



**Figure 1.4 Frame 9 - X50 Terminal Block Location**



# PowerFlex® 700H Control Wiring

Important points to remember about I/O wiring:

- Always use 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).

**Important:** Control (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:** Inputs must be configured with software and jumpers (see page 2-6). In addition, configuring an analog input for 0-20mA operation and driving it from a voltage source could cause component damage. Verify proper configuration prior to applying input signals.

**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.

## Signal and Control Wire Types

**Table 2.A Recommended Signal Wire**

| Signal Type | Wire Type(s) | Description | Minimum Insulation Rating |
|---|---|---|---|
| Analog I/O | Belden 8760/9460 (or equiv.) | 0.750 $mm^2$ (18 AWG), twisted pair, 100% shield with drain (1). | 300V, 75-90° C (167-194° F) |
| | Belden 8770 (or equiv.) | 0.750 $mm^2$ (18 AWG), 3 cond., shielded for remote pot only. | |
| EMC Compliance | Refer to EMC Instructions on page 1-7 for details. | | |

(1) 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.

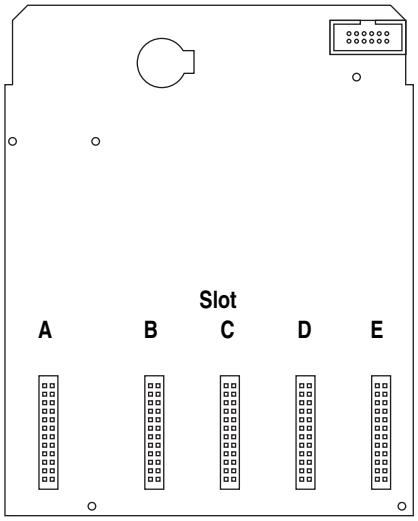
**Table 2.B Recommended Control Wire for Digital I/O**

| Type | Wire Type(s) | Description | Minimum Insulation Rating |
|---|---|---|---|
| Unshielded | Per US NEC or applicable national or local code | – | 300V, 60° C (140° F) |
| Shielded | Multi-conductor shielded cable such as Belden 8770 (or equiv.) | 0.750 $mm^2$ (18 AWG), 3 conductor, shielded. | |

## 700H Control Circuit Board Designations

The PowerFlex 700H control circuit board allows for a variety of I/O boards to be installed depending upon your application. Each option I/O circuit board is described below.

**Figure 2.1 PowerFlex 700H Control Circuit Board**




**Important:** The boards identified in the table below can only be installed in the designated slot. Boards and slots are not interchangeable.

**Table 2.C Control Board Slot Designations**

| Slot | Used for Circuit Board . . . | Part No. |
|---|---|---|
| A | 24V DC Digital Input with Analog I/O | 20C-DA1-A |
| | 115V AC Digital Input with Analog I/O | 20C-DA1-B |
| B | 24/115V Digital Output | 20C-DO1 |
| | 24V DC Digital Gate Disable option(1) | 20C-DG1 |
| C | (Not Used) | – |
| D | (Not Used) | – |
| E | DPI Option Board | 20C-DPI1 |

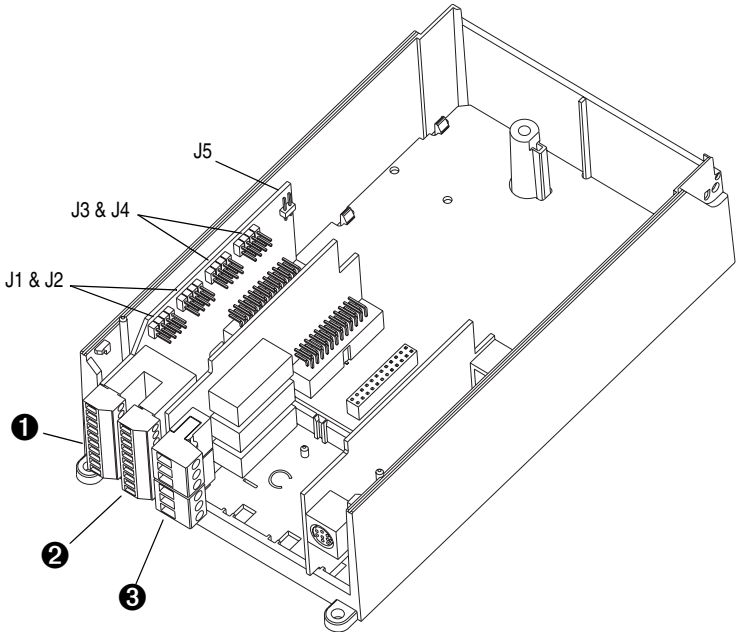
(1) Refer to Appendix F, Instructions for ATEX Approved PowerFlex 700H Drives in Group II Category (2) Applications with ATEX Approved Motors for more information on installing and configuring the Gate Disable option board.

### Drive Catalog Numbers for 700H Control I/O Board Options

The following codes are designated in position 15 of the drive catalog string to indicate the desired combination of 700H I/O option boards supplied with the drive:

| Code | Board in Slot A | Board in Slot B | Board in Slot E |
|---|---|---|---|
| A | 20C-DA1-A | 20C-DO1 | 20C-DPI1 |
| B | 20C-DA1-B | 20C-DO1 | 20C-DPI1 |
| G | 20C-DA1-A | 20C-DG1 | 20C-DPI1 |
| N | none | none | 20C-DPI1 |

**Figure 2.2 PowerFlex 700H I/O Terminal Blocks & Jumpers**




I/O Terminal Blocks and Jumpers

## I/O Terminal Blocks

**Table 2.D I/O Terminal Block Specifications**

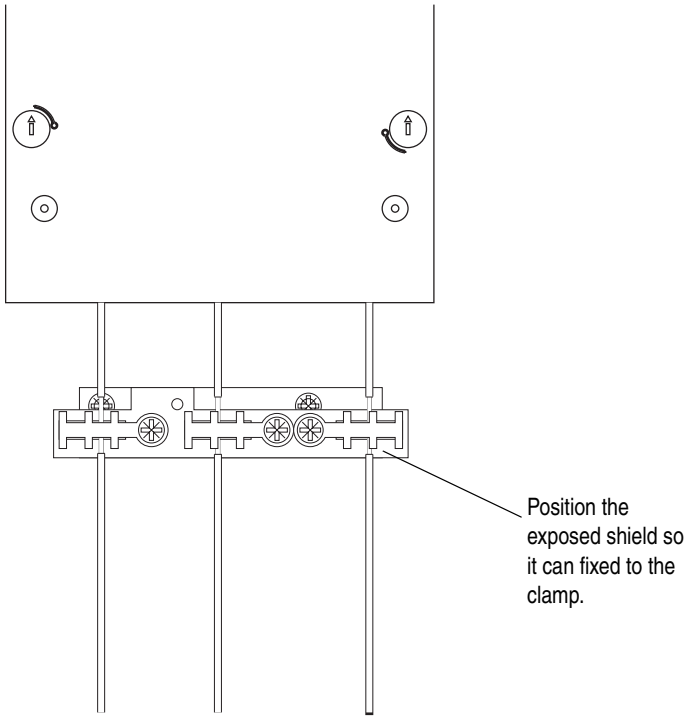
| No. | Name | Description | Wire Size Range[2] | | Torque | |
|---|---|---|---|---|---|---|
| | | | Maximum | Minimum | Maximum | Recommended |
| 1 | Analog I/O | Analog I/O Signals | 2.5 $mm^2$ (14 AWG) | 0.5 $mm^2$ (22 AWG) | 0.2 N-m 1.8 lb.-in. | 0.2 N-m 1.8 lb.-in. |
| 2 | Digital Inputs | Digital Input Signals | 2.5 $mm^2$ (14 AWG) | 0.5 $mm^2$ (22 AWG) | 0.2 N-m 1.8 lb.-in. | 0.2 N-m 1.8 lb.-in. |
| 3 | Digital Outputs[1] | Digital Out Relays | 2.5 $mm^2$ (14 AWG) | 0.5 $mm^2$ (22 AWG) | 0.5 N-m 4.5 lb.-in. | 0.5 N-m 4.5 lb.-in. |

(1) Refer to Appendix F, Instructions for ATEX Approved PowerFlex 700H Drives in Group II Category (2) Applications with ATEX Approved Motors for more information on installing and configuring the Gate Disable option board.

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

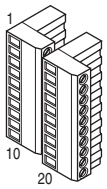
## I/O Cable Grounding

When installing shielded multi-conductor for analog and digital I/O, strip the cable at such a distance from the terminal plug so you can fix the shield to the cable clamp for grounding.




**Note**: This clamp is not designed for strain relief.

**Figure 2.3 I/O Terminal Designations**

| | No. | Signal | Factory Default | Description | Related Parameter(s) |
|---|---|---|---|---|---|
|  | 1 | Analog Input 1 (–)(1) | (2) | Isolated(3), bipolar, differential, 9 bit & sign, 88k ohm input impedance. A jumper (page 2-6) selects: 0-10V, ±10V, 4-20mA. Default: 0-10V (Ri =200k), 4-20mA (Ri=100 ohm). | 320 - 327 |
| | 2 | Analog Input 1 (+)(1) | | | |
| | 3 | Analog Input 2 (–)(1) | | | |
| | 4 | Analog Input 2 (+)(1) | | | |
| | 5 | –10V Pot Reference | – | 2k ohm minimum, 10 mA maximum load, 1% accuracy. | |
| | 6 | Pot Common (GND) | | For (+) and (–) 10V pot references. | |
| | 7 | +10V Pot Reference | – | 2k ohm minimum, 10mA maximum load, 1% accuracy. | |
| | 8 | Analog Output 1 (+) | (2) | Bipolar (current out is not bipolar), 9 bit & sign, 2k ohm minimum load. A jumper (see page 2-6) selects: 0-10V, ±10V, 4-20mA. | 340 - 347 |
| | 9 | Analog Output Common | | | |
| | 10 | Analog Output 2 (+) | | | |
| | 11 | Digital Input 1 | Stop - CF | 115V ac, 50/60 Hz - Opto isolated<br>Low State: less than 30V ac<br>High State: greater than 40V ac<br>24V dc - Opto isolated (250V)<br>Low State: less than 5V dc<br>High State: greater than 20V dc<br>11.2 mA DC<br>Enable: Digital Input 6 is jumper selectable for HW Enable.<br>On-Time: < 16.7ms, Off-Time < 1ms | 361 - 366 |
| | 12 | Digital Input 2 | Start | | |
| | 13 | Digital Input 3 | Auto/Man | | |
| | 14 | Digital Input 4 | Speed Sel 1 | | |
| | 15 | Digital Input 5 | Speed Sel 2 | | |
| | 16 | Digital Input 6/Hardware Enable, see pg. 2-6 | Speed Sel 3 | | |
| | 17<br>18 | Digital Input Common | | Allows source or sink operation. Terminals 17/18 & 19 can also be used to provide backup power to DPI and control devices. | |
| | 19 | +24VDC (4) | – | Drive supplied logic input power. | |
| | 20 | 24V Common(4) | – | Common for internal power supply. | |
|  | 21 | Digital Output 1 – N.C. (5) | Fault | Max. Resistive Load:<br>240V ac/30V dc – 1200VA, 150W<br>Max. Current: 5A, Min. Load: 10mA<br>Max. Inductive Load:<br>240V ac/30V dc – 840VA, 105W<br>Max. Current: 3.5A, Min. Load: 10mA | 380 - 391 |
| | 22 | Digital Output 1 Common | | | |
| | 23 | Digital Output 1 – N.O. (5) | NOT Fault | | |
| | 24 | Digital Output 2 – N.C. (5) | NOT Run | | |
| | 25 | Digital Output 2/3 Com. | | | |
| | 26 | Digital Output 3 – N.O. (5) | Run | | |

(1) **Important:** Input must be configured with a jumper. Drive damage may occur if jumper is not installed properly. Refer to page 2-6.

(2) These inputs/outputs are dependant on a number of parameters (see “Related Parameters” column in table).

(3) Differential Isolation - External source must be maintained at less than 160V with respect to PE. Input provides high common mode immunity.

(4) 150mA maximum load. Not present on 115V versions. Can be used to provide control power from an external 24V source when main power is not applied. Refer to page 2-6.

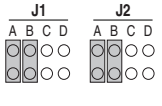
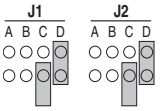
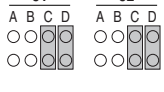
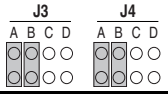
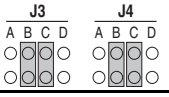
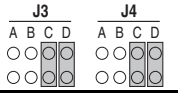
(5) Contacts in un-powered state. Any relay programmed as Fault or Alarm will energize (pick up) when power is applied to drive and de-energize (drop out) when a fault or alarm exists. Relays selected for other functions will energize only when that condition exists and will de-energize when condition is removed.

## Analog I/O Configuration

**Important:** Analog I/O must be configured through programming, as well as the jumpers shown below. Refer to publication 20C-PM001…, *PowerFlex 700H Adjustable Frequency AC Drive - Programming Manual.*

Refer to Figure 2.2 on page 2-3 for the location of the jumpers indicated in the table below.

**Table 2.E I/O Configuration**

| Signal | Jumper | Setting | | |
|---|---|---|---|---|
| Analog Inputs | J1 (Analog In 1)<br>J2 (Analog In 2) | 0-20 mA | 0-10V | ±10V |
| | |  |  |  |
| Analog Outputs | J3 (Analog Out 1)<br>J4 (Analog Out 2) | 0-20 mA | 0-10V | ±10V |
| | |  |  |  |

## Hardware Enable Circuitry

By default, the user can program a digital input as an Enable input. The status of this input is *interpreted by drive software*. If the application requires the drive to be disabled *without* software interpretation, a "dedicated" hardware enable configuration can be utilized. This is done by removing jumper J5 and wiring the enable input to "Digital In 6" (see below). Verify that parameter 366 [Digital In6 Sel] is set to "1 - Enable".

**Table 2.F Hardware Enable Configuration**

| Signal | Jumper | Setting | |
|---|---|---|---|
| Hardware Enable | J5 | Hardware Enable | Input Programmable (No Hardware Enable) |
| | |  |  |

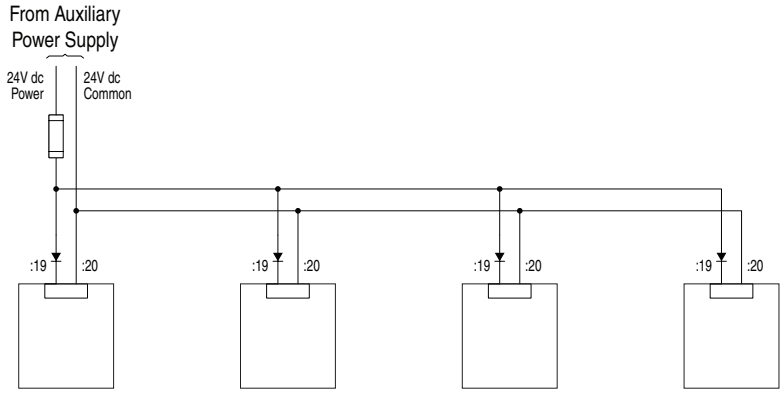
## Auxiliary Power Supply

You may use an auxiliary power supply to keep the 700H Control Unit energized, when input power is de-energized. This provides back-up power for the Control Unit and is sufficient for setting parameters. Connect 24V dc power to pin 19 and 24V dc common to pin 20 of the 24V dc version of the I/O card.

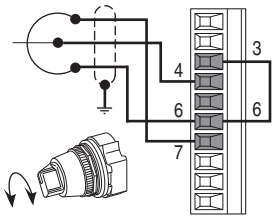
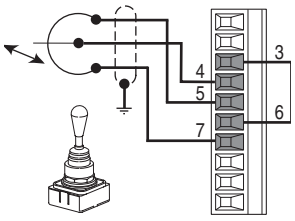
### Auxiliary Power Supply Specifications

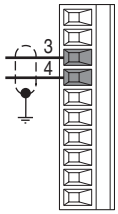
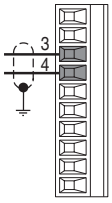
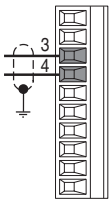
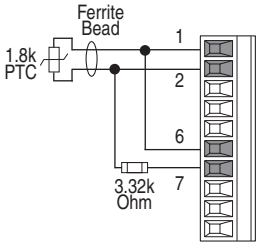
| Voltage | Current (Min) | Current (Max) |
|---|---|---|
| 24V dc ± 15% | 150 mA | 250 mA |

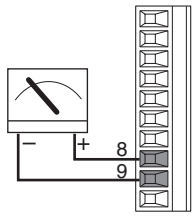
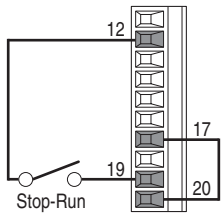
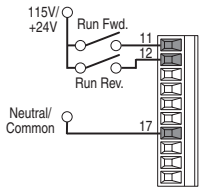
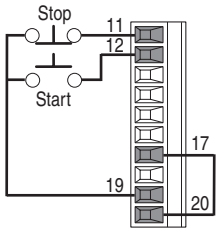
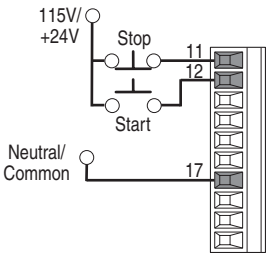
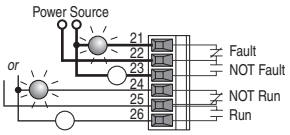
If 24V terminals of several drives are connected in parallel, we recommend using a diode circuit to block current flow in the opposite direction. Reverse current flow could damage the Control Board.

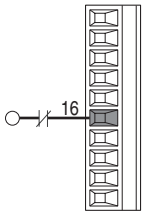



## I/O Wiring Examples

| Input/Output | Connection Example | Required Parameter Changes |
|---|---|---|
| **Potentiometer Unipolar Speed Reference**(1)<br>10k Ohm Pot.<br>Recommended<br>(2k Ohm Minimum) |  | • Set I/O configuration (refer to Analog I/O Configuration on page 2-6).<br>• Adjust Scaling: Parameters 91 [Speed Ref A Hi] / 92 [Speed Ref A Lo] and 325 [Analog In 2 Hi] / 326 [Analog In 2 Lo]<br>• View Results: Parameter 002 [Commanded Speed] |
| **Joystick Bipolar Speed Reference**(1)<br>±10V Input |  | • Set I/O configuration (refer to Analog I/O Configuration on page 2-6).<br>• Set parameter 190 [Direction Mode] = 1 “Bipolar”<br>• Adjust Scaling: Parameters 91 [Speed Ref A Hi] / 92 [Speed Ref A Lo] and 325 [Analog In 2 Hi] / 326 [Analog In 2 Lo]<br>• View Results: Parameter 002 [Commanded Speed] |

| Input/Output | Connection Example | Required Parameter Changes |
|---|---|---|
| **Analog Input Bipolar Speed Reference**<br>±10V Input |  | • Set I/O configuration (refer to Analog I/O Configuration on page 2-6).<br>• Set parameter 190 [Direction Mode] = 1 “Bipolar”<br>• Adjust Scaling:<br>Parameters 91 [Speed Ref A Hi] / 92 [Speed Ref A Lo] and 325 [Analog In 2 Hi] / 326 [Analog In 2 Lo]<br>• View Results:<br>Parameter 002 [Commanded Speed] |
| **Analog Voltage Input Unipolar Speed Reference**<br>0 to +10V Input |  | • Set I/O configuration (refer to Analog I/O Configuration on page 2-6).<br>• Configure Input with parameter 320 [Anlg In Config]<br>• Adjust Scaling:<br>Parameters 91 [Speed Ref A Hi] / 92 [Speed Ref A Lo] and 325 [Analog In 2 Hi] / 326 [Analog In 2 Lo]<br>• View Results:<br>Parameter 002 [Commanded Speed] |
| **Analog Current Input Unipolar Speed Reference**<br>4-20 mA Input |  | • Set I/O configuration (refer to Analog I/O Configuration on page 2-6).<br>• Configure Input for Current:<br>Parameter 320 [Anlg In Config] and add jumper at appropriate terminals<br>• Adjust Scaling:<br>Parameters 91 [Speed Ref A Hi] / 92 [Speed Ref A Lo] and 325 [Analog In 2 Hi] / 326 [Analog In 2 Lo]<br>• View Results:<br>Parameter 002 [Commanded Speed] |
| **Analog Input, PTC 0-10V Input**<br>PTC OT set > 5V<br>PTC OT cleared < 5V<br>PTC Short < 0.2V |  | • Set I/O configuration (refer to Analog I/O Configuration on page 2-6).<br>• Configure Analog Input for PTC function:<br>Set parameter 259 [Alarm Config 1] bit 14 “PTC Config” = Enabled<br>• Configure Analog Input for Fault when input goes below 0.2V:<br>Set parameter 324 [Analog In 1 Loss] = 1 “Fault”<br>• Enable Fault:<br>Set parameter 238 [Fault Config 1] bit 7 “Motor Therm” = Enabled<br>• Enable Alarm:<br>Set parameter 259 [Alarm Config 1], bit 11 “Motor Therm” = Enabled |

| Input/Output | Connection Example | Required Parameter Changes |
|---|---|---|
| **Analog Output**<br>±10V, 4-20 mA Bipolar<br>+10V Unipolar<br>*(shown)* |  | • Set I/O configuration (refer to Analog I/O Configuration on page 2-6).<br>• Configure with Parameter 340 [Anlg Out Config]<br>• Select Source Value: Parameter 384 [Digital Out1 Sel]<br>• Adjust Scaling: Parameters 343 [Analog Out1 Hi] / 344 [Analog Out1 Lo] |
| **2-Wire Control Non-Reversing**(2)<br>24V dc internal supply |  | • Disable Digital Input:#1: Parameter 361 [Digital In1 Sel] = 0 "Not Used"<br>• Set Digital Input #2: Parameter 362 [Digital In2 Sel] = 7 "Run"<br>• Set Direction Mode: Parameter 190 [Direction Mode] = 0 "Unipolar" |
| **2-Wire Control Reversing**(2)<br>External supply<br>(I/O Board dependent) |  | • Set Digital Input:#1: Parameter 361 [Digital In1 Sel] = 8 "Run Forward"<br>• Set Digital Input #2: Parameter 362 [Digital In2 Sel] = 9 "Run Reverse" |
| **3-Wire Control**<br>Internal supply |  | • No Changes Required |
| **3-Wire Control**<br>External supply<br>(I/O Board dependent).<br>Requires 3-wire functions only ([Digital In1 Sel]).<br>Using 2-wire selections will cause a type 2 alarm. |  | • No Changes Required |
| **Digital Output**<br>Relays shown in powered state with drive faulted. See page 2-5.<br>2 relays at terminals 24-26. |  | • Select Source to Activate: Parameters 380 [Digital Out1 Sel] / 384 [Digital Out2 Sel] |

| Input/Output | Connection Example | Required Parameter Changes |
|---|---|---|
| **Enable Input** |  | • Configure with parameter 366 [Digital In6 Sel]<br>For dedicated hardware Enable: Remove Jumper J5 (see page 2-6) |

(1) Refer to the Attention statement on page 2-1 for important bipolar wiring information.

(2) **Important:** Programming inputs for 2 wire control deactivates all HIM Start buttons unless parameter 192 [Save HIM Ref], bit 1 "Manual Mode" = "1." This will allow the HIM to control Start and Jog.

## Reference Control

### "Auto" Speed Sources

The drive speed command can be obtained from a number of different sources. The source is determined by drive programming and the condition of the Speed Select digital inputs, Auto/Manual digital inputs or reference select bits of a command word.

The default source for a command reference (all speed select inputs open) is the selection programmed in parameter 90 [Speed Ref A Sel]. If any of the speed select inputs are closed, the drive will use other parameters as the speed command source.

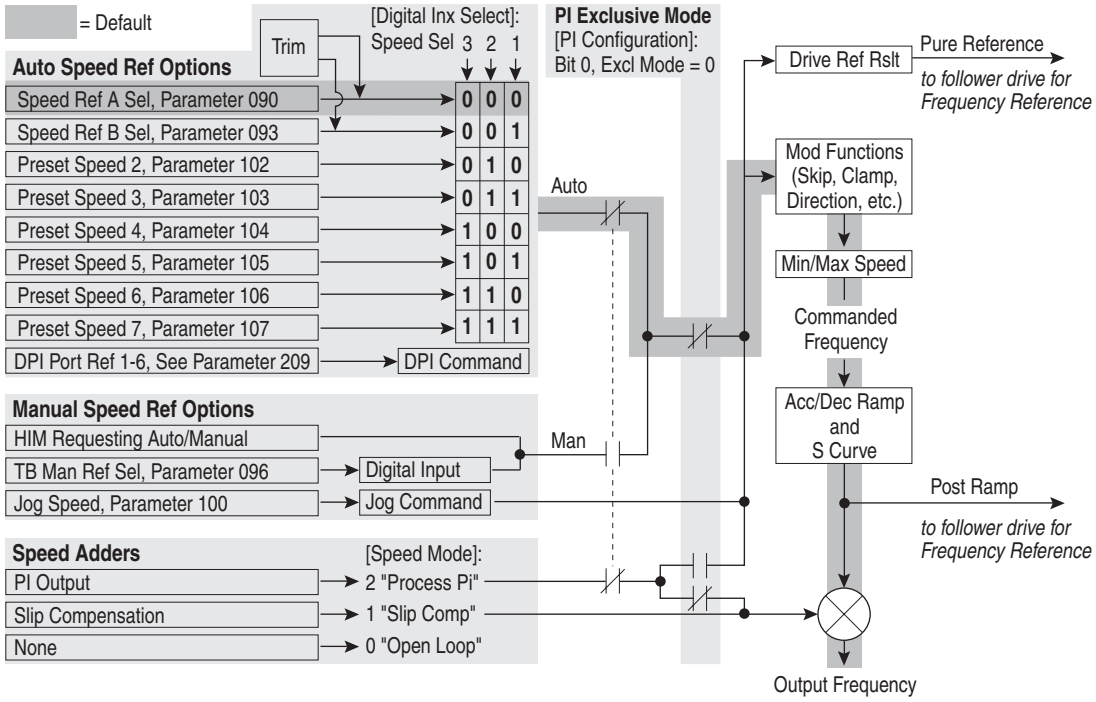
### "Manual" Speed Sources

The manual source for speed command to the drive is either the HIM requesting manual control or the control terminal block (analog input) if a digital input is programmed to "Auto/Manual."

### Changing Speed Sources

The selection of the active Speed Reference can be made through digital inputs, DPI command, jog button or Auto/Manual HIM operation.

**Figure 2.4 Speed Reference Selection Chart(1)**




## Auto/Manual Examples

### PLC = Auto, HIM = Manual

A process is run by a PLC when in Auto mode and requires manual control from the HIM during set-up. The Auto speed reference is issued by the PLC through a communications module installed in the drive. Since the internal communications is designated as Port 5, [Speed Ref A Sel] is set to "DPI Port 5" with the drive running from the Auto source.

#### Attain Manual Control

- Press ALT then Auto/Man on the HIM.
  When the HIM attains manual control, the drive speed command comes from the HIM speed control keys or analog potentiometer.

#### Release to Auto Control

- Press ALT then Auto/Man on the HIM again.
  When the HIM releases manual control, the drive speed command returns to the PLC.

(1) To access Preset Speed 1, set parameter 090 or 093 to "Preset Speed 1."

## PLC = Auto, Terminal Block = Manual

A process is run by a PLC when in Auto mode and requires manual control from an analog potentiometer wired to the drive terminal block. The auto speed reference is issued by the PLC through a communications module installed in the drive. Since the internal communications is designated as Port 5, [Speed Ref A Sel] is set to "DPI Port 5" with the drive running from the Auto source. Since the Manual speed reference is issued by an analog input ("Analog In 1 or 2"), parameter 96 [TB Man Ref Sel] is set to the same input. To switch between Auto and Manual, parameter 364 [Digital In4 Sel] is set to "Auto/ Manual".

### Attain Manual Control

- Close the digital input.
  With the input closed, the speed command comes from the pot.

### Release to Auto Control

- Open the digital input.
  With the input open, the speed command returns to the PLC.

## Auto/Manual Notes

1. Manual control is exclusive. If a HIM or Terminal Block takes manual control, no other device can take manual control until the controlling device releases manual control.
2. If a HIM has manual control and power is removed from the drive, the drive will return to Auto mode when power is reapplied.
3. Parameter 192 [Save HIM Ref] can enable manual mode to allow starts and jogs from the HIM in 2-wire mode.

# Control Wiring for PowerFlex 700S Drives with Phase I Control

## I/O Wiring

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 limited to a 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 3.A 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. | |

| Type | | Wire Type(s) | Description | Insulation Rating |
|---|---|---|---|---|
| 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 Instructions on page 1-7 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.

## 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 the connections.

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.

**Table 3.B Main Control Board I/O Terminal Locations**

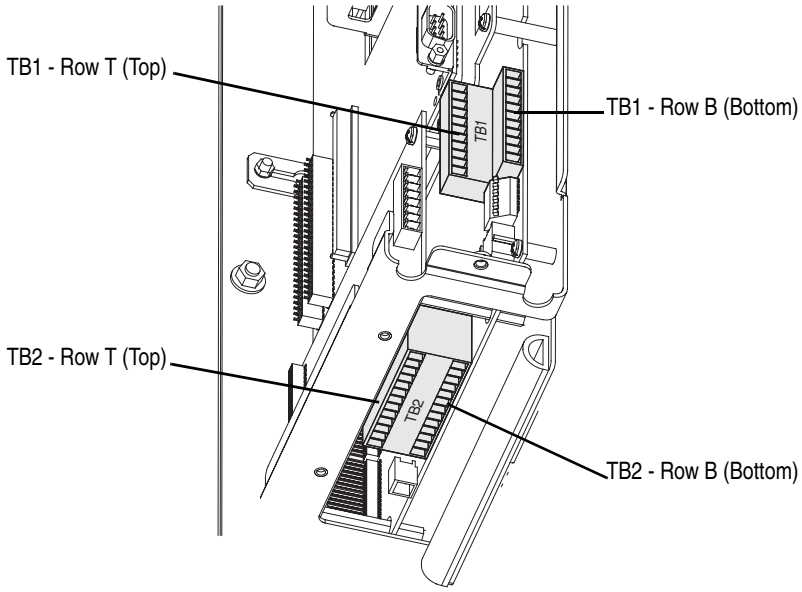
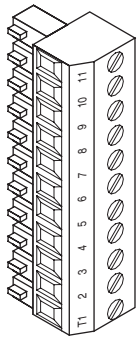



**Table 3.C Main Control Board I/O Terminal Block Specifications**

| | | 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) | 0.14 $mm^2$ (28 AWG) | 0.25 N-m (2.2 lb.-in.) | 0.22 N-m (1.9 lb.-in.) |

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

**Table 3.D TB1 - Row T (Top) Terminals**




| Terminal | Signal | Description | Related Parameter |
|---|---|---|---|
| T11 | Power Supply 24V dc Return (-) | Power and common for precharge 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<br><br>Default = Precharge | For common DC bus drives. Must be high, for drive to complete the precharge cycle. Load: 20 mA at 24V dc. | 824, 826, 827, 828, 829, 838 |
| 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. | 824, 843, 844 |
| T5 | Digital Output 2 | 24V dc open collector (sinking logic) output. Rating: 25 mA maximum. | 824, 845, 846 |
| 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. Refer to Appendix A, “Supplemental Information”, in publication 20D-UM001..., *User Manual - PowerFlex 700S High Performance AC Drive, Phase I Control*, for approved motors. | 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.

**Figure 3.1 TB1 - Row T (Top) Wiring Examples**

The following definitions are used throughout this section:

**Source**

A. Apply positive voltage through the device to the input or output.

B. Connect the input or output common (return) directly to the power supply common.

**Sinking**

A. Apply the positive voltage directly to the input or output common (return).

B. Connect the input or output to the power supply common through the device

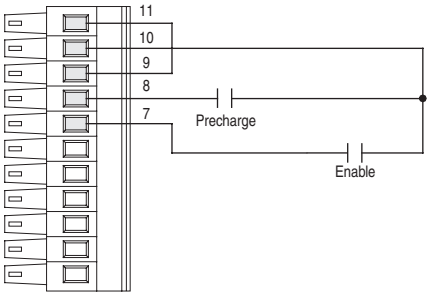
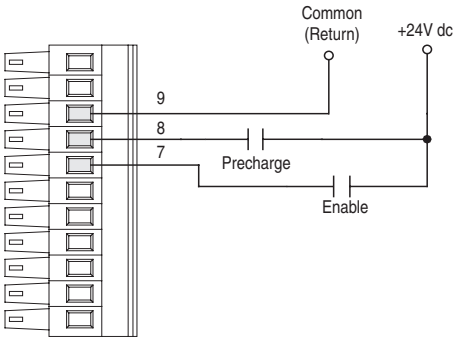
| Input/Output | Connection Example | Required Parameter Changes |
|---|---|---|
| Digital Inputs used for enable and precharge control.<br><br>*Note:*<br>**24V dc Supply** - supports only on-board digital inputs. Do not use for circuits outside the drive. | Sourcing Precharge and Enable Inputs - using internal power supply<br>  <br>Sourcing Precharge and Enable Inputs - using external power<br>  | **Enable** - In a sourcing configuration, this circuit must connect to a 24V dc power for the drive to run.<br><br>**Precharge**<br>Precharge control is used in common bus configurations and is not required for AC fed drives.<br><br>If precharge control is not required, reprogram Par 838 [DigIn1 Sel] to a value of zero or replace the contact shown with a jumper from terminal 8 to terminal 10.<br><br>If precharge is needed, in sourcing configuration, this circuit must connect to 24V dc power for the drive to complete the precharge cycle. |

**Figure 3.1 TB1 - Row T (Top) Wiring Examples**

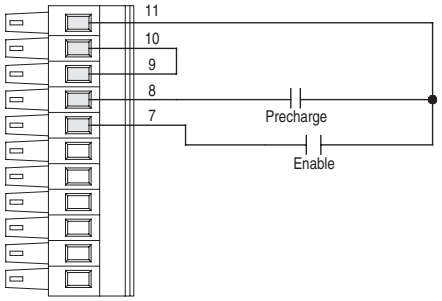
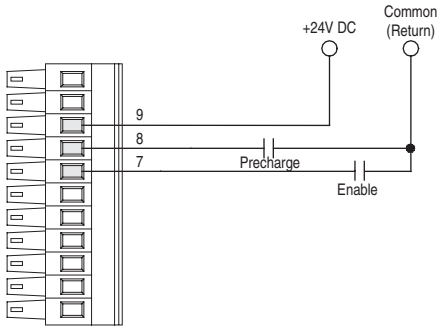
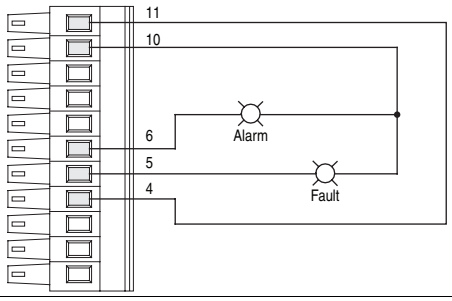
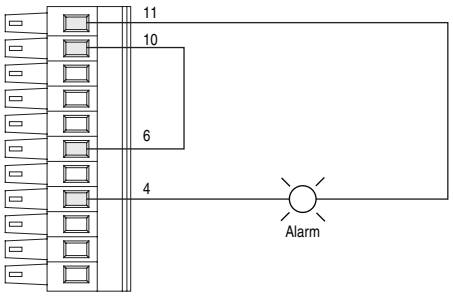
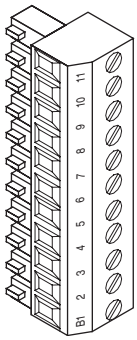
| Input/Output | Connection Example | Required Parameter Changes |
|---|---|---|
| | Sinking Precharge and Enable Inputs - using internal power supply<br>  | **Enable** - In a sinking configuration, this circuit must connect to a 24V dc return for the drive to run.<br><br>**Precharge**<br>Precharge control is used in common bus configurations and is not required for AC fed drives.<br><br>If precharge control is not required, reprogram Par 838 [DigIn1 Sel] to a value of zero or replace the contact shown with a jumper from terminal 8 to terminal 11.<br><br>If precharge is needed, in sinking configuration, this circuit must connect to a 24V dc return for the drive to complete the precharge cycle. |
| | Sinking Precharge and Enable Inputs - using external power supply<br>  | |
| **Digital Outputs** - 24V dc outputs 25 mA maximum per output. | Digital Output 1 Indicating Alarm and Digital Output 2 Indicating Fault - in sourcing configuration<br>  | **Example: Using Digital Outputs 1 and 2 to Annunciate Alarms and Faults**<br>• Link Parameter 155 [Logic Status], the source, to Parameter 843 [DigOut 1 Data], the sink<br>• Set Parameter 844 [DigOut 1 Bit] to a value of 8, so that parameter 155 [Logic Status], bit 8 “Alarm” will control the output<br>• Link Parameter 155 [Logic Status], the source, to Parameter 845 [DigOut 2 Data], the sink<br>• Set Parameter 846 [DigOut 2 Bit] to a value of 7, so that Parameter 155 [Logic Status], bit 7 “Faulted” will control the output |
| **Digital Output** - 24V dc output 25 mA maximum per output.<br><br>If one output is configured in sinking, the other output is not available. | Digital Output 1 Indicating Alarm Fault - in sinking configuration<br>  | **Example: Using Digital Output 1 to Annunciate Alarms**<br>• Link Parameter 155 [Logic Status], the source, to Parameter 843 [DigOut 1 Data], the sink<br>• Set Parameter 844 [DigOut 1 Bit] to a value of 8, so that Parameter 155 [Logic Status], bit 8 “Alarm” will control the output |

**Table 3.E 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, 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, 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. | 812, 814, 815, 817, 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. | 813, 819, 820, 822, 823, |
| B2 | Analog Output 2 Return (-) | | |
| B1 | Analog Output Shield | Optional connection point for analog shields. | |

(1) Refer to Analog Input Settings on page 3-17 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.

**Figure 3.2 TB1 - Row B (Bottom) Wiring Examples**

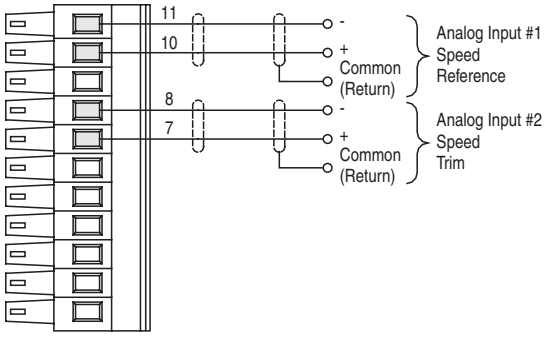
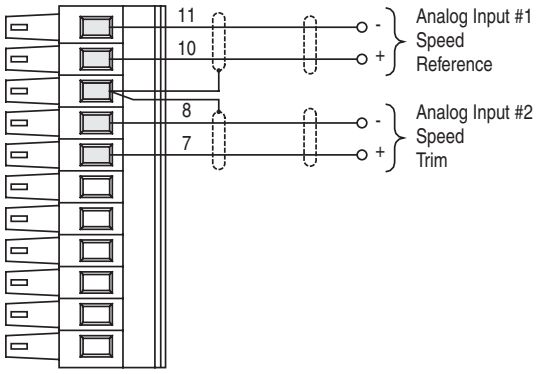
| Input/Output | Connection Example | Required Parameter Changes |
|---|---|---|
| **Analog Inputs**<br>+/-10V dc or +/-1.0V dc (DIP switch selectable)<br>Terminate shields at the analog source if analog common is available<br><br>Used for Speed Reference and Speed Trim | Analog Inputs for Speed Reference and Speed Trim - shield terminated at the source<br>  <br>Analog Inputs for Speed Reference and Speed Trim - shield terminated at the drive<br>  | **Example: Using Analog Input 1 as 0-10V speed reference**<br>• Adjust Parameter 803 [Anlg In1 Offset] so that the minimum analog signal creates the minimum speed reference (if the minimum input is 0V dc and the minimum speed reference is zero, enter a value of zero)<br>• Adjust Parameter 802 [Anlg In1 Scale] so that the maximum analog signal creates the maximum speed reference (if the maximum input is 10V dc and the maximum speed reference is motor base speed, enter a value of 0.1)<br>• Send the data to the Speed Reference parameter Par 10 [Speed Ref 1] (the destination) linked to Par 800 [Anlg In1 Data] (the source)<br>• Select 1 - “Spd Ref 1” as the active speed ref in Par 16 [Speed Ref Sel]<br>• In Par 153 [Control Options] set bit 0 “Bipolar SRef” = 1<br>**Example: Using Analog Input 2 as -10 to +10V speed trim @ 10%:**<br>• Adjust Parameter 809 [Anlg In2 Offset] so that the minimum analog signal creates the minimum speed trim (if the minimum input is 0V dc and the minimum trim is zero, enter a value of zero)<br>• Adjust Parameter 808 [Anlg In2 Scale] so that the maximum analog signal creates the maximum speed trim (if the maximum input is 10V dc and the maximum speed trim is 10%, enter a value of 0.01)<br>• Send the data to the Par 12 [Speed Ref 2] (the destination) linked to Par 806 [Anlg In2 Data] (the source)<br>• Use Par 10 [Spd Ref 1] as the active speed reference and Par 12 [Spd Ref 2] as the speed trim. Set Par 16 [Speed Ref Sel] = 3 - “Spd Ref 3” |

**Figure 3.2 TB1 - Row B (Bottom) Wiring Examples**

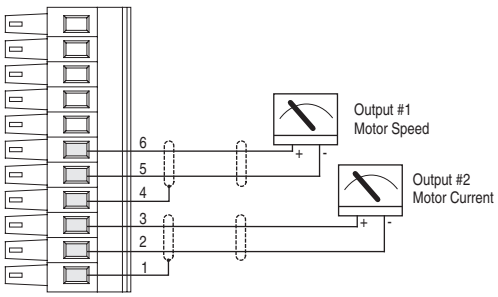
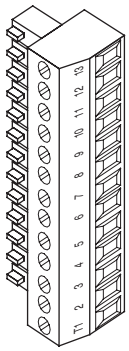
| Input/Output | Connection Example | Required Parameter Changes |
|---|---|---|
| **Analog Outputs**<br>+/-10V dc or +/-1.0V dc<br><br>Used to drive analog meters displaying speed and current | Analog Outputs Indicating Motor Speed and Motor Current<br>  <br> | **Example: Using Analog Output 1, -10V to +10V to meter Motor RPM and direction:**<br>• Adjust Parameter 812 [Anlg Out1 Offset] so that minimum speed creates a minimum signal (if the minimum speed is zero and the minimum signal is zero, enter a zero)<br>• Adjust Parameter 817 [Anlg Out1 Scale] so that the maximum speed creates a maximum signal (if the maximum speed is 100% of motor base speed and the maximum signal is 10V dc, enter a value of 0.1)<br>• Send the data to the Analog Output: Par 815 [Anlg Out1 Real] (the destination) linked to Par 300 [Motor Spd Fdbk] (the source)<br>**Example: Using Analog Output 2, -10V to +10V to meter Motor Current**<br>• Adjust Parameter 813 [Anlg Out2 Offset] so that minimum current creates a minimum signal (if the minimum current is zero and the minimum signal is zero, enter a zero)<br>• Adjust Parameter 822 [Anlg Out2 Scale] so that the maximum current creates a maximum signal (if the maximum current is 200% of motor NP FLA and the maximum signal is 10V dc, enter a value of 2.0)<br>• Send the data to the Analog Output Par 820 [Anlg Out2 Real] (the destination) linked to Par 308 [Output Current] (the source)<br>• Scale the Output to the source parameter Par 822 [Anlg Out2 Scale] = xx (Par2 [Motor NP FLA]/10V Output) |

**Table 3.F 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 Maximum input frequency for Encoders 0 & 1 is 500 kHz. | 222, 230, 231, 232, 233, 234, 235, 236, 237, 238 |
| | 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, 830, 831, 832, 833, 839 |
| | T5 | Digital Input #2 Return | | |
| | T4 | Digital Input #3 | High speed 12-24V dc sinking digital input. | 824, 834, 835, 836, 837, 840 |
| | T3 | Digital Input #3 Return | | |
| | T2 | Power Supply +12V dc (A) (+) | 5/12V dc power supply for primary encoder interface and high speed inputs. Rating 300 mA(2) (3) | |
| | T1 | Power Supply +12V dc Return (A) (-) | | |

(1) Refer to Encoder Input Settings on page 3-17 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.

(3) To enable 5V supply, set Jumper J6 (located in the Main Control Board) to positions T2 and T3. Default 12V supply is set to T1 and T2.

**Figure 3.3 TB2 - Row T (Top) Wiring Examples**

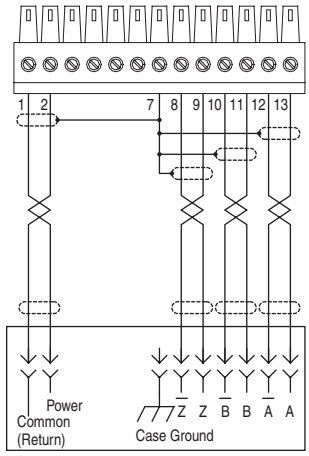
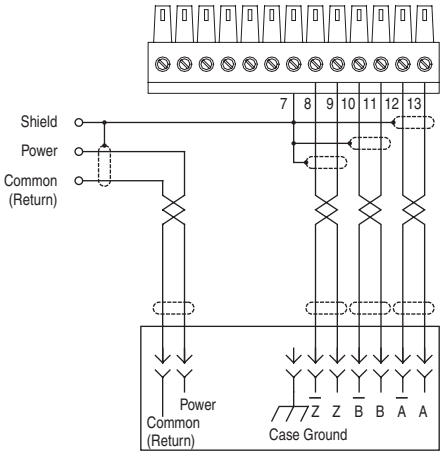
| Input/Output | Connection Examples | Required Parameter Changes |
|---|---|---|
| **Primary Encoder Interface** - Supports 12V dc differential encoders with internal power supply.<br><br>5V dc differential encoders may require external power supply and special jumper settings. Refer to Main Control Board I/O and Encoder Settings on page 3-17 for external power supply and jumper settings.<br><br>For 5V dc differential encoders with internal power supply, set Jumper J6 to positions T2 and T3. | Primary Encoder - using internal power supply<br>  <br>Primary Encoder - using external power supply<br>  | **Example: Using Encoder 0 for Primary Motor Speed Feedback**<br>• Set the value of Parameter 222 [Motor Fdbk Sel] to a value of 0 - “Encoder 0”, so the drive will use this encoder as the primary motor speed feedback device.<br>• Set the value of Parameter 232 [Encoder0 PPR] to match the encoder’s resolution. |

**Figure 3.3 TB2 - Row T (Top) Wiring Examples**

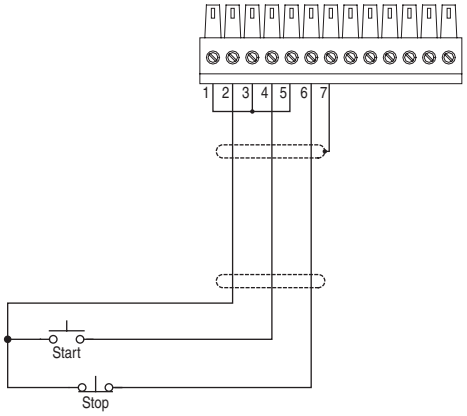
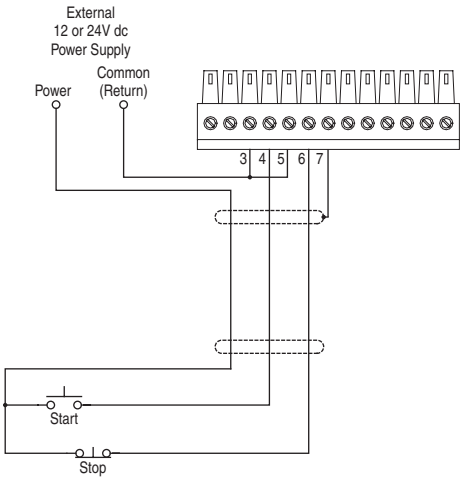
| Input/Output | Connection Examples — 3-Wire Control | Required Parameter Changes |
|---|---|---|
| **High Speed Inputs**<br>12 or 24V dc | Sourcing High Speed Inputs, Used for 3 Wire Control - using the internal power supply<br>  | **Example: Three Wire Control**<br>• Set the value of Parameter 839 [DigIn 2 Sel] to 1 - "Normal Stop"<br>• Set the value of Parameter 840 [DigIn 3 Sel] to 2 - "Start"<br>• Set Parameter 153 [Control Options], bit 8 "3WireControl" = 1<br><br>**Note:** +12V and +24V are also available from TB1 Top 10 & 11. |
| | Sourcing High Speed Inputs, Used for 3 Wire Control - using an external power supply<br>  | |

**Figure 3.3 TB2 - Row T (Top) Wiring Examples**

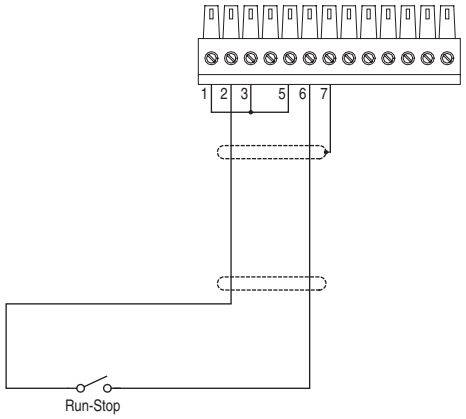
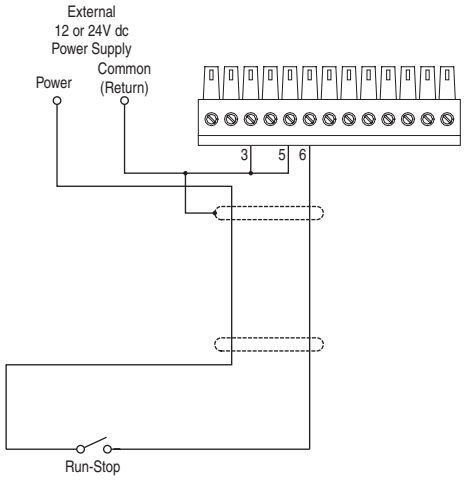
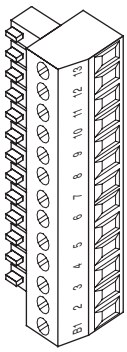
| Input/Output | Connection Examples — 2-Wire Control | Required Parameter Changes |
|---|---|---|
| **High Speed Inputs**<br>12 or 24V dc | Sourcing High Speed Inputs, Used for 2 Wire Control - using the internal power supply<br>  | **Example: Two Wire Control**<br>• Set the value of Parameter 839 [DigIn 2 Sel] to 3 -"Run"<br>• Set Parameter 153 [Control Options], bit 9 "2W CoastStop" = 1, to make the drive coast stop when Digital Input 2 goes low<br>• Reset Parameter 153 [Control Options], bit 9 "2W CoastStop" = 0, to make the drive ramp stop when Digital Input 2 goes low<br>• Reset Parameter 153 [Control Options], bit 8 "3WireControl" = 0, for 2 wire control |
| | Sourcing High Speed Inputs, Used for 2 Wire Control - using an external power supply<br>  | **Note:** +12V and +24V are also available from TB1 Top 10 & 11. |

**Table 3.G TB2 - Row B (Bottom) Terminals**

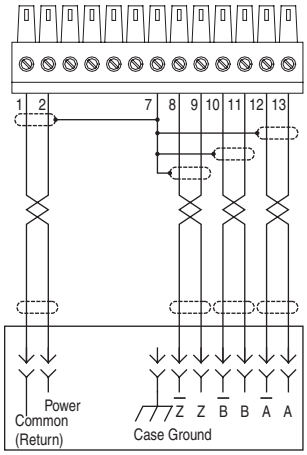
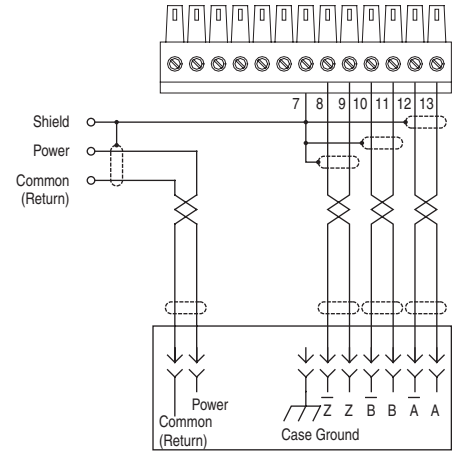
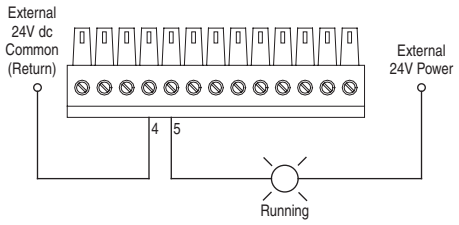
| | Terminal | Signal | Description | Related Parameter |
|---|---|---|---|---|
|  | B13 | Encoder Signal A | Secondary encoder interface. 5 or 12V dc switch selectable (1), Nominal current draw per channel @ 12V dc 45 mA, @5V dc 32 mA Maximum input frequency for Encoders 0 & 1 is 500 kHz. | 222, 240, 241, 242, 243, 244, 245, 246, 247, 248 |
| | 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 dc (B) (+) | 15/2V dc power supply for secondary encoder interface. Rating 300 mA(2) (3) | |
| | B1 | Power Supply +12V dc Return (B) (-) | | |

(1) Refer to Encoder Input Settings on page 3-17 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

(3) To enable 5V supply, set Jumper J6 (located in the Main Control Board) to positions T2 and T3. Default 12V supply is set to T1 and T2.

**Figure 3.4 TB2 - Row B (Bottom) Wiring Examples**

| Input/Output | Connection Example | Required Parameter Changes |
|---|---|---|
| **Secondary Encoder Interface** - Supports 12V dc differential encoders with internal power supply.<br><br>5V dc differential encoders require external power supply and special jumper settings. Refer to Auxiliary Power Supply on page 3-16 for external power supply and jumper settings.<br><br>For 5V dc differential encoders with internal power supply, set Jumper J6 to positions T2 and T3. | Secondary Encoder - using internal power supply<br>  | **Example: Using Encoder 1 for Primary Motor Speed Feedback**<br>• Set the value of Parameter 222 [Motor Fdbk Sel] to 1 - "Encoder 1", so the drive will use this encoder as the primary motor speed feedback device<br>• Set the value of Parameter 242 [Encoder1 PPR] to match the encoder's resolution |
| | Secondary Encoder - using external power supply<br>  | |
| **Auxiliary Output** - Relay contact output | Auxiliary Output, Used to Indicate Running<br>  | **Example: Using Auxiliary Output to Indicate Running**<br>• Link Parameter 155 [Logic Status], the source, to Parameter 841 [Relay Out Data], the sink<br>• Set Parameter 842 [Relay Out Bit] to 1, so that Parameter 155 [Logic Status], bit 1 "Running" will control the output. |

## Hardware Enable Circuitry

The PowerFlex 700S provides a dedicated hardware enable input for applications that require the drive to be disabled without software interpretation.

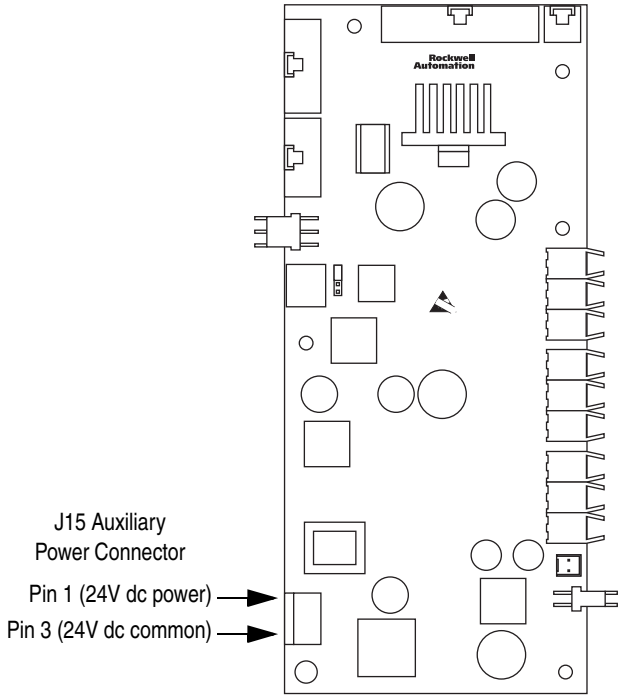
## Auxiliary Power Supply

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 Fiber Optic Interface board. You must set parameter 153 [Control Options], bit 17 “Aux Pwr Sply” to enable this feature.

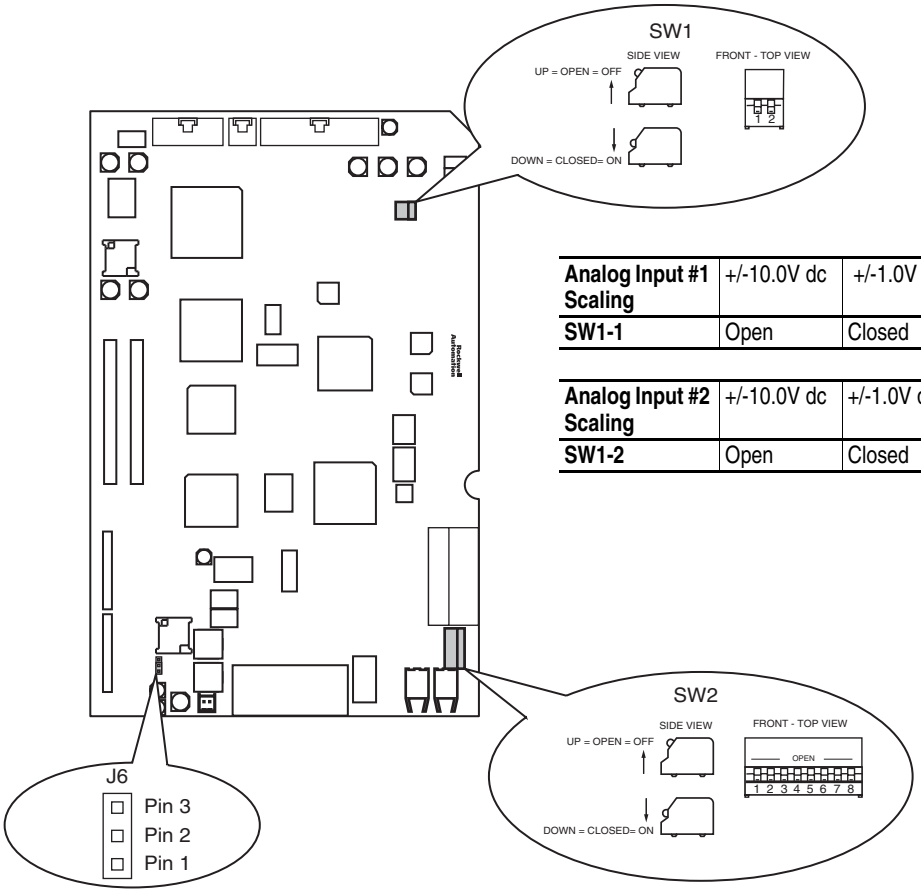
**Table 3.H Auxiliary Power Supply Specifications**

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

**Figure 3.5 PowerFlex Fiber Optic Interface Board**



## Main Control Board I/O and Encoder Settings




| 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.

## Connecting SynchLink

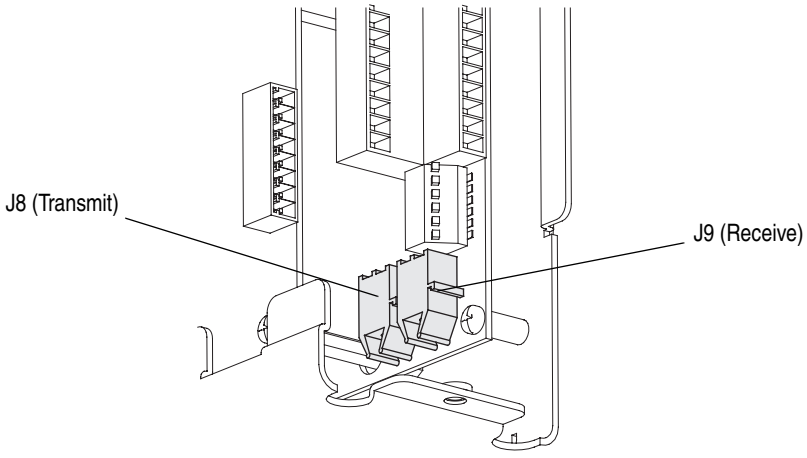
SynchLink provides high-speed synchronization and communication between multiple PowerFlex 700S drives (or other products with SynchLink capability).

### 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 3.I 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 3.J Fiber Optic Cable Assembly**

| Specification | |
|---|---|
| Connecting Cables | 200/230 micron HCS (Hard Clad Silica)<br>• Versalink V-System<br>• Lucent Technologies,<br>• Specialty Fibers Technology Division |
| Maximum Cable Length | 300 meters with no more than one splice or one adapter |
| Minimum Cable Length | 1 meter |
| 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<br>• 256 - Star Configuration |

## Notes:

# Control Wiring for PowerFlex 700S Drives with Phase II Control

## I/O Wiring

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 4.A 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 Instructions on page 1-7 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.

## 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.

**Important:** For NEMA/UL Type 1 applications, all wiring must be routed through the conduit plate on the drive. Route any wires from the expanded cassette to the base cassette and out of the drive.

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.

**Table E Control & Encoder Terminal Block Specifications**

| | | Wires Size Range[1] | | Torque | |
|---|---|---|---|---|---|
| **Name** | **Description** | Maximum | Minimum | Maximum | Recommended |
| I/O Blocks | Signal & Encoder power connections | 1.5 $mm^2$ (16 AWG) | 0.14 $mm^2$ (28 AWG) | 0.25 N-m (2.2 lb.-in.) | 0.22 N-m (1.9 lb.-in.) |

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

**Main Control Board I/O Terminal Locations**

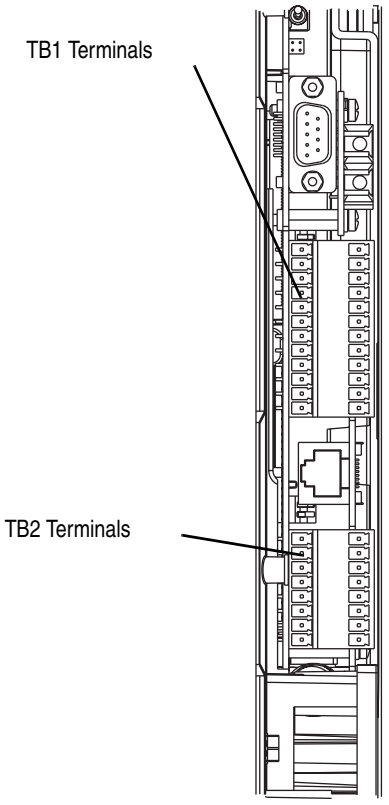
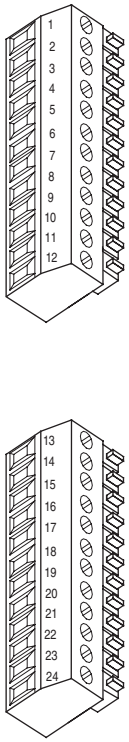


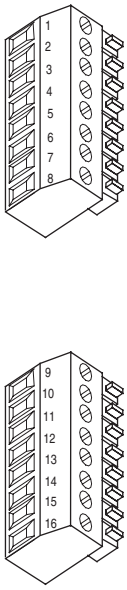
**Table F TB1 Terminals**




| Terminal | Signal | Factory Default | Description |
|---|---|---|---|
| 1 | Analog Input 1 Comm. | (Volt) | Bipolar, differential input, +/-10V, 0-20 mA, 13 bit + sign<br>20k Ohm impedance at Volt; 500 Ohm impedance at mA(1) |
| 2 | Analog Input 1 (+/-) | | |
| 3 | Shield | NA | Analog Input Shield |
| 4 | Analog Input 2 Comm. | (Volt) | Bipolar, differential input, +/-10V, 0-20 mA, 13 bit + sign<br>20k Ohm impedance at Volt; 500 Ohm impedance at mA |
| 5 | Analog Input 2 (+/-) | | |
| 6 | Analog Input 3 [NTC-] Comm. | (Volt) | Differential input, 0-10V, 10 bit (for motor control mode FVC2, this is the temperature adaptation input). |
| 7 | Analog Input 3 [NTC+] | | |
| 8 | Shield | NA | Analog Output Shield |
| 9 | Analog Output 1 (-) | (Volt) | Bipolar, differential output, +/-10V, 0-20 mA, 11 bit + sign<br>2k Ohm minimum load |
| 10 | Analog Output 1 (+) | | |
| 11 | Analog Output 2 (-) | (Volt) | |
| 12 | Analog Output 2 (+) | | |
| 13 | +10V Reference | NA | Rating: 20 mA maximum load (Recommend 5k Ohm pot) |
| 14 | Reference Common | NA | |
| 15 | -10V Reference | NA | |
| 16 | Encoder A | NA | Normal current draw per channel: 20 mA |
| 17 | Encoder A (Not) | NA | |
| 18 | Encoder B | NA | |
| 19 | Encoder B (Not) | NA | |
| 20 | Encoder Z | NA | |
| 21 | Encoder Z (Not) | NA | |
| 22 | Encoder Reference (+) | NA | 12 or 5V DC power supply for primary encoder interface<br>Rating: 300 mA maximum |
| 23 | Encoder Reference (-) | NA | |
| 24 | Encoder Shield | NA | Connection point for encoder shield |

(1) The analog inputs are not isolated. However, the analog inputs can be connected in series when using current mode. Note that at 20mA the voltage source must be capable of providing 10V dc at the drive terminals for one drive - - 20V dc is required for two drives and 30V dc is required for three drives.

**Table G TB2 Terminals**

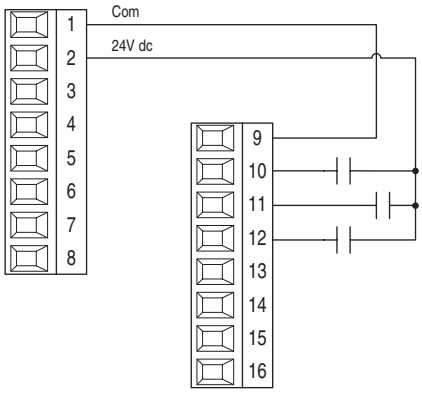
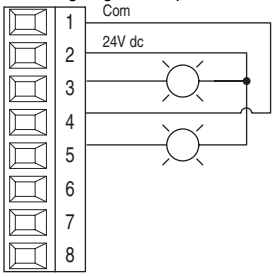
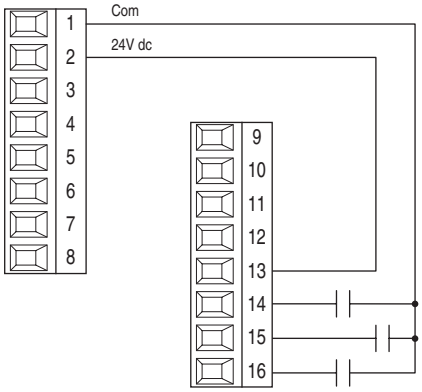
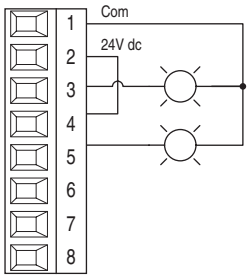



| Terminal | Signal | Factory Default | Description |
|---|---|---|---|
| 1 | 24V DC Common (-) | NA | Drive supplied 24V DC logic input power<br>Rating: 300 mA maximum load |
| 2 | 24V DC Source (+) | NA | |
| 3 | Digital Output 1 | | 24V DC Open Collector (sinking logic)<br>Rating: Internal Source = 150 mA max.<br>External Source = 750 mA |
| 4 | Digital Output 1/2 Com | NA | Common for Digital Output 1 & 2 |
| 5 | Digital Output 2 | | 24V DC Open Collector (sinking logic)<br>Rating: Internal Source = 150 mA max.<br>External Source = 750 mA |
| 6 | Relay Output 3 (NC) | | Relay contact output<br>Rating: 115V AC or 24V DC = 2 A max.<br>Inductive/Resistive |
| 7 | Relay Output 3 Com | NA | |
| 8 | Relay Output 3 (NO) | | |
| 9 | Digital Input 1-3 Com | NA | Common for Digital Inputs 1-3 |
| 10 | Digital Input 1 | | High speed 12V or 24V DC(1), sinking<br>Load:15 mA at 24V DC |
| 11 | Digital Input 2 | | |
| 12 | Digital Input 3 | | Load:15 mA at 24V DC sourcing |
| 13 | Digital Input 4-6 Com | NA | Common for Digital Inputs 4-6 |
| 14 | Digital Input 4 | | Load: 10 mA at 24V DC sinking/sourcing<br>Load: 7.5 mA at 115V AC<br>**Note**: The 115 VAC Digital Inputs can withstand 2 milliamps of leakage current without turning on. If an output device has a leakage current greater than 2 milliamps a burden resistor is required. A 68.1K ohm resistor with a 0.5 watt rating should be used to keep the 115 VAC output below 2 milliamps. |
| 15 | Digital Input 5 | | |
| 16 | Digital Input 6 | HW Enable | |

(1) Digital Inputs 1 and 2 are configured for 12V or 24V DC via DIP switches S3-1 and S3-2, respectively. 24V DC is the default setting.

## I/O Wiring Examples

**Table H TB2 Terminals — Digital Wiring Examples**

| Input/Output | Connection Example | |
|---|---|---|
| Digital Inputs used for enable and precharge control.<br><br>*Note:*<br>**24V DC Supply** - supports only on-board digital inputs. Do not use for circuits outside the drive.<br><br>*Note*:<br>The factory default for Digital Inputs is 24V. This must be switched in order to use 115V. | Sourcing Digital Inputs - Internal Power Supply<br>  | **Sourcing and Sinking Definitions**<br>The digital inputs and digital outputs of the PowerFlex 700S AC drive support Sourcing or Sinking configuration. Typically, digital inputs are sourcing devices and digital outputs are sinking devices. The following definitions apply throughout this section:<br><br>• **Sourcing a Digital Input** - The digital input common (return) is connected to the power supply common. Applying a positive voltage to the digital input will cause it to activate (pull up).<br>• **Sinking a Digital Input** - The digital input common (return) is connected to the power supply positive voltage. Applying 0V or common to the digital input will cause it to activate (pull down).<br>• **Sourcing a Digital Output** - The digital output common (return) is connected to the power supply common. The device to be controlled by the digital output is connect to the positive voltage and the device common is connected to the digital output.<br>• **Sinking a Digital Output** - The digital output common (return) is connected to the power supply positive voltage. The digital output is connect to the device to be controlled and the device common is connected to the power supply common.<br><br>*Note*:<br>Digital Inputs 1-3 can only be configured as sourcing inputs. Digital Inputs 4-6 can be configured as sourcing or sinking inputs. |
| | Sourcing Digital Outputs - Internal Power Supply<br>  | |
| | Sinking Digital Inputs - Internal Power Supply<br>  | |
| | Sinking Digital Output - Internal Power Supply<br>  | |

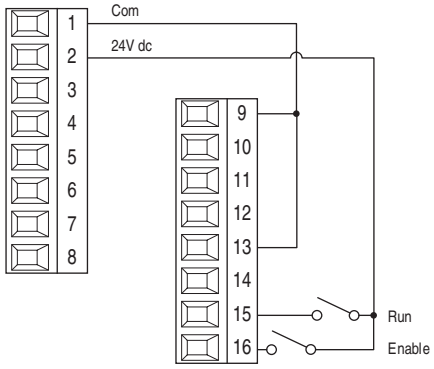
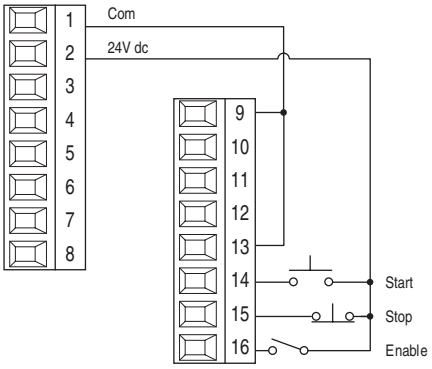
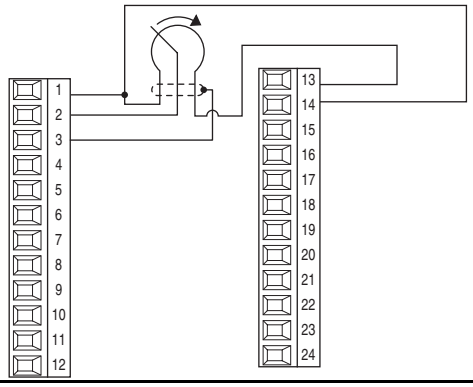
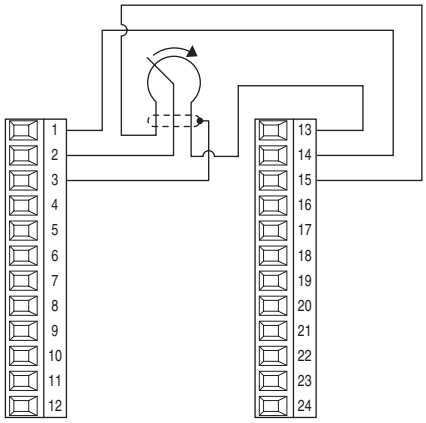
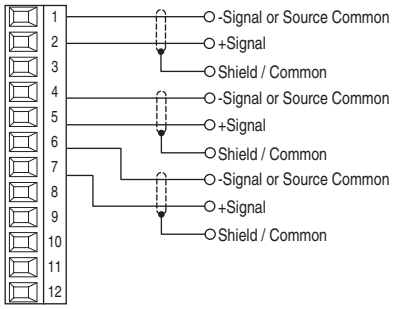
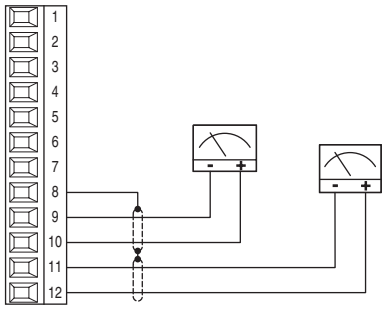
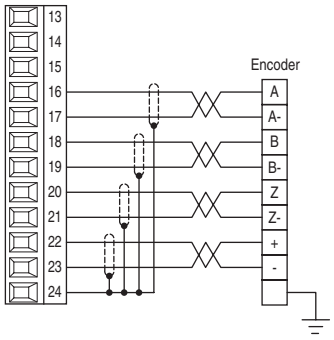
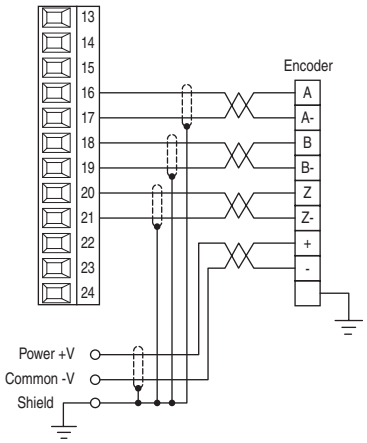
| Input/Output | Connection Example | |
|---|---|---|
| **Digital Inputs**<br>24V DC | Sourcing Digital Inputs - Internal Power Supply, 2-Wire Control<br>  | **Required Parameter Changes**<br>• Set the value of Par 829 [Dig In5 Sel] to a value of 7 - "Run"<br>• Par 153 [Control Options], bit 8 "3WireControl" will automatically be off (0) for 2-wire control.<br>• Set Par 168 [Normal Stop Mode] for the desired stopping mode:<br>0 = Ramp Stop<br>1 = CurLim Stop<br>2 = Coast Stop |
| **Digital Inputs**<br>24V DC | Sourcing Digital Inputs- Internal Power Supply, 3-Wire<br>  | • Set the value of Par 829 [Dig In5 Sel] to a value of 14 - "Normal Stop"<br>• Set Par 828 [Dig In4 Sel] to a value of 5 - "Start"<br>• Par 153 [Control Options], bit 8 "3WireControl" will automatically be off (0) for 2-wire control.<br>• Set Par 168 [Normal Stop Mode] for the desired stopping mode:<br>0 = Ramp Stop<br>1 = CurLim Stop<br>2 = Coast Stop |

**Table I TB1 Terminals— Analog Wiring Examples**

| Input/Output | Connection Example | |
|---|---|---|
| **0-10V Analog Input** | 0-10V Analog Input - Internal Source<br>  | **Required Parameter Changes**<br>na |

| Input/Output | Connection Example | |
|---|---|---|
| **0-10V Analog Input** | 0-10V Analog Input - Bi-Polar<br>  | na |
| **0-10V Analog Input** | 0-10V Analog Input - External Source<br>  | **Required Parameter Changes**<br>na |
| **Analog Output**<br>+/-10V DC<br><br>Used to drive analog meters displaying speed and current | 0-10V Analog Output<br>  | **Using Analog Out 1, -10V to + 10V to meter Motor RPM and direction:**<br>• Send the data to the Analog Output Par 833 [Anlg Out1 Real] (the destination) linked to Par 71 [Filtered SpdFdbk] (the source)<br>• Scale the Output to the source parameter Par 835 [Anlg Out1 Scale] = 175 (Par 4 [Motor NP RPM] = 1750 / 10V)<br><br>**Using Analog Out 2, -10V to + 10V to meter Motor Current:**<br>• Send the data to the Analog Output Par 840 [Anlg Out2 Real] (the destination) linked to Par 308 [Output Current] (the source)<br>• Scale the Output to the source parameter Par 822 [Anlg Out2 Scale] = xx (Par 2 [Motor NP FLA] / 10 V Output) |

| Input/Output | Connection Example | |
|---|---|---|
| **Primary Encoder Interface -**<br>Supports 5V/12V DC differential encoders with internal power supply.<br><br>Used as primary closed loop speed feedback, | Primary Encoder - Internal Supply<br>  <br> | **Using Encoder 0 as speed feedback:**<br>• Par 222 [Motor Fdkbk Sel] = 0 - “Encoder 0” (default)<br>• Par 232 [Encoder0 PPR] = Pulses/Rev for installed encoder |
| | Primary Encoder - External Supply<br>  <br> | |

## Hard Enable Circuitry

The PowerFlex 700S provides a dedicated hardware enable input for applications that require the drive to be disabled without software interpretation.

## Auxiliary Power Supply

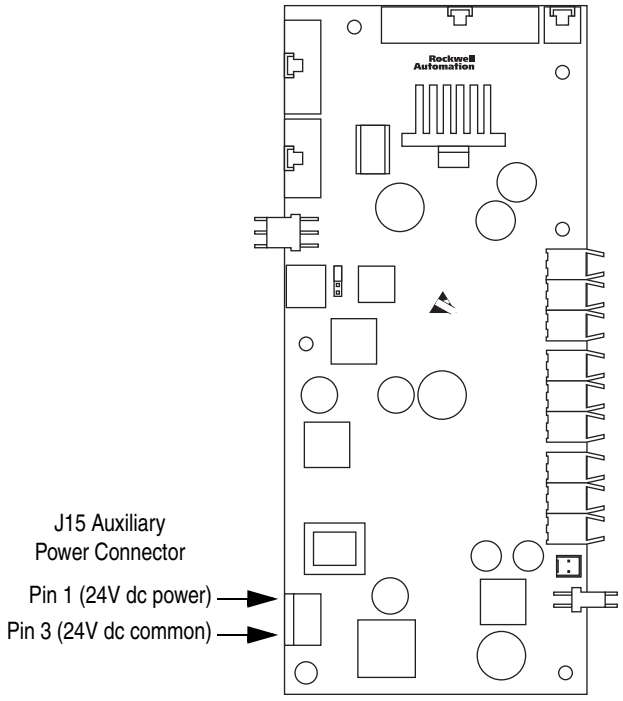
You may use an auxiliary power supply to keep the 700S Control Assembly energized, when input power is de-energized. This allows the Main Control Board, DriveLogix controller and any feedback option cards to continue operation. Connect auxiliary power to J15 on the Fiber Optic Interface board. You must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

**Important:** For drives manufactured prior to June 2006, the Voltage Feedback board provides the bulk 24 volts for the Fiber Optic Fiber Optic Interface board. If the auxiliary power supply (24 volts) is greater than the Voltage Feedback board (24 volts) then the switch mode power supply on the Voltage Feedback board will shut down. If the auxiliary power supply has an adjustable voltage, then the voltage should be lowered (23.75). This will allow the Voltage Feedback board power supply to supply the 24 volts. If the auxiliary power supply cannot be adjusted, then a 500 ohm resistor needs to be added to the Voltage Feedback board. In this case, please contact Drives Technical Support for details.

**Table 4.B Auxiliary Power Supply Specifications**

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

**Figure 4.1 PowerFlex Fiber Optic Interface Board**



## DIP Switch Settings

**ATTENTION:** The DIP switches for Digital Inputs 4 - 6 are set to 24V DC at the factory. If you are running a 115V AC input application, the switches must be set as indicated below before applying power to the drive or damage to the Main Control board may occur.

**Figure 3 Main Control Board Dip Switches**

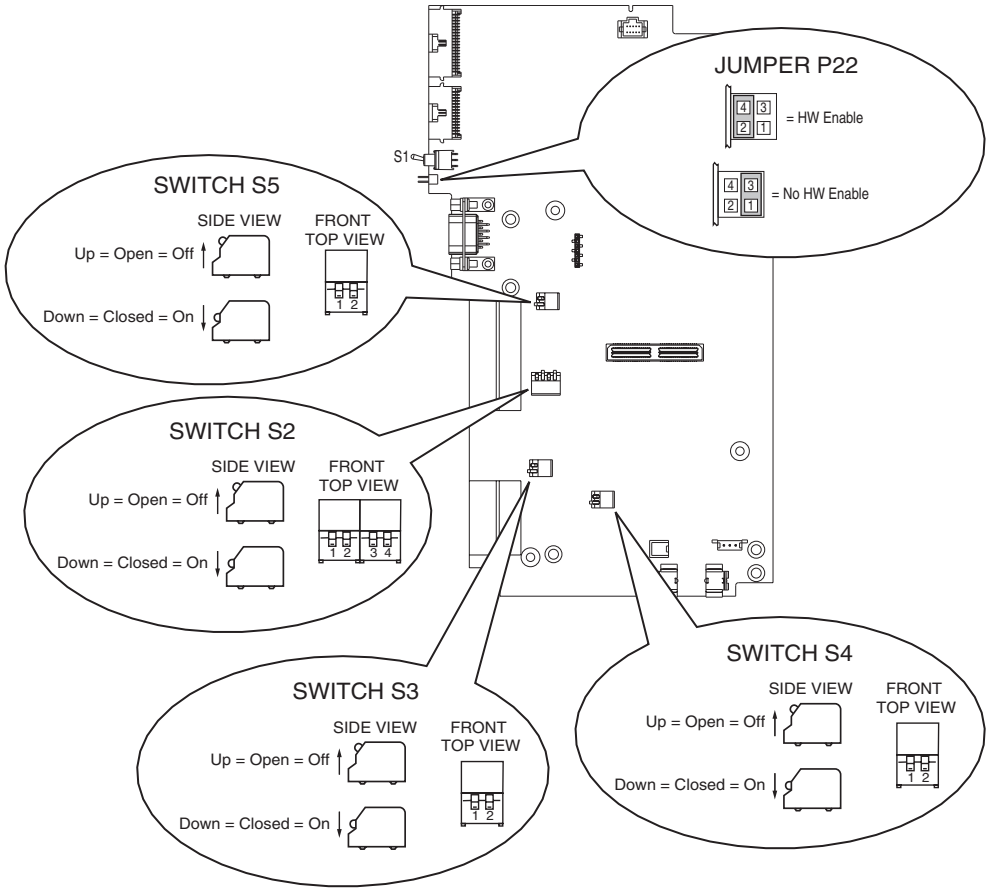



**Table E Switch Settings**

| Function | Default | Switch | Open | Closed | Notes |
|---|---|---|---|---|---|
| Configuring Digital Input 6 for Hardware Enable (HW Enbl) | pin 2-4 HW Enbl | P22 Jumper | pin 2-4 HW Enbl | pin 1-3 No Enbl | No Jmpr = HW Enbl |
| Analog Input 1 | Voltage | S5-2 | Voltage | Current | Change with Power Off |
| Analog Input 2 | Voltage | S5-1 | Voltage | Current | Change with Power Off |
| Digital Inputs 4-6 Voltage | 24V DC | S4-1, S4-2 | 115V AC | 24V DC | Change with Power Off |
| Digital Input 1 Voltage | 24V DC | S3-1 | 24V DC | 12V DC | Change with Power Off |
| Digital Input 2 Voltage | 24V DC | S3-2 | 24V DC | 12V DC | Change with Power Off |

| Function | Default | Switch | Open | Closed | Notes |
|---|---|---|---|---|---|
| Encoder Supply Voltage | 12V DC | S2-4 | 12V DC | 5V DC | Change with Power Off<br><br>Set all switches the same |
| Encoder Signal A Voltage | 12V DC | S2-1 | 12V DC | 5V DC | |
| Encoder Signal B Voltage | 12V DC | S2-2 | 12V DC | 5V DC | |
| Encoder Signal Z Voltage | 12V DC | S2-3 | 12V DC | 5V DC | |

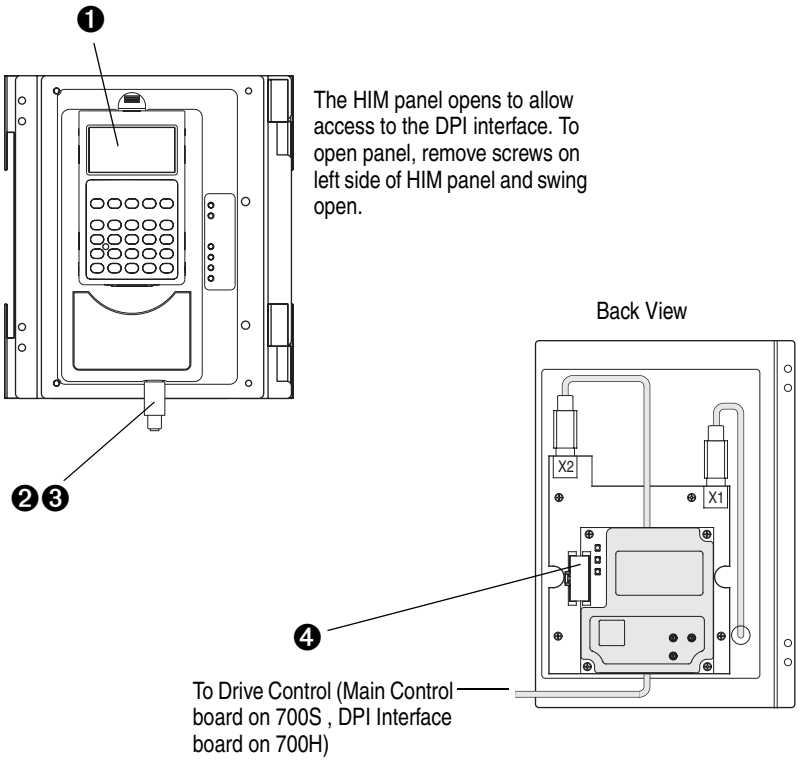
| Function | Down | Switch | Up | Center | Notes |
|---|---|---|---|---|---|
| DriveLogix Processor | Run | S1 | Prog | Remote | Processor Mode |

Please note there are two separate values for an encoder.

# Communication Options

## Communication Module Locations

**Figure 5.1 DPI Port Locations**




| No. | Connector | Description |
|---|---|---|
| ❶ | DPI Port 1 | HIM connection when installed in the drive. |
| ❷ | DPI Port 2 | Cable connection for handheld and remote options. |
| ❸ | DPI Port 3 or 2 | Splitter cable connected to DPI Port 2 provides additional port. |
| ❹ | DPI Port 5 | Cable connection for communications adapter. |

**Note:** DPI Port 4 is not available.

## Communication Configurations

### Typical Programmable Controller Configurations

**Important:** If block transfers are programmed to continuously write information to the drive, care must be taken to properly format the block transfer. If attribute 10 is selected for the block transfer, values will be written only to RAM and will not be saved by the drive. This is the preferred attribute for continuous transfers. If attribute 9 is selected, each program scan will complete a write to the drives non-volatile memory (EEprom). Since the EEprom has a fixed number of allowed writes, continuous block transfers will quickly damage the EEprom. Do Not assign attribute 9 to continuous block transfers. Refer to the individual communications adapter User Manual for details.

### Logic Command/Status Words

**Figure 5.2 PowerFlex 700H Logic Command Word**

| Logic Bits | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | **Command** | **Description** |
| | | | | | | | | | | | | | | | x | Stop[1] | 0 = Not Stop<br>1 = Stop |
| | | | | | | | | | | | | | | x | | Start[1][2] | 0 = Not Start<br>1 = Start |
| | | | | | | | | | | | | | x | | | Jog | 0 = Not Jog<br>1 = Jog |
| | | | | | | | | | | | | x | | | | Clear Faults | 0 = Not Clear Faults<br>1 = Clear Faults |
| | | | | | | | | | | x | x | | | | | Direction | 00 = No Command<br>01 = Forward Command<br>10 = Reverse Command<br>11 = Hold Present Direction |
| | | | | | | | | | x | | | | | | | Local Control | 0 = No Local Control<br>1 = Local Control |
| | | | | | | | | x | | | | | | | | MOP Increment | 0 = Not Increment<br>1 = Increment |
| | | | | | | x | x | | | | | | | | | Accel Rate | 00 = No Command<br>01 = Use Accel Time 1<br>10 = Use Accel Time 2<br>11 = Use Present Time |
| | | | | x | x | | | | | | | | | | | Decel Rate | 00 = No Command<br>01 = Use Decel Time 1<br>10 = Use Decel Time 2<br>11 = Use Present Time |
| | x | x | x | | | | | | | | | | | | | Reference Select[3] | 000 = No Command<br>001 = Ref. 1 (Ref A Select)<br>010 = Ref. 2 (Ref B Select)<br>011 = Ref. 3 (Preset 3)<br>100 = Ref. 4 (Preset 4)<br>101 = Ref. 5 (Preset 5)<br>110 = Ref. 6 (Preset 6)<br>111 = Ref. 7 (Preset 7) |
| x | | | | | | | | | | | | | | | | MOP Decrement | 0 = Not Decrement<br>1 = Decrement |

(1) A “0 = Not Stop” condition (logic 0) must first be present before a “1 = Start” condition will start the drive. The Start command acts as a momentary Start command. A “1” will start the drive, but returning to “0” will not stop the drive.

(2) This Start will not function if a digital input (Pars 361-366) is programmed for 2-Wire Control (option 7, 8 or 9).

(3) This Reference Select will not function if a digital input (Pars. 361-366) is programmed for “Speed Sel 1, 2 or 3” (option 15, 16 or 17). Note that Reference Selection is “Exclusive Ownership.”

**Figure 5.3 PowerFlex 700H Logic Status Word**

| Logic Bits | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | **Status** | **Description** |
| | | | | | | | | | | | | | | | x | Ready | 0 = Not Ready<br>1 = Ready |
| | | | | | | | | | | | | | | x | | Active | 0 = Not Active<br>1 = Active |
| | | | | | | | | | | | | | x | | | Command Direction | 0 = Reverse<br>1 = Forward |
| | | | | | | | | | | | | x | | | | Actual Direction | 0 = Reverse<br>1 = Forward |
| | | | | | | | | | | | x | | | | | Accel | 0 = Not Accelerating<br>1 = Accelerating |
| | | | | | | | | | | x | | | | | | Decel | 0 = Not Decelerating<br>1 = Decelerating |
| | | | | | | | | | x | | | | | | | Alarm | 0 = No Alarm<br>1 = Alarm |
| | | | | | | | | x | | | | | | | | Fault | 0 = No Fault<br>1 = Fault |
| | | | | | | | x | | | | | | | | | At Speed | 0 = Not At Reference<br>1 = At Reference |
| | | | | x | x | x | | | | | | | | | | Local Control[1] | 000 = Port 0 (TB)<br>001 = Port 1<br>010 = Port 2<br>011 = Port 3<br>100 = Port 4<br>101 = Port 5<br>110 = Reserved<br>111 = No Local |
| x | x | x | x | | | | | | | | | | | | | Reference Source | 0000 = Ref A Auto<br>0001 = Ref B Auto<br>0010 = Preset 2 Auto<br>0011 = Preset 3 Auto<br>0100 = Preset 4 Auto<br>0101 = Preset 5 Auto<br>0110 = Preset 6 Auto<br>0111 = Preset 7 Auto<br>1000 = Term Blk Manual<br>1001 = DPI 1 Manual<br>1010 = DPI 2 Manual<br>1011 = DPI 3 Manual<br>1100 = DPI 4 Manual<br>1101 = DPI 5 Manual<br>1110 = Reserved<br>1111 = Jog Ref |

(1) See “Owners” for further information.

**Figure 5.4 PowerFlex 700S Logic Command Word**

| Logic Bits | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Command | Description |
| | | | | | | | | | | | | | | | x | Normal Stop | 0 = Not Normal Stop<br>1 = Normal Stop |
| | | | | | | | | | | | | | | x | | Start(1) | 0 = Not Start<br>1 = Start |
| | | | | | | | | | | | | | x | | | Jog 1 | 0 = Not Jog using [Jog Speed 1]<br>1 = Jog using [Jog Speed 1] |
| | | | | | | | | | | | | x | | | | Clear Fault(2) | 0 = Not Clear Fault<br>1 = Clear Fault |
| | | | | | | | | | | x | x | | | | | Unipolar Direction | 00 = No Command<br>01 = Forward Command<br>10 = Reverse Command<br>11 = Hold Direction Control |
| | | | | | | | | | x | | | | | | | Reserved | |
| | | | | | | | | x | | | | | | | | Jog 2 | 0 = Not Jog using [Jog Speed 2]<br>1 = Jog using [Jog Speed 2] |
| | | | | | | | x | | | | | | | | | Current Limit Stop | 0 = Not Current Limit Stop<br>1 = Current Limit Stop |
| | | | | | | x | | | | | | | | | | Coast Stop | 0 = Not Coast to Stop<br>1 = Coast to Stop |
| | | | | | x | | | | | | | | | | | Reserved | |
| | | | | x | | | | | | | | | | | | Reserved | |
| | | | x | | | | | | | | | | | | | Spd Ref Sel0 | |
| | | x | | | | | | | | | | | | | | Spd Ref Sel1 | |
| | x | | | | | | | | | | | | | | | Spd Ref Sel2 | |
| x | | | | | | | | | | | | | | | | Reserved | |

| Bits | | | | |
|---|---|---|---|---|
| 14 | 13 | 12 | | |
| 0 | 0 | 0 | = | Spd Ref A |
| 0 | 0 | 1 | = | Spd Ref B |
| 0 | 1 | 0 | = | Preset 2 |
| 0 | 1 | 1 | = | Ref. 3 (Preset 3) |
| 1 | 0 | 0 | = | Ref. 4 (Preset 4) |
| 1 | 0 | 1 | = | Ref. 5 (Preset 5) |
| 1 | 1 | 0 | = | Ref. 6 (Preset 6) |
| 1 | 1 | 1 | = | Ref. 7 (Preset 7) |

(1) A Not Stop condition (logic bit 0 = 0, logic bit 8 = 0, and logic bit 9 = 0) must first be present before a 1 = Start condition will start the drive.

(2) To perform this command, the value must switch from “0” to “1.”

**Figure 5.5 PowerFlex 700S Logic Status Word**

| Logic Bits | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | **Status** | **Description** |
| | | | | | | | | | | | | | | | x | Active | 0 = Not Active<br>1 = Active |
| | | | | | | | | | | | | | | x | | Running | 0 = Not Running<br>1 = Running |
| | | | | | | | | | | | | | x | | | Command Direction | 0 = Reverse<br>1 = Forward |
| | | | | | | | | | | | | x | | | | Actual Direction | 0 = Reverse<br>1 = Forward |
| | | | | | | | | | | | x | | | | | Accel | 0 = Not Accelerating<br>1 = Accelerating |
| | | | | | | | | | | x | | | | | | Decel | 0 = Not Decelerating<br>1 = Decelerating |
| | | | | | | | | | x | | | | | | | Jogging | 0 = Not Jogging<br>1 = Jogging |
| | | | | | | | | x | | | | | | | | Fault | 0 = No Fault<br>1 = Fault |
| | | | | | | | x | | | | | | | | | Alarm | 0 = No Alarm<br>1 = Alarm |
| | | | | | | x | | | | | | | | | | Flash Mode | 0 = Not in Flash Mode<br>1 = In Flash Mode |
| | | | | | x | | | | | | | | | | | Run Ready | 0 = Not Ready to Run<br>1 = Ready to Run |
| | | | | x | | | | | | | | | | | | At Limit(1) | 0 = Not At Limit<br>1 = At Limit |
| | | | x | | | | | | | | | | | | | Tach Loss Sw | 0 = Not Tach Loss Sw<br>1 = Tach Loss Sw |
| | | x | | | | | | | | | | | | | | At Zero Spd | 0 = Not At Zero Speed<br>1 = At Zero Speed |
| | x | | | | | | | | | | | | | | | At Setpt Spd | 0 = Not At Setpoint Speed<br>1= At Setpoint Speed |
| x | | | | | | | | | | | | | | | | Enable | 0 = Not Enabled<br>1 = Enabled |

(1) See Parameter 304 - [Limit Status] in the PowerFlex 700S drive for a description of the limit status conditions.

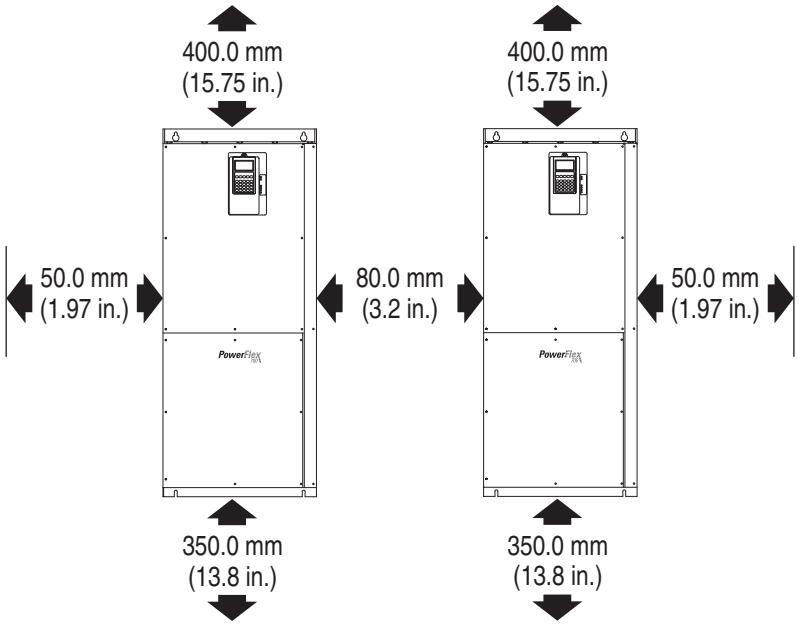
## Notes:

# Frame 9 Installation

Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All information in Chapter 1 “General Installation Information” and in this chapter must be read and understood before the actual installation begins.

**ATTENTION:** The following information is merely a guide for proper installation. Rockwell Automation, Inc. cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

## Minimum Mounting Clearances




Refer to Figure 6.1 for detailed dimension information.

## Operating Temperatures

Frame 9 drives require a minimum of 1300 $m^3$/h (765 cfm) of cooling air.

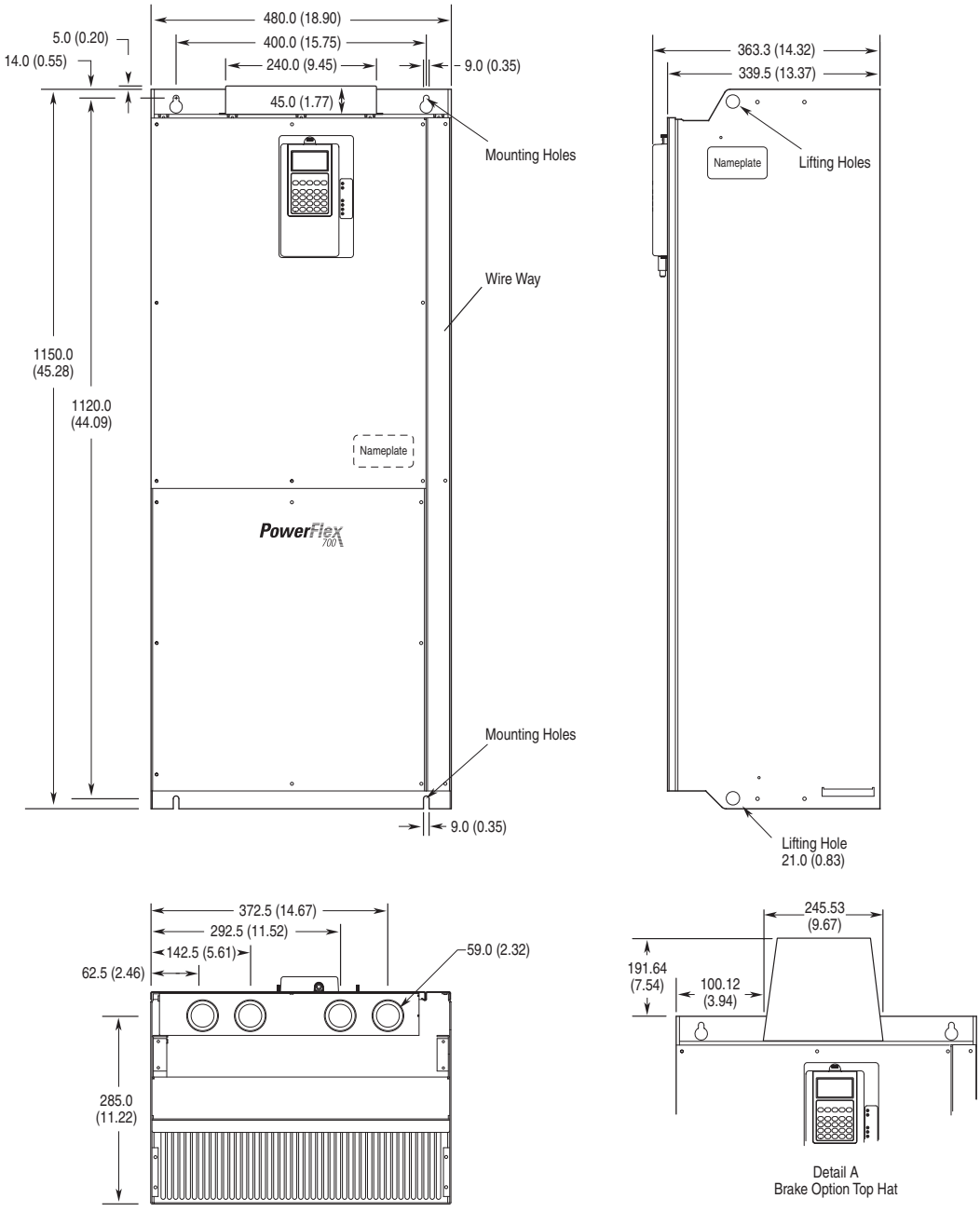
| PowerFlex Drive | Voltage Class | Amp Rating | Surrounding Air Temperature | |
|---|---|---|---|---|
| | | | Normal Duty | Heavy Duty |
| 700H | All | All | 0 to 40° C (32 to 104° F) | 0 to 50° C (32 to 122° F) |
| 700S | 400/480V AC (540/650V DC) | All | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |
| | 600/690V AC (810/932V DC) | 170 | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |
| | | 208 | 0 to 35° C (32 to 95° F) | 0 to 40° C (32 to 104° F) |

## Nameplate Location

Refer to Figure 6.1 below.

## Dimensions

**Figure 6.1 Frame 9 Dimensions**

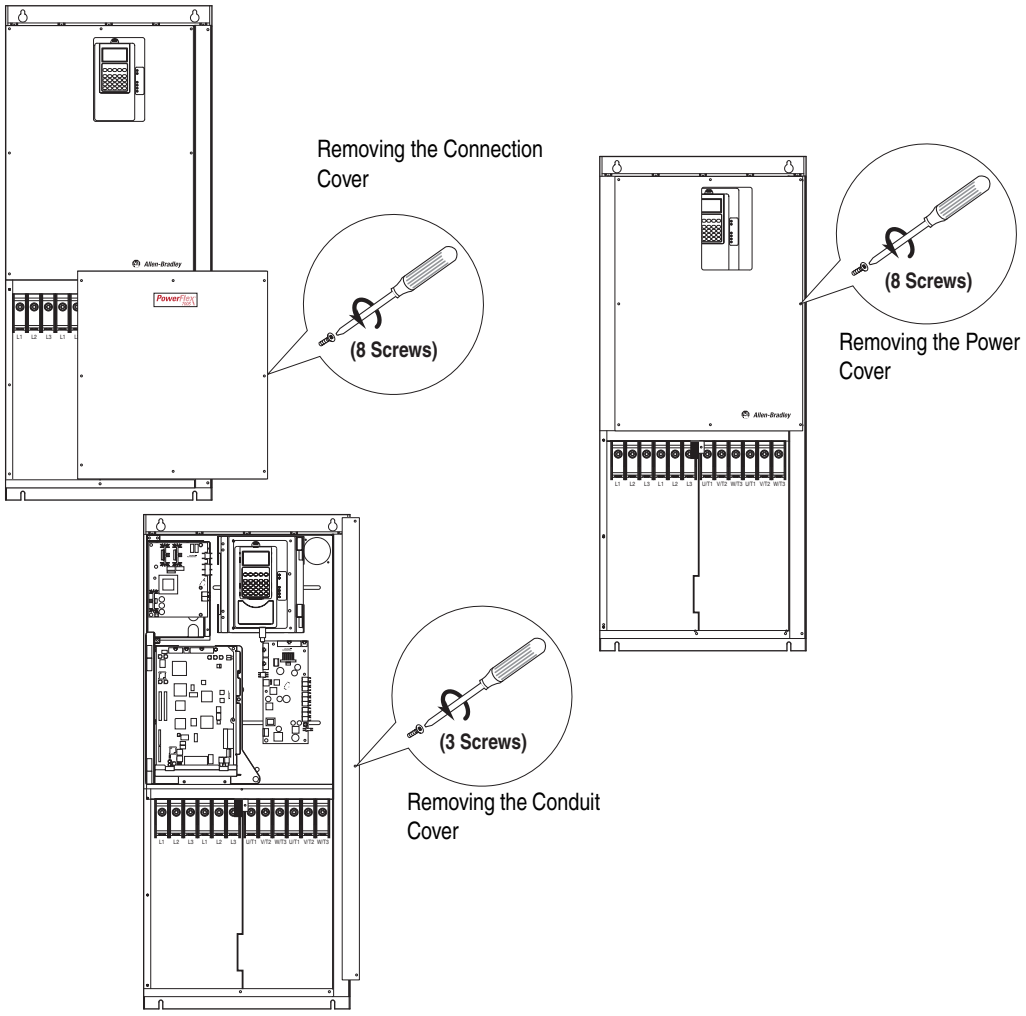



Dimensions are in millimeters and (inches).

## Lifting and Mounting Frame 9 Drives

Refer to Appendix B - Lifting and Mounting Instructions for detailed instructions.

## Removing the Protective Covers




## Ungrounded, Unbalanced or High Resistive Ground Installations

CE frame 9 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 drive.

## Power Wiring

**Table 6.A Frame 9 Power Terminal Specifications**

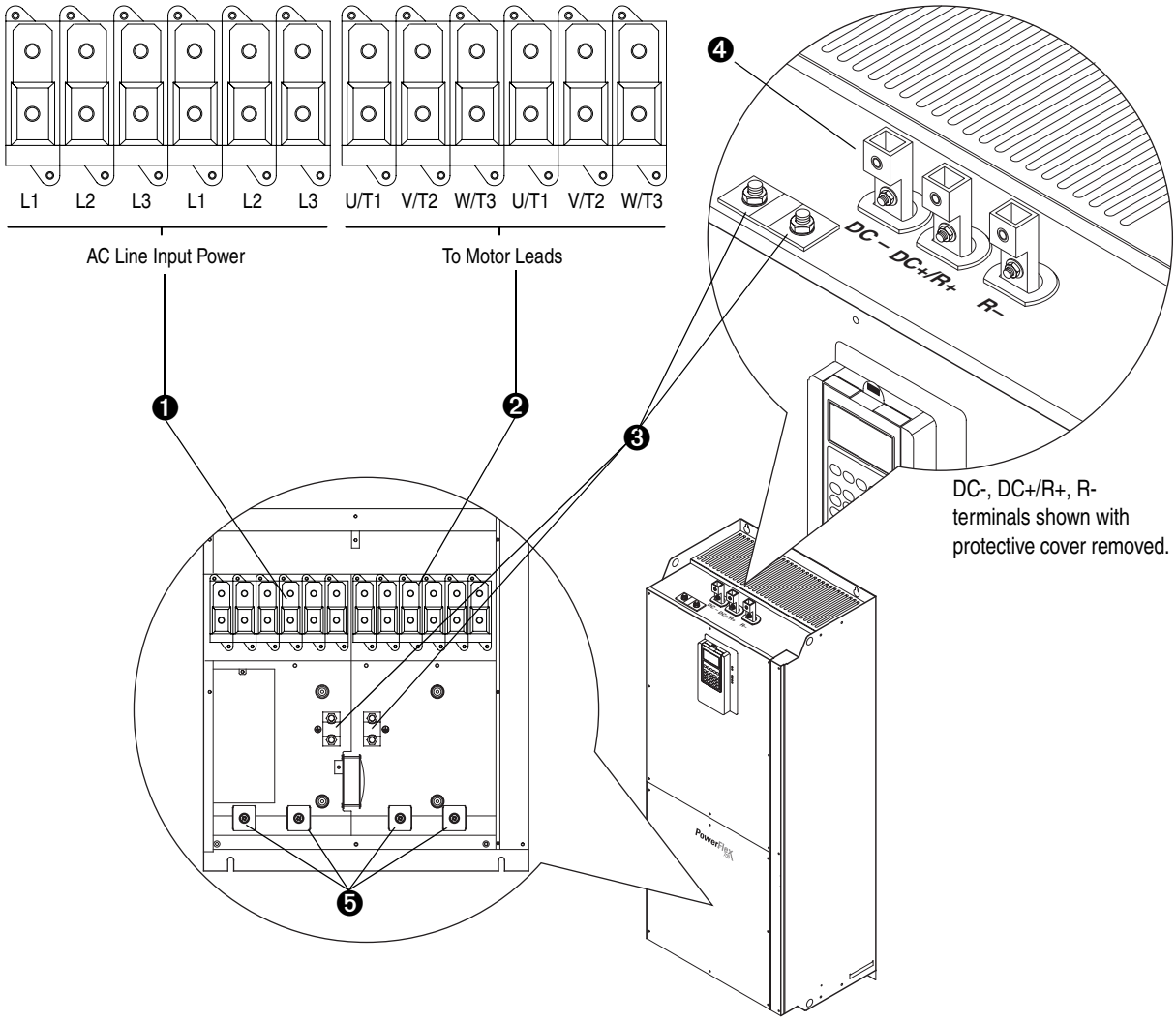
| No. | Name | Description | Wire Size Range[1] Maximum | Wire Size Range[1] Minimum | Torque Recommended |
|---|---|---|---|---|---|
| ❶ | Input Power Terminal Block[2]<br>L1, L2, L3 | Input power | 185.0 $mm^2$<br>(350 MCM) | 95.0 $mm^2$<br>(4/0 AWG) | 40 N•m<br>(354 lb•in) |
| ❷ | Output Power Terminal Block[2]<br>U/T1, V/T2, W/T3 | Motor connections | 185.0 $mm^2$<br>(350 MCM) | 95.0 $mm^2$<br>(4/0 AWG) | 40 N•m<br>(354 lb•in) |
| ❸ | SHLD Terminal, PE, Motor Ground | Terminating point for wiring shields | 95.0 $mm^2$<br>(4/0 AWG) | 5.0 mm2<br>(10 AWG) | 22 N•m<br>(195 lb•in) |
| ❹ | DC Bus[3]<br>(2 Terminals; DC–, DC+) | DC input or external brake resistor<br>*(Internal Brake option not provided - Refer to Frame 9 DC Bus/Brake Connections on page 6-6.)* | 185.0 $mm^2$<br>(350 MCM) | 95.0 $mm^2$<br>(4/0 AWG) | 40 N•m<br>(354 lb•in) |
| | DC Bus w/Brake[3]<br>(3 Terminals; DC–, DC+/R+, R–) | DC input/internal brake<br>*(Internal Brake option is provided - Refer to Frame 9 DC Bus/Brake Connections on page 6-6.)* | 185.0 $mm^2$<br>(350 MCM) | 95.0 $mm^2$<br>(4/0 AWG) | 40 N•m<br>(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 6.2 Terminal Locations and Power Terminal Block**



## Frame 9 DC Bus/Brake Connections

**Figure 6.3 Connecting to DC Source Only (No Brake Option Ordered)**

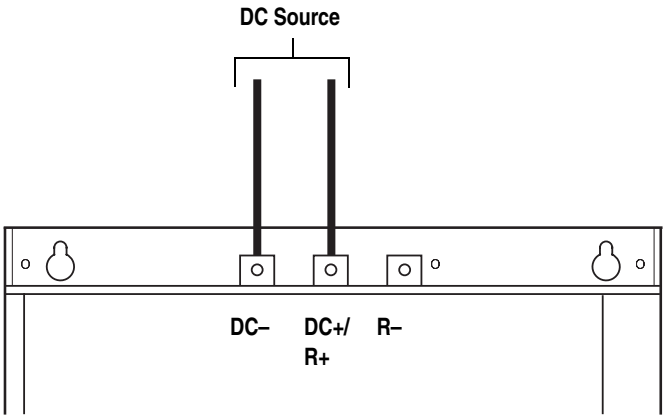



**Figure 6.4 Connecting to an External Brake Resistor (Brake Option Ordered)**

See Table 6.B on page 6-7 for brake resistor sizing information.

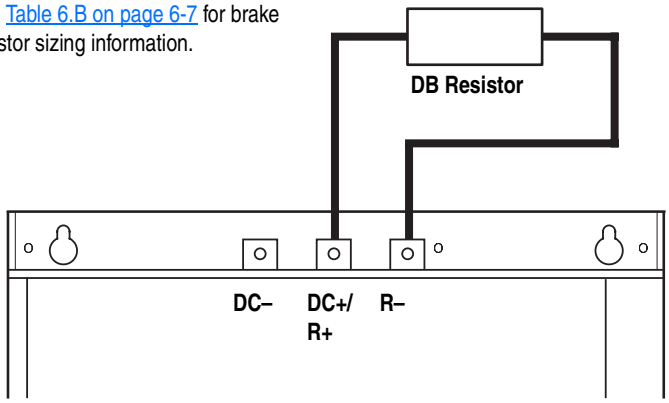



**Figure 6.5 Connecting to an External Braking IGBT and Resistor (No Brake Option Ordered)**

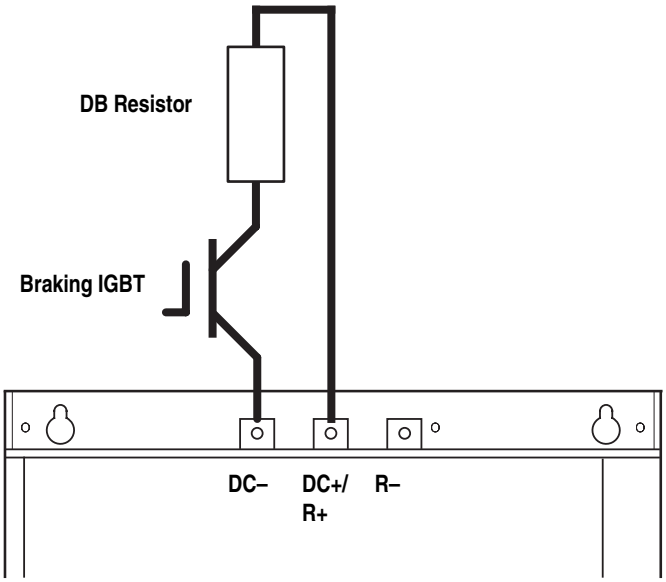
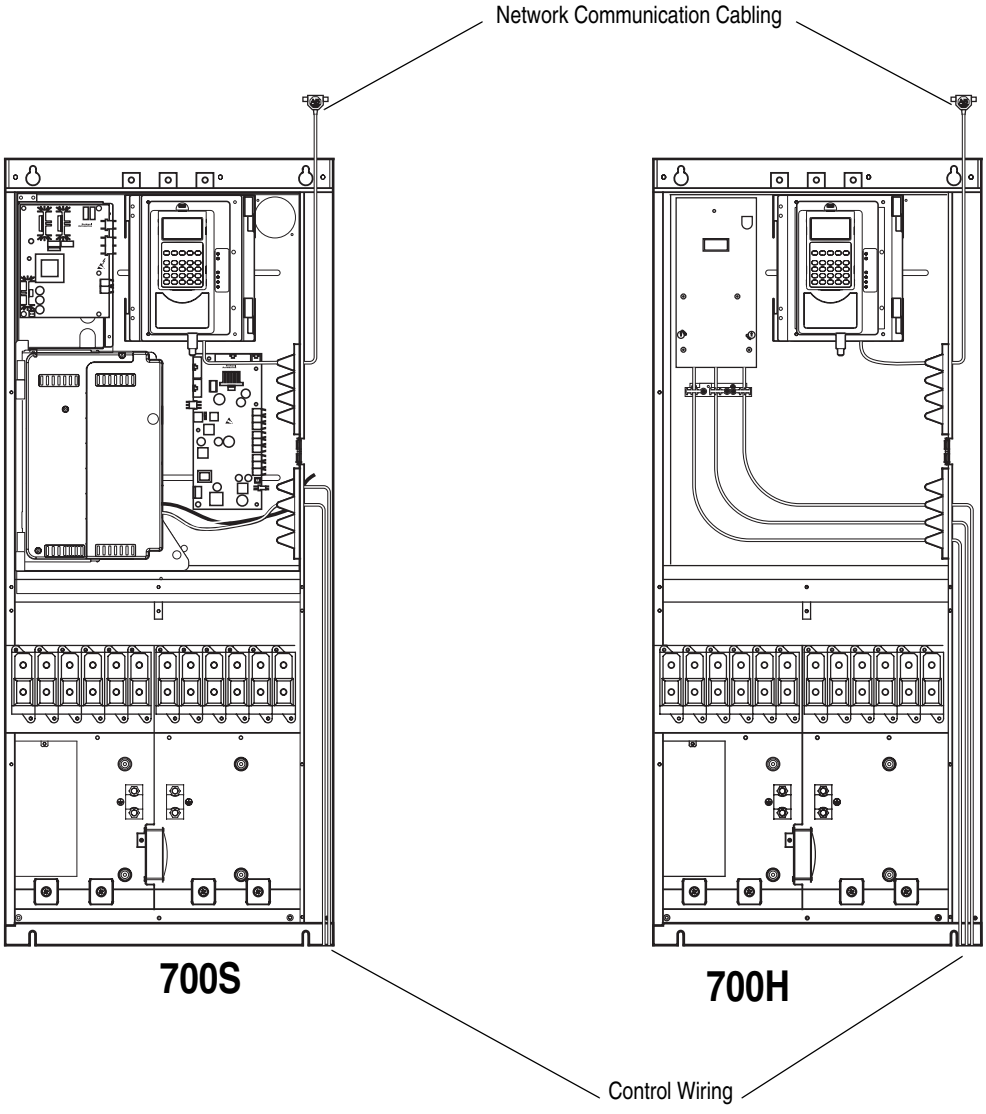


**Table 6.B Frame 9 Brake Resistor Ratings**

| Input Voltage | Drive Catalog Number | ND Rating | Cont. Output (Amps) | Maximum Brake Current (Amps) | Resistor Nominal (Ohms) |
|---|---|---|---|---|---|
| 400V AC | 20DC261 | 132 kW | 261 | 222 | 3.3 |
| | 20DC300 | 160 kW | 300 | 222 | 3.3 |
| 480V AC | 20DD261 | 200 HP | 261 | 222 | 3.3 |
| | 20DD300 | 250 HP | 300 | 222 | 3.3 |
| 600V AC | 20DE170 | 150 HP | 170 | 157.1 | 7 |
| | 20DE208 | 200 HP | 208 | 157.1 | 7 |
| 690V AC | 20DF170 | 160 kW | 170 | 157.1 | 7 |
| | 20DF208 | 200 kW | 208 | 157.1 | 7 |

## Routing for I/O Wiring and Communication Cabling



## Notes:

# Frame 10 Installation

Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All information in Chapter 1 “General Installation Information” and in this chapter must be read and understood before the actual installation begins.

**ATTENTION:** The following information is merely a guide for proper installation. Rockwell Automation, Inc. cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

## Minimum Mounting Clearances

**Figure 7.1 Enclosure Codes: A (NEMA/UL Type 1, IP21), M (NEMA/UL Type 1, IP21 w/ Conformal Coat), H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/ Conformal Coat)**

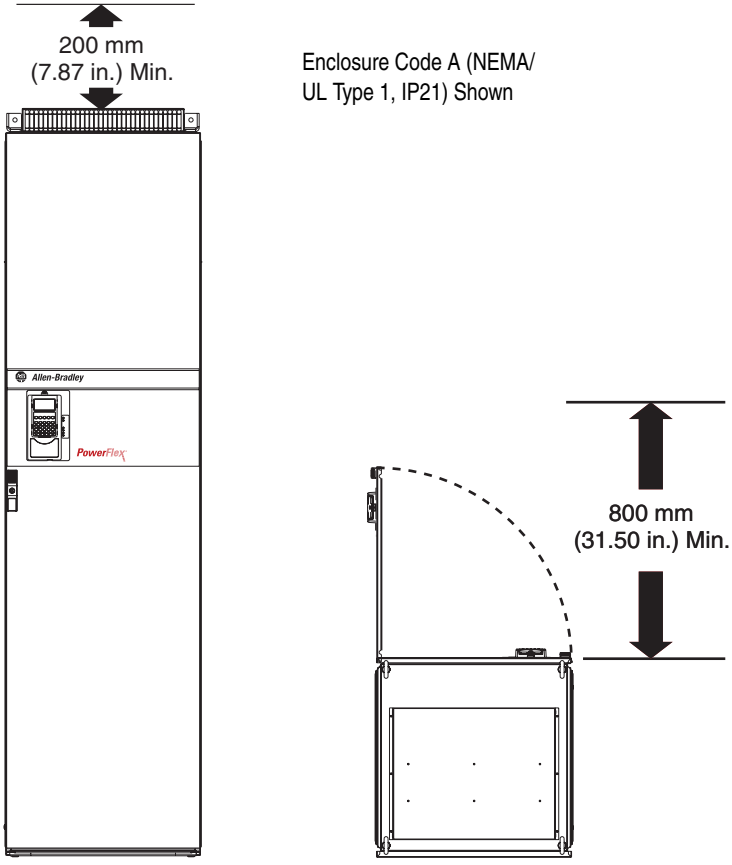
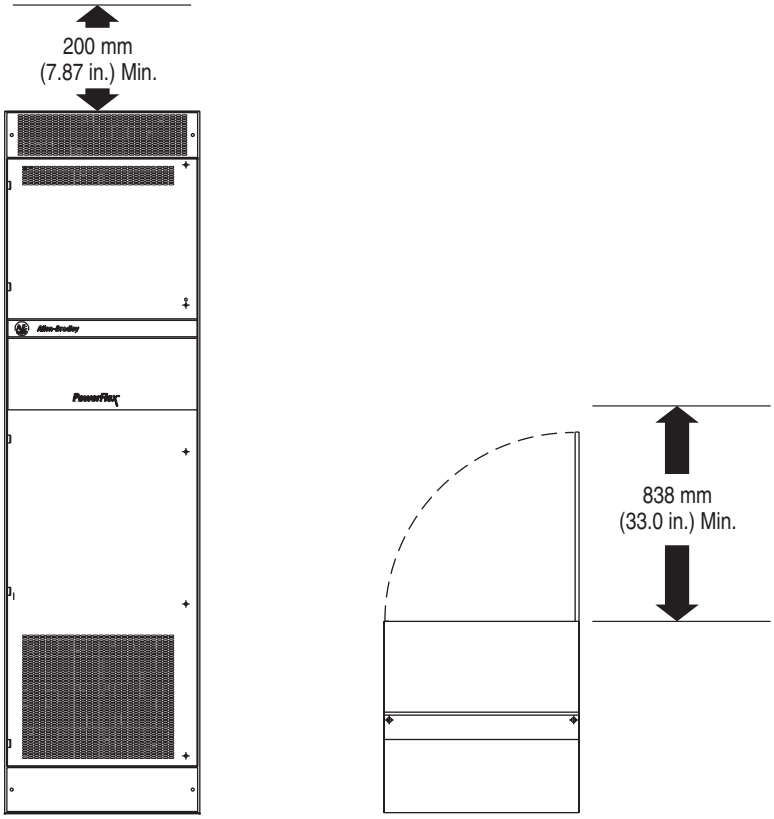


**Figure 7.2 Enclosure Code B (NEMA/UL Type 1, IP21) and K (NEMA/UL Type 1, IP21 w/Conformal Coat)**




## Operating Temperatures

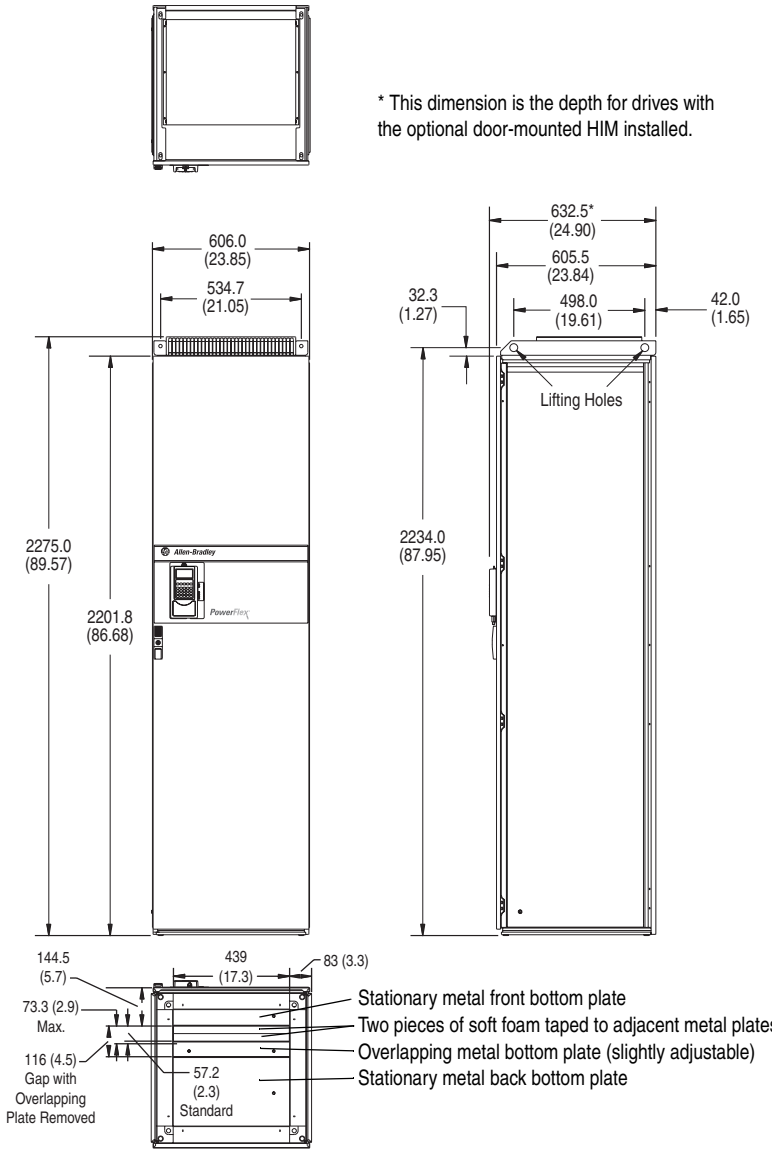
Frame 10 drives require a minimum of 2600 $m^3$/h (1530 cfm) of cooling air.

| PowerFlex Drive | Voltage Class | Amp Rating | Surrounding Air Temperature | |
|---|---|---|---|---|
| | | | Normal Duty | Heavy Duty |
| 700H & 700S | 400/480V AC (540/650V DC) | All | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |
| | 600/690V AC (810/932V DC) | 261, 325, 385 | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |
| | 600/690V AC (810/932V DC) | 416 | 0 to 35° C (32 to 95° F) | 0 to 40° C (32 to 104° F) |

## Dimensions

**Figure 7.3 Enclosure Code A (NEMA/UL Type 1, IP21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)**

Dimensions are in millimeters and (inches).




Wire entry for this enclosure is between two pieces of soft foam. If the adjustable plate is slid back, a gap develops between the foam pieces. Otherwise, the foam acts as a loose gasket around the wires.

**Figure 7.4 Enclosure Code B (NEMA/UL Type 1, IP20 MCC) and K (NEMA/UL Type 1, IP20 MCC w/Conformal Coat)**

Dimensions are in millimeters and (inches).

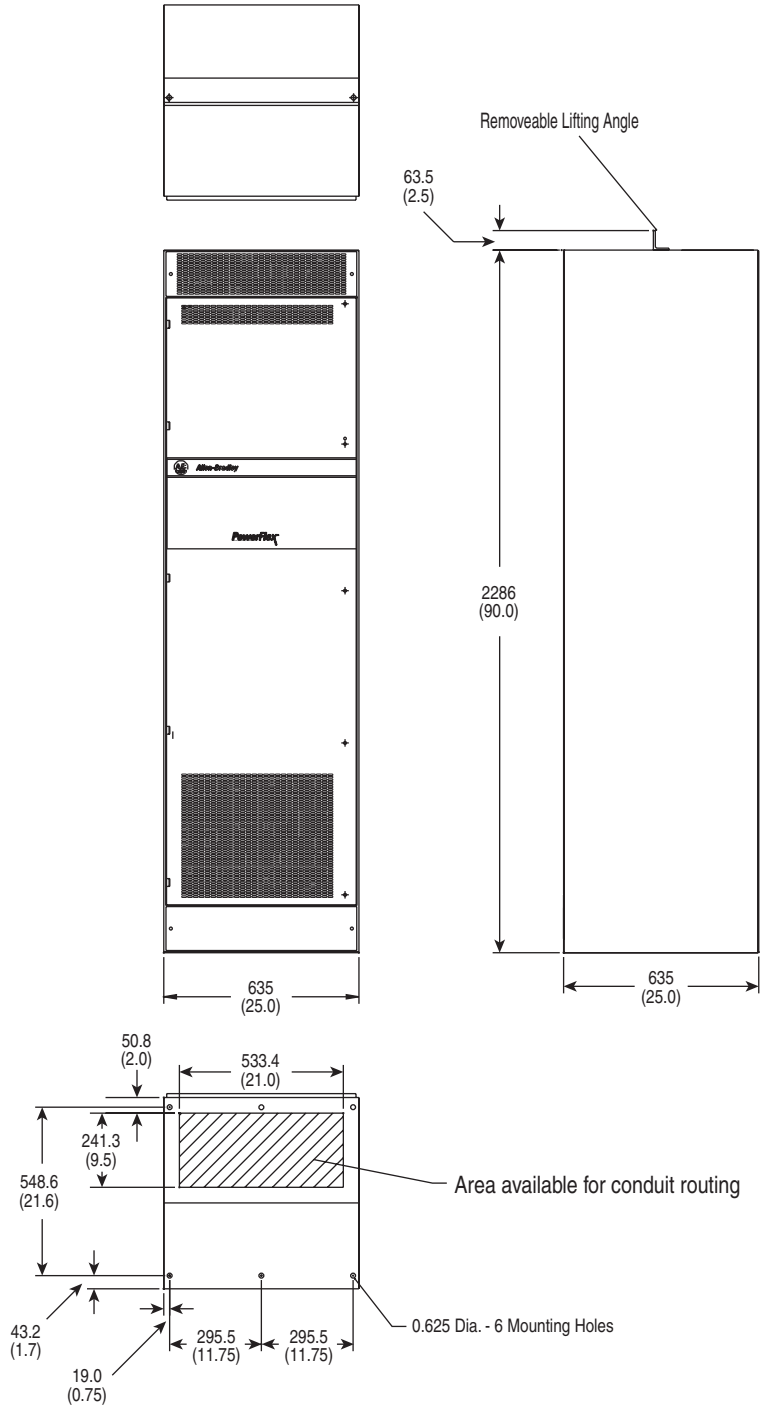
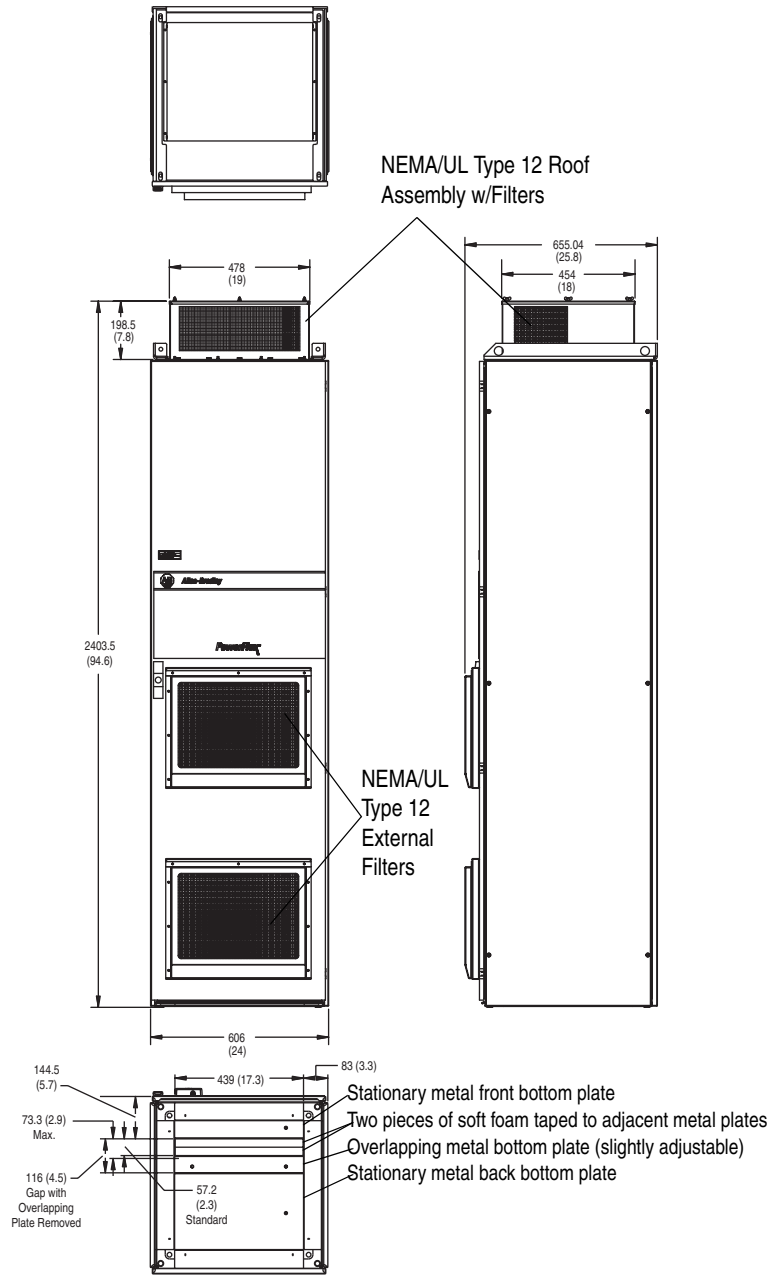


**Figure 7.5 Enclosure Code H (NEMA/UL Type 12 - IP54) and W (NEMA/UL Type 12 - IP54 w/Conformal Coat)**

Dimensions are in millimeters and (inches).




Wire entry for this enclosure is between two pieces of soft foam. If the adjustable plate is slid back, a gap develops between the foam pieces. Otherwise, the foam acts as a loose gasket around the wires.

## Lifting and Mounting Frame 10 Drives

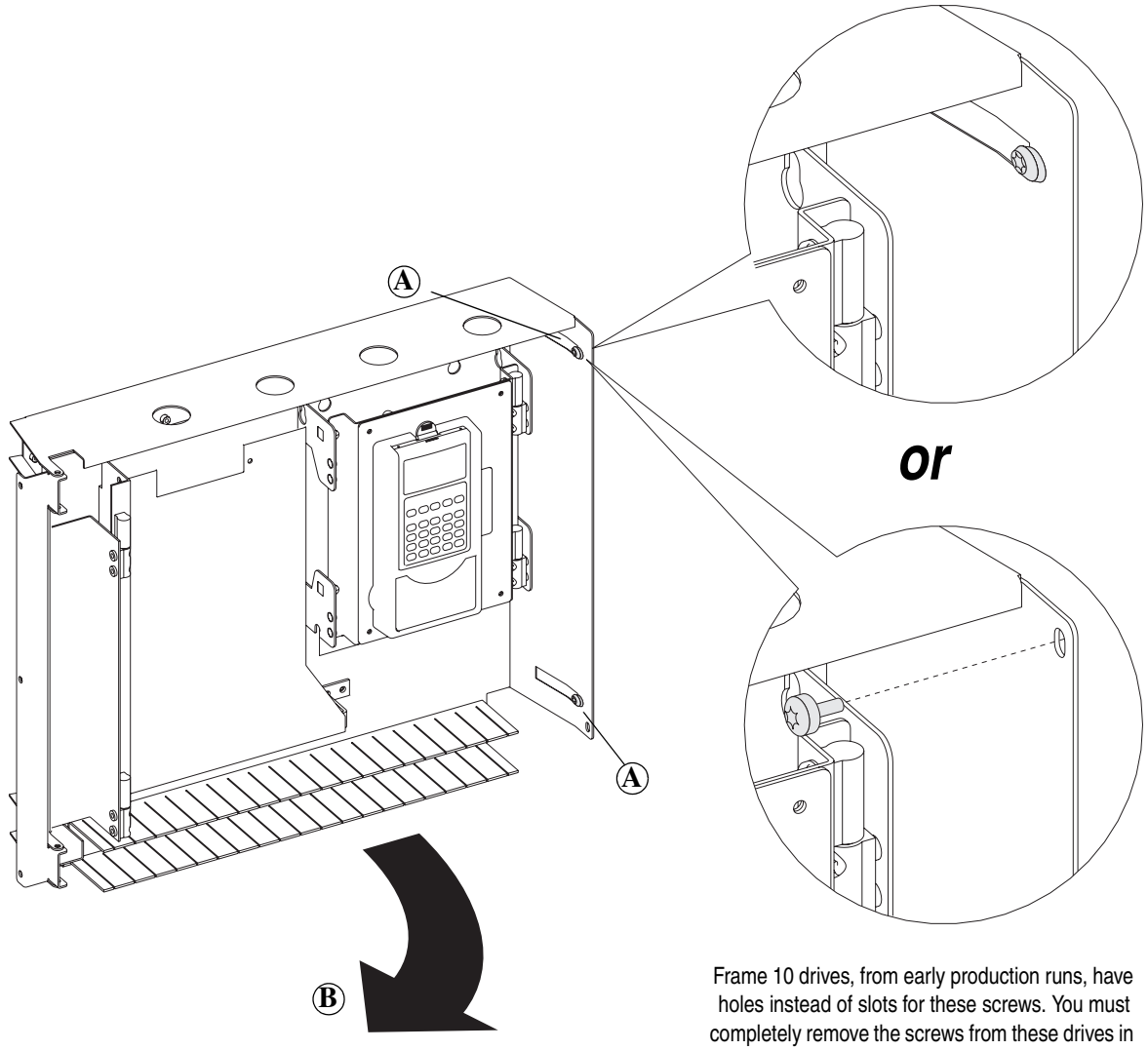
Refer to Appendix B - Lifting and Mounting Instructions for detailed instructions on lifting and mounting the drive. When you have completed the instructions in Appendix B, continue with the installation as directed below.

## Removing the Protective Covers

### Moving the Control Frame

To gain access to the power wiring terminals, airflow plate and protective covers you may need to move the Control Frame out of the way. If you do not need to move the control frame, continue with "Removing the Airflow Plate" on page 7-7.

| Task | Description |
|---|---|
| Ⓐ | Loosen the T8 Torx-head screws that secure the Control Frame to the drive enclosure (Remove screws on early frame 10 drives). |
| Ⓑ | Swing the Control Frame out and away from the power structure. |

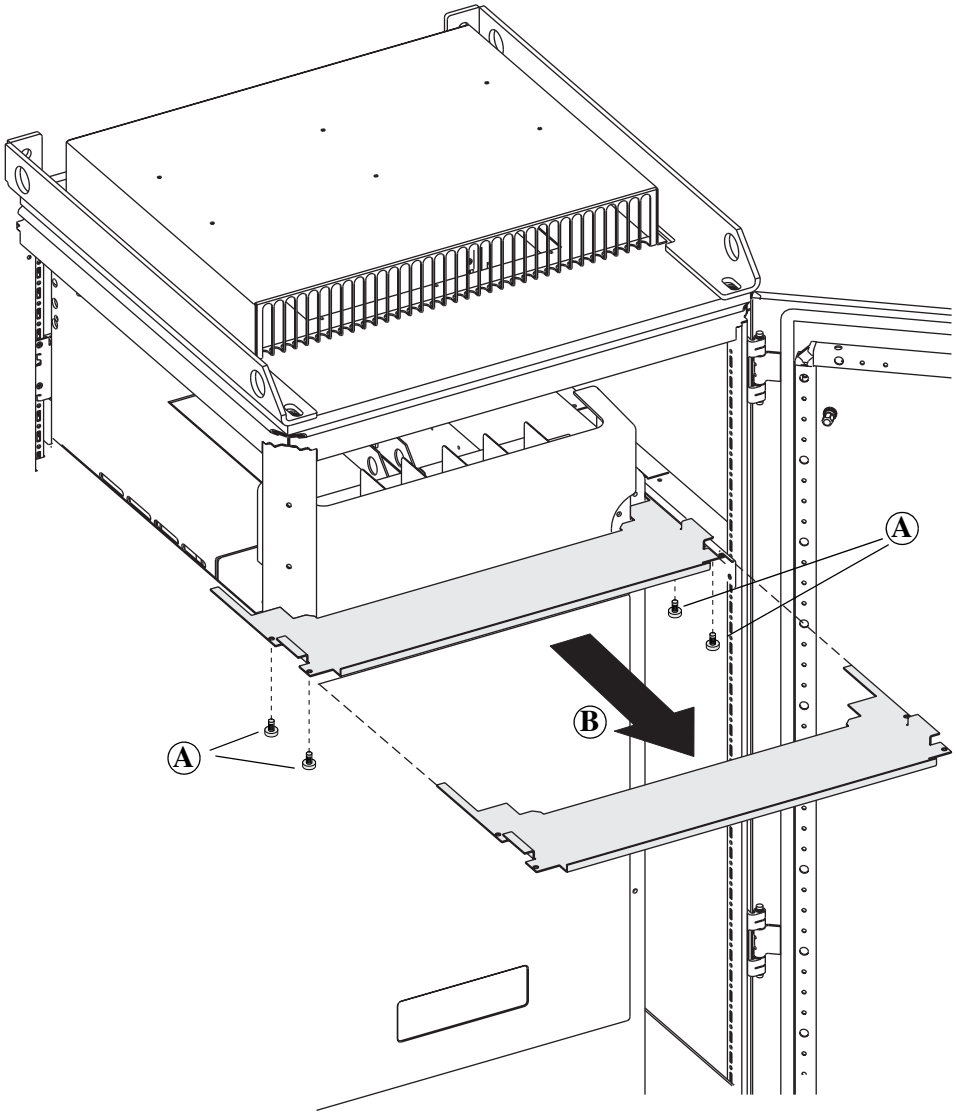



Frame 10 drives, from early production runs, have holes instead of slots for these screws. You must completely remove the screws from these drives in order to swing-open the control frame.

## Removing the Airflow Plate

The drive is equipped with a plate, just above the Control Frame, that directs air flow through the drive. You may need to remove this plate in order to access the protective covers and the power terminals. If you do not need to remove the airflow plate, continue with "Removing the Protective Covers" on page 7-8.

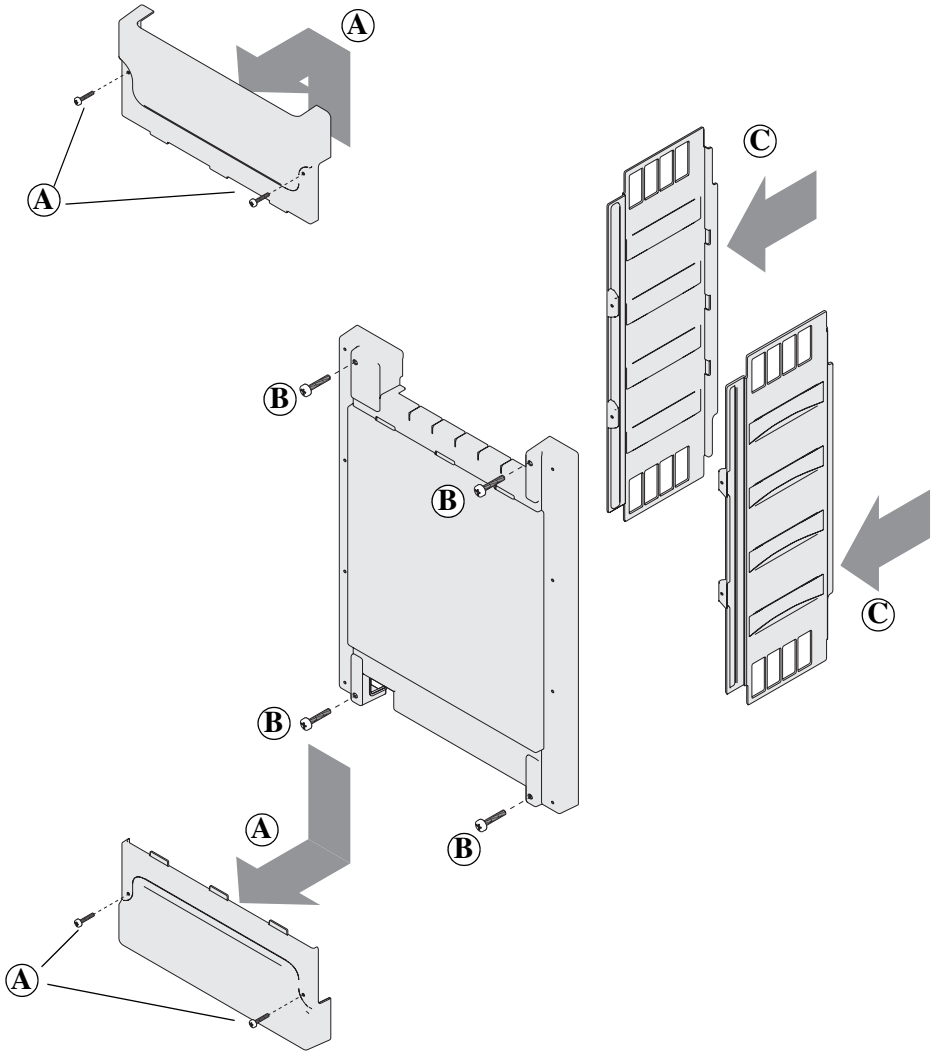
| Task | Description |
|---|---|
| Ⓐ | Remove the T8 Torx-head screws that secure the airflow plate to the drive. |
| Ⓑ | Slide the airflow plate off of the drive. |



## Removing the Protective Covers

You must remove the protective covers to gain access to the power structure.

| Task | Description |
|---|---|
| Ⓐ | Remove the four M5 POZIDRIV screws that secure the top and bottom protective covers to the main front protective cover, then remove the top and bottom protective covers.<br><br>***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 ones.* |
| Ⓑ | Remove the four M5 POZIDRIV screws that secure the main front protective cover to the drive, then remove the protective cover. |
| Ⓒ | Remove the side protective covers. |



## Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations

Frame 10 size drives are equipped with common mode capacitors and capacitors that are connected to the input terminals. To guard against drive damage, these capacitors should be disconnected depending upon the type of ground system on which the drive is installed.

### Installation on an Ungrounded Distribution System or High Resistive Ground

If you are installing a **400/480V** AC input drive on an ungrounded distribution system or high resistive ground, you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 7-11.
- Should insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 7-12.
- Must disconnect the small capacitors from the input terminals - refer to "Disconnect the Small Capacitors from the Input Terminals" on page 7-13.

If you are installing a **600/690V** AC input drive on an ungrounded distribution system or high resistive ground you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 7-11.
- Must insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 7-12.
- Must disconnect the small capacitors from the input terminals - refer to "Disconnect the Small Capacitors from the Input Terminals" on page 7-13.

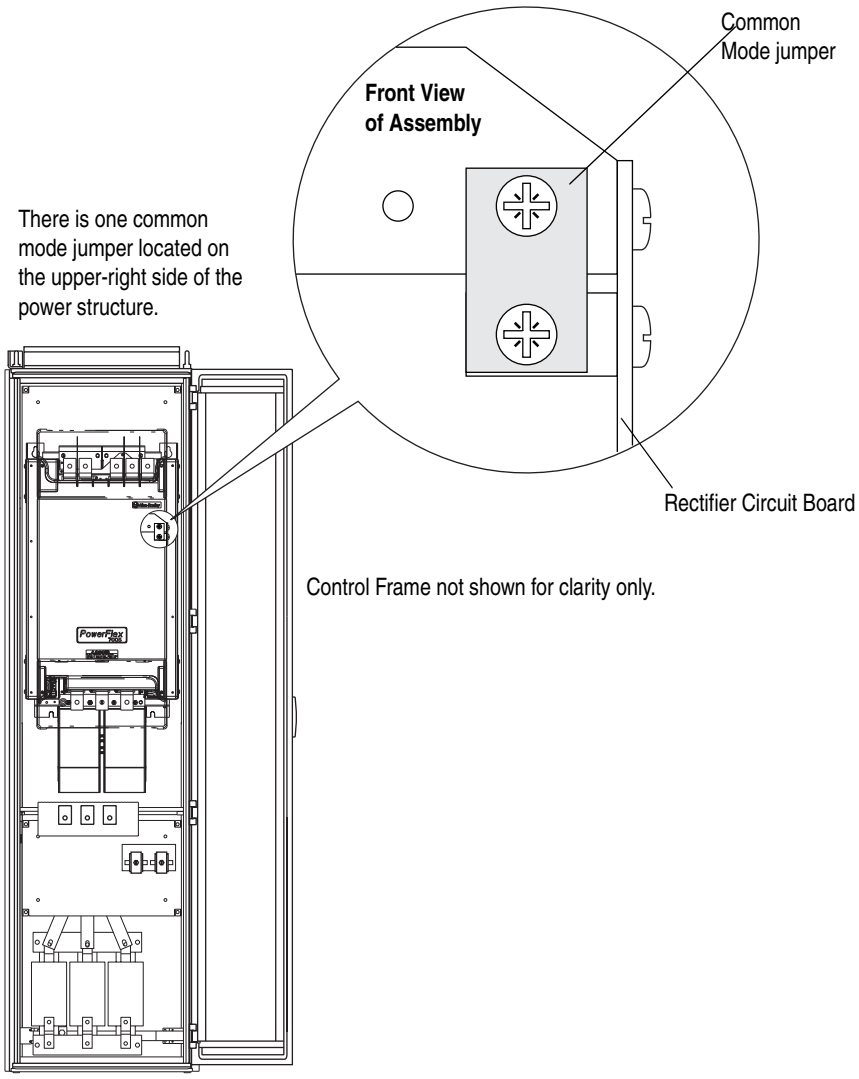
### Installation on a Grounded B Phase Delta System

If you are installing a drive on a grounded B phase Delta system you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 7-11.
- Must insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 7-12.
- Must disconnect the small capacitors from the input terminals - refer to "Disconnect the Small Capacitors from the Input Terminals" on page 7-13.

**Note:** Refer to *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives - Installation Instructions*, publication DRIVES-IN001…, for additional information on an ungrounded distribution system or high resistive ground installation.

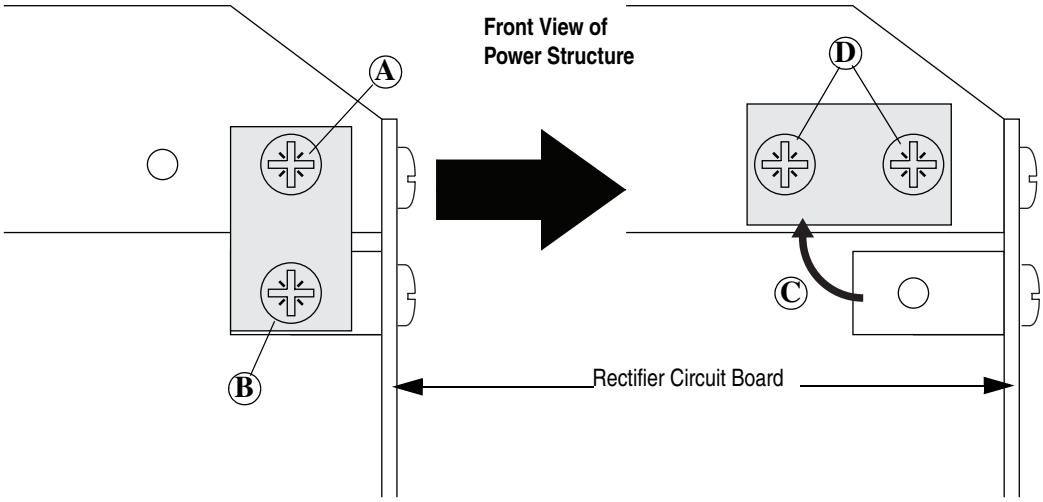
**Figure 7.6 Common Mode Jumper and Rectifier Circuit Board Location**



### Move the Common Mode Jumper to the Disconnected Position

Follow the lettered steps below to move the common mode jumper to the disconnected position (refer to Figure 7.6 for jumper location):

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

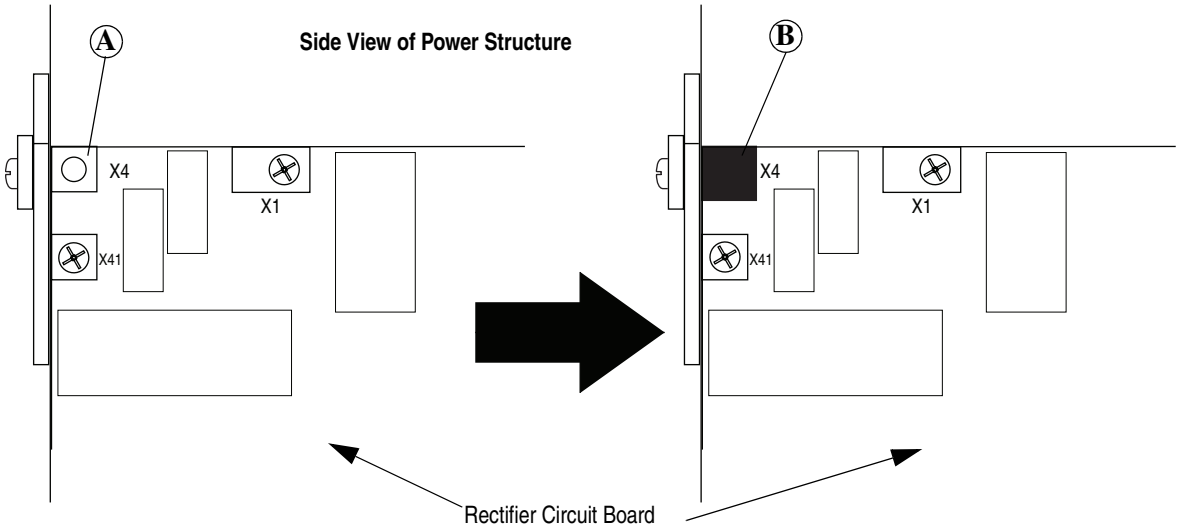


### Insulate Terminal X4 on the Rectifier Circuit Board

Follow the lettered steps below to insulate terminal X4 on the Rectifier circuit board (refer to Figure 7.6 for Rectifier board location):

| Task | Description |
|---|---|
| Ⓐ | Remove the screw from the X4 connection on the Rectifier circuit board. |
| Ⓑ | Insulate the top and bottom of the X4 connection on the Rectifier circuit board. |

**Important:** Do not install the screw and washer that was removed from this connection.



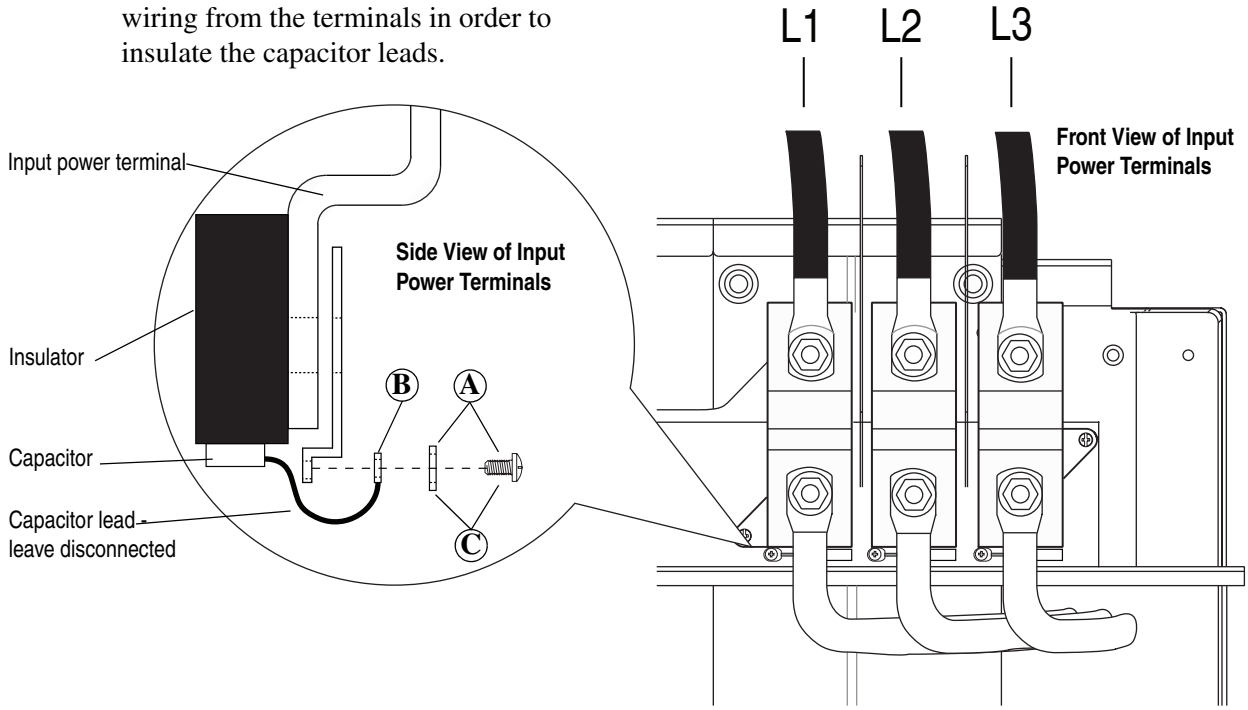
### Disconnect the Small Capacitors from the Input Terminals

Follow the lettered steps below to disconnect the small capacitors from the input 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 and leave disconnected. |
| Ⓒ | Install and tighten the screws and lock washers only. |

**Important:** Do not re-install the capacitor leads.

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



## Power Wiring

**Important:** Once power wiring has been completed, the protective covers must be installed before energizing the drive. Installation is in reverse order of removal (refer to "Removing the Protective Covers" on page 7-6.)

**Table 7.A 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 [3]<br>L1, L2, L3 | Input power | 300 $mm^2$<br>(600 MCM) | 2.1 $mm^2$<br>(14 AWG) | 40 N•m<br>(354 lb•in) | M12 |
| ❷ | Output Power Terminal Block[3]<br>U/T1, V/T2, W/T3 | Motor connections | 300 $mm^2$<br>(600 MCM) | 2.1 $mm^2$<br>(14 AWG) | 40 N•m<br>(354 lb•in) | M12 |
| ❸ | SHLD Terminal, PE, Motor Ground [3] | Terminating point for wiring shields | 300 $mm^2$<br>(600 MCM) | 2.1 $mm^2$<br>(14 AWG) | 40 N•m<br>(354 lb•in) | M10 |
| ❹ | DC Bus [3]<br>(2 Terminals; DC–, DC+) | DC input or external brake | 300 $mm^2$<br>(600 MCM) | 2.1 $mm^2$<br>(14 AWG) | 40 N•m<br>(354 lb•in) | M12 |
| ❺ | Cable Clamp for Shield | | | | | |

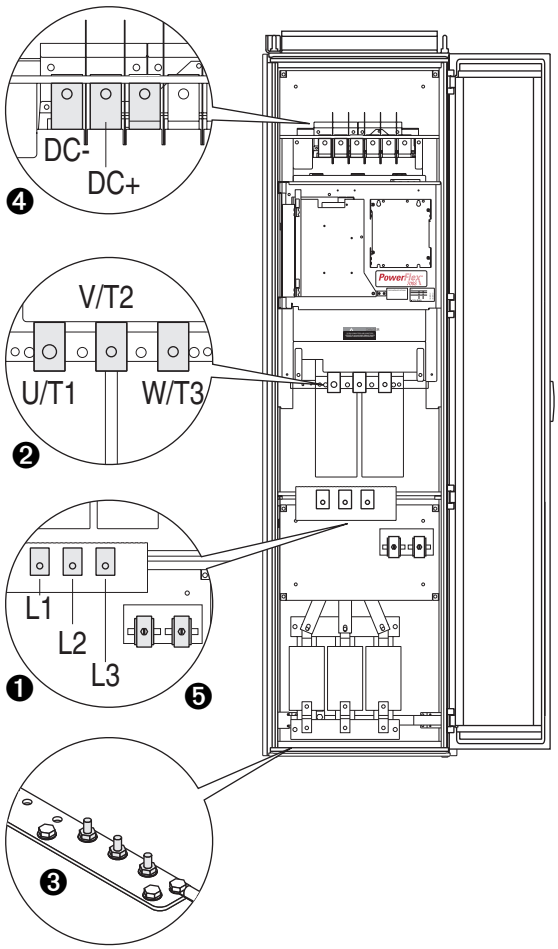
(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.

(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.

**Figure 7.7 Terminal Locations**



# Frame 11 Installation

Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All information in Chapter 1 “General Installation Information” and in this chapter must be read and understood before the actual installation begins.

**ATTENTION:** The following information is merely a guide for proper installation. Rockwell Automation, Inc. cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

## Minimum Mounting Clearances

**Figure 8.1 Enclosure Codes: A (NEMA/UL Type 1, IP21), M (NEMA/UL Type 1, IP21 w/ Conformal Coat), H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/ Conformal Coat)**

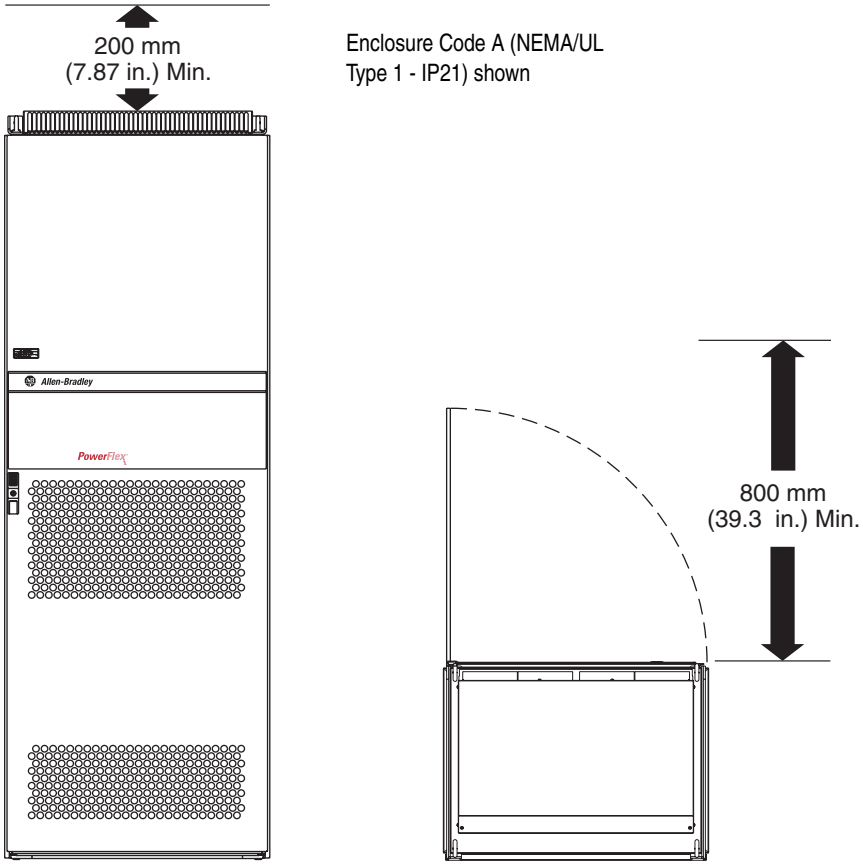
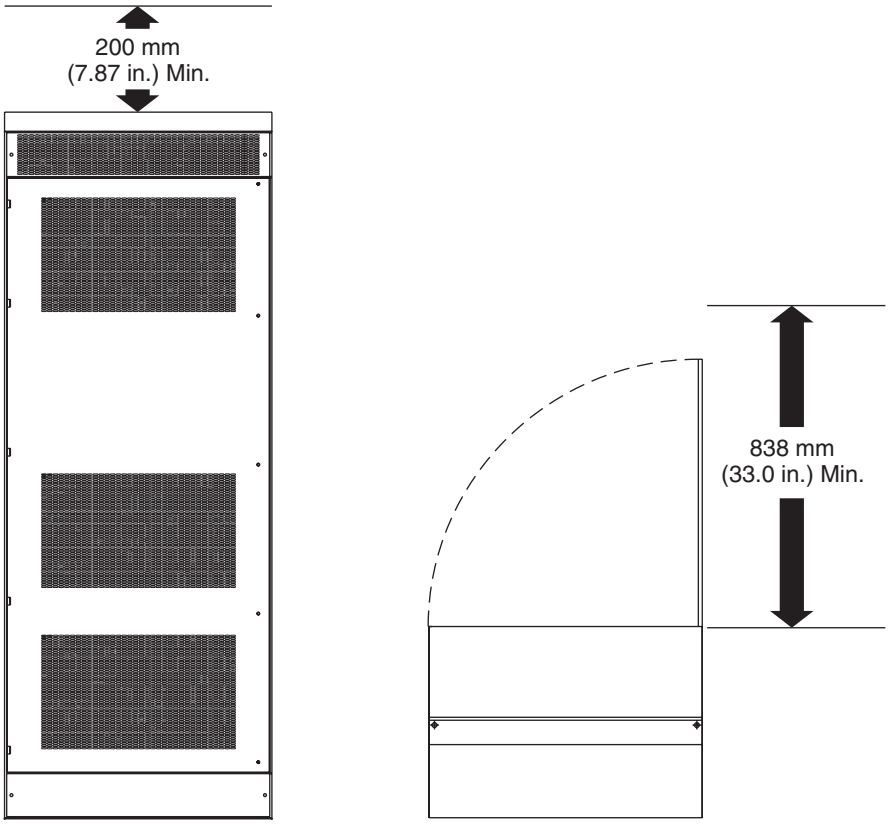


**Figure 8.2 Enclosure Code B (NEMA/UL Type 1, IP21) and K (NEMA/UL Type 1, IP21 w/Conformal Coat)**




## Operating Temperatures

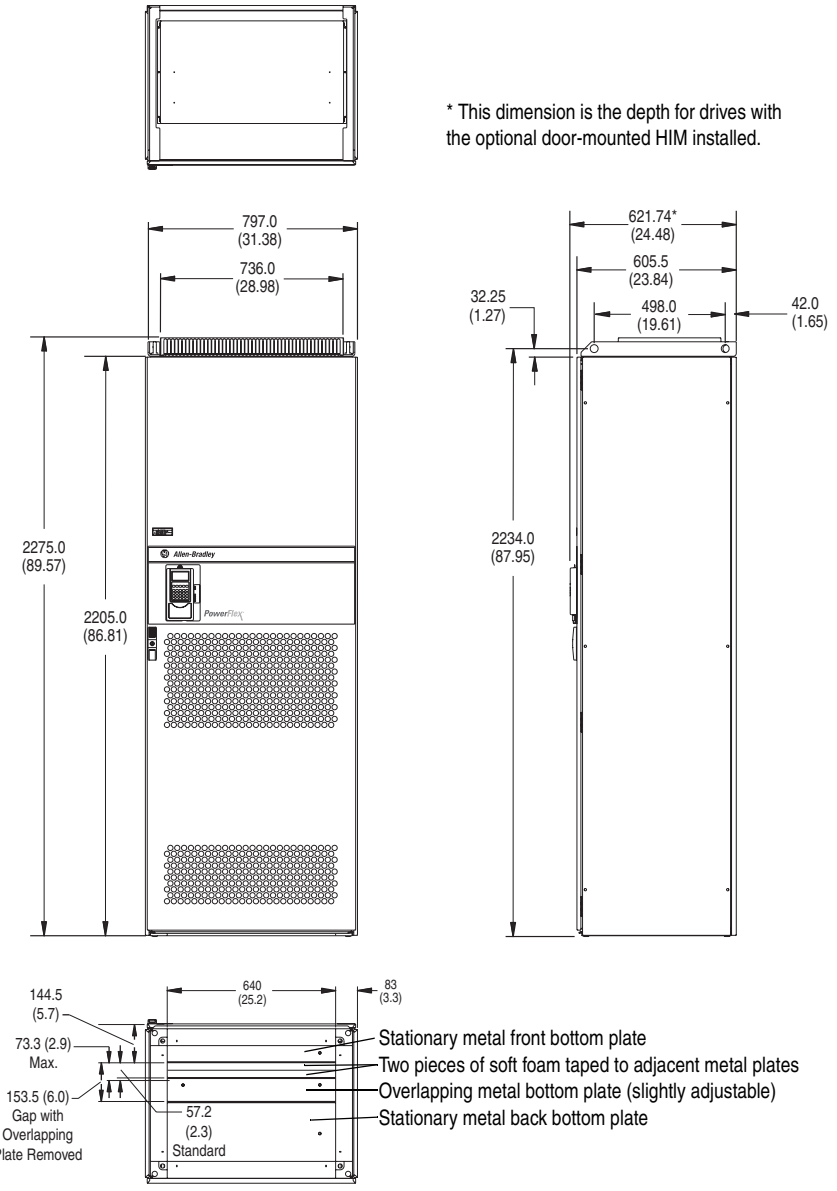
Frame 11 drives require a minimum of 3900 $m^3$/h (2295 cfm) of cooling air.

| PowerFlex Drive | Voltage Class | Amp Rating | Surrounding Air Temperature | |
|---|---|---|---|---|
| | | | Normal Duty | Heavy Duty |
| 700H | All | All | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |
| 700S | 400/480V AC (540/650V DC) | All | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |
| | 600/690V AC (810/932V DC) | 460, 502 | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |
| | 600/690V AC (810/932V DC) | 590 | 0 to 35° C (32 to 95° F) | 0 to 35° C (32 to 95° F) |

## Dimensions

**Figure 8.3 Enclosure Code A NEMA/UL Type 1 - IP21 and M (NEMA/UL Type 1, IP21 w/ Conformal Coat)**

Dimensions are in millimeters and (inches).




Wire entry for this enclosure is between two pieces of soft foam. If the adjustable plate is slid back, a gap develops between the foam pieces. Otherwise, the foam acts as a loose gasket around the wires.

**Figure 8.4 Enclosure Code B (NEMA/UL Type 1, IP20 MCC) and K (NEMA/UL Type 1, IP20 MCC w/Conformal Coat)**

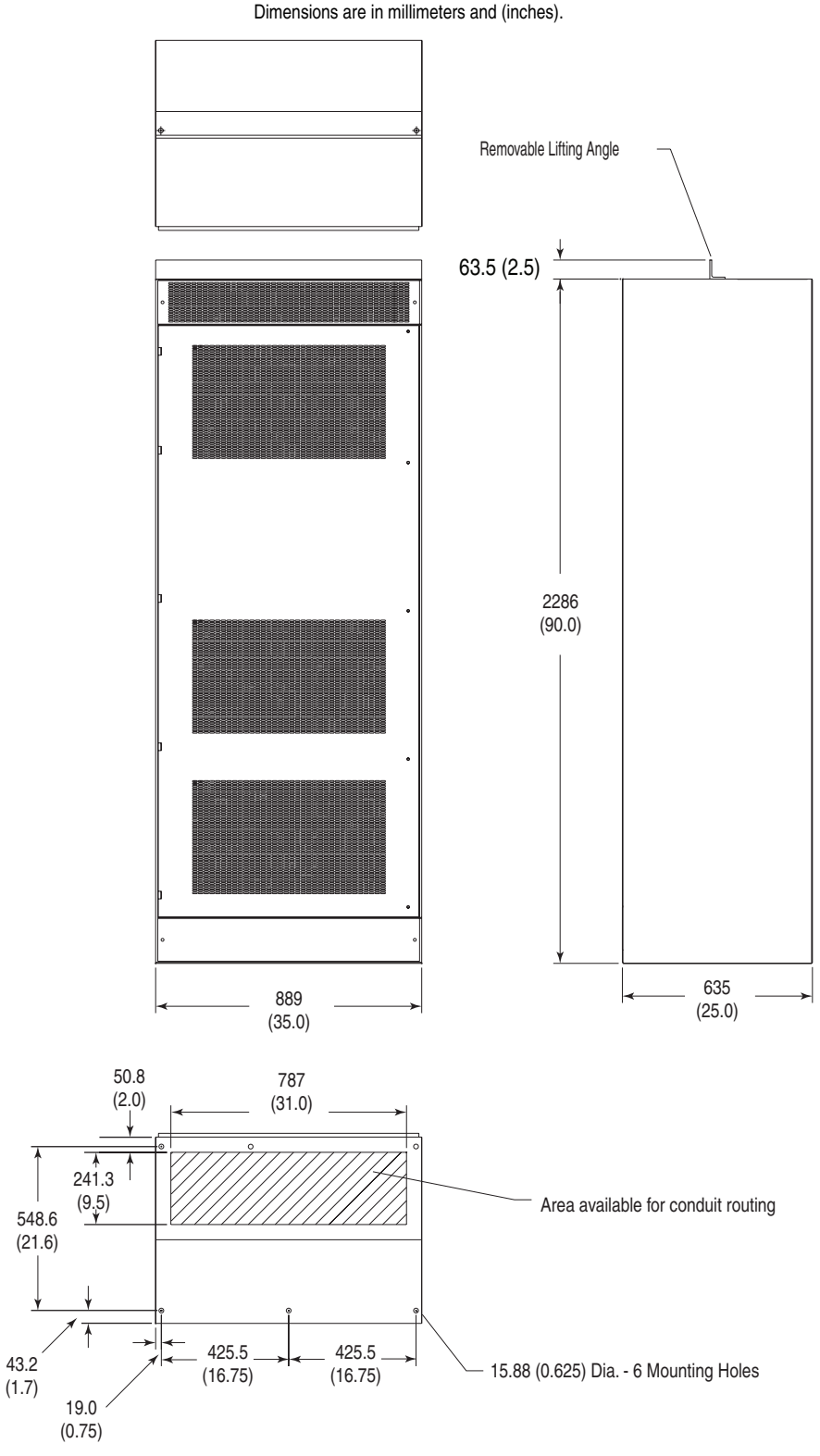
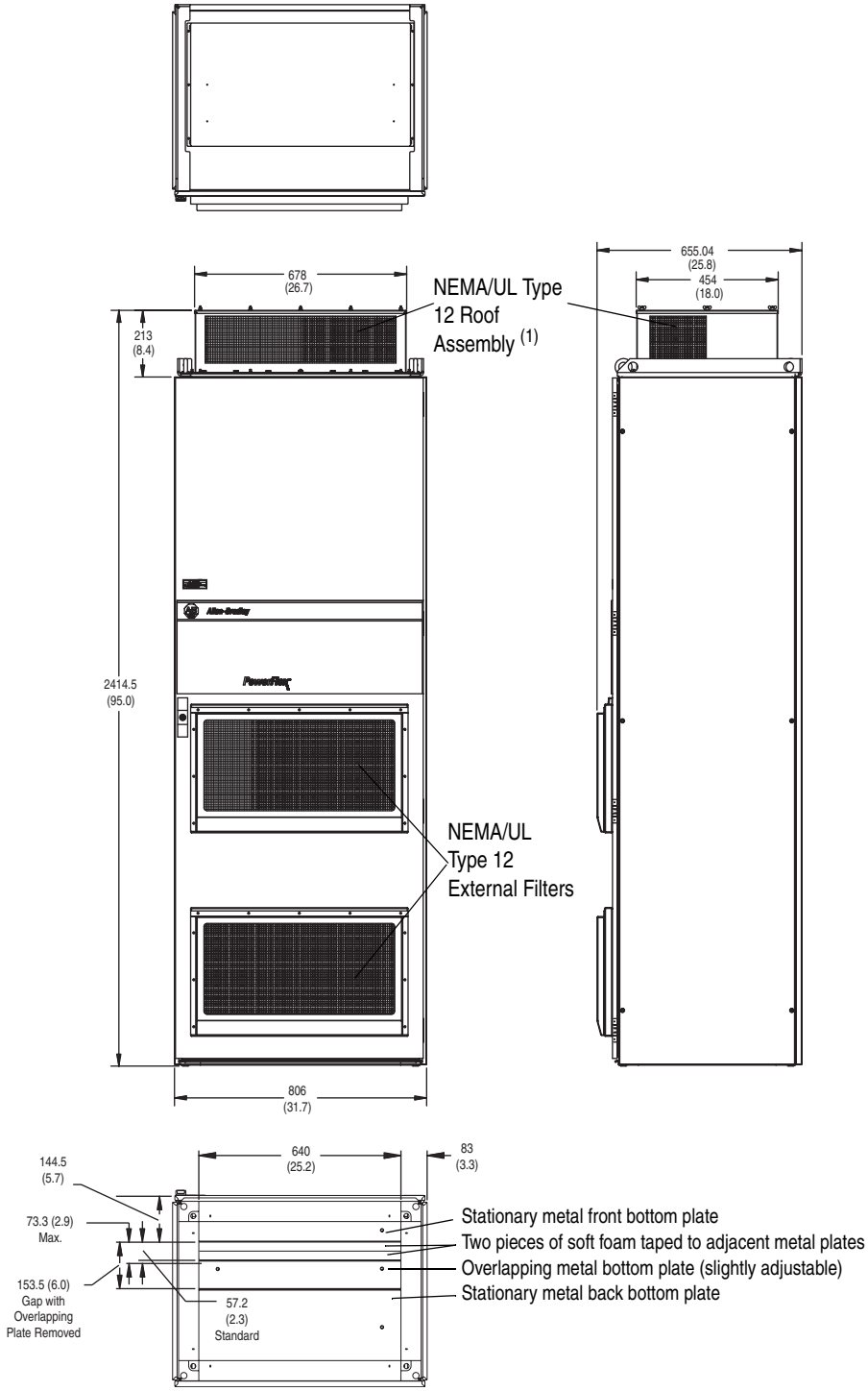


**Figure 8.5 Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12 - IP54 w/Conformal Coat)**

Dimensions are in millimeters and (inches).




Wire entry for this enclosure is between two pieces of soft foam. If the adjustable plate is slid back, a gap develops between the foam pieces. Otherwise, the foam acts as a loose gasket around the wires.

(1) NEMA/UL Type 12/IP54 Roof Assembly is 242 mm (9.5 in.) for Frame 11, 400V 730A and 600V, 590A drives. For these drives, the total height of the drive is 2443.5 mm (104.5 in.).

## Lifting and Mounting Frame 11 Drives

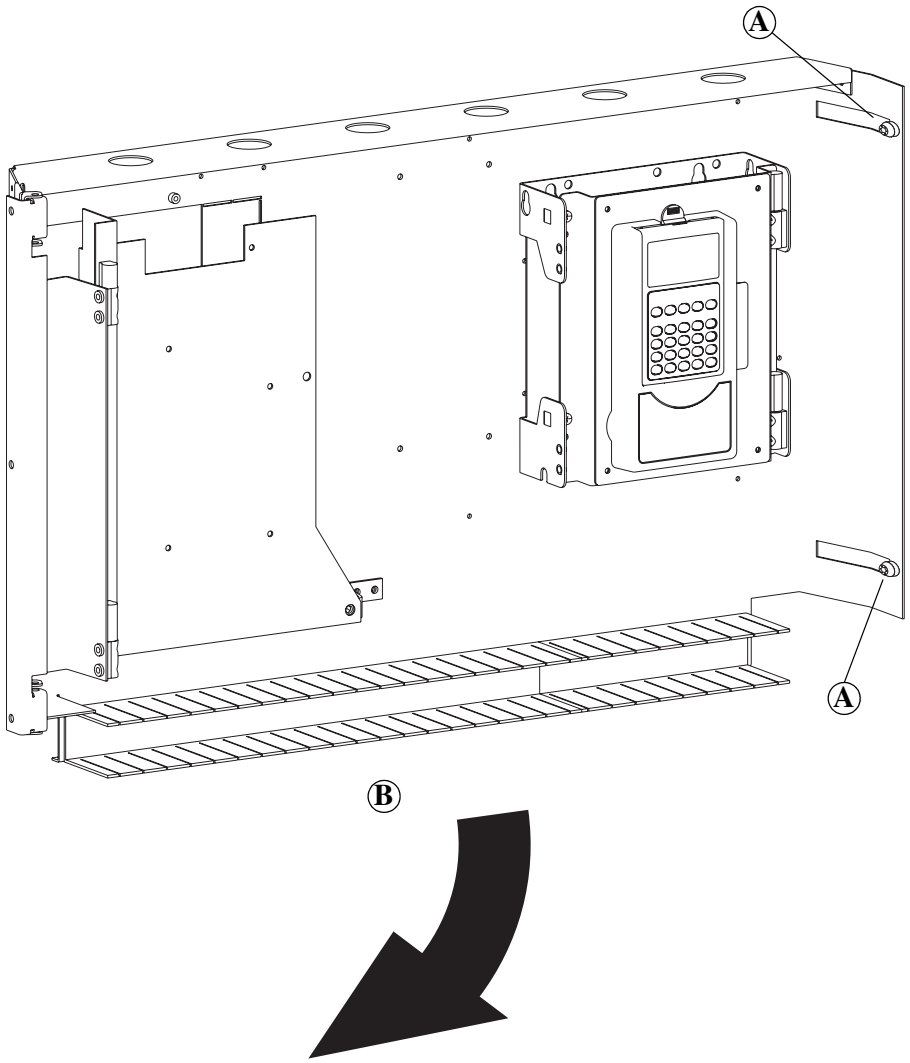
Refer to Appendix B - Lifting and Mounting Instructions for detailed instructions on lifting and mounting the drive. When you have completed the instructions in Appendix B, continue with the installation as directedd below.

## Removing the Protective Covers

### Moving the Control Frame

To gain access to the power wiring terminals, airflow plate and protective covers you may need to move the Control Frame out of the way. If you do not need to move the control frame, continue with "Removing the Airflow Plate" on page 8-7.

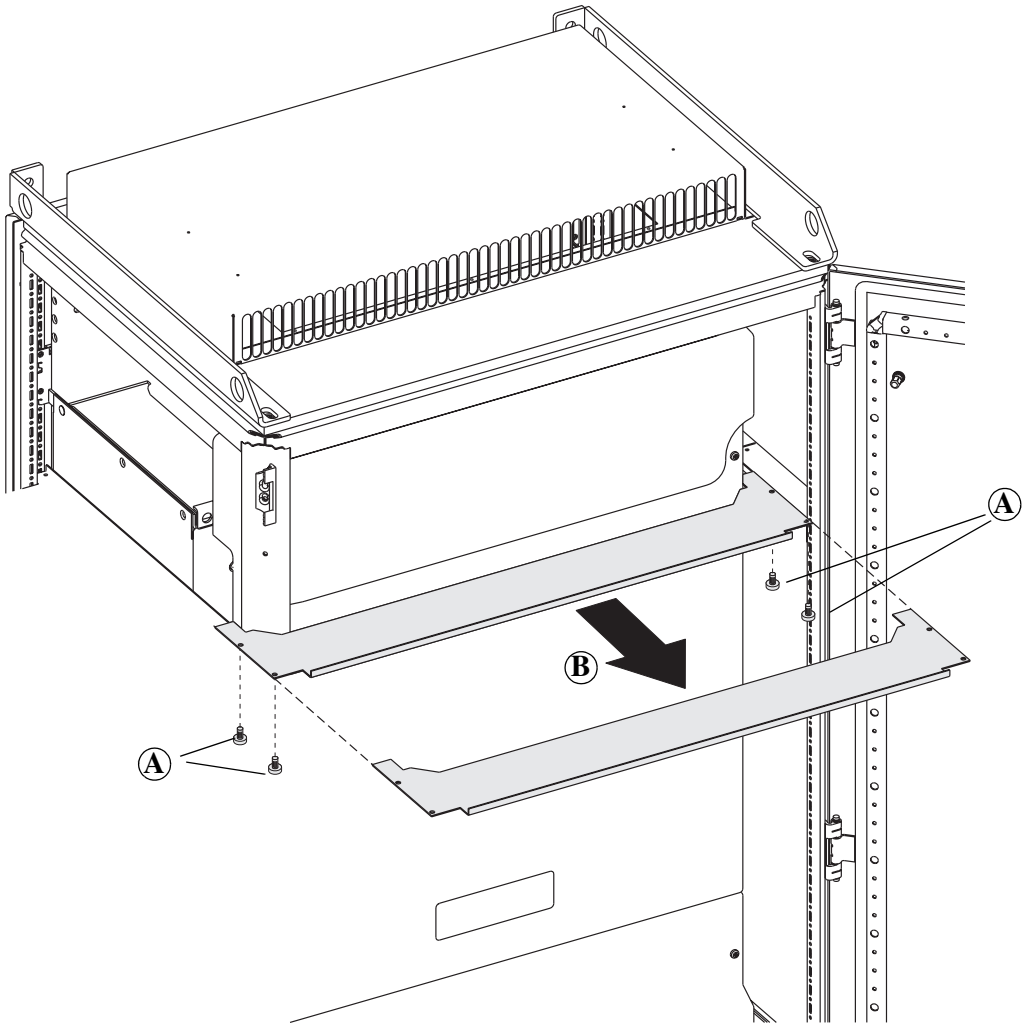
| Task | Description |
|---|---|
| Ⓐ | Loosen the T8 Torx-head screws that secure the Control Frame to the drive enclosure. |
| Ⓑ | Swing the Control Frame out and away from the power structure. |



## Removing the Airflow Plate

The drive is equipped with a plate, just above the Control Frame, that directs air flow through the drive. You may need to remove this plate in order to access the protective covers and the power terminals. If you do not need to remove the airflow plate, continue with "Removing the Protective Covers" on page 8-8.

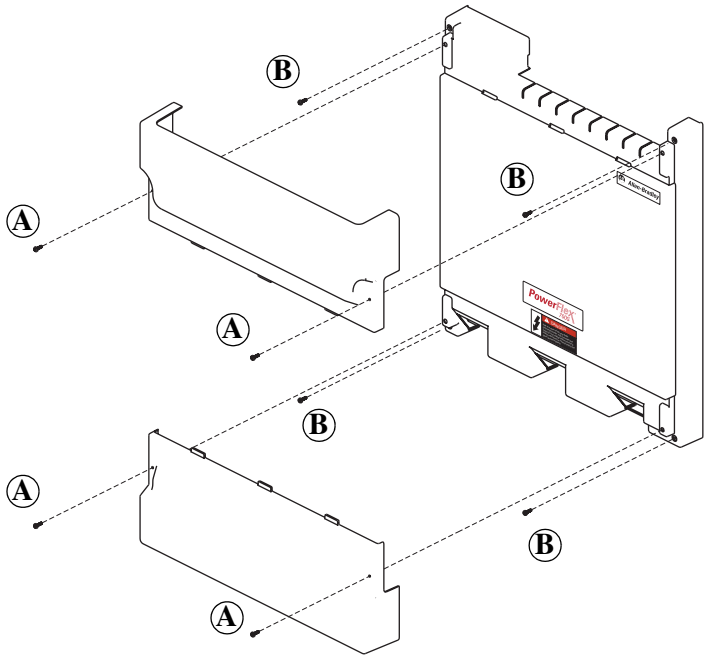
| Task | Description |
|---|---|
| Ⓐ | Remove the T8 Torx-head screws that secure the airflow plate to the drive. |
| Ⓑ | Slide the airflow plate off of the drive. |



## Removing the Protective Covers

You must remove the protective covers to gain access to the power terminals.

| Task | Description |
|---|---|
| Ⓐ | Remove the four M5 POZIDRIV screws that secure the top and bottom protective covers to the main front protective cover, then remove the top and bottom protective covers. |
| Ⓑ | Remove the four M5 POZIDRIV screws that secure the main front protective cover to the drive, then remove the protective cover. |



## Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations

Frame 11 size drives are equipped with common mode capacitors. To guard against drive damage, these capacitors should be disconnected depending upon the type of ground system on which the drive is installed.

### Installation on an Ungrounded Distribution System or High Resistive Ground

If you are installing a **400/480V** AC input drive on an ungrounded distribution system or high resistive ground, you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 8-11.
- Should insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 8-12.

If you are installing a **600/690V** AC input drive on an ungrounded distribution system or high resistive ground, you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 8-11.
- Must insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 8-12.

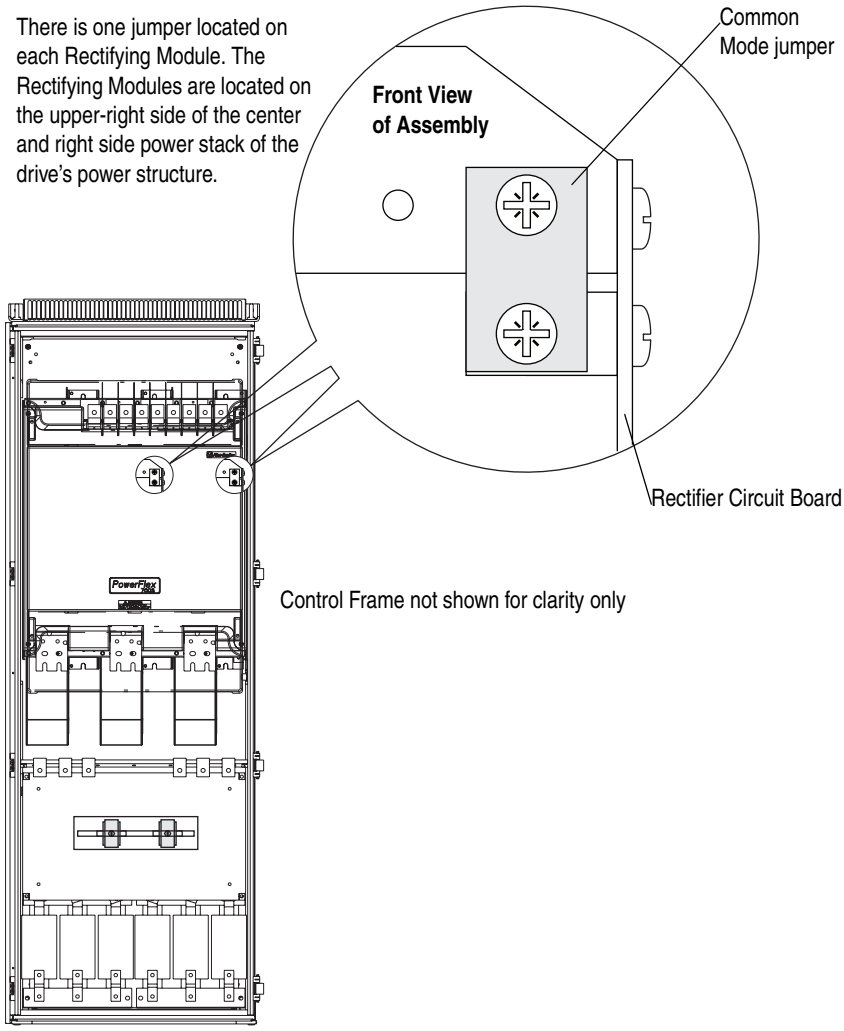
### Installation on a Grounded B Phase Delta System

If you are installing a drive on a grounded B phase Delta system, you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 8-11.
- Must insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 8-12.

**Note:** Refer to *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives - Installation Instructions*, publication DRIVES-IN001…, for additional information on an ungrounded distribution system or high resistive ground installation.

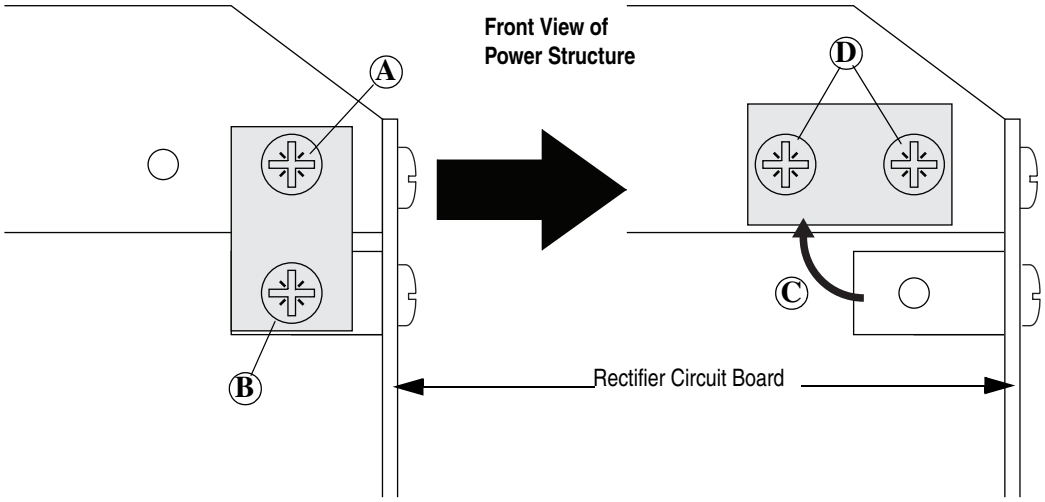
**Figure 8.6 Common Mode Jumper and Rectifier Circuit Board Location**



### Move the Common Mode Jumper to the Disconnected Position

Follow the lettered steps below to move the common mode jumper to the disconnected position (refer to Figure 8.6 for jumper location):

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

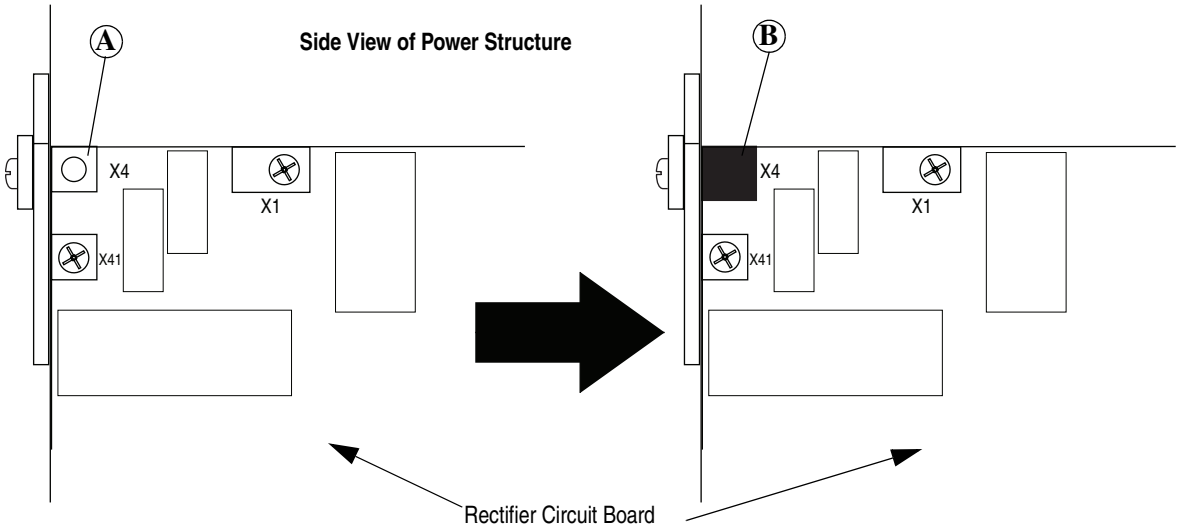


## Insulate Terminal X4 on the Rectifier Circuit Board

Follow the lettered steps below to insulate terminal X4 on the Rectifier circuit board (refer to Figure 8.6 for Rectifier board location):

| Task | Description |
|---|---|
| Ⓐ | Remove the screw from the X4 connection on the Rectifier circuit board. |
| Ⓑ | Insulate the top and bottom of the X4 connection on the Rectifier circuit board. |

**Important:** Do not install the screw and washer that was removed from this connection.



## Power Wiring

### AC Input Wiring

The table below identifies which frame 11 drives contain only one rectifying module and which frame 11 drives contain two rectifying modules. Drives with one rectifying module contain only one set of input power terminals. Drives with two parallel rectifying modules contain two sets of input power terminals--you must supply power to both sets of input terminals on these drives. There are several methods for accomplishing this. Each of these methods is shown below.

| Voltage Class | Amps | Number of Rectifiers |
|---|---|---|
| 400/480V AC Input | 590 | 2 |
| | 650 | 2 |
| | 730 | 2 |
| 600/690V AC Input | 460 | 1 |
| | 502 | 1 |
| | 590 | 2 |

**Important:** Parallel wiring must have the same cable dimensions, type and routing. Non-symmetrical wiring may cause unequal loading between the converters and reduce the drive's ability to deliver current to the motor.

**Figure 8.1 AC Wiring Example: Two Fuses per Phase**

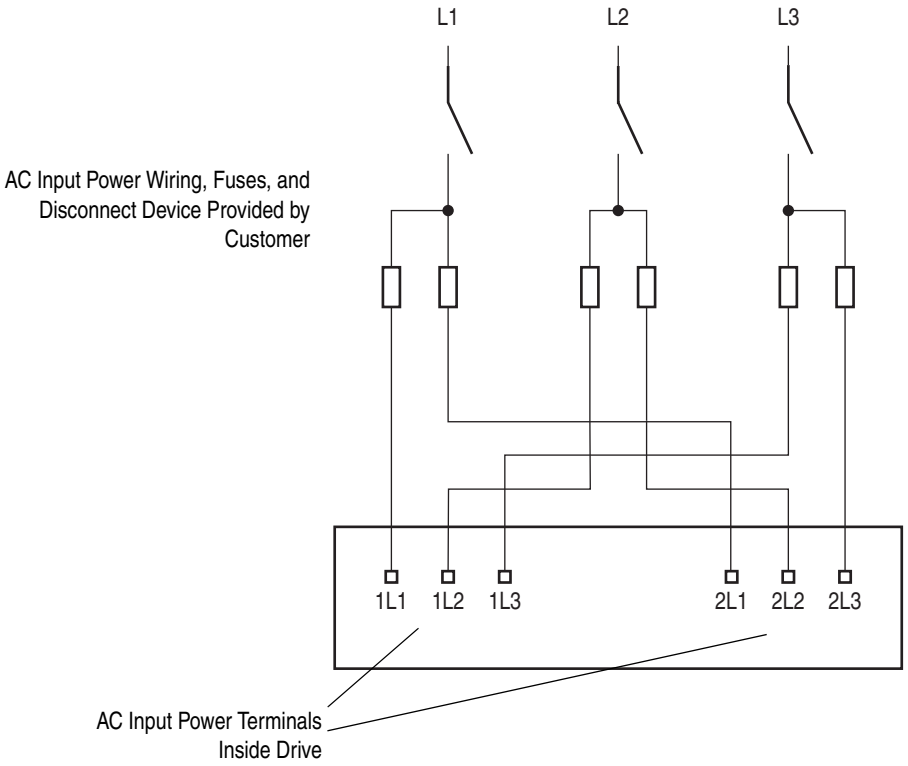


**Figure 8.2 AC Wiring Example: One Fuse per Phase**

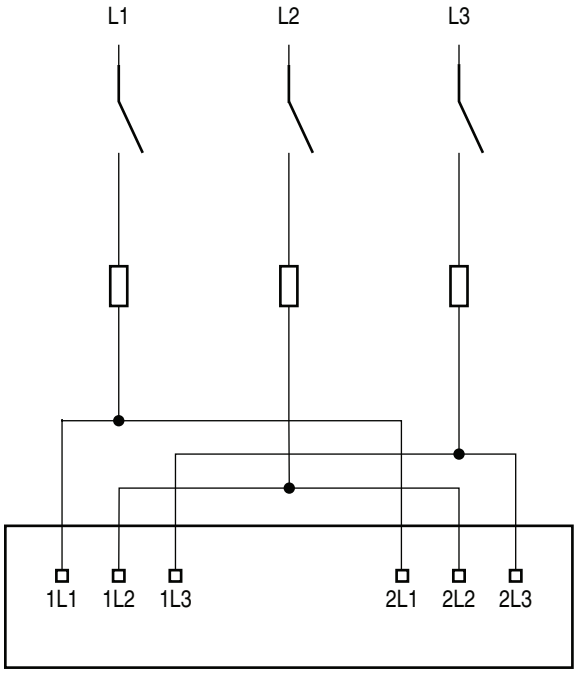
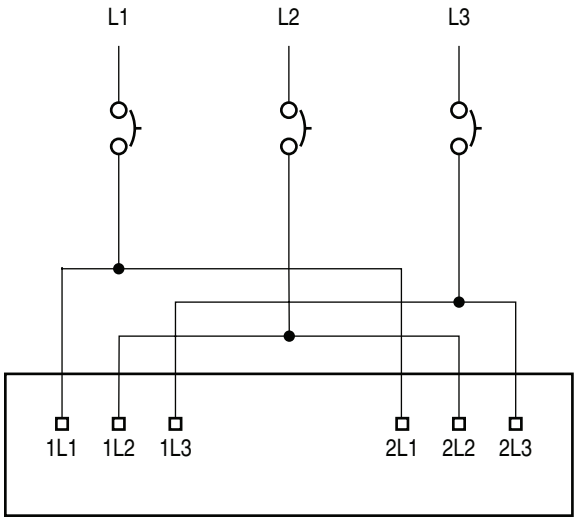



**Figure 8.3 AC Wiring Example: Circuit Breaker**




**Important:** Once power wiring has been completed, the protective covers must be installed before energizing the drive. Installation is in reverse order of removal (refer to "Removing the Protective Covers" on page 8-6.)

**Table 8.A 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 (3)<br>1L1, 1L2, 1L3, 2L1, 2L2, 2L3 | AC Input power | 300 $mm^2$<br>(600 MCM) | 2.1 $mm^2$<br>(14 AWG) | 40 N•m<br>(354 lb•in) | M12 |
| ❷ | Output Power Terminal Block (3)<br>U/T1, V/T2, W/T3 | Motor connections | 300 $mm^2$<br>(600 MCM) | 2.1 $mm^2$<br>(14 AWG) | 40 N•m<br>(354 lb•in) | M12 |
| ❸ | SHLD Terminal, PE, Motor Ground (3) | Terminating point for wiring shields | 300 $mm^2$<br>(600 MCM) | 2.1 $mm^2$<br>(14 AWG) | 40 N•m<br>(354 lb•in) | M10 |
| ❹ | DC Bus (3)<br>(2 Terminals; DC–, DC+) | DC input or external brake | 300 $mm^2$<br>(600 MCM) | 2.1 $mm^2$<br>(14 AWG) | 40 N•m<br>(354 lb•in) | M12 |
| ❺ | Cable Clamp for Shield | | | | | |

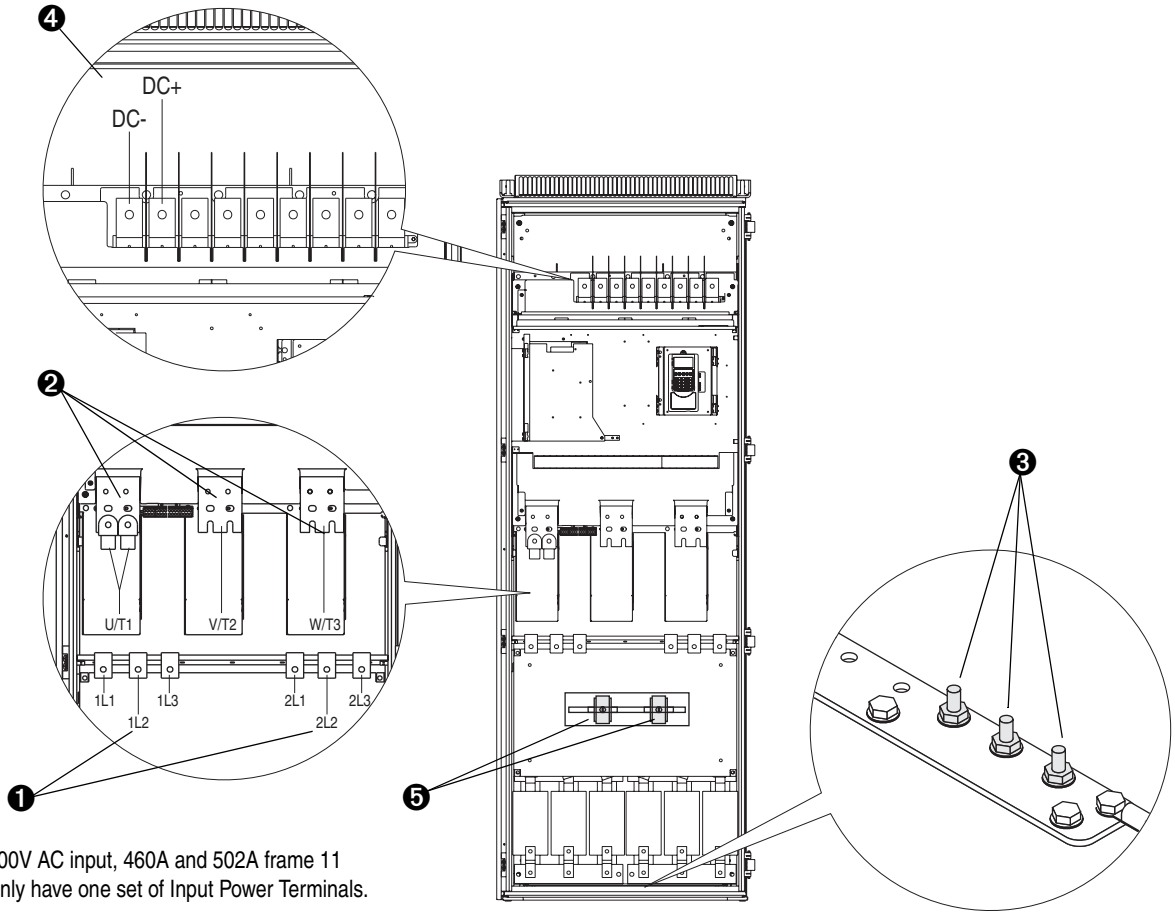
(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.

(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.

**Figure 8.7 Terminal Locations**




**Note**: 600V AC input, 460A and 502A frame 11 drives only have one set of Input Power Terminals.

## Notes:

# Frame 12 Installation

Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All information in Chapter 1 “General Installation Information” and in this chapter must be read and understood before the actual installation begins.

**ATTENTION:** The following information is merely a guide for proper installation. Rockwell Automation, Inc. cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

## Minimum Mounting Clearances

**Figure 9.1 Enclosure Codes A (NEMA/UL Type 1, IP21), M (NEMA/UL Type 1, IP21 w/ Conformal Coat), H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/ Conformal Coat)**

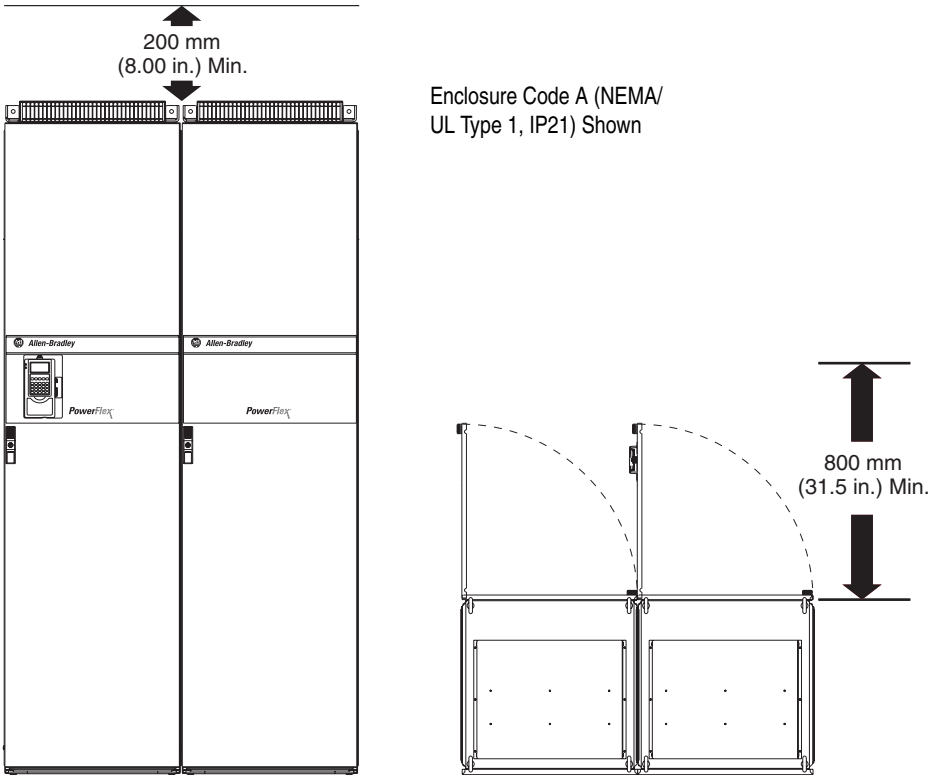
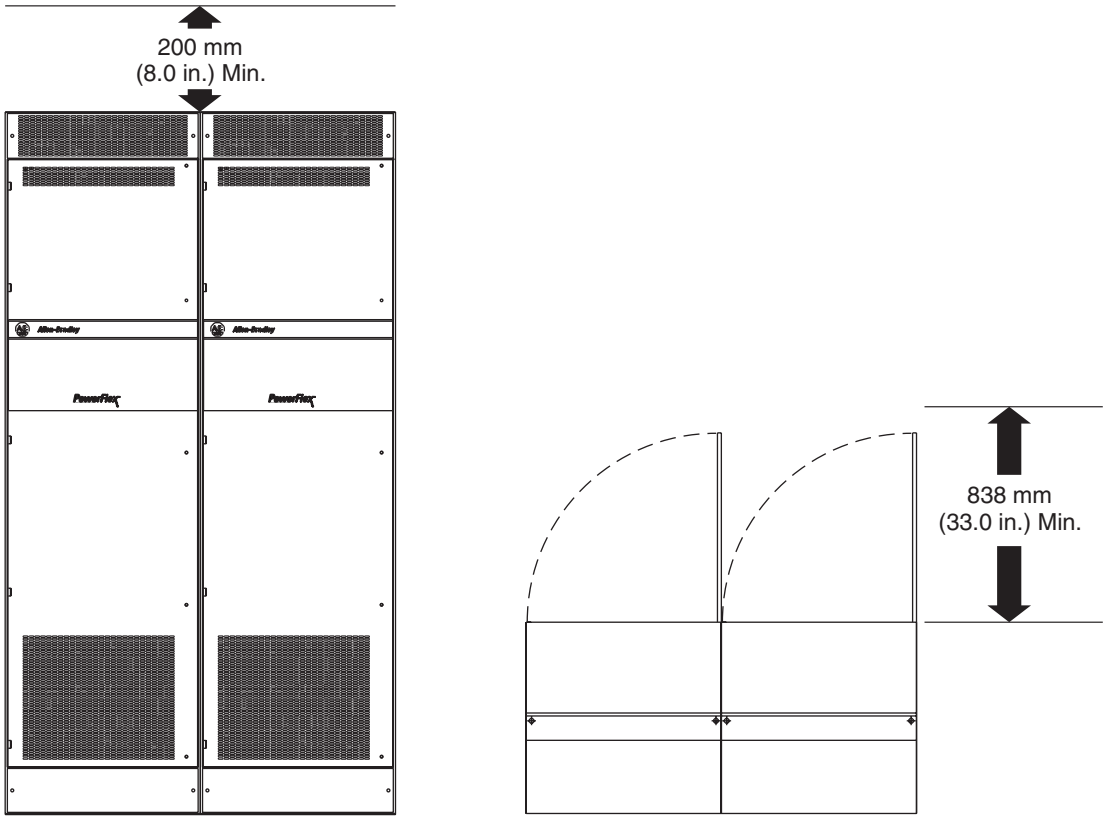


**Figure 9.2 Enclosure Code B (NEMA/UL Type 1, IP21) and K (NEMA/UL Type 1, IP21 w/Conformal Coat)**




## Operating Temperatures

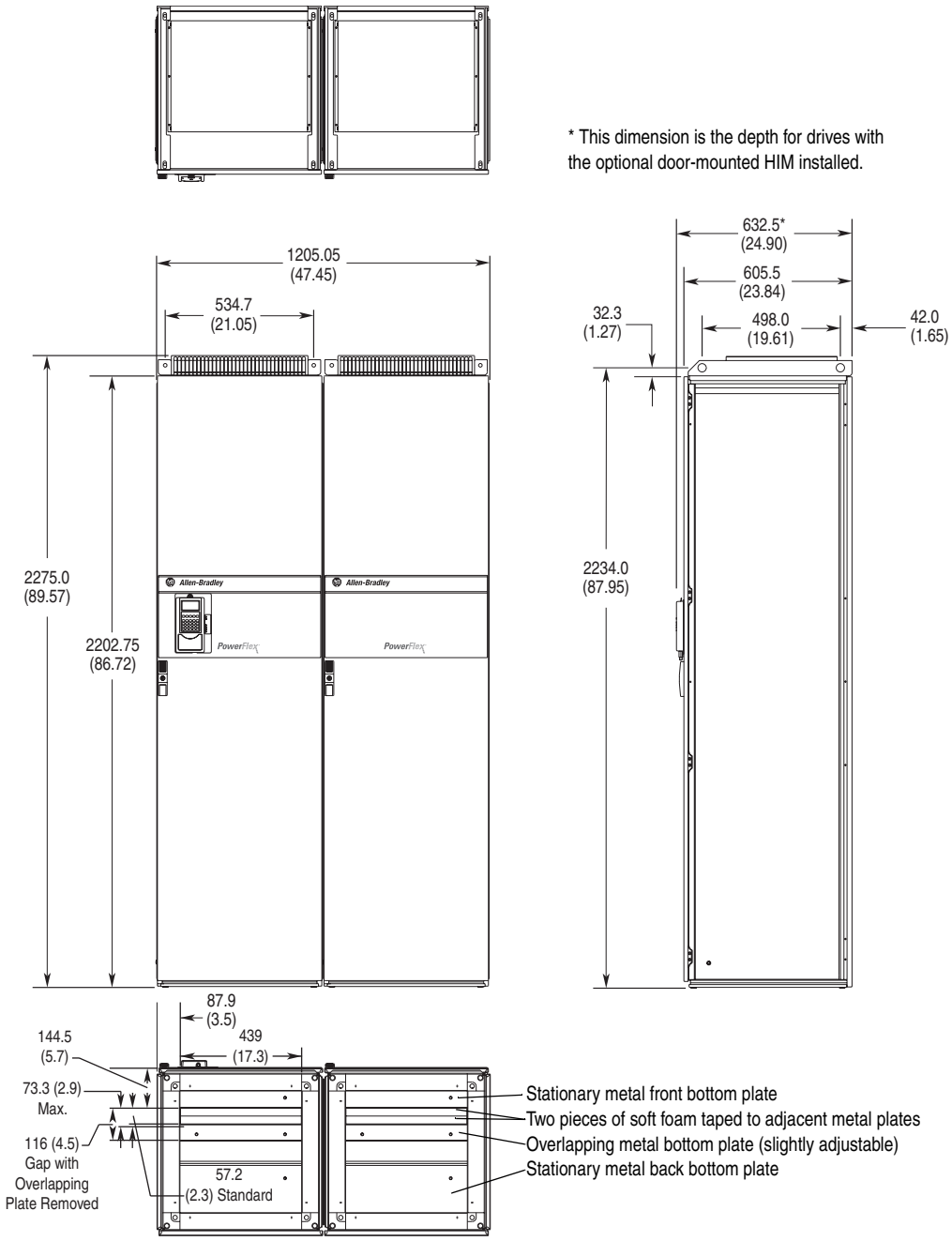
Frame 12 drives require a minimum of 5200 $m^3$/h (3060 cfm) of cooling air.

| PowerFlex Drive | Voltage Class | Amp Rating | Surrounding Air Temperature | |
|---|---|---|---|---|
| | | | Normal Duty | Heavy Duty |
| 700H | 400/480V AC (540/650V DC) | 820, 920 | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |
| | 400/480V AC (540/650V DC) | 1030 | 0 to 40° C (32 to 104° F) | 0 to 35° C (32 to 95° F) |
| | 600/690V AC (810/932V DC) | 820, 920 | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |
| | 600/690V AC (810/932V DC) | 1030 | 0 to 35° C (32 to 95° F) | 0 to 40° C (32 to 104° F) |
| 700S | 400/480V AC (540/650V DC) | 820, 920 | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |
| | 400/480V AC (540/650V DC) | 1030 | 0 to 40° C (32 to 104° F) | 0 to 35° C (32 to 95° F) |
| | 600/690V AC (810/932V DC) | 820, 920 | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |
| | 600/690V AC (810/932V DC) | 1030 | 0 to 35° C (32 to 95° F) | 0 to 35° C (32 to 95° F) |

## Dimensions

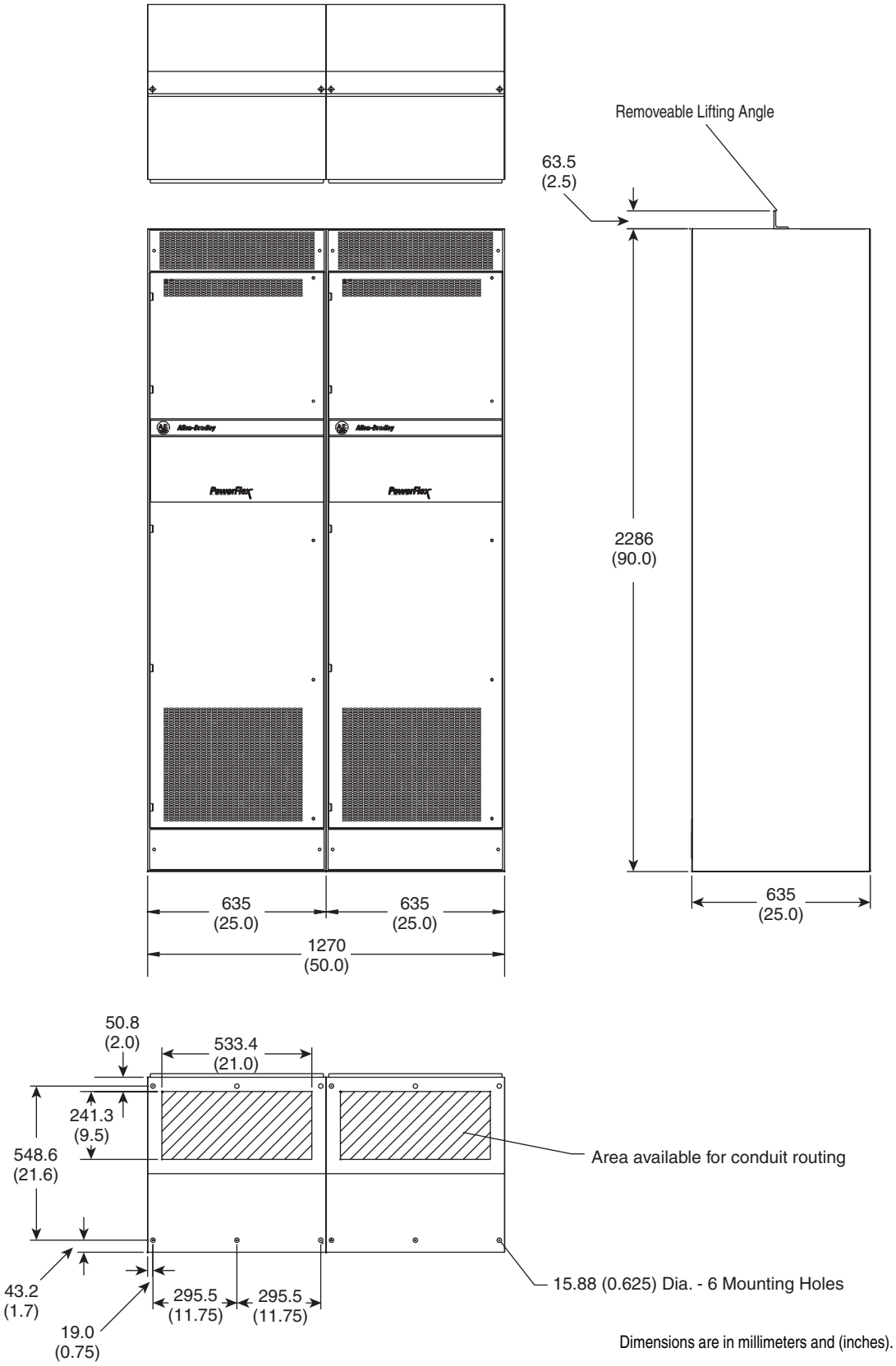
**Figure 9.3 Enclosure Code A (NEMA/UL Type 1 - IP21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)**

Dimensions are in millimeters and (inches).




Wire entry for this enclosure is between two pieces of soft foam. If the adjustable plate is slid back, a gap develops between the foam pieces. Otherwise, the foam acts as a loose gasket around the wires.

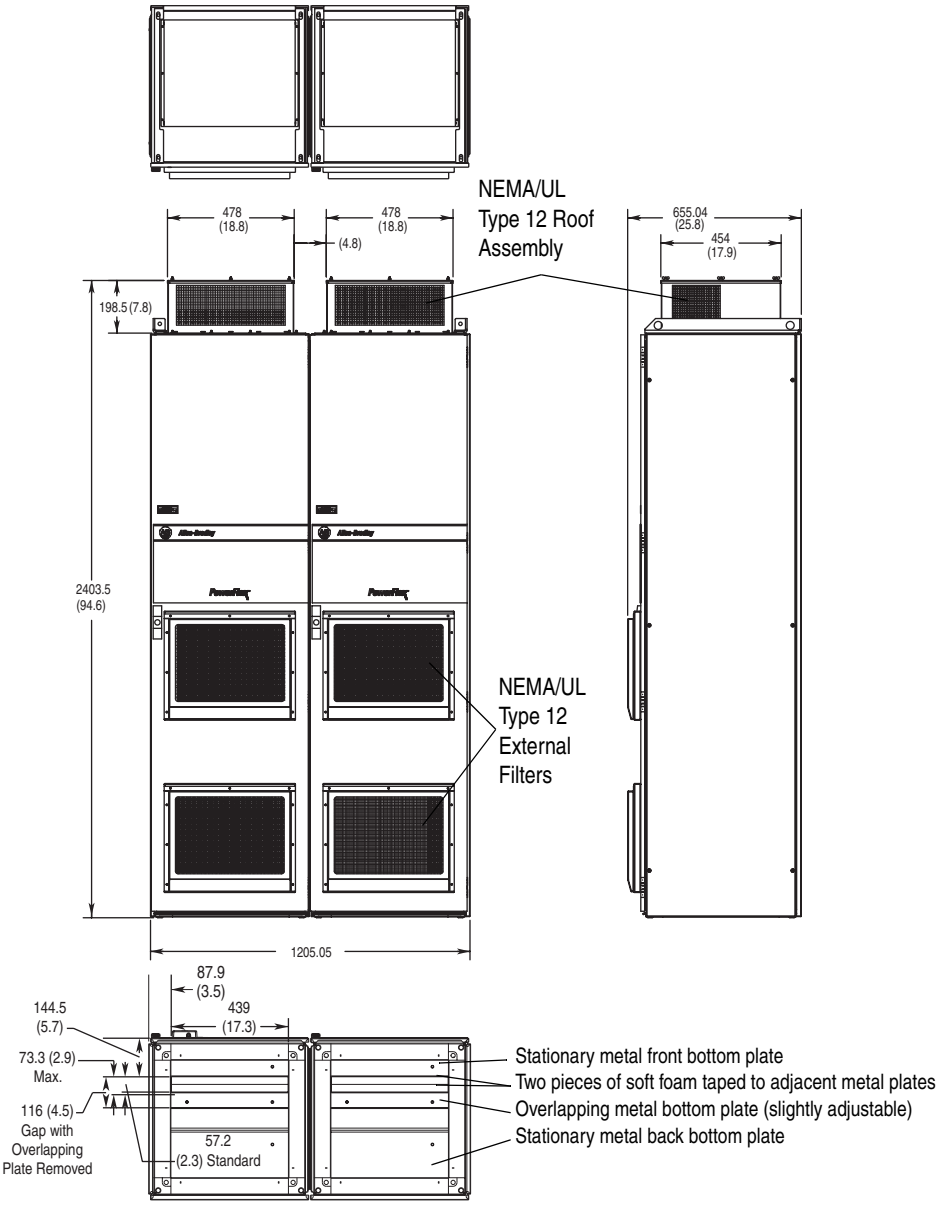
**Figure 9.4 Enclosure Code B (NEMA/UL Type 1, IP21) and K (NEMA/UL Type 1, IP21 w/Conformal Coat)**




Dimensions are in millimeters and (inches).

**Figure 9.5 Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/Conformal Coat)**

Dimensions are in millimeters and (inches).




Wire entry for this enclosure is between two pieces of soft foam. If the adjustable plate is slid back, a gap develops between the foam pieces. Otherwise, the foam acts as a loose gasket around the wires.

## Lifting and Mounting Frame 12 Drives

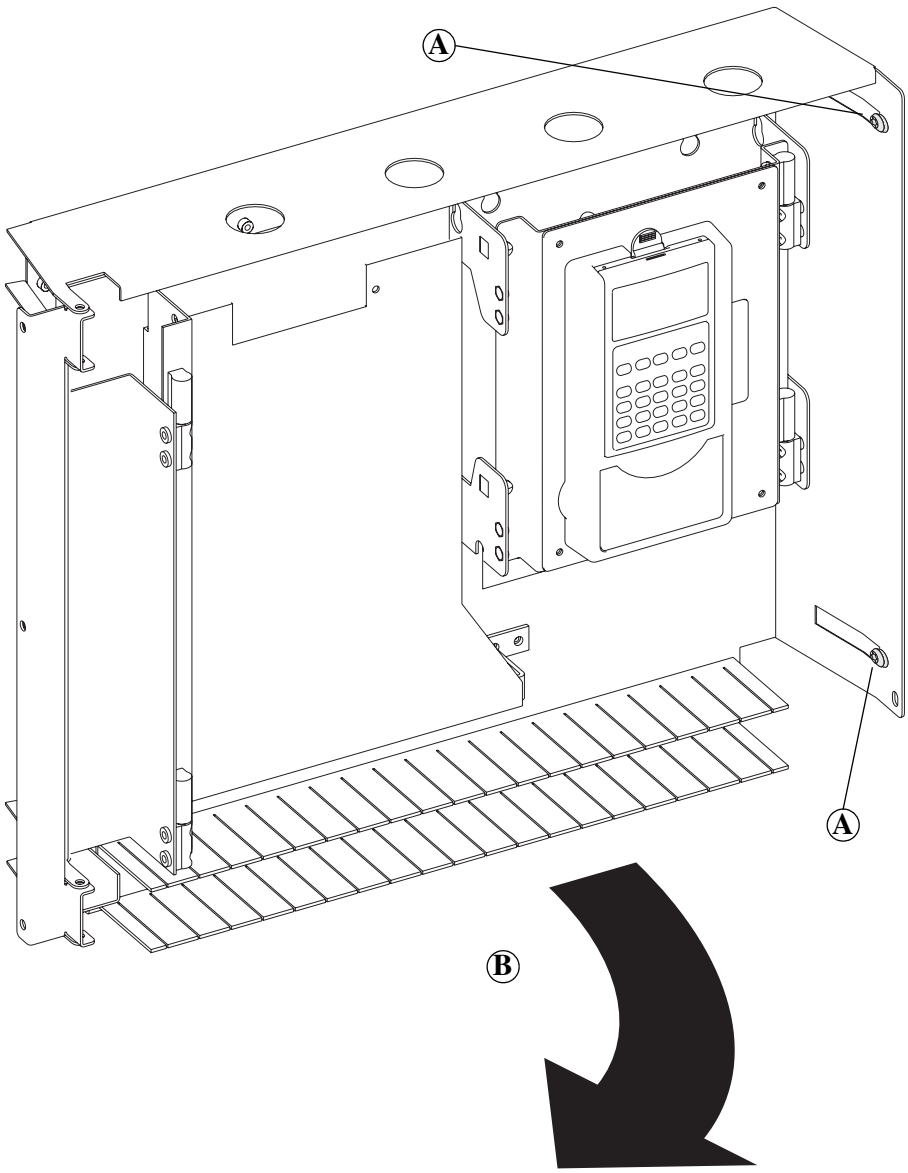
Refer to Appendix B - Lifting and Mounting Instructions for detailed instructions on lifting and mounting the drive. When you have completed the instructions in Appendix B, continue with the installation as directed below.

## Removing the Protective Covers

### Moving the Control Frame

To gain access to the power wiring terminals, airflow plate and protective covers you may need to move the Control Frame out of the way. If you do not need to move the control frame, continue with "Removing the Airflow Plate" on page 9-7.

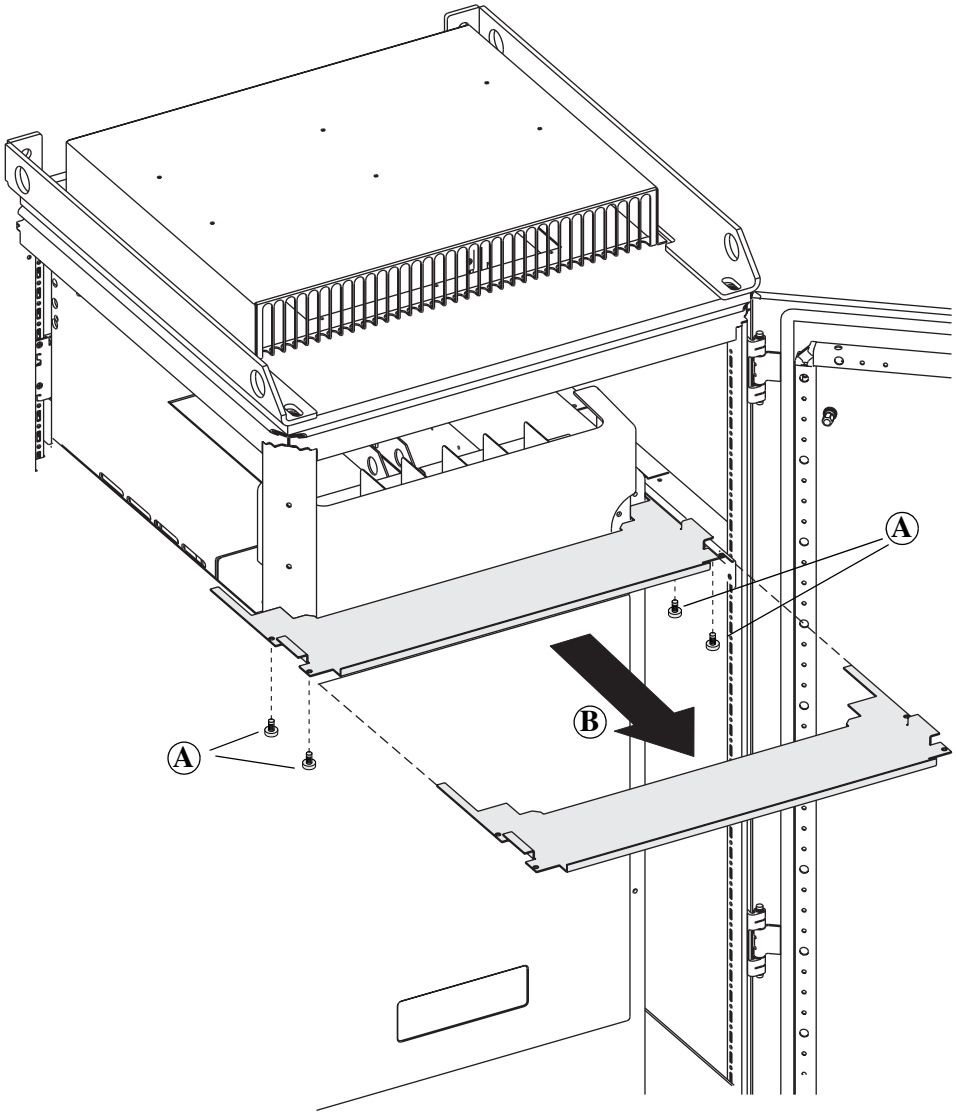
| Task | Description |
|---|---|
| Ⓐ | Loosen the T8 Torx-head screws that secure the Control Frame to the drive enclosure (Remove screws on early frame 10 drives). |
| Ⓑ | Swing the Control Frame out and away from the power structure. |



## Removing the Airflow Plate

The drive is equipped with a plate, just above the Control Frame, that directs air flow through the drive. You may need to remove this plate in order to access the protective covers and the power terminals. If you do not need to remove the airflow plate, continue with "Removing the Protective Covers" on page 9-8.

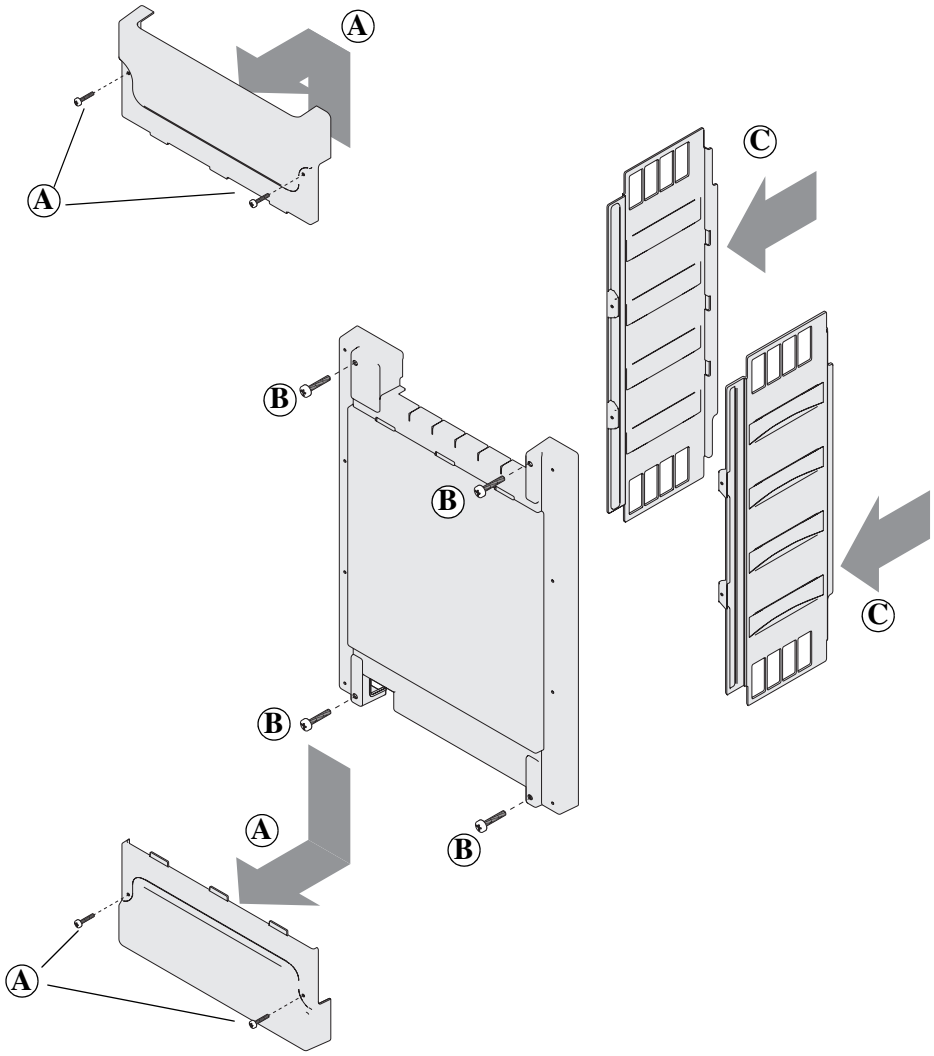
| Task | Description |
|---|---|
| Ⓐ | Remove the T8 Torx-head screws that secure the airflow plate to the drive. |
| Ⓑ | Slide the airflow plate off of the drive. |



## Removing the Protective Covers

You must remove the protective covers to gain access to the Power structure.

| Task | Description |
|---|---|
| Ⓐ | Remove the four M5 POZIDRIV screws that secure the top and bottom protective covers to the main front protective cover, then remove the top and bottom protective covers.<br><br>***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 ones.* |
| Ⓑ | Remove the four M5 POZIDRIV screws that secure the main front protective cover to the drive, then remove the protective cover. |
| Ⓒ | Remove the side protective covers. |



## Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations

Frame 12 size drives are equipped with common mode capacitors and capacitors that are connected to the input terminals. To guard against drive damage, these capacitors should be disconnected depending upon the type of ground system on which the drive is installed.

### Installation on an Ungrounded Distribution System or High Resistive Ground

If you are installing a **400/480V** AC input drive on an ungrounded distribution system or high resistive ground, you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 9-11.
- Should insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 9-12.
- Must disconnect the small capacitors from the input terminals - refer to "Disconnect the Small Capacitors from the Input Terminals" on page 9-13.

If you are installing a **600/690V** AC input drive on an ungrounded distribution system or high resistive ground, you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 9-11.
- Must insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 9-12.
- Must disconnect the small capacitors from the input terminals - refer to "Disconnect the Small Capacitors from the Input Terminals" on page 9-13.

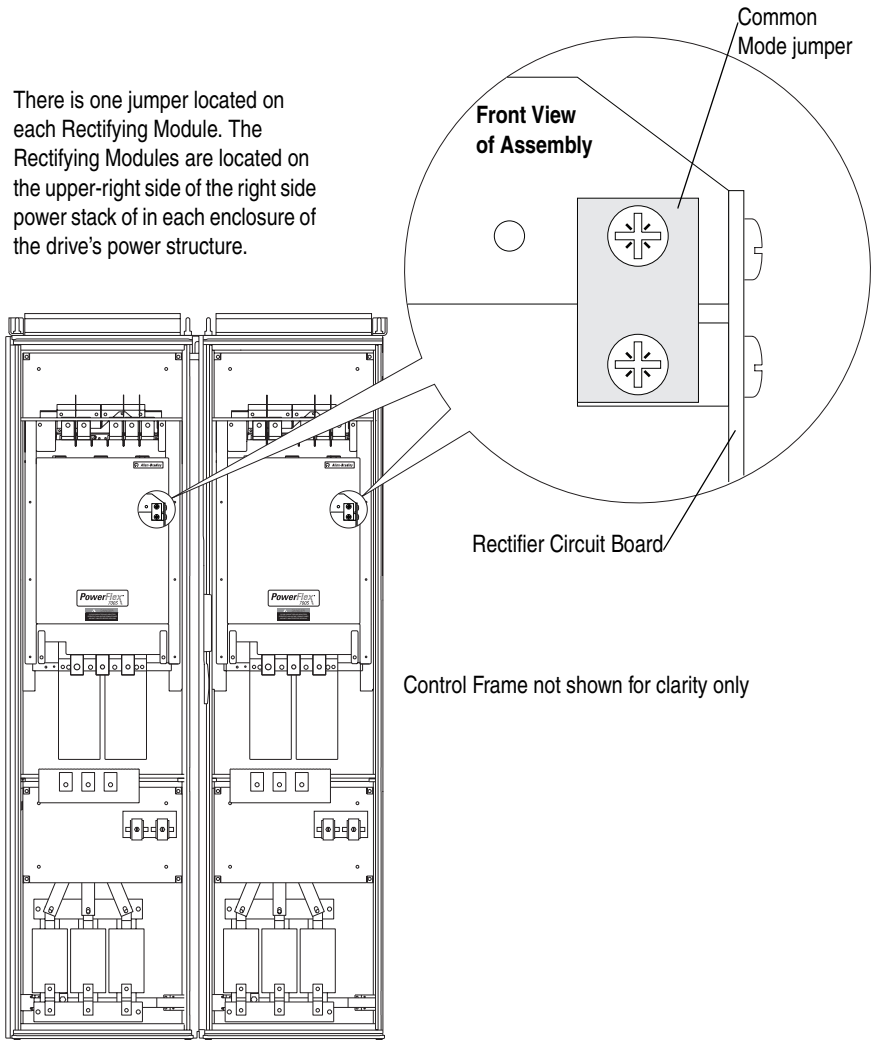
### Installation on a Grounded B Phase Delta System

If you are installing a drive on a grounded B phase Delta system, you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 9-11.
- Must insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 9-12.
- Must disconnect the small capacitors from the input terminals - refer to "Disconnect the Small Capacitors from the Input Terminals" on page 9-13.

**Note:** Refer to *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives - Installation Instructions*, publication DRIVES-IN001…, for additional information on an ungrounded distribution system or high resistive ground installation.

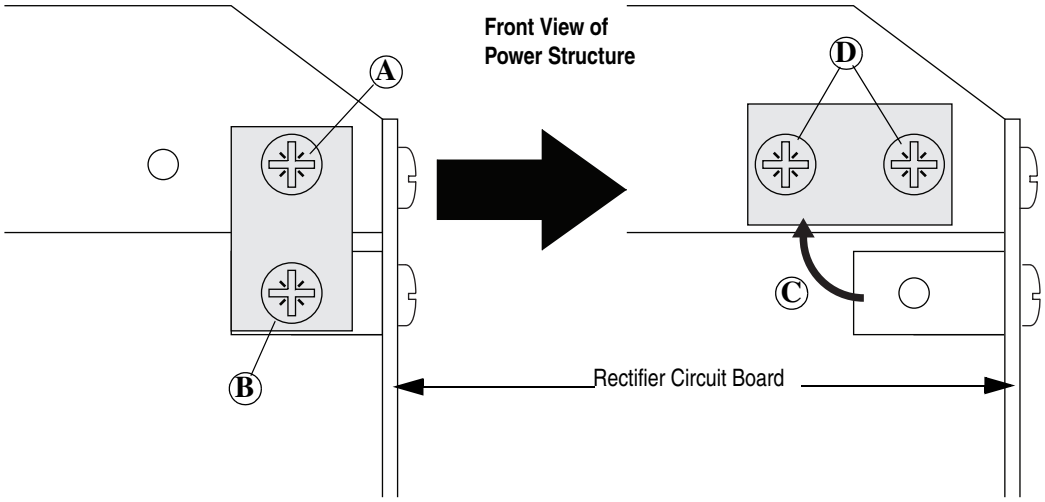
**Figure 9.6 Common Mode Jumper and Rectifier Circuit Board Location**



### Move the Common Mode Jumper to the Disconnected Position

Follow the lettered steps below to move the common mode jumper to the disconnected position (refer to Figure 9.6 for jumper location):

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

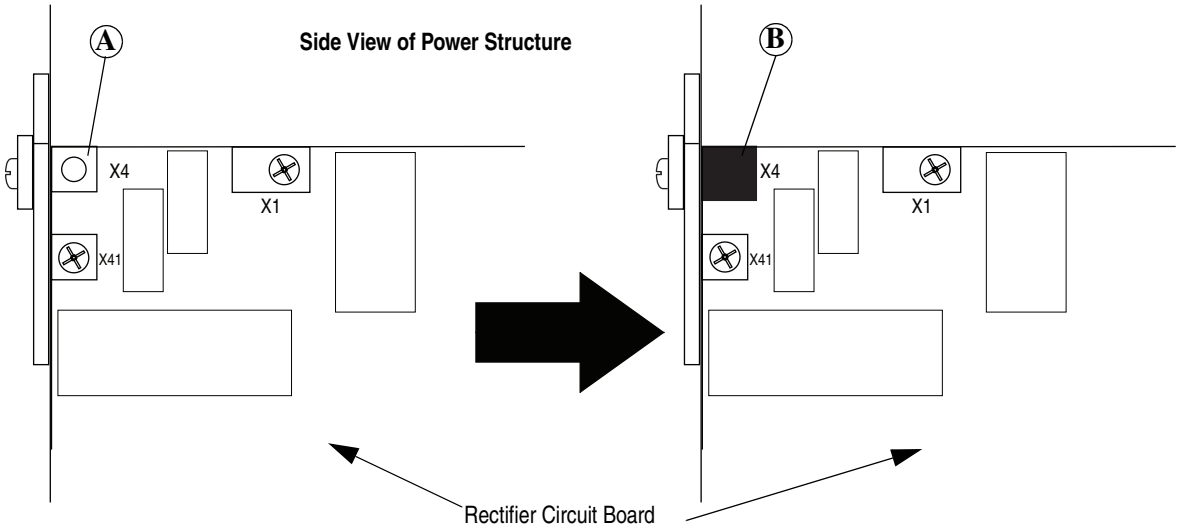


## Insulate Terminal X4 on the Rectifier Circuit Board

Follow the lettered steps below to insulate terminal X4 on the Rectifier circuit board (refer to Figure 9.6 for Rectifier board location):

| Task | Description |
|---|---|
| Ⓐ | Remove the screw from the X4 connection on the Rectifier circuit board. |
| Ⓑ | Insulate the top and bottom of the X4 connection on the Rectifier circuit board. |

**Important:** Do not install the screw and washer that was removed from this connection.



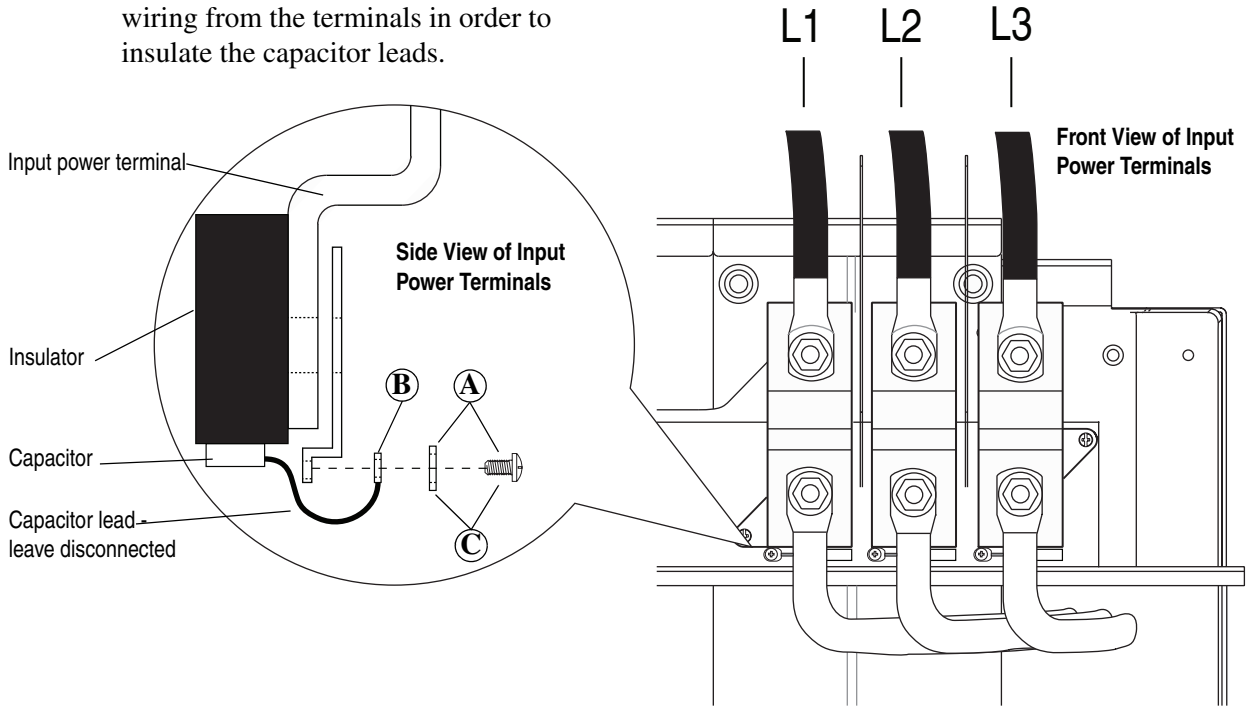
### Disconnect the Small Capacitors from the Input Terminals

Follow the lettered steps below to disconnect the small capacitors from the input 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 and leave disconnected. |
| Ⓒ | Install and tighten the screws and lock washers only. |

**Important:** Do not re-install the capacitor leads.

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



## Power Wiring

### Input Power Wiring

Frame 12 drives utilize two parallel power structures, and therefore have two sets of AC input power terminals. You must supply power to both sets of input terminals. There are several methods for accomplishing this.

**Important:** Parallel wiring must have the same cable dimensions, type and routing. Non-symmetrical wiring may cause unequal loading between the converters and reduce the drive's ability to deliver current to the motor.

**Figure 9.4 Frame 12 AC Wiring Example: Two Fuses per Phase**

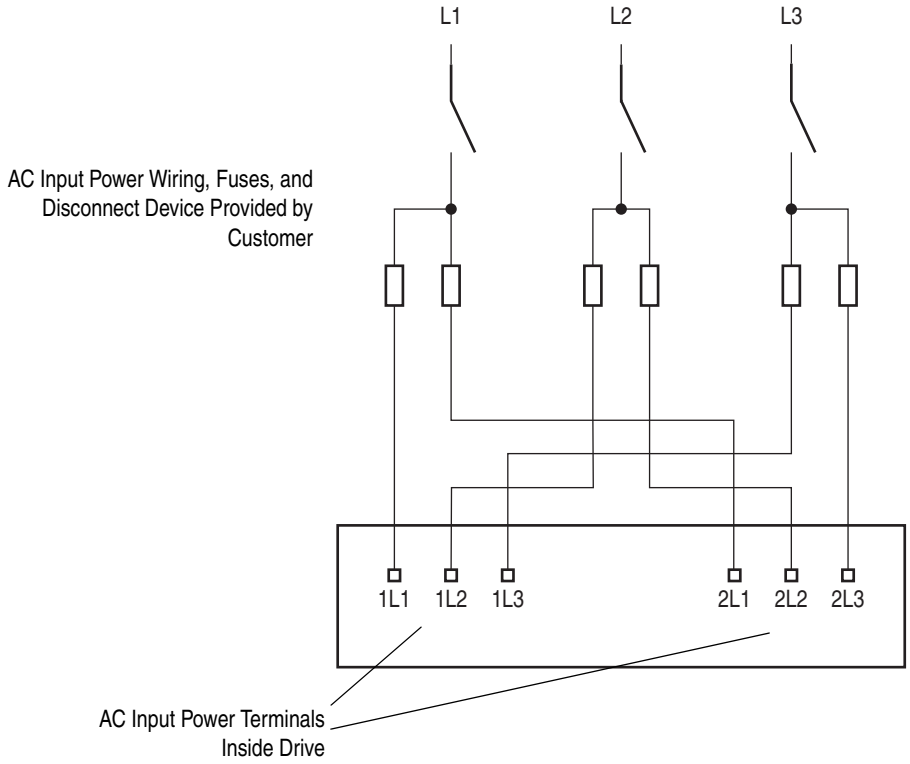


**Figure 9.5 Frame 12 AC Wiring Example: One Fuse per Phase**

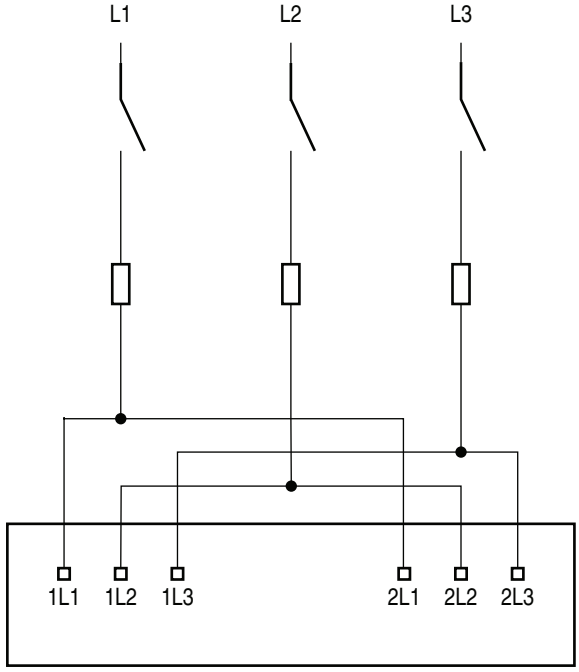
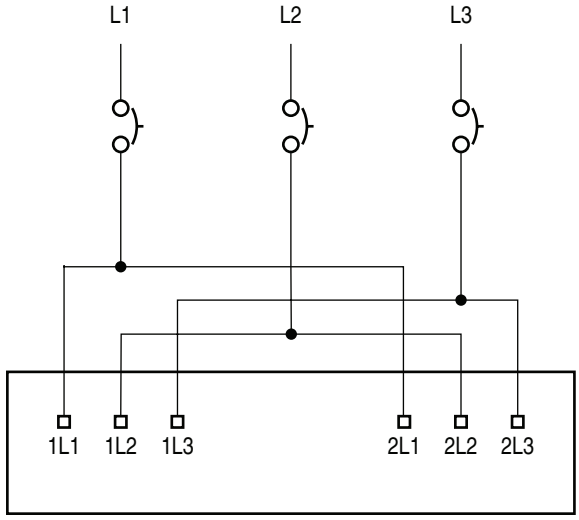



**Figure 9.6 Frame 12 AC Wiring Example: Circuit Breaker**



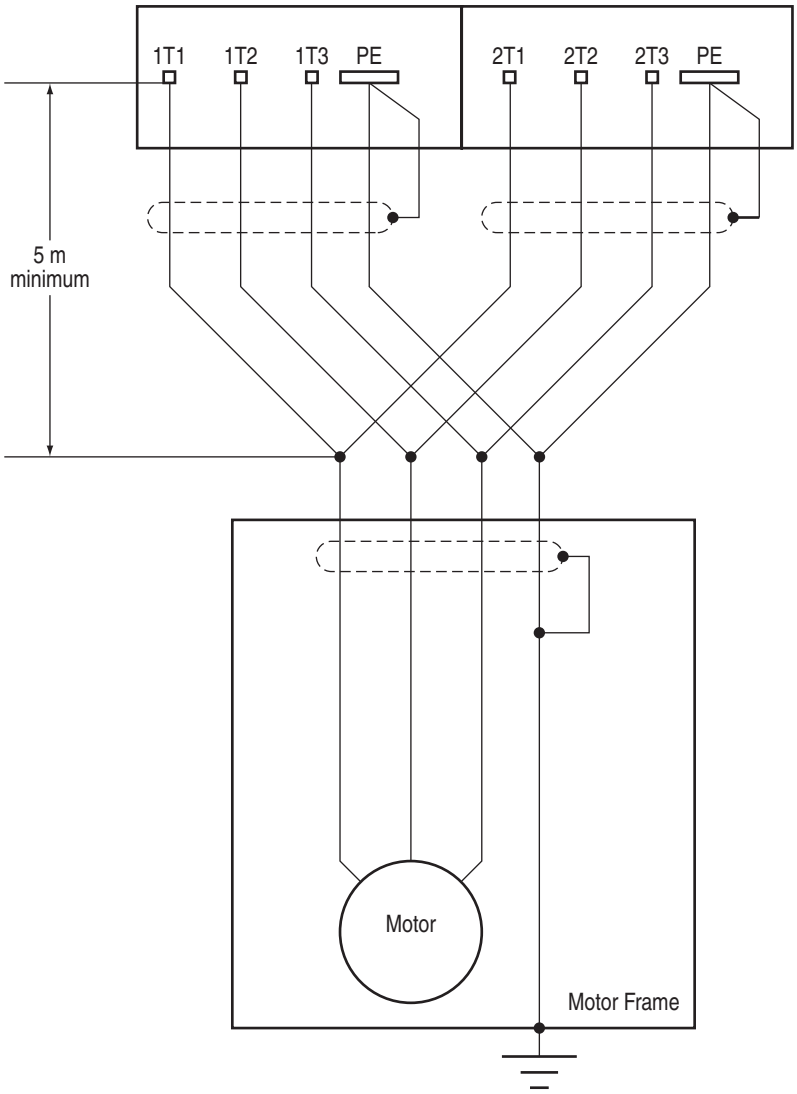
## Output Power Wiring

Frame 12 drives utilize two parallel power structures, and therefore have two sets of output power terminals. You must connect the motor to both sets of output power terminals.

**Important:** Parallel wiring must have the same cable dimensions, type and routing. Non-symmetrical wiring may cause unequal loading between the converters and reduce the drive's ability to deliver current to the motor.

**Important:** The minimum cable length for parallel motor cables from the drive to the point where the cables connect is 5m (16.4 ft). Join the parallel cables at the motor end (not the drive end). Or, install a reactor on the output of each power module with a minimum of 5 µH prior to joining the parallel cables at the motor end.

**Figure 9.7 Frame 12 Motor Wiring Example**



**Important:** Once power wiring has been completed, the protective covers must be installed before energizing the drive. Installation is in reverse order of removal (refer to "Removing the Protective Covers" on page 9-6.)

**Table 9.A Frame 12 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 (3)<br>1L1, 1L2, 1L3, 2L1, 2L2, 2L3 | 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)<br>1U/1T1, 1V/1T2, 1W/1T3,<br>2U/2T1, 2V/2T2, 2W/2T3 | 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)<br>(2 Terminals; DC–, DC+) | DC input or external brake | 300 $mm^2$ (600 MCM) | 2.1 $mm^2$ (14 AWG) | 40 N•m (354 lb•in) | M12 |
| ❺ | Cable Clamp for Shield | | | | | |

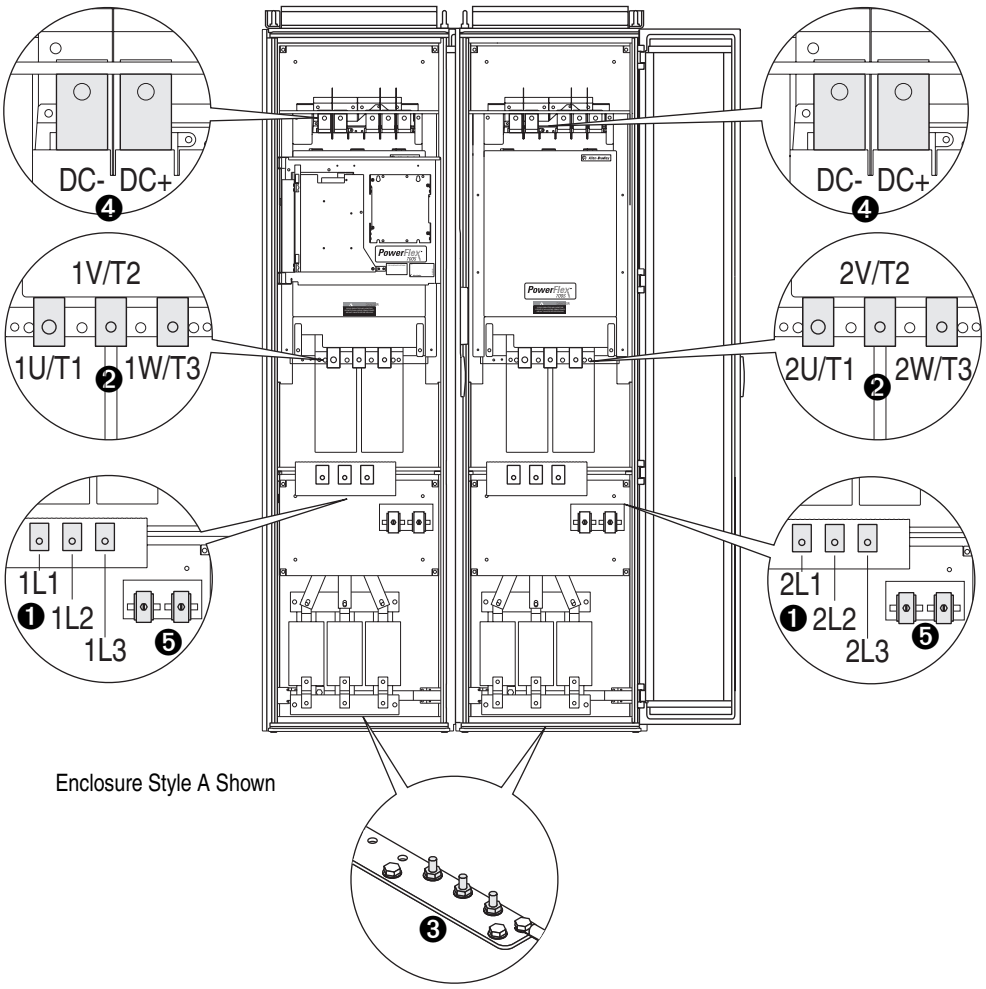
(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.

(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.

**Figure 9.7 Terminal Locations**




Enclosure Style A Shown

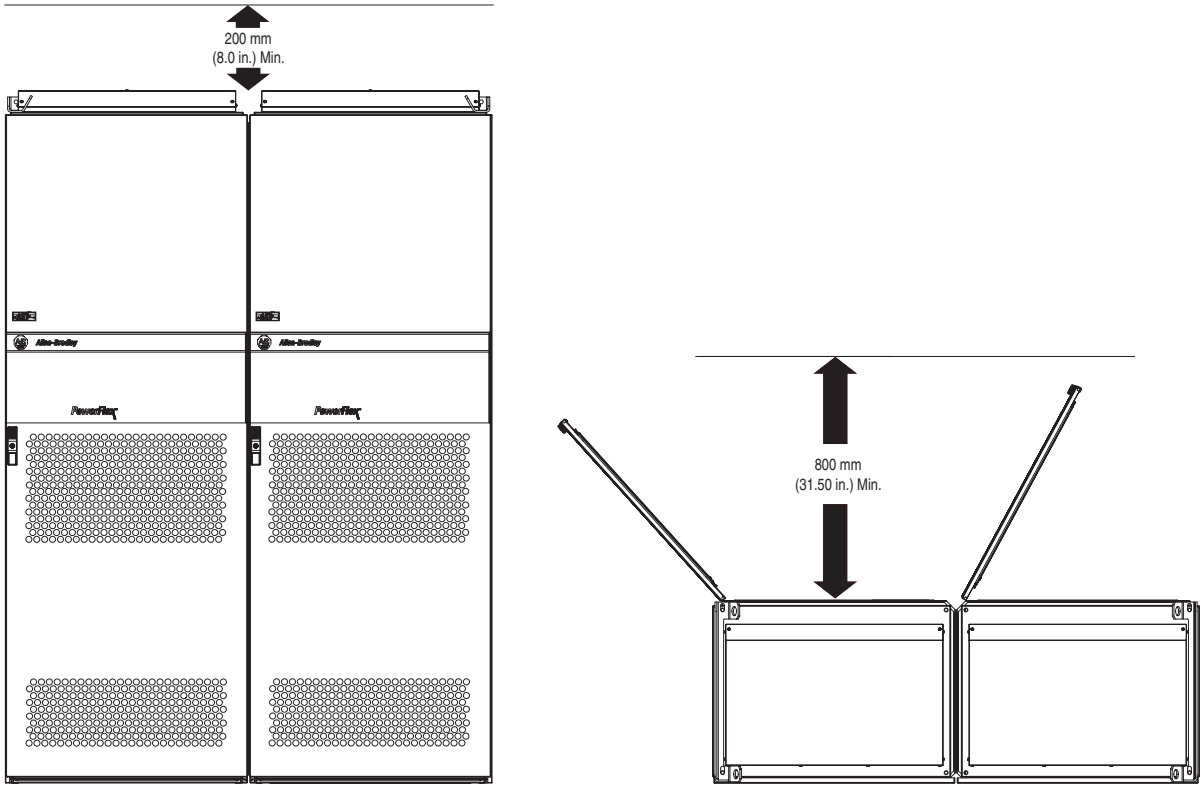
## Notes:

# Frame 13 Installation

Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All information in Chapter 1 “General Installation Information” and in this chapter must be read and understood before the actual installation begins.

**ATTENTION:** The following information is merely a guide for proper installation. Rockwell Automation, Inc. cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

## Minimum Mounting Clearances




1600 mm, Style “A” Enclosure Shown.

## Operating Temperatures

Frame 13 drives require a minimum of 4200 $m^3$/h (2472 cfm) of cooling air for the Inverter unit and 1150 $m^3$/h (677 cfm) of cooling air for each Converter unit.

| PowerFlex Drive | Voltage Class | Amp Rating | Surrounding Air Temperature | |
|---|---|---|---|---|
| | | | Normal Duty | Heavy Duty |
| 700H | All | All | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |
| 700S | 400/480V AC (540/650V DC) | All | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |
| | 600/690V AC (810/932V DC) | 920, 1030 | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |
| | 600/690V AC (810/932V DC) | 1180 | 0 to 35° C (32 to 95° F) | 0 to 35° C (32 to 95° F) |

## Dimensions

**Figure 10.1 Enclosure Code A (NEMA/UL Type 1, IP21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)**

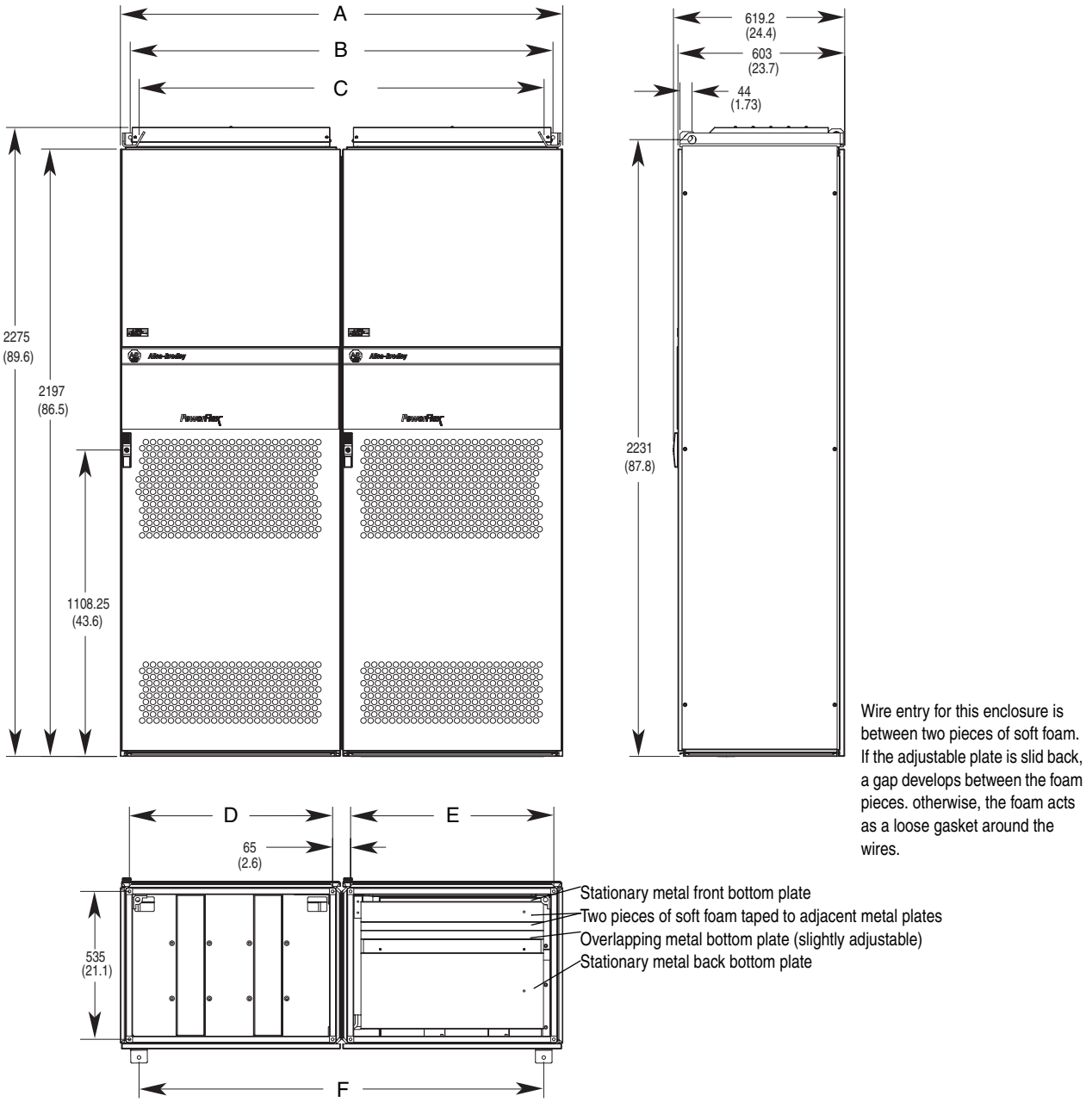



**Table 10.A Frame 13 Dimensions for Enclosure Code A (NEMA/UL Type 1, IP21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)**

| Voltage Class | Amps | A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|
| 400/480V AC (540/650V DC) | 1150 | 1412 (56) | 1329 (52) | 1264 (50) | 535 (21) | 735 (29) | 1264 (50) |
| | 1300 | 1600 (63) | 1529 (60) | 1464 (58) | 735 (29) | 735 (29) | 1464 (58) |
| | 1450 | | | | | | |
| 600/690V AC (810/932V DC) | 920 | 1412 (56) | 1329 (52) | 1264 (50) | 535 (21) | 735 (29) | 1264 (50) |
| | 1030 | | | | | | |
| | 1180 | | | | | | |

Dimensions are in mm and (in.)

**Figure 10.2 Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/Conformal Coat)**

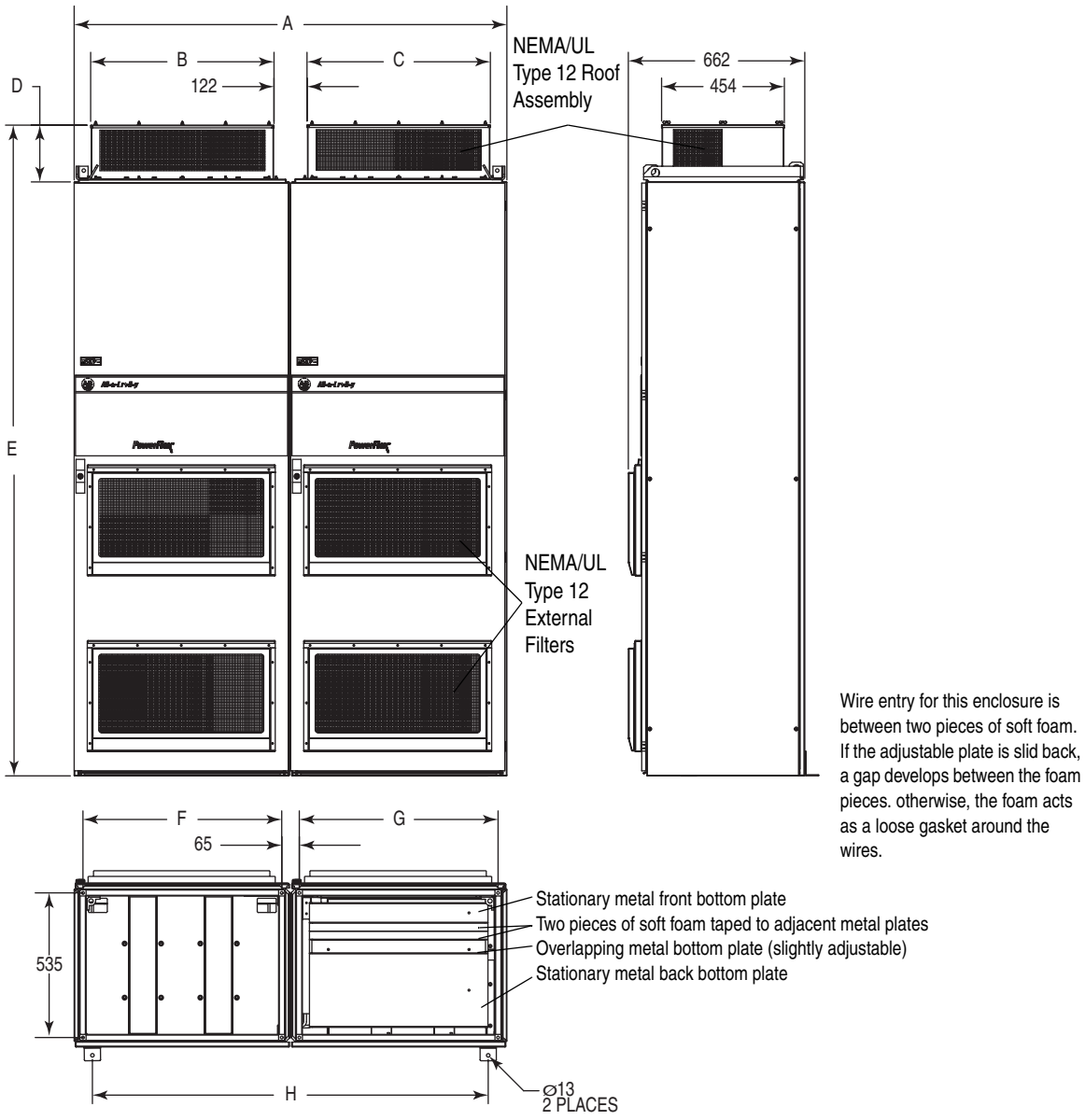



**Table 10.B Frame 13 Dimensions for Enclosure Code H (NEMA/UL Type 12 - IP54) and W (NEMA/UL Type 12, IP54 w/Conformal Coat)**

| Voltage Class | Amps | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|---|
| 400/480V AC (540/650V DC) | 1150 | 1412 (56) | 478 (18.8) | 678 (26.7) | 1 @ 242 (9.5)<br>1 @ 213 (8.4) | 2443.5 (104.5) max. | 535 (21) | 735 (29) | 1264 (50) |
| | 1300 | 1600 (63) | 678 (26.7) | 678 (26.7) | 2 @ 242 (9.5) | 2443.5 (104.5) | 735 (29) | 735 (29) | 1464 (58) |
| | 1450 | | | | | | | | |
| 600/690V AC (810/932V DC) | 920 | 1412 (56) | 478 (18.8) | 678 (26.7) | 1 @ 242 (9.5)<br>1 @ 213 (8.4) | 2443.5 (104.5) max. | 535 (21) | 735 (29) | 1264 (50) |
| | 1030 | | | | | | | | |
| | 1180 | | | | | | | | |

Dimensions are in millimeters and (inches).

## Lifting and Mounting Frame 13 Drives

Enclosed Frame 13 Drives with DC Input

Enclosed Frame 13 drives with DC input are shipped with the control pan mounted in the motor connection area of the right-hand enclosure. The control pan must be moved from this location to a location in the adjacent enclosure, away from the power connections.

Refer to Appendix B - Lifting and Mounting Instructions for detailed instructions on lifting and mounting the drive. When you have completed the instructions in Appendix B, continue with the installation as directed below.

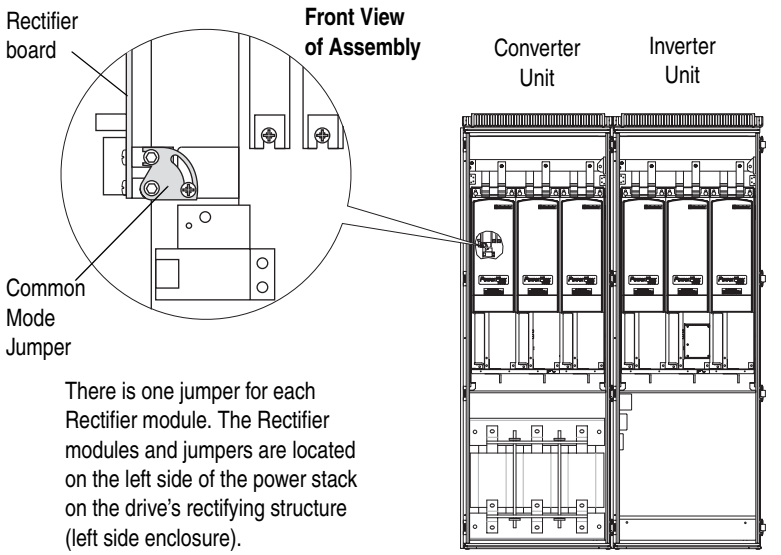
## Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations

Frame 13 size drives are equipped with common mode capacitors. To guard against drive damage, these capacitors should be disconnected depending upon the type of ground system on which the drive is installed.

To access and move the common mode jumper(s) and disconnect the capacitor connections you must first move the Control frame and remove the protective covers from the Converter unit. These steps are detailed on the following pages.

**Note:** Refer to *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives - Installation Instructions*, publication DRIVES-IN001…, for additional information on an ungrounded distribution system or high resistive ground installation.

**Figure 10.3 Common Mode Jumper and Rectifier Circuit Board Location**

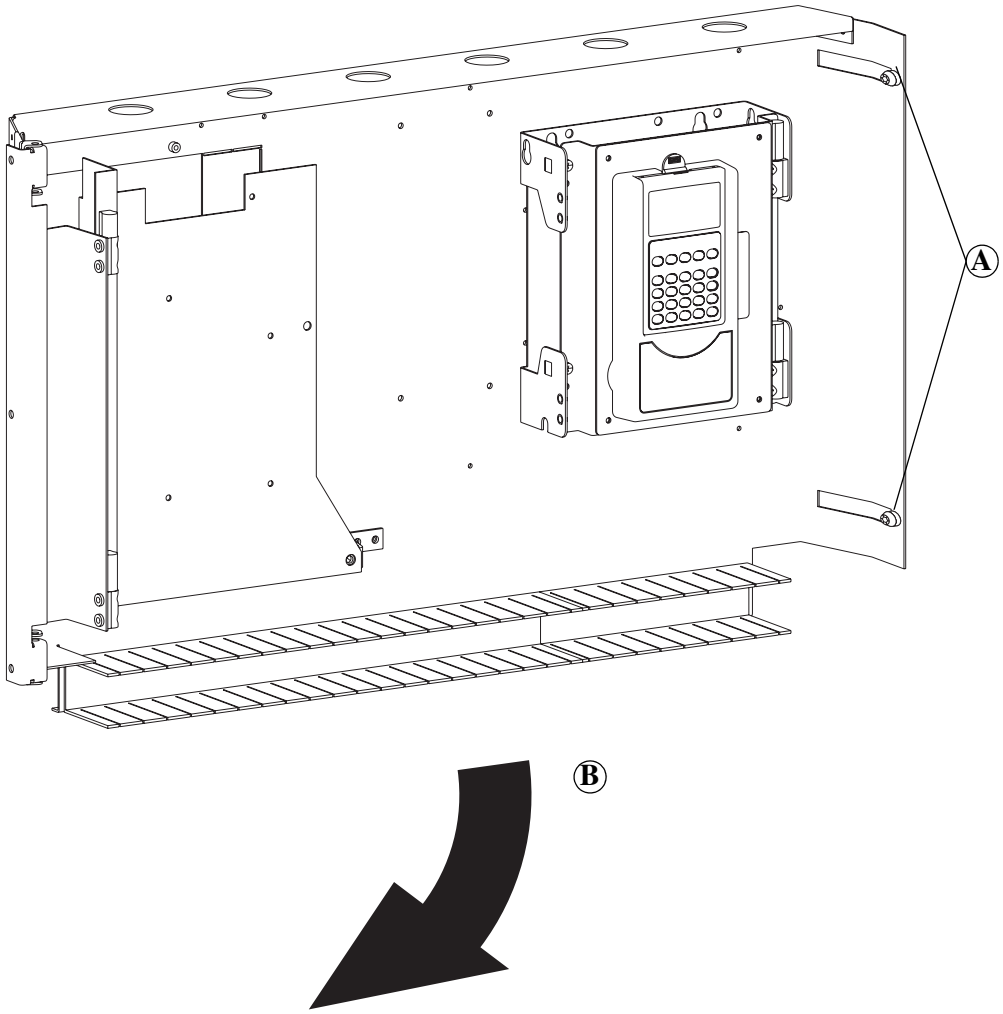


## Removing the Protective Covers from the Converter Unit

### Moving the Control Frame

You must move the Control Frame in order to access and remove the protective covers from the drive's Converter unit.

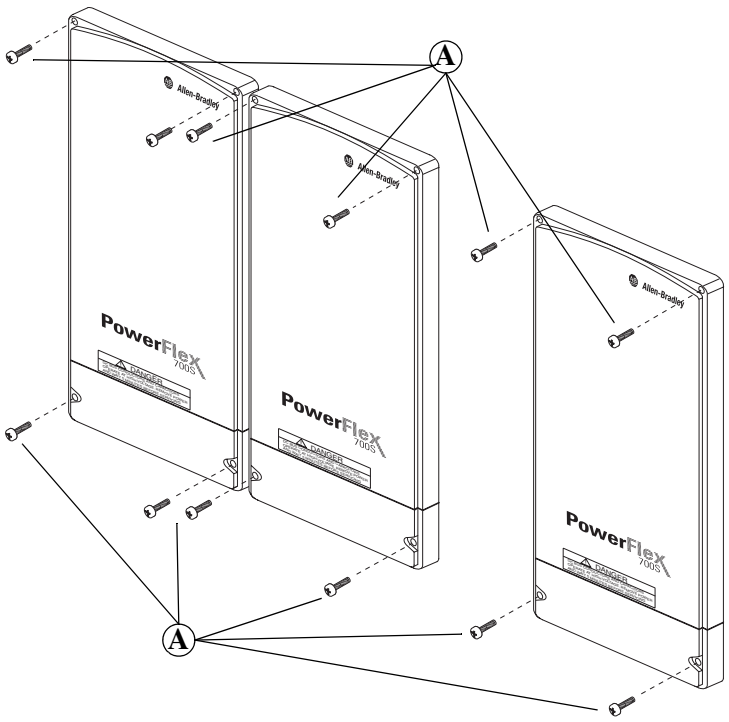
| Task | Description |
|---|---|
| Ⓐ | Loosen the T8 Torx-head screws that secure the Control Frame to the drive enclosure. |
| Ⓑ | Swing the Control Frame out and away from the converter unit. |



## Removing the Protective Covers

You must remove the protective covers from the converter unit to gain access to the common mode jumper(s) and Rectifier circuit board.

| Task | Description |
|---|---|
| Ⓐ | Remove the four M5 POZIDRIV screws that secure each of the two or three main and bottom protective covers to the drive, then remove the protective covers. |




## Installation on an Ungrounded Distribution System or High Resistive Ground

If you are installing a **400/480V** AC input drive on an ungrounded distribution system or high resistive ground, you:

- Must move the common mode jumper(s) to the disconnected position - refer to "Move the Common Mode Jumper(s) to the Disconnected Position" on page 10-8.
- Should insulate terminal X4 on the Rectifier circuit board - refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 10-9.

If you are installing a **600/690V** AC input drive on an ungrounded distribution system or high resistive ground, you:

- Must move the common mode jumper(s) to the disconnected position - refer to "Move the Common Mode Jumper(s) to the Disconnected Position" on page 10-8.
- Must insulate terminal X4 on the Rectifier circuit board - refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 10-9.

## Installation on a Grounded B Phase Delta System

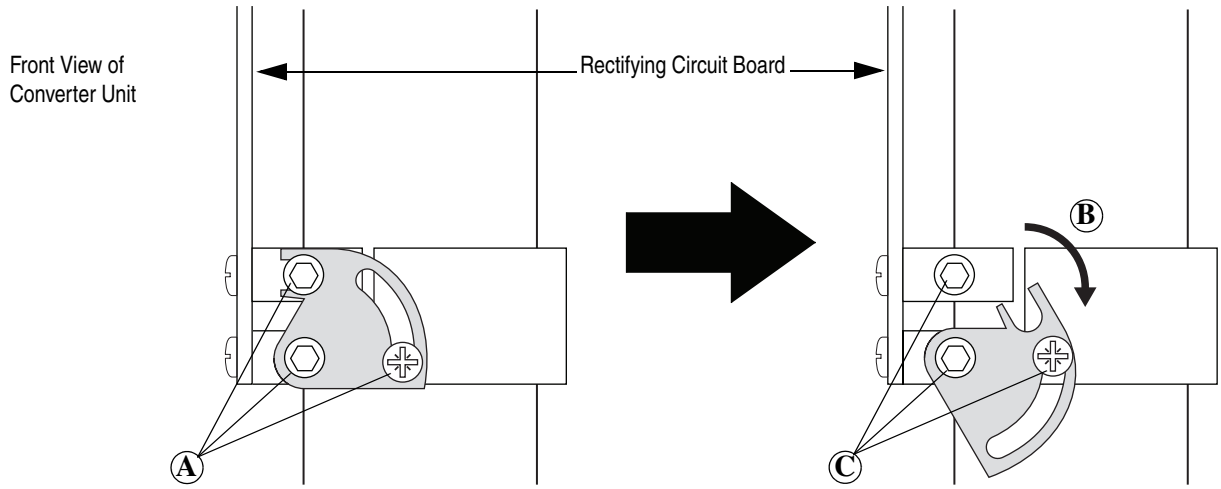
If you are installing a drive on a grounded B phase Delta system, you:

- Must move the common mode jumper(s) to the disconnected position - refer to "Move the Common Mode Jumper(s) to the Disconnected Position" on page 10-8.
- Must insulate terminal X4 on the Rectifier circuit board - refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 10-9.

## Move the Common Mode Jumper(s) to the Disconnected Position

Follow the lettered steps below to move the common mode jumper(s) to the disconnected position for each converter unit (refer to Figure 10.3 for jumper location).:

| Task | Description |
|---|---|
| Ⓐ | Loosen the screws and two fasteners that secure the jumper. |
| Ⓑ | Rotate the jumper to the lower position. |
| Ⓒ | Tighten the screw and two fasteners. |

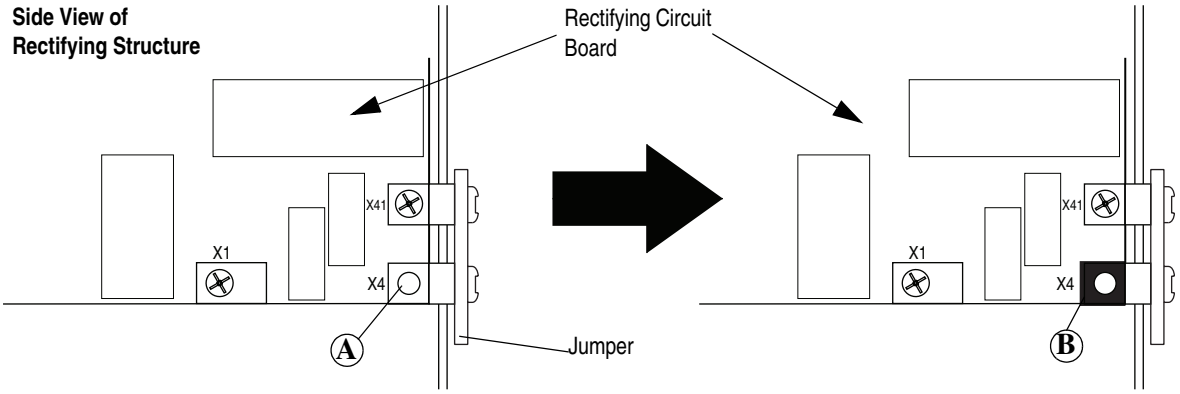


## Insulate Terminal X4 on the Rectifier Circuit Board

Follow the lettered steps below to insulate terminal X4 on the Rectifier circuit board for each converter unit (refer to Figure 10.3 for Rectifier board location):

| Task | Description |
|---|---|
| Ⓐ | Remove the screw from the X4 connection on the Rectifier circuit board. |
| Ⓑ | Insulate the top and bottom of the X4 connection on the Rectifier circuit board. |

**Important:** Do not install the screw and washer that was removed from this connection.

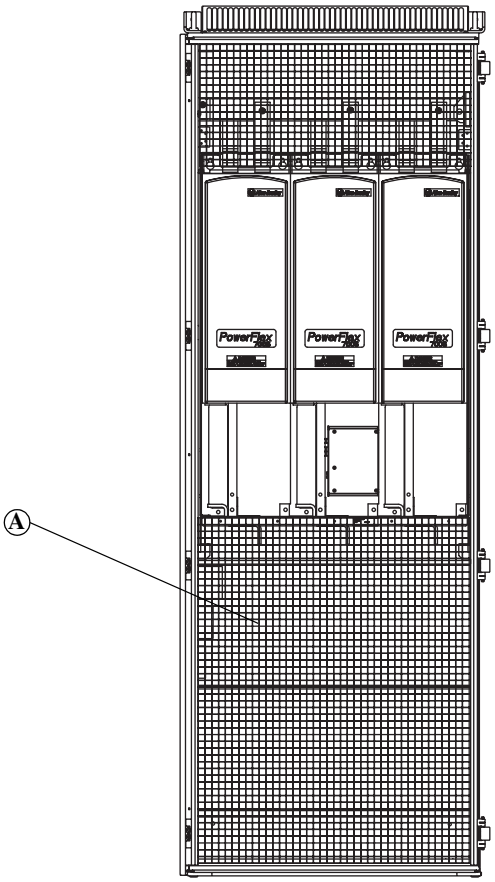


## Removing the Protective Covers from the Inverter Unit

### Removing the Lower Protective Screen

To access the power terminals, you must first remove the lower protective screen (on NEMA/UL Type 1 and Type 12 enclosures).

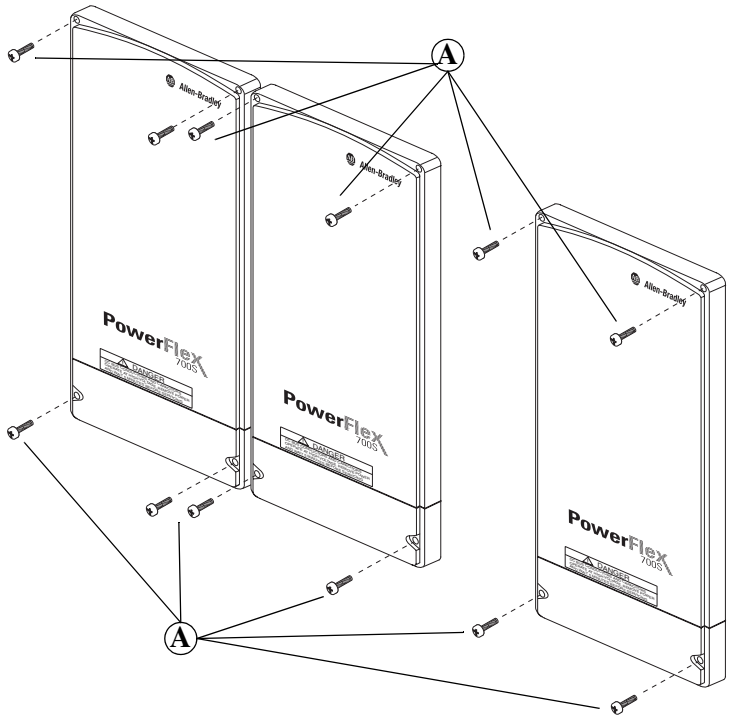
| Task | Description |
|---|---|
| Ⓐ | Remove the screws that secure the lower protective screen to the right side enclosure only and remove the screen. |



## Removing the Protective Covers

You must remove the protective covers to gain access to the Inverter units.

| Task | Description |
|---|---|
| Ⓐ | Remove the four M5 POZIDRIV screws that secure each of the two or three main and bottom protective covers to the drive, then remove the protective covers. |



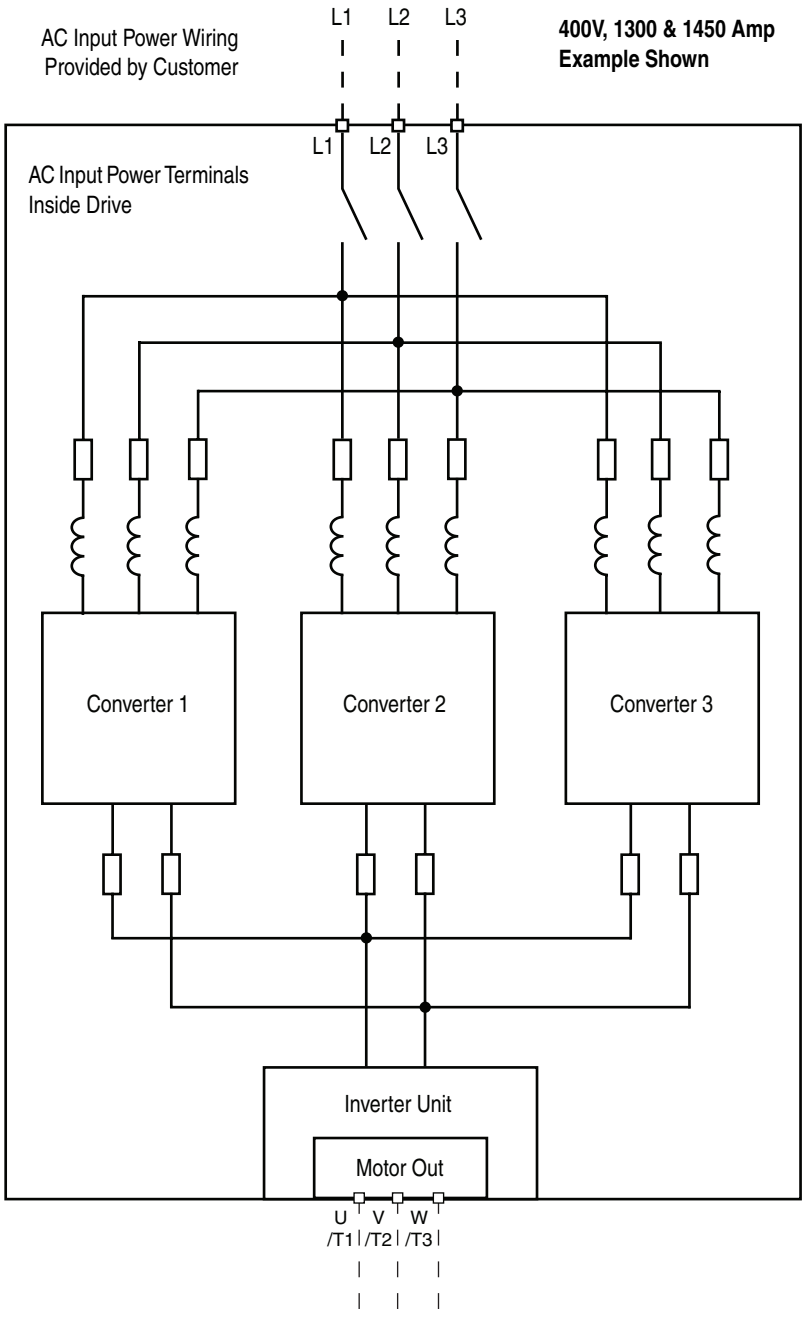
## Power Wiring

Frame 13 400 and 600 Volt Class AC Input Power Wiring

Frame 13 size drives utilize two or three parallel power structures that are pre-connected to line reactors through a fused input switch.

**Important:** Parallel wiring must have the same cable dimensions, type and routing. Non-symmetrical wiring may cause unequal loading between the converters and reduce the drive's ability to deliver current to the motor.

**Figure 10.4 Frame 13 AC Wiring Example: Three Internal Fuses per Phase**

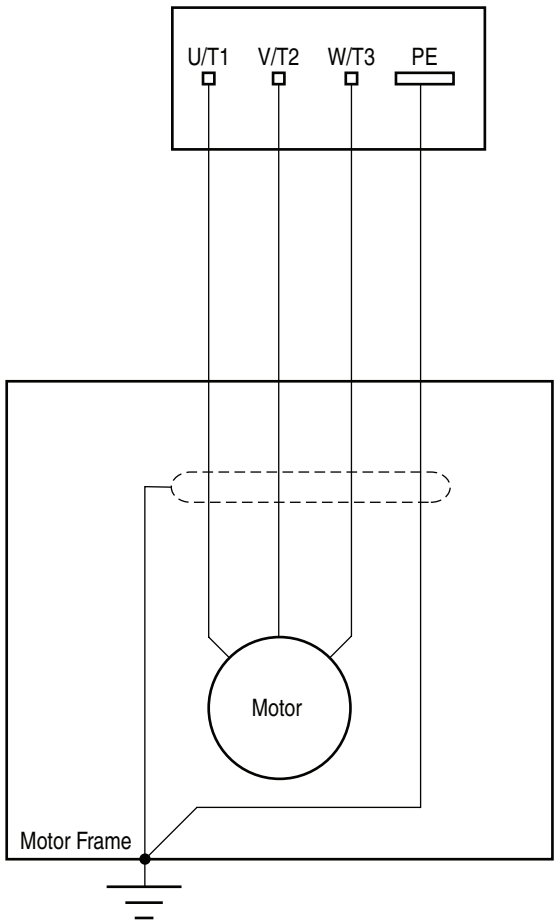


## Output Power Wiring

Connect the motor to the output power terminals.

**Important:** Parallel wiring must have the same cable dimensions, type and routing. Non-symmetrical wiring may cause unequal loading between the converters and reduce the drive's ability to deliver current to the motor.

**Figure 10.5 Frame 13 Motor Wiring Example**




**Important:** Once power wiring has been completed, the protective covers must be installed before energizing the drive. Installation is in reverse order of removal (refer to "Removing the Protective Covers from the Converter Unit" on page 10-6 and "Removing the Protective Covers from the Inverter Unit" on page 10-10.)

**Table 10.C Frame 13 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 (1)<br>L1, L2, L3 | Input power | 300 $mm^2$<br>(600 MCM) | 2.1 $mm^2$<br>(14 AWG) | 40 N•m<br>(354 lb•in) | M12 |
| ❷ | Output Power Terminal Block (3)<br>U/T1, V/T2, W/T3 | Motor connections | 300 $mm^2$<br>(600 MCM) | 2.1 $mm^2$<br>(14 AWG) | 40 N•m<br>(354 lb•in) | M12 |
| ❸ | SHLD Terminal, PE, Motor Ground (3) | Terminating point for wiring shields | 300 $mm^2$<br>(600 MCM) | 2.1 $mm^2$<br>(14 AWG) | 40 N•m<br>(354 lb•in) | M10 |
| ❹ | DC Bus (3)<br>(3 Terminals; DC–, DC+) | DC input or external brake | 300 $mm^2$<br>(600 MCM) | 2.1 $mm^2$<br>(14 AWG) | 40 N•m<br>(354 lb•in) | M12 |

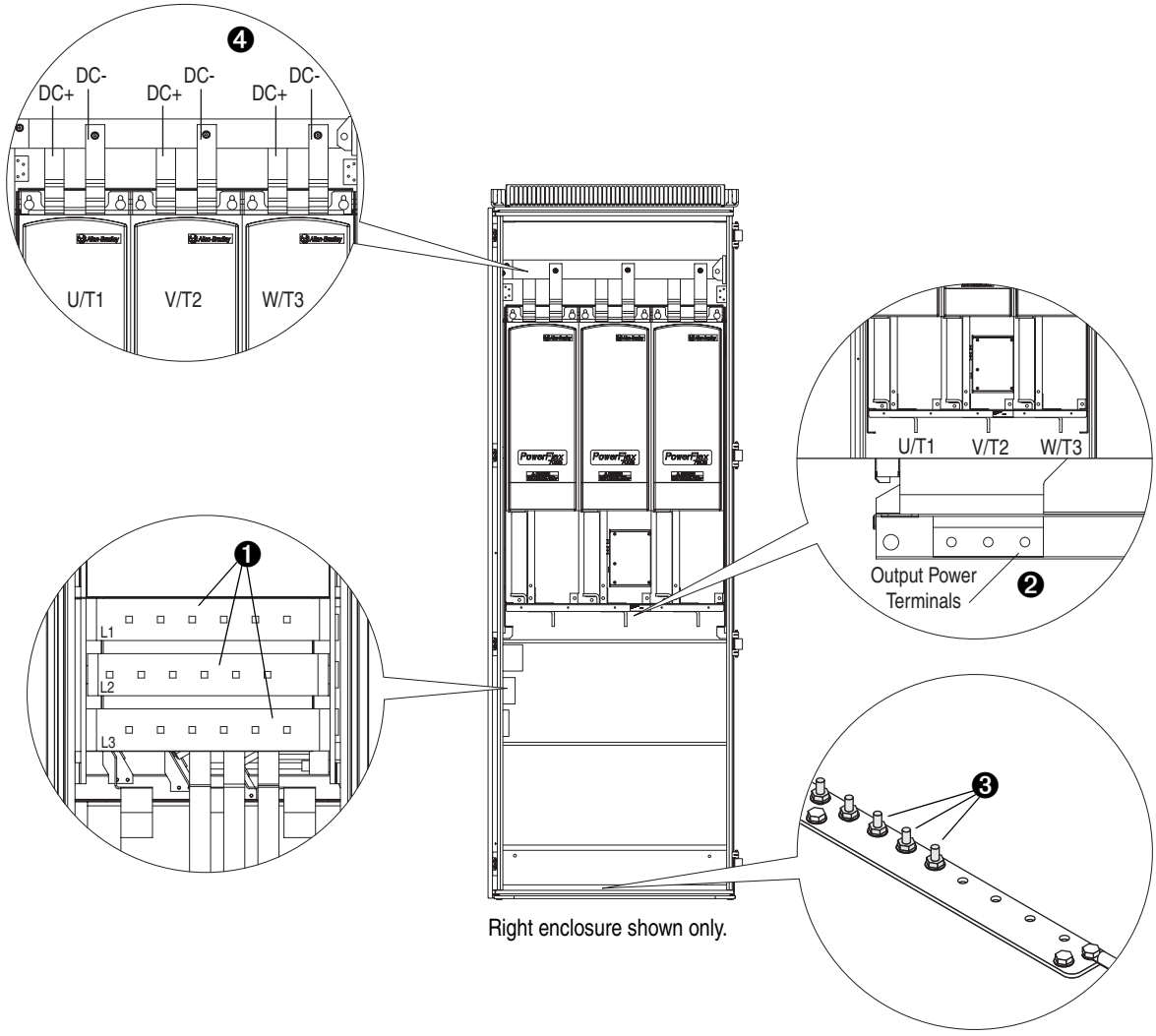
(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.

(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.

**Figure 10.6 Frame 13 Drive Terminal Locations**

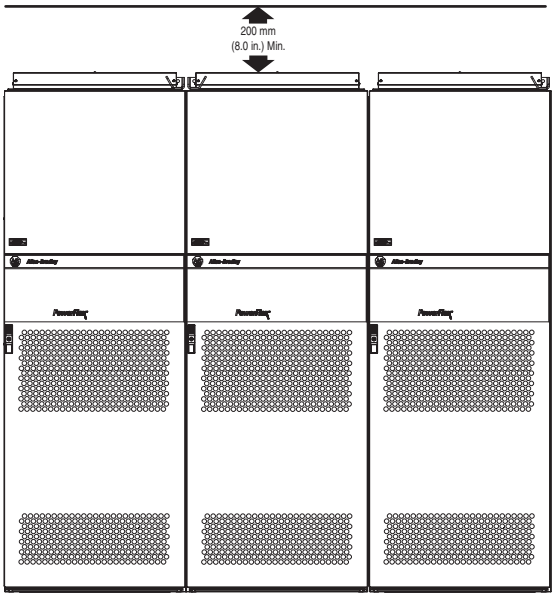


# Frame 14 Installation

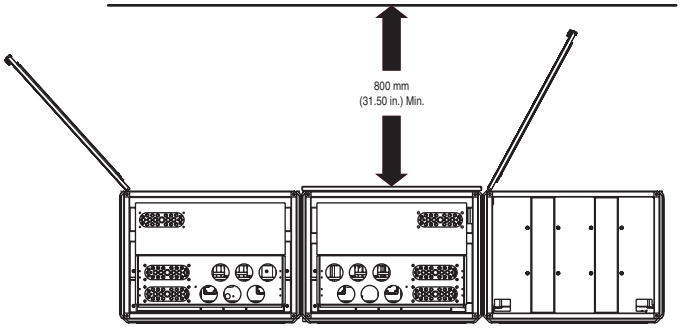
Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All information in Chapter 1 “General Installation Information” and in this chapter must be read and understood before the actual installation begins.

**ATTENTION:** The following information is merely a guide for proper installation. Rockwell Automation, Inc. cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

## Minimum Mounting Clearances




1500A Drive - 2400 mm Enclosure Shown.




## Operating Temperatures

Frame 14 drives require a minimum of 4200 $m^3$/h (2472 cfm) of cooling air for each Inverter unit and 1150 $m^3$/h (677 cfm) of cooling air for each Converter unit.

| PowerFlex Drive | Voltage Class | Amp Rating | Surrounding Air Temperature | |
|---|---|---|---|---|
| | | | Normal Duty | Heavy Duty |
| 700H | 400/480V AC (540/650V DC) | All | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |
| | 600/690V AC (810/932V DC) | 1500, 1900 | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |
| | 600/690V AC (810/932V DC) | 2250 | 0 to 35° C (32 to 95° F) | 0 to 35° C (32 to 95° F) |
| 700S | 600/690V AC (810/932V DC) | 1500 | 0 to 40° C (32 to 104° F) | 0 to 40° C (32 to 104° F) |

**Table 11.A Frame 14 Number of Inverter and Converter Units Per Drive**

| Voltage Class | Amp Rating | No. Converter Units | No. Inverter Units |
|---|---|---|---|
| 400/480V AC | 1700, 2150 | 4 | 6 |
| | 2700 | 6 | 6 |
| 600/690V AC | 1500 | 3 | 6 |
| | 1900, 2250 | 4 | 6 |

## Dimensions

**Figure 11.1 Drives Above 1500 A, 2800 mm Enclosure Code A (NEMA/UL Type 1, IP21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)**

Dimensions are in millimeters and (inches).

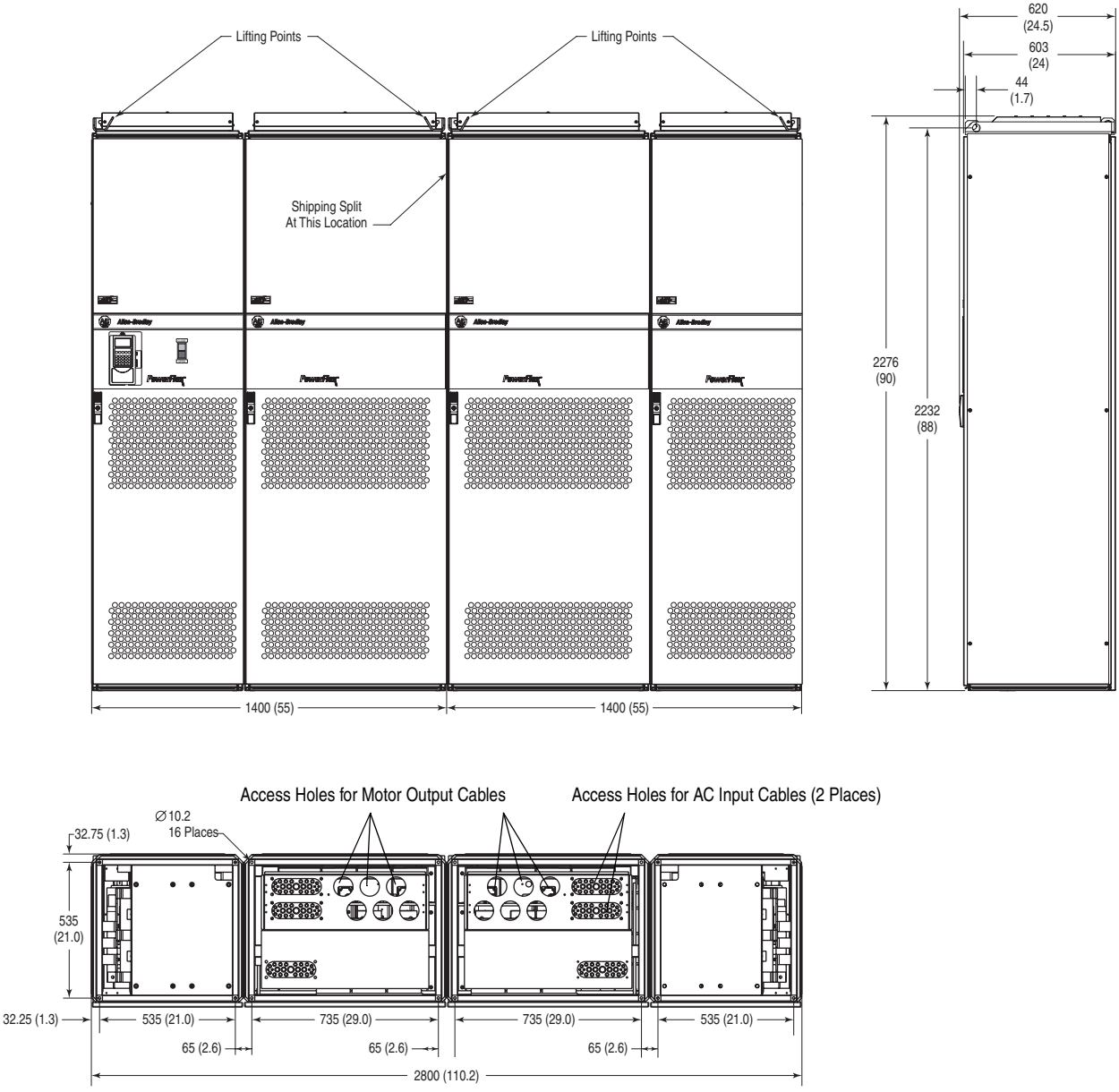


**Figure 11.2 Drives Above 1500 A 2800 mm Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/Conformal Coat)**

Dimensions are in millimeters and (inches).

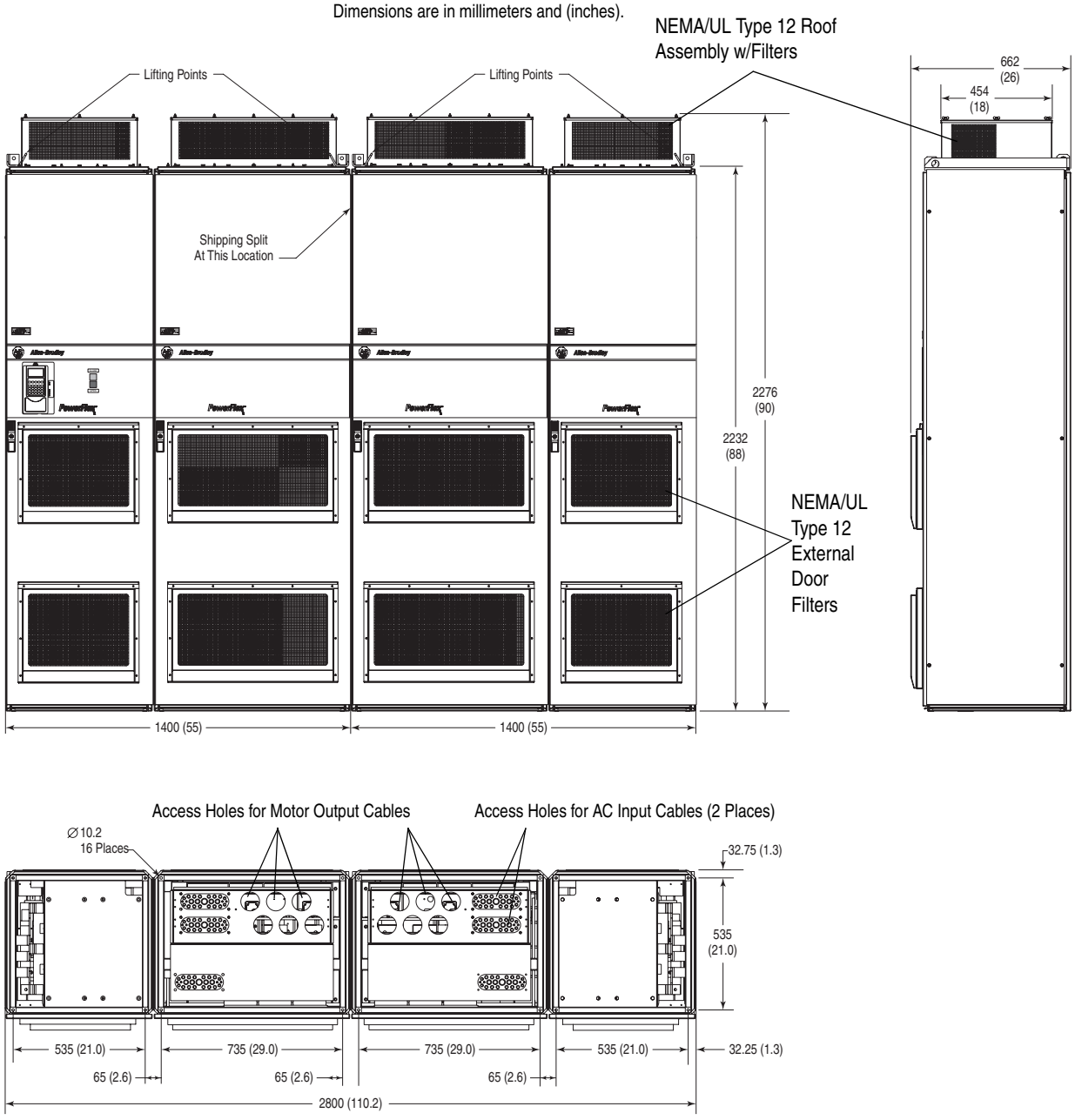


**Figure 11.3 1500 A Drives 2400 mm Enclosure Code A (NEMA/UL Type 1, IP 21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)**

Dimensions are in millimeters and (inches).

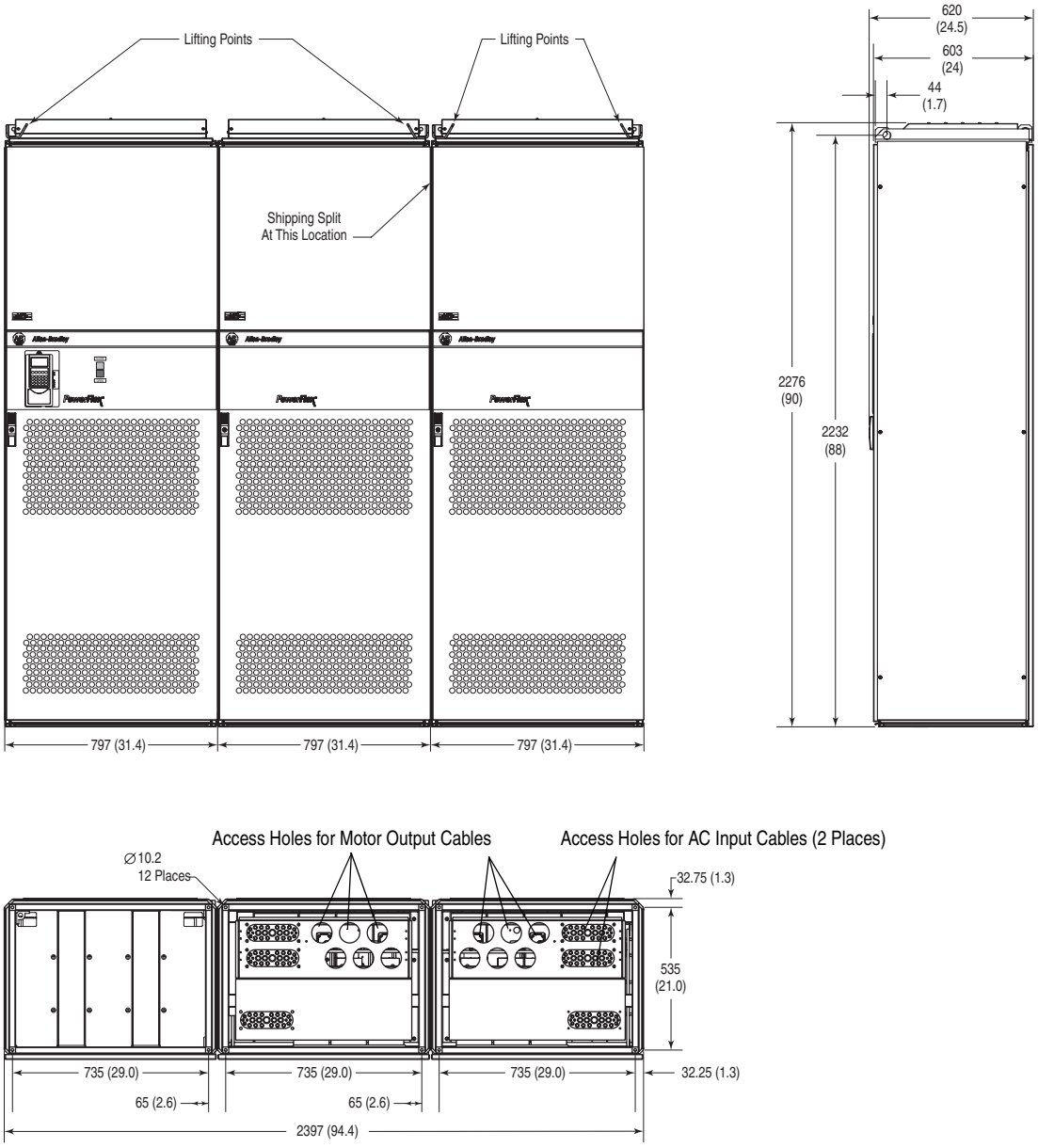


**Figure 11.4 1500 A Drives 2400 mm Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/Conformal Coat)**

Dimensions are in millimeters and (inches).

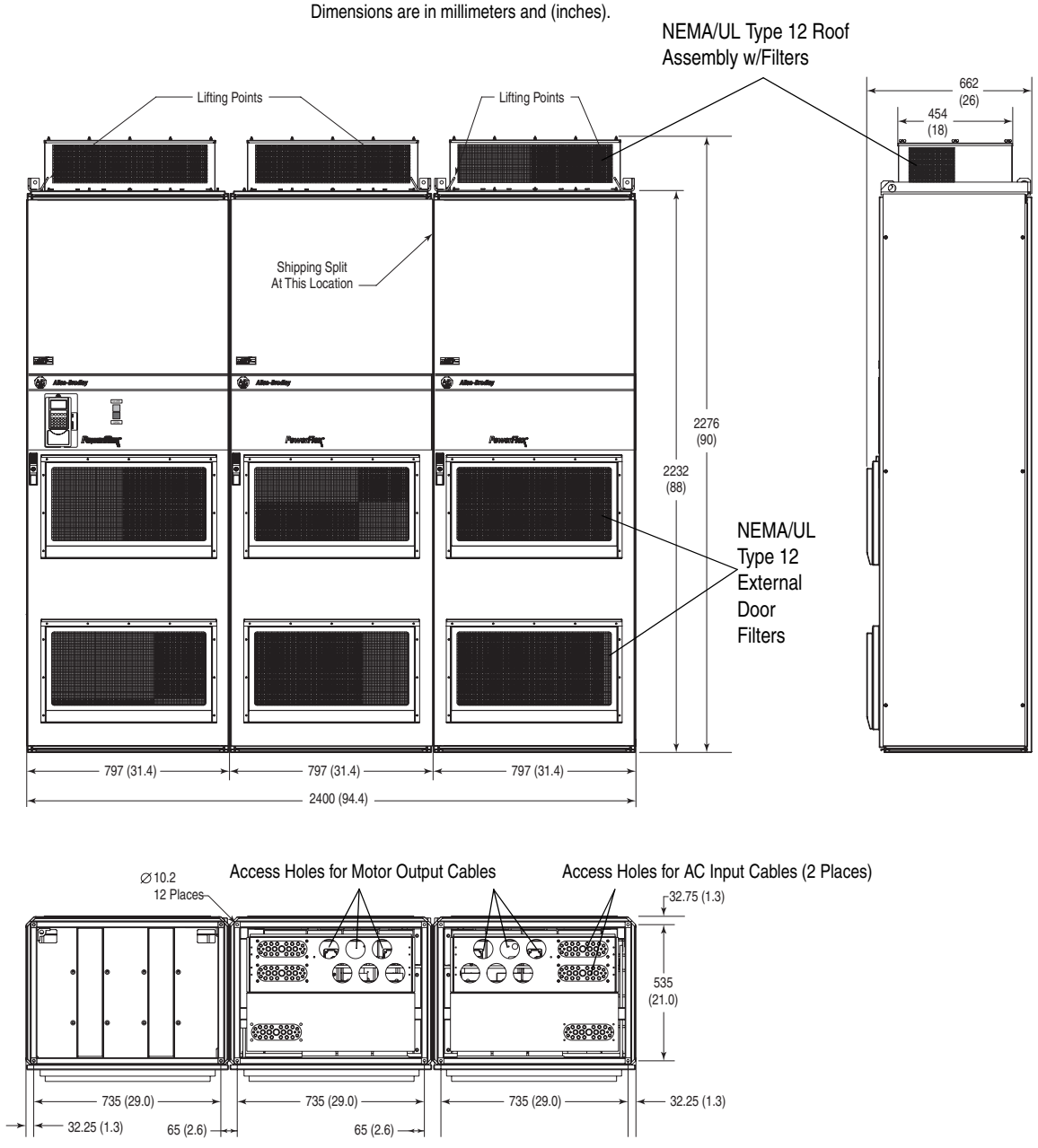
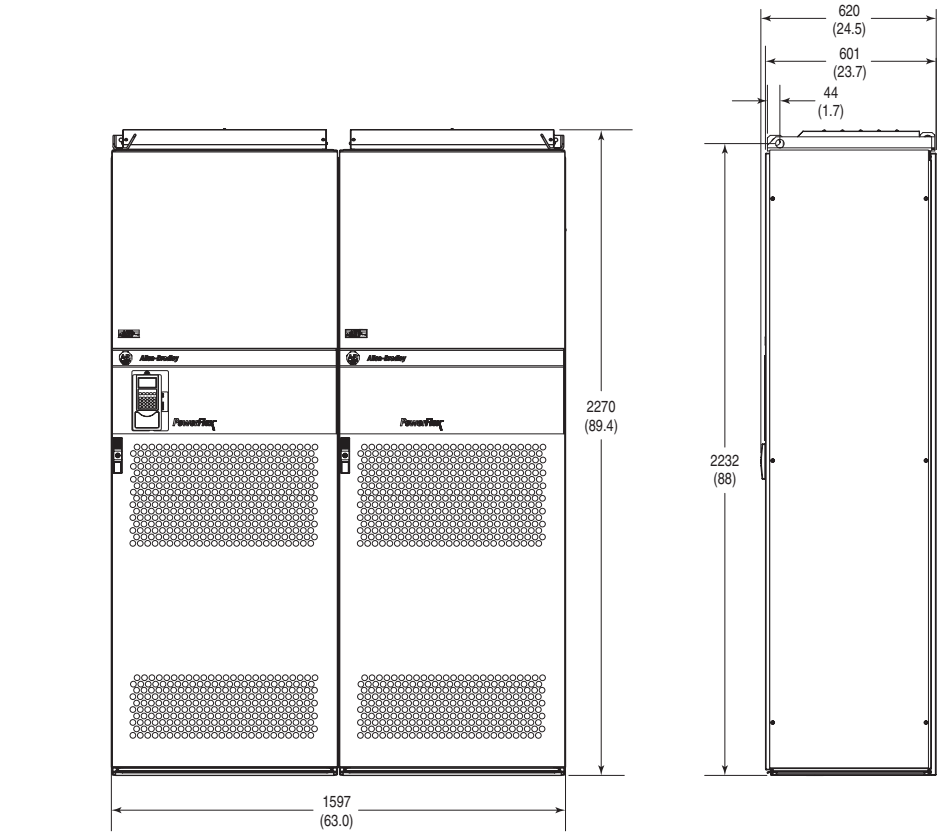
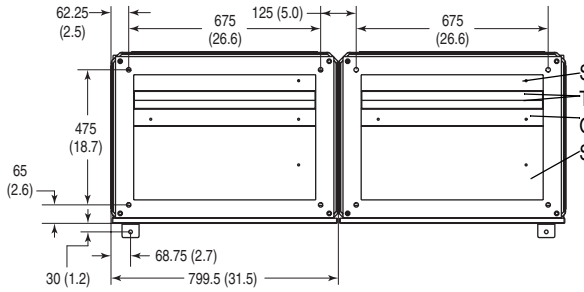


**Figure 11.5 DC Input Drive Enclosure Code A (NEMA/UL Type 1, IP 21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)**

Dimensions are in millimeters and (inches).



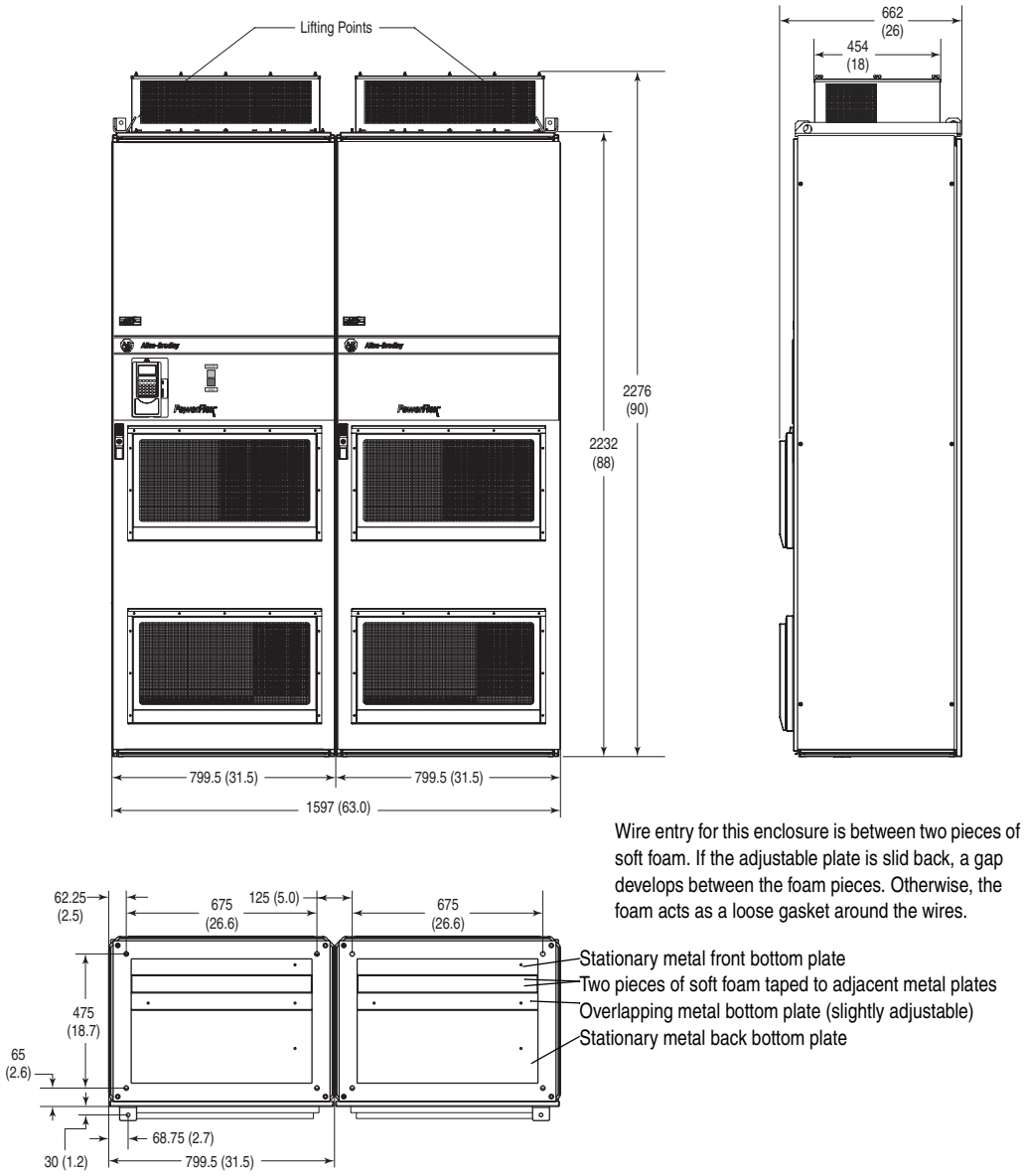




Wire entry for this enclosure is between two pieces of soft foam. If the adjustable plate is slid back, a gap develops between the foam pieces. Otherwise, the foam acts as a loose gasket around the wires.

Stationary metal front bottom plate
Two pieces of soft foam taped to adjacent metal plates
Overlapping metal bottom plate (slightly adjustable)
Stationary metal back bottom plate

**Figure 11.6 DC Input Drive Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/Conformal Coat)**

Dimensions are in millimeters and (inches).




## Lifting and Mounting Frame 14 Drives

### Enclosed Frame 14 Drives with DC Input

Enclosed Frame 14 drives with DC input are shipped with the control pan mounted in the motor connection area of the left-hand enclosure. The control pan must be moved from this location to a location in the adjacent enclosure, away from the power connections.

Refer to Appendix B - Lifting and Mounting Instructions for detailed instructions on lifting and mounting the drive. When you have completed the instructions in Appendix B, continue with the installation as directed below.

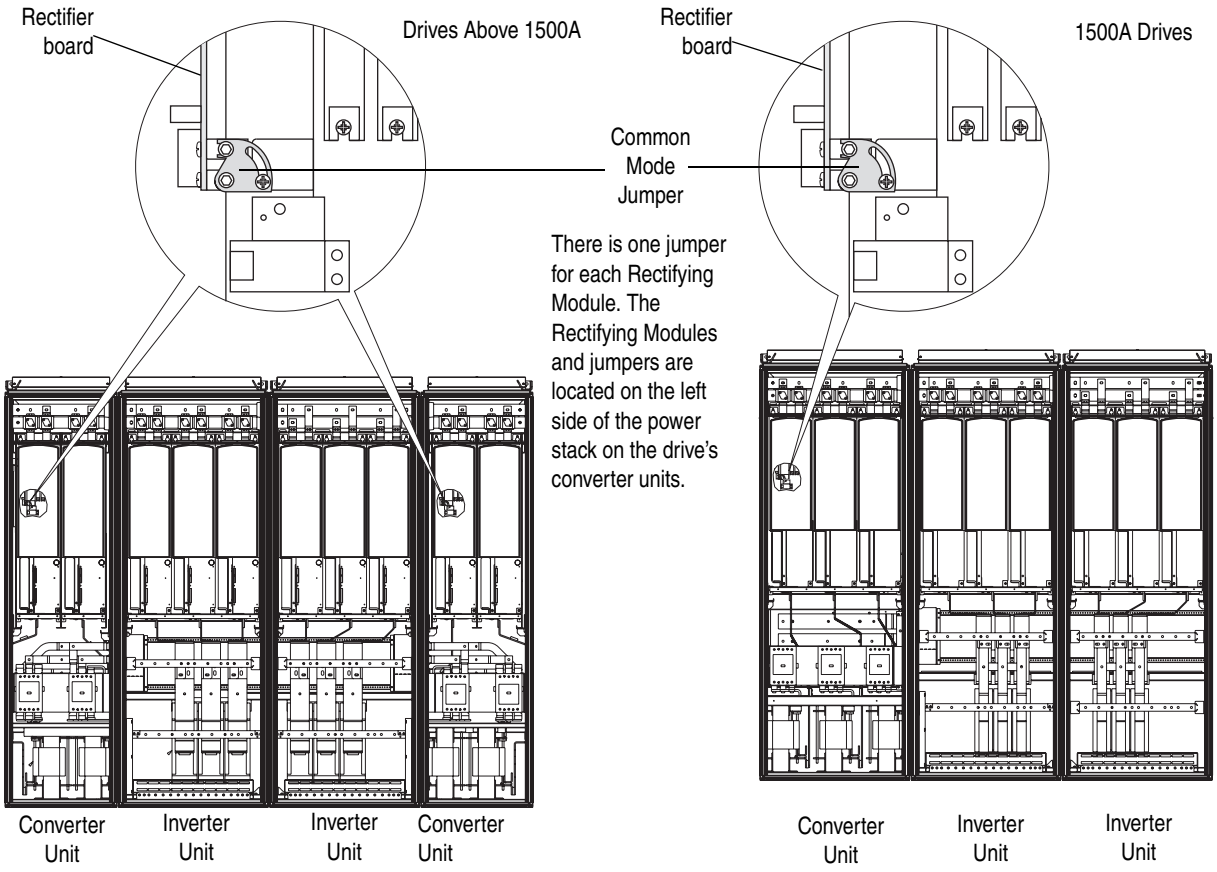
## Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations

Frame 14 size drives are equipped with common mode capacitors. To guard against drive damage, these capacitors should be disconnected depending upon the type of ground system on which the drive is installed.

To access and move the common mode jumper(s) and disconnect the capacitor connections you must first move the Control frame and remove the protective covers from the Converter unit. These steps are detailed on the following pages.

**Note:** Refer to *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives - Installation Instructions*, publication DRIVES-IN001…, for additional information on an ungrounded distribution system or high resistive ground installation.

**Figure 11.7 Common Mode Jumper and Rectifier Circuit Board Location**




Control Frame not shown for clarity only

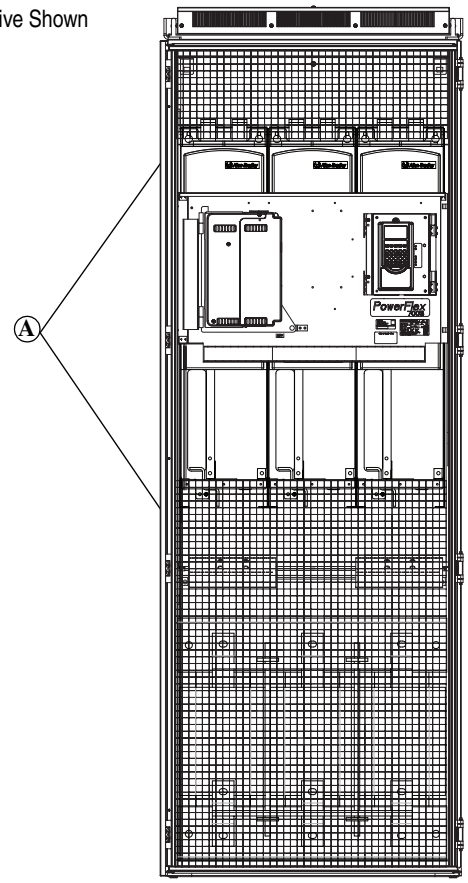
## Removing the Protective Covers from the Converter Unit(s)

### Removing the Protective Screens

To access the components within the Converter unit(s), you must first remove the protective screens from the drive.

| Task | Description |
|---|---|
| Ⓐ | Remove the screws that secure the protective screens to the Converter unit(s) and remove the screens. |

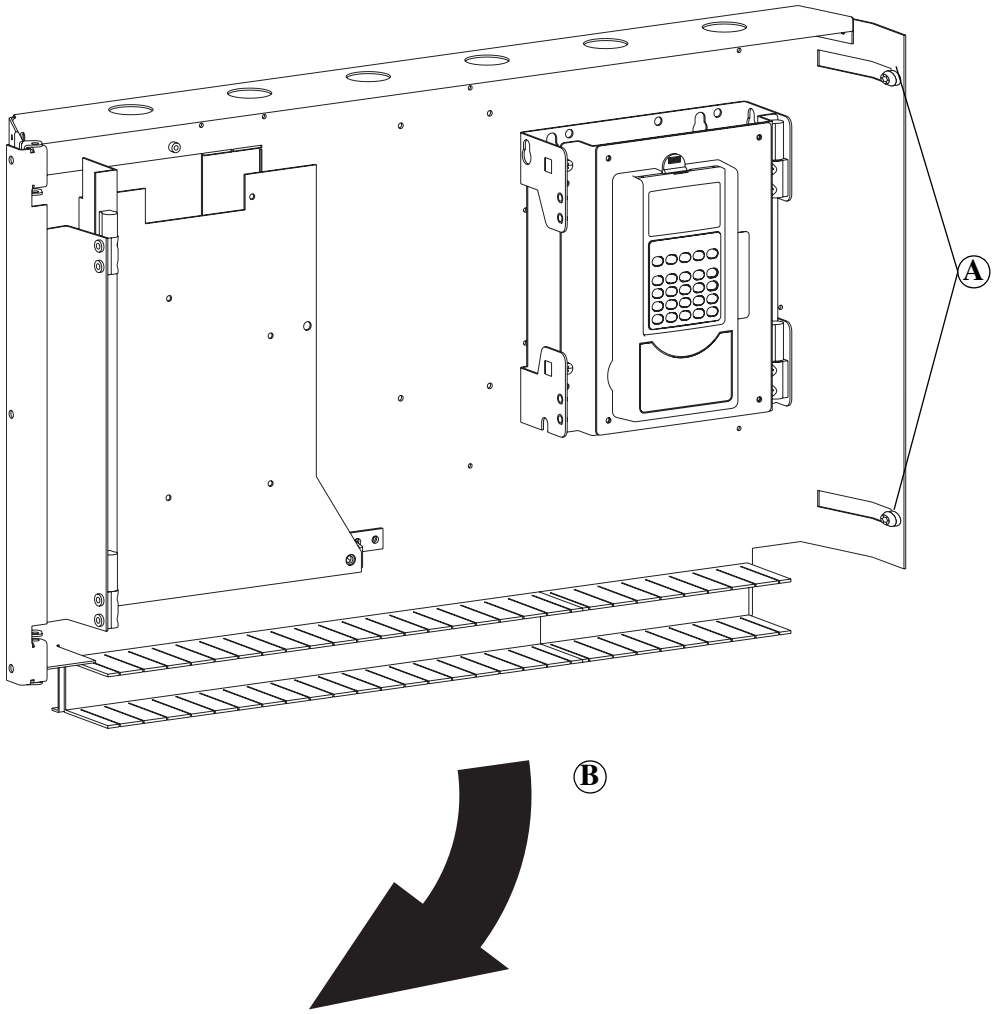
1500A Drive Shown



## Moving the Control Frame

To gain access to the airflow plate and protective covers on the left side Converter unit of the drive you must move the Control Frame.

| Task | Description |
|---|---|
| Ⓐ | Loosen the T8 Torx-head screws that secure the Control Frame to the drive enclosure. |
| Ⓑ | Swing the Control Frame out and away from the Converter unit. |

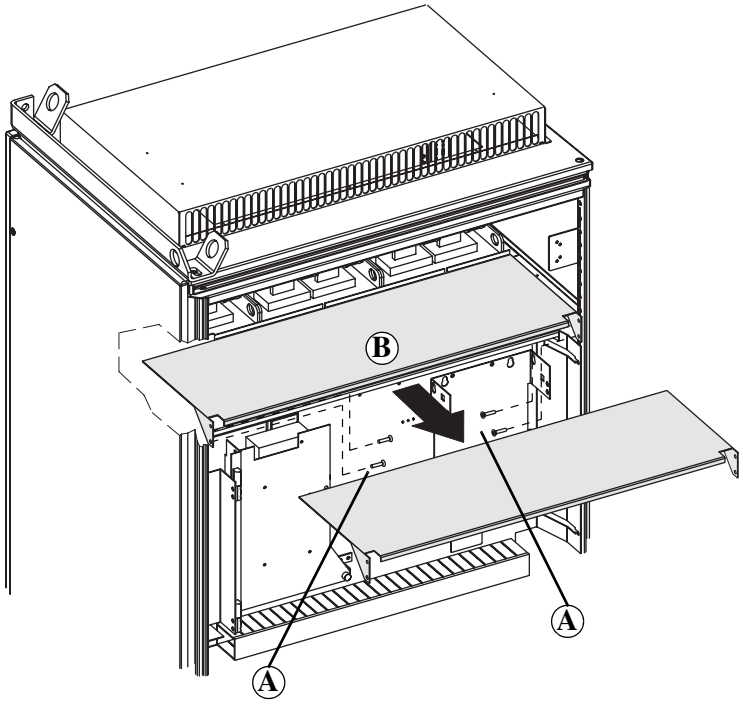


## Removing the Airflow Plate(s)

The drive is equipped with a plate(s), just above the Converter unit(s), that directs airflow through the drive enclosure(s). You must remove this plate(s) in order to access the protective covers.

| Task | Description |
|---|---|
| Ⓐ | Remove the T8 Torx-head screws that secure the airflow plate to the drive. |
| Ⓑ | Slide the airflow plate off of the drive. |

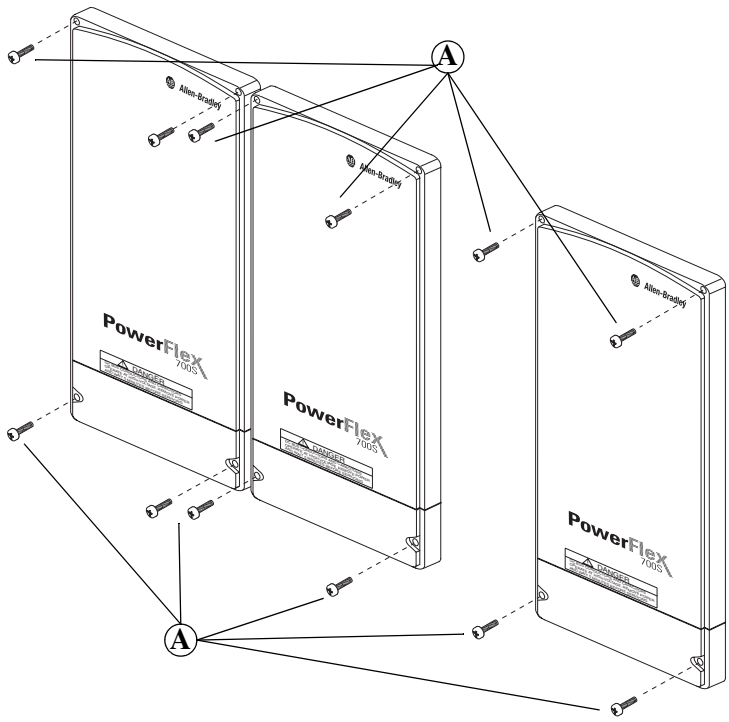
1500A Drive Shown



## Removing the Protective Covers

You must remove the protective covers to gain access to the Converter unit(s).

| Task | Description |
|---|---|
| Ⓐ | Remove the four M5 POZIDRIV screws that secure each of the two or three main and bottom protective covers to the drive, then remove the protective covers. |




## Installation on an Ungrounded Distribution System or High Resistive Ground

- Must move the common mode jumper(s) to the disconnected position - refer to "Move the Common Mode Jumper(s) to the Disconnected Position" on page 11-14.
- Should insulate terminal X4 on the Rectifier circuit board - refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 11-15.

If you are installing a **600/690V** AC input drive on an ungrounded distribution system or high resistive ground, you:

- Must move the common mode jumper(s) to the disconnected position - refer to "Move the Common Mode Jumper(s) to the Disconnected Position" on page 11-14.
- Must insulate terminal X4 on the Rectifier circuit board - refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 11-15.

### Installation on a Grounded B Phase Delta System

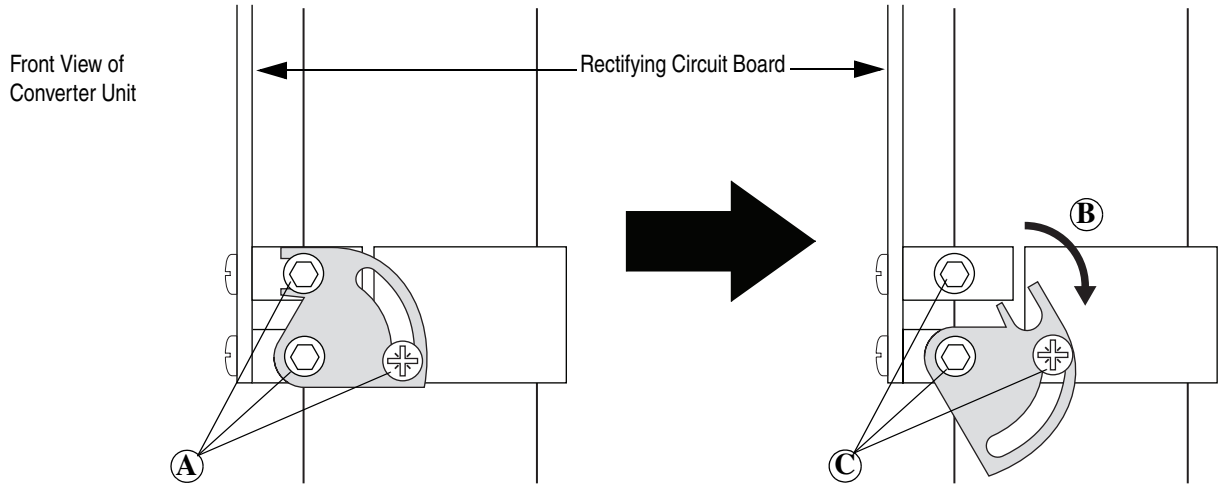
If you are installing a drive on a grounded B phase Delta system, you:

- Must move the common mode jumper(s) to the disconnected position - refer to "Move the Common Mode Jumper(s) to the Disconnected Position" on page 11-14.
- Must insulate terminal X4 on the Rectifier circuit board - refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 11-15.

### Move the Common Mode Jumper(s) to the Disconnected Position

Follow the lettered steps below to move the common mode jumper(s) to the disconnected position for each converter unit (refer to Figure 11.7 for MOV jumper location).:

| Task | Description |
|---|---|
| Ⓐ | Loosen the screws and two fasteners that secure the jumper. |
| Ⓑ | Rotate the jumper to the lower position. |
| Ⓒ | Tighten the screw and two fasteners. |

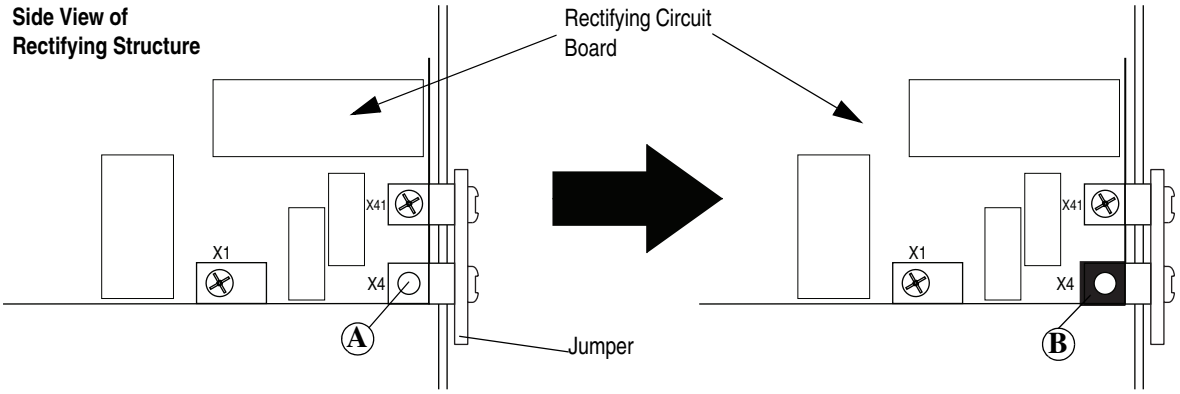


## Insulate Terminal X4 on the Rectifier Circuit Board

Follow the lettered steps below to insulate terminal X4 on the Rectifier circuit board for each converter unit (refer to Figure 11.7 for Rectifier board location):

| Task | Description |
|---|---|
| Ⓐ | Remove the screw from the X4 connection on the Rectifier circuit board. |
| Ⓑ | Insulate the top and bottom of the X4 connection on the Rectifier circuit board. |

**Important:** Do not install the screw and washer that was removed from this connection.



## Power Wiring

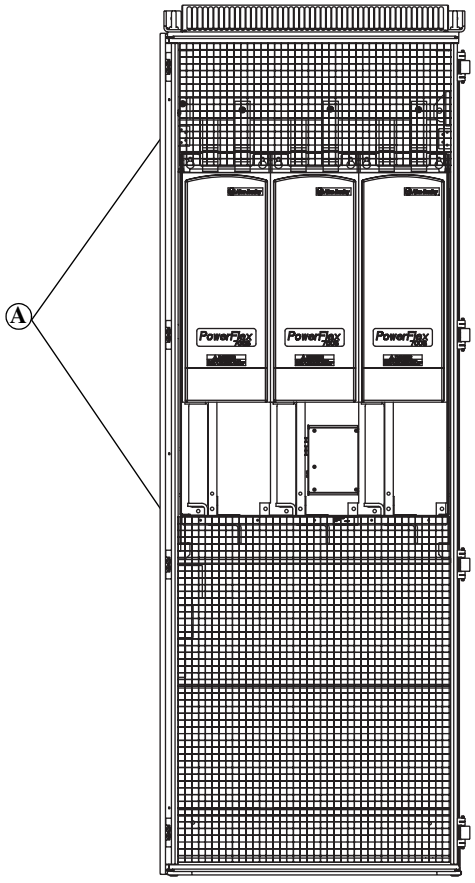
To access the power terminals, you must first remove the protective screens (on NEMA/UL Type 1 and Type 12 enclosures), air flow plate and protective covers from the Inverter units. These steps are detailed below.

## Removing the Protective Covers from the Inverter Units

### Removing the Protective Screens

To access the components within the Power Structures, you must first remove the protective screens from the Inverter units.

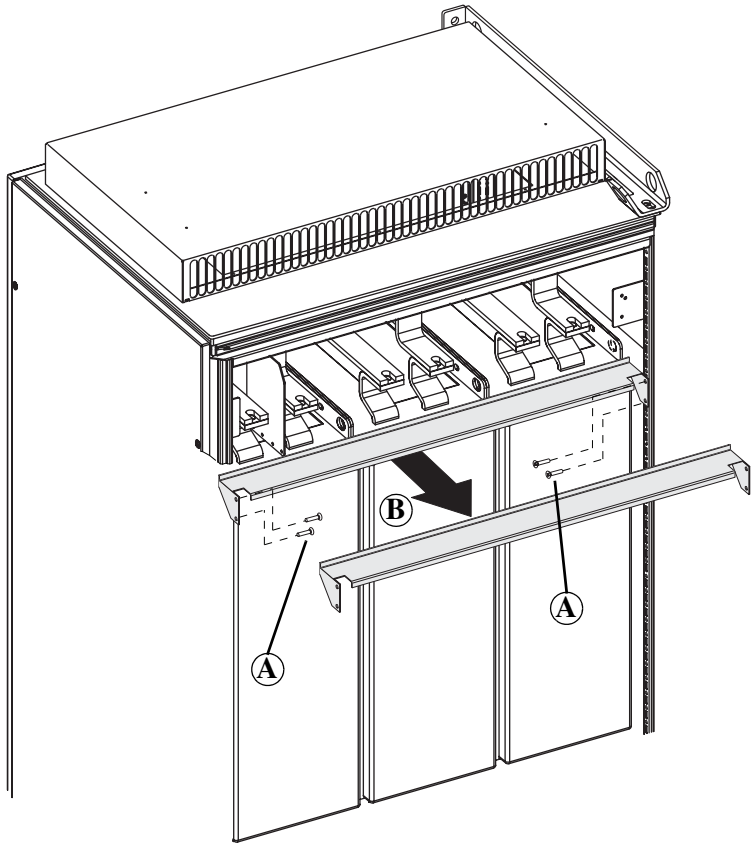
| Task | Description |
|---|---|
| Ⓐ | Remove the screws that secure the protective screens to the inverter units and remove the screens. |



## Removing the Airflow Plates

The drive is equipped with plates, just above the top of the protective covers, that direct airflow through the drive enclosure. You must remove these plates in order to access the protective covers.

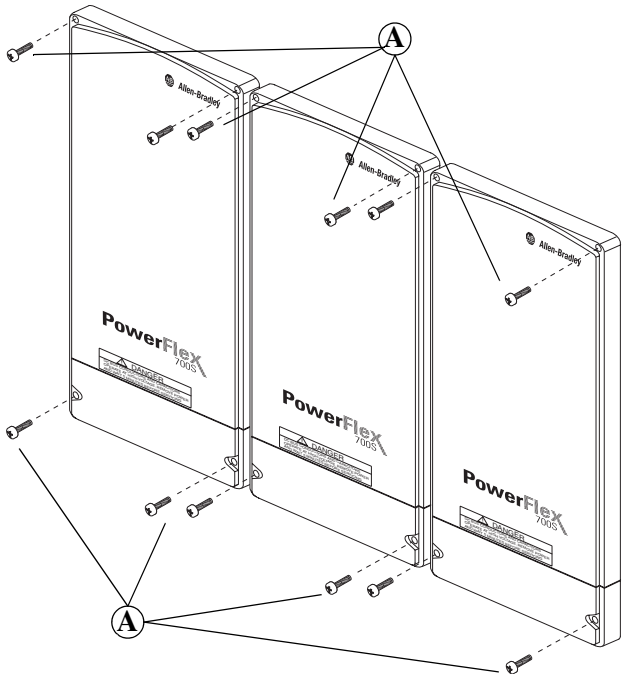
| Task | Description |
|---|---|
| Ⓐ | Remove the T8 Torx-head screws that secure the airflow plates to the drive. |
| Ⓑ | Slide the airflow plates off of the drive. |



## Removing the Protective Covers

You must remove the protective covers from the Inverter units in order to gain access to the power terminals.

| Task | Description |
|---|---|
| Ⓐ | Remove the four M5 POZIDRIV screws that secure each of the three main and bottom protective covers to the drive, then remove the protective covers. |




## 400 and 690 Volt Class AC Input Wiring for Frame 14 Drives

Frame 14 size drives utilize three parallel converter units or two pairs of two parallel converter units that are pre-connected to line reactors and are fed through motor operated circuit breakers.

**Important:** Parallel wiring must have the same cable dimensions, type and routing. Non-symmetrical wiring may cause unequal loading between the converters and reduce the drive's ability to deliver current to the motor.

Frame 14 drives can be ordered with or without du/dt filters. The du/dt filter limits the rate of change of output voltage and the rate of change in the IGBT or output transistor switching event.

Refer to the *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives*, publication DRIVES-IN001…, for minimum inductance on installations where du/dt filters are not installed.

**Figure 11.8 1500A Drive AC Wiring Example:**

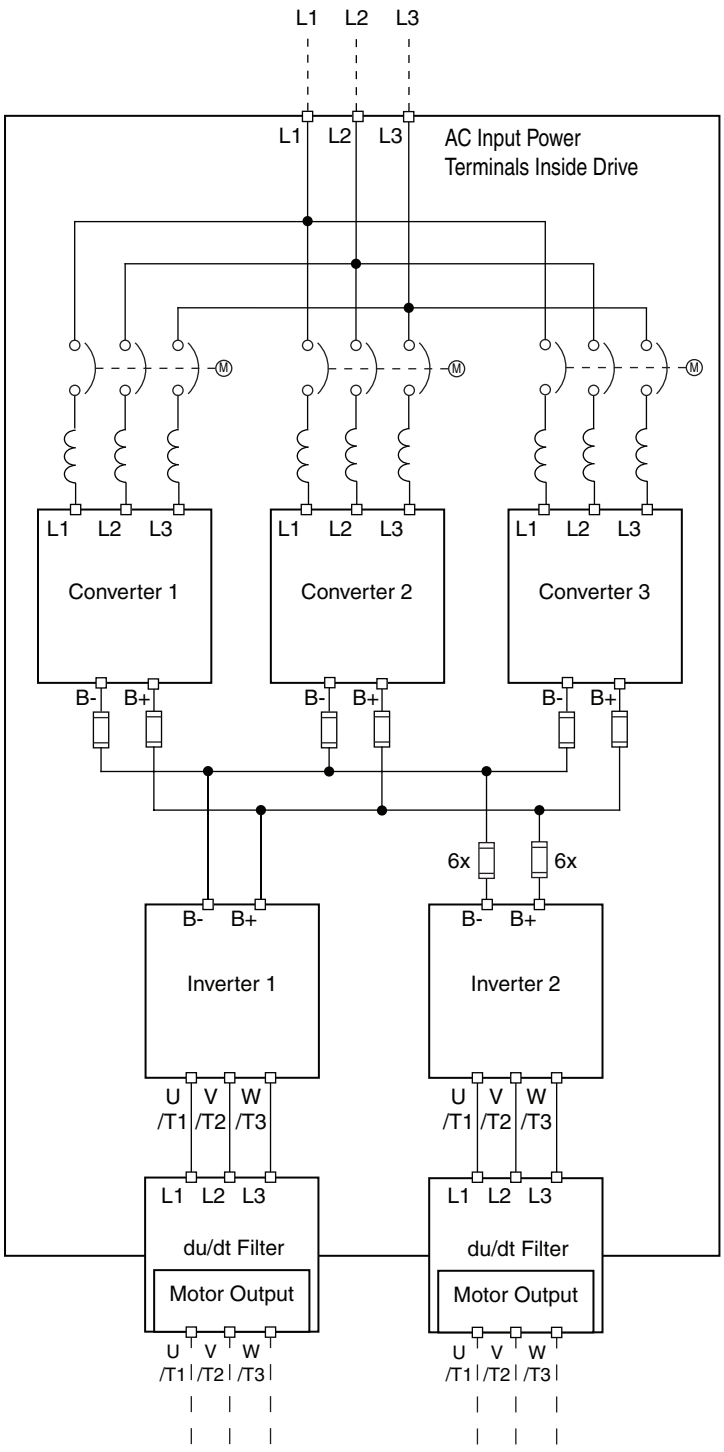
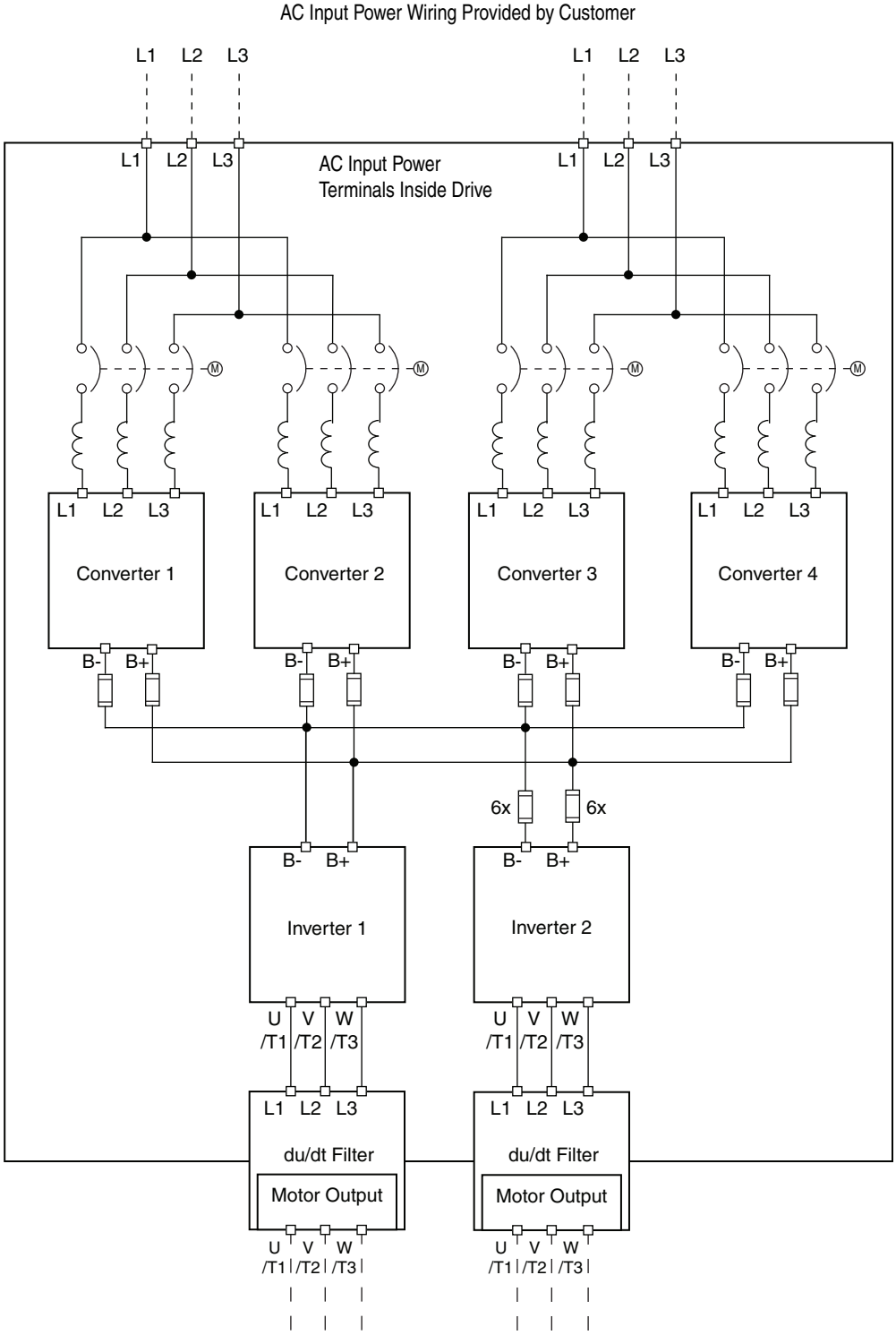


**Figure 11.9 Drives Above 1500A AC Wiring Example:**



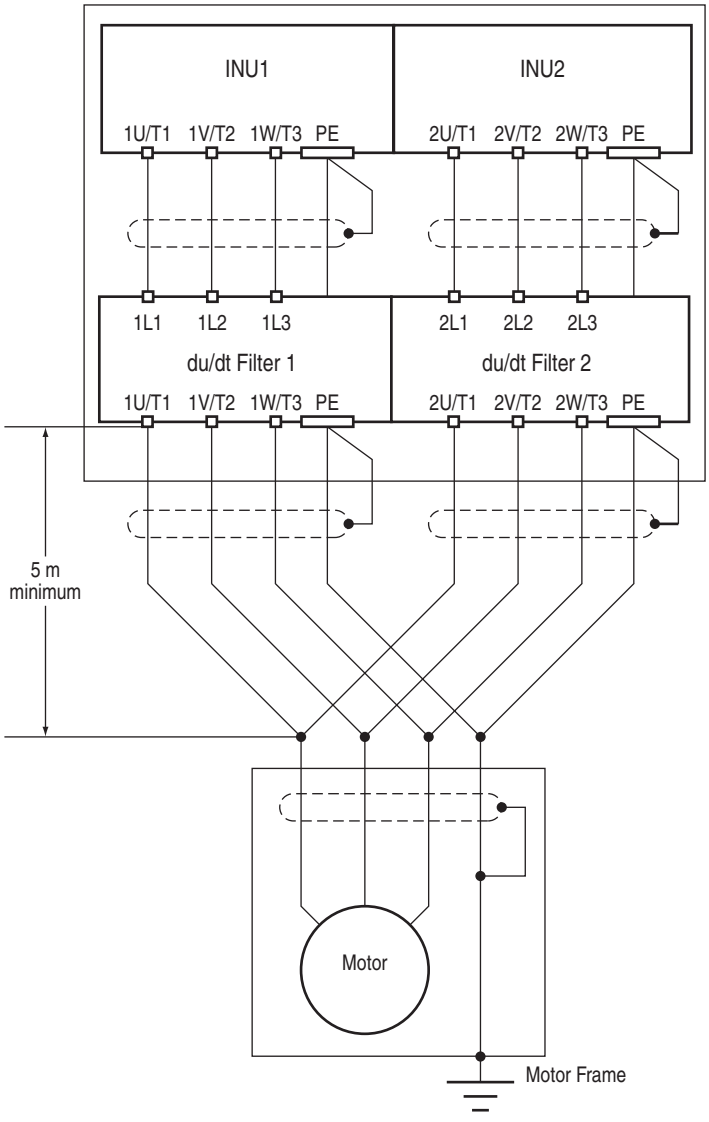
## Output Power Wiring for Frame 14 Drives

Frame 14 drives utilize two parallel power structures, and therefore have two sets of output power terminals. You must connect the motor to both sets of output power terminals.

**Important:** Parallel wiring must have the same cable dimensions, type and routing. Non-symmetrical wiring may cause unequal loading between the converters and reduce the drive's ability to deliver current to the motor.

**Important:** The minimum cable length for parallel motor cables from the drive to the point where the cables connect is 5m (16.4 ft.). Join the parallel cables at the motor end (not the drive end). Or, install a reactor on the output of each power module with a minimum of 5 µH prior to joining the parallel cables at the motor end.

**Figure 11.8 Motor Wiring Example**



**Important:** Once power wiring has been completed, the protective covers must be installed before energizing the drive. Installation is in reverse order of removal (refer to "Removing the Protective Covers from the Converter Unit(s)" on page 11-10 and "Removing the Protective Covers from the Inverter Units" on page 11-16.)

**Table 11.B 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 (1)<br>L1, L2, L3 | 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)<br>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)<br>(3 Terminals; DC–, DC+) | DC input or external brake | 300 $mm^2$ (600 MCM) | 2.1 $mm^2$ (14 AWG) | 40 N•m (354 lb•in) | M12 |

(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.

**Figure 11.10 1500A Drive Terminal Locations**

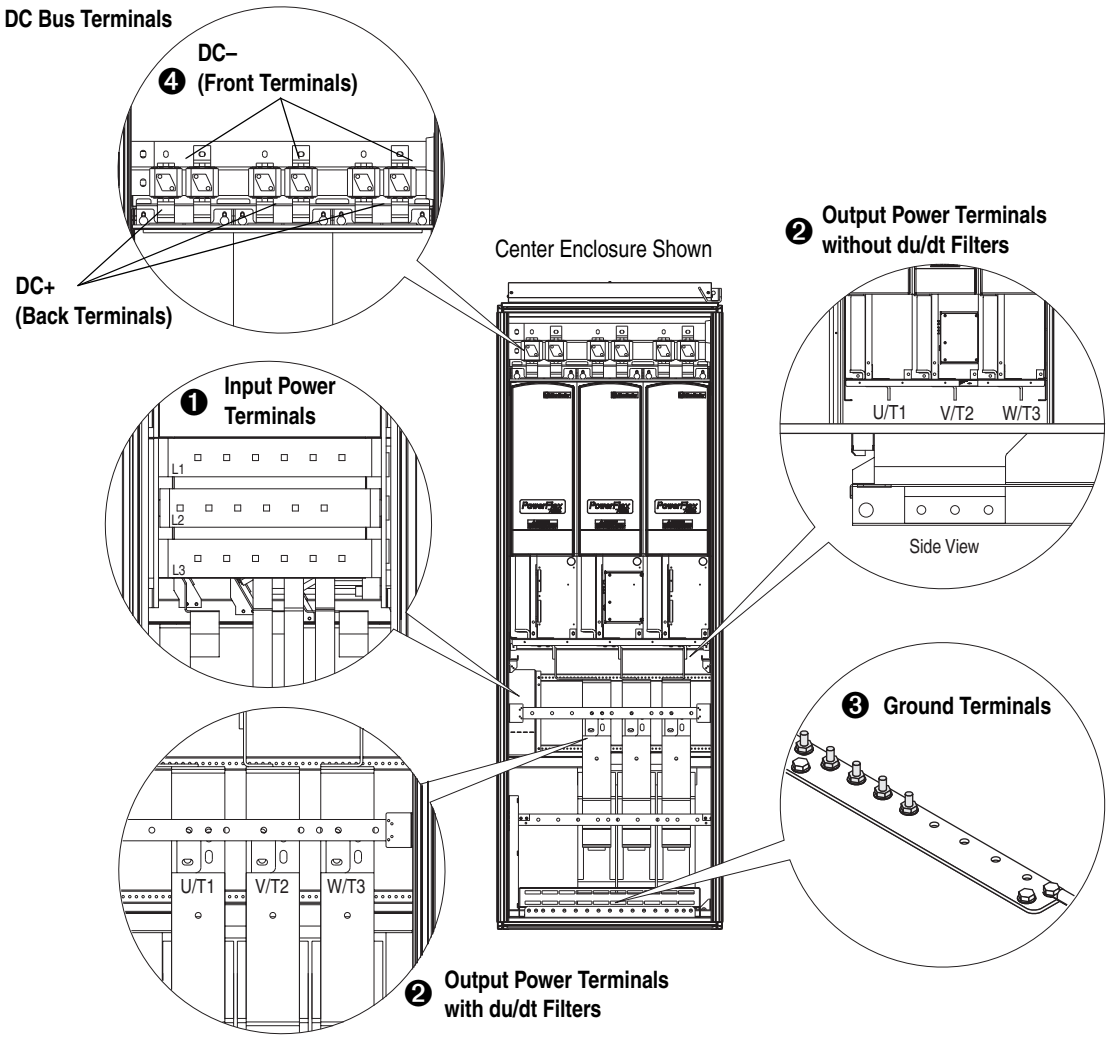
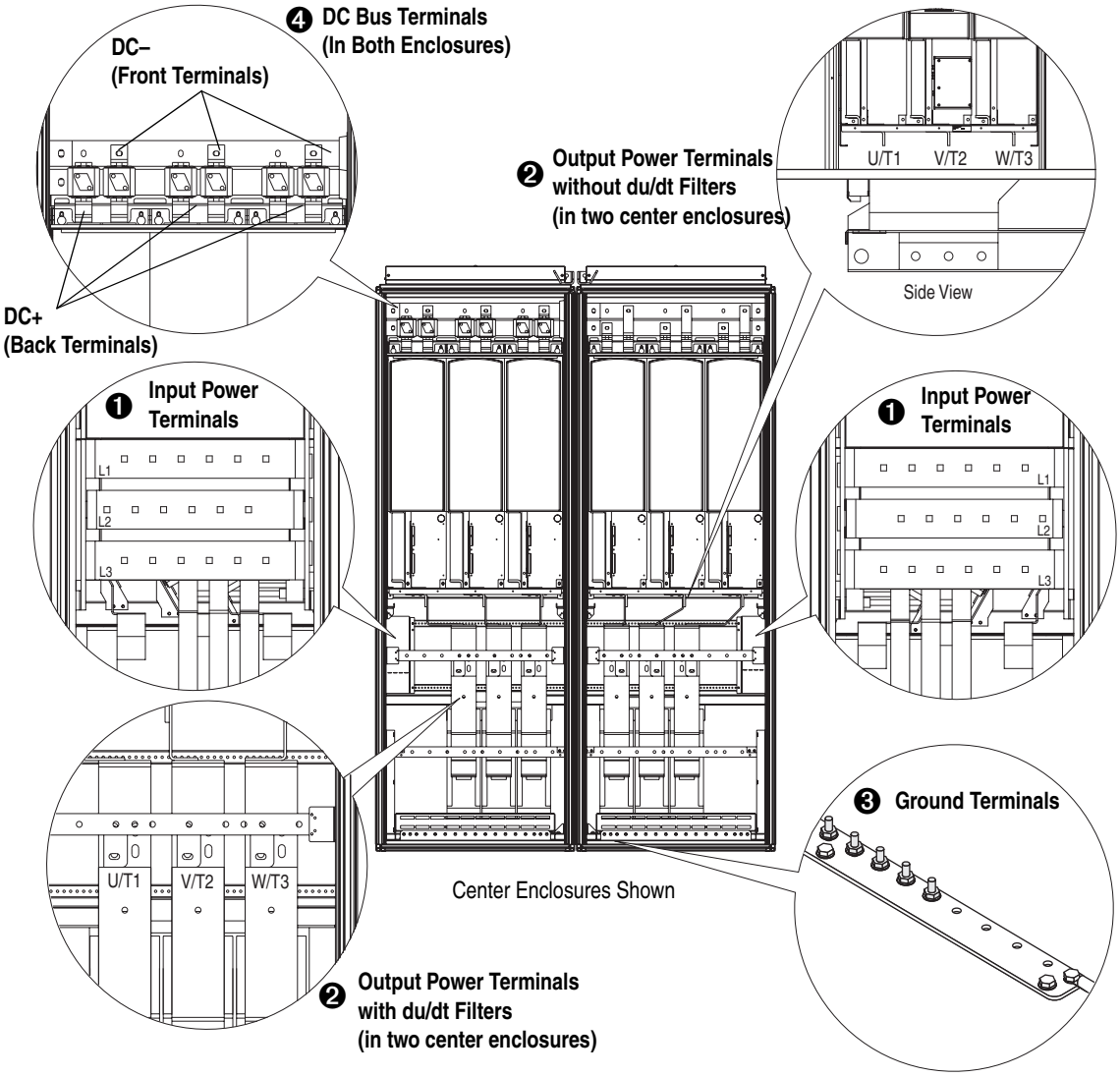
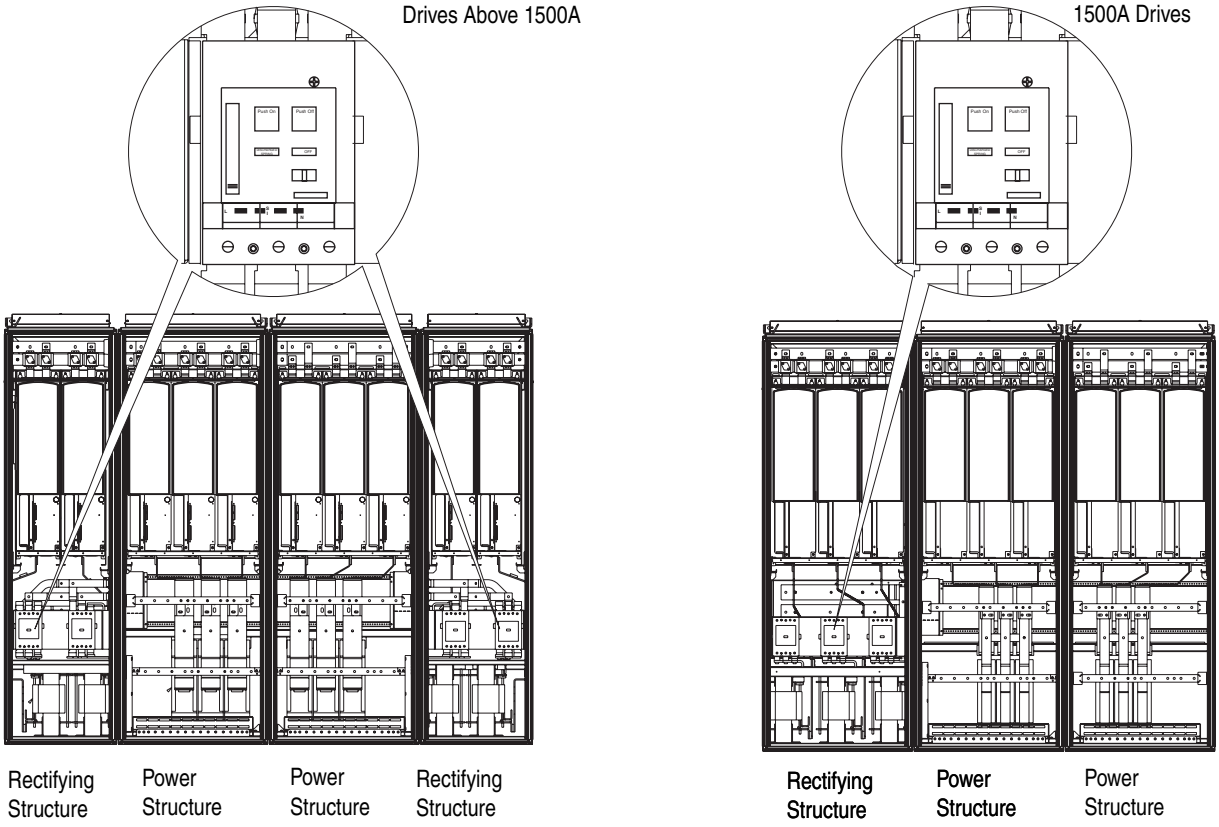


**Figure 11.11 Drives Above 1500A Terminal Locations**



## Frame 14 Circuit Breakers

Frame 14 drives utilize molded case circuit breakers (MCCBs) to provide overload/overcurrent and undervoltage protection on the incoming AC lines and to synchronize the energizing of the power structures. The circuit breakers are located inside of the enclosures in front of the AC Chokes.




Note: Control Frame not shown for clarity only.

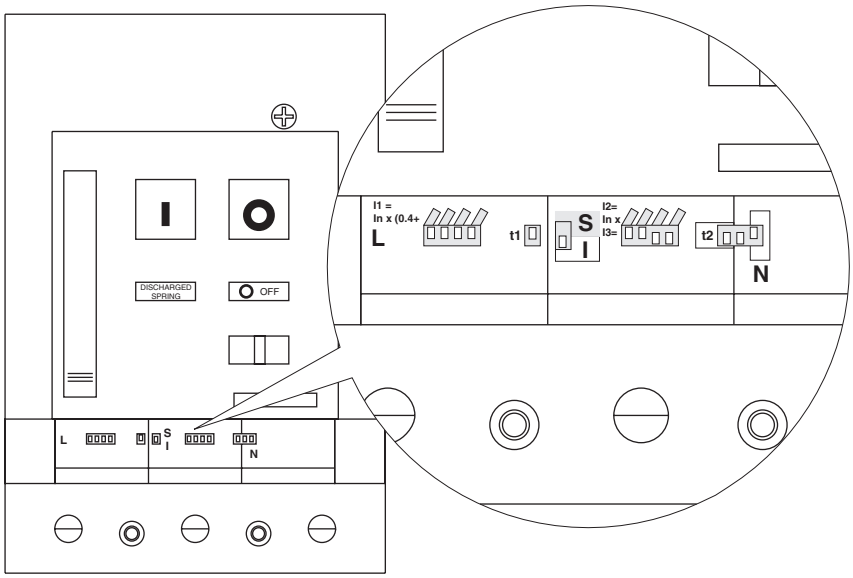
## Circuit Breaker DIP Switch Settings

The DIP switches on the circuit breakers are configured to the correct settings at the factory. However, the settings detailed in Table 11.C below should be verified before charging the circuit breaker motor operators and operating the drive.

**Table 11.C Circuit Breaker DIP Switch Settings**

| Voltage Class | Drive ND Cont. Amp Rating | L | | S/I | | | N | |
|---|---|---|---|---|---|---|---|---|
| | | I1 | t1 | S/I | I3 | t2 | ON/OFF | 50% / 100% |
| 400/480V AC | 1770 | 0.76 | 3 s | S | 1.5 | 0.1 s | OFF | na |
| | 2150 | 0.92 | 3 s | S | 1.5 | 0.1 s | OFF | na |
| 600/690V AC | 1500 | 0.88 | 3 s | S | 1.0 | 0.1 s | OFF | na |
| | 1900 | 0.84 | 3 s | S | 1.0 | 0.1 s | OFF | na |
| | 2250 | 0.96 | 3 s | S | 1.5 | 0.1 s | OFF | na |

**Figure 11.12 Circuit Breaker DIP Switches Location**

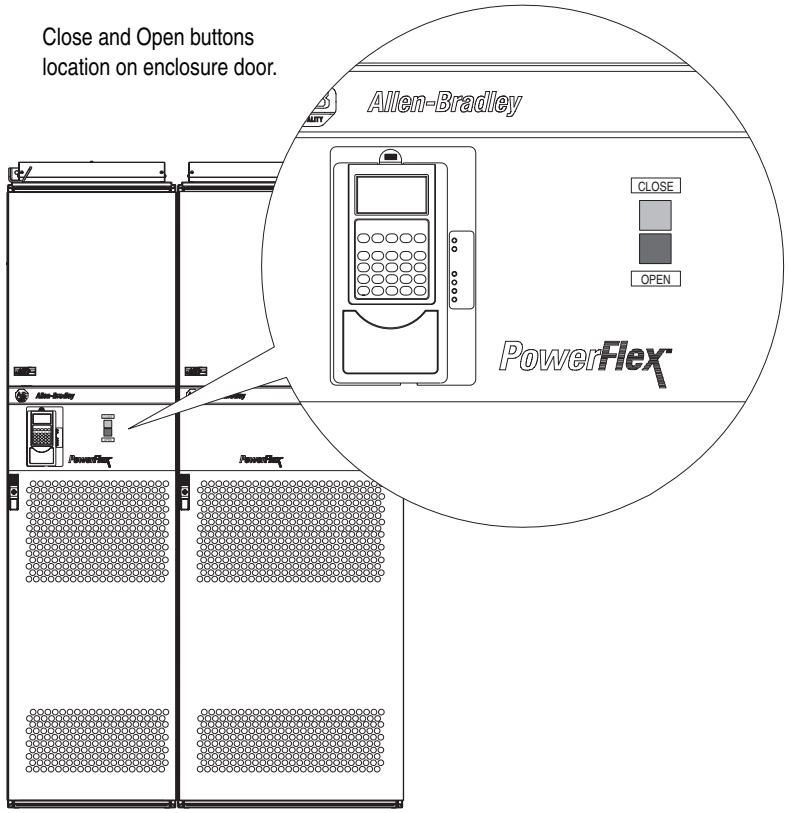


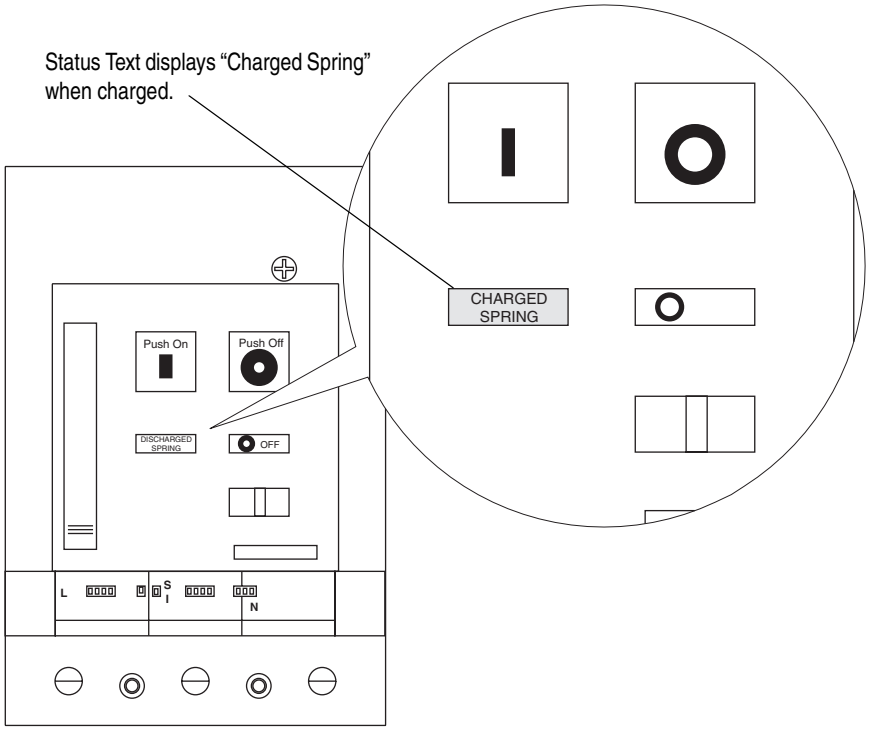
## Charging the MCCB Motor Operators

The stored energy motor operators must be charged prior to the first time the circuit breakers are closed and whenever input power is removed and re-applied to the drive.

**ATTENTION:** When an external device for circuit breaker motor operator status is not used, the enclosure door(s) must be open in order to view the status indicator on the circuit breakers. Only qualified personnel familiar with PowerFlex 700S and 700H drives 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.

1. With the doors of the enclosures containing the MCCBs open, apply control voltage to the drive.
2. Press and hold the “Open” (red) control button on the enclosure door until the status text “Charged Spring” displays on each of the MCCBs (see illustration below).






3. The MCCBs can now be closed (see "Closing the Circuit Breakers and Energizing the Drive" on page 11-27).

## Closing the Circuit Breakers and Energizing the Drive

1. Close and latch all enclosure doors.
2. Press the “Close” (green) control button on the enclosure door.
3. The circuit breakers can be opened by pressing the “Open” (red) control button on the enclosure door.

The motor operators are automatically recharged when they are opened.

### Resetting the Circuit Breakers

The electronic trip unit will open the circuit breaker in the case of a drive overload/overcurrent condition. When a voltage drop (U < 0.7 x Un) or loss of the main supply occurs, the undervoltage release coil of the circuit breakers will open. The trip indicator contacts of the circuit breakers are connected in series. Therefore, if one circuit breakers trips due to an undervoltage or overload/overcurrent condition, all circuit breakers will open/trip.

If the circuit breakers have opened due to an overcurrent fault, the condition that caused the fault must be corrected and the fault cleared before the circuit breakers can be reset and the drive started. In this case, refer to "Charging the MCCB Motor Operators" on page 11-26.

# Specifications

| Category | | PowerFlex 700H | PowerFlex 700S |
|---|---|---|---|
| **Agency Certification** |  | Listed to UL508C and CAN/CSA-C2.2 No. 14-M91. | UL and cUL Listed to UL508C and CAN/CSA - 22.2 No. 14-95. |
| |  | Marked for all applicable European Directives(1)<br>EMC Directive (89/336/EEC)<br>EN 61800-3 Adjustable Speed electrical power drive systems<br>Low Voltage Directive (73/23/EEC)<br>EN 50178 Electronic Equipment for use in Power Installations | Marked for all applicable European Directives<br>EMC Directive (89/336/EEC)<br>Emissions:<br>EN 61800-3 Adjustable Speed electrical power drive systems Part 3<br>Low Voltage Directive (73/23/EEC)<br>EN 50178 Electronic Equipment for use in Power Installations |
| |  <br>N223 | Certified to AS/NZS, 1997 Group 1, Class A. | Certified to AS/NZS, 1997 Group 1, Class A. |
| |  II 2 G/D | Certified to ATEX directive 94/9/EC. Group II Category (2) GD Applications with ATEX Approved Motors. Refer to Appendix E - Instructions for ATEX Approved PowerFlex 700H Drives in Group II Category (2) Applications with ATEX Approved Motors for more information. | Certified to ATEX directive 94/9/EC. Group II Category (2) GD Applications with ATEX Approved Motors. PowerFlex 700S Phase II Control drives only. Refer to publication 20D-UM006… for more information. |
| |  | NA | TUV functional safety report only (no FS mark on the label) |
| | | The drive is also designed to meet the following specifications:<br>NFPA 70 - US National Electrical Code<br>NEMA ICS 7.1 - Safety standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.<br>IEC 146 - International Electrical Code. | The drive is designed to meet applicable requirements of the following codes/standards:<br>IEC 61800-2 Adjustable speed electrical power drive systems - General requirements<br>IEC 61800-5-1 Adjustable speed electrical power drive systems - Safety requirements<br>NFPA 70 - US National Electrical Code |

(1) Applied noise impulses may be counted in addition to the standard pulse train causing erroneously high [Pulse Freq] readings.

| Category | Specification | PowerFlex 700H | | | | | PowerFlex 700S | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Protection** | **Drive** | **380/400V** | **480V** | **500V** | **600V** | **690V** | **380/400V** | **480V** | **500V** | **600V** | **690V** |
| | AC Input Overvoltage Trip: | 611Vac | 611Vac | 611Vac | 806Vac | 806Vac | 675Vac | 675Vac | 675Vac | 889Vac | 889Vac |
| | AC Input Undervoltage Trip: | 235Vac | 235Vac | 235Vac | 326Vac | 326Vac | Adjustable | | | | |
| | Bus Overvoltage Trip: | 911Vdc | 911Vdc | 911V dc | 1200V dc | 1200V dc | 911Vdc | 911Vdc | 911Vdc | 1200Vdc | 1200Vdc |
| | Bus Undervoltage Shutoff/Fault: | 333Vdc | 333Vdc | 333Vdc | 461Vdc | 461Vdc | Adjustable | | | | |
| | Nominal Bus Voltage (Full Load): | 517Vdc | 621Vdc | 645Vdc | 776Vdc | 890Vdc | 540Vdc | 648Vdc | 645Vdc | 810Vdc | 931V dc |
| | Heat Sink Thermistor: | Monitored by microprocessor overtemp trip | | | | | Monitored by microprocessor overtemp trip | | | | |
| | Drive Overcurrent Trip<br>Software Overcurrent Trip:<br>Hardware Overcurrent Trip:<br>Instantaneous Current Limit: | —<br>360% of rated Heavy Duty current (typical)<br>— | | | | | Calculated value, 105% of motor rated to 200% of drive rated<br>360% of rated Heavy Duty current (typical)<br>— | | | | |
| | Line transients: | up to 6000 volts peak per IEEE C62.41-1991 | | | | | Up to 6000 volts peak per IEEE C62.41-1991 | | | | |
| | Control Logic Noise Immunity: | Showering arc transients up to 1500V peak | | | | | Showering arc transients up to 1500V peak | | | | |
| | Power Ride-Thru: | 15 milliseconds at full load | | | | | 15 milliseconds at full load | | | | |
| | Logic Control Ride-Thru: | 0.5 seconds minimum, 2 seconds typical | | | | | 0.25 seconds, drive not running | | | | |
| | Ground Fault Trip: | Phase-to-ground on drive output | | | | | Phase-to-ground on drive output | | | | |
| | Short Circuit Trip: | Phase-to-phase on drive output | | | | | Phase-to-phase on drive output | | | | |

| Category | Specification | PowerFlex 700H | | | | PowerFlex 700S | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Environment** | Altitude: | 1000 m (3300 ft.) maximum without derating. Derate the drive by 1% for every 100 m (328 ft.) above 1000 m (3300 ft.). | | | | 1000 m (3300 ft.) maximum without derating. Derate the drive by 1% for every 100 m (328 ft.) above 1000 m (3300 ft.). | | | |
| | Maximum Surrounding Air Temperature without De-rating: | Based on drive rating, refer to Drive Frame chapters | | | | Based on drive rating, refer to Drive Frame chapters. | | | |
| | Storage Temperature (all const.): | –40 to 60° C (–40 to 140° F) | | | | –40 to 70° C (–40 to 158° F) | | | |
| | Atmosphere: | **Important:** Drive **must not** be installed in an area where the ambient atmosphere contains volatile or corrosive gas, vapors or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere. | | | | **Important:** Drive **must not** be installed in an area where the ambient atmosphere contains volatile or corrosive gas, vapors or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere. | | | |
| | Relative Humidity: | 5 to 95% non-condensing | | | | 5 to 95% non-condensing | | | |
| | Shock:<br>Non-operational | 15G peak for 11ms duration (±1.0 ms) | | | | 15G peak for 11ms duration (±1.0 ms) | | | |
| | Vibration: | 2 mm (0.0787 in.) displacement, 1G peak<br>EN50178 / EN60068-2-6 | | | | 2 mm (0.0787 in.) displacement, 1G peak<br>EN50178 / EN60068-2-6 | | | |
| | Sound: | Frame | Sound Level | Back-ground Noise Level | **Note**: Sound pressure level is measured at 1 meter. All devices measured are 400V IP21 and in power up mode. | Frame | Sound Level | Back-ground Noise Level | **Note**: Sound pressure level is measured at 1 meter. All devices measured are 400V IP21 and in power up mode. |
| | | 9 | 78 dba | 49 dba | | 9 | 78 dba | 49 dba | |
| | | 10 | 77 dba | 49 dba | | 10 | 77 dba | 49 dba | |
| | | 13 | 76d ba | 46 dba | | 13 | 76d ba | 46 dba | |
| **Electrical** | AC Input Voltage Tolerance: | ±10% | | | | ±10% | | | |
| | Frequency Tolerance: | 47-63 Hz. | | | | 47-63 Hz. | | | |
| | Input Phases: | Three-phase input provides full rating for all drives.<br>Single-phase operation provides 50% of rated current. | | | | Three-phase input provides full rating for all drives.<br>Single-phase operation provides 50% of rated current. | | | |
| | Displacement Power Factor: | 0.98 across entire speed range. | | | | 0.98 across entire speed range. | | | |
| | Efficiency: | 97.5% at rated amps, nominal line volts. | | | | 97.5% at rated amps, nominal line volts. | | | |
| | Maximum Short Circuit Rating: | ≤200,000 Amps symmetrical. | | | | ≤200,000 Amps symmetrical. | | | |
| | Actual Short Circuit Rating: | Determined by AIC rating of installed fuse/circuit breaker. | | | | Determined by AIC rating of installed fuse/circuit breaker. | | | |
| | Maximum Drive to Motor Power Ratio: | Recommended not greater than 2:1 ratio. | | | | Drive to motor rating cannot exceed a 2:1 ratio. | | | |

| Category | Specification | PowerFlex 700H | PowerFlex 700S |
|---|---|---|---|
| **Control** | Method: | Sine coded PWM with programmable carrier frequency. Ratings apply to all drives (refer to the *Derating Guidelines* in the PowerFlex Reference Manual). The drive can be supplied as 6 pulse or 12 pulse in a configured package. | Sine coded PWM with programmable carrier frequency, Indirect Self-Organized, Field-Oriented Control, Current-regulated. Ratings apply to all drives (refer to the *Derating Guidelines* in the PowerFlex 700S Phase II Reference Manual, publication PFLEX-RM003...). The drive can be supplied as 6 pulse or 12 pulse in a configured package. |
| | Carrier Frequency: | 1-6 kHz. | 2 kHz<br>Settings: 2, 4, 6, 8, 10 kHz<br>(6 kHz is for V/Hz operation only) |
| | Output Voltage Range: | 0 to rated motor voltage | 0 to rated motor voltage |
| | Output Frequency Range: | 0 to 320 Hz | 0 to 400 Hz<br>Note: For output frequencies above 320 - 400 Hz consult the factory. |
| | Frequency Accuracy<br>Digital Input:<br>Analog Input: | <br>Within ±0.01% of set output frequency.<br>Within ±0.4% of maximum output frequency. | – |
| | Frequency Control: | Speed regulation - with Slip Compensation<br>0.5% of base speed across 40:1 speed range<br>40:1 operating range | – |
| | Speed Control: | | Speed regulation - without feedback<br>0.1% of base speed across 120:1 speed range<br>120:1 operating range<br>50 rad/sec bandwidth |
| | | | Speed regulation - with feedback<br>0.001% of base speed across 120:1 speed range<br>1000:1 operating range<br>300 rad/sec bandwidth |
| | Torque Regulation: | | Torque Regulation - without feedback<br>±10%, 600 rad/sec bandwidth |
| | | | Torque Regulation - with feedback<br>±5%, 2500 rad/sec bandwidth |
| | Selectable Motor Control: | Sensorless Vector with full tuning. Standard V/Hz with full custom capability. | Field Oriented Control with and without a feedback device and permanent magnet motor control |
| | Stop Modes: | Multiple programmable stop modes including - Ramp, Coast, DC-Brake, Ramp-to-Hold and S-curve. | Multiple programmable stop modes including - Ramp, Coast and Current Limit. |
| | Accel/Decel: | Two independently programmable accel and decel times. Each time may be programmed from 0 to 3276.7 seconds in 0.1 second increments. | Two independently programmable accel and decel times. Each time may be programmed from 0 - 6553.5 seconds in 0.1 second increments. |
| | S-Curve Time: | 0-100% of accel/decel time. | Adjustable from 0.5 to 4.0 seconds. |
| | Intermittent Overload: | 110% Overload capability for up to 1 minute<br>150% Overload capability for up to 2 seconds | 110% Overload capability for up to 1 minute<br>150% Overload capability for up to 3 seconds |
| | Current Limit Capability: | Proactive Current Limit programmable from 20 to 160% of rated output current. Programmable proportional gain. | Independent Motoring and Regenerating Power Limits programmable to 800% of rated output current |
| | Electronic Motor Overload Protection: | Class 10 protection with speed sensitive response. Investigated by U.L. to comply with N.E.C. Article 430. U.L. File E59272, volume 12. | Class 10 protection with speed sensitive response. Investigated by U.L. to comply with N.E.C. Article 430. U.L. File E59272, volume 12. |

<table>
<tr><th>Category</th><th>Specification</th><th>PowerFlex 700H</th><th>PowerFlex 700S</th></tr>
<tr><td rowspan="16">Feedback</td><td>Encoder Inputs (2):</td><td rowspan="16"></td><td>Dual Channel Plus Marker, Isolated with differential transmitter Output (Line Drive) Incremental, Dual Channel Quadrature type</td></tr>
<tr><td>Encoder Voltage Supply:</td><td>5V DC or 12 V DC 320 mA/channel<br>5V DC minimum high state voltage of 3.0V DC, maximum low state voltage at 0.4V DC<br>12 V DC minimum high state voltage of 7.0V DC, maximum low state voltage of 0.4V DC</td></tr>
<tr><td>Encoder PPR Rating:</td><td>Encoder PPR ratings are limited to the values specified in the table below:
<table>
<tr><th>n =</th><th>$2^n$ =</th><th>x</th><th>mod 75</th><th>mod 125</th><th>mod 225</th><th>mod 375</th><th>mod 625</th><th>mod1125</th></tr>
<tr><td>0</td><td>1</td><td></td><td>75</td><td>125</td><td>225</td><td>375</td><td>625</td><td>1125</td></tr>
<tr><td>1</td><td>2</td><td></td><td>150</td><td>250</td><td>450</td><td>750</td><td>1250</td><td>2250</td></tr>
<tr><td>2</td><td>4</td><td></td><td>300</td><td>500</td><td>900</td><td>1500</td><td>2500</td><td>4500</td></tr>
<tr><td>3</td><td>8</td><td></td><td>600</td><td>1000</td><td>1800</td><td>3000</td><td>5000</td><td>9000</td></tr>
<tr><td>4</td><td>16</td><td></td><td>1200</td><td>2000</td><td>3600</td><td>6000</td><td>10000</td><td>18000</td></tr>
<tr><td>5</td><td>32</td><td></td><td>2400</td><td>4000</td><td>7200</td><td>12000</td><td>20000</td><td>--</td></tr>
<tr><td>6</td><td>64</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>7</td><td>128</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>8</td><td>256</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>9</td><td>512</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>10</td><td>1024</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>11</td><td>2048</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>12</td><td>4096</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>13</td><td>8192</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>14</td><td>16384</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
</table></td></tr>
<tr><td>Maximum Required Input Frequency:</td><td>400 kHz</td></tr>
<tr><td>Hi-Resolution Stegmann Option:</td><td rowspan="5"></td><td>Refer to specifications on page C-1</td></tr>
<tr><td>Encoder Voltage Supply:</td><td>11.5V dc @ 130 mA</td></tr>
<tr><td>Hi-Resolution Feedback:</td><td>Sine/Cosine 1V P-P Offset 2.5</td></tr>
<tr><td>Maximum Cable Length:</td><td>182 m (600 ft.)</td></tr>
<tr><td>RS-485 Interface:</td><td>Hi-Resolution Feedback Option card obtains the following information via the Hiperface RS-485 interface shortly after power-up: Address, Command Number, Mode, Number of turns, Number of Sine/Cos cycles, Checksum</td></tr>
<tr><td>Customer-I/O Plug (P1) - Hi Res:</td><td></td><td>Allen-Bradley PN: S94262912<br>Weidmuller PN: BL3.50/90/12BK</td></tr>
<tr><td>Resolver Option:</td><td rowspan="5"></td><td></td></tr>
<tr><td>Excitation Frequency:</td><td>2400 Hz</td></tr>
<tr><td>Excitation Voltage:</td><td>4.25-26 Vrms</td></tr>
<tr><td>Operating Frequency Range:</td><td>1 - 10 kHz</td></tr>
<tr><td>Feedback Voltage:</td><td>2V ± 300 mV</td></tr>
<tr><td>Maximum Cable Length:</td><td>304.8 meters (1000 ft.)</td></tr>
<tr><td rowspan="7">DriveLogix</td><td>User Available MemoryBase:<br>With Memory Expansion Board:</td><td rowspan="7"></td><td>256 kbytes<br>768 kbytes</td></tr>
<tr><td>Battery:</td><td>1756-BA1 (Allen-Bradley PN 94194801) 0.59g lithium</td></tr>
<tr><td rowspan="4">Serial Cable:</td><td>1761-CBLPM02 to 1761-NET-AIC</td></tr>
<tr><td>1761-CBLPA00 to 1761-NET-AIC</td></tr>
<tr><td>1756-CP3 directly to controller</td></tr>
<tr><td>1747-CP3 directly to controller</td></tr>
<tr><td>Flex I/O Connection:</td><td>category 3 (2)</td></tr>
<tr><td>FLEXBUS Current Output:</td><td>Up to (8) modules</td></tr>
<tr><td>Cable:</td><td>640 mA maximum @ 5.1V dc</td></tr>
<tr><td></td><td></td><td></td><td>4100-CCF3</td></tr>
</table>

## Drive Ratings and Protection Devices Catalog Number Designations

The first three characters of the drive catalog numbers in the tables on the following pages designate the type of drive control. The information in the tables are valid for PowerFlex drives with both the 700H and 700S control. Therefore, the third character of the drive catalog number in each table is replaced with an “x”. For ordering purposes, drives with the 700H control are designated as “20C” and drives with the 700S control are designated as “20D”.

## Drive Ratings

The tables on the following pages provide drive ratings (including continuous, 1 minute and 3 seconds), PWM frequency ratings, ambient operating temperatures and watts loss information.

**Table A.A 400 Volt AC Input Frames 9 - 14 Drive Ratings**

| Drive Catalog Number | Frame | kW Rating | | PWM Freq. | Temp. | Input Ratings | Output Amps | | | Watts Loss |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ND | HD | kHz | °C | Amps | Cont. | 1 Min. | 3 Sec. | Watts |
| 20xC261 | 9 | 132 | - | 2 | 40 | 263 | 261 | 287 | 410 | 2700 |
| | | - | 110 | 2 | 40 | 207 | 205 | 308 | 410 | 2700 |
| 20xC300 | 9 | 160 | - | 2 | 40 | 302 | 300 | 330 | 450 | 3100 |
| | | - | 132 | 2 | 40 | 247 | 245 | 368 | 490 | 3100 |
| 20xC385 | 10 | 200 | - | 2 | 40 | 388 | 385 | 424 | 600 | 4320 |
| | | - | 160 | 2 | 40 | 302 | 300 | 450 | 600 | 4320 |
| 20xC460 | 10 | 250 | - | 2 | 40 | 463 | 460 | 506 | 770 | 5335 |
| | | - | 200 | 2 | 40 | 388 | 385 | 578 | 770 | 5335 |
| 20xC500 | 10 | 250 | - | 2 | 40 | 504 | 500 | 550 | 750 | 5921 |
| | | - | 250 | 2 | 40 | 423 | 420 | 630 | 840 | 5921 |
| 20xC590 | 11 | 315 | - | 2 | 40 | 594 | 590 | 649 | 956 | 6620 |
| | | - | 250 | 2 | 40 | 524 | 520 | 780 | 956 | 6620 |
| 20xC650 | 11 | 355 | - | 2 | 40 | 655 | 650 | 715 | 1062 | 7538 |
| | | - | 315 | 2 | 40 | 594 | 590 | 885 | 1062 | 7538 |
| 20xC730 | 11 | 400 | - | 2 | 40 | 735 | 730 | 803 | 1095 | 8312 |
| | | - | 355 | 2 | 40 | 655 | 650 | 975 | 1170 | 8312 |
| 20xC820 | 12 | 450 | - | 2 | 40 | 826 | 820 | 902 | 1230 | 9201 |
| | | - | 400 | 2 | 40 | 735 | 730 | 1095 | 1314 | 9201 |
| 20xC920 | 12 | 500 | - | 2 | 40 | 927 | 920 | 1012 | 1380 | 10670 |
| | | - | 450 | 2 | 40 | 826 | 820 | 1230 | 1476 | 10670 |
| 20xC1K0 | 12 | 560 | - | 2 | 40 | 1038 | 1030 | 1133 | 1555 | 11729 |
| | | - | 500 | 2 | 35 | 927 | 920 | 1370 | 1600 | 11729 |
| 20xC1K1 | 13 | 630 | - | 2 | 40 | 1158 | 1150 | 1265 | 1620 | 13801 |
| | | - | 560 | 2 | 40 | 1038 | 1030 | 1545 | 1620 | 13801 |
| 20xC1K3 | 13 | 710 | - | 2 | 40 | 1310 | 1300 | 1430 | 2079 | 15077 |
| | | - | 630 | 2 | 40 | 1158 | 1150 | 1725 | 2079 | 15077 |
| 20xC1K4 | 13 | 800 | - | 2 | 40 | 1461 | 1450 | 1595 | 2175 | 16511 |
| | | - | 710 | 2 | 40 | 1209 | 1200 | 1800 | 2400 | 16511 |
| 20xC1K7[1] | 14 | 1000 | - | 2 | 40 | 1783 | 1770 | 1947 | 2655 | 24800 |
| | | - | 900 | 2 | 40 | 1612 | 1600 | 2400 | 2880 | 24800 |
| 20xC2K1[1] | 14 | 1200 | - | 2 | 40 | 2166 | 2150 | 2365 | 3225 | 29900 |
| | | - | 1100 | 2 | 40 | 1954 | 1940 | 2910 | 3492 | 29900 |
| 20xC2K7[1] | 14 | 1600 | - | 2 | 40 | 2720 | 2700 | 2970 | 3933 | 39680 |
| | | - | 1300 | 2 | 40 | 2317 | 2300 | 3287 | 3933 | 39680 |

(1) Not available with 700S Control.

**Table A.B 480 Volt AC Input Frames 9 - 14 Drive Ratings**

| Drive Catalog Number | Frame | HP Rating | | PWM Freq. | Temp. | Input Ratings | Output Amps | | | Watts Loss |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ND | HD | kHz | °C | Amps | Cont. | 1 Min. | 3 Sec. | Watts |
| 20xD261 | 9 | 200 | - | 2 | 40 | 252 | 261 | 287 | 410 | 2700 |
| | | - | 150 | 2 | 40 | 207 | 205 | 308 | 410 | 2700 |
| 20xD300 | 9 | 250 | - | 2 | 40 | 290 | 300 | 330 | 450 | 3100 |
| | | - | 200 | 2 | 40 | 247 | 245 | 368 | 490 | 3100 |
| 20xD385 | 10 | 300 | - | 2 | 40 | 372 | 385 | 424 | 600 | 4320 |
| | | - | 250 | 2 | 40 | 302 | 300 | 450 | 600 | 4320 |
| 20xD460 | 10 | 350 | - | 2 | 40 | 444 | 460 | 506 | 770 | 5335 |
| | | - | 300 | 2 | 40 | 388 | 385 | 578 | 770 | 5335 |
| 20xD500 | 10 | 450 | - | 2 | 40 | 483 | 500 | 550 | 750 | 5921 |
| | | - | 350 | 2 | 40 | 423 | 420 | 630 | 840 | 5921 |
| 20xD590 | 11 | 500 | - | 2 | 40 | 570 | 590 | 649 | 956 | 6620 |
| | | - | 450 | 2 | 40 | 524 | 520 | 780 | 956 | 6620 |
| 20xD650 | 11 | 500 | - | 2 | 40 | 628 | 650 | 715 | 1062 | 7538 |
| | | - | 500 | 2 | 40 | 594 | 590 | 885 | 1062 | 7538 |
| 20xD730 | 11 | 600 | - | 2 | 40 | 705 | 730 | 803 | 1095 | 8312 |
| | | - | 500 | 2 | 40 | 655 | 650 | 975 | 1170 | 8312 |
| 20xD820 | 12 | 700 | - | 2 | 40 | 792 | 820 | 902 | 1230 | 9201 |
| | | - | 600 | 2 | 40 | 735 | 730 | 1095 | 1314 | 9201 |
| 20xD920 | 12 | 800 | - | 2 | 40 | 888 | 920 | 1012 | 1380 | 10670 |
| | | - | 700 | 2 | 40 | 826 | 820 | 1230 | 1476 | 10670 |
| 20xD1K0 | 12 | 900 | - | 2 | 40 | 994 | 1030 | 1133 | 1555 | 11729 |
| | | - | 800 | 2 | 35 | 927 | 920 | 1370 | 1600 | 11729 |
| 20xD1K1 | 13 | 1000 | - | 2 | 40 | 1110 | 1150 | 1265 | 1620 | 13801 |
| | | - | 900 | 2 | 40 | 994 | 1030 | 1545 | 1620 | 13801 |
| 20xD1K3 | 13 | 1200 | - | 2 | 40 | 1255 | 1300 | 1430 | 2079 | 15077 |
| | | - | 1000 | 2 | 40 | 1110 | 1150 | 1725 | 2079 | 15077 |
| 20xD1K4 | 13 | 1250 | - | 2 | 40 | 1400 | 1450 | 1595 | 2175 | 16511 |
| | | - | 1000 | 2 | 40 | 1158 | 1200 | 1800 | 2400 | 16511 |
| 20xD1K7[1] | 14 | 1500 | - | 2 | 40 | 1709 | 1770 | 1947 | 2655 | 24800 |
| | | - | 1400 | 2 | 40 | 1545 | 1600 | 2400 | 2880 | 24800 |
| 20xD2K1[1] | 14 | 1900 | - | 2 | 40 | 2076 | 2150 | 2365 | 3225 | 29900 |
| | | - | 1700 | 2 | 40 | 1873 | 1940 | 2910 | 3492 | 29900 |
| 20xD2K7[1] | 14 | 2300 | - | 2 | 40 | 2607 | 2700 | 2970 | 3933 | 39680 |
| | | - | 2000 | 2 | 40 | 2220 | 2300 | 3287 | 3933 | 39680 |

(1) Not available with 700S Control.

**Table A.C 600 Volt AC Input Frames 9 - 14 Drive Ratings**

| Drive Catalog Number | Frame | HP Rating | | PWM Freq. | Temp. | Input Ratings | Output Amps | | | Watts Loss |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ND | HD | kHz | ° C | Amps | Cont. | 1 Min. | 3 Sec. | Watts |
| 20xE170 | 9 | 150 | – | (3) | 40 | 164 | 170 | 187 | 245 | – |
| | | – | 150 | (3) | 40 | 139 | 144 | 216 | 245 | – |
| 20xE208 | 9 | 200 | – | (3) | 35 | 201 | 208 | 230 | 289 | – |
| | | – | 150 | (3) | 40 | 164 | 170 | 250 | 289 | – |
| 20xE261 | 10 | 250 | – | (3) | 40 | 252 | 261 | 287 | 375 | 4206 |
| | | – | 200 | (3) | 40 | 201 | 208 | 312 | 375 | 4206 |
| 20xE325 | 10 | 350 | – | (3) | 40 | 314 | 325 | 358 | 470 | 4751 |
| | | – | 250 | (3) | 40 | 252 | 261 | 392 | 470 | 4751 |
| 20xE385 | 10 | 400 | – | (3) | 40 | 372 | 385 | 424 | 585 | 5527 |
| | | – | 350 | (3) | 40 | 314 | 325 | 488 | 585 | 5527 |
| 20xE416 | 10 | 450 | – | (3) | 35 | 402 | 416 | 458 | 585 | 5622 |
| | | – | 350 | (3) | 40 | 314 | 325 | 488 | 585 | 5622 |
| 20xE460 | 11 | 500 | – | (3) | 40 | 444 | 460 | 506 | 693 | 6345 |
| | | – | 400 | (3) | 40 | 372 | 385 | 578 | 693 | 6345 |
| 20xE502 | 11 | 500 | – | (3) | 40 | 485 | 502 | 552 | 828 | 6925 |
| | | – | 500 | (3) | 40 | 444 | 460 | 690 | 828 | 6925 |
| 20xE590 | 11 | 600 | – | (3) | 35 | 570 | 590 | 649 | 885 | 7539 |
| | | – | 500 | (3) | 35 | 485 | 502 | 753 | 904 | 7539 |
| 20xE650 | 12 | 700 | – | (3) | 40 | 628 | 650 | 715 | 1062 | 9502 |
| | | – | 650 | (3) | 40 | 570 | 590 | 885 | 1062 | 9502 |
| 20xE750 | 12 | 800 | – | (3) | 40 | 724 | 750 | 825 | 1170 | 10570 |
| | | – | 700 | (3) | 40 | 628 | 650 | 975 | 1170 | 10570 |
| 20xE820(1) | 12 | 900 | – | (3) | 35 | 792 | 820 | 902 | 1170 | 11082 |
| | | – | 700 | (3) | 35 | 628 | 650 | 975 | 1170 | 11082 |
| 20xE920 | 13 | 1000 | – | (3) | 40 | 888 | 920 | 1012 | 1380 | 12690 |
| | | – | 900 | (3) | 40 | 792 | 820 | 1230 | 1410 | 12690 |
| 20xE1K0 | 13 | 1100 | – | (3) | 40 | 994 | 1030 | 1133 | 1545 | 15907 |
| | | – | 1000 | (3) | 40 | 888 | 920 | 1380 | 1755 | 15907 |
| 20xE1K1 | 13 | 1300 | – | (3) | 35 | 1139 | 1180 | 1298 | 1755 | 17306 |
| | | – | 1100 | (3) | 35 | 994 | 1030 | 1463 | 1755 | 17306 |
| 20xE1K5 | 14 | 1600 | – | (3) | 40 | 1448 | 1500 | 1650 | 2250 | 22500 |
| | | – | 1400 | (3) | 40 | 1255 | 1300 | 1950 | 2340 | 22500 |
| 20xE1K9(2) | 14 | 2000 | – | (3) | 40 | 1834 | 1900 | 2090 | 2700 | 28500 |
| | | – | 1600 | (3) | 40 | 1448 | 1500 | 2250 | 2700 | 28500 |
| 20xE2K2(2) | 14 | 2400 | – | (3) | 30 | 2172 | 2250 | 2475 | 3335 | 33400 |
| | | – | 2000 | (3) | 30 | 1834 | 1900 | 2782 | 3335 | 33400 |

(1) 20DE820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.
(2) Not available with 700S Control.
(3) Rated PWM for 700H control 1.5kHz, Rated PWM for 700S control 2.0kHz.

**Table A.D 690 Volt AC Input Frames 9 - 14 Drive Ratings**

| Drive Catalog Number | Frame | kW Rating | | PWM Freq. | Temp. | Input Ratings | Output Amps | | | Watts Loss |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ND | HD | kHz | ° C | Amps | Cont. | 1 Min. | 3 Sec. | Watts |
| 20xF170 | 9 | 160 | – | 2 | 40 | 171 | 170 | 187 | 245 | – |
| | | – | 132 | 2 | 40 | 145 | 144 | 216 | 245 | – |
| 20xF208 | 9 | 200 | – | 2 | 35 | 210 | 208 | 230 | 289 | – |
| | | – | 160 | 2 | 40 | 171 | 170 | 250 | 289 | – |
| 20xF261 | 10 | 250 | – | 2 | 40 | 263 | 261 | 287 | 375 | 4206 |
| | | – | 200 | 2 | 40 | 210 | 208 | 312 | 375 | 4206 |
| 20xF325 | 10 | 315 | – | 2 | 40 | 327 | 325 | 358 | 470 | 4751 |
| | | – | 250 | 2 | 40 | 263 | 261 | 392 | 470 | 4751 |
| 20xF385 | 10 | 355 | – | 2 | 40 | 388 | 385 | 424 | 585 | 5527 |
| | | – | 315 | 2 | 40 | 327 | 325 | 488 | 585 | 5527 |
| 20xF416 | 10 | 400 | – | 2 | 35 | 419 | 416 | 458 | 585 | 5622 |
| | | – | 315 | 2 | 40 | 327 | 325 | 488 | 585 | 5622 |
| 20xF460 | 11 | 450 | – | 2 | 40 | 463 | 460 | 506 | 693 | 6345 |
| | | – | 355 | 2 | 40 | 388 | 385 | 578 | 693 | 6345 |
| 20xF502 | 11 | 500 | – | 2 | 40 | 506 | 502 | 552 | 828 | 6925 |
| | | – | 400 | 2 | 40 | 463 | 460 | 690 | 828 | 6925 |
| 20xF590 | 11 | 560 | – | 2 | 35 | 594 | 590 | 649 | 885 | 7539 |
| | | – | 500 | 2 | 35 | 506 | 502 | 753 | 904 | 7539 |
| 20xF650 | 12 | 630 | – | 2 | 40 | 655 | 650 | 715 | 1062 | 9502 |
| | | – | 560 | 2 | 40 | 594 | 590 | 885 | 1062 | 9502 |
| 20xF750 | 12 | 710 | – | 2 | 40 | 756 | 750 | 825 | 1170 | 10570 |
| | | – | 630 | 2 | 40 | 655 | 650 | 975 | 1170 | 10570 |
| 20xF820[1] | 12 | 800 | – | 2 | 35 | 826 | 820 | 902 | 1170 | 11082 |
| | | – | 630 | 2 | 35 | 655 | 650 | 975 | 1170 | 11082 |
| 20xF920 | 13 | 900 | – | 2 | 40 | 927 | 920 | 1012 | 1380 | 12690 |
| | | – | 800 | 2 | 40 | 826 | 820 | 1230 | 1410 | 12690 |
| 20xF1K0 | 13 | 1000 | – | 2 | 40 | 1038 | 1030 | 1133 | 1545 | 15907 |
| | | – | 900 | 2 | 40 | 927 | 920 | 1380 | 1755 | 15907 |
| 20xF1K1 | 13 | 1100 | – | 2 | 35 | 1189 | 1180 | 1298 | 1755 | 17306 |
| | | – | 1000 | 2 | 35 | 1038 | 1030 | 1463 | 1755 | 17306 |
| 20xF1K5 | 14 | 1500 | – | 2 | 40 | 1511 | 1500 | 1650 | 2250 | 22500 |
| | | – | 1300 | 2 | 40 | 1310 | 1300 | 1950 | 2340 | 22500 |
| 20xF1K9[2] | 14 | 1800 | – | 2 | 40 | 1914 | 1900 | 2090 | 2700 | 28500 |
| | | – | 1500 | 2 | 40 | 1511 | 1500 | 2250 | 2700 | 28500 |
| 20xF2K2[2] | 14 | 2000 | – | 2 | 30 | 2267 | 2250 | 2475 | 3335 | 33400 |
| | | – | 1800 | 2 | 30 | 1914 | 1900 | 2782 | 3335 | 33400 |

(1) 20DF820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.
(2) Not available with 700S Control.

**Table A.E 540 Volt DC Input Frames 9 - 14 Drive Ratings**

| Drive Catalog Number | Frame | kW Rating | | PWM Freq. | Temp. | DC Input Ratings | Output Amps | | |
|---|---|---|---|---|---|---|---|---|---|
| | | ND | HD | kHz | °C | Amps | Cont. | 1 Min. | 3 Sec. |
| 20xH261 | 9 | 132 | - | 2 | 40 | 307 | 261 | 287 | 410 |
| | | - | 110 | 2 | 40 | 241 | 205 | 308 | 410 |
| 20xH300 | 9 | 160 | - | 2 | 40 | 353 | 300 | 330 | 450 |
| | | - | 132 | 2 | 40 | 288 | 245 | 368 | 490 |
| 20xH385 | 10 | 200 | - | 2 | 40 | 453 | 385 | 424 | 600 |
| | | - | 160 | 2 | 40 | 353 | 300 | 450 | 600 |
| 20xH460 | 10 | 250 | - | 2 | 40 | 541 | 460 | 506 | 770 |
| | | - | 200 | 2 | 40 | 453 | 385 | 578 | 770 |
| 20xH500 | 10 | 250 | - | 2 | 40 | 589 | 500 | 550 | 750 |
| | | - | 250 | 2 | 40 | 494 | 420 | 630 | 840 |
| 20xH590 | 11 | 315 | - | 2 | 40 | 695 | 590 | 649 | 956 |
| | | - | 250 | 2 | 40 | 612 | 520 | 780 | 956 |
| 20xH650 | 11 | 355 | - | 2 | 40 | 765 | 650 | 715 | 1062 |
| | | - | 315 | 2 | 40 | 695 | 590 | 885 | 1062 |
| 20xH730 | 11 | 400 | - | 2 | 40 | 859 | 730 | 803 | 1095 |
| | | - | 355 | 2 | 40 | 765 | 650 | 975 | 1170 |
| 20xH820 | 12 | 450 | - | 2 | 40 | 965 | 820 | 902 | 1230 |
| | | - | 400 | 2 | 40 | 859 | 730 | 1095 | 1314 |
| 20xH920 | 12 | 500 | - | 2 | 40 | 1083 | 920 | 1012 | 1380 |
| | | - | 450 | 2 | 40 | 965 | 820 | 1230 | 1476 |
| 20xH1K0 | 12 | 560 | - | 2 | 40 | 1213 | 1030 | 1133 | 1555 |
| | | - | 500 | 2 | 35 | 1083 | 920 | 1370 | 1600 |
| 20xH1K1 | 13 | 630 | - | 2 | 40 | 1354 | 1150 | 1265 | 1620 |
| | | - | 560 | 2 | 40 | 1213 | 1030 | 1545 | 1620 |
| 20xH1K3 | 13 | 710 | - | 2 | 40 | 1530 | 1300 | 1430 | 2079 |
| | | - | 630 | 2 | 40 | 1354 | 1150 | 1725 | 2079 |
| 20xH1K4 | 13 | 800 | - | 2 | 40 | 1707 | 1450 | 1595 | 2175 |
| | | - | 710 | 2 | 40 | 1413 | 1200 | 1800 | 2400 |
| 20xH1K7[(1)] | 14 | 1000 | - | 2 | 40 | 2084 | 1770 | 1947 | 2655 |
| | | - | 900 | 2 | 40 | 1883 | 1600 | 2400 | 2880 |
| 20xH2K1[(1)] | 14 | 1200 | - | 2 | 40 | 2531 | 2150 | 2365 | 3225 |
| | | - | 1100 | 2 | 40 | 2284 | 1940 | 2910 | 3492 |
| 20xH2K7[(1)] | 14 | 1600 | - | 2 | 40 | 3178 | 2700 | 2970 | 3933 |
| | | - | 1300 | 2 | 40 | 2708 | 2300 | 3287 | 3933 |

(1) Not available with 700S Control.

**Table A.F 650 Volt DC Input Frames 9 - 14 Drive Ratings**

| Drive Catalog Number | Frame | HP Rating | | PWM Freq. | Temp. | DC Input Ratings | Output Amps | | |
|---|---|---|---|---|---|---|---|---|---|
| | | ND | HD | kHz | °C | Amps | Cont. | 1 Min. | 3 Sec. |
| 20xJ261 | 9 | 200 | - | 2 | 40 | 294 | 261 | 287 | 410 |
| | | - | 150 | 2 | 40 | 231 | 205 | 308 | 410 |
| 20xJ300 | 9 | 250 | - | 2 | 40 | 338 | 300 | 330 | 450 |
| | | - | 200 | 2 | 40 | 294 | 245 | 368 | 490 |
| 20xJ385 | 10 | 300 | - | 2 | 40 | 434 | 385 | 424 | 600 |
| | | - | 250 | 2 | 40 | 338 | 300 | 450 | 600 |
| 20xJ460 | 10 | 350 | - | 2 | 40 | 519 | 460 | 506 | 770 |
| | | - | 300 | 2 | 40 | 434 | 385 | 578 | 770 |
| 20xJ500 | 10 | 450 | - | 2 | 40 | 564 | 500 | 550 | 750 |
| | | - | 350 | 2 | 40 | 474 | 420 | 630 | 840 |
| 20xJ590 | 11 | 500 | - | 2 | 40 | 666 | 590 | 649 | 956 |
| | | - | 450 | 2 | 40 | 587 | 520 | 780 | 956 |
| 20xJ650 | 11 | 500 | - | 2 | 40 | 733 | 650 | 715 | 1062 |
| | | - | 500 | 2 | 40 | 666 | 590 | 885 | 1062 |
| 20xJ730 | 11 | 600 | - | 2 | 40 | 824 | 730 | 803 | 1095 |
| | | - | 500 | 2 | 40 | 733 | 650 | 975 | 1170 |
| 20xJ820 | 12 | 700 | - | 2 | 40 | 925 | 820 | 902 | 1230 |
| | | - | 600 | 2 | 40 | 824 | 730 | 1095 | 1314 |
| 20xJ920 | 12 | 800 | - | 2 | 40 | 1038 | 920 | 1012 | 1380 |
| | | - | 700 | 2 | 40 | 925 | 820 | 1230 | 1476 |
| 20xJ1K0 | 12 | 900 | - | 2 | 40 | 1162 | 1030 | 1133 | 1555 |
| | | - | 800 | 2 | 35 | 1038 | 920 | 1370 | 1600 |
| 20xJ1K1 | 13 | 1000 | - | 2 | 40 | 1297 | 1150 | 1265 | 1620 |
| | | - | 900 | 2 | 40 | 1162 | 1030 | 1545 | 1620 |
| 20xJ1K3 | 13 | 1200 | - | 2 | 40 | 1467 | 1300 | 1430 | 2079 |
| | | - | 1000 | 2 | 40 | 1297 | 1150 | 1725 | 2079 |
| 20xJ1K4 | 13 | 1250 | - | 2 | 40 | 1636 | 1450 | 1595 | 2175 |
| | | - | 1000 | 2 | 40 | 1354 | 1200 | 1800 | 2400 |
| 20xJ1K7[1] | 14 | 1500 | - | 2 | 40 | 1997 | 1770 | 1947 | 2655 |
| | | - | 1400 | 2 | 40 | 1805 | 1600 | 2400 | 2880 |
| 20xJ2K1[1] | 14 | 1900 | - | 2 | 40 | 2425 | 2150 | 2365 | 3225 |
| | | - | 1700 | 2 | 40 | 2189 | 1940 | 2910 | 3492 |
| 20xJ2K7[1] | 14 | 2300 | - | 2 | 40 | 3046 | 2700 | 2970 | 3933 |
| | | - | 2000 | 2 | 40 | 2595 | 2300 | 3287 | 3933 |

(1) Not available with 700S Control.

**Table A.G 810 Volt DC Input Frames 9 - 14 Drive Ratings**

| Drive Catalog Number | Frame | HP Rating | | PWM Freq. | Temp. | DC Input Ratings | Output Amps | | |
|---|---|---|---|---|---|---|---|---|---|
| | | ND | HD | kHz | ° C | Amps | Cont. | 1 Min. | 3 Sec. |
| 20xK170 | 9 | 150 | – | 2 | 40 | 192 | 170 | 187 | 245 |
| | | – | 150 | 2 | 40 | 162 | 144 | 216 | 245 |
| 20xK208 | 9 | 200 | – | 2 | 35 | 235 | 208 | 230 | 289 |
| | | – | 150 | 2 | 40 | 192 | 170 | 250 | 289 |
| 20xK261 | 10 | 250 | – | 2 | 40 | 294 | 261 | 287 | 375 |
| | | – | 200 | 2 | 40 | 235 | 208 | 312 | 375 |
| 20xK325 | 10 | 350 | – | 2 | 40 | 367 | 325 | 358 | 470 |
| | | – | 250 | 2 | 40 | 294 | 261 | 392 | 470 |
| 20xK385 | 10 | 400 | – | 2 | 40 | 434 | 385 | 424 | 585 |
| | | – | 350 | 2 | 40 | 367 | 325 | 488 | 585 |
| 20xK416 | 10 | 450 | – | 2 | 35 | 469 | 416 | 458 | 585 |
| | | – | 350 | 2 | 40 | 367 | 325 | 488 | 585 |
| 20xK460 | 11 | 500 | – | 2 | 40 | 519 | 460 | 506 | 693 |
| | | – | 400 | 2 | 40 | 434 | 385 | 578 | 693 |
| 20xK502 | 11 | 500 | – | 2 | 40 | 566 | 502 | 552 | 828 |
| | | – | 500 | 2 | 40 | 519 | 460 | 690 | 828 |
| 20xK590 | 11 | 600 | – | 2 | 35 | 666 | 590 | 649 | 885 |
| | | – | 500 | 2 | 35 | 566 | 502 | 753 | 904 |
| 20xK650 | 12 | 700 | – | 2 | 40 | 733 | 650 | 715 | 1062 |
| | | – | 650 | 2 | 40 | 666 | 590 | 885 | 1062 |
| 20xK750 | 12 | 800 | – | 2 | 40 | 846 | 750 | 825 | 1170 |
| | | – | 700 | 2 | 40 | 733 | 650 | 975 | 1170 |
| 20xK820 (1) | 12 | 900 | – | 2 | 35 | 925 | 820 | 902 | 1170 |
| | | – | 700 | 2 | 35 | 733 | 650 | 975 | 1170 |
| 20xK920 | 13 | 1000 | – | 2 | 40 | 1038 | 920 | 1012 | 1380 |
| | | – | 900 | 2 | 40 | 925 | 820 | 1230 | 1410 |
| 20xK1K0 | 13 | 1100 | – | 2 | 40 | 1162 | 1030 | 1133 | 1545 |
| | | – | 1000 | 2 | 40 | 1038 | 920 | 1380 | 1755 |
| 20xK1K1 | 13 | 1300 | – | 2 | 35 | 1331 | 1180 | 1298 | 1755 |
| | | – | 1100 | 2 | 35 | 1162 | 1030 | 1463 | 1755 |
| 20xK1K5 | 14 | 1600 | – | 2 | 40 | 1692 | 1500 | 1650 | 2250 |
| | | – | 1400 | 2 | 40 | 1467 | 1300 | 1950 | 2340 |
| 20xK1K9(2) | 14 | 2000 | – | 2 | 40 | 2143 | 1900 | 2090 | 2700 |
| | | – | 1600 | 2 | 40 | 1692 | 1500 | 2250 | 2700 |
| 20xK2K2(2) | 14 | 2400 | – | 2 | 30 | 2538 | 2250 | 2475 | 3335 |
| | | – | 2000 | 2 | 30 | 2143 | 1900 | 2782 | 3335 |

(1) 20DK820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.
(2) Not available with 700S Control.

**Table A.H 932 Volt DC Input Frames 9 - 14 Drive Ratings**

| Drive Catalog Number | Frame | kW Rating | | PWM Freq. | Temp. | DC Input Ratings | Output Amps | | |
|---|---|---|---|---|---|---|---|---|---|
| | | ND | HD | kHz | °C | Amps | Cont. | 1 Min. | 3 Sec. |
| 20xM170 | 9 | 160 | – | 2 | 40 | 200 | 170 | 187 | 245 |
| | | – | 132 | 2 | 40 | 170 | 144 | 216 | 245 |
| 20xM208 | 9 | 200 | – | 2 | 35 | 245 | 208 | 230 | 289 |
| | | – | 160 | 2 | 40 | 200 | 170 | 250 | 289 |
| 20xM261 | 10 | 250 | – | 2 | 40 | 307 | 261 | 287 | 375 |
| | | – | 200 | 2 | 40 | 245 | 208 | 312 | 375 |
| 20xM325 | 10 | 315 | – | 2 | 40 | 383 | 325 | 358 | 470 |
| | | – | 250 | 2 | 40 | 307 | 261 | 392 | 470 |
| 20xM385 | 10 | 355 | – | 2 | 40 | 453 | 385 | 424 | 585 |
| | | – | 315 | 2 | 40 | 383 | 325 | 488 | 585 |
| 20xM416 | 10 | 400 | – | 2 | 35 | 490 | 416 | 458 | 585 |
| | | – | 315 | 2 | 40 | 383 | 325 | 488 | 585 |
| 20xM460 | 11 | 450 | – | 2 | 40 | 542 | 460 | 506 | 693 |
| | | – | 355 | 2 | 40 | 453 | 385 | 578 | 693 |
| 20xM502 | 11 | 500 | – | 2 | 40 | 591 | 502 | 552 | 828 |
| | | – | 400 | 2 | 40 | 542 | 460 | 690 | 828 |
| 20xM590 | 11 | 560 | – | 2 | 35 | 695 | 590 | 649 | 885 |
| | | – | 500 | 2 | 35 | 591 | 502 | 753 | 904 |
| 20xM650 | 12 | 630 | – | 2 | 40 | 765 | 650 | 715 | 1062 |
| | | – | 560 | 2 | 40 | 695 | 590 | 885 | 1062 |
| 20xM750 | 12 | 710 | – | 2 | 40 | 883 | 750 | 825 | 1170 |
| | | – | 630 | 2 | 40 | 765 | 650 | 975 | 1170 |
| 20xM820[1] | 12 | 800 | – | 2 | 35 | 965 | 820 | 902 | 1170 |
| | | – | 630 | 2 | 35 | 765 | 650 | 975 | 1170 |
| 20xM920 | 13 | 900 | – | 2 | 40 | 1038 | 920 | 1012 | 1380 |
| | | – | 800 | 2 | 40 | 925 | 820 | 1230 | 1410 |
| 20xM1K0 | 13 | 1000 | – | 2 | 40 | 1162 | 1030 | 1133 | 1545 |
| | | – | 900 | 2 | 40 | 1038 | 920 | 1380 | 1755 |
| 20xM1K1 | 13 | 1100 | – | 2 | 35 | 1331 | 1180 | 1298 | 1755 |
| | | – | 1000 | 2 | 35 | 1162 | 1030 | 1463 | 1755 |
| 20xM1K5 | 14 | 1500 | – | 2 | 40 | 1766 | 1500 | 1650 | 2250 |
| | | – | 1300 | 2 | 40 | 1530 | 1300 | 1950 | 2340 |
| 20xM1K9[2] | 14 | 1800 | – | 2 | 40 | 2237 | 1900 | 2090 | 2700 |
| | | – | 1500 | 2 | 40 | 1766 | 1500 | 2250 | 2700 |
| 20xM2K2[2] | 14 | 2000 | – | 2 | 30 | 2649 | 2250 | 2475 | 3335 |
| | | – | 1800 | 2 | 30 | 2237 | 1900 | 2782 | 3335 |

(1) 20DM820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.
(2) Not available with 700S Control.

## Drive Fuse & Circuit Breaker Ratings

The tables on the following pages provide recommended AC line input fuse and circuit breaker information. Both types of short circuit protection are acceptable for UL and IEC requirements. Sizes listed are the recommended sizes based on 40 degree C and the U.S. N.E.C. Other country, state or local codes may require different ratings. Tables with DC Link fuse recommendations are also provided.

### Fusing

**If fuses are chosen as the desired protection method**, refer to the recommended types listed below. If available amp ratings do not match the tables provided, the closest fuse rating that exceeds the drive rating should be chosen.

- IEC – BS88 (British Standard) Parts 1 & 2[(1)], EN60269-1, Parts 1 & 2, type gG or equivalent should be used.
- UL – UL Class T, J or L should be used.

### Circuit Breakers

The "non-fuse" listings in the following tables include both circuit breakers (inverse time or instantaneous trip) and motor circuit protectors for AC Input drives. **If one of these is chosen as the desired protection method**, the following requirements apply.

- IEC and UL – Both types of devices are acceptable for IEC and UL installations.

(1) Typical designations include, but may not be limited to the following; Ora 1 & 2:AC, AD, BC, BD, CD, DD, ED, EFS, EF, FF, FG, GF, GG, GH

## Table A.I 400 Volt AC Input Frames 9 - 14 Drive Protection Devices

| Drive Catalog Number | Frame | kW Rating | | Input Ratings | Dual Element Time Delay Fuse | | Non-Time Delay Fuse | | Bussmann Style Semi-Conductor Fuse | Circuit Breaker[5] | Motor Circuit Protector[7] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ND | HD | Amps | Min.[2] | Max.[3] | Min.[2] | Max.[3] | | Max.[6] | Max. |
| 20xC261 | 9 | 132 | - | 263 | 350 | 550 | 350 | 700 | 170M5813 | 700 | 400 |
| | | - | 110 | 207 | 275 | 450 | 275 | 600 | 170M5813 | 600 | 300 |
| 20xC300 | 9 | 160 | - | 302 | 400 | 650 | 400 | 900 | 170M5813 | 900 | 400 |
| | | - | 132 | 247 | 350 | 500 | 350 | 700 | 170M5813 | 700 | 400 |
| 20xC385 | 10 | 200 | - | 388 | 500 | 850 | 500 | 1100 | 170M5813 | 1100 | 600 |
| | | - | 160 | 302 | 400 | 650 | 400 | 900 | 170M5813 | 900 | 400 |
| 20xC460 | 10 | 250 | - | 463 | 600 | 1000 | 600 | 1300 | 170M8547 | 1300 | 600 |
| | | - | 200 | 388 | 500 | 850 | 500 | 1100 | 170M8547 | 1100 | 600 |
| 20xC500 | 10 | 250 | - | 504 | 650 | 1100 | 650 | 1500 | 170M8547 | 1500 | 700 |
| | | - | 250 | 423 | 550 | 900 | 550 | 1200 | 170M8547 | 1200 | 600 |
| 20xC590 | 11 | 315 | - | 594 | 750 (1 per phs)<br>375 (2 per phs) | 1300 | 750 (1 per phs)<br>375 (2 per phs) | 1700 | 170M5813 | 1700 | 800 |
| | | - | 250 | 524 | 700 (1 per phs)<br>350 (2 per phs) | 1100 | 700 (1 per phs)<br>350 (2 per phs) | 1500 | 170M5813 | 1500 | 700 |
| 20xC650 | 11 | 355 | - | 655 | 850 (1 per phs)<br>425 (2 per phs) | 1400 | 850 (1 per phs)<br>425 (2 per phs) | 1900 | 170M5813 | 1900 | 1000 |
| | | - | 315 | 594 | 750 (1 per phs)<br>375 (2 per phs) | 1300 | 750 (1 per phs)<br>375 (2 per phs) | 1700 | 170M5813 | 1700 | 800 |
| 20xC730 | 11 | 400 | - | 735 | 1000 (1 per phs)<br>500 (2 per phs) | 1600 | 1000 (1 per phs)<br>500 (2 per phs) | 2100 | 170M5813 | 2100 | 1200 |
| | | - | 355 | 655 | 850 (1 per phs)<br>425 (2 per phs) | 1400 | 850 (1 per phs)<br>425 (2 per phs) | 1900 | 170M5813 | 1900 | 1000 |
| 20xC820 | 12 | 450 | - | 826 | 1100 (1 per phs)<br>550 (2 per phs) | 1800 | 1100 (1 per phs)<br>550 (2 per phs) | 2400 | 170M8547 | 2400 | 1200 |
| | | - | 400 | 735 | 1000 (1 per phs)<br>500 (2 per phs) | 1600 | 1000 (1 per phs)<br>500 (2 per phs) | 2100 | 170M8547 | 2100 | 1200 |
| 20xC920 | 12 | 500 | - | 927 | 1200 (1 per phs)<br>600 (2 per phs) | 2000 | 1200 (1 per phs)<br>600 (2 per phs) | 2700 | 170M8547 | 2700 | 1200 |
| | | - | 450 | 826 | 1100 (1 per phs)<br>550 (2 per phs) | 1800 | 1100 (1 per phs)<br>550 (2 per phs) | 2400 | 170M8547 | 2400 | 1200 |
| 20xC1K0 | 12 | 560 | - | 1038 | 1350 (1 per phs)<br>700 (2 per phs) | 2300 | 1350 (1 per phs)<br>700 (2 per phs) | 3000 | 170M8547 | 3000 | 1400 |
| | | - | 500 | 927 | 1200 (1 per phs)<br>600 (2 per phs) | 2000 | 1200 (1 per phs)<br>600 (2 per phs) | 2700 | 170M8547 | 2700 | 1200 |
| 20xC1K1 | 13 | 630 | - | 1158 | 1350 (1 per phs)<br>700 (2 per phs) | 2300 | 1350 (1 per phs)<br>700 (2 per phs) | 3000 | 170M6466[4] | 3000 | 1400 |
| | | - | 560 | 1038 | 1500 (1 per phs)<br>750 (2 per phs) | 2500 | 1500 (1 per phs)<br>750 (2 per phs) | 3400 | 170M6466[4] | 3400 | 1500 |
| 20xC1K3 | 13 | 710 | - | 1310 | 1700 (1 per phs)<br>850 (2 per phs) | 2900 | 1700 (1 per phs)<br>850 (2 per phs) | 3900 | 170M6466[4] | 3900 | 1700 |
| | | - | 630 | 1158 | 1500 (1 per phs)<br>750 (2 per phs) | 2500 | 1500 (1 per phs)<br>750 (2 per phs) | 3400 | 170M6466[4] | 3400 | 1500 |
| 20xC1K4 | 13 | 800 | - | 1461 | 1900 (1 per phs)<br>950 (2 per phs) | 3000 | 1900 (1 per phs)<br>950 (2 per phs) | 4300 | 170M6466[4] | 4300 | 1900 |
| | | - | 710 | 1209 | 1600 (1 per phs)<br>800 (2 per phs) | 2700 | 1600 (1 per phs)<br>800 (2 per phs) | 3600 | 170M6466[4] | 3600 | 1600 |
| 20xC1K7[1] | 14 | 1000 | - | 1783 | 2500 (1 per phs)<br>825 (3 per phs) | 3900 | 2500 (1 per phs)<br>825 (3 per phs) | 5300 | 170M6466 | 5300 | 2500 |
| | | - | 900 | 1612 | 2100 (1 per phs)<br>700 (3 per phs) | 3500 | 2100 (1 per phs)<br>700 (3 per phs) | 4800 | 170M6466 | 4800 | 2100 |
| 20xC2K1[1] | 14 | 1200 | - | 2166 | 3000 (1 per phs)<br>1000 (3 per phs) | 4800 | 3000 (1 per phs)<br>1000 (3 per phs) | 6400 | 170M6466 | 6400 | 3000 |
| | | - | 1100 | 1954 | 2500 (1 per phs)<br>825 (3 per phs) | 4300 | 2500 (1 per phs)<br>825 (3 per phs) | 5800 | 170M6466 | 5800 | 2500 |
| 20xC2K7[1] | 14 | 1600 | - | 2720 | 3500 (1 per phs)<br>1200 (3 per phs) | 6000 | 3500 (1 per phs)<br>1200 (3 per phs) | 8000 | 170M6466 | 8000 | 3500 |
| | | - | 1300 | 2317 | 3000 (1 per phs)<br>1000 (3 per phs) | 5000 | 3000 (1 per phs)<br>1000 (3 per phs) | 6900 | 170M6466 | 6900 | 3000 |

(1) Not available with 700S Control.

(2) Minimum protection device size is the lowest rated device that supplies maximum protection without nuisance tripping.

(3) Maximum protection device size is the highest rated device that supplies drive protection.

(4) These fuses and disconnect are supplied with AC input NEMA/UL Type 1 drives.

(5) Inverse time breaker. Ratings shown are maximum.

(6) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.

(7) Motor Circuit Protector - instantaneous trip circuit breaker. For US NEC minimum size is 125% of motor/drive FLA. Ratings shown are suggested. Instantaneous trip settings must be set to US NEC code. Not to exceed 1300% FLA.

**Table A.J 480 Volt AC Input Frames 9 - 14 Drive Protection Devices**

| Drive Catalog Number | Frame | HP Rating | | Input Ratings | Dual Element Time Delay Fuse | | Non-Time Delay Fuse | | Bussmann Style Semi-Conductor Fuse | Circuit Breaker(5) | Motor Circuit Protector(7) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ND | HD | Amps | Min.(2) | Max.(3) | Min.(2) | Max.(3) | | Max.(6) | Max. |
| 20xD261 | 9 | 200 | - | 252 | 350 | 550 | 350 | 700 | 170M5813 | 700 | 400 |
| | | - | 150 | 207 | 275 | 450 | 275 | 600 | 170M5813 | 600 | 300 |
| 20xD300 | 9 | 250 | - | 290 | 400 | 650 | 400 | 900 | 170M5813 | 900 | 400 |
| | | - | 200 | 247 | 350 | 550 | 350 | 700 | 170M5813 | 700 | 400 |
| 20xD385 | 10 | 300 | - | 372 | 500 | 850 | 500 | 1100 | 170M5813 | 1100 | 600 |
| | | - | 250 | 302 | 400 | 650 | 400 | 900 | 170M5813 | 900 | 400 |
| 20xD460 | 10 | 350 | - | 444 | 600 | 1000 | 600 | 1300 | 170M8547 | 1300 | 600 |
| | | - | 300 | 388 | 500 | 850 | 500 | 1100 | 170M8547 | 1100 | 600 |
| 20xD500 | 10 | 450 | - | 483 | 650 | 1000 | 650 | 1500 | 170M8547 | 1500 | 700 |
| | | - | 350 | 423 | 550 | 900 | 550 | 1200 | 170M8547 | 1200 | 600 |
| 20xD590 | 11 | 500 | - | 570 | 750 (1 per phs)<br>375 (2 per phs) | 1300 | 750 (1 per phs)<br>375 (2 per phs) | 1700 | 170M5813 | 1700 | 800 |
| | | - | 450 | 524 | 700 (1 per phs)<br>350 (2 per phs) | 1100 | 700 (1 per phs)<br>350 (2 per phs) | 1500 | 170M5813 | 1500 | 700 |
| 20xD650 | 11 | 500 | - | 628 | 800 (1 per phs)<br>400 (2 per phs) | 1400 | 800 (1 per phs)<br>400 (2 per phs) | 1900 | 170M5813 | 1900 | 800 |
| | | - | 500 | 594 | 750 (1 per phs)<br>375 (2 per phs) | 1300 | 750 (1 per phs)<br>375 (2 per phs) | 1700 | 170M5813 | 1700 | 800 |
| 20xD730 | 11 | 600 | - | 705 | 900 (1 per phs)<br>450 (2 per phs) | 1600 | 900 (1 per phs)<br>450 (2 per phs) | 2100 | 170M5813 | 2100 | 900 |
| | | - | 500 | 655 | 850 (1 per phs)<br>425 (2 per phs) | 1400 | 850 (1 per phs)<br>425 (2 per phs) | 1900 | 170M5813 | 1900 | 900 |
| 20xD820 | 12 | 700 | - | 792 | 1000 (1 per phs)<br>500 (2 per phs) | 1800 | 1000 (1 per phs)<br>500 (2 per phs) | 2400 | 170M8547 | 2400 | 1000 |
| | | - | 600 | 735 | 900 (1 per phs)<br>475 (2 per phs) | 1600 | 900 (1 per phs)<br>475 (2 per phs) | 2100 | 170M8547 | 2100 | 1000 |
| 20xD920 | 12 | 800 | - | 888 | 1200 (1 per phs)<br>600 (2 per phs) | 2000 | 1200 (1 per phs)<br>600 (2 per phs) | 2700 | 170M8547 | 2700 | 1200 |
| | | - | 700 | 826 | 1100 (1 per phs)<br>550 (2 per phs) | 1800 | 1100 (1 per phs)<br>550 (2 per phs) | 2400 | 170M8547 | 2400 | 1200 |
| 20xD1K0 | 12 | 900 | - | 994 | 1300 (1 per phs)<br>650 (2 per phs) | 2300 | 1300 (1 per phs)<br>650 (2 per phs) | 3000 | 170M8547 | 3000 | 1300 |
| | | - | 800 | 927 | 1200 (1 per phs)<br>600 (2 per phs) | 2000 | 1200 (1 per phs)<br>600 (2 per phs) | 2700 | 170M8547 | 2700 | 1200 |
| 20xD1K1 | 13 | 1000 | - | 1110 | 1400 (1 per phs)<br>700 (2 per phs) | 2500 | 1400 (1 per phs)<br>700 (2 per phs) | 3400 | 170M6466 (4) | 3400 | 1400 |
| | | - | 900 | 994 | 1300 (1 per phs)<br>650 (2 per phs) | 2300 | 1300 (1 per phs)<br>650 (2 per phs) | 3000 | 170M6466 (4) | 3000 | 1300 |
| 20xD1K3 | 13 | 1200 | - | 1255 | 1600 (1 per phs)<br>800 (2 per phs) | 2900 | 1600 (1 per phs)<br>800 (2 per phs) | 3900 | 170M6466 (4) | 3900 | 1600 |
| | | - | 1000 | 1110 | 1400 (1 per phs)<br>700 (2 per phs) | 2500 | 1400 (1 per phs)<br>700 (2 per phs) | 3400 | 170M6466 (4) | 3400 | 1400 |
| 20xD1K4 | 13 | 1250 | - | 1400 | 1800 (1 per phs)<br>900 (2 per phs) | 3200 | 1800 (1 per phs)<br>900 (2 per phs) | 4300 | 170M6466 (4) | 4300 | 1800 |
| | | - | 1000 | 1158 | 1500 (1 per phs)<br>750 (2 per phs) | 2700 | 1500 (1 per phs)<br>750 (2 per phs) | 3600 | 170M6466 (4) | 3600 | 1500 |
| 20xD1K7(1) | 14 | 1500 | - | 1709 | 2200 (1 per phs)<br>750 (3 per phs) | 3800 | 2200 (1 per phs)<br>750 (3 per phs) | 5300 | 170M6466 | 5300 | 2200 |
| | | - | 1400 | 1545 | 2000 (1 per phs)<br>675 (3 per phs) | 3600 | 2000 (1 per phs)<br>675 (3 per phs) | 4800 | 170M6466 | 4800 | 2000 |

| Drive Catalog Number | Frame | HP Rating | | Input Ratings | Dual Element Time Delay Fuse | | Non-Time Delay Fuse | | Bussmann Style Semi-Conductor Fuse | Circuit Breaker[5] | Motor Circuit Protector[7] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ND | HD | Amps | Min.[2] | Max.[3] | Min.[2] | Max.[3] | | Max.[6] | Max. |
| 20xD2K1[1] | 14 | 1900 | - | 2076 | 2600 (1 per phs)<br>900 (3 per phs) | 4800 | 2600 (1 per phs)<br>900 (3 per phs) | 6400 | 170M6466 | 6400 | 2600 |
| | | - | 1700 | 1873 | 2400 (1 per phs)<br>800 (3 per phs) | 4300 | 2400 (1 per phs)<br>800 (3 per phs) | 5800 | 170M6466 | 5800 | 2400 |
| 20xD2K7[1] | 14 | 2300 | - | 2607 | 3000 (1 per phs)<br>1100 (3 per phs) | 6000 | 3000 (1 per phs)<br>1100 (3 per phs) | 8000 | 170M6466 | 8000 | 3300 |
| | | - | 2000 | 2220 | 2800 (1 per phs)<br>900 (3 per phs) | 5000 | 2800 (1 per phs)<br>900 (3 per phs) | 6900 | 170M6466 | 6900 | 2800 |

(1) Not available with 700S Control.

(2) Minimum protection device size is the lowest rated device that supplies maximum protection without nuisance tripping.

(3) Maximum protection device size is the highest rated device that supplies drive protection.

(4) These fuses and disconnect are supplied with AC input NEMA/UL Type 1 drives.

(5) Inverse time breaker. Ratings shown are maximum.

(6) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.

(7) Motor Circuit Protector - instantaneous trip circuit breaker. For US NEC minimum size is 125% of motor/drive FLA. Ratings shown are suggested. Instantaneous trip settings must be set to US NEC code. Not to exceed 1300% FLA.

### Table A.K 600 Volt AC Input Frames 9 - 14 Drive Protection Devices

| Drive Catalog Number | Frame | HP Rating | | Input Ratings | Dual Element Time Delay Fuse | | Non-Time Delay Fuse | | Bussmann Style Semi-Conductor Fuse | Circuit Breaker[6] | Motor Circuit Protector[8] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ND | HD | Amps | Min.[3] | Max.[4] | Min.[3] | Max.[4] | | Max[7] | Max. |
| 20xE170 | 9 | 150 | – | 164 | 225 | 375 | 225 | 500 | 170M3819 | 500 | 250 |
| | | – | 150 | 139 | 175 | 300 | 175 | 500 | 170M3819 | 500 | 200 |
| 20xE208 | 9 | 200 | – | 201 | 275 | 450 | 275 | 600 | 170M3819 | 600 | 300 |
| | | – | 150 | 164 | 225 | 375 | 225 | 500 | 170M3819 | 500 | 250 |
| 20xE261 | 10 | 250 | – | 252 | 325 | 575 | 325 | 775 | 170M5813 | 700 | 350 |
| | | – | 200 | 201 | 275 | 450 | 275 | 600 | 170M5813 | 600 | 300 |
| 20xE325 | 10 | 350 | – | 314 | 400 | 725 | 400 | 950 | 170M5813 | 900 | 450 |
| | | – | 250 | 252 | 325 | 575 | 325 | 775 | 170M5813 | 750 | 400 |
| 20xE385 | 10 | 400 | – | 372 | 475 | 850 | 475 | 1100 | 170M5813 | 1100 | 500 |
| | | – | 350 | 314 | 400 | 725 | 400 | 950 | 170M5813 | 900 | 450 |
| 20xE416 | 10 | 450 | – | 402 | 525 | 900 | 525 | 1200 | 170M5813 | 1200 | 550 |
| | | – | 350 | 314 | 400 | 725 | 400 | 950 | 170M5813 | 900 | 450 |
| 20xE460 | 11 | 500 | – | 444 | 575 (1 per phs)<br>300 (2 per phs) | 1000 | 575 (1 per phs)<br>300 (2 per phs) | 1300 | 170M8547 | 1300 | 600 |
| | | – | 400 | 372 | 475 (1 per phs)<br>250 (2 per phs) | 850 | 475 (1 per phs)<br>250 (2 per phs) | 1100 | 170M8547 | 1100 | 500 |
| 20xE502 | 11 | 500 | – | 485 | 625 (1 per phs)<br>325 (2 per phs) | 1100 | 625 (1 per phs)<br>325 (2 per phs) | 1500 | 170M8547 | 1500 | 650 |
| | | – | 500 | 444 | 575 (1 per phs)<br>300 (2 per phs) | 1000 | 575 (1 per phs)<br>300 (2 per phs) | 1300 | 170M8547 | 1300 | 600 |
| 20xE590 | 11 | 600 | – | 570 | 725 (1 per phs)<br>375(2 per phs) | 1300 | 725 (1 per phs)<br>375(2 per phs) | 1700 | 170M5813 | 1700 | 800 |
| | | – | 500 | 485 | 625 (1 per phs)<br>325 (2 per phs) | 1100 | 625 (1 per phs)<br>325 (2 per phs) | 1500 | 170M5813 | 1500 | 700 |
| 20xE650 | 12 | 700 | – | 628 | 800 (1 per phs)<br>400 (2 per phs) | 1400 | 800 (1 per phs)<br>400 (2 per phs) | 1900 | 170M5813 | 1900 | 900 |
| | | – | 650 | 570 | 725 (1 per phs)<br>375 (2 per phs) | 1300 | 725 (1 per phs)<br>375 (2 per phs) | 1700 | 170M5813 | 1700 | 800 |
| 20xE750 | 12 | 800 | – | 724 | 950 (1 per phs)<br>475 (2 per phs) | 1600 | 950 (1 per phs)<br>475 (2 per phs) | 2200 | 170M5813 | 2200 | 1000 |
| | | – | 700 | 628 | 800 (1 per phs)<br>400 (2 per phs) | 1400 | 800 (1 per phs)<br>400 (2 per phs) | 1900 | 170M5813 | 1900 | 900 |
| 20xE820[1] | 12 | 900 | – | 792 | 1000 (1 per phs)<br>500 (2 per phs) | 1800 | 1000 (1 per phs)<br>500 (2 per phs) | 2400 | 170M5813 | 2400 | 1100 |
| | | – | 700 | 628 | 800 (1 per phs)<br>400 (2 per phs) | 1400 | 800 (1 per phs)<br>400 (2 per phs) | 1900 | 170M5813 | 1900 | 900 |
| 20xE920 | 13 | 1000 | – | 888 | 1200 (1 per phs)<br>600 (2 per phs) | 2000 | 1200 (1 per phs)<br>600 (2 per phs) | 2700 | 170M6466 [5] | 2700 | 1200 |
| | | – | 900 | 792 | 1000 (1 per phs)<br>500 (2 per phs) | 1800 | 1000 (1 per phs)<br>500 (2 per phs) | 2400 | 170M6466 [5] | 2400 | 1100 |

| Drive Catalog Number | Frame | HP Rating | | Input Ratings | Dual Element Time Delay Fuse | | Non-Time Delay Fuse | | Bussmann Style Semi-Conductor Fuse | Circuit Breaker[6] | Motor Circuit Protector[8] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ND | HD | Amps | Min.[3] | Max.[4] | Min.[3] | Max.[4] | | Max [7] | Max. |
| 20xE1K0 | 13 | 1100 | – | 994 | 1300 (1 per phs)<br>650 (2 per phs) | 2300 | 1300 (1 per phs)<br>650 (2 per phs) | 3000 | 170M6466 [5] | 3000 | 1300 |
| | | – | 1000 | 888 | 1200 (1 per phs)<br>600 (2 per phs) | 2000 | 1200 (1 per phs)<br>600 (2 per phs) | 2700 | 170M6466 [5] | 2700 | 1200 |
| 20xE1K1 | 13 | 1300 | – | 1139 | 1500 (1 per phs)<br>750 (2 per phs) | 2600 | 1500 (1 per phs)<br>750 (2 per phs) | 3500 | 170M6466 [5] | 3500 | 1500 |
| | | – | 1100 | 994 | 1300 (1 per phs)<br>650 (2 per phs) | 2200 | 1300 (1 per phs)<br>650 (2 per phs) | 3000 | 170M6466 [5] | 3000 | 1300 |
| 20xE1K5 | 14 | 1000 | – | 1448 | 1900 (1 per phs)<br>650 (3 per phs) | 3300 | 1900 (1 per phs)<br>650 (3 per phs) | 4500 | 170M6466 | 4500 | 1900 |
| | | – | 900 | 1255 | 1600 (1 per phs)<br>550 (3 per phs) | 2900 | 1600 (1 per phs)<br>550 (3 per phs) | 3900 | 170M6466 | 3900 | 1700 |
| 20xE1K9[2] | 14 | 1100 | – | 1834 | 2300 (1 per phs)<br>800 (3 per phs) | 4200 | 2300 (1 per phs)<br>800 (3 per phs) | 5700 | 170M6466 | 5700 | 2400 |
| | | – | 1000 | 1448 | 1900 (1 per phs)<br>650 (3 per phs) | 3200 | 1900 (1 per phs)<br>650 (3 per phs) | 4500 | 170M6466 | 4500 | 1900 |
| 20xE2K2[2] | 14 | 1200 | – | 2172 | 2800 (1 per phs)<br>950 (3 per phs) | 5000 | 2800 (1 per phs)<br>950 (3 per phs) | 6700 | 170M6466 | 6700 | 2900 |
| | | – | 1100 | 1834 | 2300 (1 per phs)<br>800 (3 per phs) | 4200 | 2300 (1 per phs)<br>800 (3 per phs) | 5700 | 170M6466 | 5700 | 2400 |

(1) 20DE820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.
(2) Not available with 700S Control.
(3) Minimum protection device size is the lowest rated device that supplies maximum protection without nuisance tripping.
(4) Maximum protection device size is the highest rated device that supplies drive protection.
(5) These fuses and disconnect are supplied with AC input NEMA/UL Type 1 drives.
(6) Inverse time breaker. Ratings shown are maximum.
(7) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.
(8) Motor Circuit Protector - instantaneous trip circuit breaker. For US NEC minimum size is 125% of motor/drive FLA. Ratings shown are suggested. Instantaneous trip settings must be set to US NEC code. Not to exceed 1300% FLA.

### Table A.L 690 Volt AC Input Frames 9 - 14 Drive Protection Devices

| Drive Catalog Number | Frame | kW Rating | | Input Ratings | Dual Element Time Delay Fuse | | Non-Time Delay Fuse | | Bussmann Style Semi-Conductor Fuse | Circuit Breaker[6] | Motor Circuit Protector[8] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ND | HD | Amps | Min.[3] | Max. [4] | Min.[3] | Max.[4] | | Max.[7] | Max. |
| 20xF170 | 9 | 160 | – | 171 | 225 | 375 | 225 | 500 | 170M3819 | 500 | 250 |
| | | – | 132 | 145 | 200 | 300 | 200 | 500 | 170M3819 | 400 | 200 |
| 20xF208 | 9 | 200 | – | 210 | 275 | 450 | 275 | 600 | 170M3819 | 600 | 300 |
| | | – | 160 | 171 | 225 | 375 | 225 | 500 | 170M3819 | 500 | 250 |
| 20xF261 | 10 | 250 | – | 263 | 350 | 575 | 350 | 775 | 170M5813 | 750 | 350 |
| | | – | 200 | 210 | 275 | 450 | 275 | 600 | 170M5813 | 600 | 300 |
| 20xF325 | 10 | 315 | – | 327 | 425 | 725 | 425 | 950 | 170M5813 | 900 | 450 |
| | | – | 250 | 263 | 350 | 575 | 350 | 775 | 170M5813 | 750 | 400 |
| 20xF385 | 10 | 355 | – | 388 | 500 | 850 | 500 | 1100 | 170M5813 | 1100 | 500 |
| | | – | 315 | 327 | 425 | 725 | 425 | 950 | 170M5813 | 900 | 450 |
| 20xF416 | 10 | 400 | – | 419 | 525 | 900 | 525 | 1200 | 170M5813 | 1200 | 550 |
| | | – | 315 | 327 | 425 | 700 | 425 | 950 | 170M5813 | 900 | 450 |
| 20xF460 | 11 | 500 | – | 463 | 600 (1 per phs)<br>300 (2 per phs) | 1000 | 600 (1 per phs)<br>300 (2 per phs) | 1300 | 170M8547 | 1300 | 600 |
| | | – | 400 | 388 | 500 (1 per phs)<br>250 (2 per phs) | 850 | 500 (1 per phs)<br>250 (2 per phs) | 1100 | 170M8547 | 1100 | 500 |
| 20xF502 | 11 | 560 | – | 506 | 650 (1 per phs)<br>325 (2 per phs) | 1100 | 650 (1 per phs)<br>325 (2 per phs) | 1500 | 170M8547 | 1500 | 650 |
| | | – | 500 | 463 | 600 (1 per phs)<br>300 (2 per phs) | 1000 | 600 (1 per phs)<br>300 (2 per phs) | 1300 | 170M8547 | 1300 | 600 |
| 20xF590 | 11 | 580 | – | 594 | 750 (1 per phs)<br>375 (2 per phs) | 1300 | 750 (1 per phs)<br>375 (2 per phs) | 1700 | 170M5813 | 1700 | 800 |
| | | – | 500 | 506 | 650 (1 per phs)<br>325 (2 per phs) | 1100 | 650 (1 per phs)<br>325 (2 per phs) | 1500 | 170M5813 | 1500 | 700 |

| Drive Catalog Number | Frame | kW Rating | | Input Ratings | Dual Element Time Delay Fuse | | Non-Time Delay Fuse | | Bussmann Style Semi-Conductor Fuse | Circuit Breaker[6] | Motor Circuit Protector[8] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ND | HD | Amps | Min.[3] | Max.[4] | Min.[3] | Max.[4] | | Max.[7] | Max. |
| 20xF650 | 12 | 630 | – | 655 | 850 (1 per phs)<br>425 (2 per phs) | 1400 | 850 (1 per phs)<br>425 (2 per phs) | 1900 | 170M5813 | 1900 | 900 |
| | | – | 560 | 594 | 750 (1 per phs)<br>375 (2 per phs) | 1300 | 750 (1 per phs)<br>375 (2 per phs) | 1700 | 170M5813 | 1700 | 800 |
| 20xF750 | 12 | 710 | – | 756 | 950 (1 per phs)<br>475 (2 per phs) | 1600 | 950 (1 per phs)<br>475 (2 per phs) | 2200 | 170M5813 | 2200 | 1000 |
| | | – | 630 | 655 | 850 (1 per phs)<br>425 (2 per phs) | 1400 | 850 (1 per phs)<br>425 (2 per phs) | 1900 | 170M5813 | 1900 | 900 |
| 20xF820[1] | 12 | 800 | – | 826 | 1100 (1 per phs)<br>550 (2 per phs) | 1800 | 1100 (1 per phs)<br>550 (2 per phs) | 2400 | 170M5813 | 2400 | 1100 |
| | | – | 630 | 655 | 850 (1 per phs)<br>425 (2 per phs) | 1400 | 850 (1 per phs)<br>425 (2 per phs) | 1900 | 170M5813 | 1900 | 900 |
| 20xF920 | 13 | 900 | – | 927 | 1200 (1 per phs)<br>600 (2 per phs) | 2000 | 1200 (1 per phs)<br>600 (2 per phs) | 2700 | 170M6466 [5] | 2700 | 1200 |
| | | – | 800 | 826 | 1100 (1 per phs)<br>550 (2 per phs) | 1800 | 1100 (1 per phs)<br>550 (2 per phs) | 2400 | 170M6466 [5] | 2400 | 1100 |
| 20xF1K0 | 13 | 1000 | – | 1038 | 1300 (1 per phs)<br>650 (2 per phs) | 2300 | 1300 (1 per phs)<br>650 (2 per phs) | 3000 | 170M6466 [5] | 3000 | 1300 |
| | | – | 900 | 927 | 1200 (1 per phs)<br>600 (2 per phs) | 2000 | 1200 (1 per phs)<br>600 (2 per phs) | 2700 | 170M6466 [5] | 2700 | 1200 |
| 20xF1K1 | 13 | 1100 | – | 1189 | 1500 (1 per phs)<br>750 (2 per phs) | 2600 | 1500 (1 per phs)<br>750 (2 per phs) | 3500 | 170M6466 [5] | 3500 | 1500 |
| | | – | 1000 | 1038 | 1300 (1 per phs)<br>650 (2 per phs) | 2300 | 1300 (1 per phs)<br>650 (2 per phs) | 3000 | 170M6466 [5] | 3000 | 1300 |
| 20xF1K5 | 14 | 1500 | – | 1511 | 1900 (1 per phs)<br>650 (3 per phs) | 3300 | 1900 (1 per phs)<br>650 (3 per phs) | 4500 | 170M6466 | 4500 | 1900 |
| | | – | 1300 | 1310 | 1700 (1 per phs)<br>575 (3 per phs) | 2900 | 1700 (1 per phs)<br>575 (3 per phs) | 3900 | 170M6466 | 3900 | 1700 |
| 20xF1K9[2] | 14 | 1800 | – | 1914 | 2400 (1 per phs)<br>800 (3 per phs) | 4200 | 2400 (1 per phs)<br>800 (3 per phs) | 5700 | 170M6466 | 5700 | 2400 |
| | | – | 1500 | 1511 | 1900 (1 per phs)<br>650 (3 per phs) | 3200 | 1900 (1 per phs)<br>650 (3 per phs) | 4500 | 170M6466 | 4500 | 1900 |
| 20xF2K2[2] | 14 | 2000 | – | 2267 | 2900 (1 per phs)<br>950 (3 per phs) | 5000 | 2900 (1 per phs)<br>950 (3 per phs) | 6700 | 170M6466 | 6700 | 2900 |
| | | – | 1800 | 1914 | 2400 (1 per phs)<br>800 (3 per phs) | 4200 | 2400 (1 per phs)<br>800 (3 per phs) | 5700 | 170M6466 | 5700 | 2400 |

(1) 20DF820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.

(2) Not available with 700S Control.

(3) Minimum protection device size is the lowest rated device that supplies maximum protection without nuisance tripping.

(4) Maximum protection device size is the highest rated device that supplies drive protection.

(5) These fuses and disconnect are supplied with AC input NEMA/UL Type 1 drives.

(6) Inverse time breaker. Ratings shown are maximum.

(7) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.

(8) Motor Circuit Protector - instantaneous trip circuit breaker. For US NEC minimum size is 125% of motor/drive FLA. Ratings shown are suggested. Instantaneous trip settings must be set to US NEC code. Not to exceed 1300% FLA.

**Table A.M 540 Volt DC Input Frames 9 - 14 Drive Protection Devices**

| Drive Catalog Number | Frame | kW Rating | | DC Input Ratings | Fuse | Bussmann Style Fuse |
|---|---|---|---|---|---|---|
| | | ND | HD | Amps | | |
| 20xH261 | 9 | 132 | - | 307 | 500 | 170M6608 |
| | | - | 110 | 241 | 500 | 170M6608 |
| 20xH300 | 9 | 160 | - | 353 | 630 | 170M6610 |
| | | - | 132 | 288 | 630 | 170M6610 |
| 20xH385 | 10 | 200 | - | 453 | 700 | 170M6611 |
| | | - | 160 | 353 | 700 | 170M6611 |
| 20xH460 | 10 | 250 | - | 541 | 900 | 170M6613 |
| | | - | 200 | 453 | 900 | 170M6613 |
| 20xH500 | 10 | 250 | - | 589 | 500 (2 per phs) | 170M6608 |
| | | - | 250 | 494 | 500 (2 per phs) | 170M6608 |
| 20xH590 | 11 | 315 | - | 695 | 550 (2 per phs) | 170M6609 |
| | | - | 250 | 612 | 550 (2 per phs) | 170M6609 |
| 20xH650 | 11 | 355 | - | 765 | 630 (2 per phs) | 170M6610 |
| | | - | 315 | 695 | 630 (2 per phs) | 170M6610 |
| 20xH730 | 11 | 400 | - | 859 | 700 (2 per phs) | 170M6611 |
| | | - | 355 | 765 | 700 (2 per phs) | 170M6611 |
| 20xH820 | 12 | 450 | - | 965 | 700 (2 per phs) | 170M6611 |
| | | - | 400 | 859 | 700 (2 per phs) | 170M6611 |
| 20xH920 | 12 | 500 | - | 1083 | 550 (3 per phs) | 170M6609 |
| | | - | 450 | 965 | 550 (3 per phs) | 170M6609 |
| 20xH1K0 | 12 | 560 | - | 1213 | 630 (3 per phs) | 170M6610 |
| | | - | 500 | 1083 | 630 (3 per phs) | 170M6610 |
| 20xH1K1 | 13 | 630 | - | 1354 | 2400 | 170M7107 |
| | | - | 560 | 1213 | 2400 | 170M7107 |
| 20xH1K3 | 13 | 710 | - | 1530 | 2400 | 170M7107 |
| | | - | 630 | 1354 | 2400 | 170M7107 |
| 20xH1K4 | 13 | 800 | - | 1707 | 2400 | 170M7107 |
| | | - | 710 | 1413 | 2400 | 170M7107 |
| 20xH1K7(1) | 14 | 1000 | - | 2084 | – | 170M8610 |
| | | - | 900 | 1883 | – | 170M8610 |
| 20xH2K1(1) | 14 | 1200 | - | 2531 | – | 170M8610 |
| | | - | 1100 | 2284 | – | 170M8610 |
| 20xH2K7(1) | 14 | 1600 | - | 3178 | – | 170M8610 |
| | | - | 1300 | 2708 | – | 170M8610 |

(1) Not available with 700S Control.

**Table A.N 650 Volt DC Input Frames 9 - 14 Drive Protection Devices**

| Drive Catalog Number | Frame | HP Rating | | DC Input Ratings | Fuse | Bussmann Style Fuse |
|---|---|---|---|---|---|---|
| | | ND | HD | Amps | | |
| 20xJ261 | 9 | 200 | - | 294 | 500 | 170M6608 |
| | | - | 150 | 231 | 500 | 170M6608 |
| 20xJ300 | 9 | 250 | - | 338 | 630 | 170M6610 |
| | | - | 200 | 294 | 630 | 170M6610 |
| 20xJ385 | 10 | 300 | - | 434 | 700 | 170M6611 |
| | | - | 250 | 338 | 700 | 170M6611 |
| 20xJ460 | 10 | 350 | - | 519 | 900 | 170M6613 |
| | | - | 300 | 434 | 900 | 170M6613 |
| 20xJ500 | 10 | 450 | - | 564 | 500 (2 per phs) | 170M6608 |
| | | - | 350 | 474 | 500 (2 per phs) | 170M6608 |
| 20xJ590 | 11 | 500 | - | 666 | 550 (2 per phs) | 170M6609 |
| | | - | 450 | 587 | 550 (2 per phs) | 170M6609 |
| 20xJ650 | 11 | 500 | - | 733 | 630 (2 per phs) | 170M6610 |
| | | - | 500 | 666 | 630 (2 per phs) | 170M6610 |
| 20xJ730 | 11 | 600 | - | 824 | 700 (2 per phs) | 170M6611 |
| | | - | 500 | 733 | 700 (2 per phs) | 170M6611 |
| 20xJ820 | 12 | 700 | - | 925 | 700 (2 per phs) | 170M6611 |
| | | - | 600 | 824 | 700 (2 per phs) | 170M6611 |

| Drive Catalog Number | Frame | HP Rating | | DC Input Ratings | Fuse | Bussmann Style Fuse |
|---|---|---|---|---|---|---|
| | | ND | HD | Amps | | |
| 20xJ920 | 12 | 800 | - | 1038 | 550 (3 per phs) | 170M6609 |
| | | - | 700 | 925 | 550 (3 per phs) | 170M6609 |
| 20xJ1K0 | 12 | 900 | - | 1162 | 630 (3 per phs) | 170M6610 |
| | | - | 800 | 1038 | 630 (3 per phs) | 170M6610 |
| 20xJ1K1 | 13 | 1000 | - | 1297 | 2400 | 170M7107 |
| | | - | 900 | 1162 | 2400 | 170M7107 |
| 20xJ1K3 | 13 | 1200 | - | 1467 | 2400 | 170M7107 |
| | | - | 1000 | 1297 | 2400 | 170M7107 |
| 20xJ1K4 | 13 | 1250 | - | 1636 | 2400 | 170M7107 |
| | | - | 1000 | 1354 | 2400 | 170M7107 |
| 20xJ1K7(1) | 14 | 1500 | - | 1997 | – | 170M8610 |
| | | - | 1400 | 1805 | – | 170M8610 |
| 20xJ2K1(1) | 14 | 1900 | - | 2425 | – | 170M8610 |
| | | - | 1700 | 2189 | – | 170M8610 |
| 20xJ2K7(1) | 14 | 2300 | - | 3046 | – | 170M8610 |
| | | - | 2000 | 2595 | – | 170M8610 |

(1) Not available with 700S Control.

### Table A.O 810 Volt DC Input Frames 9 - 14 Drive Protection Devices

| Drive Catalog Number | Frame | HP Rating | | DC Input Ratings | Fuse | Bussmann Style Fuse |
|---|---|---|---|---|---|---|
| | | ND | HD | Amps | | |
| 20xK170 | 9 | 150 | – | 192 | 400 | 170M5608 |
| | | – | 150 | 162 | 400 | 170M5608 |
| 20xK208 | 9 | 200 | – | 235 | 450 | 170M5609 |
| | | – | 150 | 192 | 450 | 170M5609 |
| 20xK261 | 10 | 250 | – | 294 | 450 | 170M5609 |
| | | – | 200 | 235 | 450 | 170M5609 |
| 20xK325 | 10 | 350 | – | 367 | 550 | 170M6609 |
| | | – | 250 | 294 | 550 | 170M6609 |
| 20xK385 | 10 | 400 | – | 434 | 700 | 170M6611 |
| | | – | 350 | 367 | 700 | 170M6611 |
| 20xK416 | 10 | 450 | – | 469 | 800 | 170M6612 |
| | | – | 350 | 367 | 800 | 170M6612 |
| 20xK460 | 11 | 500 | – | 519 | 450 (2 per phs) | 170M5609 |
| | | – | 400 | 434 | 450 (2 per phs) | 170M5609 |
| 20xK502 | 11 | 500 | – | 566 | 500 (2 per phs) | 170M6608 |
| | | – | 500 | 519 | 500 (2 per phs) | 170M6608 |
| 20xK590 | 11 | 600 | – | 666 | 500 (2 per phs) | 170M6608 |
| | | – | 500 | 566 | 500 (2 per phs) | 170M6608 |
| 20xK650 | 12 | 700 | – | 733 | 500 (2 per phs) | 170M6608 |
| | | – | 650 | 666 | 500 (2 per phs) | 170M6608 |
| 20xK750 | 12 | 800 | – | 846 | 630 (2 per phs) | 170M6610 |
| | | – | 700 | 733 | 630 (2 per phs) | 170M6610 |
| 20xK820 (1) | 12 | 900 | – | 925 | 630 (2 per phs) | 170M6610 |
| | | – | 700 | 733 | 630 (2 per phs) | 170M6610 |
| 20xK920 | 13 | 1000 | – | 1038 | 2400 | 170M7107 |
| | | – | 900 | 925 | 2400 | 170M7107 |
| 20xK1K0 | 13 | 1100 | – | 1162 | 2400 | 170M7107 |
| | | – | 1000 | 1038 | 2400 | 170M7107 |
| 20xK1K1 | 13 | 1300 | – | 1331 | 2400 | 170M7107 |
| | | – | 1100 | 1162 | 2400 | 170M7107 |
| 20xK1K5 | 14 | 1600 | – | 1692 | – | 170M8610 |
| | | – | 1400 | 1467 | – | 170M8610 |
| 20xK1K9(2) | 14 | 2000 | – | 2143 | – | 170M8610 |
| | | – | 1600 | 1692 | – | 170M8610 |
| 20xK2K2(2) | 14 | 2400 | – | 2538 | – | 170M8610 |
| | | – | 2000 | 2143 | – | 170M8610 |

(1) 20DK820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.
(2) Not available with 700S Control.

**Table A.P 932 Volt DC Input Frames 9 - 14 Drive Protection Devices**

| Drive Catalog Number | Frame | kW Rating | | DC Input Ratings | Fuse | Bussmann Style Fuse |
|---|---|---|---|---|---|---|
| | | ND | HD | Amps | | |
| 20xM170 | 9 | 160 | – | 200 | 315 | 170M3746 |
| | | – | 132 | 170 | 315 | 170M3746 |
| 20xM208 | 9 | 200 | – | 245 | 400 | 170M5742 |
| | | – | 160 | 200 | 400 | 170M5742 |
| 20xM261 | 10 | 250 | – | 307 | 500 | 170M5744 |
| | | – | 200 | 245 | 500 | 170M5744 |
| 20xM325 | 10 | 315 | – | 383 | 630 | 170M5746 |
| | | – | 250 | 307 | 630 | 170M5746 |
| 20xM385 | 10 | 355 | – | 453 | 700 | 170M6745 |
| | | – | 315 | 383 | 700 | 170M6745 |
| 20xM416 | 10 | 400 | – | 490 | 700 | 170M6745 |
| | | – | 315 | 383 | 700 | 170M6745 |
| 20xM460 | 11 | 450 | – | 542 | 450 (2 per phs) | 170M5743 |
| | | – | 355 | 453 | 450 (2 per phs) | 170M5743 |
| 20xM502 | 11 | 500 | – | 591 | 500 (2 per phs) | 170M5744 |
| | | – | 400 | 542 | 500 (2 per phs) | 170M5744 |
| 20xM590 | 11 | 560 | – | 695 | 500 (2 per phs) | 170M5744 |
| | | – | 500 | 591 | 500 (2 per phs) | 170M5744 |
| 20xM650 | 12 | 630 | – | 765 | 550 (2 per phs) | 170M5745 |
| | | – | 560 | 695 | 550 (2 per phs) | 170M5745 |
| 20xM750 | 12 | 710 | – | 883 | 630 (2 per phs) | 170M5746 |
| | | – | 630 | 765 | 630 (2 per phs) | 170M5746 |
| 20xM820(1) | 12 | 800 | – | 965 | 630 (2 per phs) | 170M5746 |
| | | – | 630 | 765 | 630 (2 per phs) | 170M5746 |
| 20xM920 | 13 | 900 | – | 1038 | 2400 | 170M7107 |
| | | – | 800 | 925 | 2400 | 170M7107 |
| 20xM1K0 | 13 | 1000 | – | 1162 | 2400 | 170M7107 |
| | | – | 900 | 1038 | 2400 | 170M7107 |
| 20xM1K1 | 13 | 1100 | – | 1331 | 2400 | 170M7107 |
| | | – | 1000 | 1162 | 2400 | 170M7107 |
| 20xM1K5 | 14 | 1500 | – | 1766 | – | 170M8610 |
| | | – | 1300 | 1530 | – | 170M8610 |
| 20xM1K9(2) | 14 | 1800 | – | 2237 | – | 170M8610 |
| | | – | 1500 | 1766 | – | 170M8610 |
| 20xM2K2(2) | 14 | 2000 | – | 2649 | – | 170M8610 |
| | | – | 1800 | 2237 | – | 170M8610 |

(1) 20DM820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.
(2) Not available with 700S Control.

## Notes:

# Lifting and Mounting Instructions

## Lifting Drives

**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.

- For lifting instructions for frame 9 size drives, see Lifting Frame 9 Size Drives on page B-2.
- For lifting instructions for frame 10 - 14 size drives, see Lifting Frame 10-14 Size Drives on page B-3.

## Lifting Frame 9 Size Drives

**Important:** When lifting frame 9 drives, a rod must be placed between the lifting holes as shown in Figure B.1.

**Figure B.1 Frame 9 Lifting**

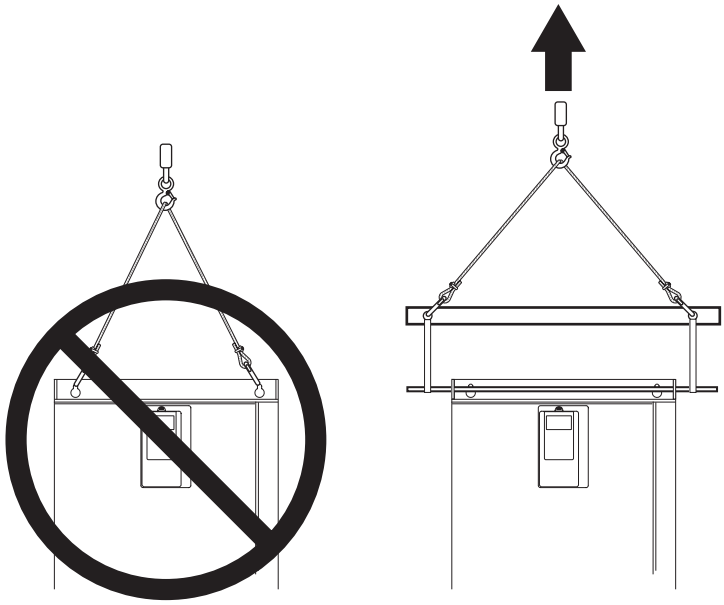


**Table B.A Frame 9 - Approximate Drive and Enclosure Weights**

| Voltage Class | Drive Rating Amps | AC Input Drive & Enclosure Weight *kg (lbs.)* | AC Input Drive, Enclosure & Packaging Weight *kg (lbs.)* | DC Input Drive & Enclosure Weight *kg (lbs.)* | DC Input Drive, Enclosure & Packaging Weight *kg (lbs.)* |
|---|---|---|---|---|---|
| 400/480V AC (540/650V DC) | 261 | 143 (315) | 205 (452) | 109 (240) | 171 (377) |
| 400/480V AC (540/650V DC) | 300 | 151 (333) | 213 (470) | 117 (258) | 179 (395) |
| 600/690V AC (810/932V DC) | 170 | 143 (315) | 205 (452) | 109 (240) | 171 (377) |
| 600/690V AC (810/932V DC) | 208 | 143 (315) | 205 (452) | 109 (240) | 171 (377) |

## Lifting Frame 10-14 Size Drives

When lifting frame 10-14 size drives you must:

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

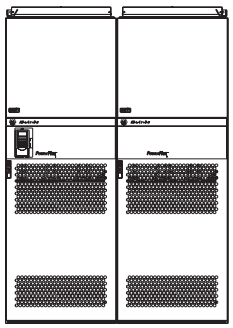
### Step 1: Attaching the Lifting Hardware to the Drive

**Important:** AC Input frame 14 drives are shipped as multiple enclosure sections that must be lifted separately and then connected after they have been properly mounted.

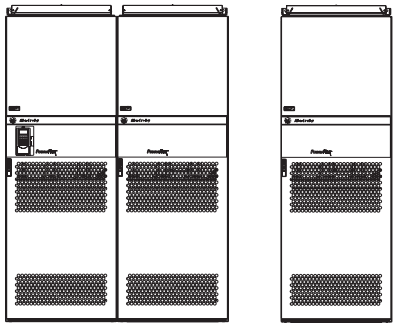
**ATTENTION:** Do Not lift frame 14 drive enclosure sections after they have been connected as one unit. Lifting connected frame 14 drive enclosure sections as one unit may result in a hazardous condition that could cause personal injury and/or equipment damage.

**Figure B.2 Frame 14 Shipping Sections**

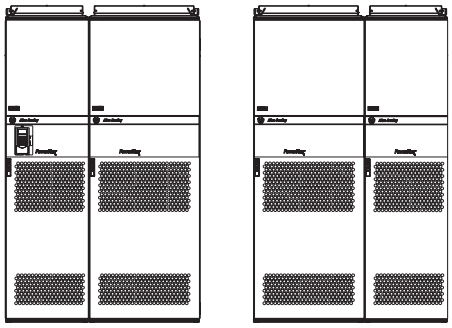
**DC Input Drive - Lift as one unit.**



**AC Input Drive, 1500A - 2 sections shipped. Lift each enclosure section separately.**



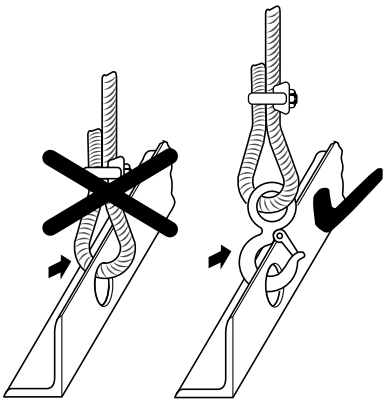
**AC Input Drive, > 1500A - 2 sections shipped. Lift each enclosure section separately.**



## Directions for Lifting Drives in Rittal Enclosures (Codes “A” and “H”)

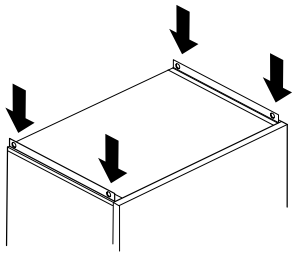
**ATTENTION:** Always use slings with load rated safety hooks or shackles.

**A All Size Drives**

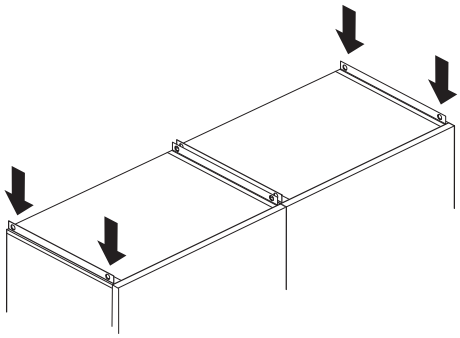


**TIP:** To ensure that the angle between the roof of the enclosure and the chain or cable is greater than 60°, make the length of the chain or cable between the center lifting point and the corners (B) is longer than the distance between the opposite corners (A).

**B Frame 10, 11, 13 and 14 Size Drives**

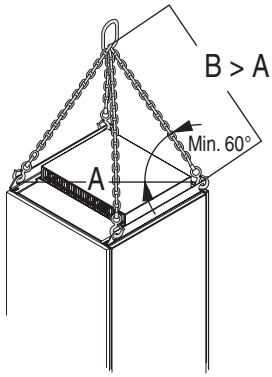


**B Frame 12, 13 and 14 Size Drives**



Note: Lift each Frame 14 drive enclosure section separately.

**C Frame 10, 11, 13 and 14 Size Drives**




**C Frame 12, 13 and 14 Size Drives**

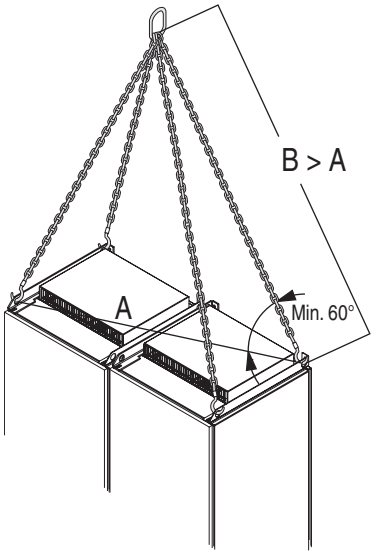



**Table B.B Frame 10 - 13 Approximate Drive and Enclosure Weights**

| Frame Size | 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.)* |
|---|---|---|---|---|---|---|
| 10 | 400/480V AC (540/650V DC) | 385 | 382 (842) | 432 (952) | 267 (589) | 317 (699) |
| | | 460 | 382 (842) | 432 (952) | 267 (589) | 317 (699) |
| | | 500 | 382 (842) | 432 (952) | 267 (589) | 317 (699) |
| | 600/690V AC (810/932V DC) | 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) |

| Frame Size | 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.)* |
|---|---|---|---|---|---|---|
| 11 | 400/480V AC (540/650V DC) | 590 | 564 (1243) | 614 (1354) | 396 (873) | 446 (983) |
| | | 650 | 564 (1243) | 614 (1354) | 396 (873) | 446 (983) |
| | | 730 | 564 (1243) | 614 (1354) | 396 (873) | 446 (983) |
| | 600/690V AC (810/932V DC) | 460 | 511 (1127) | 561 (1237) | 396 (873) | 446 (983) |
| | | 502 | 511 (1127) | 561 (1237) | 396 (873) | 446 (983) |
| | | 590 | 626 (1380) | 676 (1490) | 396 (873) | 446 (983) |
| 12 | 400/480V AC (540/650V DC) | 820 | 814 (1795) | 864 (1905) | 584 (1287) | 634 (1398) |
| | | 920 | 814 (1795) | 864 (1905) | 584 (1287) | 634 (1398) |
| | | 1030 | 814 (1795) | 864 (1905) | 584 (1287) | 634 (1398) |
| | 600/690V AC (810/932V DC) | 650 | 752 (1658) | 802 (1768) | 584 (1287) | 634 (1398) |
| | | 750 | 752 (1658) | 802 (1768) | 584 (1287) | 634 (1398) |
| | | 820 | 752 (1658) | 802 (1768) | 584 (1287) | 634 (1398) |
| 13 | 400/480V AC (540/650V DC) | 1150 | 1348 (2972) | 1468 (3236) | 600 (1323) | 720 (1587) |
| | | 1300 | 1400 (3086) | 1520 (3351) | 600 (1323) | 720 (1587) |
| | | 1450 | 1400 (3086) | 1520 (3351) | 600 (1323) | 720 (1587) |
| | 600/690V AC (810/932V DC) | 920 | 1248 (2751) | 1368 (3016) | 600 (1323) | 720 (1587) |
| | | 1030 | 1248 (2751) | 1368 (3016) | 600 (1323) | 720 (1587) |
| | | 1180 | 1248 (2751) | 1368 (3016) | 600 (1323) | 720 (1587) |

**Table B.C AC Input Frame 14 Approximate Drive and Enclosure Weights**

| Voltage Class | Drive Rating Amps | Section 1 Drive & Enclosure Weight *kg (lbs.)* | Section 1 Drive, Enclosure & Packaging Weight *kg (lbs.)* | Section 2 Drive & Enclosure Weight *kg (lbs.)* | Section 2 Drive, Enclosure & Packaging Weight *kg (lbs.)* | Total Drive & Enclosure Weight (All Sections) *kg (lbs.)* |
|---|---|---|---|---|---|---|
| 400 | 1770 | 1120 (2469) | 1240 (2733) | 1120 (2469) | 1240 (2733) | 2240 (4938) |
| | 2150 | 1150 (2535) | 1270 (2799) | 1150 (2535) | 1270 (2799) | 2300 (5071) |
| | 2700 | 1920 (4233) | 2040 (4497) | 1920 (4233) | 2040 (4497) | 3840 (8466) |
| 600 | 1500 | 1270 (2800) | 1390 (3064) | 650 (1433) | 770 (1697) | 1920 (4233) |
| | 1900 | 1120 (2469) | 1240 (2733) | 1120 (2469) | 1240 (2733) | 2240 (4938) |
| | 2250 | 1150 (2535) | 1270 (2799) | 1150 (2535) | 1270 (2799) | 2300 (5071) |

**Table B.D DC Input Frame 14 Approximate Drive and Enclosure Weights**

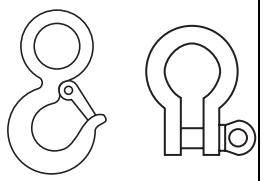
| Voltage Class | Drive Rating Amps | Drive & Enclosure Weight *kg (lbs.)* | Drive, Enclosure & Packaging Weight *kg (lbs.)* |
|---|---|---|---|
| 400 | 1770 | 1330 (2866) | 1450 (3130) |
| | 2150 | 1330 (2866) | 1450 (3130) |
| | 2700 | 1330 (2866) | 1450 (3130) |
| 600 | 1500 | 1220 (2690) | 1340 (2954) |
| | 1900 | 1330 (2866) | 1450 (3130) |
| | 2250 | 1330 (2866 | 1450 (3130) |

## Directions for Lifting Drives in an MCC Enclosure (Code “B”)

**ATTENTION:** Always use slings with load rated safety hooks or shackles.

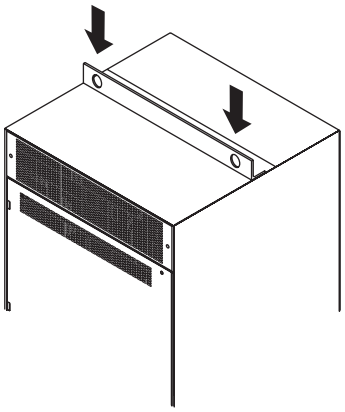
**A All Size Drives**

**TO BE USED**

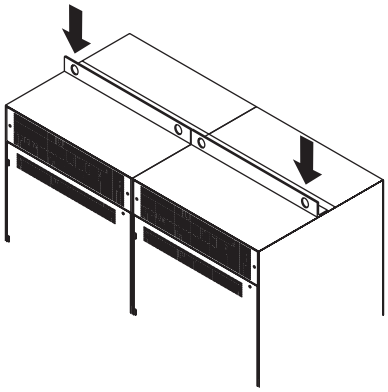


**TIP:** The height (of the lift point) above the lift angle should be at least one half "A" (the distance between lift holes). This assures an angle of less than 45° with the vertical.

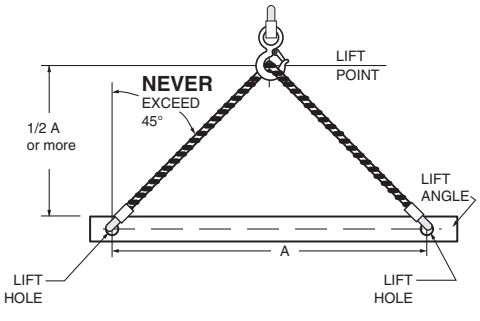
**B Frame 10 and 11 Size Drives**



**B Frame 12 Size Drives**



**C Frame 10 and 11 Size Drives**




**C Frame 12 Size Drives**

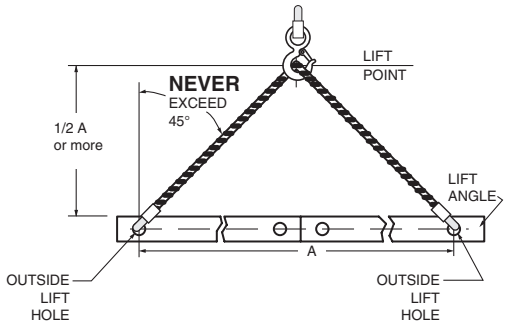
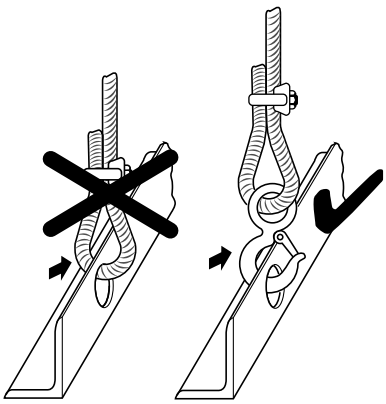



**Table B.E Frame 10 - 12 Approximate Drive and MCC Style Enclosure (Code “B”) Weights**

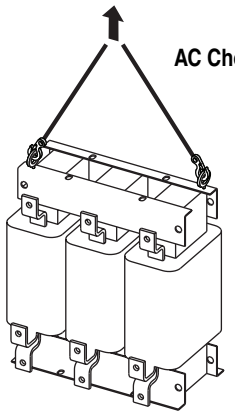
| Frame | Voltage Class | Drive Rating Amps | Drive & Enclosure Weight *kg (lbs.)* | Drive, Enclosure & Packaging Weight *kg (lbs.)* |
|---|---|---|---|---|
| 10 | 400V AC | 385 - 500 | 454 (1100) | 522 (1150) |
| | 600V AC | 261-416 | 449 (990) | 480 (1058) |
| 11 | 400 V AC | 590 - 730 | 696 (1535) | 719 (1585) |
| | 600 V AC | 460 - 590 | 640 (1411) | 661 (1457) |
| 12 | 400 V AC | 820 - 1030 | 966 (2130) | 989 (2180) |
| | 600 V AC | 650 - 820 | 888 (1958) | 909 (2003) |

## Directions for Lifting NEMA/UL Type 1, IP00/Open Drives (Code "N")

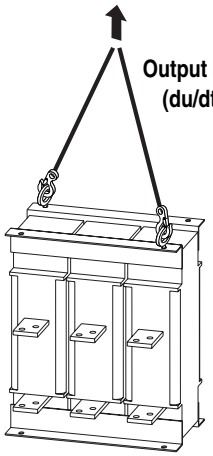
**A** **All Size Drives**



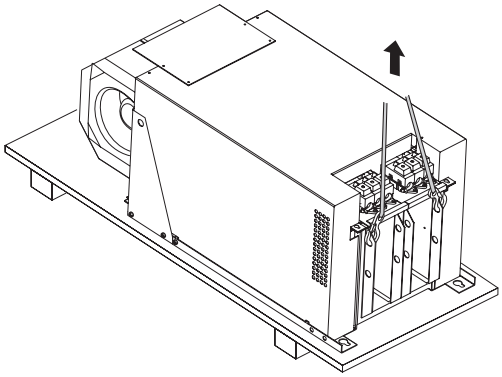
**B** **All Size Drives**



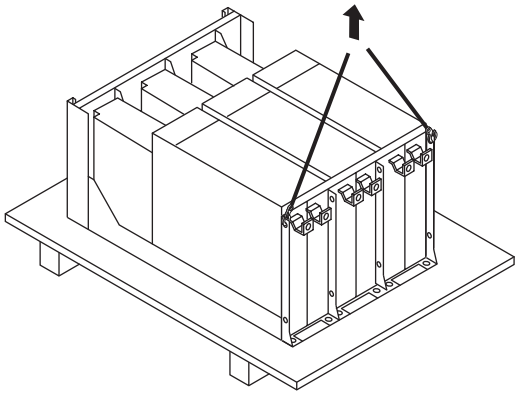

**B** **Frame 14 Drives**



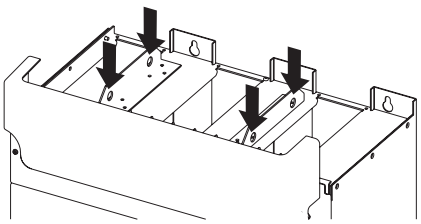

**C** **Frame 10, 11 and 12 Size Drives**

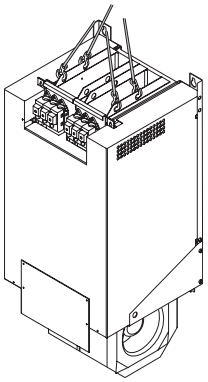


**C** **Frame 13 and 14 Size Drives**



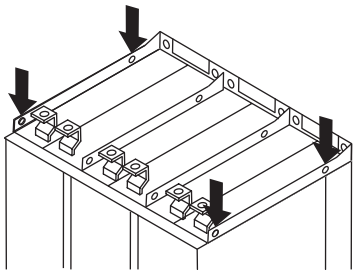
**D** **Frame 10, 11 and 12 Size Drives**





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

**D** **Frame 13 and 14 Size Drives**



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

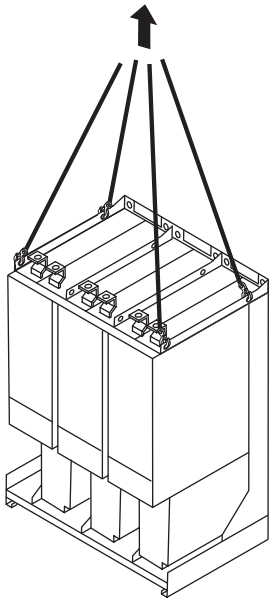


**Table B.F Frames 10 - 12 Open Type Drives - Approximate Weights**

| Frame Size | Drive Voltage Class | Drive Rating Amps | Power Structure Weight *kg (lbs.)* | AC Choke Weight *kg (lbs.)* | AC Input Drive & Packaging Weight *kg (lbs.)*[4] |
|---|---|---|---|---|---|
| 10 | 400 | 385 | 120 (265) | 115 (254) | 235 (519) |
| | | 460 | 120 (265) | 115 (254) | 235 (519) |
| | | 500 | 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) |
| 11 | 400 | 590 | 210 (463) | 84 (185)[2] | 378 (833) |
| | | 650 | 210 (463) | 84 (185)[2] | 378 (833) |
| | | 730 | 210 (463) | 84 (185)[2] | 378 (833) |
| | 600 | 460 | 210 (463) | 115 (254) | 325 (717) |
| | | 502 | 210 (463) | 115 (254) | 325 (717) |
| | | 590 | 210 (463) | 115 (254)[2] | 440 (970) |
| 12 | 400 | 820 | 120 (265)[1] | 115 (254)[3] | 350 (772) |
| | | 920 | 120 (265)[1] | 115 (254)[3] | 350 (772) |
| | | 1030 | 120 (265)[1] | 115 (254)[3] | 350 (772) |
| | 600 | 650 | 120 (265)[1] | 84 (185)[3] | 288 (635) |
| | | 750 | 120 (265)[1] | 84 (185)[3] | 288 (635) |
| | | 820 | 120 (265)[1] | 84 (185)[3] | 288 (635) |

(1) Two power structures are required per frame 12 Drive
(2) Two AC chokes are required for this frame 11 AC Drive
(3) Two AC chokes are required per frame 12 AC Drive
(4) DC input drive and packaging weight is equal to the weight of the power structure(s)

**Table B.G Frame 13 Open Type Drives - Approximate Weights**

| Drive Voltage Class | Drive Rating Amps | Power Module Weight *kg (lbs.)* | AC Choke Weight *kg (lbs.)* | NFE Module Weight *kg (lbs.)* |
|---|---|---|---|---|
| 400 | 1150 | 306 (675) | 130 (287)[1] | 67 (148)[1] |
| | 1300 | 306 (675) | 115 (254)[2] | 67 (148)[2] |
| | 1450 | 306 (675) | 115 (254)[2] | 67 (148)[2] |
| 600 | 920 | 306 (675) | 130 (287)[1] | 67 (148)[1] |
| | 1030 | 306 (675) | 130 (287)[1] | 67 (148)[1] |
| | 1180 | 306 (675) | 130 (287)[1] | 67 (148)[1] |

(1) Two AC chokes and NFE (Non-Regenerative Front-End) Modules are required for this frame 13 AC drive
(2) Three AC chokes and NFE Modules are required for this frame 13 AC drive

**Table B.H Frame 14 Open Type Drives - Approximate Weights**

| Drive Voltage Class | Drive Rating Amps | Power Module Weight *kg (lbs.)* | AC Choke Weight kg (lbs.) | NFE Module Weight *kg (lbs.)* | Output Reactor (du/dt Filter) *kg (lbs.)*[4] |
|---|---|---|---|---|---|
| 400 | 1770 | 306 (675) | 115 (254)[1] | 67 (148)[1] | 160 (353) |
| | 2150 | 306 (675) | 130 (287)[1] | 67 (148)[1] | 160 (353) |
| | 2700 | 306 (675) | 115 (254)[2] | 67 (148)[2] | 160 (353) |
| 600 | 1500 | 306 (675) | 115 (254)[3] | 67 (148)[3] | 120 (265) |
| | 1900 | 306 (675) | 115 (254)[1] | 67 (148)[1] | 160 (353) |
| | 2250 | 306 (675) | 130 (287)[1] | 67 (148)[1] | 160 (353) |

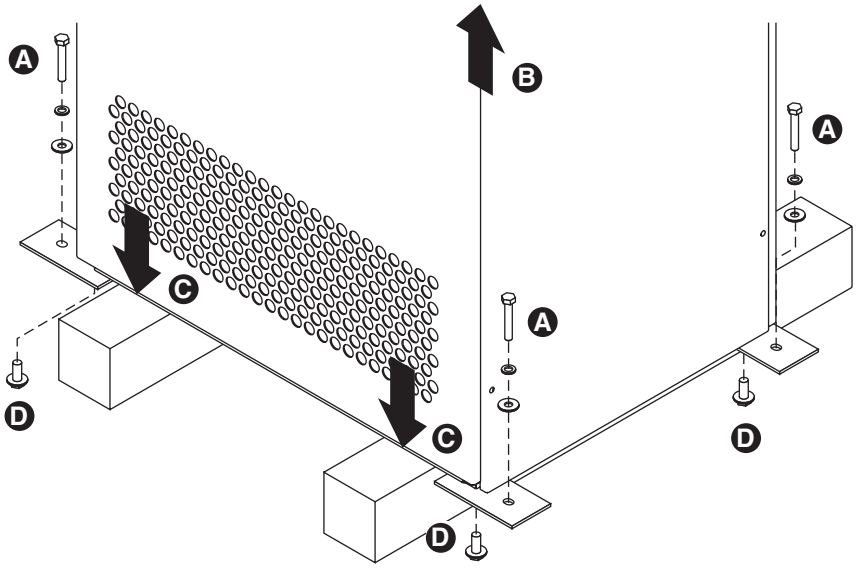
(1) Four AC chokes and NFE Modules are required for this frame 14 AC drive
(2) Six AC chokes and NFE Modules are required for this frame 14 AC drive
(3) Three AC chokes and NFE Modules are required for this frame 14 AC drive
(4) Two du/dt filters are required per frame 14 AC drive

## Step 2: Removing the Skid and Shipping Feet for Frame 10 - 14 Enclosures

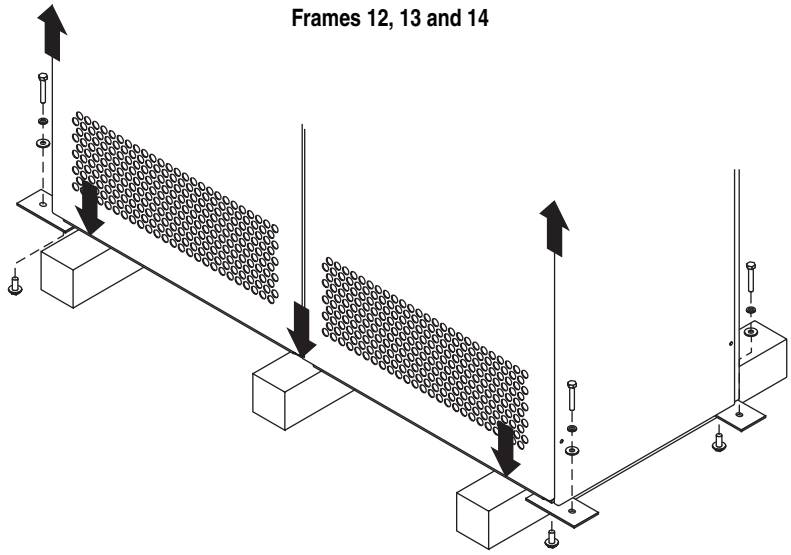
**ATTENTION:** To guard against personal injury and equipment damage, do not work under the drive unless the drive is securely mounted on appropriate blocks.

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

**Frames 10, 11, 13 and 14 (Frame 13 and 14 single enclosures only)**

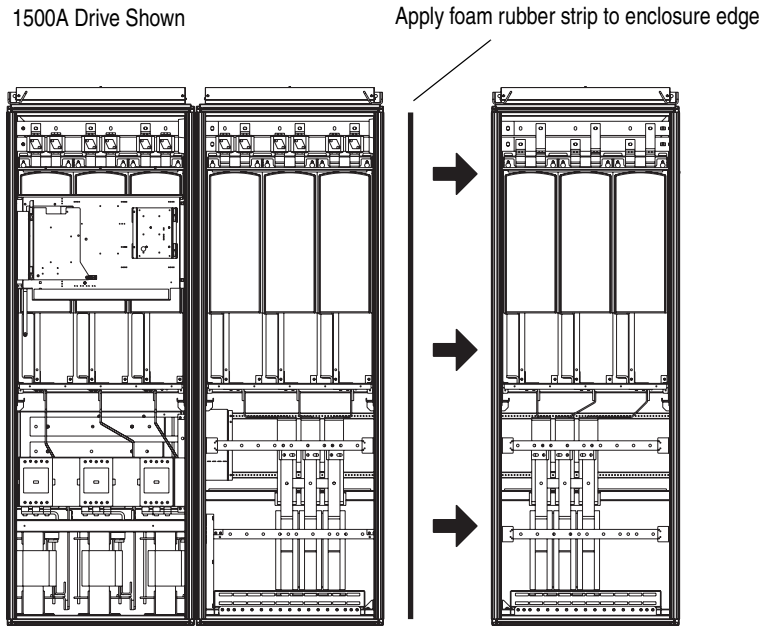



**Frames 12, 13 and 14**

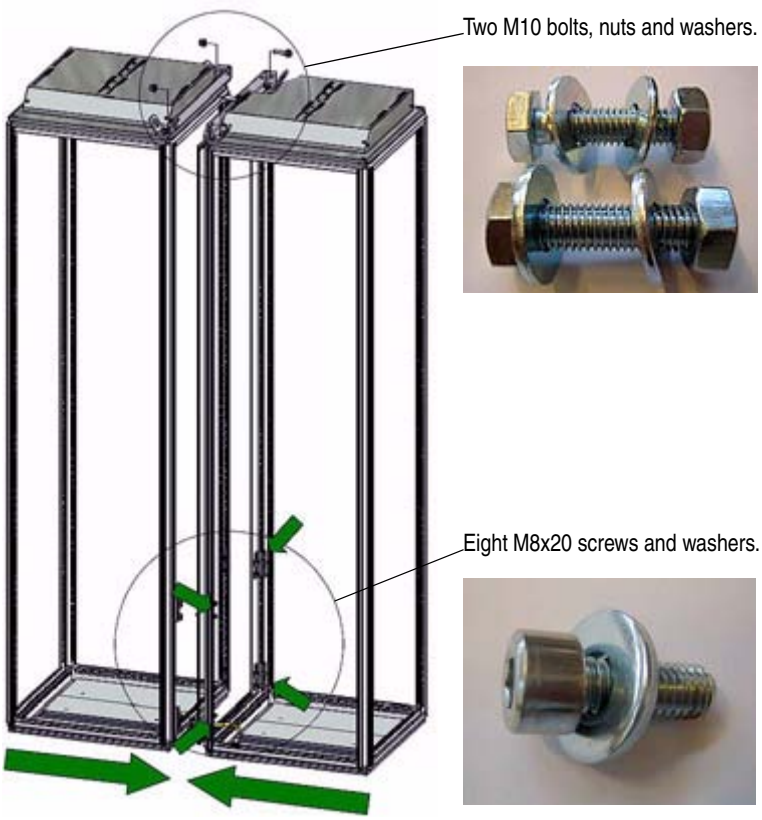


Step 3: Mounting Frame 10 - 14 Drive Enclosures to the Floor and/or Wall

**1.** For AC input frame 14 drives only, secure the foam rubber strip supplied with the drive to the edge of one of the open-sided drive enclosure sections.



**2.** For AC input frame 14 drives only, verify that the holes on the lifting angles and the four metal connecting plates mounted to the rails between the enclosures are properly aligned and secure the enclosure sections using the bolts, washers, nuts and screws provided.



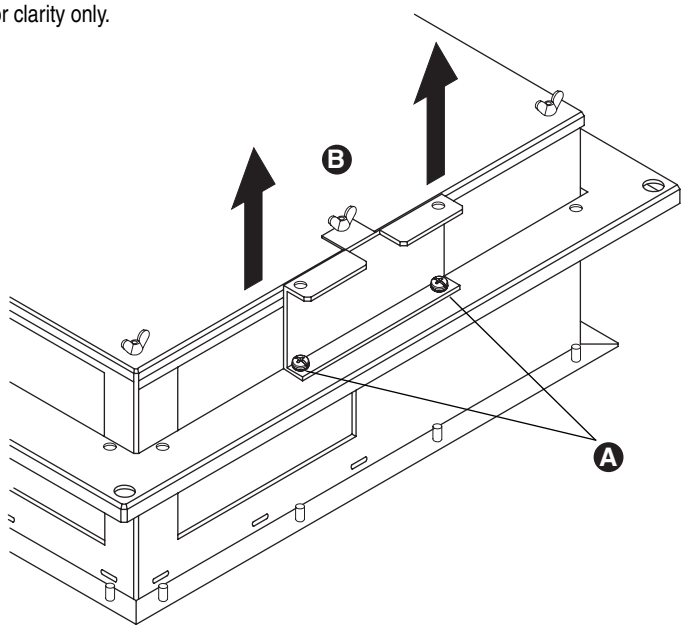

**Note**: Enclosure panels not shown for clarity only.

**3.** Drives installed in a NEMA/UL Type 12 IP54 enclosure (PowerFlex 700H Control only) are shipped with the roof assembly installed at a reduced height for shipping purposes. The roof assembly must be installed at its full height before starting the drive. Follow the steps below to install the roof assembly.

**Note**: The NEMA/UL Type 12 IP54 enclosure roof assembly is provided with the required filters installed.

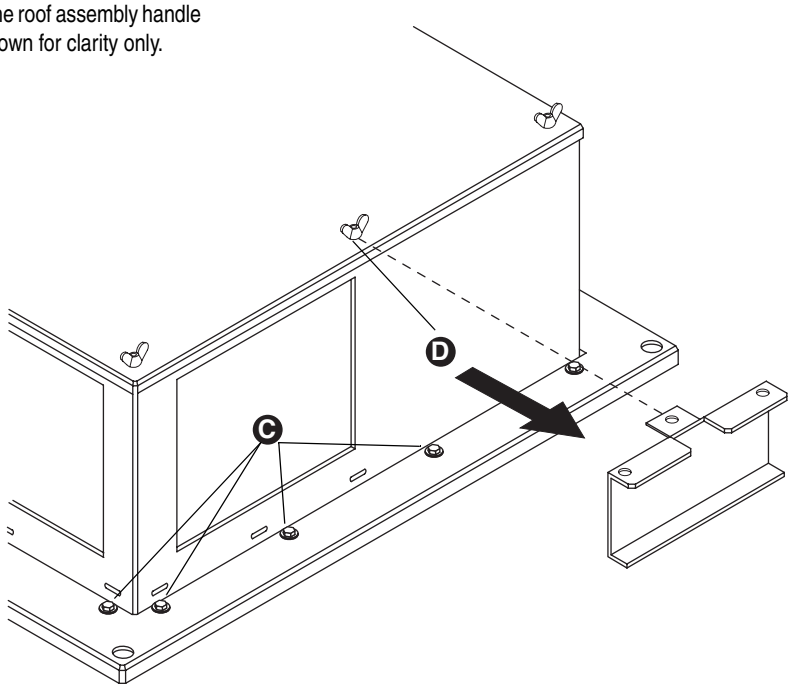
| Task | Description |
|---|---|
| Ⓐ | Remove the two sheet metal screws that secure each of the two roof assembly handles to the roof panel. |
| Ⓑ | Lift the roof assembly into place, using the handles provided. |

One roof assembly handle shown for clarity only.



| Task | Description |
|---|---|
| Ⓒ | Secure the roof assembly to the roof panel using the 16 washers and screws provided to . |
| Ⓓ | Remove the two wing nuts that hold the handles in place, remove the two handles and replace the wing nuts. |

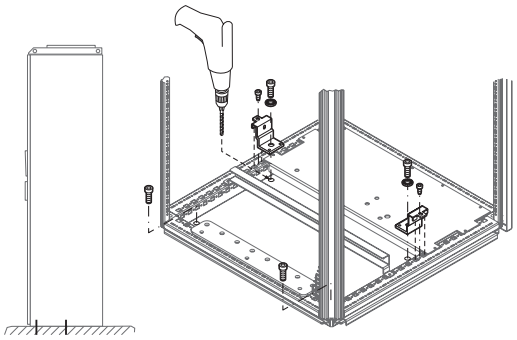
One roof assembly handle shown for clarity only.




**4.** Complete the appropriate mounting procedures for Floor Mounting (below) and/or Wall Mounting on page B-14:

### Floor Only Mounting

Secure the 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 far back as possible to the choke assembly plate. With this method the holes through base plate must be drilled on-site.

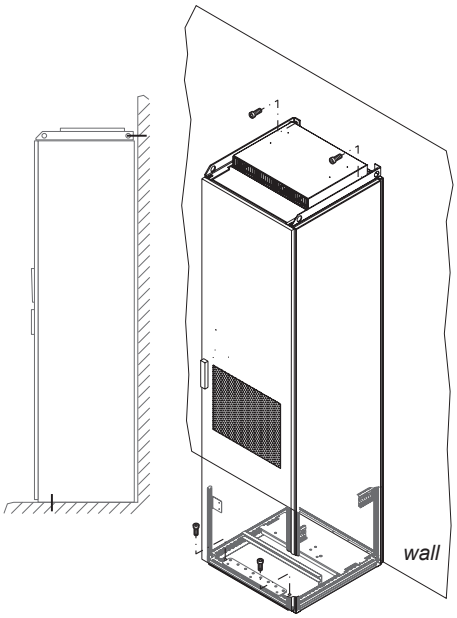


**Important:** If it is important to align the drive cabinet vertically with adjacent Rittal cabinets, you may need to place shims under the drive cabinet or use leveling feet throughout the cabinet

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

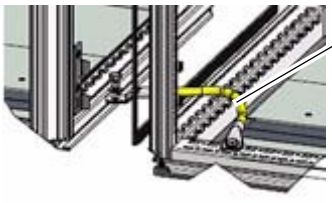
Secure drive to the floor with anchor bolts in the front corner holes of the enclosure base plate. Secure the drive by bolting the adjustable lifting rails to the rear wall or supporting structure.




If you are installing a Frame 14 drive, continue with Step 4: Connecting Frame 14 Enclosure Sections on page B-15.

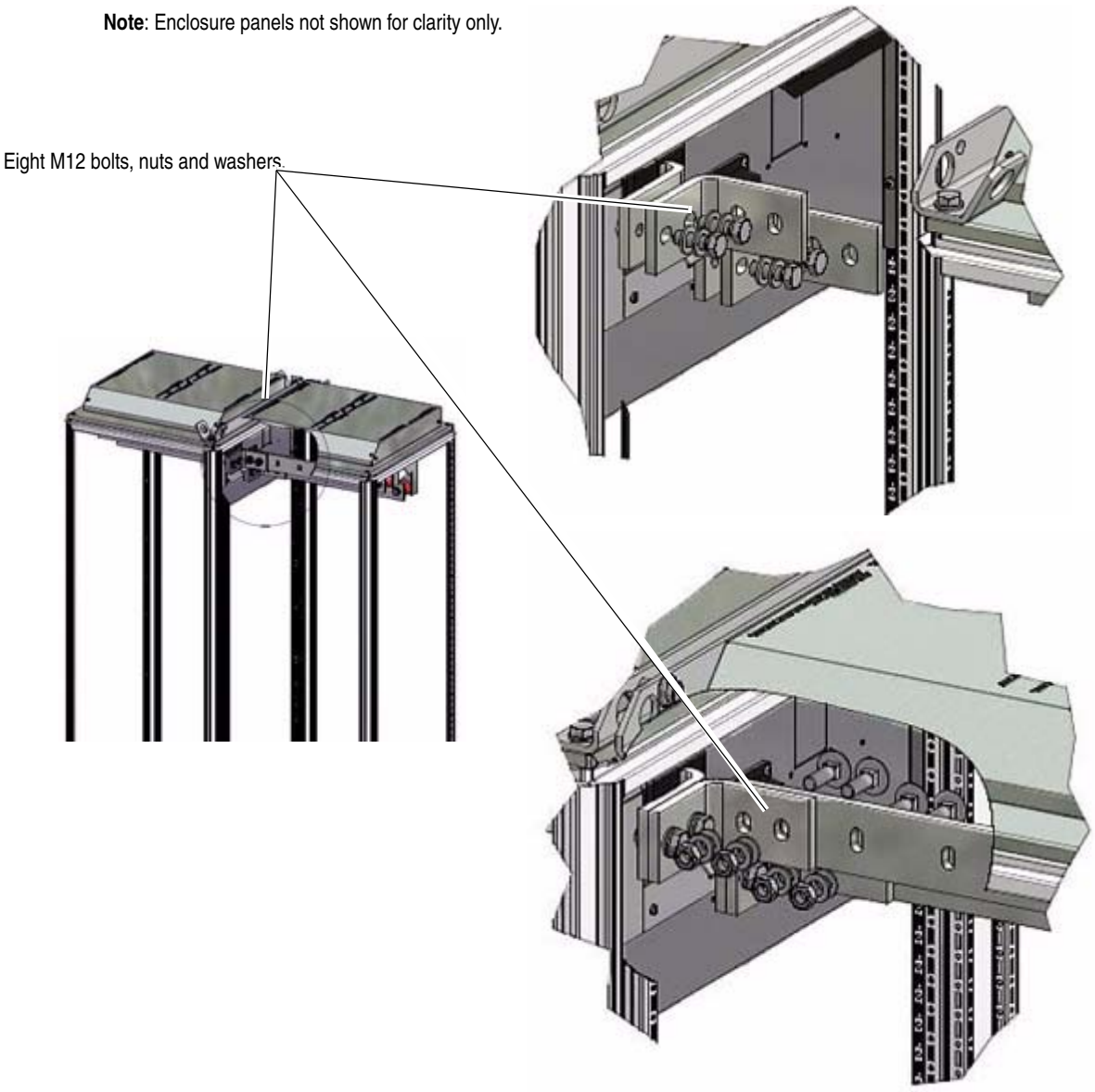
Step 4: Connecting Frame 14 Enclosure Sections

1. Secure the cable connected to the PE bar on one enclosure to the PE bar on the second enclosure using the screw provided.

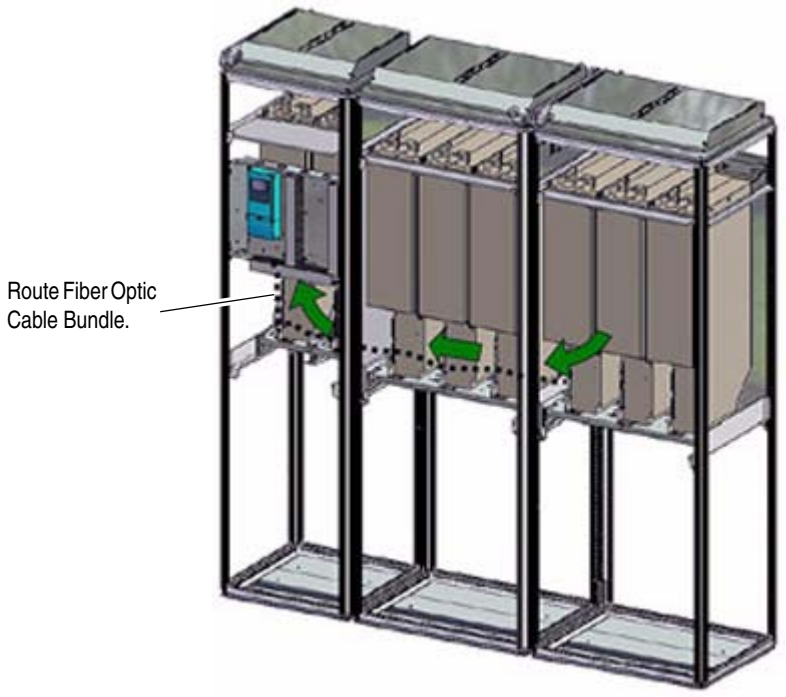



2. Secure the L-shaped bus bars to the main bus bars at the top of the enclosures with the M12 bolts, washers and nuts provided. Tightening torque is 70N•m (619.5 lb.•ft.).

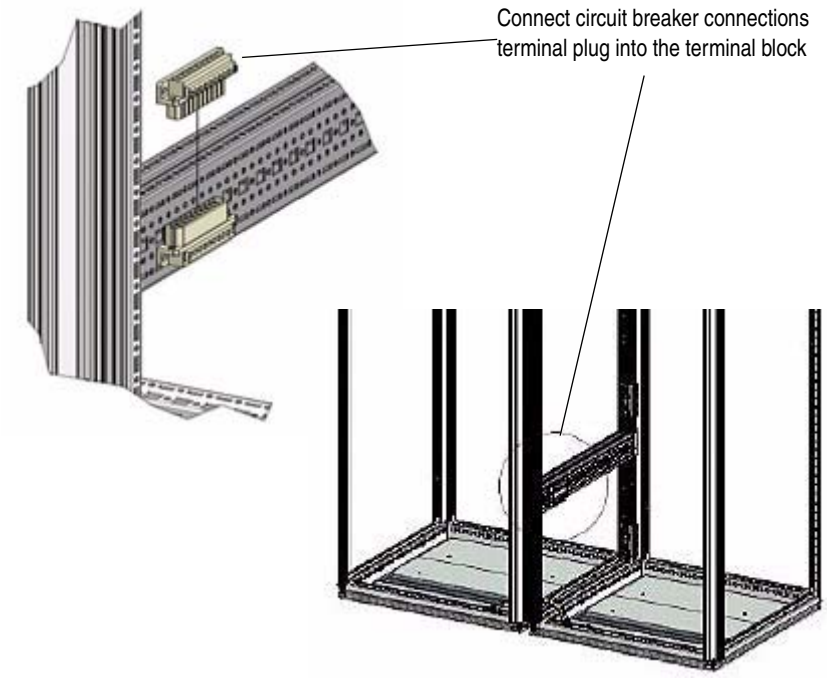
**Note**: Enclosure panels not shown for clarity only.



3. Route the fiber optic cables from the Power Structure (right-hand enclosure) to control pan and connect the cables to the 700S Fiber Optic Interface board on the back of the control plate or the 700H Star Coupler board on the back of the control frame.




4. For frame 14 drives rated above 1500 Amps, route the circuit breaker control cables and terminal plug from the right-hand enclosure and connect it to the terminal block on the enclosure frame.



# PowerFlex 700S Hi-Resolution (Stegmann) Encoder Feedback Option

## Specifications

### Hi-Resolution (Stegmann) Feedback Option Card Specifications

| Consideration | Description |
|---|---|
| Encoder Voltage Supply | 11.5V dc @ 130 mA |
| Stegmann Feedback | Sine/Cosine 1V P-P Offset 2.5 |
| Maximum Cable Length | 90m (295 ft) |
| Maximum Frequency<br>(Encoder Speed) | 12.5 µs/cycle<br>(4687.5 RPM for encoders with 1024 sine cycles per revolution)<br>(9375 RPM for encoders with 512 sine cycles per revolution) |
| RS-485 Interface | The Hi-Resolution Feedback Option card obtains the following information via the Hiperface RS-485 interface shortly after power-up:<br>• Address<br>• Command Number<br>• Mode<br>• Number of turns<br>• Number of Sine/Cos cycles<br>• Checksum |
| Customer-I/O plug (P1) | Allen-Bradley PN: S94262912<br>Weidmuller PN: BL3.50/90/12BK |

### Supported Encoders

Table C.A specifies which encoders are supported by the 700S Hi-Resolution Stegmann Encoder Feedback Option module.

**Important:** Please note that encoders must be ordered as "Single Ended". This will ensure that the RS-485 channel has the proper termination network installed at the factory.

**Table C.A Supported Stegmann Encoders**

| Model | Resolution | Comment |
|---|---|---|
| SINCOS® SCS-60, SCS-70, SCM-60, and SCM-70 | 512 sine cycles per revolution. | SCM-60 and SCM-70 have built-in mechanical turns counter. |
| SINCOS® SCS-KIT-101 and SCM-KIT-101 | 1024 sine cycles per revolution. | SCM-60 and SCM-70 have built-in mechanical turns counter. |
| SINCOS® SRS-50, SRS-60, SRM-50, and SRM-60 | 1024 sine cycles per revolution. | SRM-50 and SRM-60 have built-in mechanical turns counter. |
| SINCOS® SRS/M 25 | 1024 sine cycles per revolution | SRS25 and SRM25 have built-in mechanical turns counter. IP65 Protection Class. Size 25 square flange mounting. |

| Model | Resolution | Comment |
|---|---|---|
| SINCOS® SRS660 | 1024 sine cycles per revolution | Hollow-shaft up to 14 mm diameter |
| SINCOS® SHS-170 | 512 sine cycles per revolution. | While the software supports this encoder, the SHS-170 draws excessive current and should only be used with an external power supply. |
| Allen-Bradley 842HR | 1024 sine cycles per revolution | Has built-in mechanical turns counter. IP65 Protection Class. Size 25 square flange mounting. |

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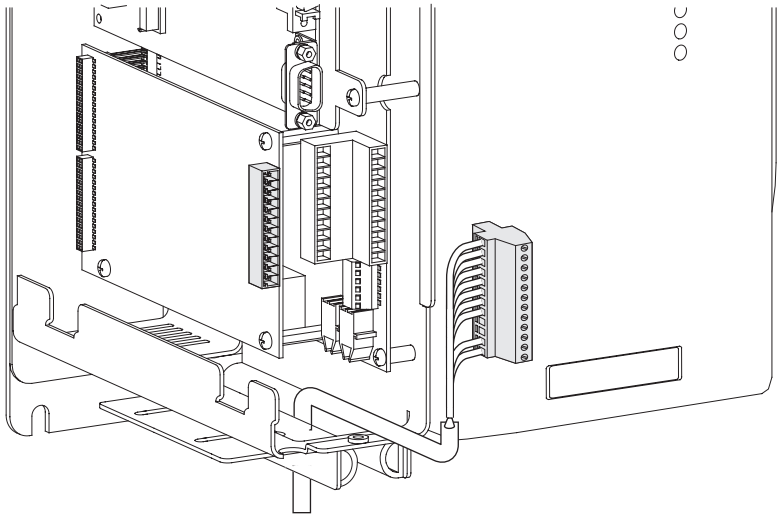
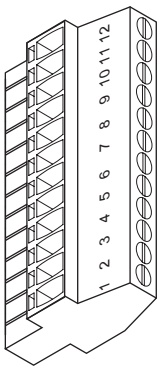
## Wiring the Hi-Resolution Feedback Option Card to an Encoder

Terminal block P1 contains connection points for a Stegmann Hiperface® encoder. This terminal block resides on the Hi-Resolution Encoder Feedback Option card.

Hiperface® is a registered trademark of Stegmann Inc.



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




| Terminal | Signal | Description |
|---|---|---|
| 12 | POWER COMMON | Power supply for encoder interface. |
| 11 | POWER | |
| 10 | REFSIN | Negative Sine signal. |
| 9 | +SIN | Positive Sine signal. |
| 8 | REFCOS | Negative Cosine signal. |
| 7 | +COS | Positive Cosine signal. |
| 6 | SHIELD | Connection point for encoder cable shield. |
| 5 | SHIELD | |
| 4 | N/C | Not connected. |
| 3 | N/C | |
| 2 | DATA+ (RS 485) | Positive DH485 terminal. |
| 1 | DATA- (RS 485) | Negative DH485 terminal. |

## Recommended Cables

| If you are using this motor and feedback device: | Use this cable: | See this wiring diagram: |
|---|---|---|
| Allen-Bradley 1326AB-BXXXX-21ML, and -21MKXL motors with embedded Stegmann rotary encoder | Allen-Bradley 1326-CECU-XXL-XXX | Figure C.1 on page C-4 |
| Allen-Bradley 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with embedded Stegmann rotary encoder | Allen-Bradley 2090-CDNFDMP-SXX | Figure C.2 on page C-4 |
| Allen-Bradley MPL-A5xx and all MPL-Bxxx motors with embedded Stegmann rotary encoder | Allen-Bradley 2090-CDNFDMP-SXX | Figure C.2 on page C-4 |
| Allen-Bradley 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with embedded Stegmann rotary encoder | Allen-Bradley 2090-XXNFMP-SXX | Figure C.3 on page C-4 |
| Allen-Bradley MPL-A5xx and all MPL-Bxxx motors with embedded Stegmann rotary encoder | Allen-Bradley 2090-XXNFMP-SXX | Figure C.3 on page C-4 |
| Allen-Bradley MPL-A3xx - MPL-A45xx and all MPG series motors with embedded Stegmann rotary encoder | Allen-Bradley 2090-XXNFMP-SXX | Figure C.4 on page C-5 |
| Allen-Bradley MPL-A3xx - MPL-A45xx and all MPG series motors with embedded Stegmann rotary encoder | Allen-Bradley 2090-UXNFDMP-SXX | Figure C.5 on page C-5 |
| Any other motor with external Stegmann SHS-170 rotary encoder | Stegmann shielded twisted-pair cable with 12-pin DIN style connector | Figure C.6 on page C-5 |
| Any other motor with external Stegmann SCS-60, SCS-70, SCM-60 or SCM-70, SRS-50, SRS-60, SRM-60, SRM-60, SRS-25, SRM-25 or Allen-Bradley 842HR rotary encoder | Stegmann shielded twisted-pair cable with 10-pin MS style connector | Figure C.7 on page C-6 |
| Any other motor with external Stegmann SCS-Kit 101 or SCK-Kit 101 rotary encoder | Stegmann shielded twisted-pair cable with 8-pin Berg style connector | Figure C.8 on page C-6 |
| Any other motor with external Stegmann SRS660 rotary encoder | Is available only with pre-attached Stegmann shielded twisted-pair cable of various lengths | Figure C.9 on page C-6 |

## Connection Examples

**Figure C.1 1326AB-BXXXX-21ML, and -21MKXL motors with a 1326-CECU-XXL-XXX cable**

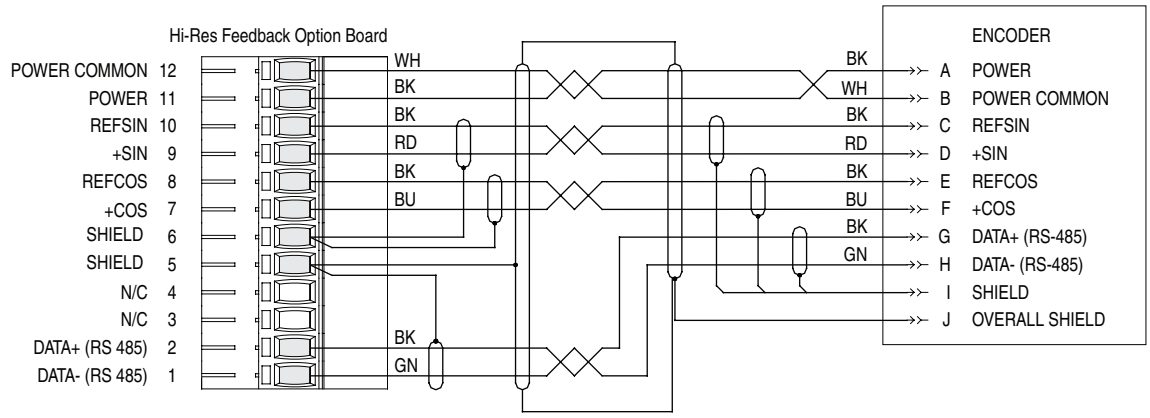



**Figure C.2 MPL-A5xx and all MPL-Bxxx motors or 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with 2090-CDNFDMP-SXX cable**

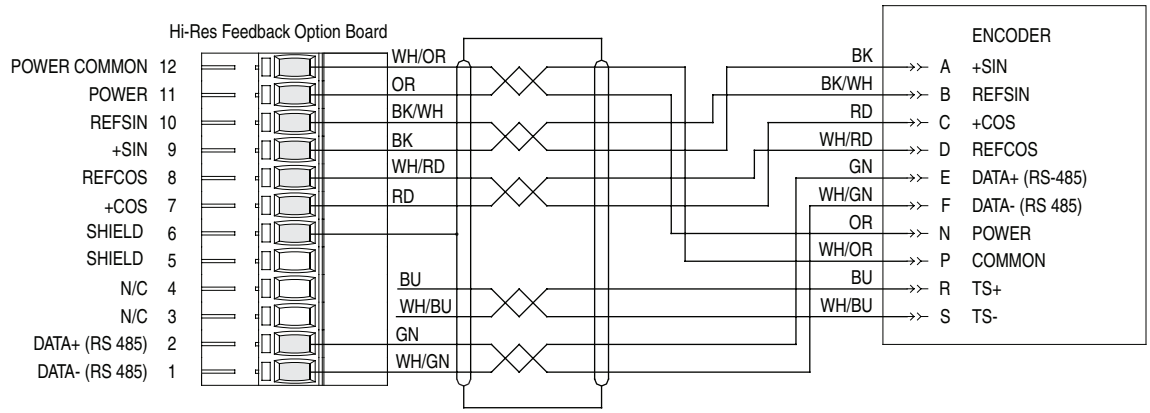
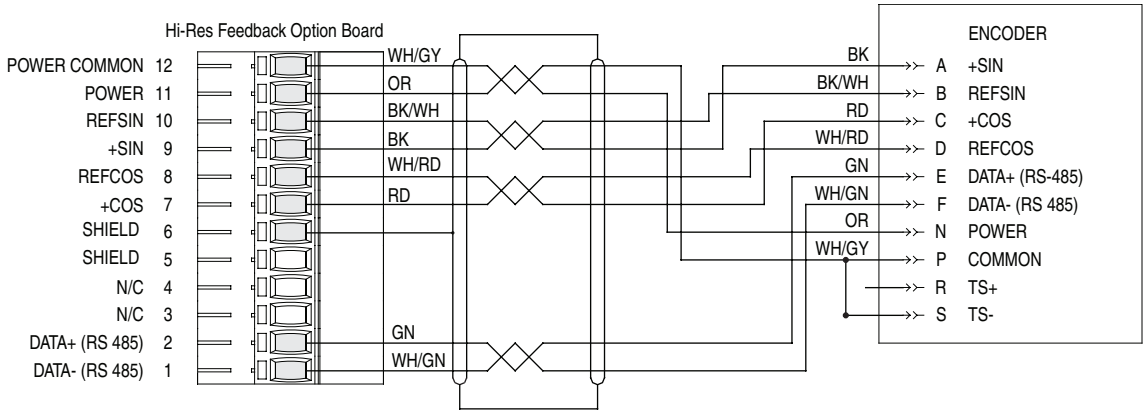


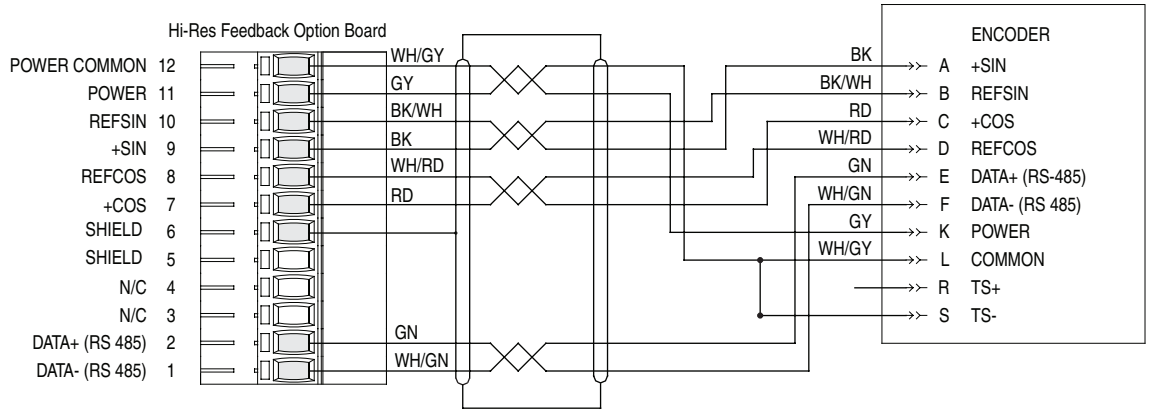

**Figure C.3 MPL-A5xx and all MPL-Bxxx Motor or 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motor with 2090-XXNFMP-SXX cable**




**Note**: Thermal Switch cannot be accessed using 2090-XXNFMP-SXX cable.

**Connection Examples**

**Figure C.4 MPL-A3xx - MPL-A45xx and all MPG series motors with 2090-XXNFMP-SXX cable**




**Note**: Thermal Switch cannot be accessed using 2090-XXNFMP-SXX cable.

**Figure C.5 MPL-A3xx - MPL-A45xx and all MPG series motors with 2090-UXNFDMP-SXX cable**

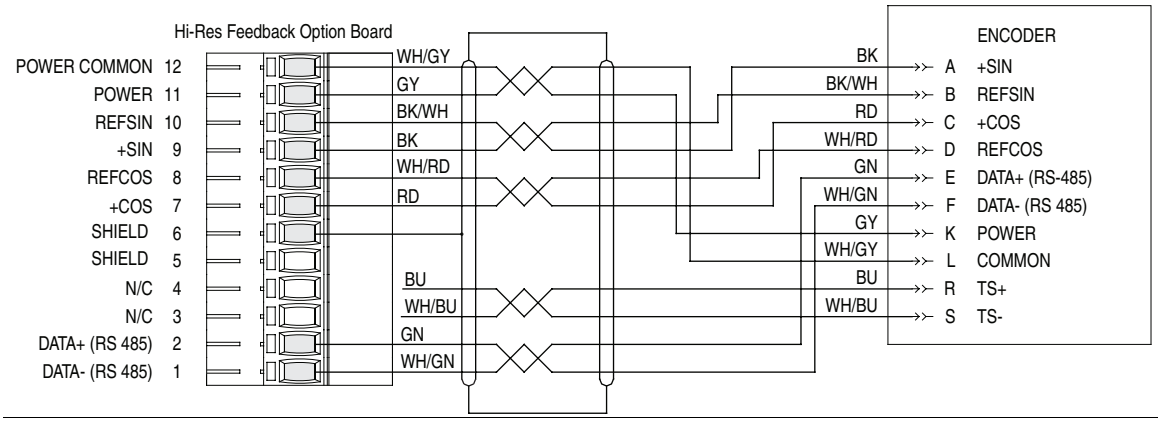
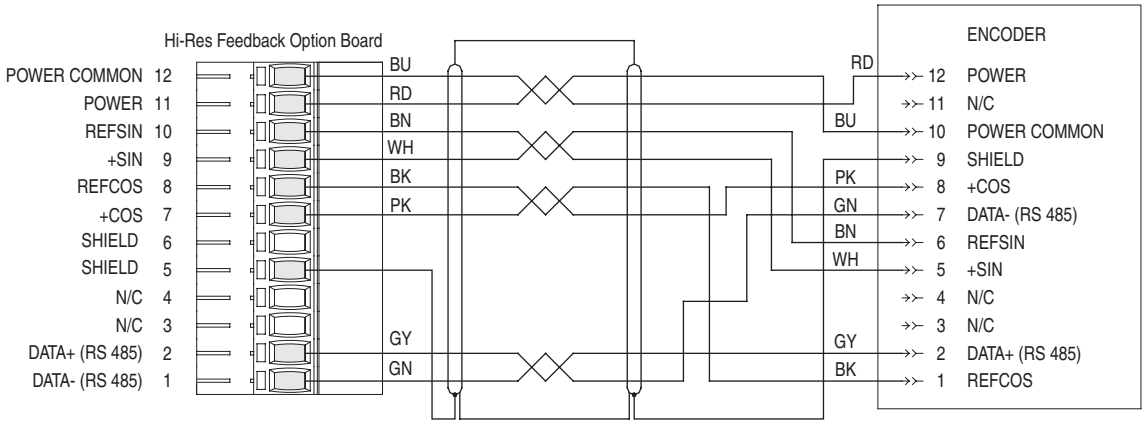



**Figure C.6 Stegmann shielded twisted-pair cable with 12-pin DIN style connector**



## Connection Examples

**Figure C.7 Stegmann shielded twisted-pair cable with 10-pin MS style connector**

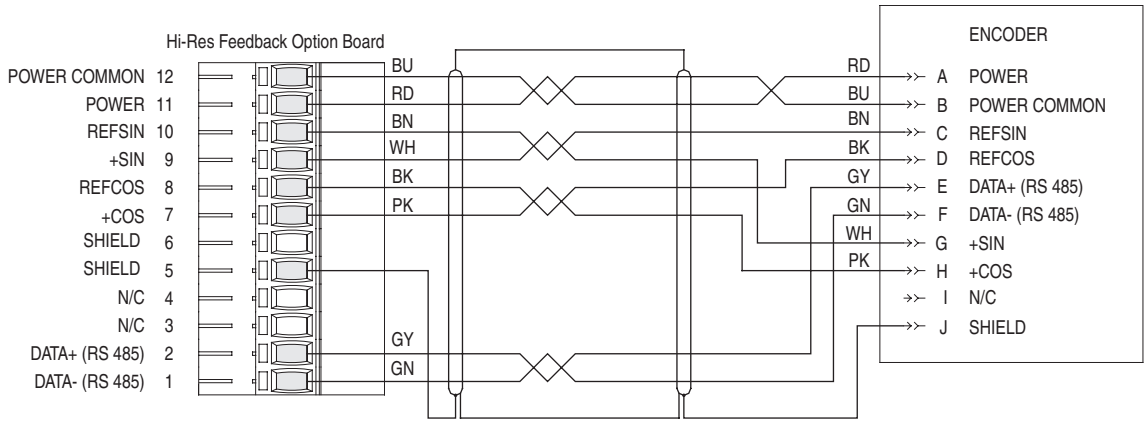



**Figure C.8 Stegmann shielded twisted-pair cable with 8-pin Berg style connector**

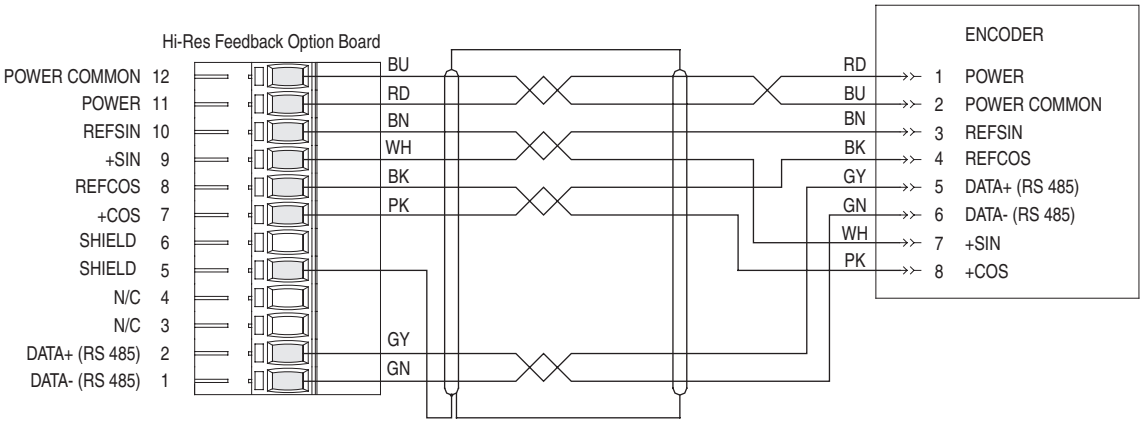
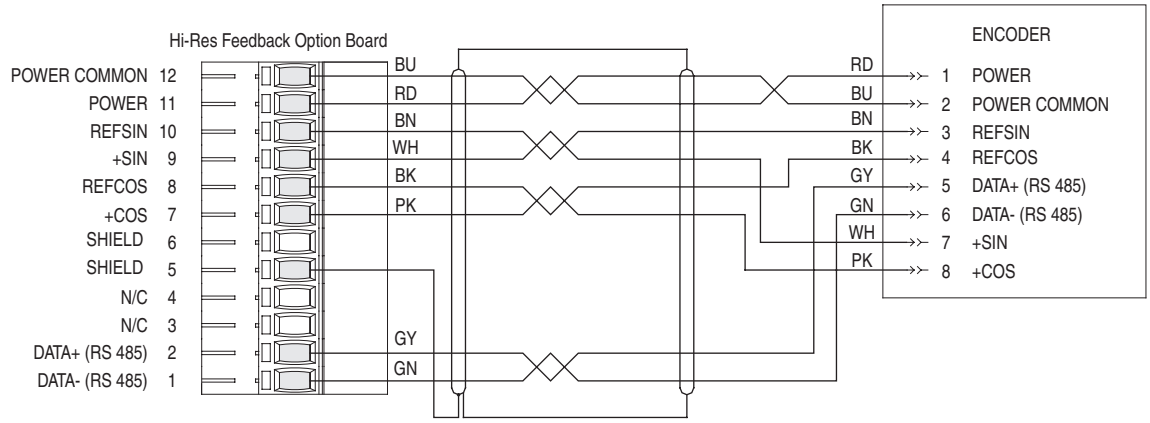



**Figure C.9 Pre-attached Stegmann shielded twisted-pair cable**



# PowerFlex 700S Resolver Feedback Option Card

## Specifications

### Resolver Feedback Option Card Specifications

| Consideration | Description |
|---|---|
| Excitation Frequency | 2381-9300 Hz |
| Excitation Voltage | 8-26 Vrms |
| Resolver Feedback Voltage | 2 Vrms +/- 300 mV |
| Customer-I/O plug (P1) | Allen-Bradley PN: S94262908<br>Weidmuller PN: BL3.50/90/8BK |

### Compatible Resolvers

Table A specifies which resolvers are supported by the 700S Resolver Feedback Option module.

**Table A Compatible Resolvers**

| Manufacturer | Manufacturer Catalog Number | Notes | Parameter 275 [Reslvr0 Type Sel] Setting for Phase I Firmware 1.17 | Parameter 275 [Reslvr0 Type Sel] Setting for Phase I Firmware 2.XX |
|---|---|---|---|---|
| Tamagawa | TS-2014N181E32 | x 1, flange-mounted enclosure | 1 - Rel800123-2R | 1 - T2014/2087x1 |
| Tamagawa | TS-2014N182E32 | x 2, flange-mounted enclosure | 2 - Rel800123-2S | 2 - T2014/2087x2 |
| Tamagawa | TS-2014N185E32 | x 5, flange-mounted enclosure | 3 - Rel800123-2T | 3 - T2014/2087x2 |
| Tamagawa | TS-2087N12E9 | x 2, HD foot-mounted enclosure, double shaft | 2 - Rel800123-2S | 2 - T2014/2087x2 |
| Tamagawa | TS-2087N1E9 | x 1, HD foot-mounted enclosure | 1 - Rel800123-2R | 1 - T2014/2087x1 |
| Tamagawa | TS-2087N2E9 | x 2, HD foot-mounted enclosure | 2 - Rel800123-2S | 2 - T2014/2087x2 |
| Tamagawa | TS-2087N5E9 | x 5, HD foot-mounted enclosure | 3 - Rel800123-2T | 3 - T2014/2087x2 |
| Tamagawa | TS-2087N11E9 | x 1, HD foot-mounted enclosure, double shaft | 1 - Rel800123-2R | 1 - T2014/2087x1 |
| Advanced Micro Controls Inc. (AMCI) | R11X-C10/7 | | N/A | 14 - AmciR11XC107 |

Allen-Bradley servo motors may be ordered with factory installed resolvers. Table B specifies which factory installed resolvers are supported by the 700S Resolver Feedback Option module.

**Table B Compatibility with Resolvers on Allen-Bradley Motors**

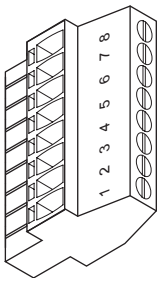
| Motor / Resolver Type | Compatible | Notes | Parameter 275 [Reslvr0 Type Sel] Setting for Phase I Firmware 1.17 | Parameter 275 [Reslvr0 Type Sel] Setting for Phase I Firmware 2.XX | Parameter 277 [Reslvr0 Type Sel] Setting for Phase II Firmware 1.XX |
|---|---|---|---|---|---|
| 1326 AB 230V Primary Resolver | No | Receiver type resolver - not supported | Not Supported | Not Supported | Not Supported |
| 1326 AB 460V Primary Resolver | Yes | Transmitter type resolver - supported | 9 - AB 164982-8 | 9 - 1326Ax 460v | 9 - 1326Ax 460v |
| 1326 AB 460V Secondary Resolver | Yes | • Secondary resolver is geared to motor - not intended for motor speed / position feedback<br>• Transmitter type resolver - supported | 13 - AB 129214-8 | 13 - Reserved | 13 - Reserved |
| 1326AD 230V Rare Earth Primary Resolver | No | Receiver type resolver - not supported | Not Supported | Not Supported | Not Supported |
| 1326AH 460V Explosion Proof Motor Primary Resolver | Yes | Transmitter type resolver - supported | 9 - AB 164982-8 | 9 - 1326Ax 460v | 9 - 1326Ax 460v |
| 1326AH 460V Explosion Proof Motor Secondary Resolver | Yes | • Secondary resolver is geared to motor - not intended for motor speed / position feedback<br>• Transmitter type resolver - supported | N/A | N/A | N/A |
| 1326AS 460V Rare Earth Primary Resolver | Yes | Transmitter type resolver - supported | 9 - AB 164982-8 | 9 - 1326Ax 460v | 9 - 1326Ax 460v |
| MPL 460V Primary Resolver | Yes | Transmitter type resolver - supported | 4 - AB 155407-8 | 4 - MPL 460v | 4 - MPL 460v |

## Recommended Cable

Rockwell Automation strongly recommends the use of Reliance Electric 417900-207CG or Belden 9730 cable for installation, or an equivalent cable that meets these specifications:

- 3 Twisted Pairs, 80°C, 300V
- Chrome FPR Jacket, Plenum Rated
- Conductor Size: 18 AWG
- Twists Per Inch: 2-3 twists per inch of wire lay per pair
- Capacitance Per Pair: not to exceed 30 pF per foot +/- 0.3 pF as read on a GEN_RAD Model 1658 RLC Digibridge or equivalent
- Capacitance Difference Pair to Pair: not to exceed 0.6 pF per foot as read on a GEN_RAD Model 1658 RLC Digibridge or equivalent
- Resistance per 1000 Feet: 17.15Ω +/- 10%
- Inductance per 1000 Feet: 0.13 mH +/- 10% as read on a GEN_RAD Model 1658 RLC Digibridge or equivalent
- Insulation Thickness: 0.008 in.
- Conductor Stranding 16/30
- Jacket Thickness: 0.018 in.

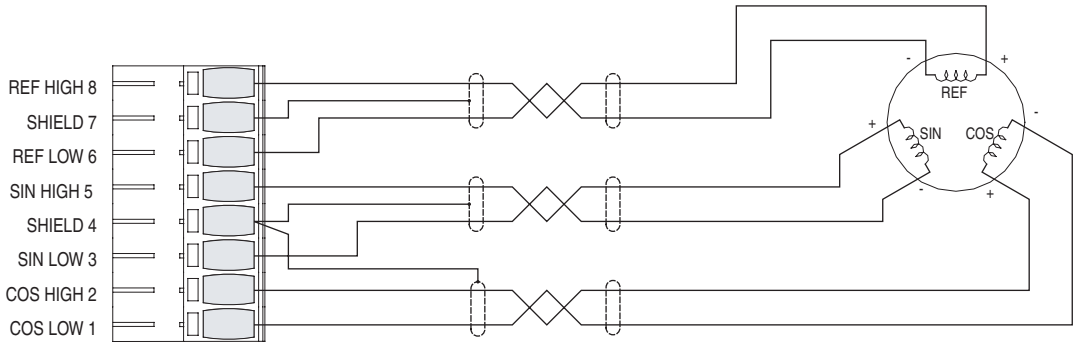
## Wiring the Resolver Feedback Option Card to a Resolver



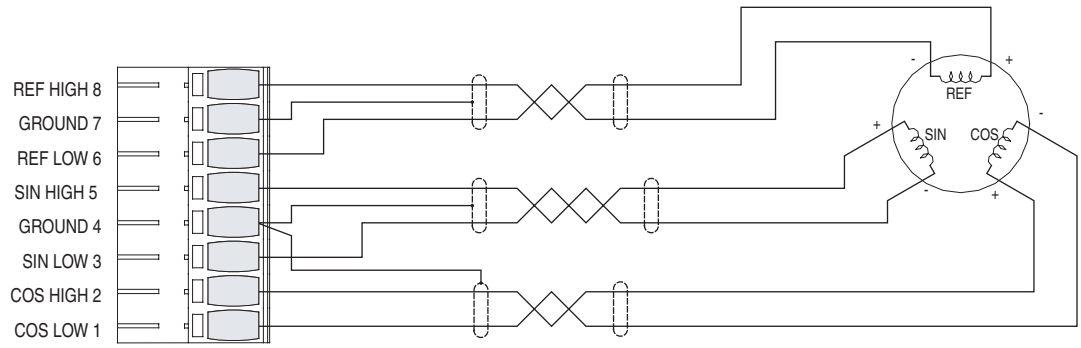

| Terminal | Signal | Description |
|---|---|---|
| 8 | REF HIGH | Positive Reference signal |
| 7 | SHIELD | Connection point for resolver cable shield |
| 6 | REF LOW | Negative Reference signal |
| 5 | SIN HIGH | Positive Sine signal |
| 4 | SHIELD | Connection point for resolver cable shield |
| 3 | SIN LOW | Negative Sine signal |
| 2 | COS HIGH | Positive Cosine signal |
| 1 | COS LOW | Negative Cosine signal |

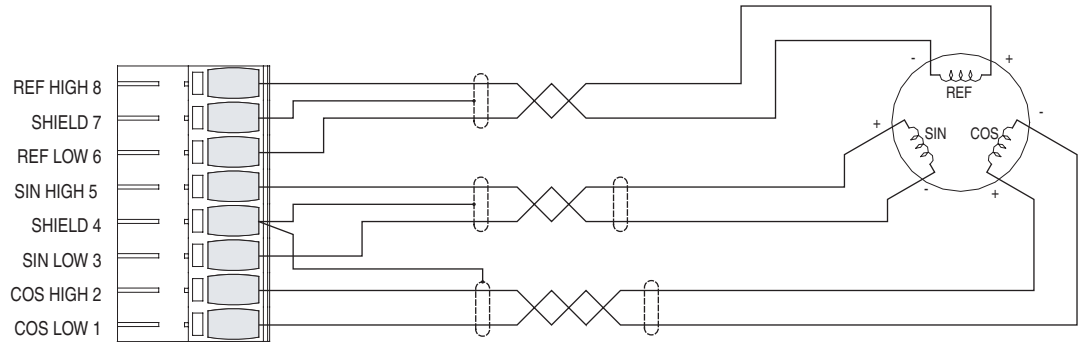
## Connection Examples

Resolver Interface - Clockwise Rotation = Count Up




Resolver Interface - Clockwise Rotation = Count Down (Reverse Polarity of Sine or Cosine Signals)



# PowerFlex 700S Multi-Device Interface Option Card

## Specifications

### MDI Option Card Specifications

| Consideration | Description |
|---|---|
| Rotary Encoder Voltage Supply | 11.5V dc @ 130 mA |
| Rotary Encoder Hi-Resolution Feedback | Sine/Cosine 1V P-P Offset 2.5 |
| Rotary Encoder Maximum Cable Length | 90m (295 ft.) |
| Linear Encoder Maximum Cable Length | 245m (800 ft.) |
| Rotary Encoder RS-485 Interface | The MDI Option card obtains the following information via the Hiperface RS-485 interface shortly after power-up:<br>• Address<br>• Command Number<br>• Mode<br>• Number of turns<br>• Number of Sine/Cos cycles<br>• Checksum |
| Registration Inputs | high speed 12-24V DC sinking digital inputs |
| Customer-I/O plug (P1) | Allen-Bradley PN: S94274917<br>Weidmuller PN: 67601782 |

### Supported Linear Sensors

Temposonics® R-Series Linear sensors with MTS® part numbers ending in 1S2G1102 work with the MDI Option.

| Part Number Character | Characteristic |
|---|---|
| 1 | Input Voltage = +24VDC |
| S | SSI output |
| 2 | Data Length = 24 Bits |
| G | Output Format = Gray Code |
| 1 | Resolution = 0.005 mm |
| 1 | Performance = Standard |
| 02 | Scale Orientation = Forward-acting Synchronized |

## Supported Rotary Encoders

Please note that encoders must be ordered as "Single Ended". This will ensure that the RS-485 channel has the proper termination network installed at the factory.

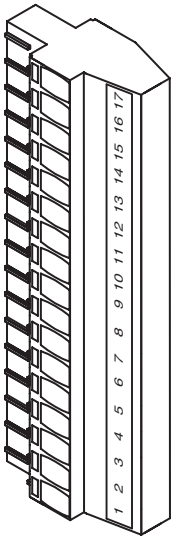
| Model | Resolution | Comment |
|---|---|---|
| SINCOS® SCS-60, SCS-70, SCM-60, and SCM-70 | 512 sine cycles per revolution. | SCM-60 and SCM-70 have built-in mechanical turns counter. |
| SINCOS® SCS-KIT-101 and SCM-KIT-101 | 1024 sine cycles per revolution. | SCM-60 and SCM-70 have built-in mechanical turns counter. |
| SINCOS® SRS-50, SRS-60, SRM-50, and SRM-60 | 1024 sine cycles per revolution. | SRM-50 and SRM-60 have built-in mechanical turns counter. |
| SINCOS® SRS/M 25 | 1024 sine cycles per revolution | SRS25 and SRM25 have built-in mechanical turns counter. IP65 Protection Class. Size 25 square flange mounting. |
| SINCOS® SRS660 | 1024 sine cycles per revolution | Hollow-shaft up to 14 mm diameter |
| SINCOS® SHS-170 | 512 sine cycles per revolution. | While the software supports this encoder, the SHS-170 draws excessive current and should only be used with an external power supply. |

SINCOS®, SINCODER® and LINCODER® are registered trademarks of Stegmann Inc.

## Recommended Cables

| If you are using this motor and feedback device: | Use this cable: | See this wiring diagram: |
|---|---|---|
| Temposonics R-Series Linear sensors with MTS part numbers ending in 1S2G1102 | Mating MTS molded extension cable for RG connector or integral P cable | Figure E.1 on page E-3 |
| Allen-Bradley 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with embedded Stegmann rotary encoder | Allen-Bradley 2090-CDNFDMP-SXX | Figure E.2 on page E-4 |
| Allen-Bradley MPL-A5xx and MPL-Bxxx motors motors with embedded Stegmann rotary encoder | Allen-Bradley 2090-CDNFDMP-SXX | Figure E.2 on page E-4 |
| Allen-Bradley 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with embedded Stegmann rotary encoder | Allen-Bradley 2090-XXNFMP-SXX | Figure E.3 on page E-4 |
| Allen-Bradley MPL-A5xx and MPL-Bxxx motors motors with embedded Stegmann rotary encoder | Allen-Bradley 2090-XXNFMP-SXX | Figure E.3 on page E-4 |
| Allen-Bradley MPL-A3xx - MPL-A45xx and all MPG series motors with embedded Stegmann rotary encoder | Allen-Bradley 2090-XXNFMP-SXX | Figure E.4 on page E-4 |
| Allen-Bradley MPL-A3xx - MPL-A45xx and all MPG series motors with embedded Stegmann rotary encoder | Allen-Bradley 2090-UXNFDMP-SXX | Figure E.5 on page E-5 |
| Any other motor with external Stegmann SHS-170 rotary encoder | Stegmann shielded twisted-pair cable with 12-pin DIN style connector | Figure E.6 on page E-5 |
| Any other motor with external Stegmann SCS-60, SCS-70, SCM-60 or SCM-70, SRS-50, SRS-60, SRM-60, SRM-60, SRS-25 or SRM-25 rotary encoder | Stegmann shielded twisted-pair cable with 10-pin MS style connector | Figure E.7 on page E-5 |
| Any other motor with external Stegmann SCS-Kit 101 or SCK-Kit 101 rotary encoder | Stegmann shielded twisted-pair cable with 8-pin Berg style connector | Figure E.8 on page E-6 |
| Any other motor with external Stegmann SRS660 rotary encoder | Is available only with pre-attached Stegmann shielded twisted-pair cable of various lengths | Figure E.9 on page E-6 |

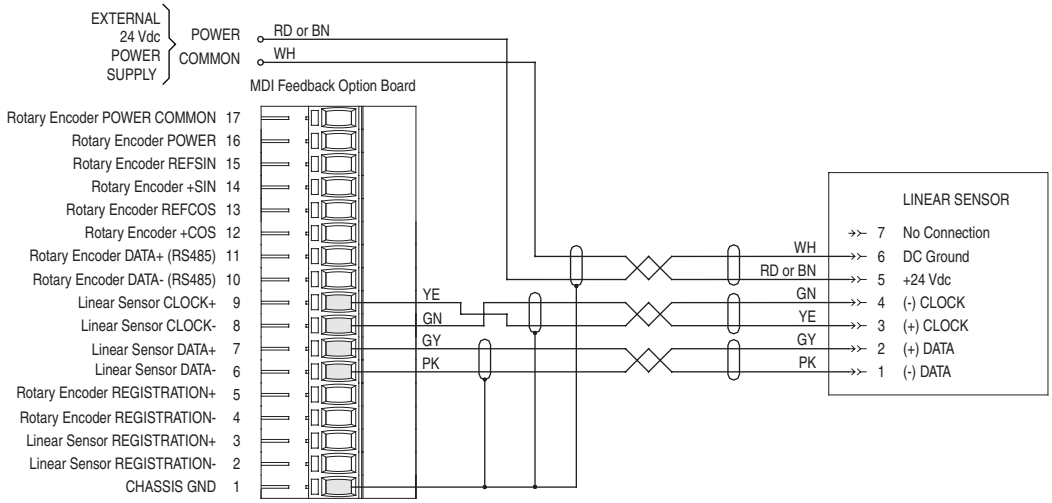
## Wiring the MDI Option




| Terminal | Signal | Description |
|---|---|---|
| 17 | Rotary Encoder POWER COMMON | Power supply for Rotary Encoder interface |
| 16 | Rotary Encoder POWER | |
| 15 | Rotary Encoder REFSIN | Positive Sine signal for Rotary Encoder interface |
| 14 | Rotary Encoder +SIN | Negative Sine signal for Rotary Encoder interface |
| 13 | Rotary Encoder REFCOS | Negative Cosine signal for Rotary Encoder interface |
| 12 | Rotary Encoder +COS | Positive Cosine signal for Rotary Encoder interface |
| 11 | Rotary Encoder DATA+ (RS485) | Positive DH485 terminal for Rotary Encoder interface |
| 10 | Rotary Encoder DATA- (RS485) | Negative DH485 terminal for Rotary Encoder interface |
| 9 | Linear Sensor CLOCK+ | Positive Clock terminal for Linear Sensor interface |
| 8 | Linear Sensor CLOCK- | Negative Clock terminal for Linear Sensor interface |
| 7 | Linear Sensor DATA+ | Positive SSI terminal for Linear Sensor interface |
| 6 | Linear Sensor DATA- | Negative SSI terminal for Linear Sensor interface |
| 5 | Rotary Encoder REGISTRATION+ | Positive terminal for Rotary Encoder registration strobe |
| 4 | Rotary Encoder REGISTRATION- | Negative terminal for Rotary Encoder registration strobe |
| 3 | Linear Sensor REGISTRATION+ | Positive terminal for Linear Sensor registration strobe |
| 2 | Linear Sensor REGISTRATION- | Negative terminal for Linear Sensor registration strobe |
| 1 | CHASSIS GND | Connection point for cable shields |

### Connection Examples

**Figure E.1 Linear Sensor connections with MDI RG connector or P integral cable**



## Connection Examples

**Figure E.2 Rotary Encoder connections for MPL-A5xx and MPL-Bxxx motors or 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with 2090-CDNFDMP-SXX cable**

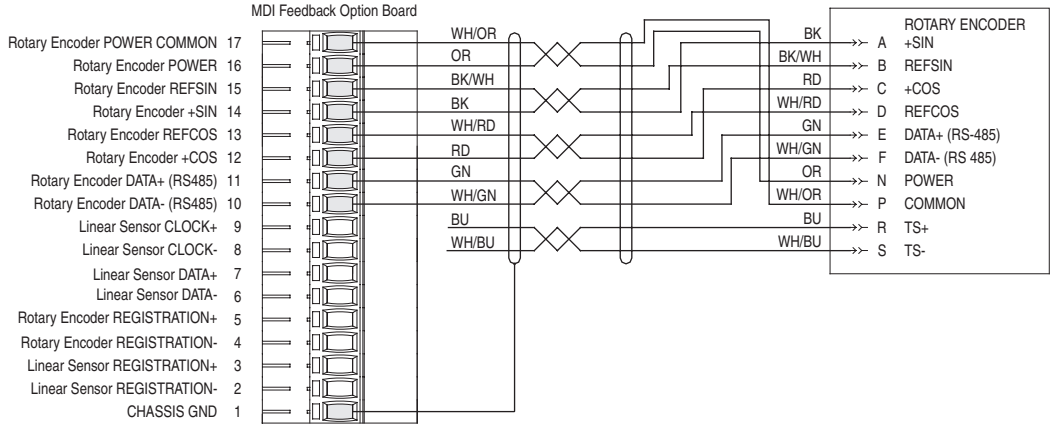
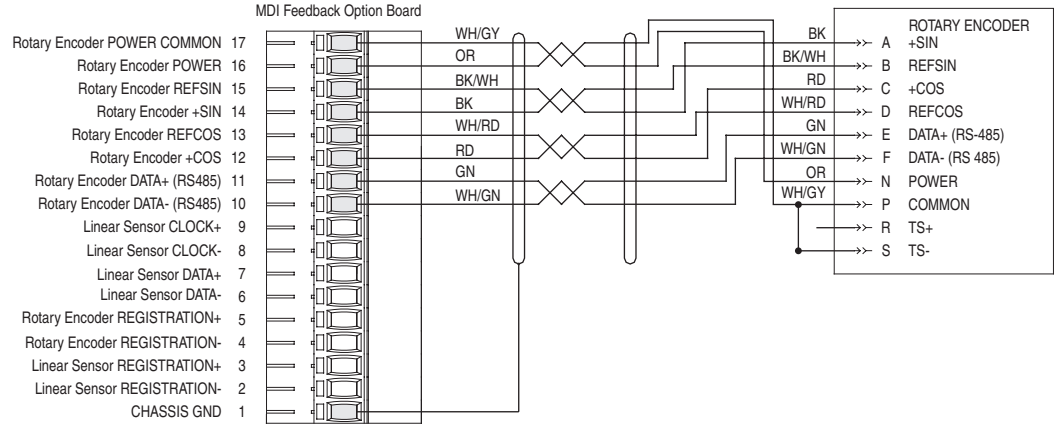
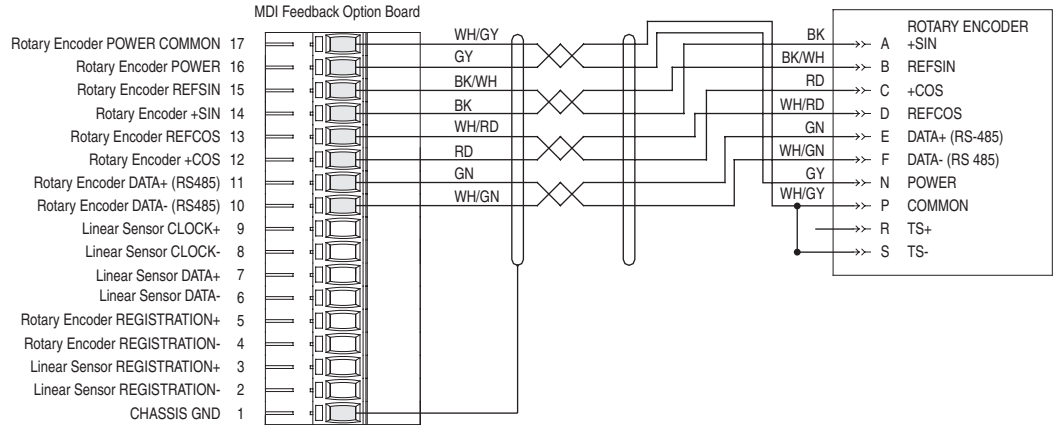



**Figure E.3 Rotary Encoder connections for MPL-A5xx and MPL-Bxxx motors or 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with 2090-XXNFMP-SXX cable**




**Note**: Thermal Switch cannot be accessed using 2090-XXNFMP-SXX cable.

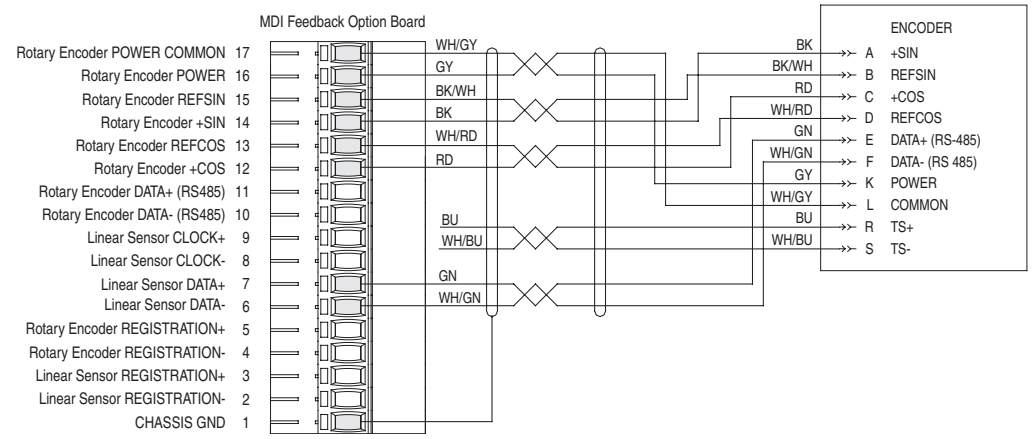
**Figure E.4 Rotary Encoder connections for MPL-A3xx - MPL-A45xx and all MPG series motors with 2090-XXNFMP-SXX cable**



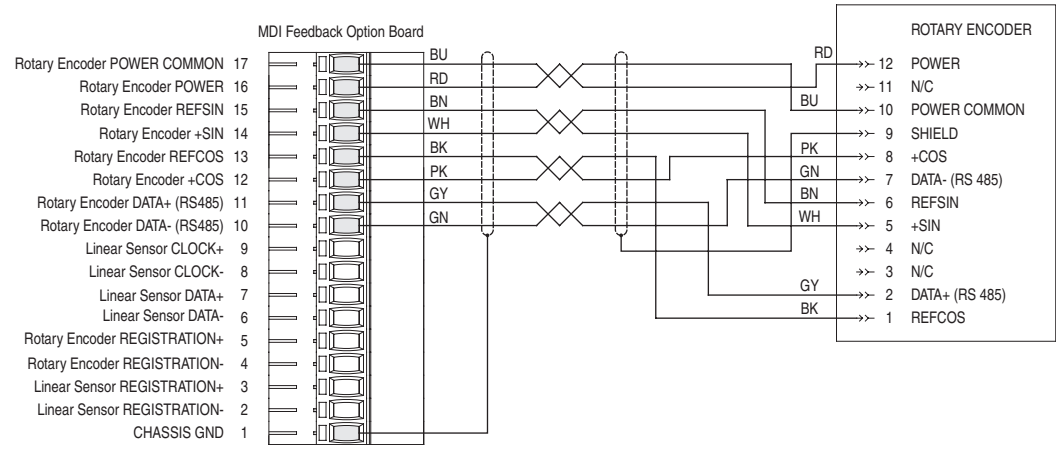

**Note**: Thermal Switch cannot be accessed using 2090-XXNFMP-SXX cable.

## Connection Examples

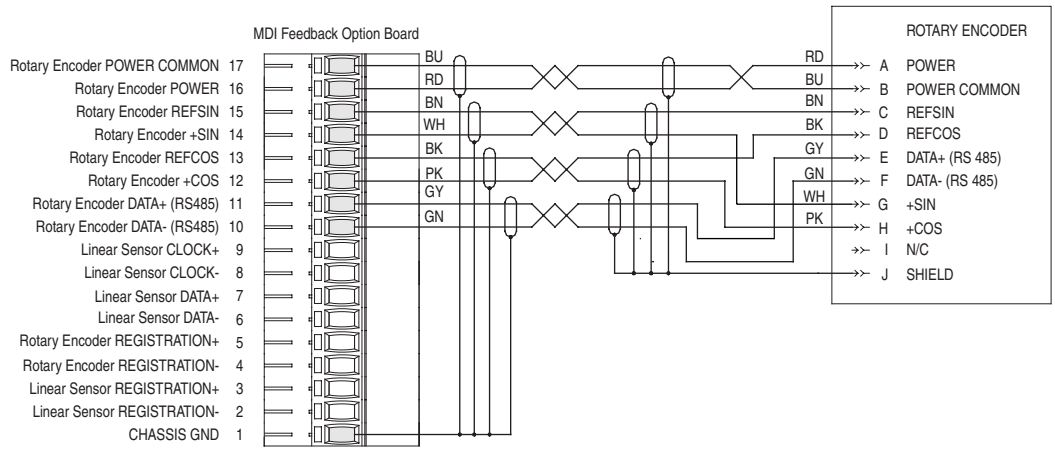
### Figure E.5 Rotary Encoder connections for MPL-A3xx - MPL-A45xx and all MPG series motors with 2090-UXNFDMP-SXX cable




### Figure E.6 Stegmann shielded twisted-pair cable with 12-pin DIN style connector

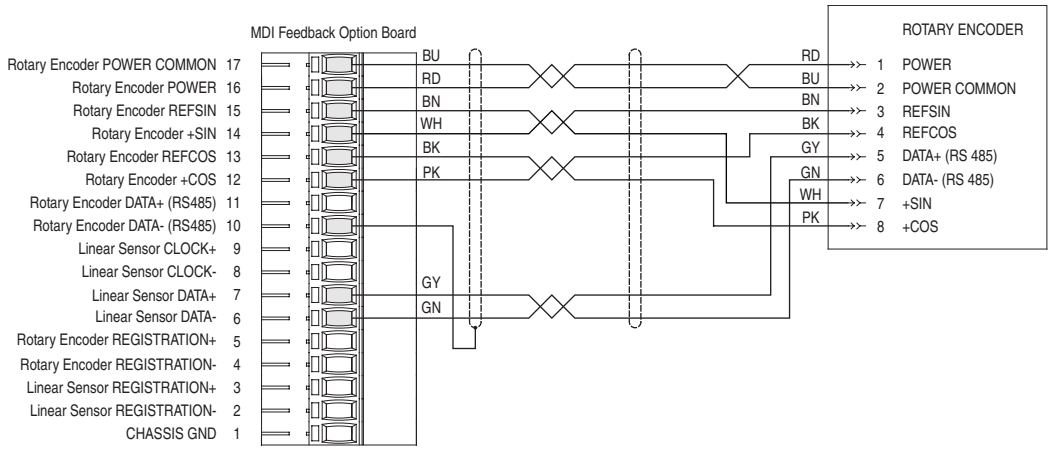



### Figure E.7 Rotary Encoder connections with Stegmann shielded twisted-pair cable and 10-pin MS style connector

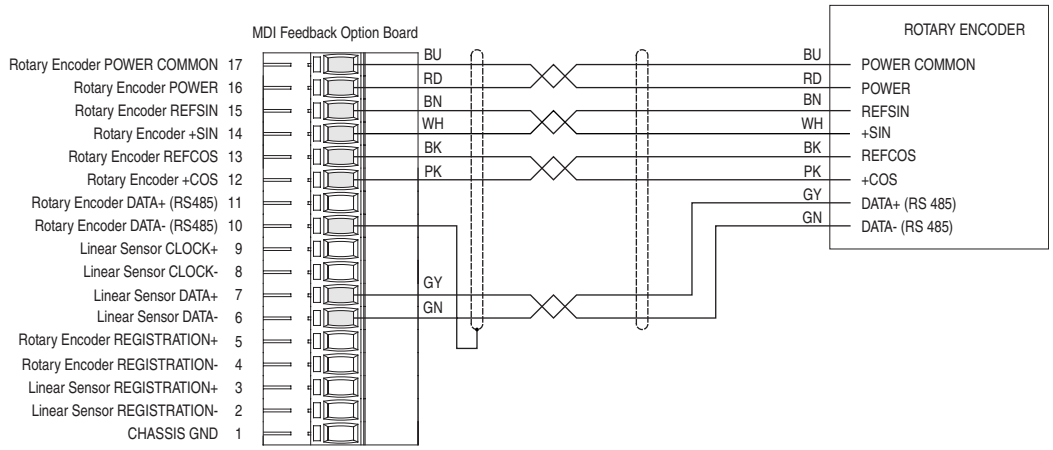


## Connection Examples

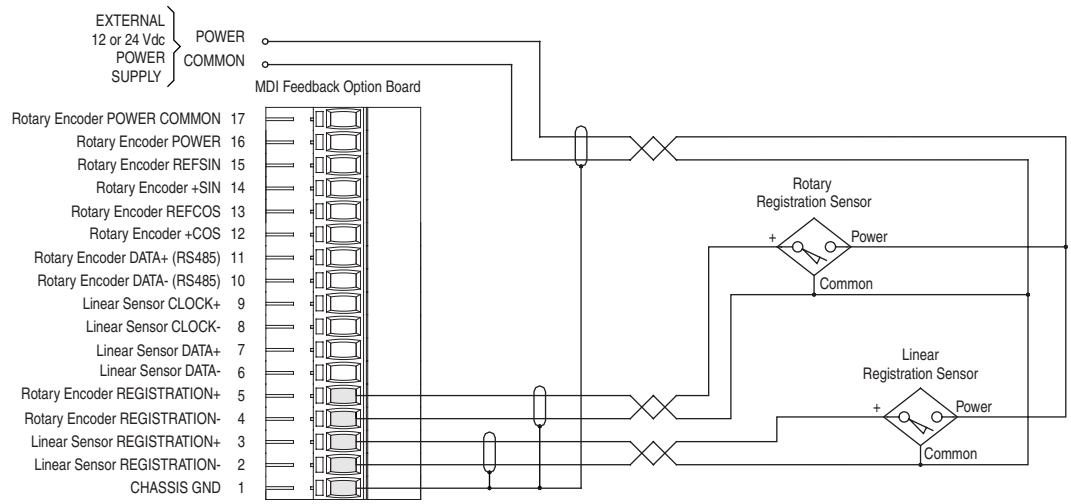
### Figure E.8 Rotary Encoder connections with Stegmann shielded twisted-pair cable and 8-pin Berg style connector




### Figure E.9 Rotary Encoder connections with Stegmann pre-attached shielded twisted-pair cable




### Figure E.10 Registration Sensor connection



# Instructions for ATEX Approved PowerFlex 700H Drives in Group II Category (2) Applications with ATEX Approved Motors

## General Information

This document provides information on operation of an ATEX[1] Approved drive and ATEX approved motor. The motor is located in a defined hazardous environment, while the drive is not. A protective system is required to stop current flow to the motor when an over temperature condition has been sensed in the motor. When sensed, the drive will go into a stop condition. To restart the drive, the over temperature condition must be resolved, followed by a valid start command to the drive. The PowerFlex 700H drive must have the 20C-DG1 option board installed in slot B of the control assembly for ATEX applications. Refer to 700H Control Circuit Board Designations on page 2-2 for more information.

The drive is manufactured under the guidelines of the ATEX directive 94/9/EC. These drives are in Group II Category (2) Applications with ATEX Approved Motors. Certification of the drive for the ATEX group and category on its nameplate requires installation, operation, and maintenance according to the requirements found in this document and the appropriate Motor Instruction Manual(s).

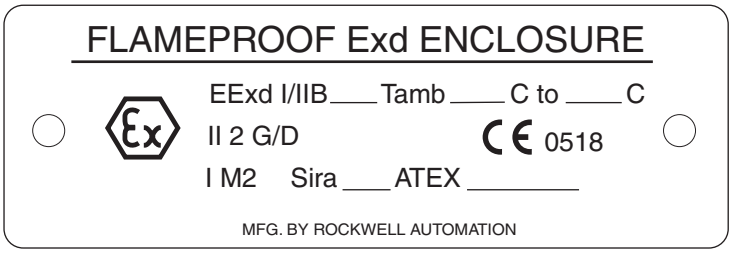
**ATTENTION:** Operation of this ATEX certified drive with an ATEX certified motor that is located in a hazardous environment requires additional installation, operation, and maintenance procedures beyond those stated in the standard user manual. Equipment damage and/or personal injury may result if all additional instructions in this document are not observed.

## Motor Requirements

- The motor must be manufactured under the guidelines of the ATEX directive 94/9/EC. It must be installed, operated, and maintained per the motor manufacturer supplied instructions.
- Only motors with nameplates marked for use on an inverter power source, and labeled for specific hazardous areas, may be used in hazardous areas on inverter (variable frequency) power.
- When the motor is indicated for ATEX Group II Category 2 for use in gas environments (Category 2G) the motor must be of flameproof construction, EEx d (according to EN50018) or Ex d (according to EN60079-1 or IEC60079-1). Group II motors are marked with a temperature or a temperature code.

(1) ATEX is the French acronym for “Atmosphères Explosibles” which translates to Explosive Atmospheres in English.

- When the motor is indicated for ATEX Group II Category 2 for use in dust environments (Category 2D) the motor must be protected by an enclosure (according to EN50281-1-1 or according to IEC61241-1: Ex tD). Group II motors are marked with a temperature.
- The motor over temperature signal supplied to the drive must be a normally closed contact (open during over temperature condition) compatible with the digital (logic) input circuitry of the drive. If multiple sensors are required in the motor, the connection at the drive must be the resultant of all required contacts wired in series.
- Refer to all product markings for additional cautions that may apply.
- Typical motor markings are contained on a motor certification nameplate similar to the sample below.

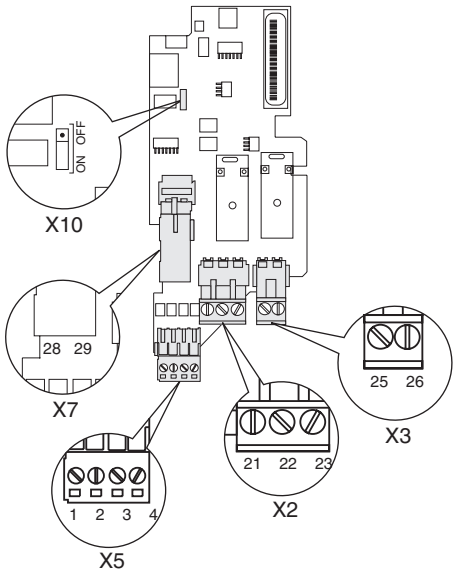



## Drive Wiring

**Important:** ATEX certification of this drive requires that two separate inputs be configured to monitor a normally closed over temperature contact (or multiple contacts wired in series) presented to the drive from the motor.

The first input must energize the SD1 input (terminals X5-1 & X5-2) on the drive option board (20C-DG1). The second input must energize the SD2 input (terminals X5-3 & X5-4) on the option board. This option board must be installed in the drive for ATEX applications. It is offered with 24V DC input only. Both input signals are wired with respect to the drive's digital input common when using a control board with 24V I/O. Refer to Figure 2.2 on page 2-3 for wiring examples. Motor supplied contacts must have ratings compatible with the input circuit ratings and applied voltage level of the drive.

**Table F.A Terminal Descriptions**




| Term. Blk. | No. | Signal | Description |
|---|---|---|---|
| X5 | 1 | SD1+ | Isolated Disable input 1 +24V +/-20% 10... 15mA |
| | 2 | SD1– | Virtual GND 1 |
| | 3 | SD2+ | Isolated Disable input 2 +24V +/-20% 10... 15mA |
| | 4 | SD2– | Virtual GND 2 |
| X2 | 21 | Digital Out 1 - N.C. | Max. Resistive Load:<br>240V ac / 30V dc - 1200VA, 150W<br>Max. Current: 5A, Min. Load: 10mA<br>Max. Inductive Load:<br>240V ac / 30V dc - 8400VA, 105W<br>Max. Current: 3.5A, Min. Load: 10mA |
| | 22 | Digital Out 1 Common | |
| | 23 | Digital Out 1 - N.O. | |
| X3 | 25 | Digital Out 2 Common | |
| | 26 | Digital Out 2 N.O. | |
| X7 | 28 | TI1+ | Thermistor input: $R_{trip} \geq 4.0\ k\Omega$ (PTC) |
| | 29 | TI1– | |

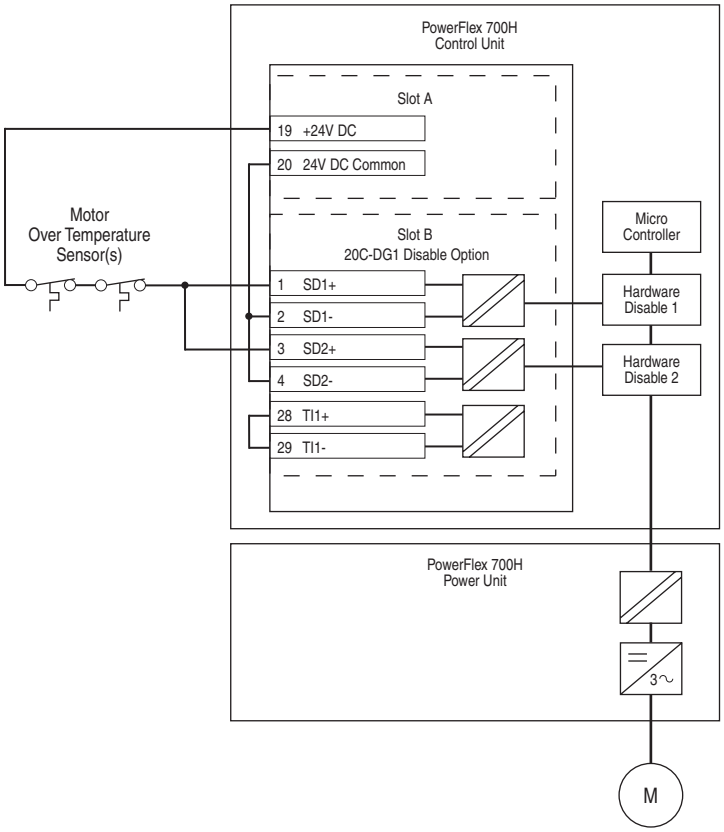
**Important:** The drive will not run unless one of the following conditions is met:

– A wire must be installed in the hardware thermistor input (X7-28 and X7-29) and the thermistor short circuit supervisor jumper X10 must be installed in the OFF position.

OR

– A thermistor must be installed in the hardware thermistor input (X7-28 and X7-29).

**Figure 1 Wiring Example - Internal 24V Power Supply**




## Configuration

The PowerFlex 700H drive can be configure in one of five ways when using the 20C-DG1 option board, each resulting in the drive being put into a Gate Disabled state when digital inputs are removed or the thermistor is out of range.

**1.** Gate Disable Fault (59):

Configured by setting bit 10 “Gate Disable” of parameter 238 [Fault Config1].

If both digital inputs open, the drive output will be disabled and the motor will coast to a stop. The drive HIM will display fault 59 “Gate Disable”.

When the condition is cleared, the fault can be reset and the drive can be restarted.

If only one digital input opens, the drive output will be disabled and the motor will coast to a stop. Refer to Table F.B on page F-6 for a description of drive conditions and actions.

2. Gate Disable Alarm (59):

   Configured by setting bit 15 “Gate Disable” of parameter 259 [Alarm Config1].

   If both digital inputs open, the drive output will be disabled and the motor will coast to a stop. The drive HIM will display alarm 59 “Gate Disable”.

   When the condition is cleared, the alarm will automatically clear in 10 seconds and the drive can be restarted.

   If only one digital input opens, the drive output will be disabled and the motor will coast to a stop. Refer to Table F.B on page F-6 for a description of drive conditions and actions.

3. Neither of the “Gate Disable” bits, 10 in parameter 238 [Fault Config1] or 15 in parameter 259 [Alarm Config1], are set.

   If both digital inputs open, the drive output will be disabled and the motor will coast to a stop. No fault or alarm indication will be given, but the Gate Disable status can be seen in bit 0 “Gate Disable” of parameter 359 [20C-DG1 Status].

   When the condition is cleared, the drive can be restarted after 3 seconds.

   If only one digital input opens, the drive will be disabled and the motor will coast to a stop. Refer to Table F.B on page F-6 for a description of drive conditions and actions.

4. Both “Gate Disable” bits, 10 in [Fault Config1] and 15 in [Alarm Config1], are set:

   The Gate Disable fault takes precedence.

5. Thermistor Input:

   If the thermistor input goes out of range, the drive output will be disabled and the motor will coast to a stop. The drive will display fault 60 “Hrdwr Therm” on the drive HIM.

   When the condition is cleared, the fault can be reset and the drive can be restarted. This configuration requires that the two digital inputs remain closed to function.

## Removing the 20C-DG1 Option Board

During maintenance or service there may be a need to remove the 20C-DG1 option board.

The drive is designed to generate a non-resettable fault F10 “System Fault” if the option board is removed. The operator must manually change parameter 358 [20C-DG1 Remove] to 1- “Remove” and then back to 0 - “Ready” to clear and acknowledge the fault.

Once maintenance or service is completed and the 20C-DG1 option card has been reinstalled, the drive will recognize the option card on power-up.

## Verify Operation

At regular intervals during the life of the machine check the protective system for proper operation. Both channels shall be verified using the table below. How frequently the protective system is checked is dependent on the safety analysis of the machine section controlled by the drive.

**Table F.B Gate Disable Status and Verification**

| Protective System Status | Drive In Gate Disable State | Drive In Gate Disable State | Drive In Gate Disable State | Drive Able To Run |
|---|---|---|---|---|
| **Channel Operation** | | | | |
| **SD1** - terminals X5-1 & X5-2 Par 359 [20C-DG1 Status], bit 3 “No Enable CH1” | Bit 3 = 1 No Power Applied | Bit 3 = 0 Power Applied | Bit 3 = 1 No Power Applied | Bit 3 = 0 Power Applied |
| **SD2** - terminals X5-3 & X5-4 Par 359 [20C-DG1 Status], bit 4 “No Enable CH2” | Bit 4 = 1 No Power Applied | Bit 4 = 1 No Power Applied | Bit 4 = 0 Power Applied | Bit 4 = 0 Power Applied |
| **Description For Verification** | | | | |
| **PowerFlex 700H Drive Status** | **Output Disabled** | **Output Disabled** | **Output Disabled** | **Output Enabled** |
| Par 359 [20C-DG1 Status], Bit 0 “Gate Disable” or Bits 2 “Unexp In Pro” and 15 “Unexp HW Pro” | Bit 0 = 1 | Bit 2 = 1 Bit 15 = 1 | Bit 2 = 1 Bit 15 = 1 | Bit 0 = 0 |
| Fault or Alarm | F59 “Gate Disable” (Fault or Alarm Based on drive set up) | F10 “System Fault” | F10 “System Fault” | None |

## Numerics



## A



## B



## C

## D

## E



## F



## G



## H



## I

## L



## M



## N



## O



## P

## R



## S



## T

## U



## V



## W

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