Installation Instructions

Allen-Bradley

PowerFlex 700H Adjustable Frequency AC Drive and PowerFlex 700S High Performance AC Drive

Frames 9...14

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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.
	**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 consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	**ARC FLASH HAZARD:** Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

This manual contains new and updated information.

New and Updated Information

This table contains the changes made to this revision.

Topic	Page
Added enclosure code H "IP54, NEMA/UL Type 12" for PowerFlex 700S drives to the Enclosure options table.	12
Updated the list of manuals in the Additional Resources table.	17
Updated the DC Input Precharge Control Wiring information.	26
Added a new Auto/Manual example when using PowerFlex 700H firmware version 5.004.	42
Removed the chapter on Control Wiring for PowerFlex 700S Drives with Phase I Control	–
Removed the "Lifting and Mounting Instructions" appendix - updated all references to refer to the appropriate Lifting and Mounting publications shipped with the drives for current information.	–
Updated the recommended cable and wiring diagrams for the Stegmann Hi-Resolution Encoder Feedback Option Card to include new motor/cable combination.	186
Updated the recommended cable and wiring diagrams for the Multi-Device Interface Option Card to include new motor/cable combination.	196
Added Appendix F - History of Changes to contain all previous manual revision information.	209

Changes to this manual for previous revisions are included in Appendix F History of Changes on page 209.

Notes:

Chapter 7

Frame 11 Mechanical Installation

Chapter 8

Frame 12 Mechanical Installation

Chapter 9

Frame 13 Mechanical Installation

Chapter 10

Frame 14 Mechanical Installation

This manual provides information on mechanical installation and for connecting incoming power, the motor, and basic I/O to frame 9...14 PowerFlex 700H and 700S AC drives. The information provided is intended for qualified installers only. 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.

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…1900	132…1200
	525…690V	150…2400	160…2300
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	IP20, 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
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
	H	Rittal TS 8 Modular	IP54, NEMA/UL Type 12(1)	Single Door - Freestanding, Filters in Door and Roof Vent
	N	No enclosure	IP00, NEMA/UL Type Open	–

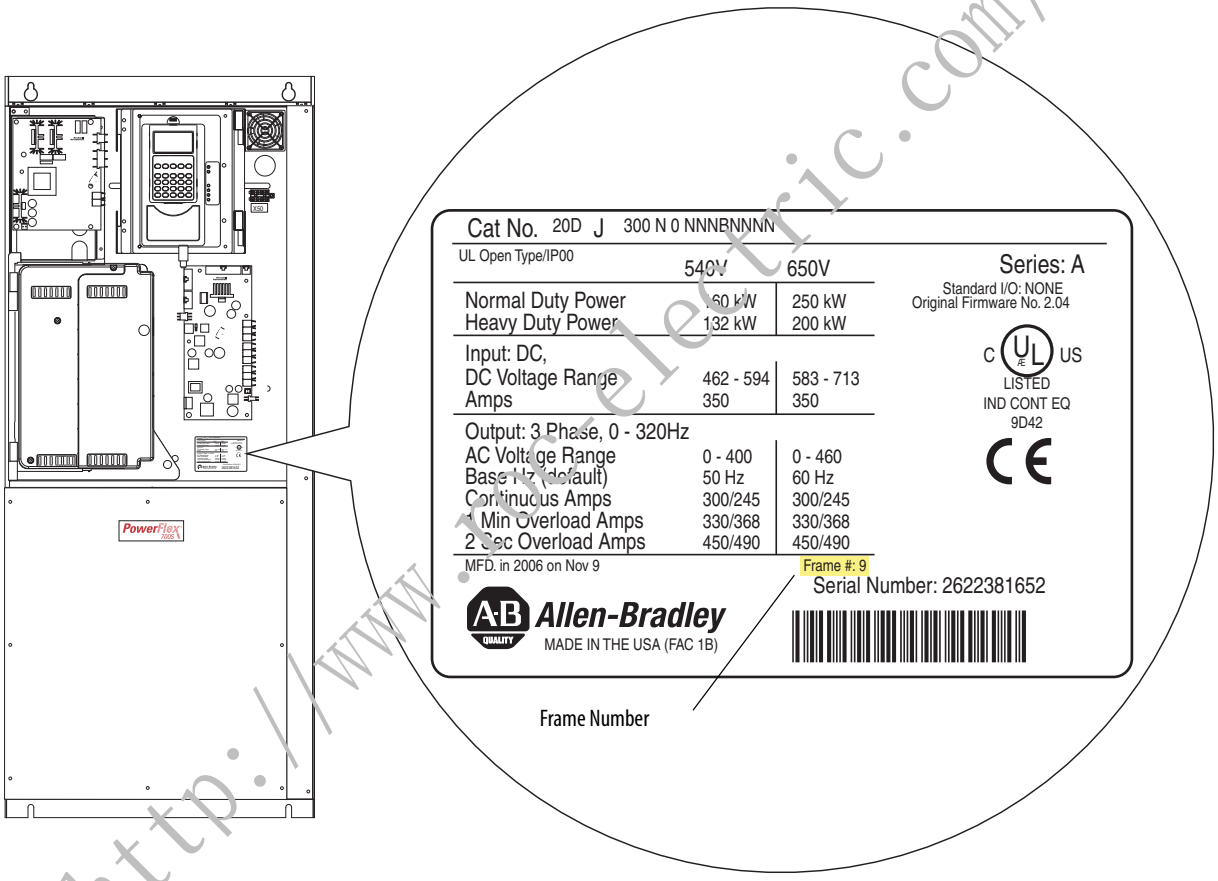
(1) For replacement filters, see the PowerFlex Architecture Class Spare Parts & Options list available at: http://www.ab.com/support/abdrives/powerflex70/PF7ReleasedParts.pdf

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 the following publications.

- PowerFlex 700H Adjustable Frequency AC Drive Technical Data, publication 20C-TD001
- PowerFlex 700S High Performance AC Drive - Phase II Control Technical Data, publication 20D-TD002

You can 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.



Conventions

- In this manual we see 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

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.

General Precautions, Continued

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.

- For PowerFlex 700H drives, 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).
- For PowerFlex 700S drives, 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.

- For PowerFlex 700H drives, 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).
- For PowerFlex 700S drives, 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.

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.
Wiring and Grounding Guidelines for pulse Width Modulated AC Drives, publication DRIVES-IN001	Provides basic information needed to properly wire and ground Pulse Width Modulated (PWM) AC drives.
Preventive Maintenance of Industrial Control and Drive System Equipment, publication DRIVES-TD001	Provides a checklist as a guide in performing preventive maintenance on industrial control and drive system equipment.
Safety Guidelines for the Application, Installation and Maintenance of Solid State Control, publication SGI-1.1	Provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solid state components.
A Global Reference Guide for Reading Schematic Diagrams, publication 100-2.10	Provides a simple cross-reference of common schematic/wiring diagram symbols used throughout various parts of the world.
Guarding Against Electrostatic Damage, publication 8000-4.5.2	Provides an explanation of the causes of Electrostatic Damage, and how you can guard against its effects.
PowerFlex 700H Adjustable Frequency AC Drive Technical Data, publication 20C-TD001	Provides detailed drive and option specifications, drive, fuse, and circuit breaker ratings, watts loss information, and derating guidelines.
PowerFlex 700S High Performance AC Drive - Phase II Control Technical Data, publication 20D-TD002	Provides detailed drive and option specifications, drive, fuse, and circuit breaker ratings, watts loss information, and derating guidelines.
PowerFlex 700S with Phase II Control Programming Manual, publication 20D-PM001	Provides information needed to start-up, program, and troubleshoot PowerFlex 700S Phase II adjustable frequency AC drives.
PowerFlex Reference Manual, publication PFLEX-RM003	Provides explanations of PowerFlex 700S drives with Phase II control functions and application programming in detail.
DriveGuard Safe Torque Off Option for PowerFlex 700S Phase II and 700L AC Drives, publication 20D-UM007	Provides information needed to plan, install and configure the DriveGuard Safe Torque Off option for PowerFlex 700S and 700L AC drives.
PowerFlex 700H Programming Manual, publication 20C-PM001	Provides information needed to start-up, program, and troubleshoot the PowerFlex 700H adjustable frequency AC drive.
PowerFlex 700H AC Drive Safe Torque Off Option User Manual, publication 20C-UM001	Provides information needed to plan, install and configure the Safe Torque Off option for PowerFlex 700H drives
PowerFlex 700H and 700S IP00 Open Power Structure, Frames 10…14 Installation Instructions, publication PFLEX-IN020	Provides instructions for the installation of PowerFlex 700S and 700H frames 10…14, IP00, NEMA/UL Type Open power structures in a customer supplied enclosure(s).
PowerFlex 700S and 700H Drives - Frame 9 Hardware Service Manual, publication PFLEX-TG001	Provides troubleshooting and repair information for PowerFlex 700S and 700H frame 9 AC drives.
PowerFlex 700S and 700H Drives - Frame 10 Hardware Service Manual, publication PFLEX-TG002	Provides troubleshooting and repair information for PowerFlex 700S and 700H frame 10 AC drives.
PowerFlex 700S and 700H Drives - Frame 11 Hardware Service Manual, publication PFLEX-TG003	Provides troubleshooting and repair information for PowerFlex 700S and 700H frame 11 AC drives.
PowerFlex 700S and 700H Drives - Frame 12 Hardware Service Manual, publication PFLEX-TG004	Provides troubleshooting and repair information for PowerFlex 700S and 700H frame 12 AC drives.
PowerFlex 700S and 700H Drives - Frame 13 Hardware Service Manual, publication PFLEX-TG005	Provides troubleshooting and repair information for PowerFlex 700S and 700H frame 13 AC drives.
PowerFlex 700S and 700H Drives - Frame 14 Hardware Service Manual, publication PFLEX-TG006	Provides troubleshooting and repair information for PowerFlex 700S and 700H frame 14 AC drives.

You can view or download publications at http:/www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Notes:

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 the drive Technical Data publications. See Additional Resources on page 17 for a list of technical publications for PowerFlex 700H and PowerFlex 700S drives.

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, see 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...	see:
Frame 9 drive	Ungrounded, Unbalanced or High Resistive Ground Installations on page 63
Frame 10 drive	Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations on page 79
Frame 11 drive	Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations on page 93
Frame 12 drive	Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations on page 109
Frame 13 drive	Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations on page 123
Frame 14 drive	Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations on page 141

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 in Table 1 on page 167 through Table 8 on page 174.

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.

See 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.

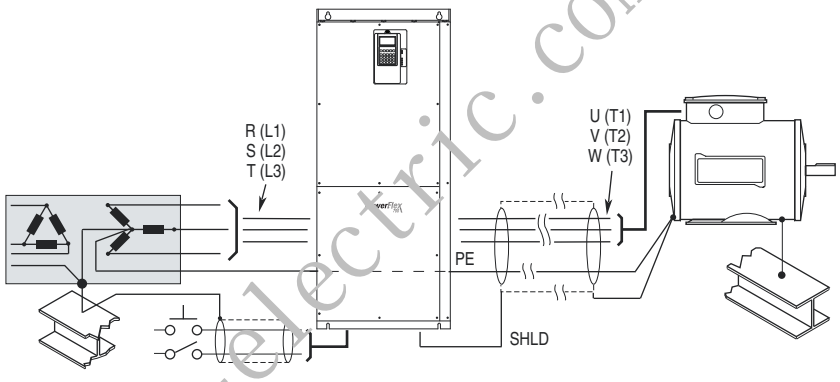
General Grounding Requirements

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 - 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. See 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. See Fuses and Circuit Breakers listed in Table 9 on page 176 through Table 16 on page 183.

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 the Technical Data publications for the drives.

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...	see:
a Frame 9 drive	Power Wiring on page 67
a Frame 10 drive	Power Wiring on page 84
a Frame 11 drive	Power Wiring on page 97
a Frame 12 drive	Power Wiring on page 114
a Frame 13 drive	Power Wiring on page 130
a Frame 14 drive	Power Wiring on page 149

Wire Recommendations

Type		Description	Min. Insulation Rating
Power (1)(2)	Standard	• Four tinned copper conductors with XLPE insulation. • Copper braid/aluminum foil combination shield and tinned copper drain wire. • PVC jacket.	600V, 75 °C (167 °F)

(1) Control and signal wires should be separated from power wires by at least 0.3 meters (1 foot).
(2) The use of shielded wire for AC input power may not be necessary but is always recommended.

Motor Considerations

Due to the operational characteristics of AC variable frequency drives, motors with inverter grade insulation systems designed to meet or exceed NEMA MG1 Part 31.40.4.2 standards for resistance to spikes of 1600 volts are recommended.

Guidelines must be followed when using non-inverter grade motors to avoid premature motor failures. Refer to Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-IN001 for recommendations.

Cable Trays and Conduit

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

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 (2006/95/EC)

- EN 61800-5-1 Adjustable speed electrical power drive systems – Part 5-1: Safety requirements – Electrical, thermal and energy.

EMC Directive (2004/108/EC)

- EN 61800-3 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 21.
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 2.

Table 2 - PowerFlex EN61800-3 EMC Compatibility

Frame	**Second Environment** *Restrict Motor Cable to 30 m (98 ft.)* *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

DC input drives do not have an internal precharge circuit. Therefore, the following must be provided.

- Precharge capability must be provided in the system to guard against possible damage.
- 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 and must be customer supplied.

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. See Figure 1 on page 27 for additional wiring information.

Table 3 - Frame 9 - X50 Terminal Block Connections

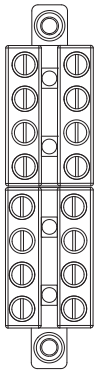
X50 Terminal Block	Terminal	Description
	1	Charge Relay Contact
	2	Charge Relay Contact
	5	Precharge Complete Signal (+24V DC)
	6	Precharge Complete Signal (Common)

Table 4 - Frames 10…14 - X50 Terminal Block Connections

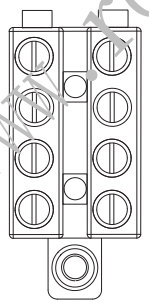
X50 Terminal Block	Frame	Terminal	Precharge Circuit Connection Description
	10, 11 & 13	21	Charge Relay Contact
		23	Charge Relay Contact
		25	Precharge Complete Signal (+24V DC)
		26	Precharge Complete Signal (Common)
	12 & 14	Power Structure 1	
		21	Charge Relay Contact
		23	Charge Relay Contact (Jumper to Power Structure 2 Terminal 21)
		25	Precharge Complete Signal (+24V DC)
		26	Precharge Complete Signal (Common)
		Power Structure 2	
		21	Charge Relay Contact (Jumper to Power Structure 1 Terminal 23)
		23	Charge Relay Contact
		25	Precharge Complete Signal (+24V DC)
		26	Precharge Complete Signal (Common)

Table 5 - X50 Terminal Block Specifications (All Frame Sizes)

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.

Figure 1 - Frame 9 Sample Precharge Wiring Diagram

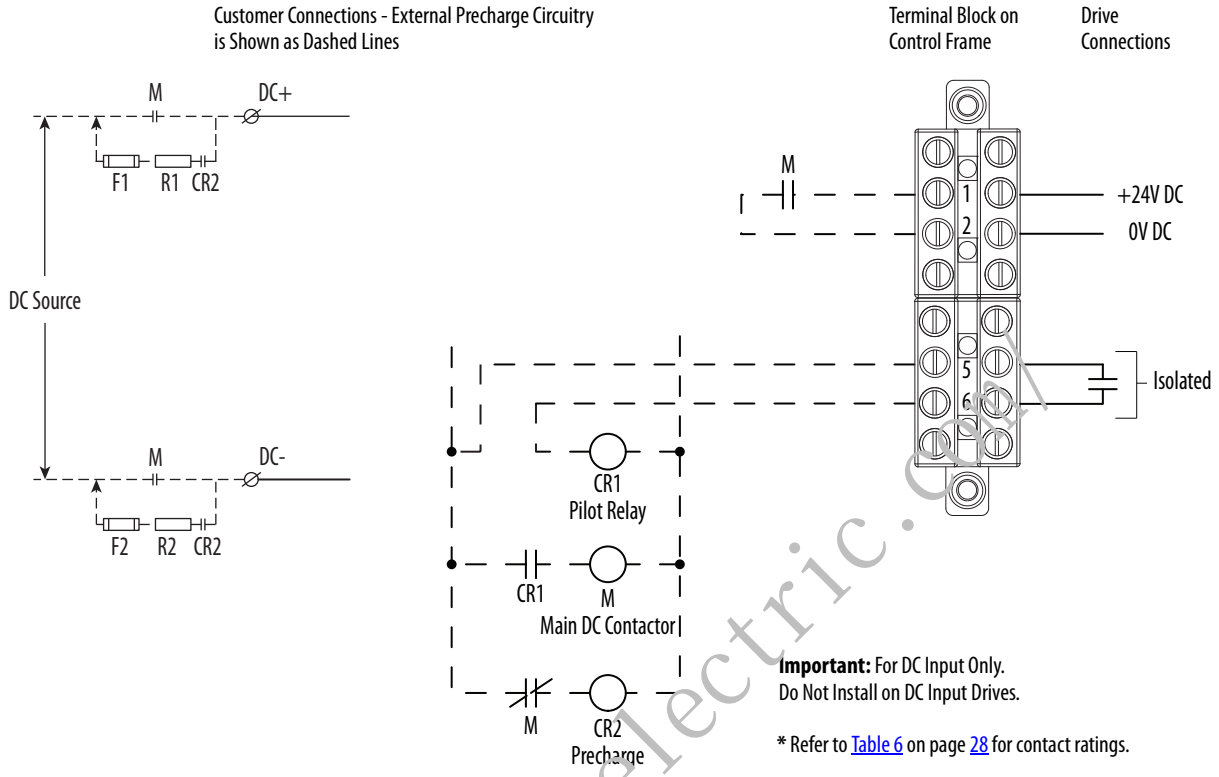


Figure 2 - Frames 10, 11 and 13 Sample Precharge Wiring Diagram

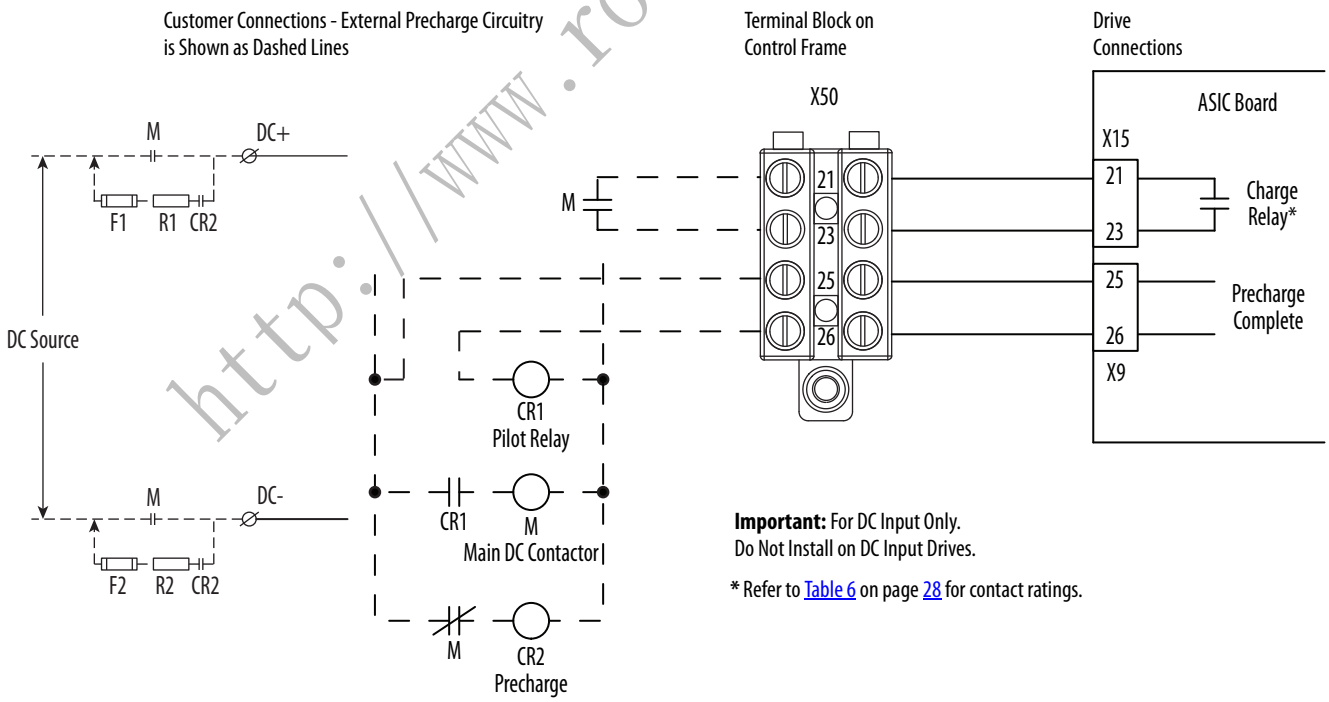
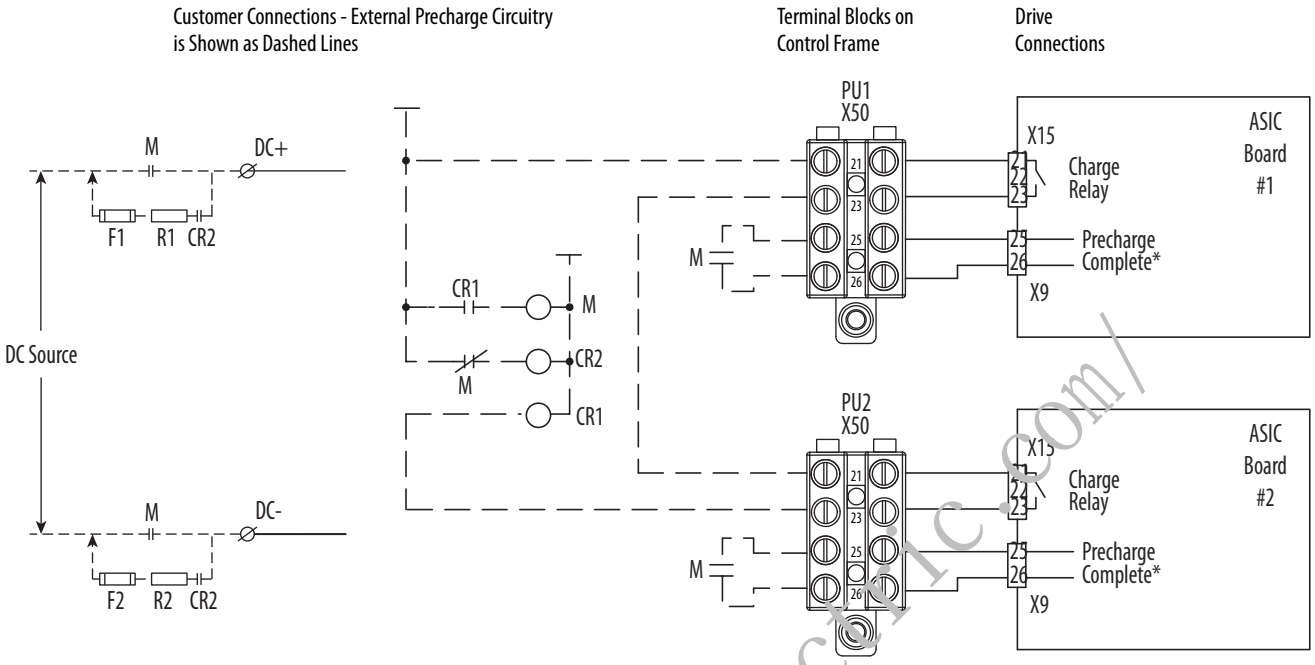


Figure 3 - Frames 12 and 14 Sample Precharge Wiring Diagram



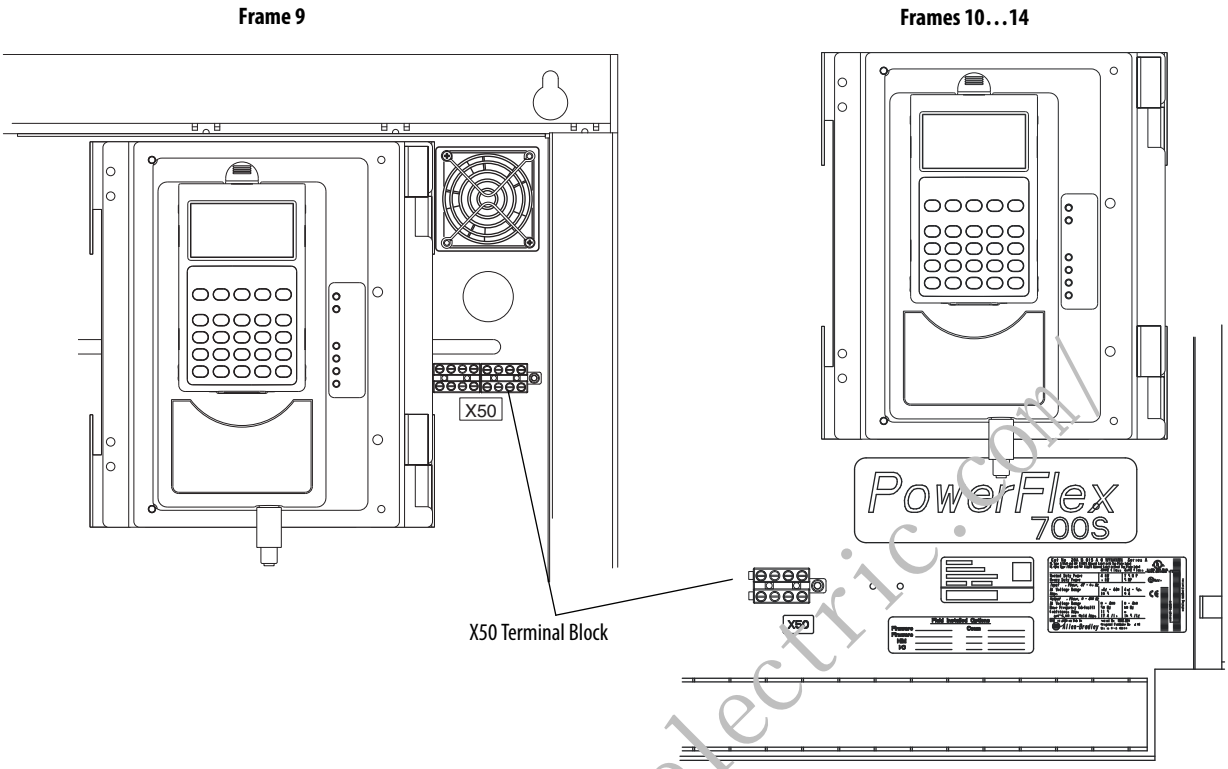
Important: For DC Input Only. Do Not Install on DC Input Drives.

* Refer to Table 6 below for contact ratings.

Table 6 - ASIC Board Charge Relay Contact Ratings

Load	Resistance load (cos ϕ = 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)
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.)

Figure 4 - X50 Terminal Block Locations



Notes:

Control Wiring for PowerFlex 700H Drives

Important points to remember about I/O wiring:

- Always use copper wire.
- Wire gauge requirements and recommendations are based on 75 °C. Do not reduce wire gauge when using higher temperature 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 36). In addition, configuring an analog input for 0…20 mA 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.

Table 7 - Recommended Control Wire

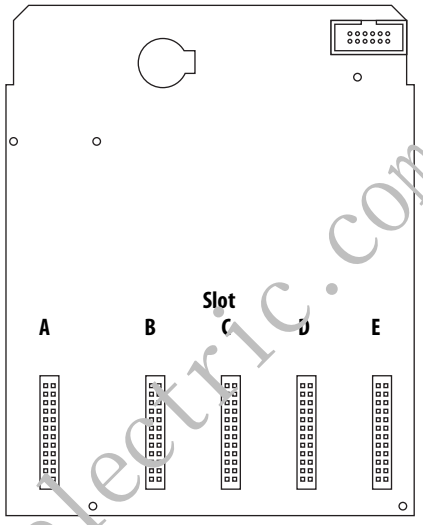
Type		Wire Type	Description	Min. Insulation Rating
Signal (1)(2)	Standard Analog I/O	–	0.750 mm^2 (18 AWG), twisted pair, 100% shield with drain.	300V, 75…90 °C (167…194 °F)
	Remote Pot	–	0.750 mm^2 (18 AWG), 3 conductor, shielded.	
Digital I/O **Safety Inputs** **Homing Input** (1)(2)	Un-shielded	–	Per US NEC or applicable national or local code.	300V, 60 °C (140 °F)
	Shielded	Multi-conductor shielded cable	0.750 mm^2 (18 AWG), 3 conductor, shielded.	

(1) Control and signal wires must be separated from power wires by at least 0.3 meters (1 foot).
(2) 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.

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 5 - 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 8 - 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

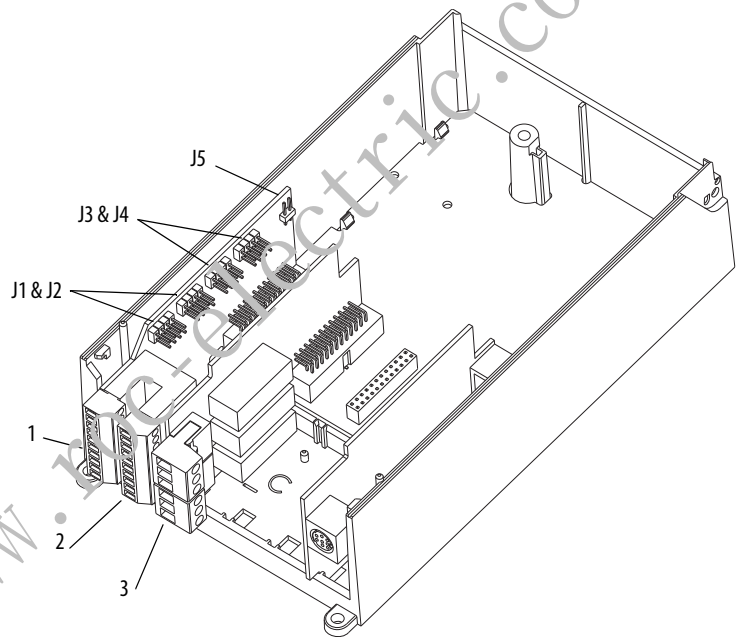
(1) See Appendix E, Instructions for ATEX Approved PowerFlex 700H Drives in Group II Category (2) Applications with ATEX Approved Motors on page 203 and the PowerFlex 700H AC Drive Safe Torque Off Option User Manual, publication 20C-UM001, for more information on installing and configuring the Gate Disable 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 6 - PowerFlex 700H I/O Terminal Blocks and Jumpers



I/O Terminal Blocks and Jumpers

I/O Terminal Blocks

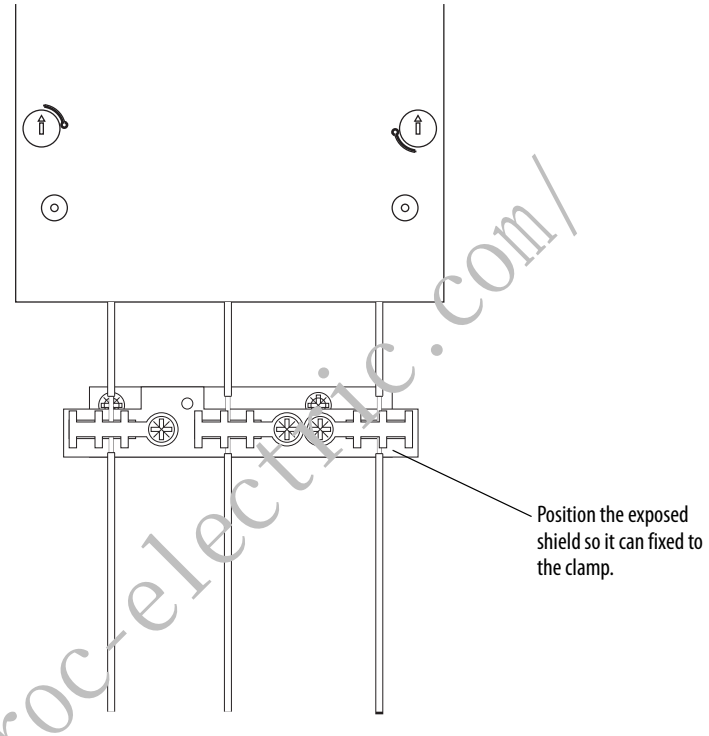
Table 9 - I/O Terminal Block Specifications

No.	Name	Description	Wire Size Range[1]		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	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) Maximum/minimum that the terminal block will accept - these are not recommendations.

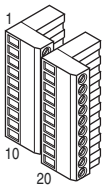
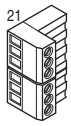
I/O Cable Grounding

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.

Table 10 - 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, 88 kΩinput impedance. A jumper (page 36) selects: 0…10V, ±10V, 0…20 mA. Default: 0…10V (Ri =200k), 4…20 mA (Ri=100 Ω).	320…327
	2	Analog Input 1 (+) (1)			
	3	Analog Input 2 (–) (1)			
	4	Analog Input 2 (+) (1)			
	5	–10V Pot Reference	–	2 kΩminimum, 10 mA maximum load, 1% accuracy.	
	6	Pot Common (GND)		For (+) and (–) 10V pot references.	
	7	+10V Pot Reference	–	2 kΩminimum, 10 mA maximum load, 1% accuracy.	
	8	Analog Output 1 (+)	(2)	Bipolar (current out is not bipolar), 9 bit and sign, 2 kΩminimum load. A jumper (page 36) selects: 0…10V, ±10V, 0…20 mA.	340…347
	9	Analog Output Common			
	10	Analog Output 2 (+)			
	11	Digital Input 1	Stop - CF	115V AC, 50/60 Hz - Opto isolated Low State: less than 30V AC High State: greater than 40V AC 24V DC - Opto isolated (250V) Low State: less than 5V DC High State: greater than 20V DC 11.2 mA DC Enable: Digital Input 6 is jumper selectable for HW Enable (see page 36). On-Time: < 16.7 ms, Off-Time < 1 ms	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	Speed Sel 3		
	17	Digital Input Common		Allows source or sink operation. Terminals 17, 18 and 19 can also be used to provide backup power to DPI and control devices.	
	18				
	19	+24V DC (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: 240V AC/30V DC – 1200VA, 150 W Max. Current: 5 A, Min. Load: 10 mA Max. Inductive Load: 240V AC/30V DC – 840VA, 105 W Max. Current: 3.5 A, Min. Load: 10 mA	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. See page 36.

(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) 150 mA 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. See page 36.

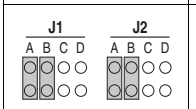
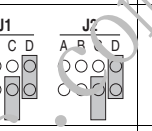
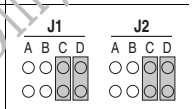
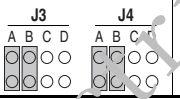
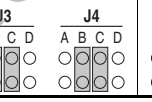
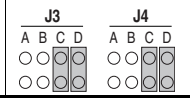
(5) Contacts in un-powered state. Any relay programmed as Fault or Alarm will energize (pick up) when power is applied to drive and de-energize (drop out) when a fault or alarm exists. Relays selected for other functions will energize only when that condition exists and will de-energize when condition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

Analog I/O Configuration

IMPORTANT Analog I/O must be configured through programming, as well as the jumpers shown below. See the PowerFlex 700H Adjustable Frequency AC Drive Programming Manual, publication 20C-PM001.

See Figure 6 on page 33 for the location of the jumpers indicated in the table below.

Table 11 - I/O Configuration

Signal	Jumper	Setting		
Analog Inputs	J1 (Analog In 1) J2 (Analog In 2)	0…20 mA	0…10V	±10V
				
Analog Outputs	J3 (Analog Out 1) 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 (see table below) and wiring the enable input to digital input 6. Verify that parameter 366 [Digital In6 Sel] is set to "1-Enable".

Table 12 - Hardware Enable Configuration

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

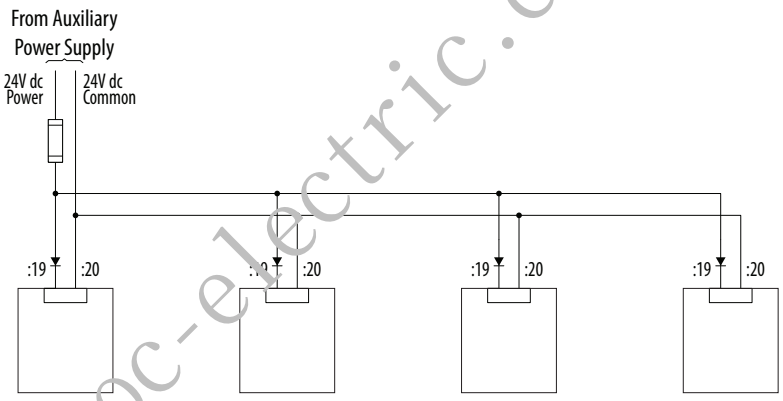
Auxiliary Power Supply

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.

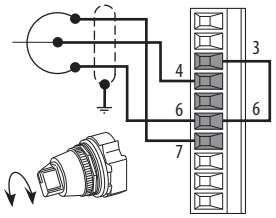
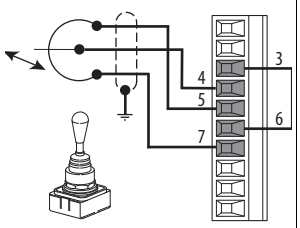
Table 13 - Auxiliary Power Supply Specifications

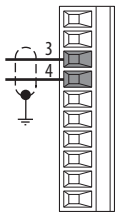
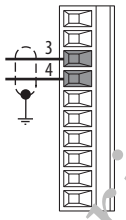
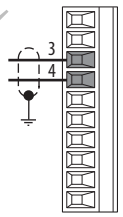
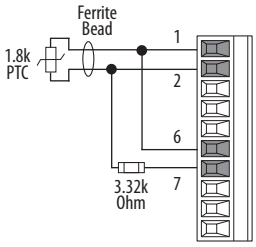
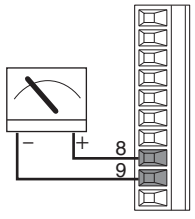
Voltage	Current (Min)	Current (Max)
24V DC ± 15%	150 mA	250 mA

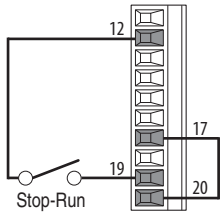
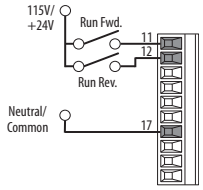
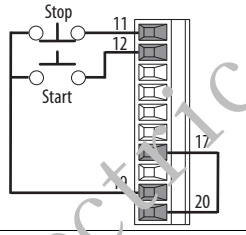
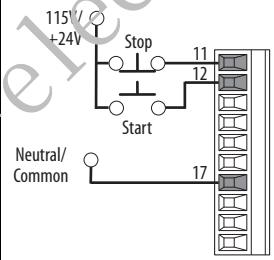
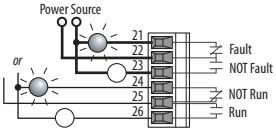
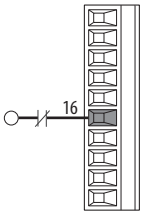
If 24V terminals of several drives are connected in parallel, it is recommend that a diode circuit to block current flow in the opposite direction is used. Reverse current flow could damage the control board.



I/O Wiring Examples

Input/Output	Connection Example	Required Parameter Changes
Potentiometer Unipolar Speed Reference 10k ΩPot. Recommended (2 kΩMinimum)		• Set I/O configuration (see Analog I/O Configuration on page 36). • Adjust Scaling: Parameters 91 [Speed Ref A Hi] / 92 [Speed Ref A Lo] and 325 [Analog In 2 Hi] / 326 [Analog In 2 Lo] • View Results: Parameter 002 [Commanded Speed]
Joystick Bipolar Speed Reference ±10V Input **Important:** See the Attention statement on page 31 for important information on bipolar wiring.		• Set I/O configuration (see Analog I/O Configuration on page 36). • Set parameter 190 [Direction Mode] = 1 "Bipolar" • Adjust Scaling: Parameters 91 [Speed Ref A Hi] / 92 [Speed Ref A Lo] and 325 [Analog In 2 Hi] / 326 [Analog In 2 Lo] • View Results: Parameter 002 [Commanded Speed]

Input/Output	Connection Example	Required Parameter Changes
Analog Input Bipolar Speed Reference ±10V Input **Important:** See the Attention statement on page 31 for important information on bipolar wiring.		• Set I/O configuration (see Analog I/O Configuration on page 36). • Set parameter 190 [Direction Mode] = 1 "Bipolar" • Adjust Scaling: Parameters 91 [Speed Ref A Hi] / 92 [Speed Ref A Lo] and 325 [Analog In 2 Hi] / 326 [Analog In 2 Lo] • View Results: Parameter 002 [Commanded Speed]
Analog Voltage Input Unipolar Speed Reference 0 to +10V Input		• Set I/O configuration (see Analog I/O Configuration on page 36). • Configure Input with parameter 320 [Anlg In Config] • Adjust Scaling: Parameters 91 [Speed Ref A Hi] / 92 [Speed Ref A Lo] and 325 [Analog In 2 Hi] / 326 [Analog In 2 Lo] • View Results: Parameter 002 [Commanded Speed]
Analog Current Input Unipolar Speed Reference 4…20 mA Input		• Set I/O configuration (see Analog I/O Configuration on page 36). • Configure Input for Current: Parameter 320 [Anlg In Config] and add jumper at appropriate terminals • Adjust Scaling: Parameters 91 [Speed Ref A Hi] / 92 [Speed Ref A Lo] and 325 [Analog In 2 Hi] / 326 [Analog In 2 Lo] • View Results: Parameter 002 [Commanded Speed]
Analog Input, PTC 0-10V Input PTC OT set > 5V PTC OT cleared < 5V PTC Short < 0.2V		• Set I/O configuration (see Analog I/O Configuration on page 36). • Configure Analog Input for PTC function: Set parameter 259 [Alarm Config 1] bit 14 "PTC Config" = Enabled • Configure Analog Input for Fault when input goes below 0.2V: Set parameter 324 [Analog In 1 Loss] = 1 "Fault" • Enable Fault: Set parameter 238 [Fault Config 1] bit 7 "Motor Therm" = Enabled • Enable Alarm: Set parameter 259 [Alarm Config 1], bit 11 "Motor Therm" = Enabled
Analog Output ±10V, 4…20 mA Bipolar +10V Unipolar *(shown)*		• Set I/O configuration (see Analog I/O Configuration on page 36). • Configure with Parameter 340 [Anlg Out Config] • Select Source Value: Parameter 384 [Digital Out1 Sel] • Adjust Scaling: Parameters 343 [Analog Out1 Hi] / 344 [Analog Out1 Lo]

Input/Output	Connection Example	Required Parameter Changes
2-Wire Control Non-Reversing(1) 24V DC internal supply		• Disable Digital Input:#1: Parameter 361 [Digital In1 Sel] = 0 "Not Used" • Set Digital Input #2: Parameter 362 [Digital In2 Sel] = 7 "Run" • Set Direction Mode: Parameter 190 [Direction Mode] = 0 "Unipolar"
2-Wire Control Reversing(1) External supply (I/O board dependent)		• Set Digital Input:#1: Parameter 361 [Digital In1 Sel] = 8 "Run Forward" • Set Digital Input #2: Parameter 362 [Digital In2 Sel] = 9 "Run Reverse"
3-Wire Control Internal supply		• No Changes Required
3-Wire Control External supply (I/O Board dependent). Requires 3-wire functions only ([Digital In1 Sel]). Using 2-wire selections will cause a type 2 alarm.		• No Changes Required
Digital Output Relays shown in powered state with drive faulted. See Table 10 on page 35. Two relays at terminals 24…26.		• Select Source to Activate: Parameters 380 [Digital Out1 Sel] / 384 [Digital Out2 Sel]
Enable Input		• Configure with parameter 366 [Digital In6 Sel] For dedicated hardware Enable: Remove Jumper J5 (see page 36)

(1) **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 Sources

"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.

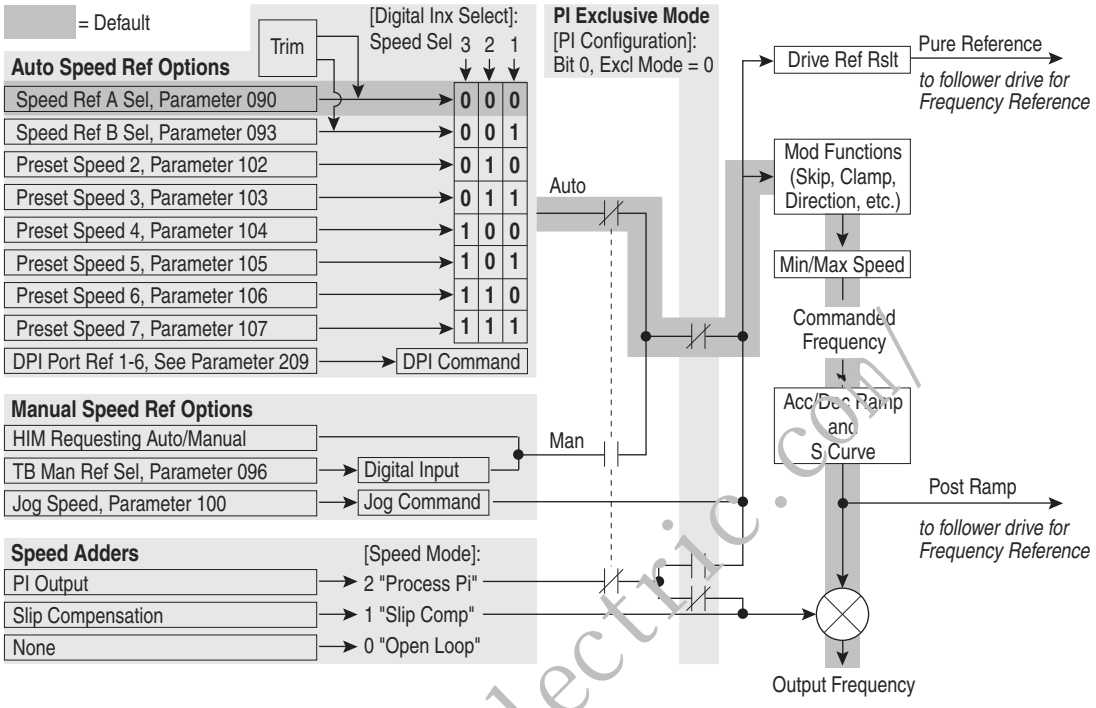
"Manual" Speed Sources

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 7 - 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 90 or 93 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 "Analog In 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 18 "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.

PLC = Auto, Terminal Block = Manual (HIM Control)

Note: This feature is only available for the 20-HIM-A3 / -A4-C3S / -C5S, Series B and PowerFlex 700H firmware v5.004 or higher.

This version of firmware allows you to configure the drive to switch smoothly from a communicated speed reference to local speed reference produced by the Human Interface Module (HIM). When the drive is commanded to switch from the automatic (communicated) speed reference to the manual reference via a digital input, it pre-loads the last value from the communicated reference into the HIM. Then you can then modify the manual reference on the HIM. This avoids a step change in speed that would otherwise occur from the switch.

Example:

- Use a communications adapter (like a 20-COMM-C or 20-COMM-E) in DPI port 5 for the primary - automatic speed reference.
- Use the on-board HIM in DPI port 1 for the secondary - manual speed reference.

Wire digital input 4 to switch between automatic and manual references (high for manual, low for automatic).

Make the following parameter selections:

- 90 [Speed Ref A Sel] = 22 "DPI Port 5"
- 96 [TB Man Ref Sel] = 18 "DPI Port 1"
- 193 [Man Ref Preload] = 1 "Enabled"
- 364 [Digital In4 Sel] = 18 "Auto/Manual"

When digital input 4 is low, the drive runs in automatic mode, consuming the speed reference from the communications adapter. When digital input 4 goes high the drive takes the last value from the communication adapter and loads it into the HIM. So, the manual speed reference produced by the HIM starts at the last value produced by the communication adapter.

Application Note:

To facilitate a smooth transfer from manual HIM speed reference back to automatic (communicated) speed reference, you will need to execute the following in controller logic:

- While the drive is in manual mode, the controller will need to continually transfer the speed feedback or output frequency into its speed reference. This will eliminate any disturbance in the speed when the drive goes from manual mode back to automatic mode.

Auto/Manual Notes

- 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.
- If a HIM has manual control and power is removed from the drive, the drive will return to Auto mode when power is reapplied.
- Parameter 192 [Save HIM Ref] can enable manual mode to allow starts and jogs from the HIM in 2-wire mode.

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 gauge requirements and recommendations are based on 75 °C. Do not reduce wire gauge when using higher temperature 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 14 - Recommended Control Wire

Type		Wire Type	Description	Min. Insulation Rating
Signal (1)(2)	Standard Analog I/O	–	0.750 mm^2 (18 AWG), twisted pair, 100% shield with drain.	300V, 75…90 °C (167…194 °F)
	Remote Pot	–	0.750 mm^2 (18 AWG), 3 conductor, shielded.	
	Encoder/ Pulse I/O <30 m (100 ft)	Combined	0.196 mm^2 (24 AWG) individually shielded pairs.	
	Encoder/ Pulse I/O 30 to 152 m (100 to 500 ft)	Signal	0.196 mm^2 (24 AWG) individually shielded pairs.	
		Power	0.750 mm^2 (18 AWG) individually shielded pairs.	
		Combined	0.330 mm^2 (22 AWG), power is 0.500 mm^2 (20 AWG) individually shielded pairs.	
	Encoder/ Pulse I/O 152 to 259 m (500 to 850 ft)	Signal	0.196 mm^2 (24 AWG) individually shielded pairs.	
		Power	0.750 mm^2 (18 AWG) individually shielded pairs.	
		Combined	0.750 mm^2 (18 AWG) individually shielded pairs.	
Digital I/O Safety Inputs Homing Input (1)(2)	Un-shielded	–	Per US NEC or applicable national or local code.	300V, 60 °C (140 °F)
	Shielded	Multi-conductor shielded cable	0.750 mm^2 (18 AWG), 3 conductor, shielded.	

(1) Control and signal wires must be separated from power wires by at least 0.3 meters (1 foot).

(2) 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.

Main Control Board Switch and Jumper Settings

ATTENTION: The 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.

IMPORTANT There are two separate values for an encoder

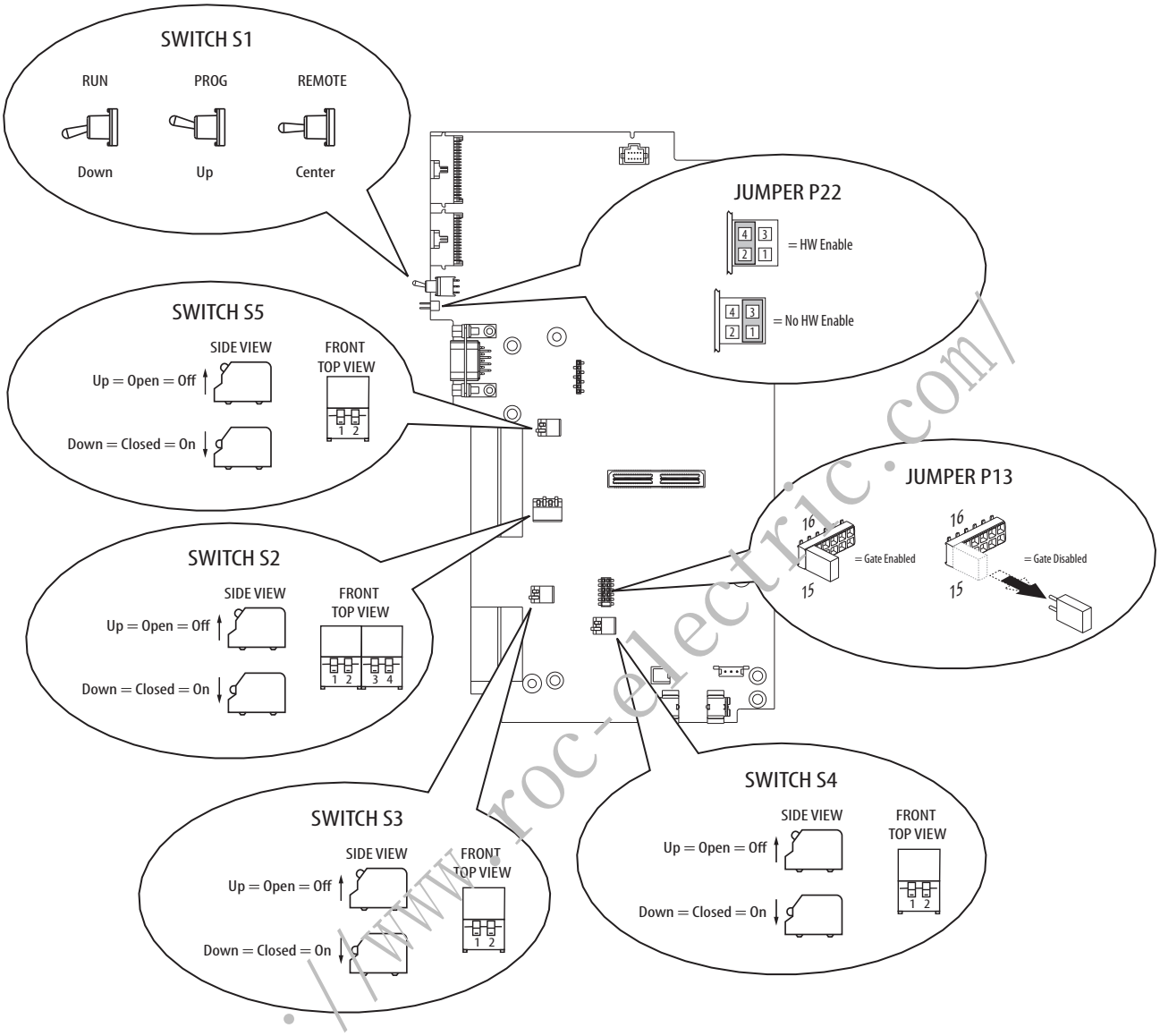
Table 15 - Switch and Jumper Settings

Function	Default	Switch	Open	Closed	Notes
HW Enable Jumper (P22)	pins 2-4 HW Enbl	SHUNT Jumper	pins 2-4 HW Enbl	pins 1-3 No Enbl	No Jmpr = HW Enbl See Hardware Enable Circuitry on page 53 for configuration.
Gate Enable Jumper (P13)	Jumper on pins 15-16	SHUNT Jumper	No Jmpr	Jumper on pins 15-16	No Jmpr = Gate disable or Safe-Off/Second Encoder board is present(1)
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
Encoder Supply Voltage	12V DC	S2-4	12V DC	5V DC	Change with Power Off
Encoder Signal A Voltage	12V DC	S2-1	12V DC	5V DC	Typically, set all switches the same
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	Switch	Down	Up	Center	Notes
DriveLogix Processor	S1	RUN	PROG	REMOTE	Processor Mode

(1) Refer to publication 20D-UM007, DriveGuard® Safe-Off Option for PowerFlex® 700S Phase II AC Drives and PowerFlex 700L Liquid-Cooled AC Drives, for more information on the Safe-Off Option board, or publication, 20D-IN009 Installation Instructions - Second Encoder Option Card for PowerFlex® 700S Drives with Phase II Control, for more information on the Second Encoder Option board.

Figure 1 Main Control Board Switches and Jumpers



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 in the control cassette. See Figure 8 below for locations.

Table 17 and Table 18 on page 49 contain detailed descriptions for the terminals on TB1 and TB2. Remove the terminal block plug from the socket and make the appropriate connections. See Removing the Control Cassette on page 55 for instructions on removing the control cassette from the drive.

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 16 - Control & Encoder Terminal Block Specifications

Name	Description	Wires Size Range (1)		Torque	
		Maximum	Minimum	Maximum	Recommended
I/O Terminal 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.

Figure 8 - Main Control Board I/O Terminal Block Locations

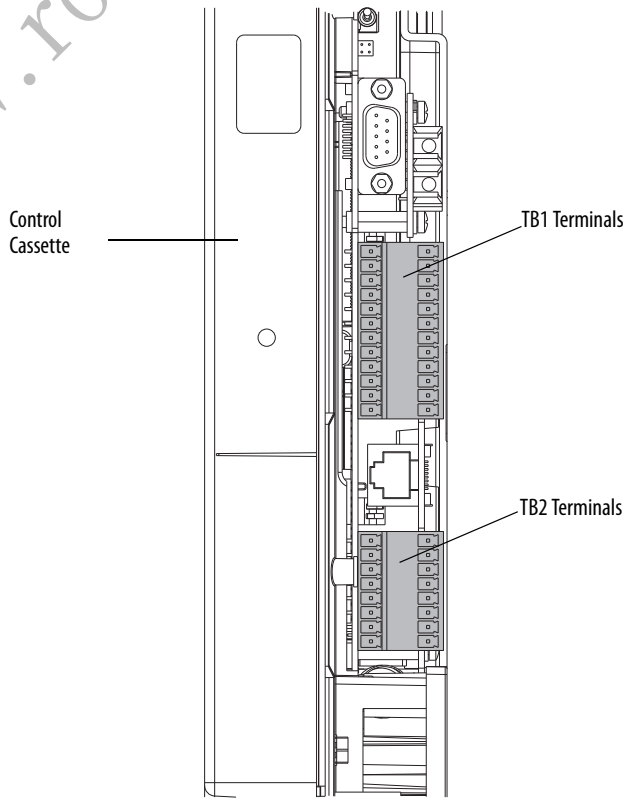
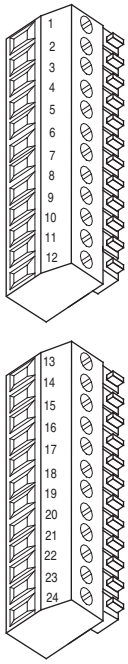


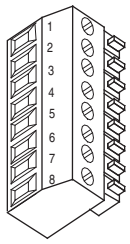
Table 17 - TB1 Terminal Descriptions

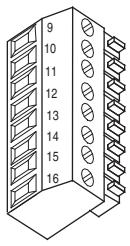


Terminal	Signal	Factory Default	Description	Related Parameter
1	Analog Input 1 Comm.	(Volt)	Bipolar, differential input, +/-10V, 0-20 mA, 13 bit + sign 20 kΩimpedance at Volt; 500 Ωimpedance at mA(1)	800
2	Analog Input 1 (+/-)			
3	Shield	NA	Analog Input shield	
4	Analog Input 2 Comm.	(Volt)	Bipolar, differential input, +/-10V, 0-20 mA, 13 bit + sign 20 kΩimpedance at Volt; 500 Ωimpedance at mA	806
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).	812
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 2 kΩminimum load	832, 833
10	Analog Output 1 (+)			
11	Analog Output 2 (-)	(Volt)		839, 840
12	Analog Output 2 (+)			
13	+10V Reference	NA	Rating: 20 mA maximum load (Recommend 5 kΩpot)	
14	Reference Common	NA		
15	-10V Reference	NA		
16	Encoder A	NA	Normal current draw per channel: 20 mA	230…233
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 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 20 mA 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 18 - TB2 Terminal Descriptions



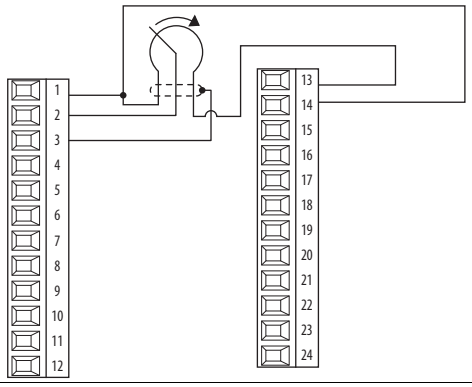
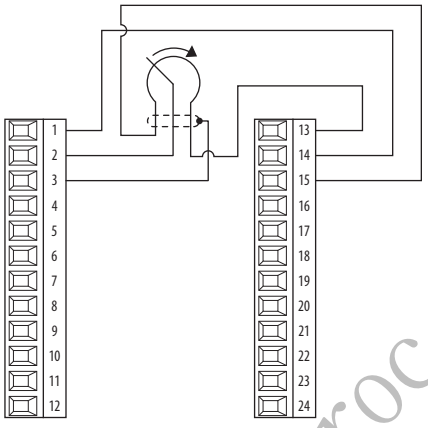
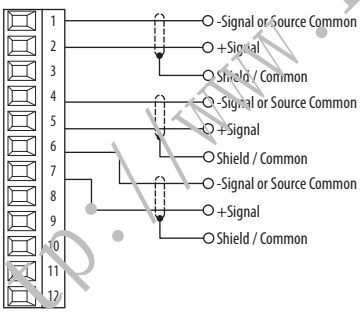
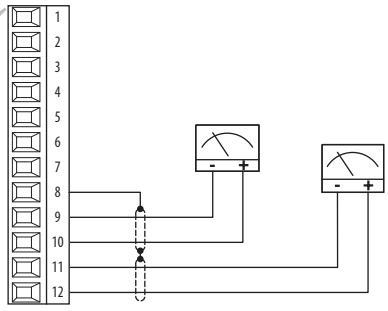


Terminal	Signal	Factory Default	Description	Related Parameter
1	24V DC Common (-)	NA	Drive supplied 24V DC logic input power Rating: 300 mA maximum load	
2	24V DC Source (+)	NA		
3	Digital Output 1		24V DC Open Collector (sinking logic) Rating: Internal Source = 150 mA max. External Source = 750 mA	816, 847
4	Digital Output 1/2 Com	NA	Common for Digital Output 1 & 2	
5	Digital Output 2		24V DC Open Collector (sinking logic) Rating: Internal Source = 150 mA max. External Source = 750 mA	851, 852
6	Relay Output 3 (NC)		Relay contact output Rating: 115V AC or 24V DC = 2 A max. Inductive/Resistive	856, 857
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 Load:15 mA at 24V DC	825
11	Digital Input 2			826
12	Digital Input 3		Load:15 mA at 24V DC sourcing	827
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 Load: 7.5 mA at 115V AC **Note**: The 115 VAC Digital Inputs can withstand 2 mA of leakage current without turning on. If an output device has a leakage current greater than 2 mA, a burden resistor is required. A 68.1 KΩ resistor with a 0.5 W rating should be used to keep the 115 VAC output below 2 mA.	828
15	Digital Input 5			829
16	Digital Input 6	HW Enable		830

(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 19 - TB1 Terminals— Analog Wiring Examples

Input/Output	Connection Example	Required Parameter Changes
0…10V Analog Input Internal Source		No Changes Required
0…10V Analog Input Bi-Polar		No Changes Required
0…10V Analog Input External Source		No Changes Required
Analog Output +/-10V DC Used to drive analog meters displaying speed and current		**Using Analog Out 1, -10V to + 10V to meter Motor RPM and direction:** • Send the data to the Analog Output Par 833 [Anlg Out1 Real] (the destination) linked to Par 71 [Filtered SpdFdbk] (the source) • Scale the Output to the source parameter Par 835 [Anlg Out1 Scale] = 175 (Par 4 [Motor NP RPM] = 1750 / 10V) **Using Analog Out 2, -10V to + 10V to meter Motor Current:** • Send the data to the Analog Output Par 840 [Anlg Out2 Real] (the destination) linked to Par 308 [Output Current] (the source) • Scale the Output to the source parameter Par 822 [Anlg Out2 Scale] = xx (Par 2 [Motor NP FLA] / 10 V Output)

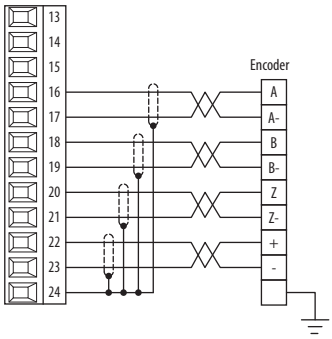
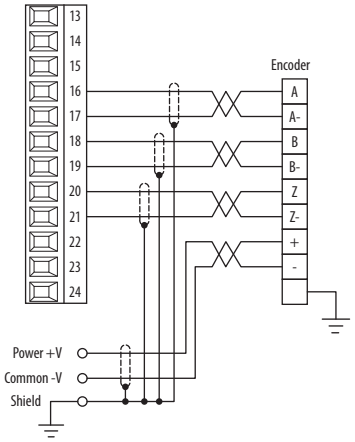
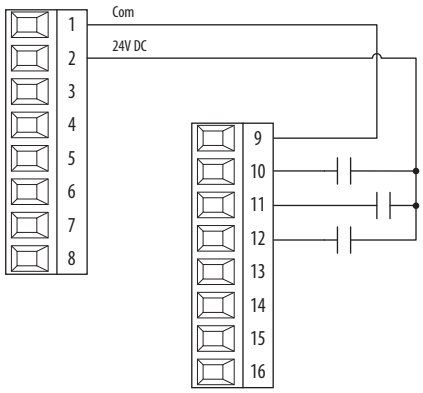
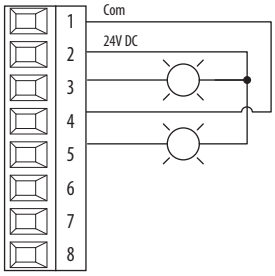
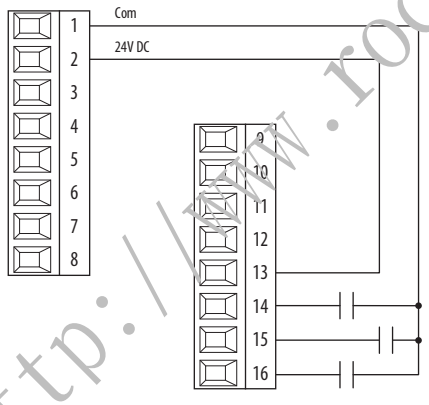
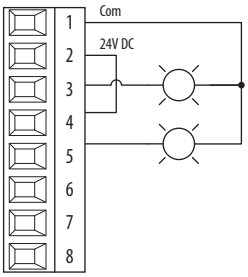
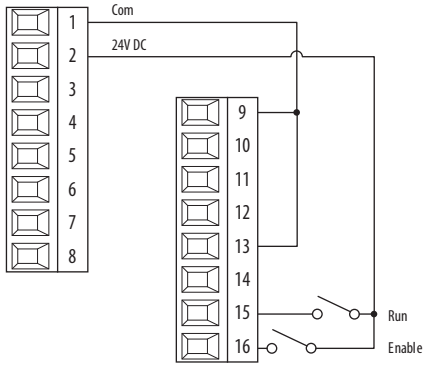
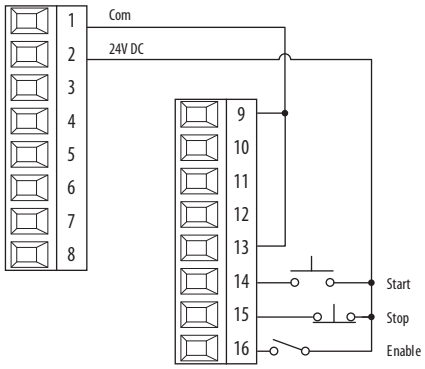
Input/Output	Connection Example	Required Parameter Changes
Primary Encoder Interface - Internal Supply Supports 5V/12V DC differential encoders with internal power supply. Used as primary closed loop speed feedback.		**Using Encoder 0 as speed feedback:** • Par 222 [Motor Fdkbk Sel] = 0 - "Encoder 0"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

Table 20 - TB2 Terminals - Digital Input Wiring Examples

Input/Output	Connection Example	Required Parameter Changes
Digital Inputs - Used for enable and precharge control. **Note:** 24V DC supply - supports only on-board digital inputs. Do not use for circuits outside the drive. **Note:** The factory default for Digital Inputs is 24V. This must be switched in order to use 115V.	Sourcing Digital Inputs - Internal Power Supply 	**Sourcing and Sinking Definitions:** 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: • **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). • **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). • **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. • **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. **Note:** 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 	
	Sinking Digital Inputs - Internal Power Supply 	
	Sinking Digital Output - Internal Power Supply 	

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

Hardware Enable Circuitry

By default, Digital Input 6 (Par 830 [Dig In6 Sel]) is configured for hardware enable input. This is for applications requiring the drive to be disabled without software interpretation. With the "HW Enable Jumper (Shunt - P22)" on the pins closest to the PCB (2 and 4), Digital Input 6 is configured as a "dedicated" hardware enable. See Figure 1 on page 47 for jumper location. If this configuration is not required, the "HW Enable Jumper (Shunt)" may be moved to the out board pins (1 and 3), making Digital Input 6 user programmable via Par 830 [Dig In6 Sel].

Auxiliary Power Supply

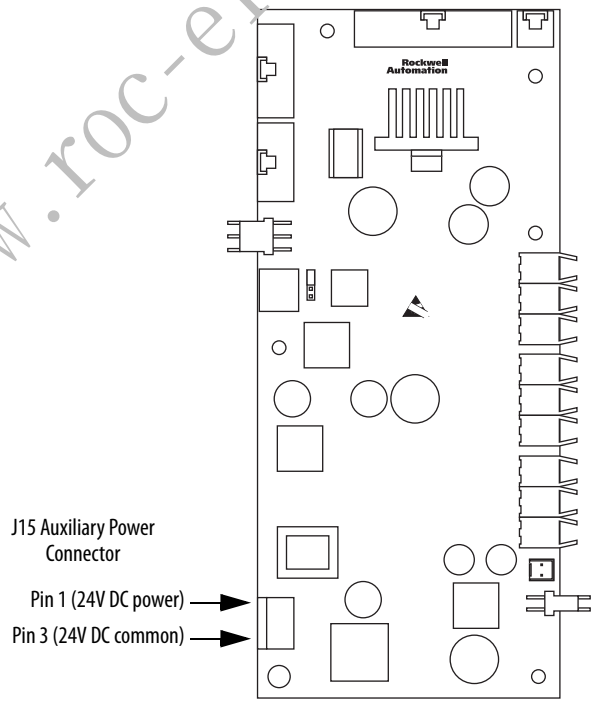
You may use an auxiliary power supply to keep the 700S control assembly energized, when input power is de-energized. This allows the main control board, DriveLogix controller and any feedback option cards to continue operation. Connect auxiliary power to J15 on the fiber optic interface board. You must 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 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 W resistor needs to be added to the voltage feedback board. In this case, please contact Drives Technical Support for details.

Table 21 - Auxiliary Power Supply Specifications

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

Figure 9 - PowerFlex Fiber Optic Interface Board

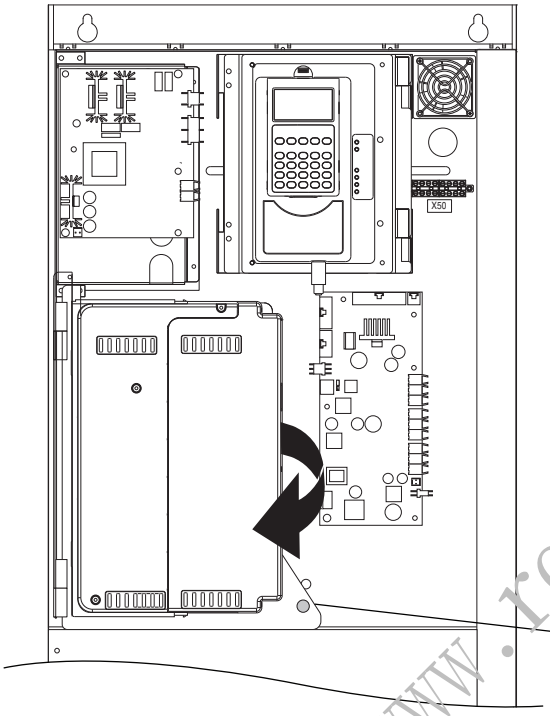


Removing the Control Cassette

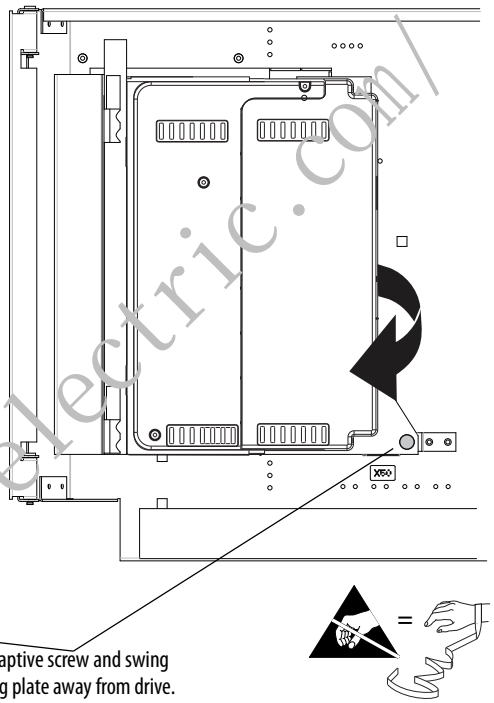
Follow the steps below to remove the control cassette in order to gain access to the I/O and control terminal blocks.

1. Disconnect any installed communications cables from the control assembly.
2. Disconnect the ribbon cables from the main control board.
3. Loosen the captive screw on the control assembly mounting plate and swing the control assembly mounting plate away from the control frame.

Frame 9

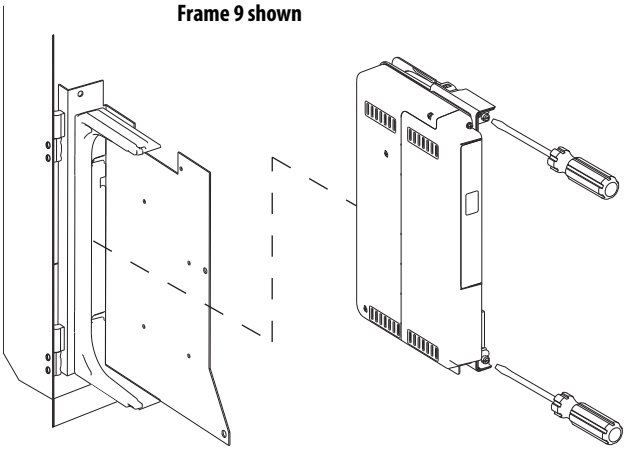


Frames 10…14



4. Loosen the two mounting screws on the front of the control assembly and slide the control cassette off the mounting bracket.

Frame 9 shown

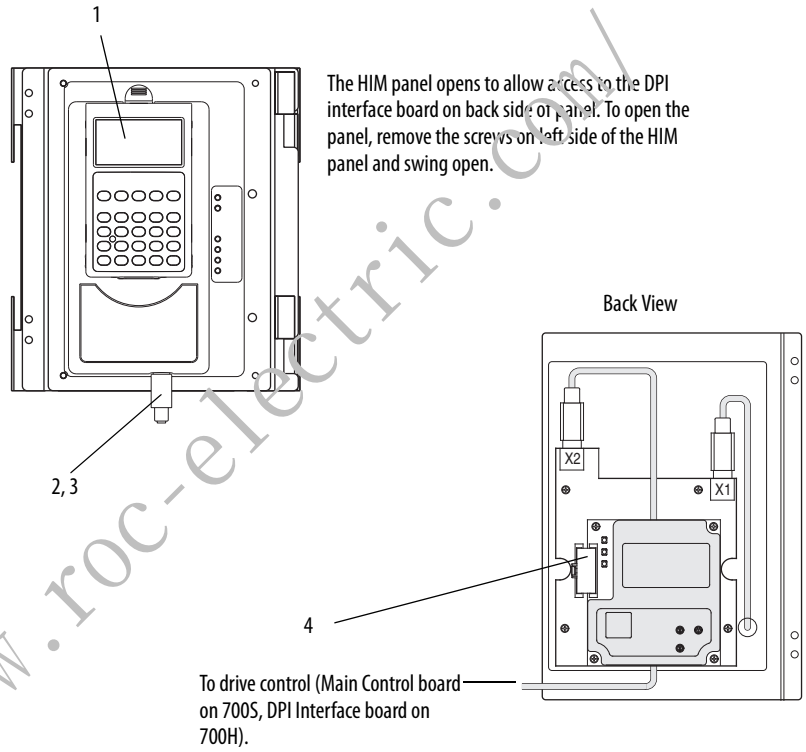


Notes:

Communication Options

Communication Module Locations

Figure 10 - DPI Port Locations



No.	Connector	Description
1	DPI Port 1	HIM connection when installed in the drive.
2	DPI Port 2	Cable connection for handheld and remote options.
3	DPI Port 3 or 2	Splitter cable connected to DPI Port 2 provides additional port.
4	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. See the individual communications adapter User Manual for details.

Logic Command/Status Words

Figure 11 - 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 1 = Stop
														x		Start (1)(2)	0 = Not Start 1 = Start
													x			Jog	0 = Not Jog 1 = Jog
												x				Clear Faults	0 = Not Clear Faults 1 = Clear Faults
										x	x					Direction	00 = No Command 01 = Forward Command 10 = Reverse Command 11 = Hold Present Direction
									x							Local Control	0 = No Local Control 1 = Local Control
								x								MOP Increment	0 = Not Increment 1 = Increment
						x	x									Accel Rate	00 = No Command 01 = Use Accel Time 1 10 = Use Accel Time 2 11 = Use Present Time
				x	x											Decel Rate	00 = No Command 01 = Use Decel Time 1 10 = Use Decel Time 2 11 = Use Present Time
	x	x	x													Reference Select (3)	000 = No Command 001 = Ref. 1 (Ref A Select) 010 = Ref. 2 (Ref B Select) 011 = Ref. 3 (Preset 3) 100 = Ref. 4 (Preset 4) 101 = Ref. 5 (Preset 5) 110 = Ref. 6 (Preset 6) 111 = Ref. 7 (Preset 7)
x																MOP Decrement	0 = Not Decrement 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 12 - 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 1 = Ready
														x		Active	0 = Not Active 1 = Active
													x			Command Direction	0 = Reverse 1 = Forward
												x				Actual Direction	0 = Reverse 1 = Forward
											x					Accel	0 = Not Accelerating 1 = Accelerating
										x						Decel	0 = Not Decelerating 1 = Decelerating
									x							Alarm	0 = No Alarm 1 = Alarm
								x								Fault	0 = No Fault 1 = Fault
							x									At Speed	0 = Not At Reference 1 = At Reference
				x	x	x										Local Control[1]	000 = Port 0 (TB) 001 = Port 1 010 = Port 2 011 = Port 3 100 = Port 4 101 = Port 5 110 = Reserved 111 = No Local
x	x	x	x													Reference Source	0000 = Ref A Auto 0001 = Ref B Auto 0010 = Preset 2 Auto 0011 = Preset 3 Auto 0100 = Preset 4 Auto 0101 = Preset 5 Auto 0110 = Preset 6 Auto 0111 = Preset 7 Auto 1000 = Term Blk Manual 1001 = DPI 1 Manual 1010 = DPI 2 Manual 1011 = DPI 3 Manual 1100 = DPI 4 Manual 1101 = DPI 5 Manual 1110 = Reserved 1111 = Jog Ref

(1) See "Owners" for further information.

Figure 13 - PowerFlex 700S Logic Command Word

Logic Bits																Command	Description
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
															x	Normal Stop	0 = Not Normal Stop 1 = Normal Stop
														x		Start(1)	0 = Not Start 1 = Start
													x			Jog 1	0 = Not Jog using [Jog Speed 1] 1 = Jog using [Jog Speed 1]
												x				Clear Fault(2)	0 = Not Clear Fault 1 = Clear Fault
										x	x					Unipolar Direction	00 = No Command 01 = Forward Command 10 = Reverse Command 11 = Hold Direction Control
									x							Reserved	
								x								Jog 2	0 = Not Jog using [Jog Speed 2] 1 = Jog using [Jog Speed 2]
							x									Current Limit Stop	0 = Not Current Limit Stop 1 = Current Limit Stop
						x										Coast Stop	0 = Not Coast to Stop 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 14 - 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 1 = Active
														x		Running	0 = Not Running 1 = Running
													x			Command Direction	0 = Reverse 1 = Forward
												x				Actual Direction	0 = Reverse 1 = Forward
											x					Accel	0 = Not Accelerating 1 = Accelerating
										x						Decel	0 = Not Decelerating 1 = Decelerating
									x							Jogging	0 = Not Jogging 1 = Jogging
								x								Fault	0 = No Fault 1 = Fault
							x									Alarm	0 = No Alarm 1 = Alarm
						x										Flash Mode	0 = Not in Flash Mode 1 = In Flash Mode
					x											Run Ready	0 = Not Ready to Run 1 = Ready to Run
				x												At Limit (1)	0 = Not At Limit 1 = At Limit
			x													Tach Loss Sw	0 = Not Tach Loss Sw 1 = Tach Loss Sw
		x														At Zero Spd	0 = Not At Zero Speed 1 = At Zero Speed
	x															At Setpt Spd	0 = Not At Setpoint Speed 1= At Setpoint Speed
x																Enable	0 = Not Enabled 1 = Enabled

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

Notes:

Frame 9 Mechanical 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.

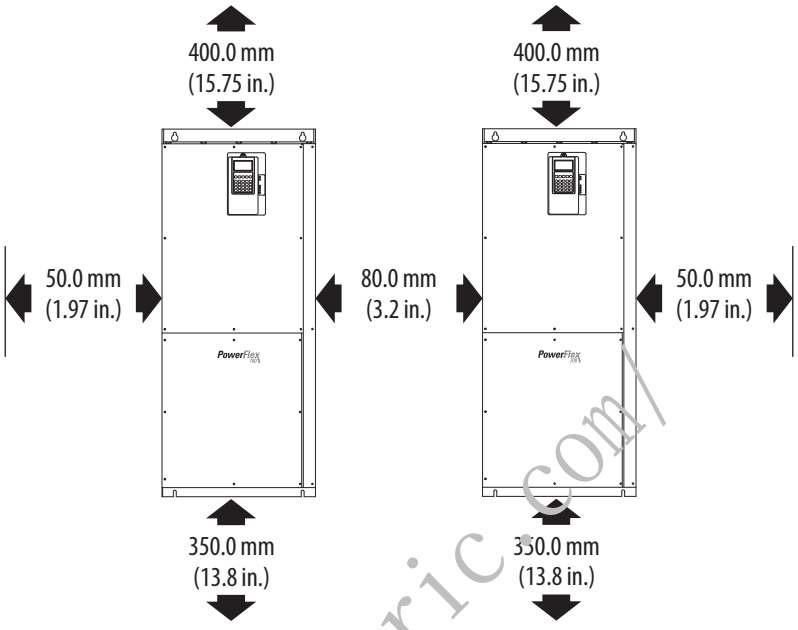
ATTENTION: The following information is merely a guide for proper installation. Rockwell Automation, Inc. cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal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

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.

Minimum Mounting Clearances



See Figure 15 on page 65 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…40° C (32…104° F)	0…50° C (32 to 122° F)
700S	400/480V AC (540/650V DC)	All	0…40° C (32…104° F)	0…40° C (32…104° F)
	600/690V AC (810/932V DC)	170	0…40° C (32…104° F)	0…40° C (32…104° F)
		208	0…35° C (32…95° F)	0…40° C (32…104° F)

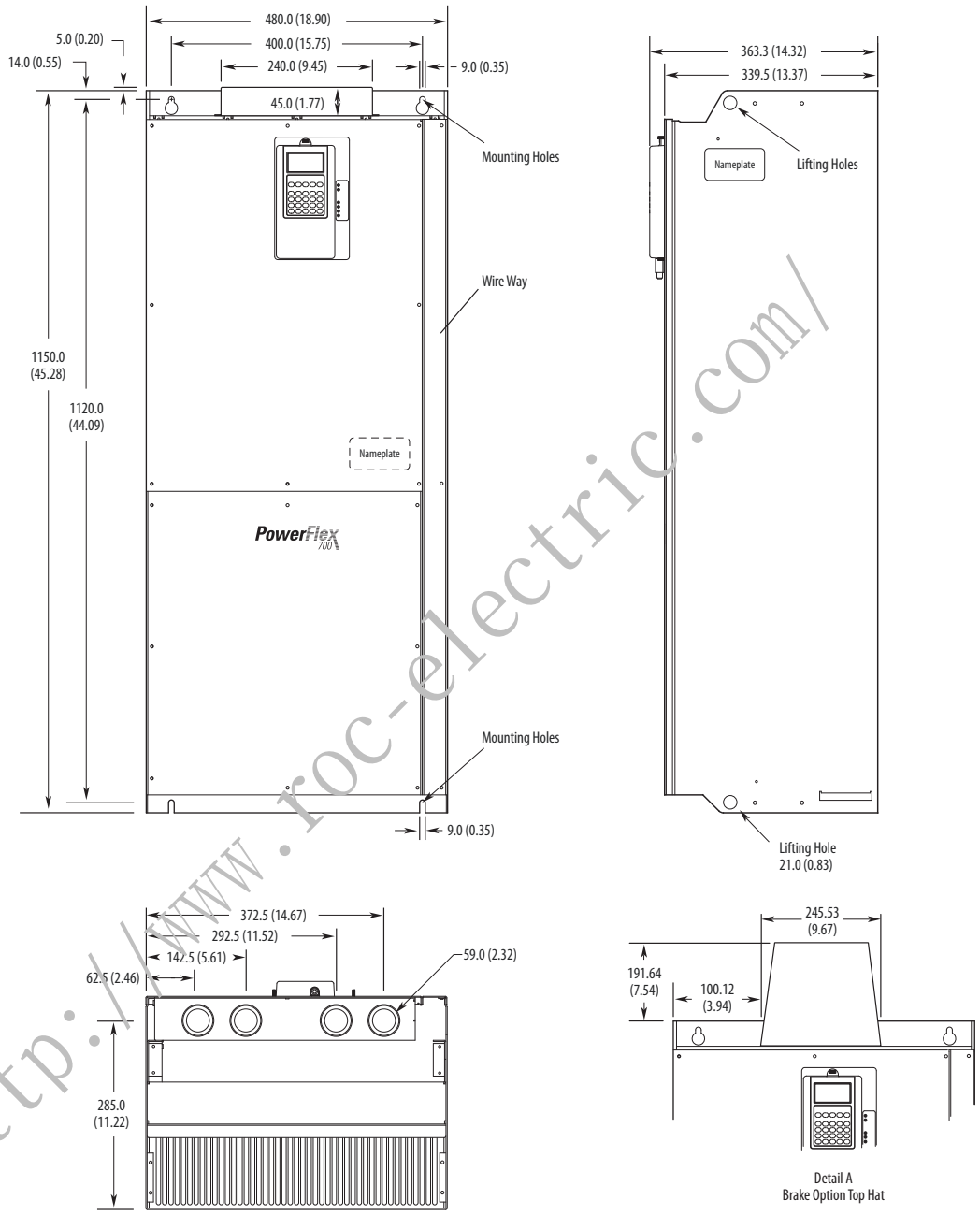
Nameplate Location

See Figure 15 on page 65.

Dimensions

Figure 15 - Frame 9 Dimensions

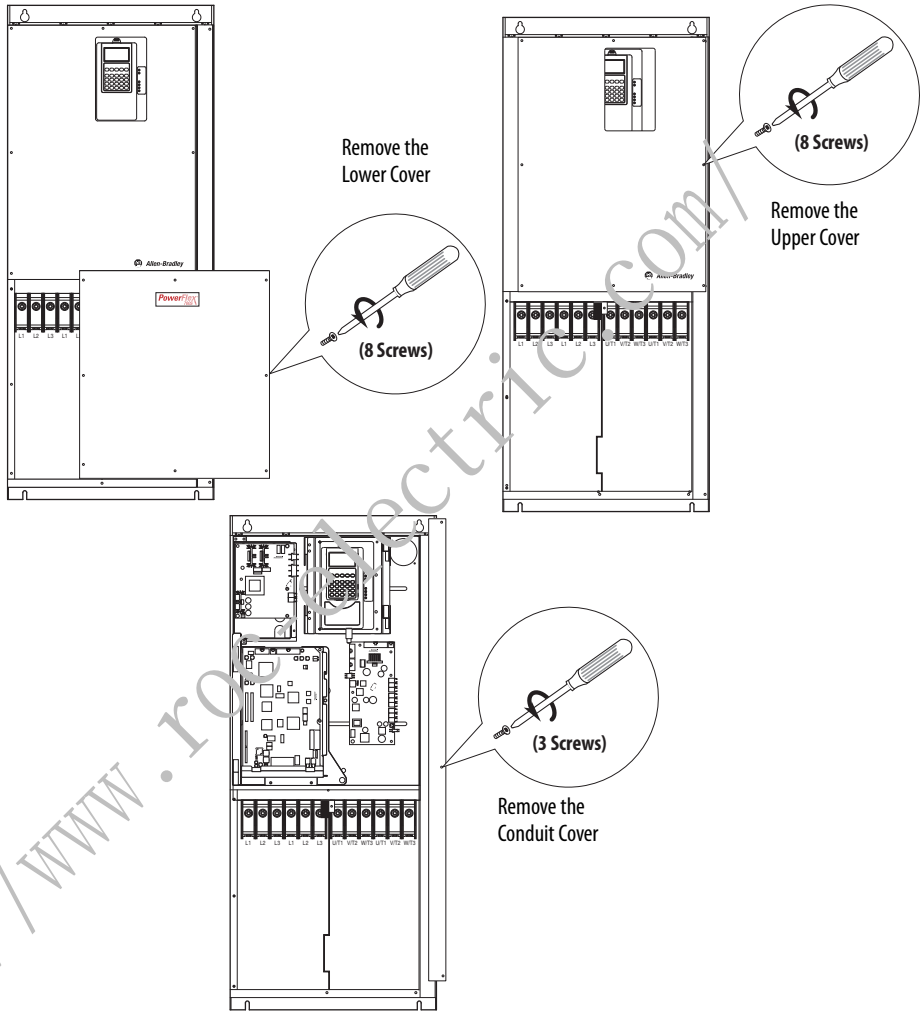
Dimensions are in millimeters and (inches).



Lifting Frame 9 Drives

See the PowerFlex 700H and 700S Frame 9 Drive Lifting Instructions, publication PFLEX-IN003, for detailed instructions. This instruction sheet is shipped with the drive. When you have completed the instructions in PFLEX-IN003, continue with the installation as directed below.

Remove the Drive Covers



Power Wiring

Table 22 - Power Terminal Specifications

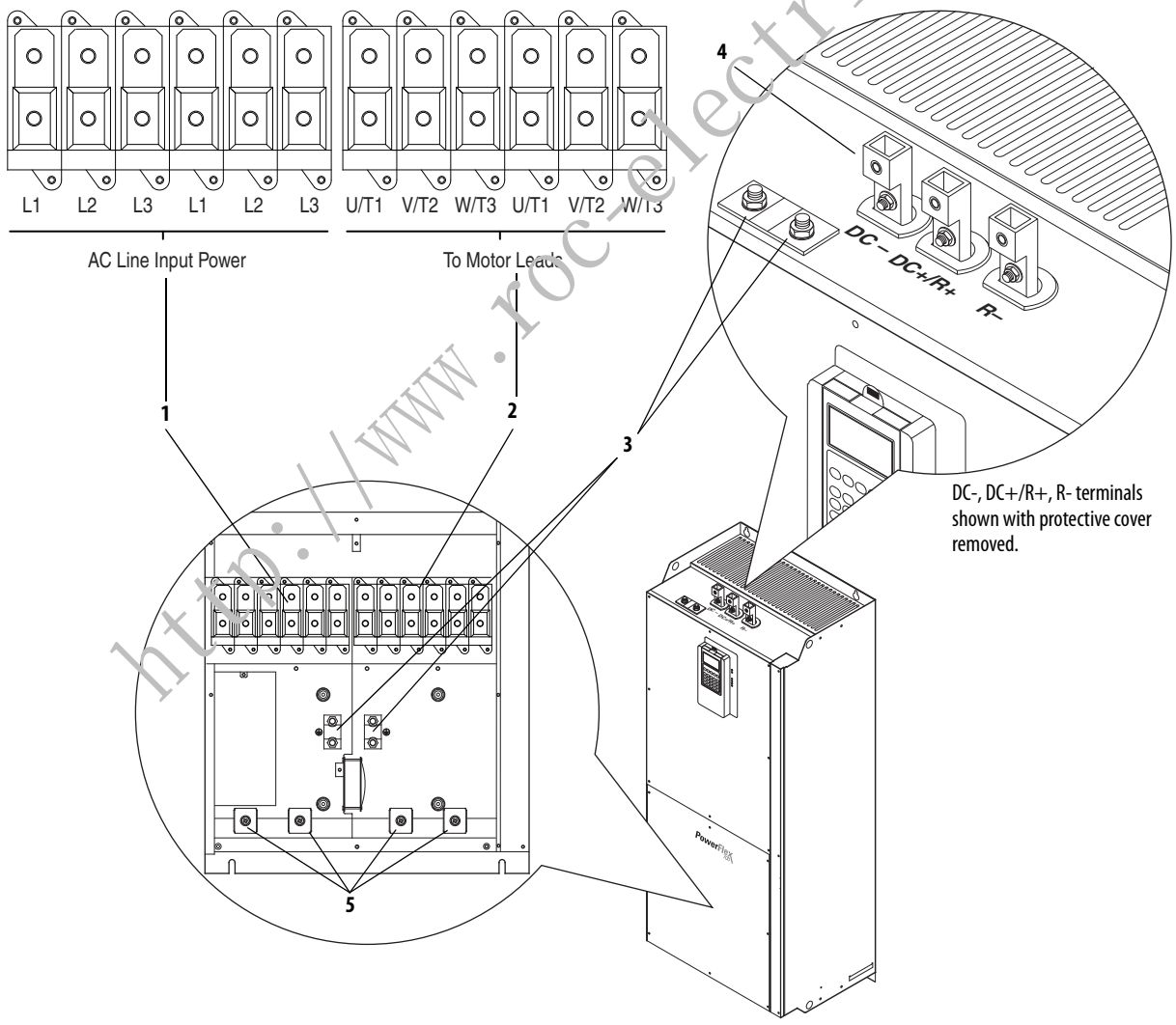
No.	Name	Description	Wire Size Range[1]		Torque
			Maximum	Minimum	Recommended
1	Input Power Terminal Block[2] L1, L2, L3	Input power	185.0 mm^2 (350 MCM)	95.0 mm^2 (4/0 AWG)	40 N•m (354 lb•in)
2	Output Power Terminal Block[2] U/T1, V/T2, W/T3	Motor connections	185.0 mm^2 (350 MCM)	95.0 mm^2 (4/0 AWG)	40 N•m (354 lb•in)
3	SHLD Terminal, PE, Motor Ground	Terminating point for wiring shields	95.0 mm^2 (4/0 AWG)	5.0 mm2 (10 AWG)	22 N•m (195 lb•in)
4	DC Bus[3] (2 Terminals; DC–, DC+)	DC input or external brake resistor (Internal Brake option not provided - See Frame 9 DC Bus/ Brake Connections on page 68.)	185.0 mm^2 (350 MCM)	95.0 mm^2 (4/0 AWG)	40 N•m (354 lb•in)
	DC Bus w/Brake[3] (3 Terminals; DC–, DC+/R+, R–)	DC input/internal brake Internal Brake option not provided - See Frame 9 DC Bus/ Brake Connections on page 68.)	185.0 mm^2 (350 MCM)	95.0 mm^2 (4/0 AWG)	40 N•m (354 lb•in)
5	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 16 - Terminal Locations and Power Terminal Block



Frame 9 DC Bus/Brake Connections

Figure 17 - Connecting to DC Source Only (No Brake Option Ordered)

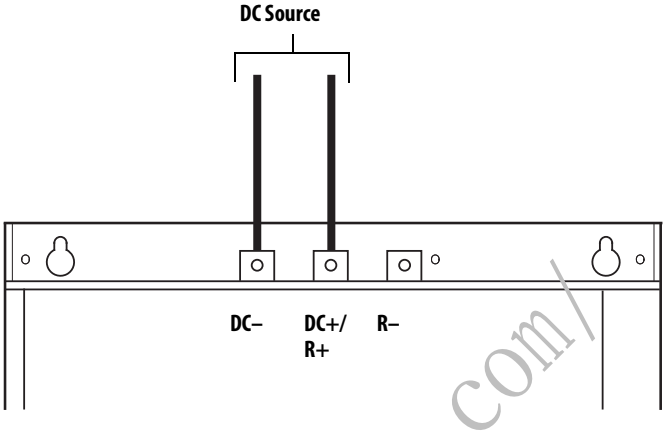


Figure 18 - Connecting to an External Brake Resistor (Brake Option Ordered)

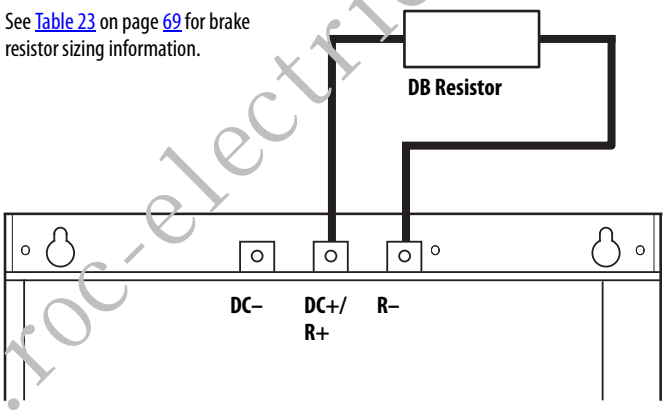


Figure 19 - Connecting to an External Braking IGBT and Resistor (No Brake Option Ordered)

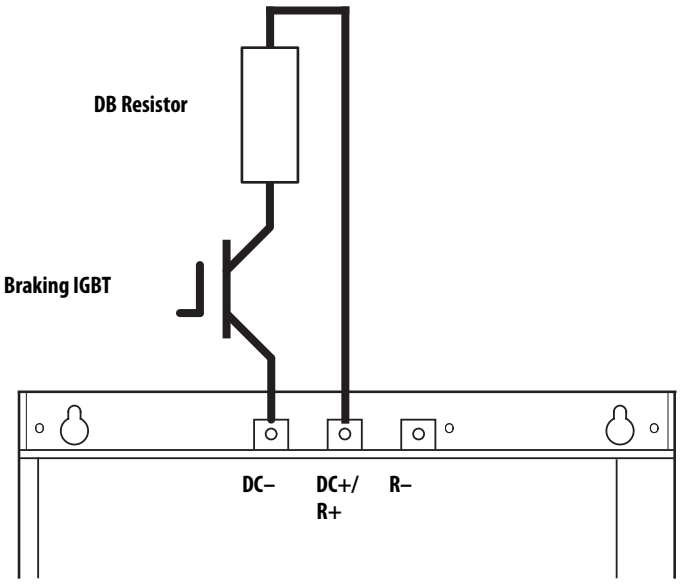
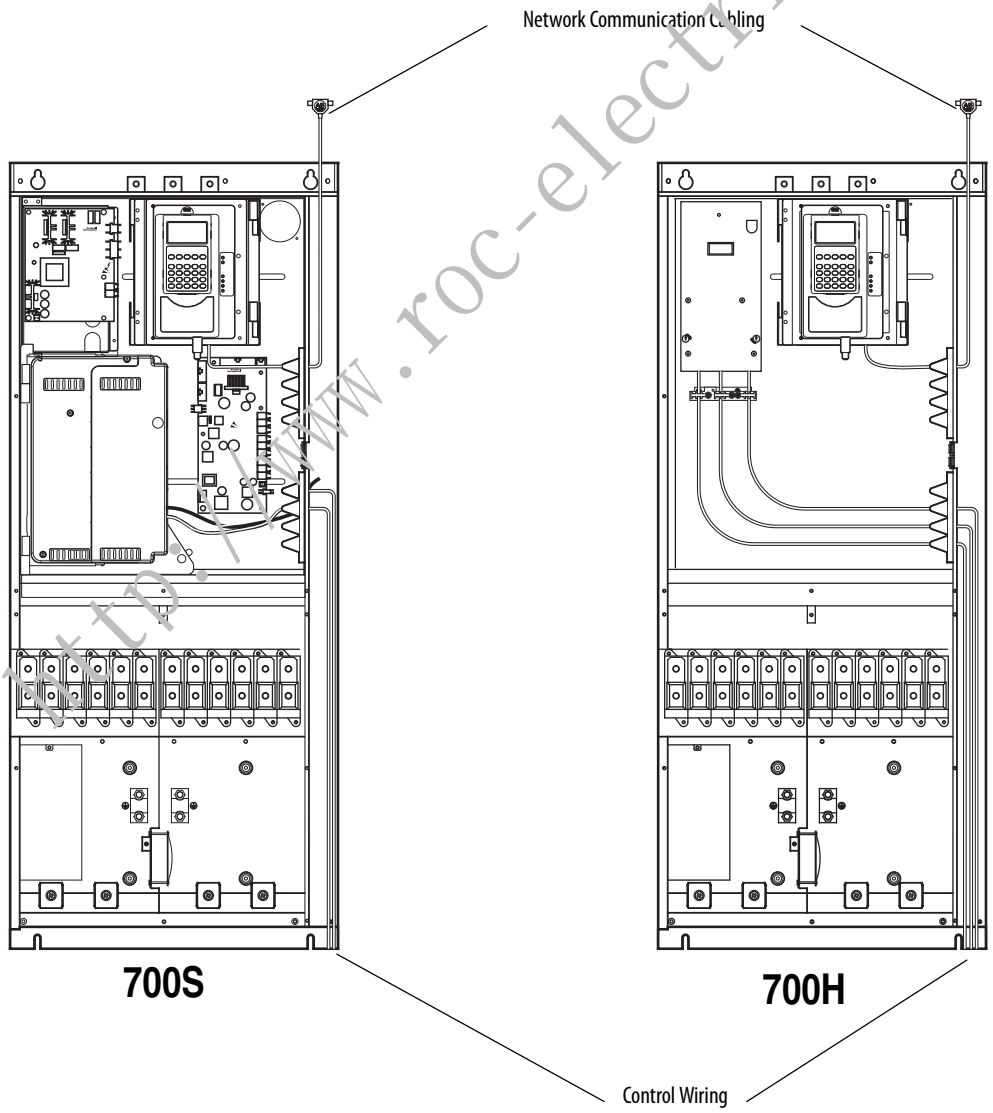


Table 23 - Frame 9 Brake Resistor Ratings

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:

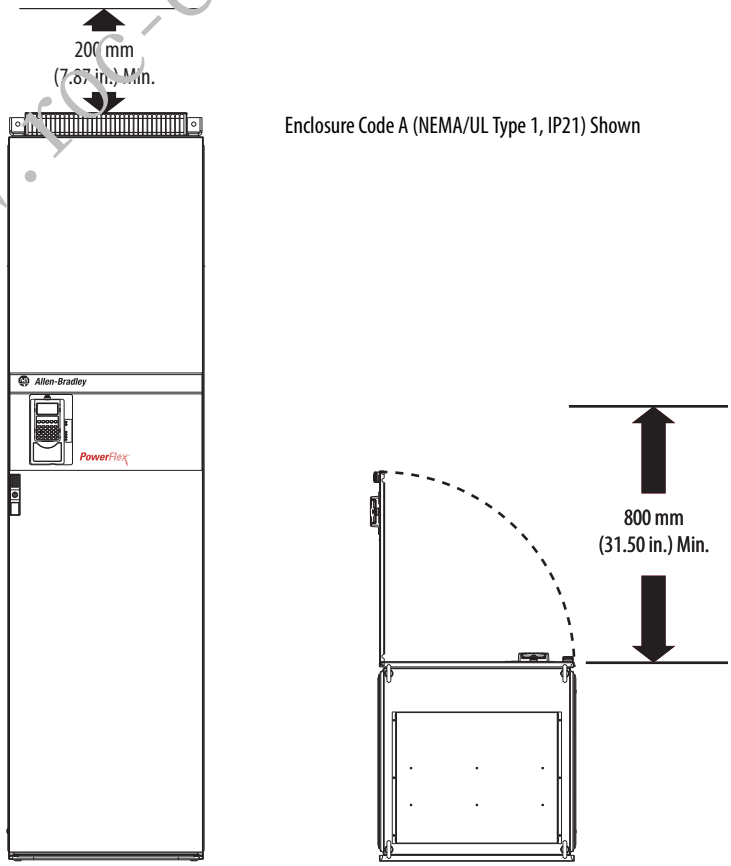
Frame 10 Mechanical Installation

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.

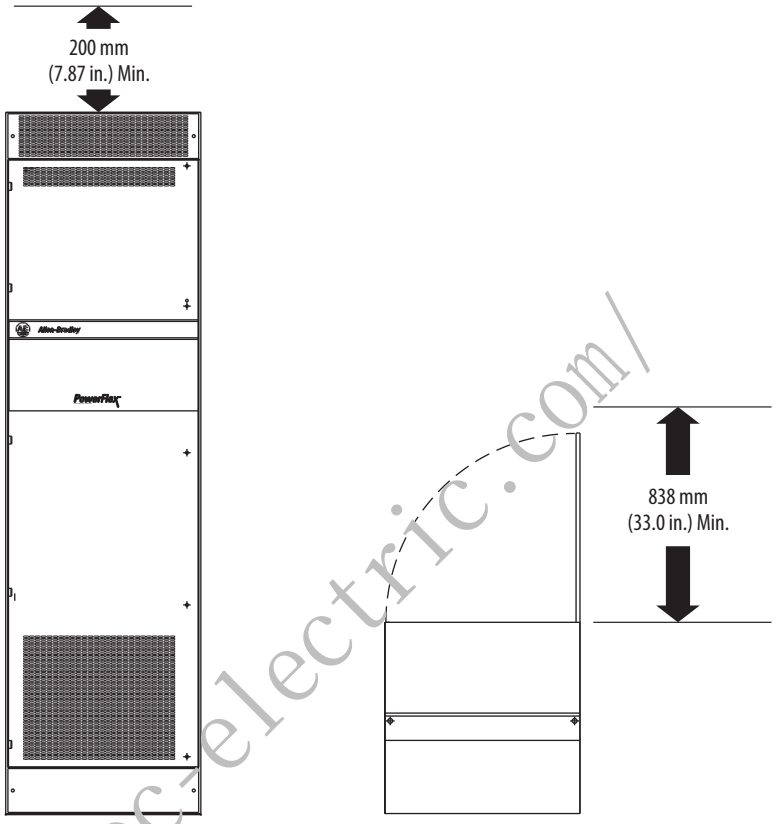
Minimum Mounting Clearances

Figure 20 - 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)



Enclosure Code A (NEMA/UL Type 1, IP21) Shown

Figure 21 - 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.

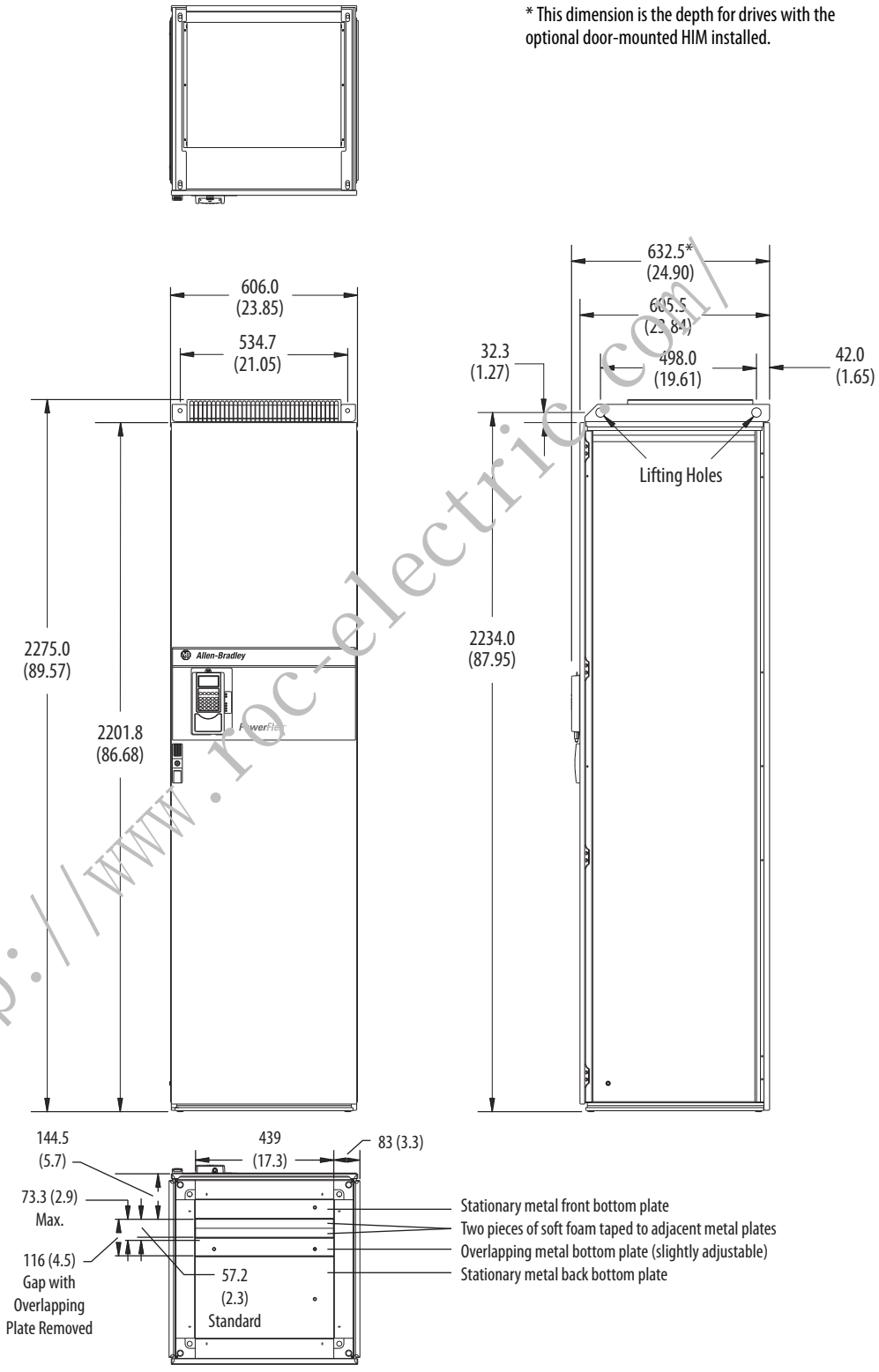
PowerFlex Drive	Voltage Class	Amp Rating	Surrounding Air Temperature	
			Normal Duty	Heavy Duty
700H & 700S	400/480V AC (540/650V DC)	All	0…40° C (32…104° F)	0…40° C (32…104° F)
	600/690V AC (810/932V DC)	261, 325, 385	0…40° C (32…104° F)	0…40° C (32…104° F)
	600/690V AC (810/932V DC)	416	0…35° C (32…95°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

Dimensions

Figure 22 - Enclosure Code A (NEMA/UL Type 1, IP21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)

Dimensions are in millimeters and (inches).

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



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 23 - 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).

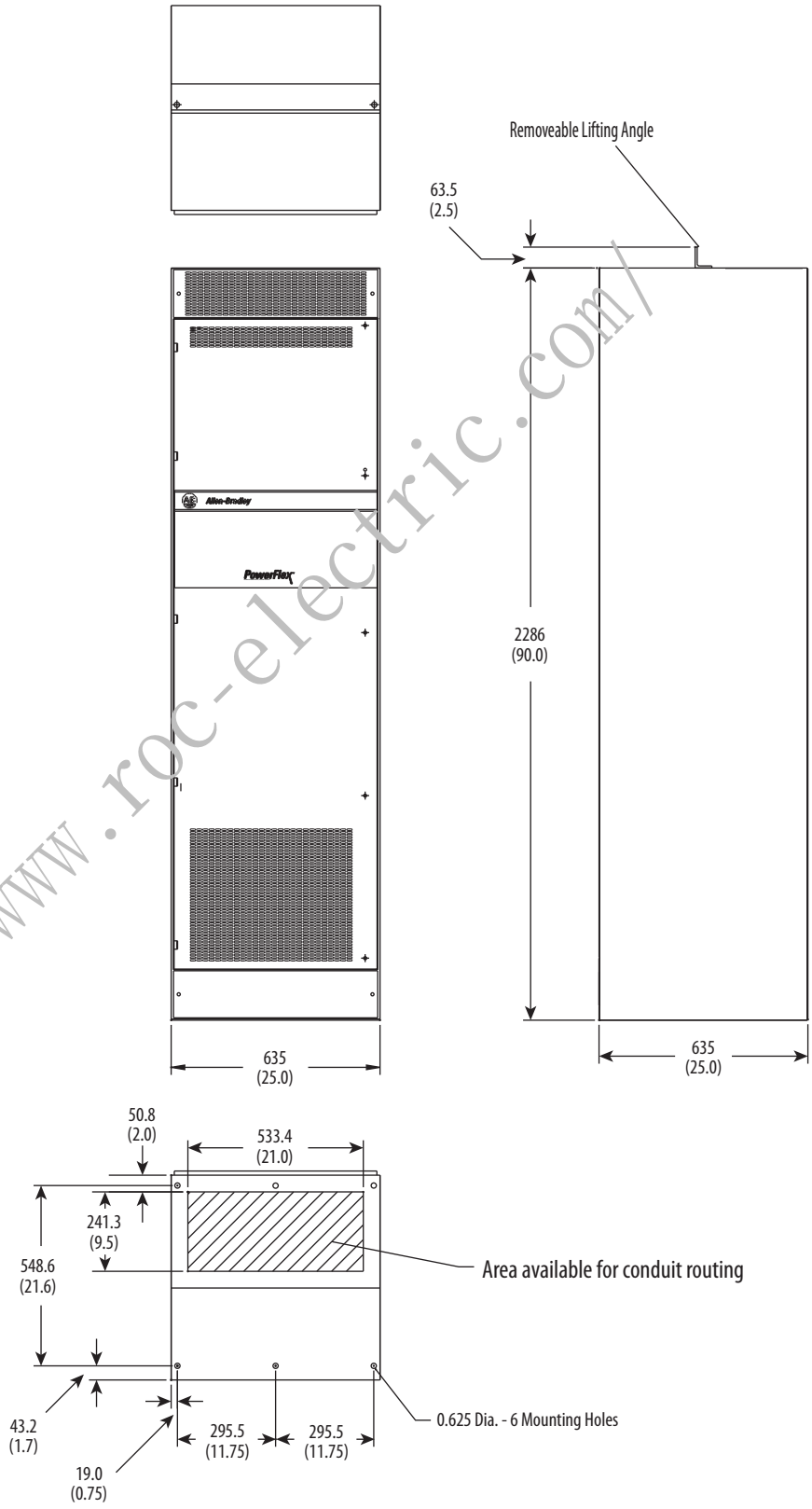
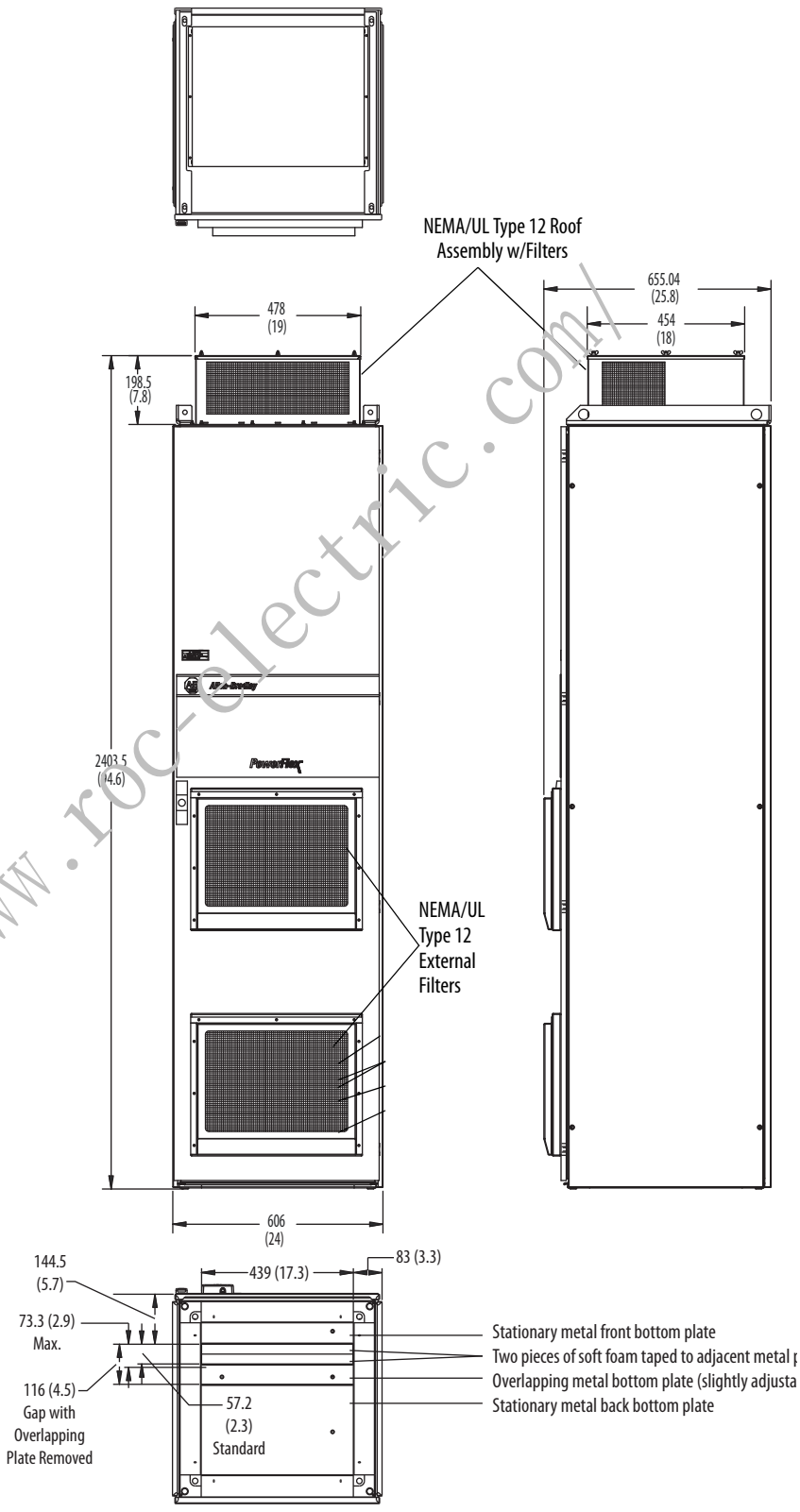


Figure 24 - Enclosure Code H (NEMA/UL Type 12 - IP54) and W (NEMA/UL Type 12 - IP54 w/ Conformal Coat)

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

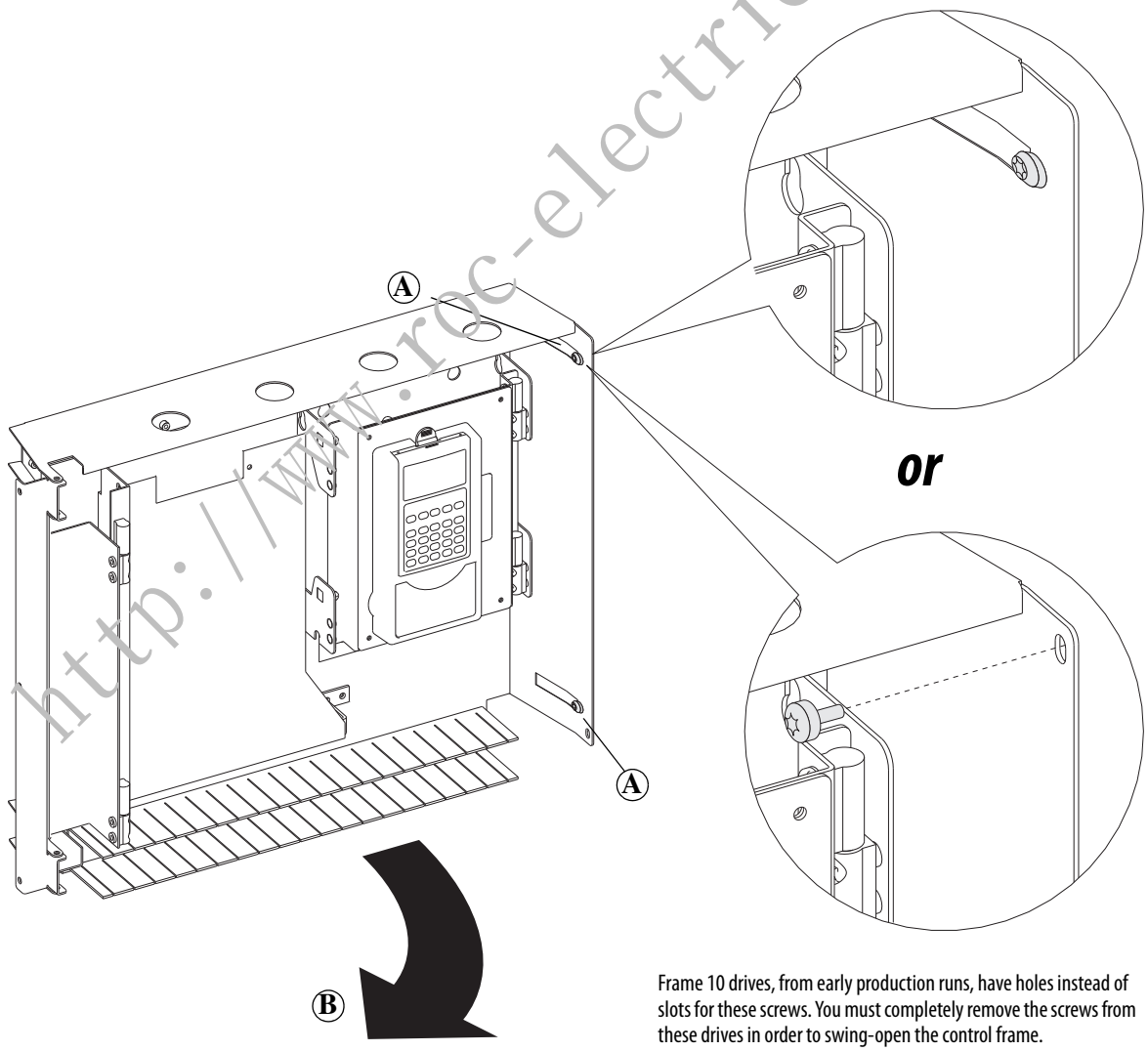
See the Lifting and Mounting PowerFlex 700S and 700H Drives, Frames 10...14, Installation Instructions, publication PFLEX-IN005, for detailed instructions. These instructions are shipped with the drive. When you have completed the instructions in PFLEX-IN005, continue with the installation as directed below.

Remove the Protective Covers

Move 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 Remove the Airflow Plate on page 77.

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.

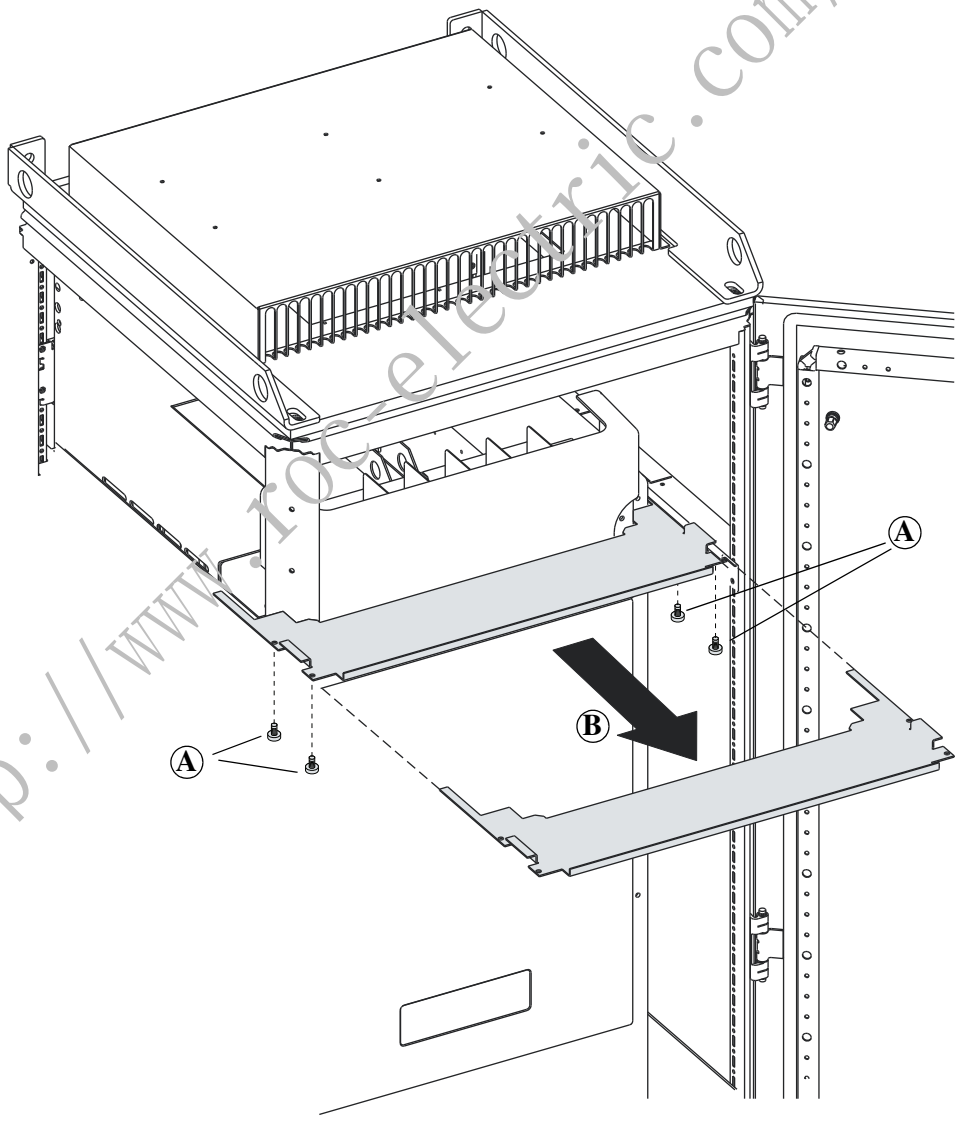


Frame 10 drives, from early production runs, have holes instead of slots for these screws. You must completely remove the screws from these drives in order to swing-open the control frame.

Remove the Airflow Plate

The drive is equipped with a plate, located near the top of the drive enclosure (just above the control frame, if installed), 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 Remove the Protective Covers on page 78.

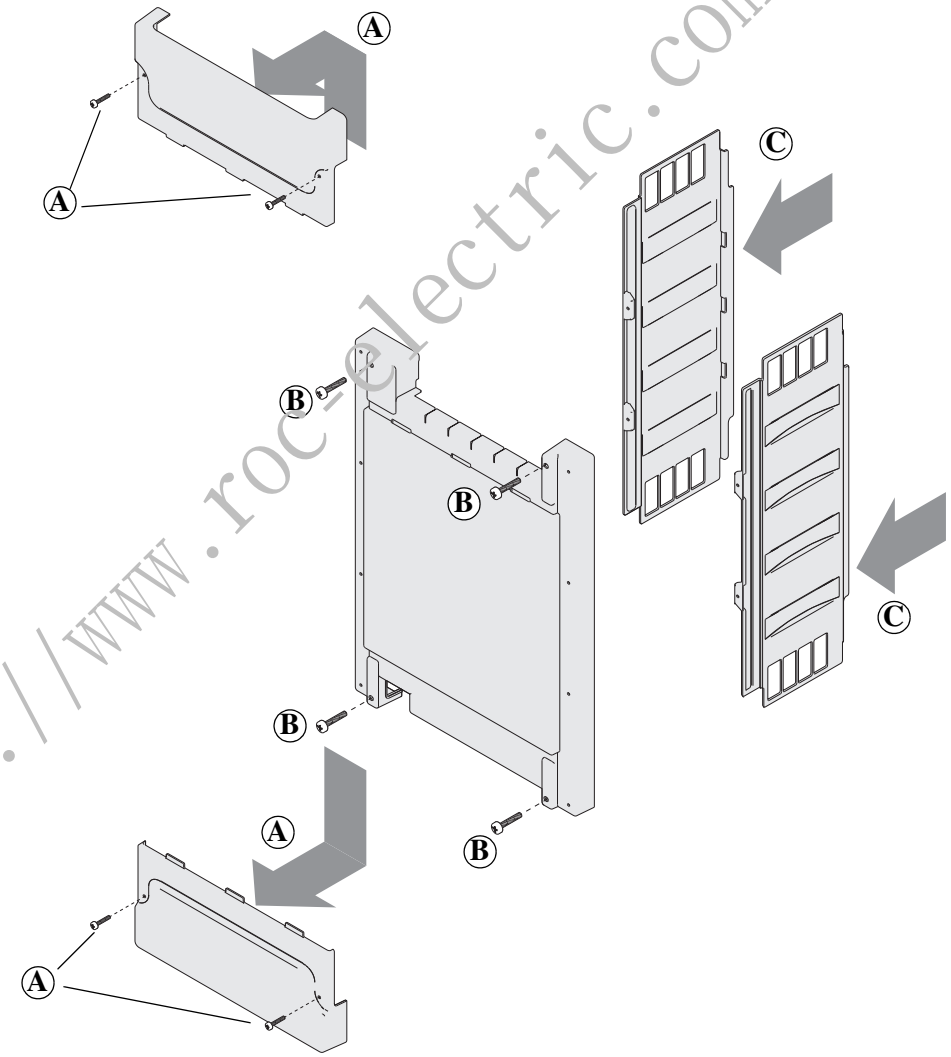
Task	Description
Ⓐ	Remove the T8 Torx-head screws that secure the airflow plate to the drive.
Ⓑ	Slide the airflow plate off of the drive.



Remove 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. 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 - see Move the Common Mode Jumper to the Disconnected Position on page 81.
- Should insulate terminal X4 on the Rectifier circuit board- see Insulate Terminal X4 on the Rectifier Circuit Board on page 82.
- Must disconnect the small capacitors from the input terminals - see Disconnect the Small Capacitors from the Input Terminals on page 83.

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 - see Move the Common Mode Jumper to the Disconnected Position on page 81.
- Must insulate terminal X4 on the Rectifier circuit board- see Insulate Terminal X4 on the Rectifier Circuit Board on page 82.
- Must disconnect the small capacitors from the input terminals - see Disconnect the Small Capacitors from the Input Terminals on page 83.

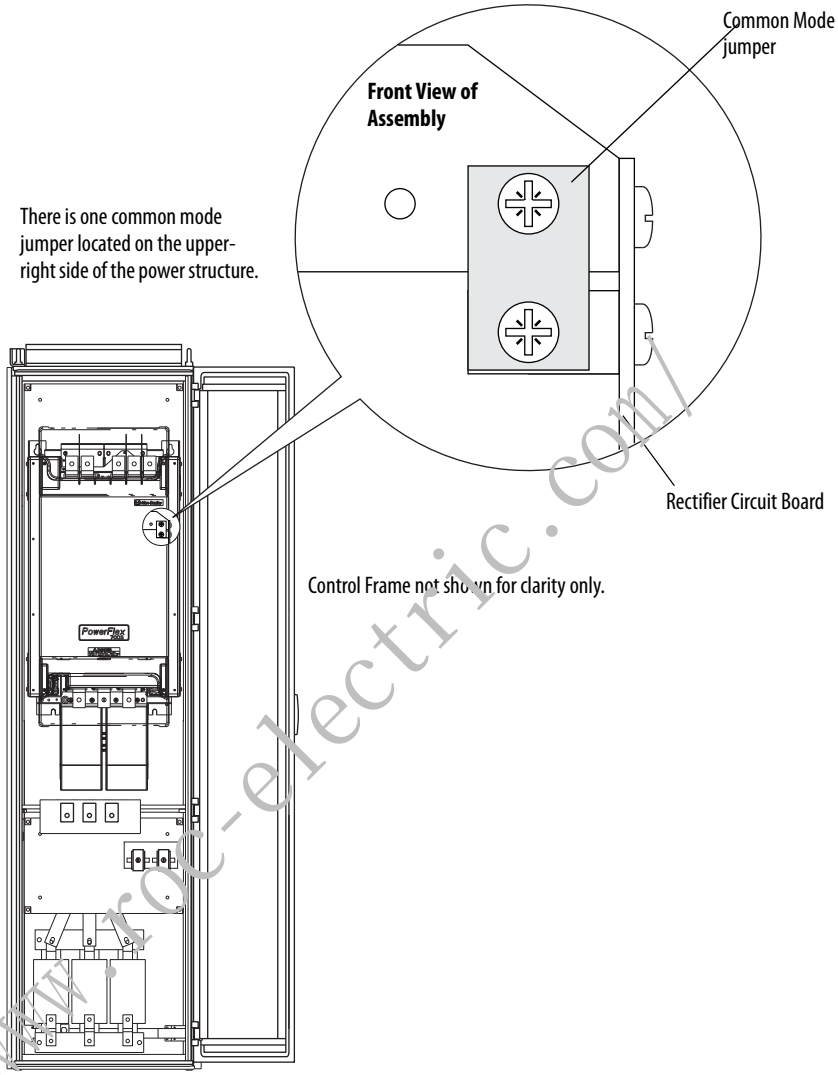
Installation on a Grounded B Phase Delta System

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

- Must move the common mode jumper to the disconnected position - see Move the Common Mode Jumper to the Disconnected Position on page 81.
- Must insulate terminal X4 on the Rectifier circuit board- see Insulate Terminal X4 on the Rectifier Circuit Board on page 82.
- Must disconnect the small capacitors from the input terminals - see Disconnect the Small Capacitors from the Input Terminals on p age 83.

Note: See 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.

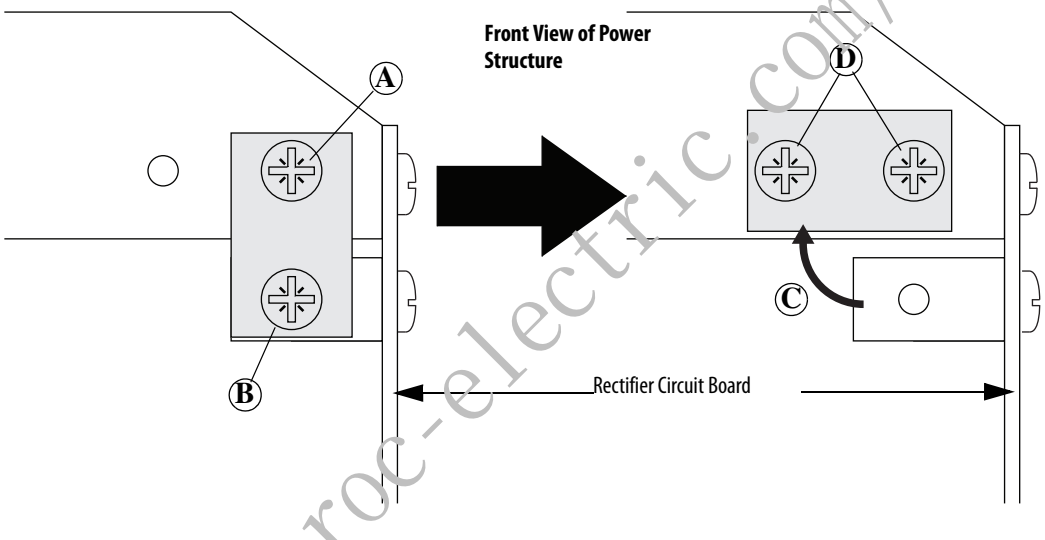
Figure 25 - Common Mode Jumper and Rectifier Circuit Board Location



Move the Common Mode Jumper to the Disconnected Position

Follow the steps below to move the common mode jumper to the disconnected position (see Figure 25 on page 80 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.

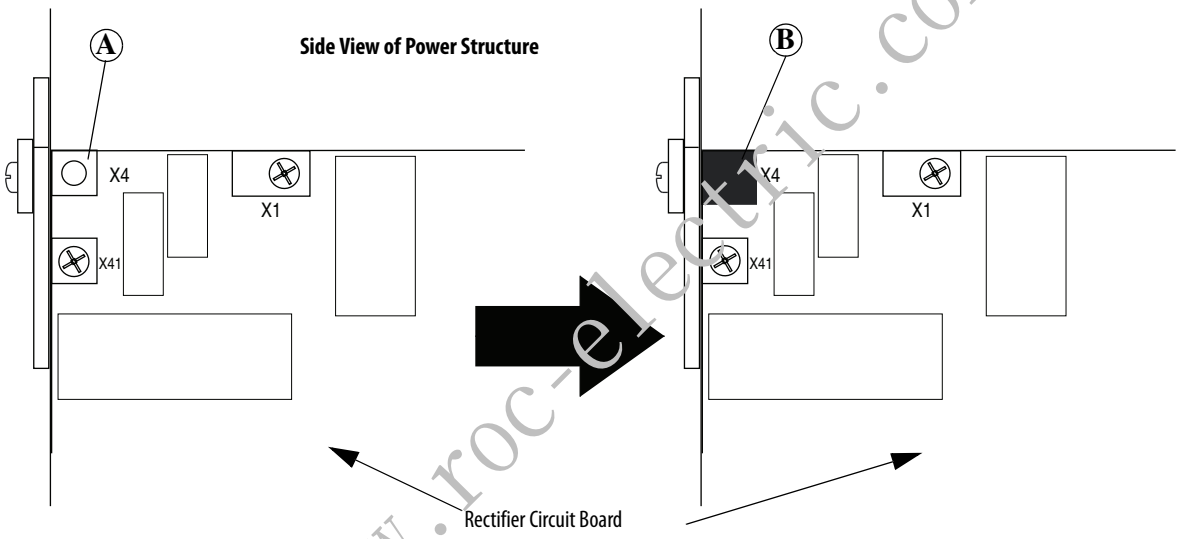


Insulate Terminal X4 on the Rectifier Circuit Board

Follow the steps below to insulate terminal X4 on the rectifier circuit board (see Figure 25 on page 80 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.



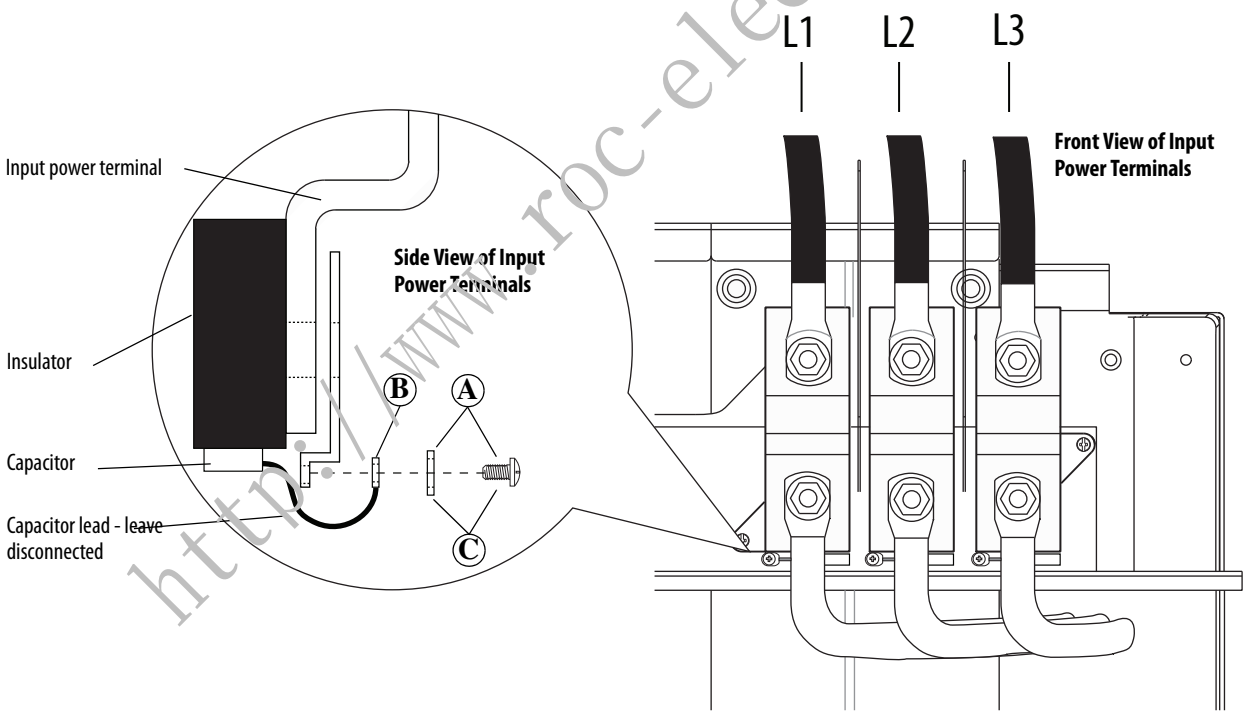
Disconnect the Small Capacitors from the Input Terminals

Follow the lettered steps below to disconnect the small capacitors from the input terminals.

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

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.



Power Wiring

IMPORTANT Once power wiring has been completed, the protective covers must be re-installed before energizing the drive. Installation is in reverse order of removal (see Remove the Protective Covers on page 78).

Table 24 - Power Terminal Specifications

No.	Name	Description	Wire Size Range (1)(2)		Torque	Terminal Bolt Size (3)(4)
			Maximum	Minimum	Recommended	
1	Input Power Terminal Block (3) L1, L2, L3	Input power	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
2	Output Power Terminal Block (3) U/T1, V/T2, W/T3	Motor connections	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
3	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
4	DC Bus (3) (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
5	Cable Clamp for Shield					

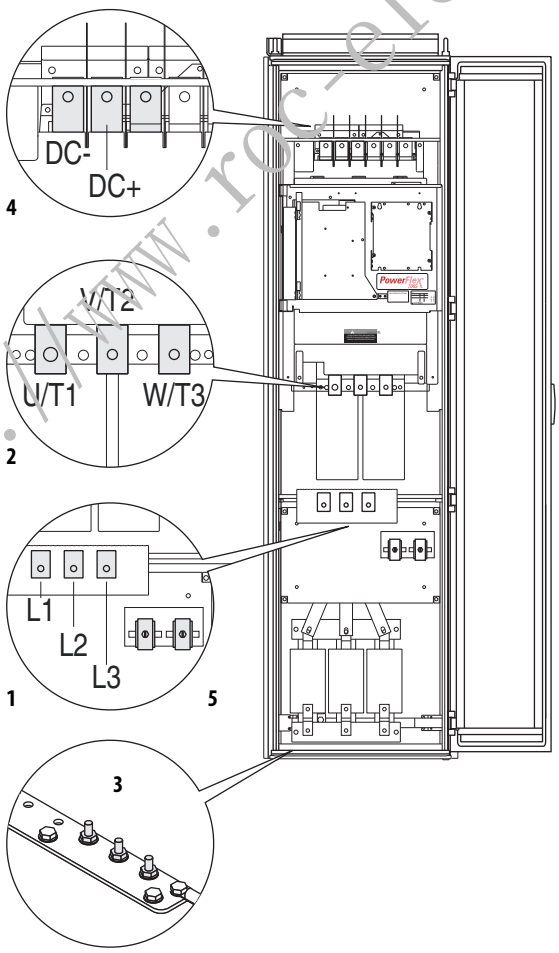
(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.

(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 26 - Power Terminal Locations



Frame 11 Mechanical 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 27 - 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)

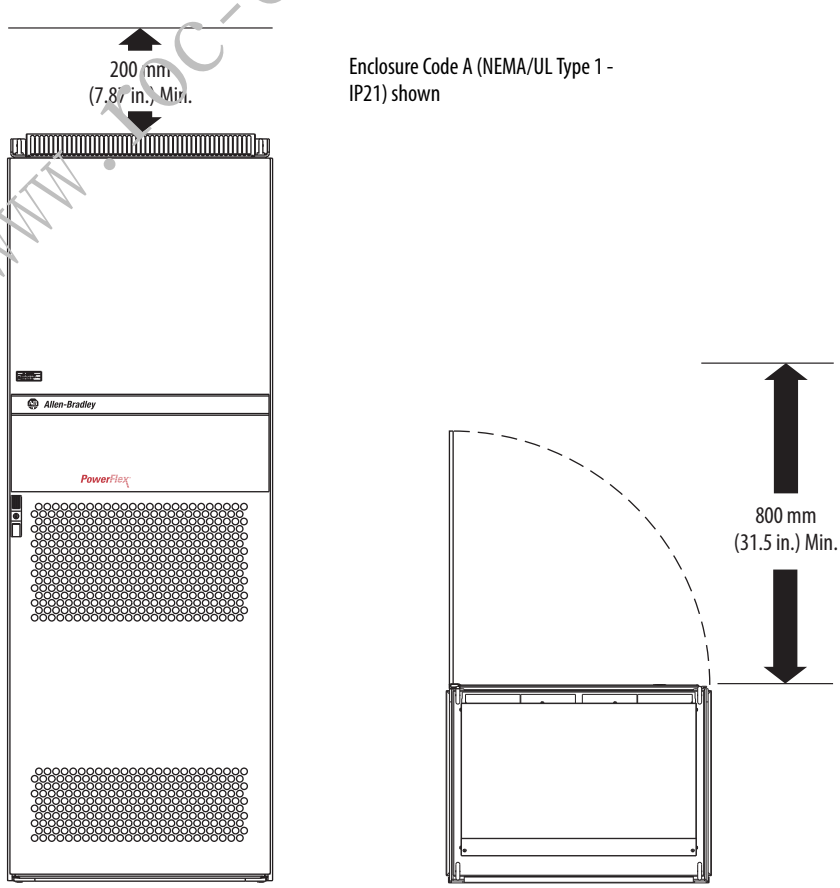
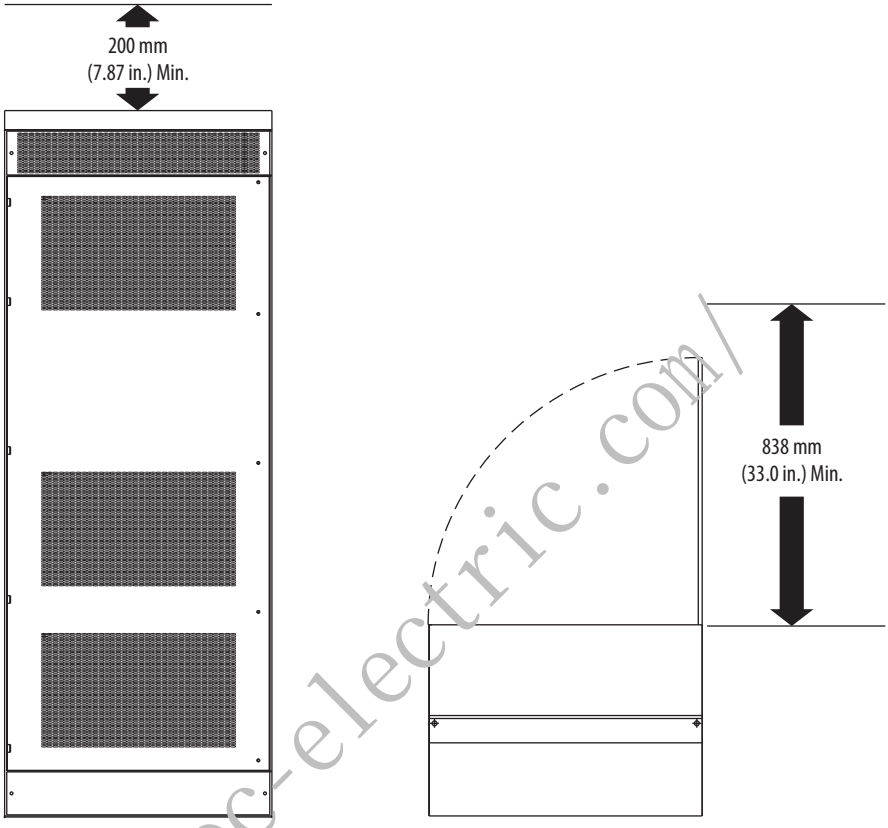


Figure 28 - Enclosure Code B (NEMA/UL Type 1, IP21) and K (NEMA/UL Type 1, IP21 w/Conformal Coat)



Operating Temperatures

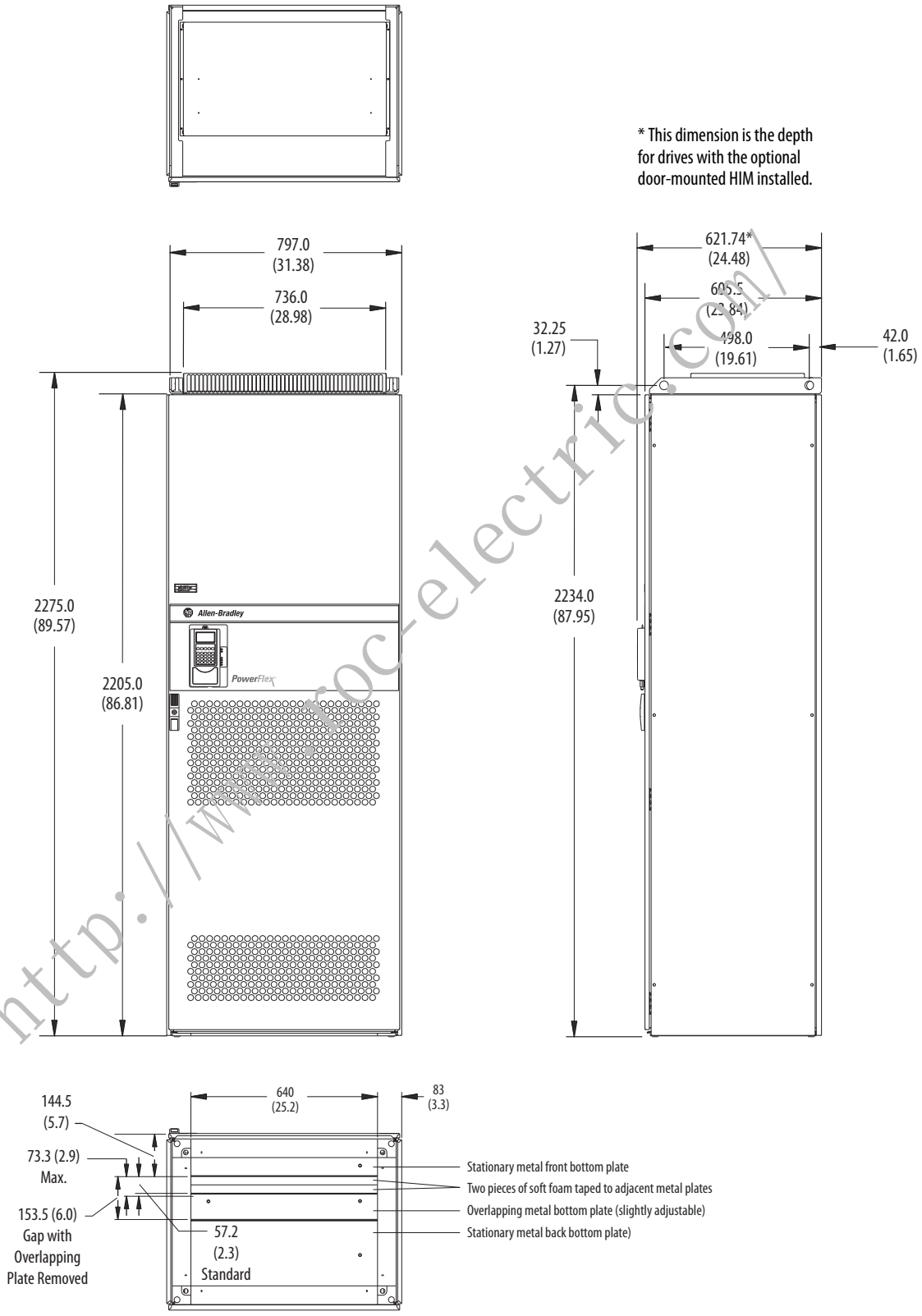
Frame 11 drives require a minimum of 3900 m^3/h (2295 cfm) of cooling air.

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

Dimensions

Figure 29 - 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 30 - 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).

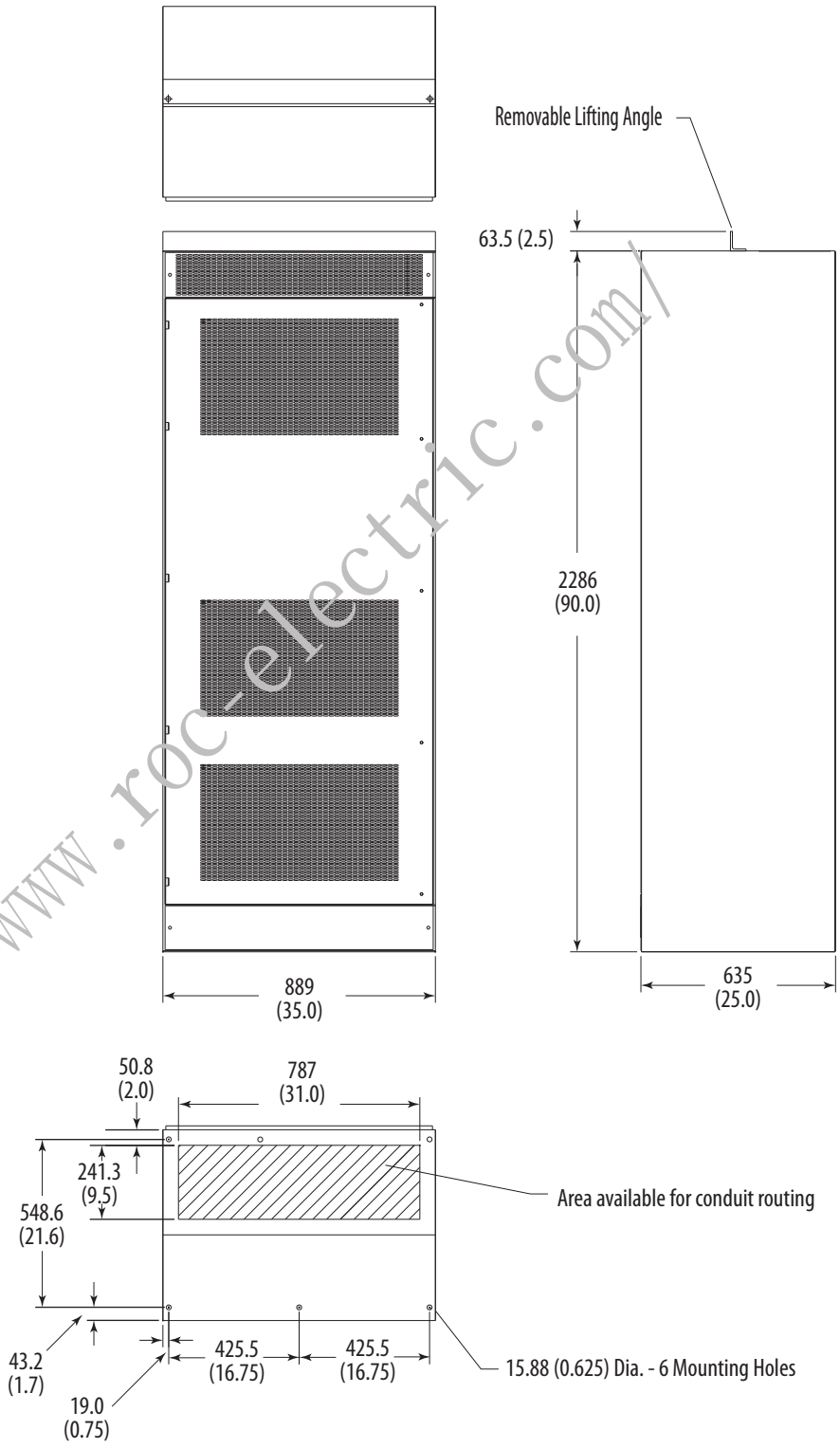
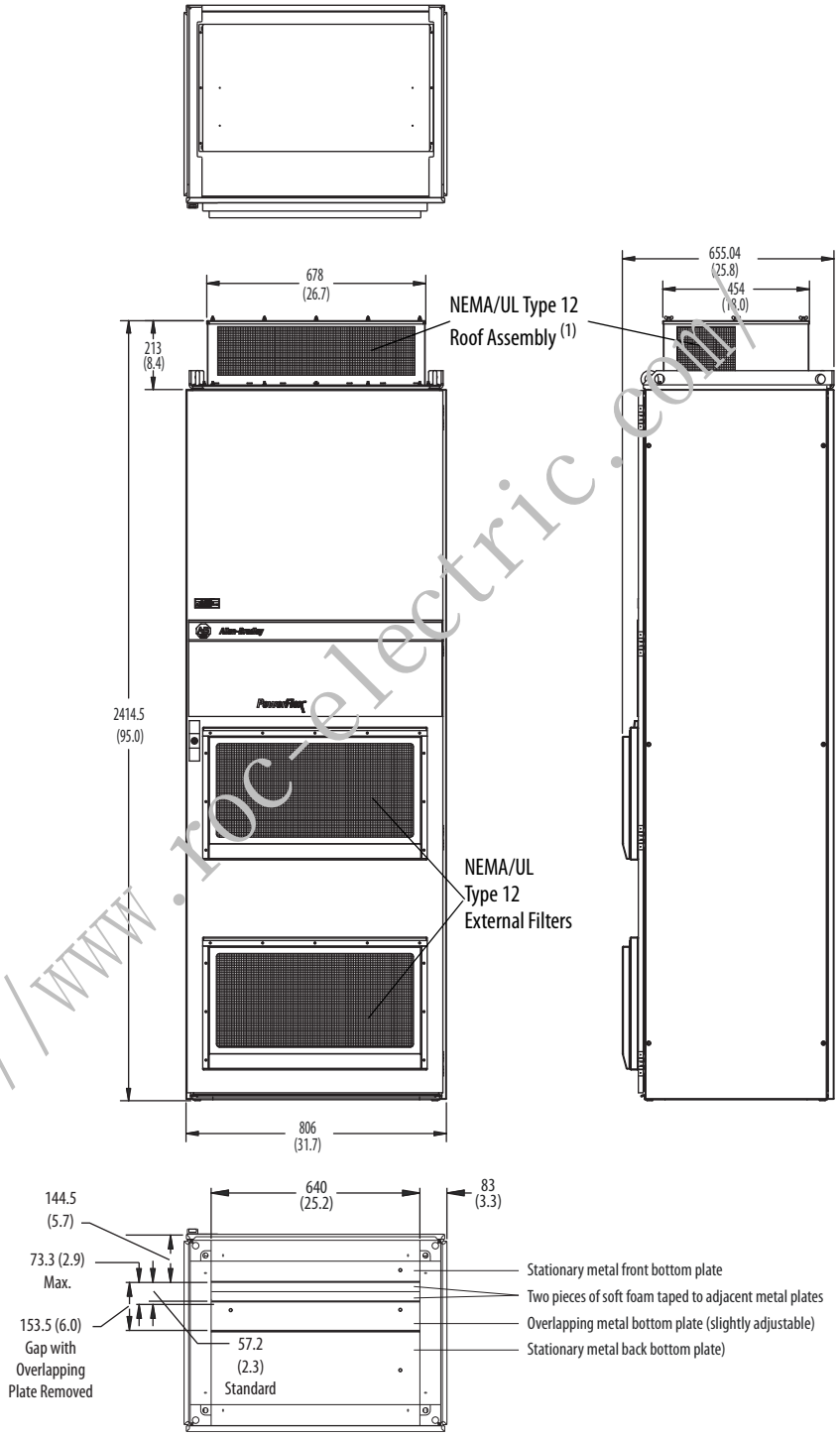


Figure 31 - Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12 - IP54 w/ Conformal Coat)

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

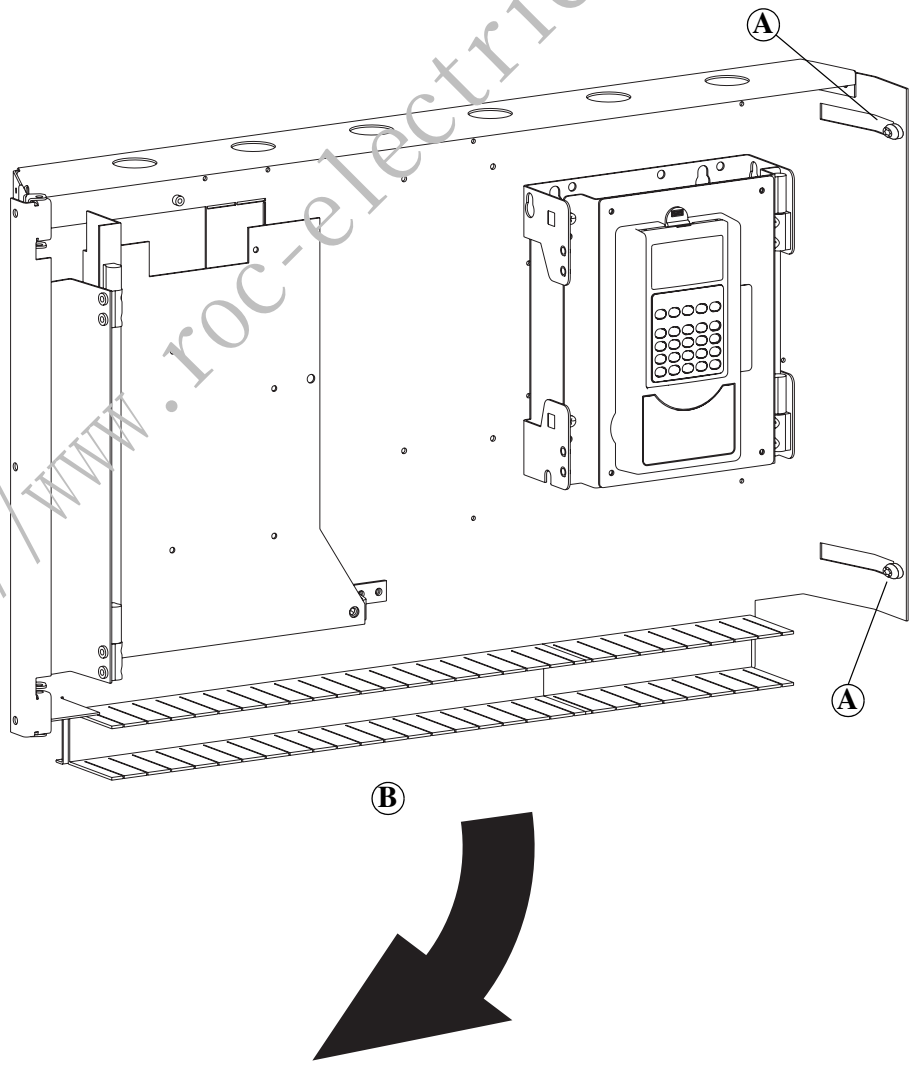
See the Lifting and Mounting PowerFlex 700S and 700H Drives, Frames 10...14, Installation Instructions, publication PFLEX-IN005, for detailed instructions. These instructions are shipped with the drive. When you have completed the instructions in PFLEX-IN005, continue with the installation as directed below.

Remove the Protective Covers

Move 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 Remove the Airflow Plate on page 91.

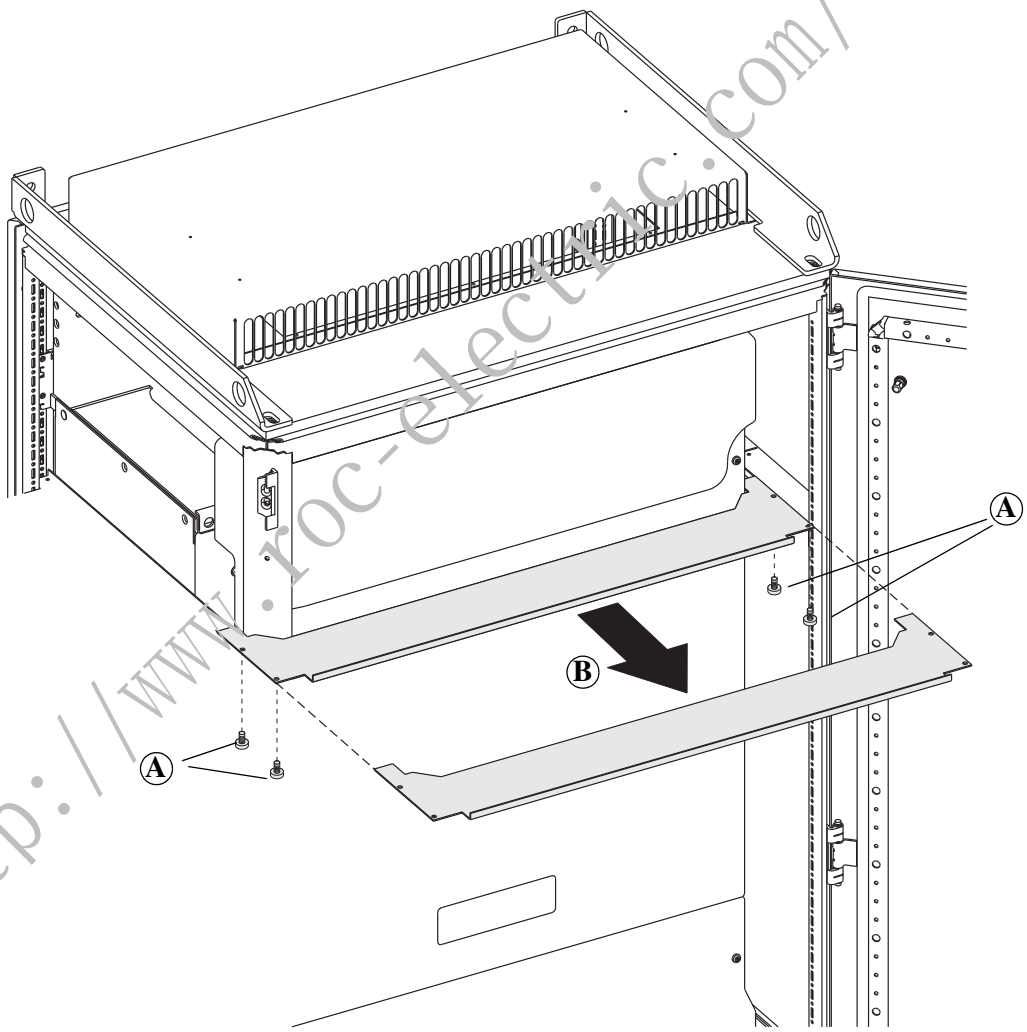
Task	Description
Ⓐ	Loosen the T8 Torx-head screws that secure the control frame to the drive enclosure.
Ⓑ	Swing the control frame out and away from the power structure.



Remove 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 Remove the Protective Covers on page 92.

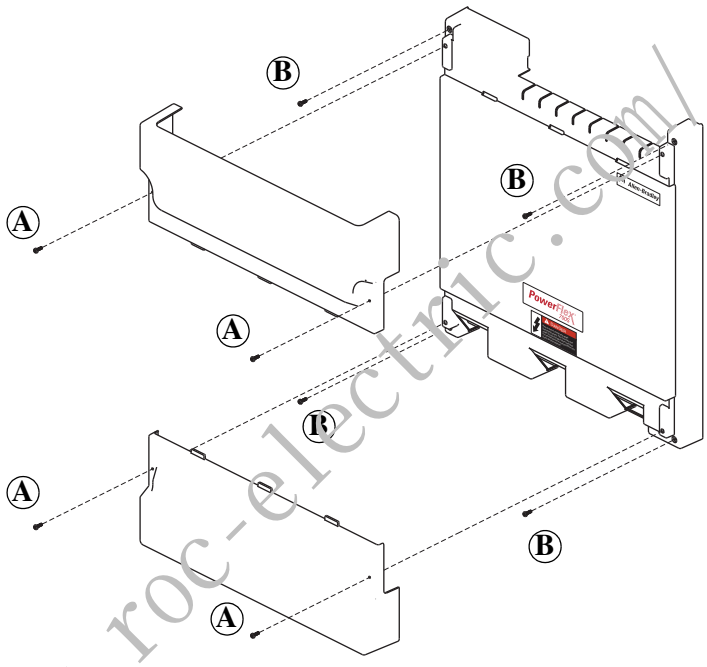
Task	Description
Ⓐ	Remove the T8 Torx-head screws that secure the airflow plate to the drive.
Ⓑ	Slide the airflow plate off of the drive.



Remove 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 - see Move the Common Mode Jumper to the Disconnected Position on page 95.
- Should insulate terminal X4 on the Rectifier circuit board- see Insulate Terminal X4 on the Rectifier Circuit Board on page 96.

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 - see Move the Common Mode Jumper to the Disconnected Position on page 95.
- Must insulate terminal X4 on the Rectifier circuit board- see 96 on page Insulate Terminal X4 on the Rectifier Circuit Board.

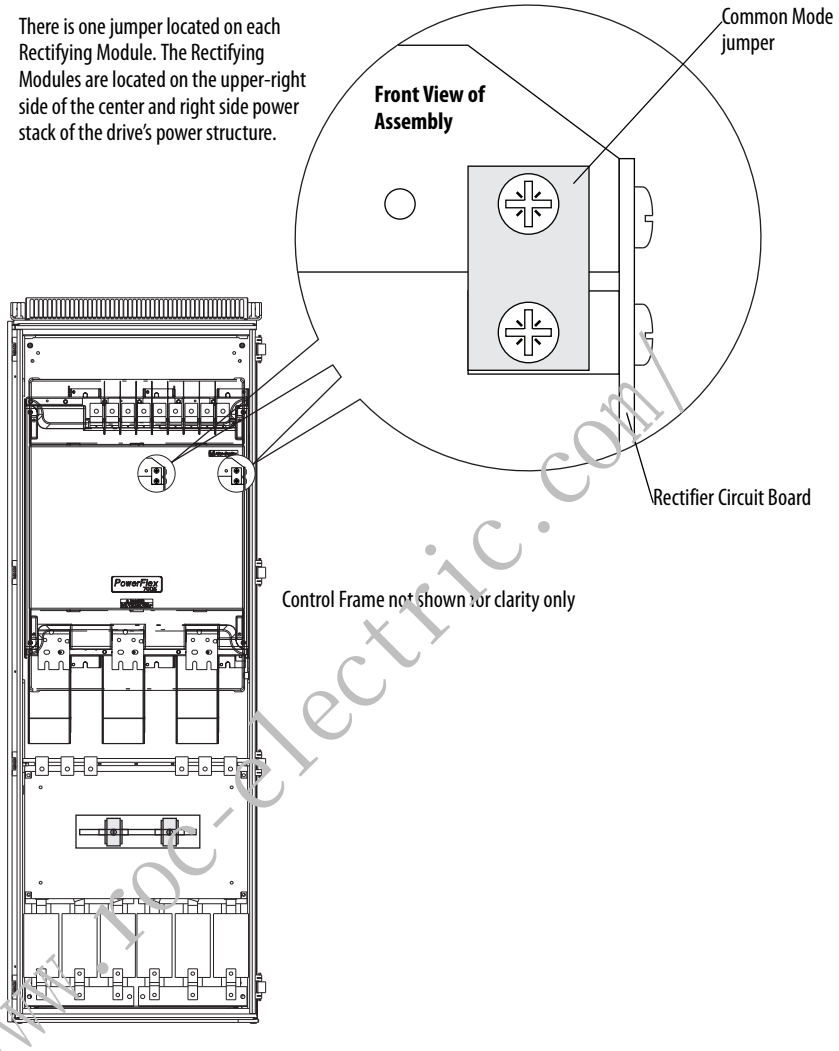
Installation on a Grounded B Phase Delta System

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

- Must move the common mode jumper to the disconnected position - see Move the Common Mode Jumper to the Disconnected Position on page 95.
- Must insulate terminal X4 on the Rectifier circuit board- see Insulate Terminal X4 on the Rectifier Circuit Board on page 96.

Note: See 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.

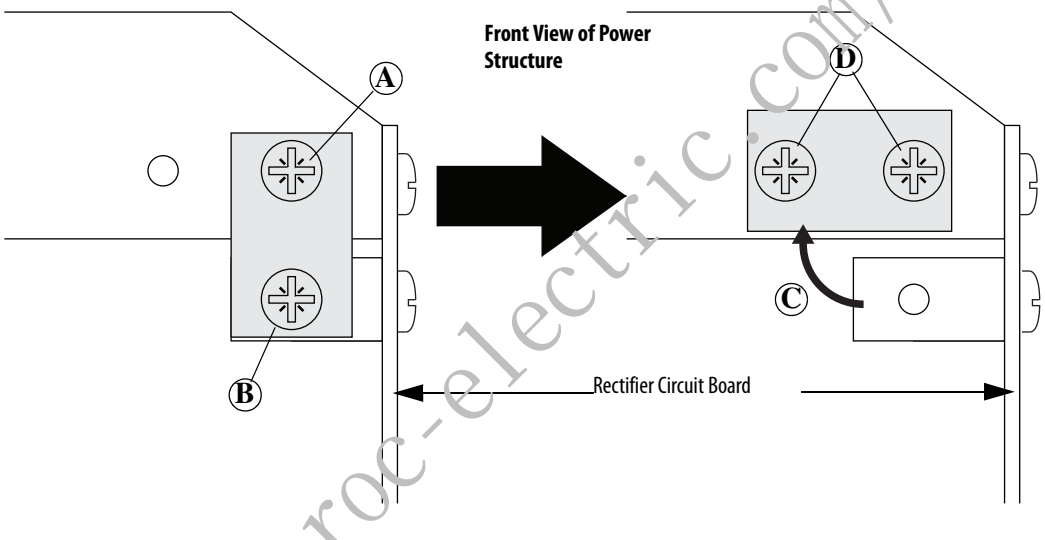
Figure 32 - Common Mode Jumper and Rectifier Circuit Board Location



Move the Common Mode Jumper to the Disconnected Position

Follow the steps below to move the common mode jumper to the disconnected position (see Figure 32 on page 94 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.

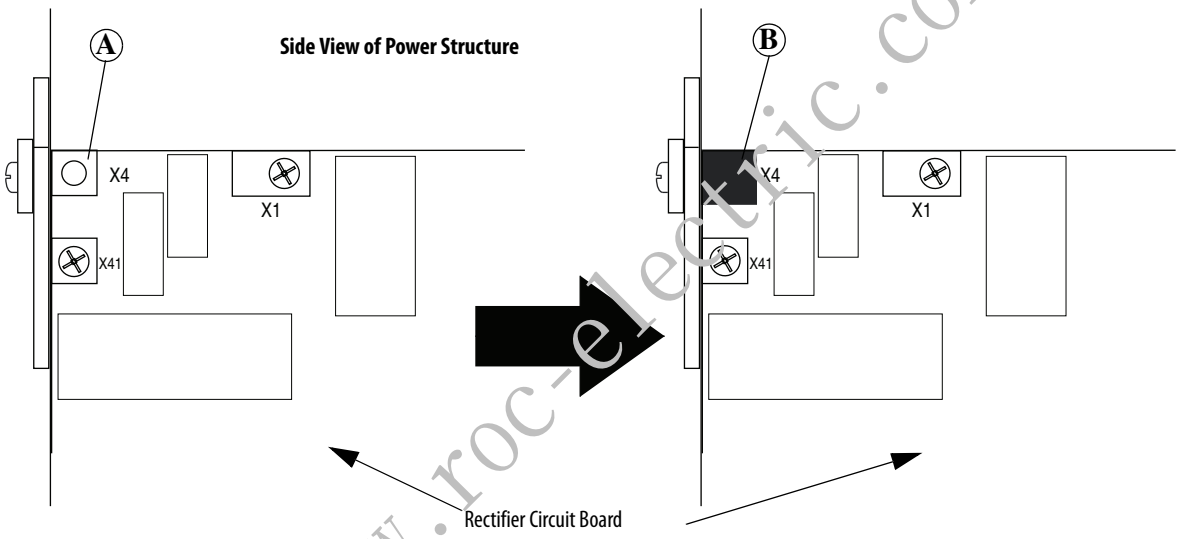


Insulate Terminal X4 on the Rectifier Circuit Board

Follow the steps below to insulate terminal X4 on the rectifier circuit board (see Figure 32 on page 94 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 33 - AC Wiring Example. Two Fuses per Phase

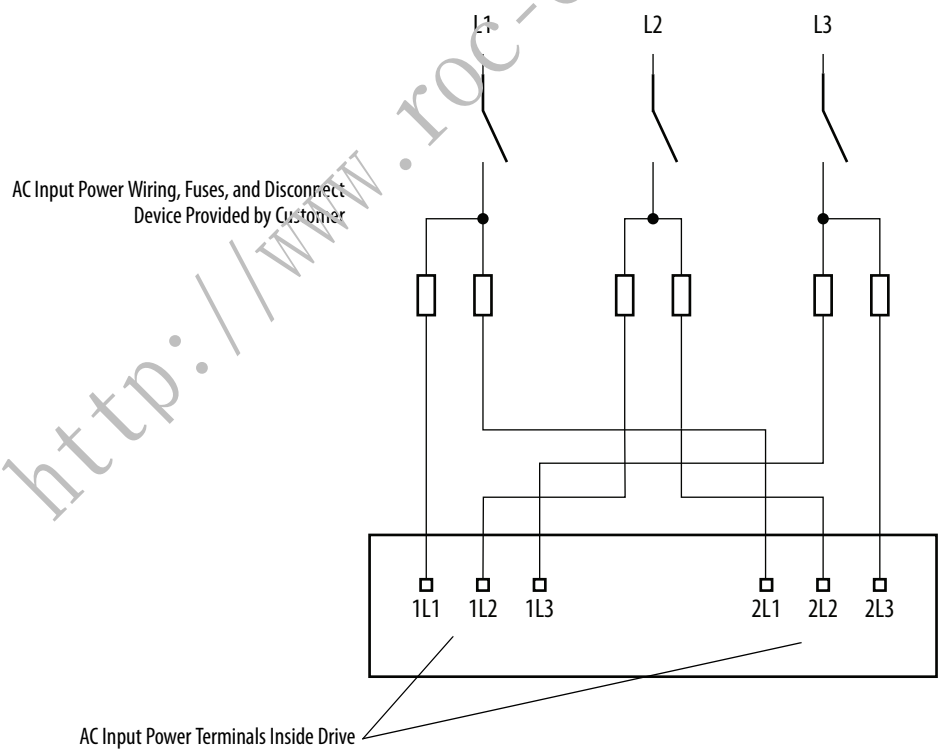


Figure 34 - AC Wiring Example: One Fuse per Phase

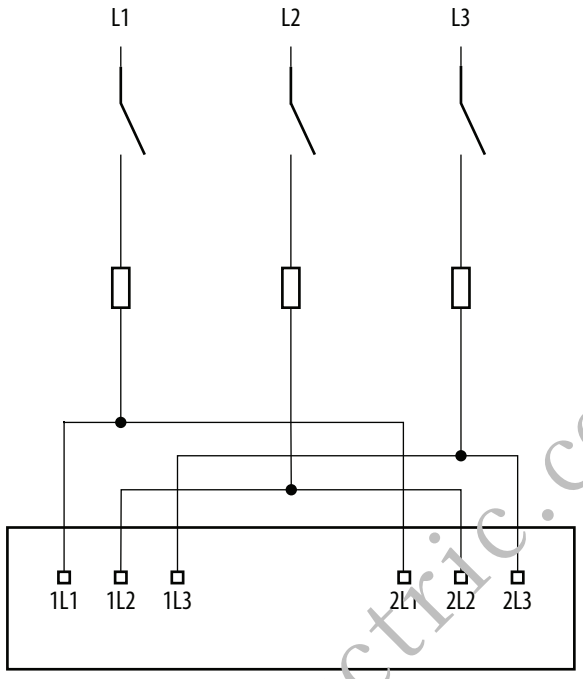
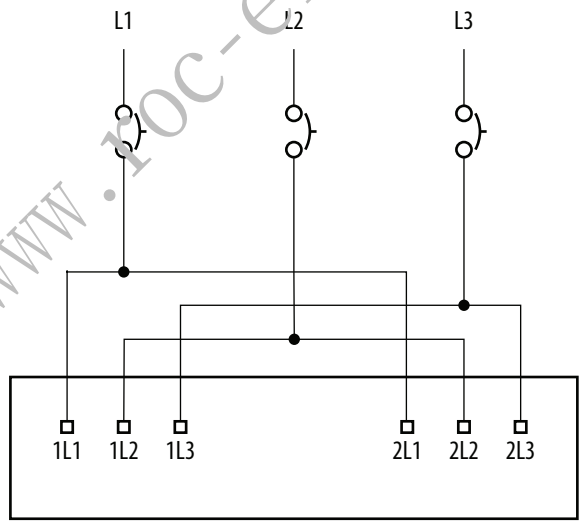


Figure 35 - AC Wiring Example: Circuit Breaker



IMPORTANT Once power wiring has been completed, the protective covers must be installed before energizing the drive. Installation is in reverse order of removal (see Remove the Protective Covers on page 90).

Table 25 - Power Terminal Specifications

No.	Name	Description	Wire Size Range (1)(2)		Torque	Terminal Bolt Size (3)(4)
			Maximum	Minimum	Recommended	
1	Input Power Terminal Block (3) 1L1, 1L2, 1L3, 2L1, 2L2, 2L3	AC Input power	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
2	Output Power Terminal Block (3) U/T1, V/T2, W/T3	Motor connections	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
3	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
4	DC Bus (3) (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
5	Cable Clamp for Shield					

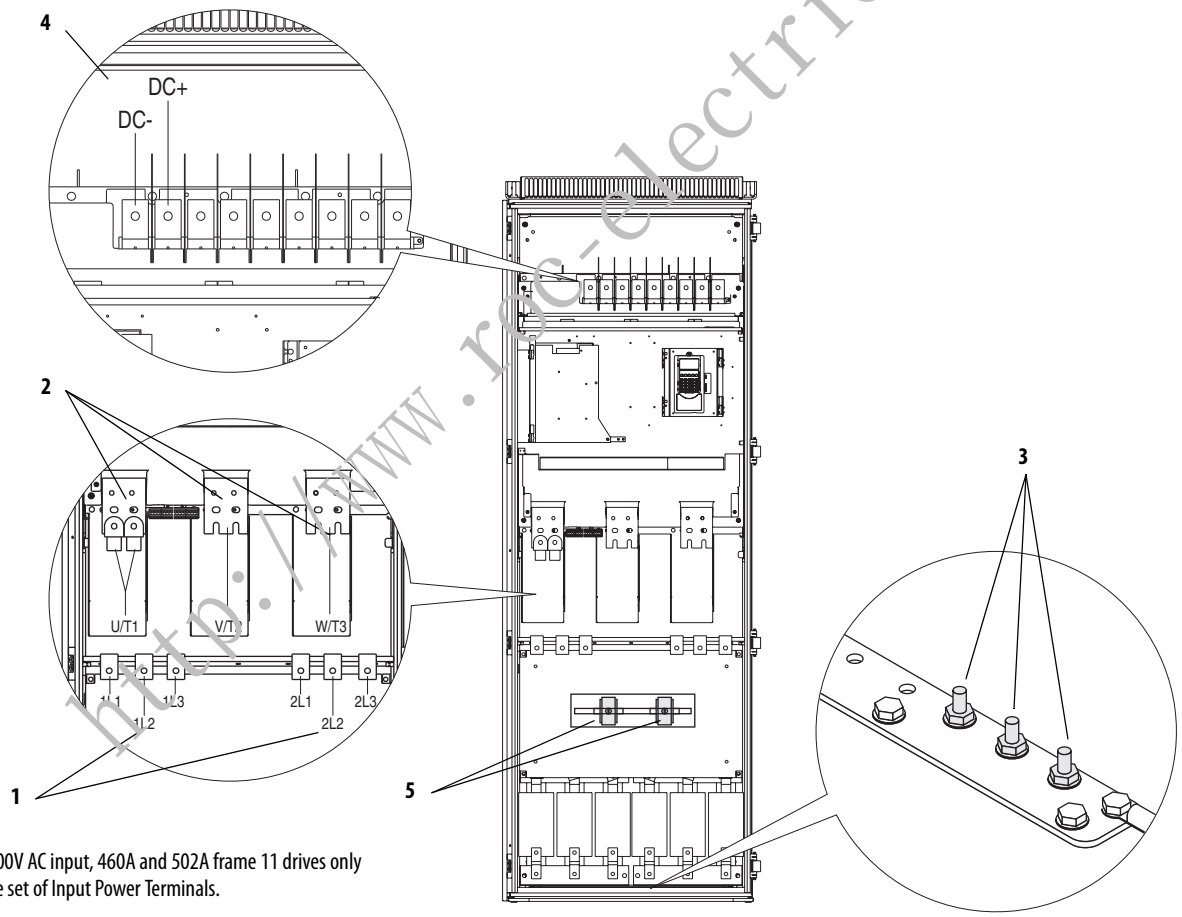
(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.

(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 36 - Power Terminal Locations



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

Notes:

Frame 12 Mechanical 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 37 - 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)

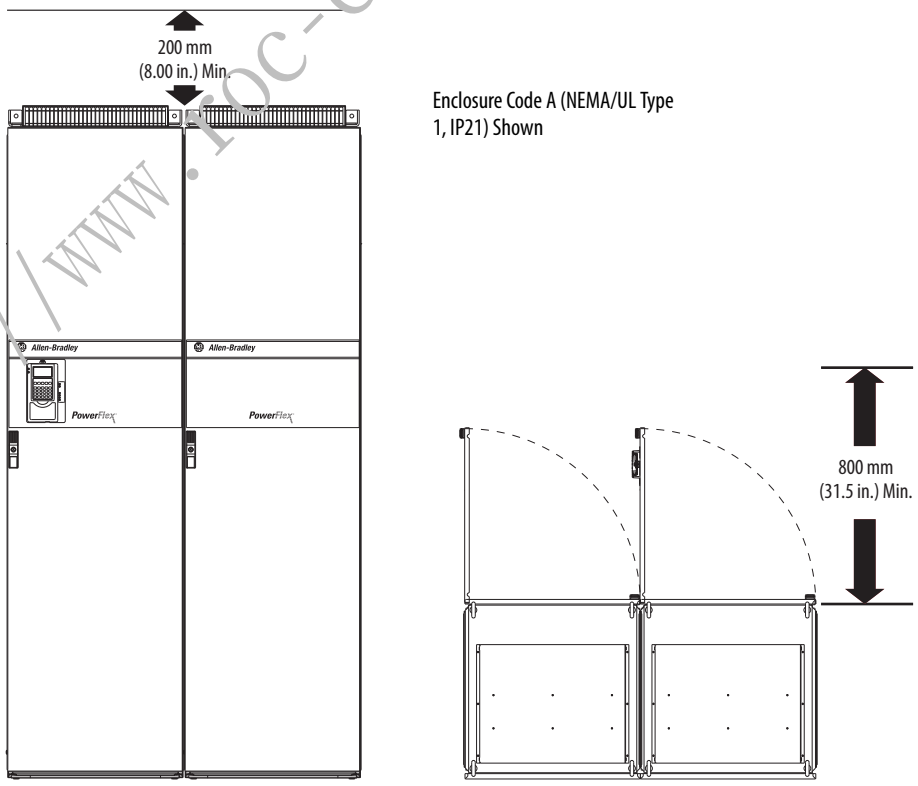
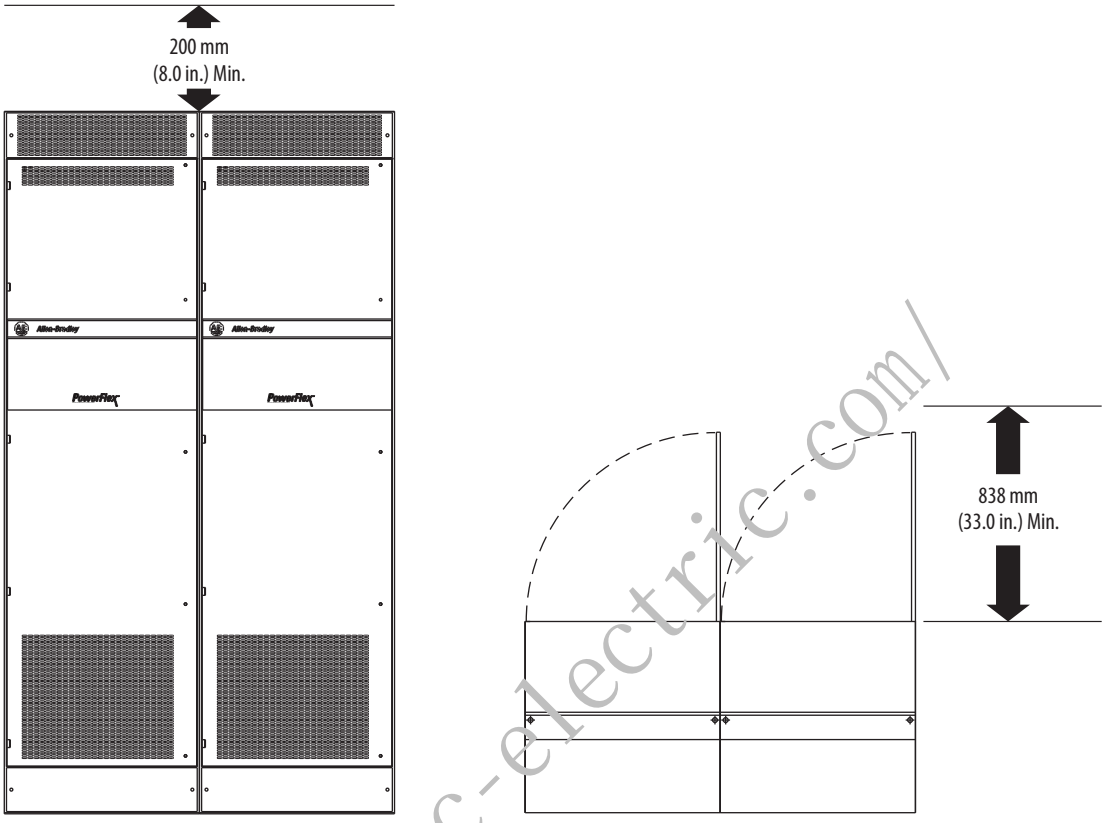


Figure 38 - Enclosure Code B (NEMA/UL Type 1, IP21) and K (NEMA/UL Type 1, IP21 w/Conformal Coat)



Operating Temperatures

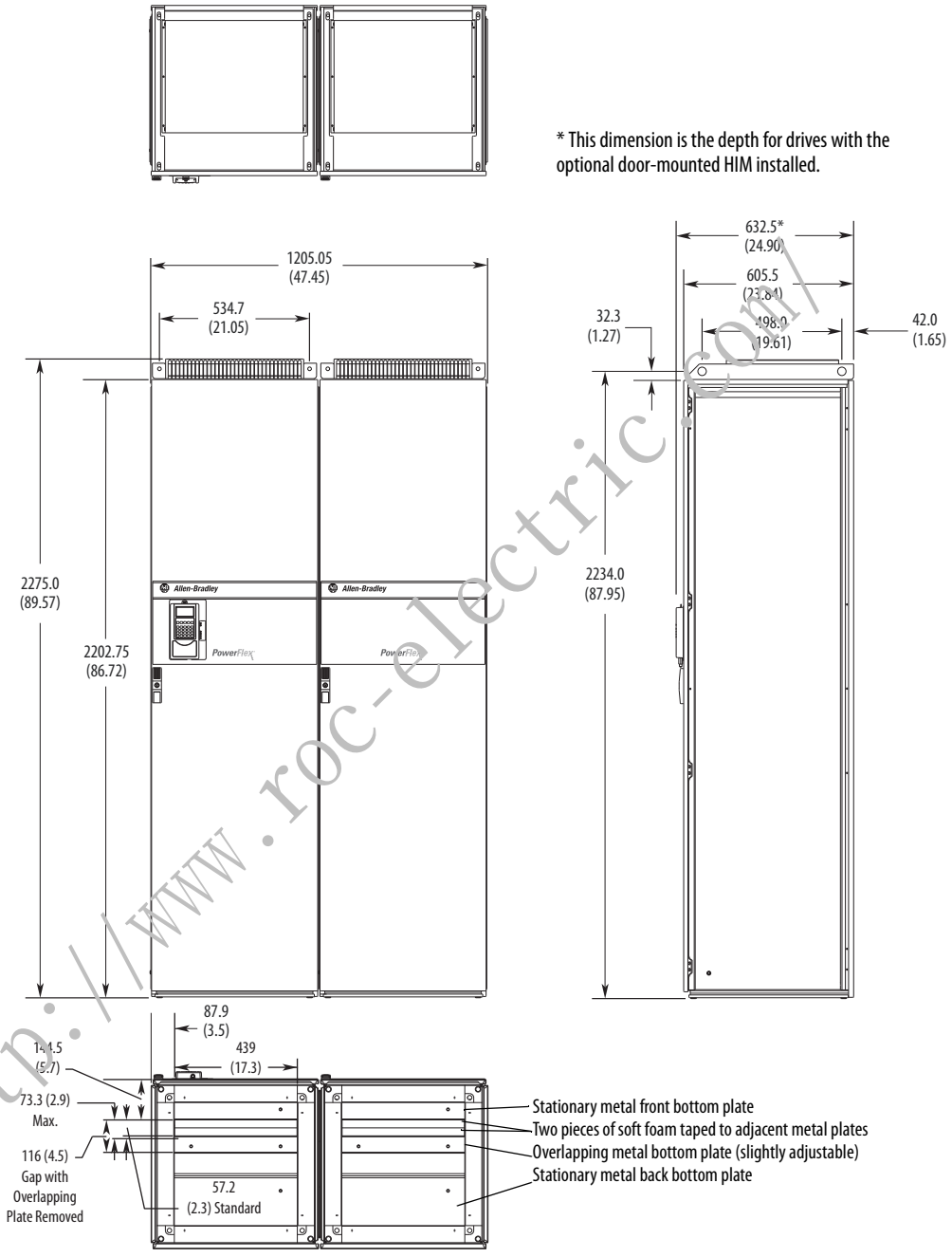
Frame 12 drives require a minimum of 5200 m^3/h (3060 cfm) of cooling air.

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

Dimensions

Figure 39 - 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 40 - Enclosure Code B (NEMA/UL Type 1, IP21) and K (NEMA/UL Type 1, IP21 w/Conformal Coat)

Dimensions are in millimeters and (inches).

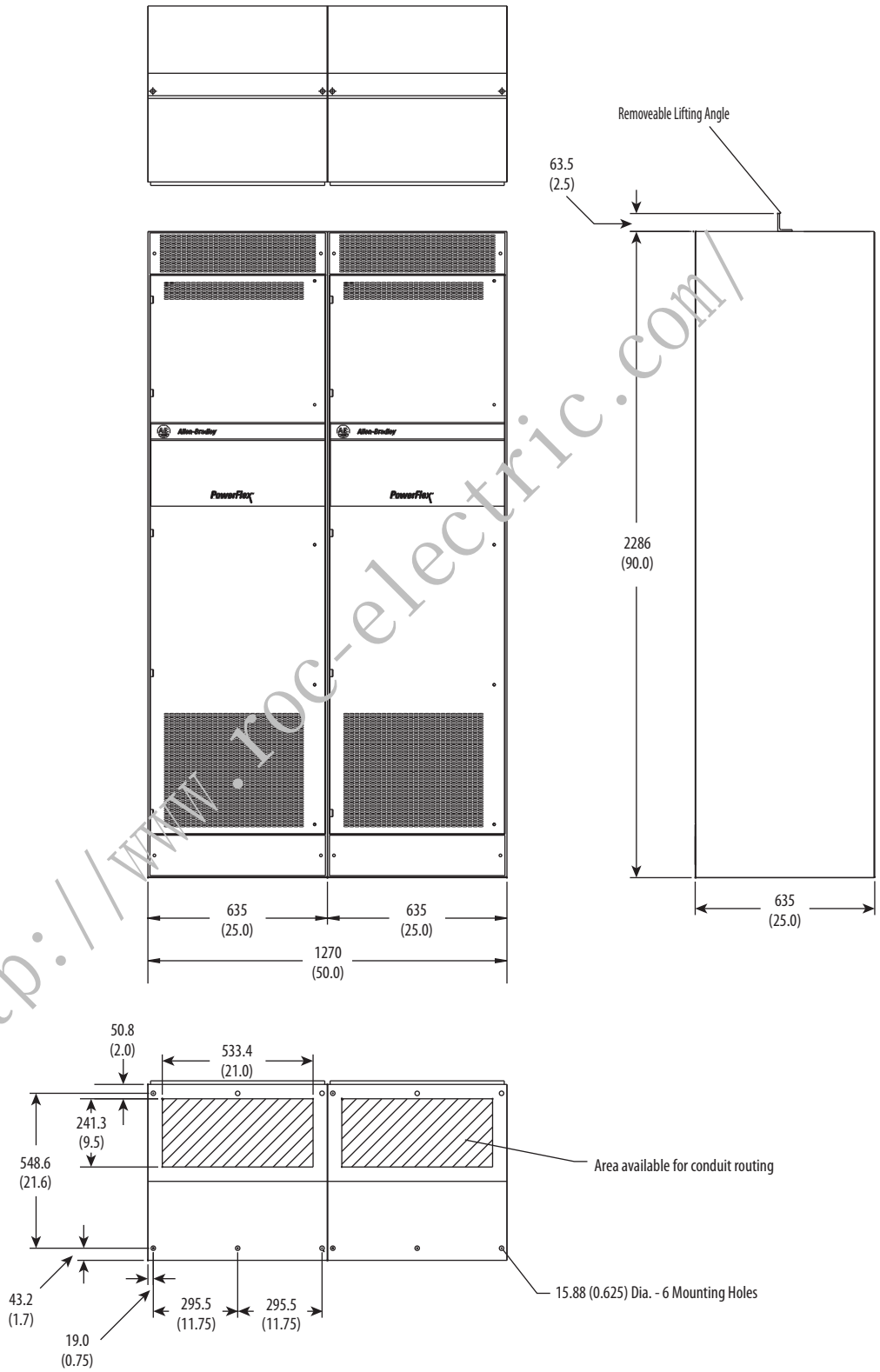
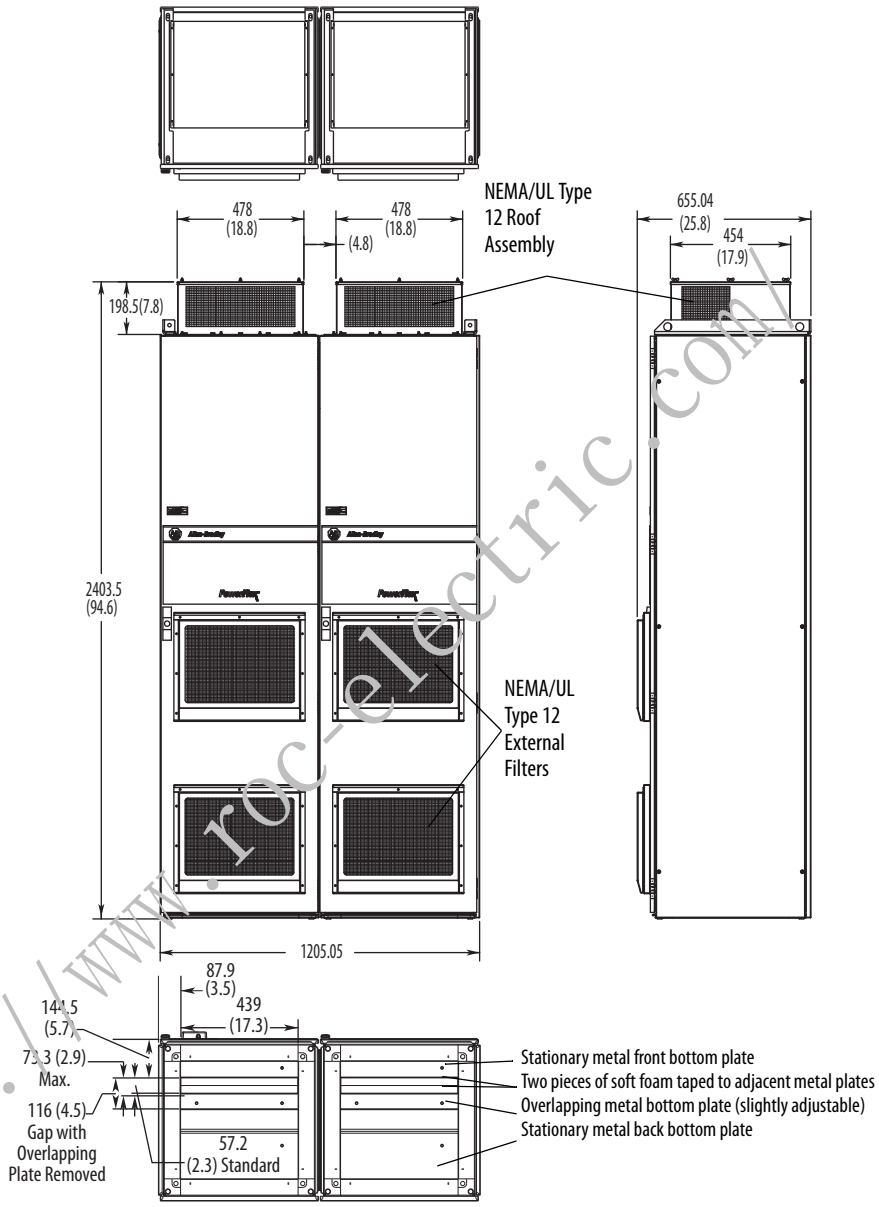


Figure 41 - Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/Conformal Coat)

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

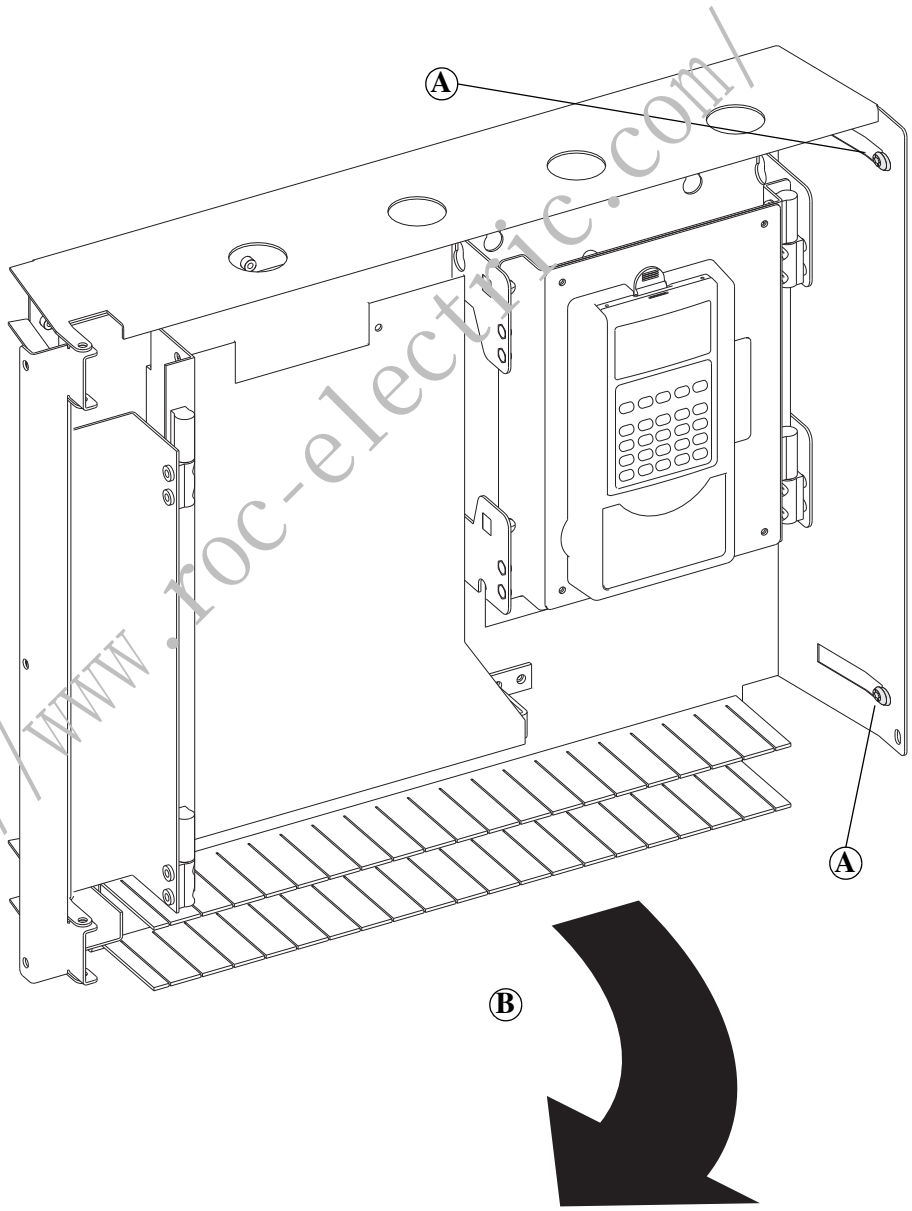
See the Lifting and Mounting PowerFlex 700S and 700H Drives, Frames 10...14, Installation Instructions, publication PFLEX-IN005, for detailed instructions. These instructions are shipped with the drive. When you have completed the instructions in PFLEX-IN005, continue with the installation as directed below.

Remove the Protective Covers

Move 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 Remove the Airflow Plate on page 107.

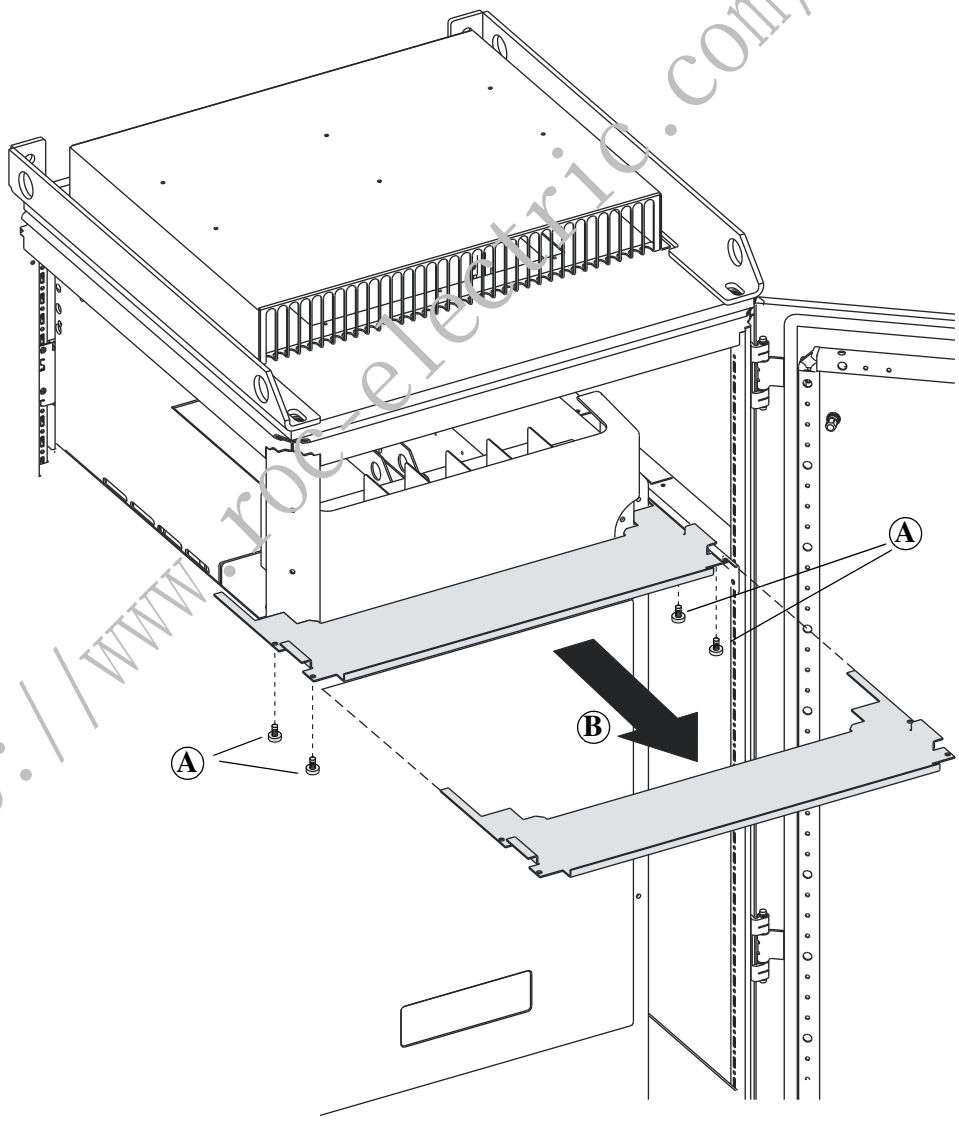
Task	Description
Ⓐ	Loosen the T8 Torx-head screws that secure the control frame to the drive enclosure (Remove screws on early frame 10 drives).
Ⓑ	Swing the control frame out and away from the power structure.



Remove 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 Remove the Protective Covers on page 108.

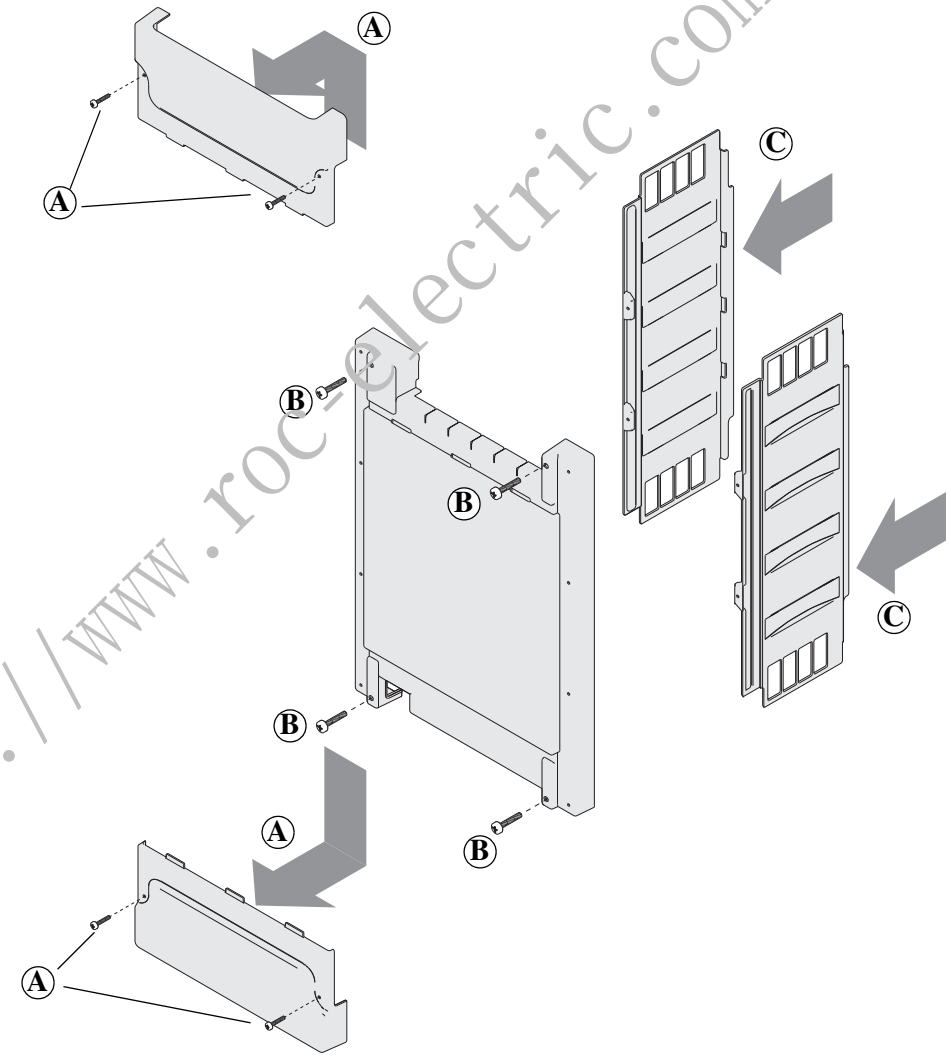
Task	Description
Ⓐ	Remove the T8 Torx-head screws that secure the airflow plate to the drive.
Ⓑ	Slide the airflow plate off of the drive.



Remove 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. 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 - see Move the Common Mode Jumper to the Disconnected Position on page 111.
- Should insulate terminal X4 on the Rectifier circuit board- see Insulate Terminal X4 on the Rectifier Circuit Board on page 112.
- Must disconnect the small capacitors from the input terminals - see Disconnect the Small Capacitors from the Input Terminals on page 113.

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 - see Move the Common Mode Jumper to the Disconnected Position on page 111.
- Must insulate terminal X4 on the Rectifier circuit board- see Insulate Terminal X4 on the Rectifier Circuit Board on page 112.
- Must disconnect the small capacitors from the input terminals - see Disconnect the Small Capacitors from the Input Terminals on page 113.

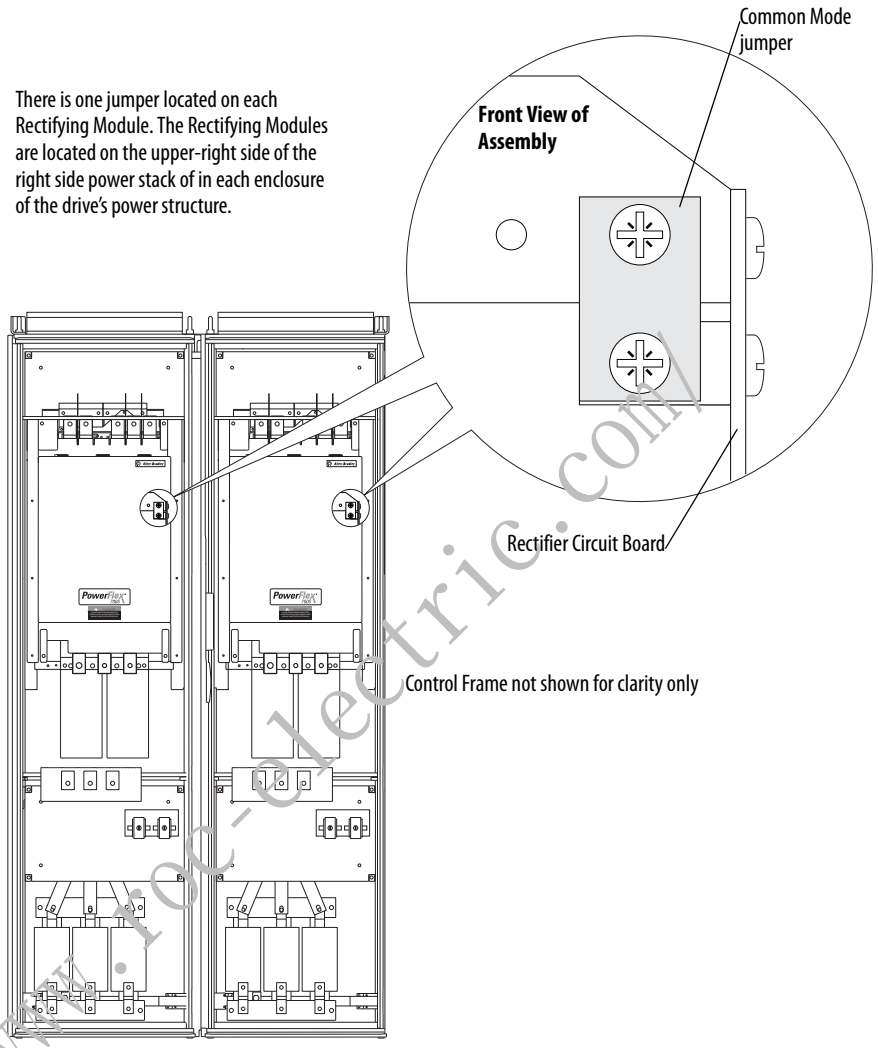
Installation on a Grounded B Phase Delta System

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

- Must move the common mode jumper to the disconnected position - see Move the Common Mode Jumper to the Disconnected Position on page 111.
- Must insulate terminal X4 on the Rectifier circuit board- see Insulate Terminal X4 on the Rectifier Circuit Board on page 112.
- Must disconnect the small capacitors from the input terminals - see Disconnect the Small Capacitors from the Input Terminals on page 113.

Note: See 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.

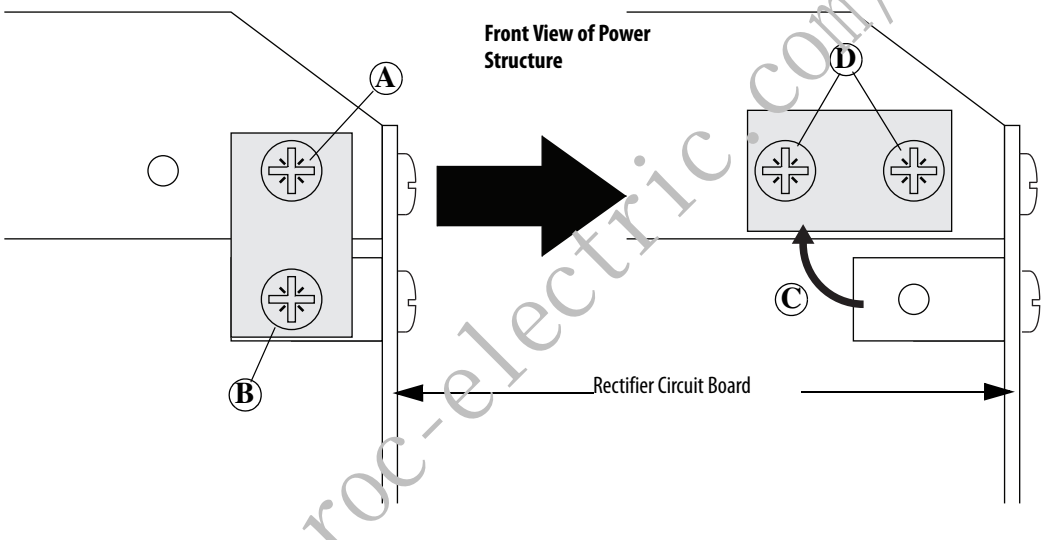
Figure 42 - Common Mode Jumper and Rectifier Circuit Board Location



Move the Common Mode Jumper to the Disconnected Position

Follow the steps below to move the common mode jumper to the disconnected position (see Figure 42 on page 110 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.

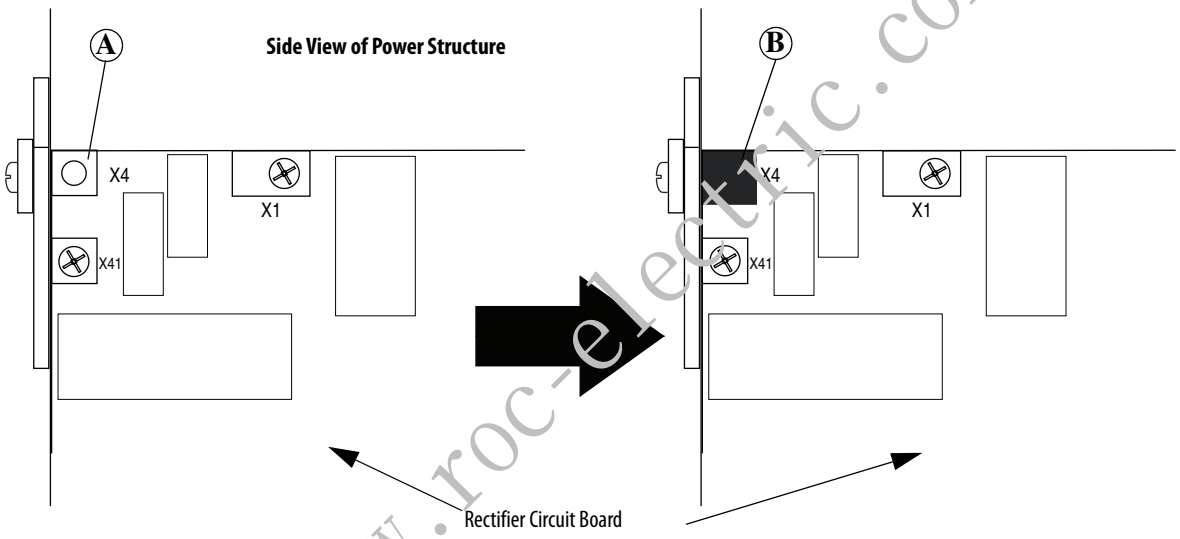


Insulate Terminal X4 on the Rectifier Circuit Board

Follow the steps below to insulate terminal X4 on the rectifier circuit board (see Figure 42 on page 110 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.



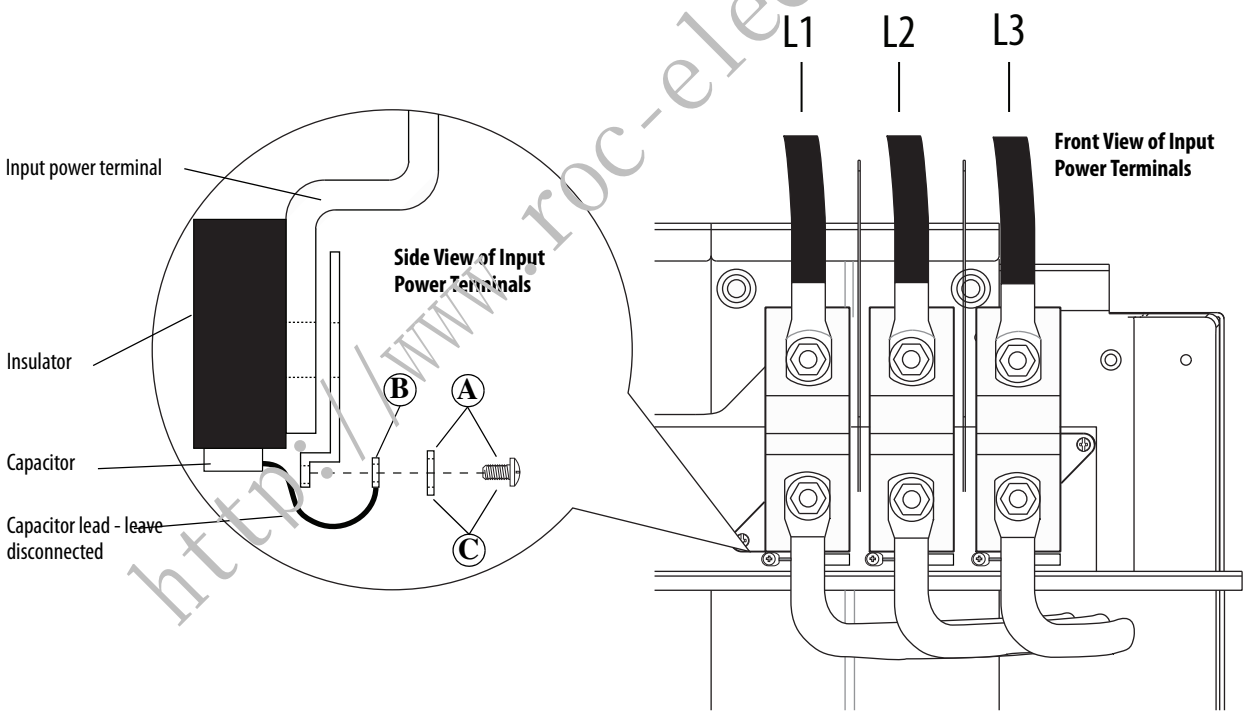
Disconnect the Small Capacitors from the Input Terminals

Follow the steps below to disconnect the small capacitors from the input terminals.

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

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.



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.

For applications that require that the DC– and DC+ terminals for PowerFlex 700S or 700H frame 12 drives be connected in common (for example, 12 pulse applications, or when using a dynamic brake), you must purchase and install the frame 12 DC Bus Connector kit, which is sold separately from the drive. See the PowerFlex 700S and 700H Frame 12 DC Bus Connector Kit, Installation Instructions, publication PFLEX-IN022.

Figure 43 - Frame 12 AC Wiring Example: Two Fuses per Phase

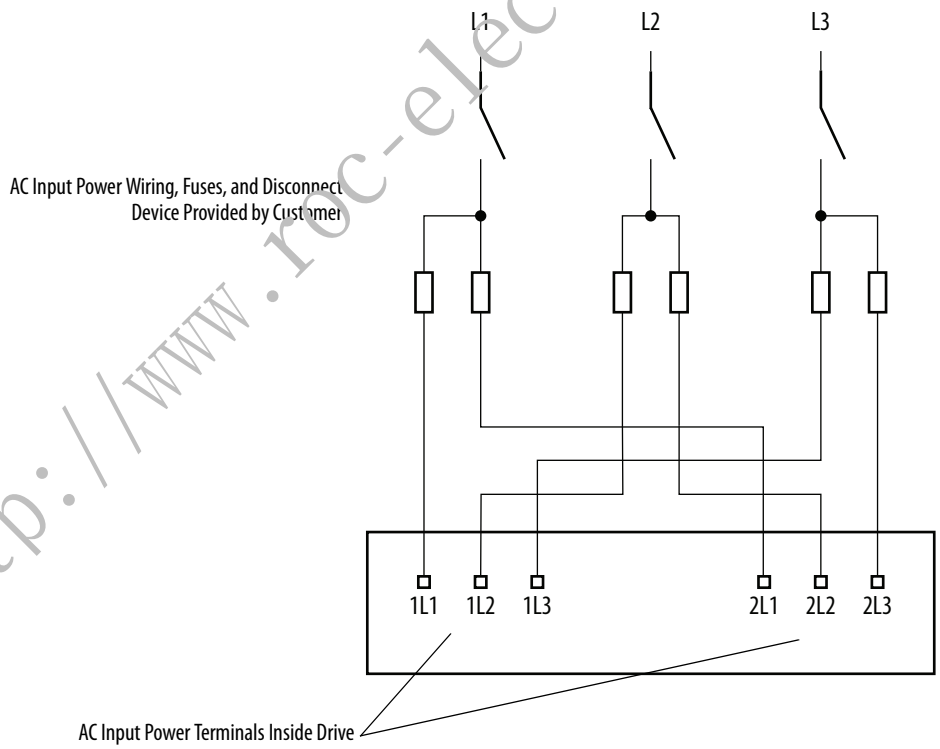


Figure 44 - Frame 12 AC Wiring Example: One Fuse per Phase

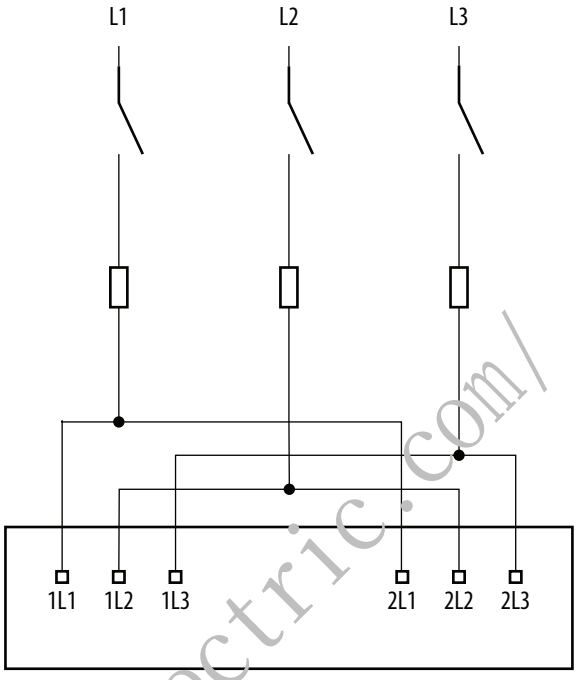
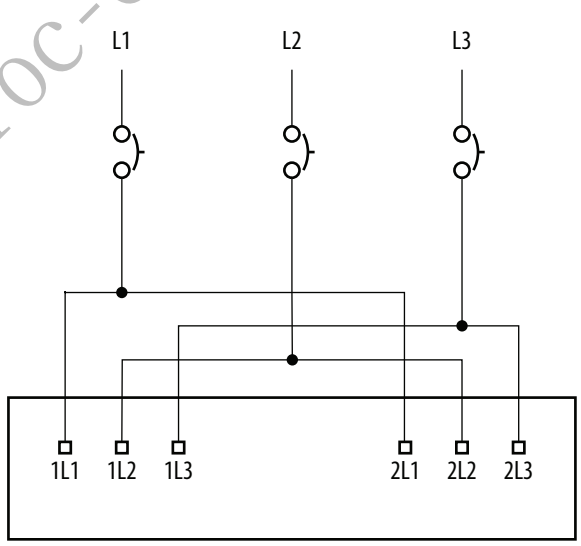


Figure 45 - Frame 12 AC Wiring Example: Circuit Breaker



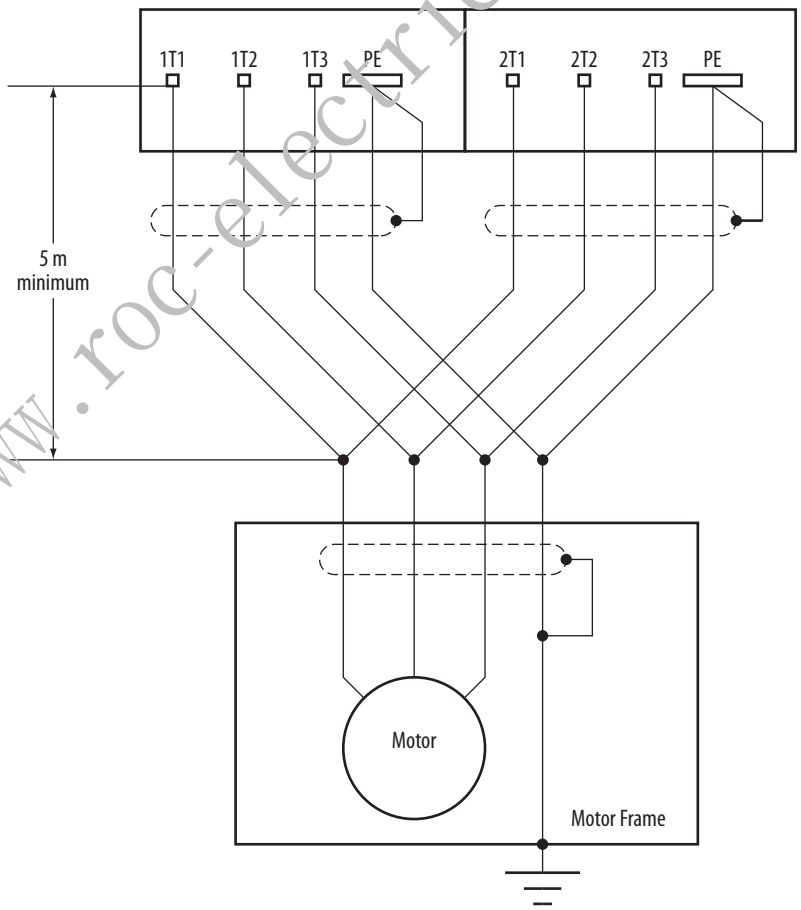
Output Power Wiring

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 5 m (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 46 - Frame 12 Motor Wiring Example



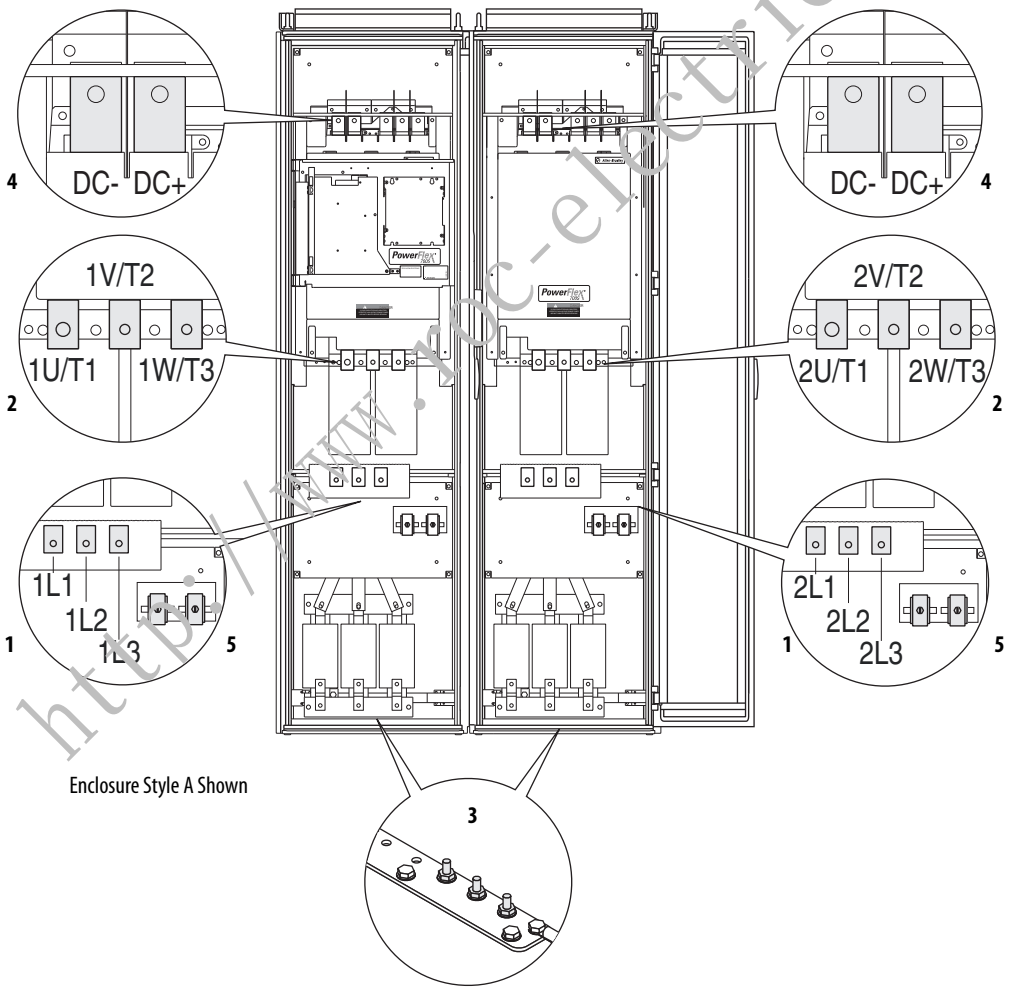
IMPORTANT Once power wiring has been completed, the protective covers must be installed before energizing the drive. Installation is in reverse order of removal (see Remove the Protective Covers on page 106).

Table 26 - Power Terminal Specifications

No.	Name	Description	Wire Size Range (1)(2)		Torque	Terminal Bolt Size (3)(4)
			Maximum	Minimum	Recommended	
1	Input Power Terminal Block (3) 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
2	Output Power Terminal Block ((3) 1U/1T1, 1V/1T2, 1W/1T3, 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
3	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
4	DC Bus (3) (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
5	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 47 - Power Terminal Locations



Enclosure Style A Shown

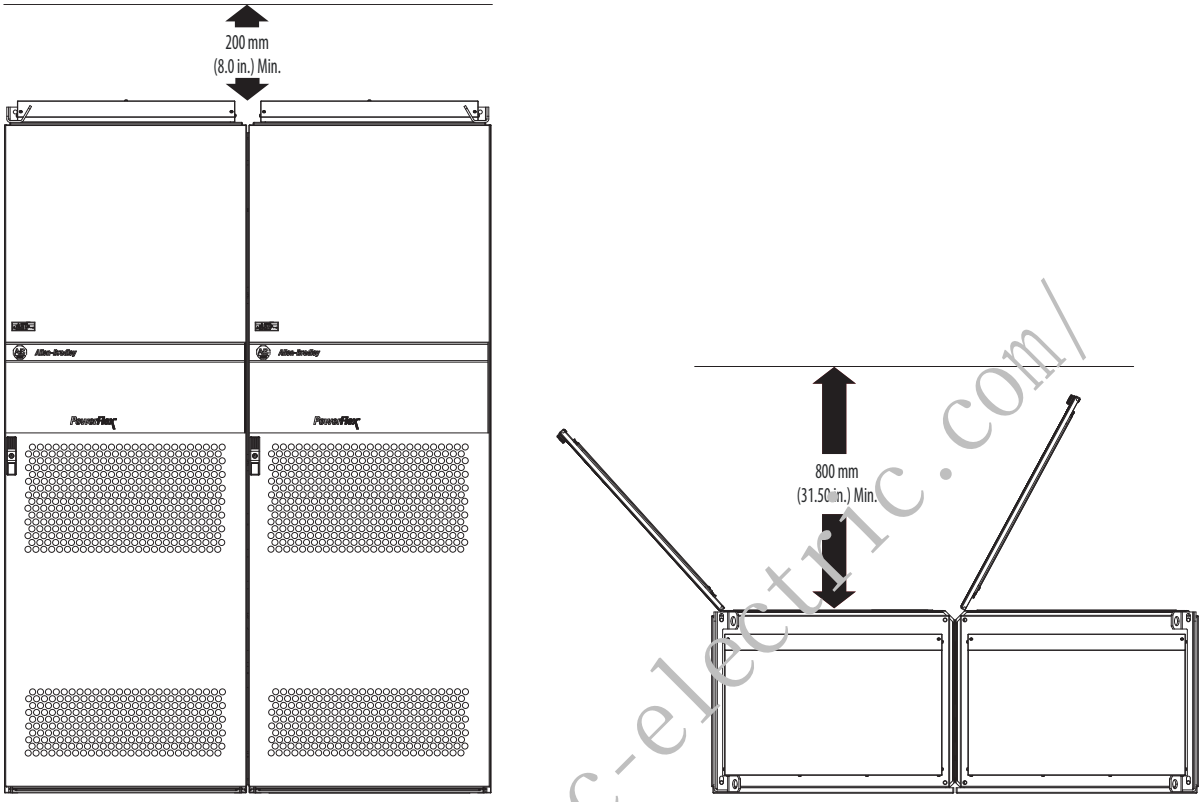
Notes:

Frame 13 Mechanical 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.

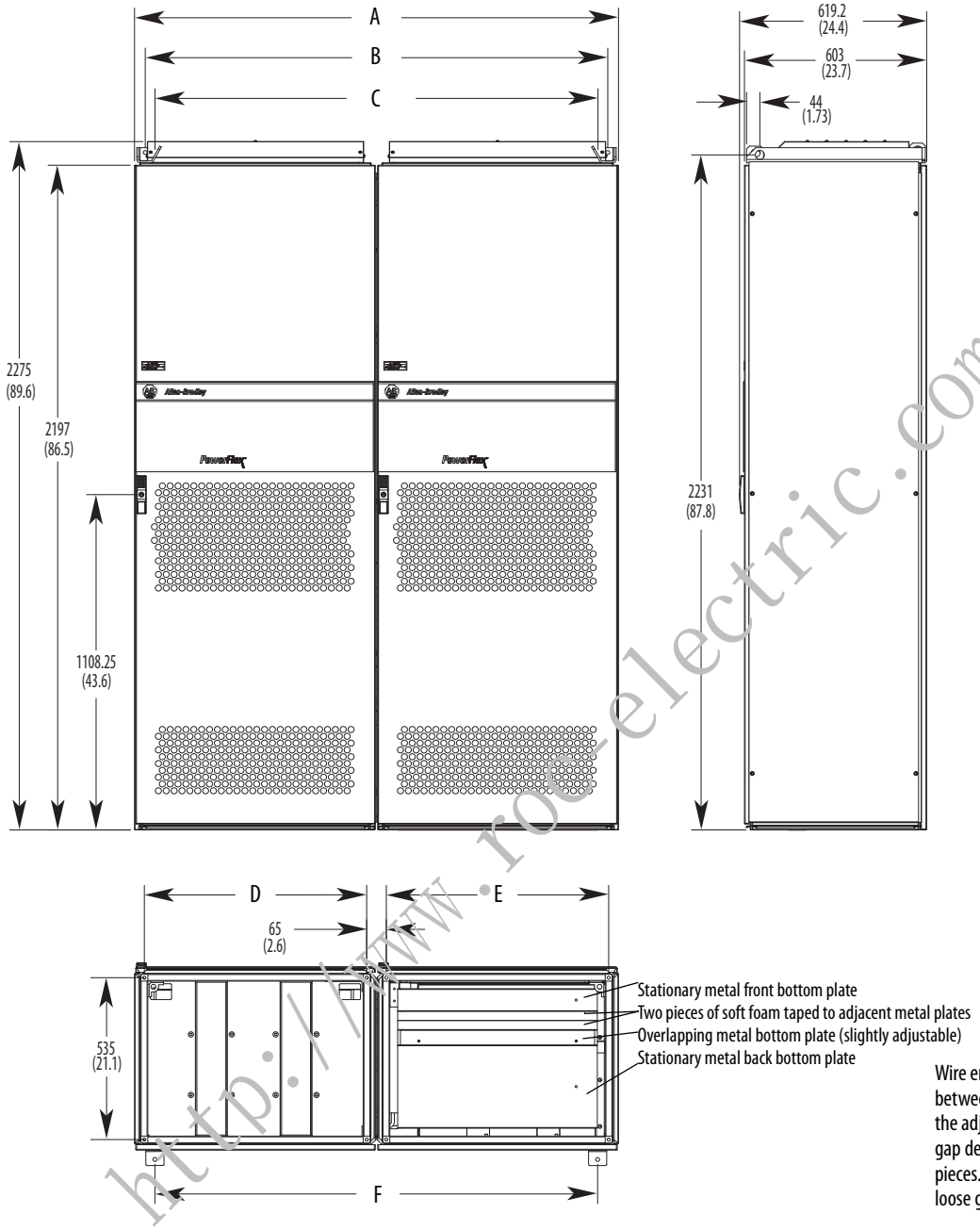
Operating Temperatures

Frame 13 drives require a minimum of 4200 m3/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…40° C (32…104° F)	0…40° C (32…104° F)
700S	400/480V AC (540/650V DC)	All	0…40° C (32…104° F)	0…40° C (32…104° F)
	600/690V AC (810/932V DC)	920, 1030	0…40° C (32…104° F)	0…40° C (32…104° F)
	600/690V AC (810/932V DC)	1180	0…35° C (32…95° F)	0…35° C (32…95° F)

Dimensions

Figure 48 - Enclosure Code A (NEMA/UL Type 1, IP21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)



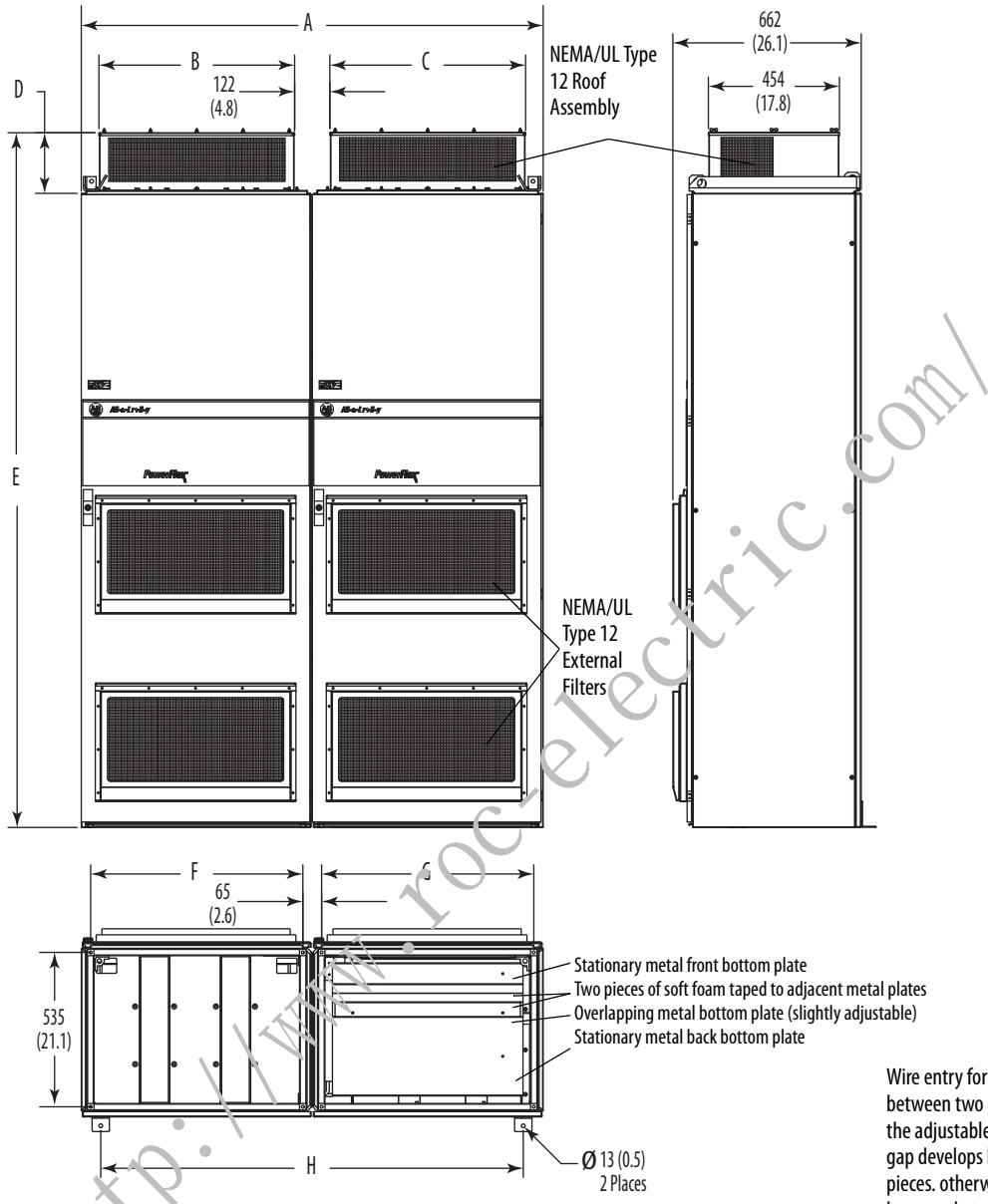
Wire entry for this enclosure is between two pieces of soft foam. If the adjustable plate is slid back, a gap develops between the foam pieces. otherwise, the foam acts as a loose gasket around the wires.

Table 27 - 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 49 - Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/Conformal Coat)



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.

Table 28 - 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) 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) 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.

See the Lifting and Mounting PowerFlex 700S and 700H Drives, Frames 10...14, Installation Instructions, publication PFLEX-IN005, for detailed instructions. These instructions are shipped with the drive. When you have completed the instructions in PFLEX-IN005, continue with the installation as directed below.

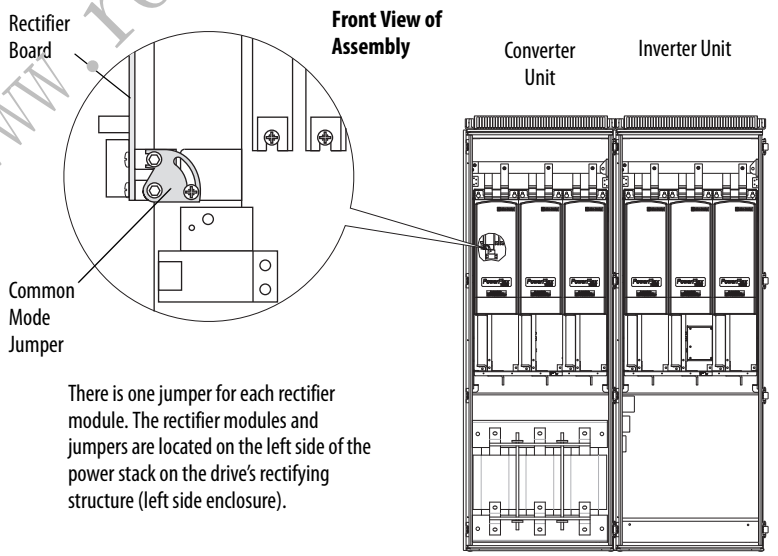
Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations

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: See the 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 50 - Common Mode Jumper and Rectifier Circuit Board Location



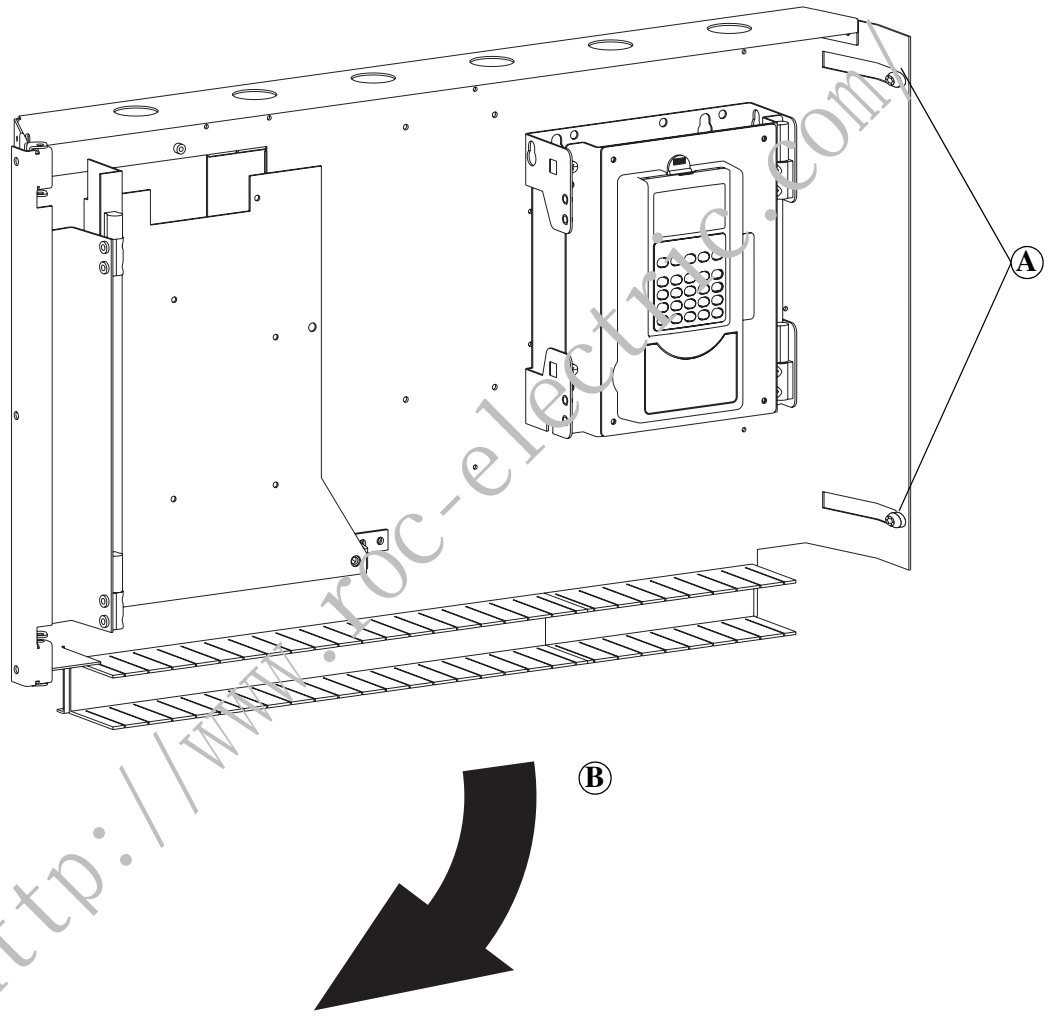
Note: Control frame not shown for clarity only.

Remove the Protective Covers from the Converter Unit

Move the Control Frame

You must move the control frame in order to access and remove the protective covers from the drive's converter unit.

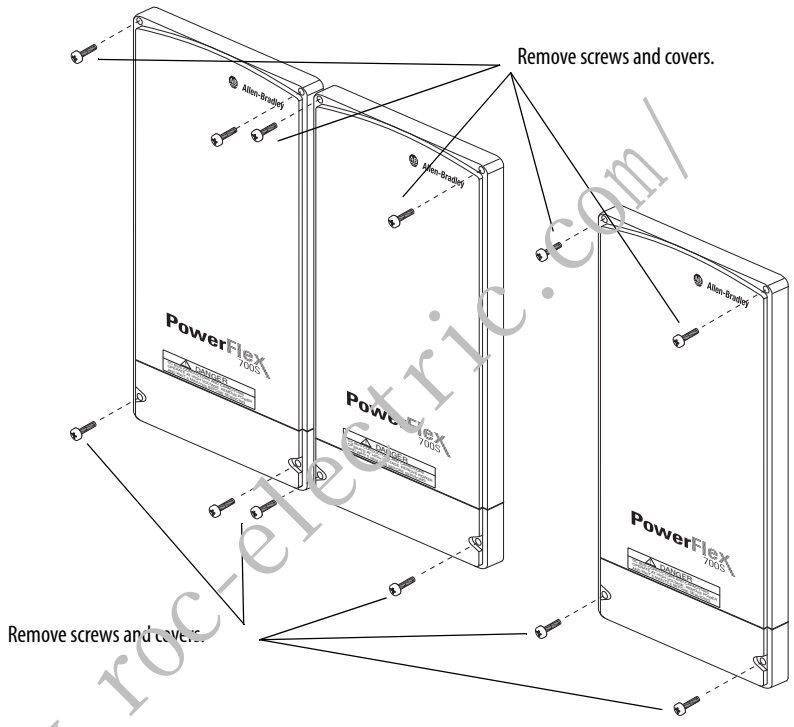
Task	Description
Ⓐ	Loosen the T8 Torx-head screws that secure the control frame to the drive enclosure.
Ⓑ	Swing the control frame out and away from the converter unit.



Remove 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.

- 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 - see Move the Common Mode Jumper(s) to the Disconnected Position on page 126.
- Should insulate terminal X4 on the rectifier circuit board - see Insulate Terminal X4 on the Rectifier Circuit Board on page 127.

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 - see Move the Common Mode Jumper(s) to the Disconnected Position on page 126.
- Must insulate terminal X4 on the rectifier circuit board - see Insulate Terminal X4 on the Rectifier Circuit Board on page 127.

Installation on a Grounded B Phase Delta System

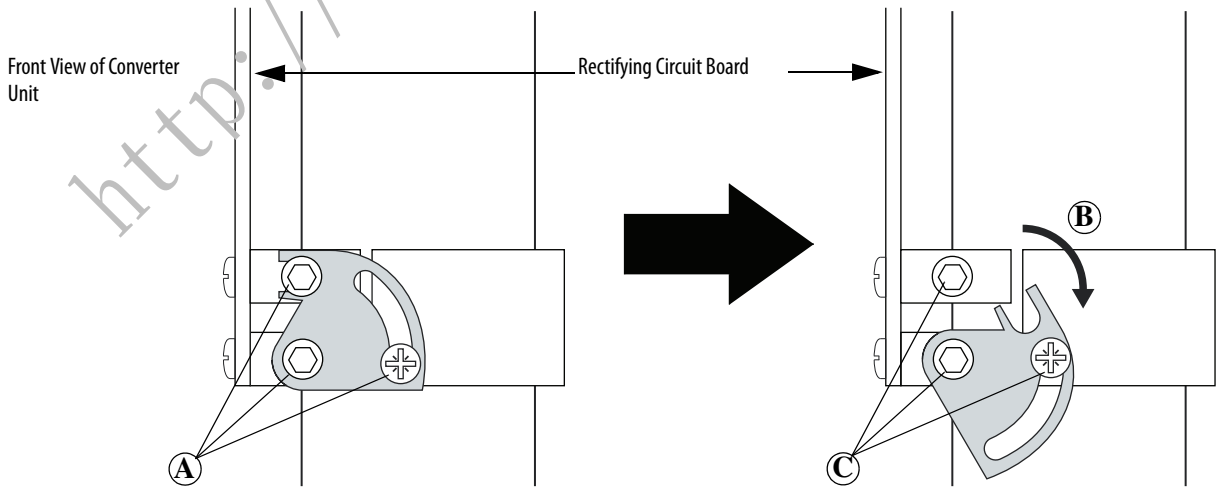
If you are installing a drive on a grounded B phase Delta system, you:

- Must move the common mode jumper(s) to the disconnected position - see Move the Common Mode Jumper(s) to the Disconnected Position on page 126.
- Must insulate terminal X4 on the rectifier circuit board - see Insulate Terminal X4 on the Rectifier Circuit Board on page 127.

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

Follow the steps below to move the common mode jumper(s) to the disconnected position for each converter unit (see Figure 50 on page 123 for jumper location).

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

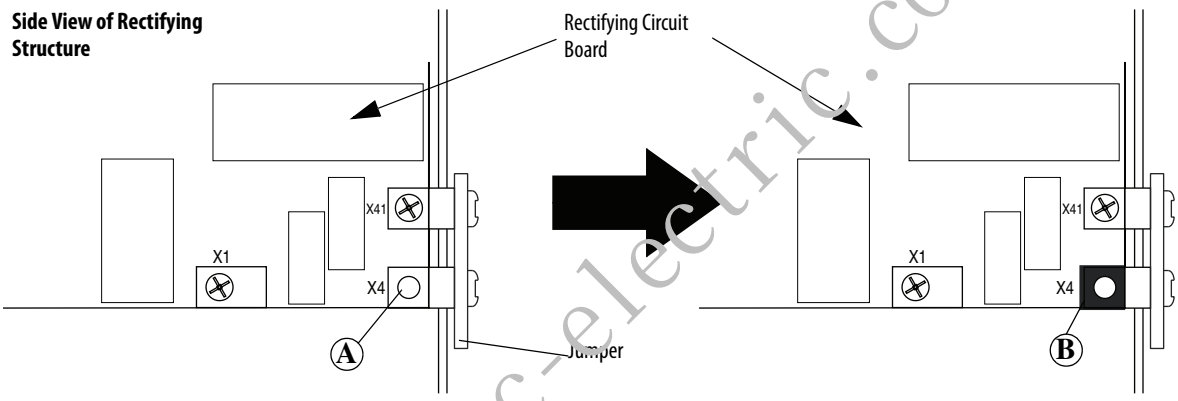


Insulate Terminal X4 on the Rectifier Circuit Board

Follow the steps below to insulate terminal X4 on the rectifier circuit board for each converter unit (see Figure 50 on page 123 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.

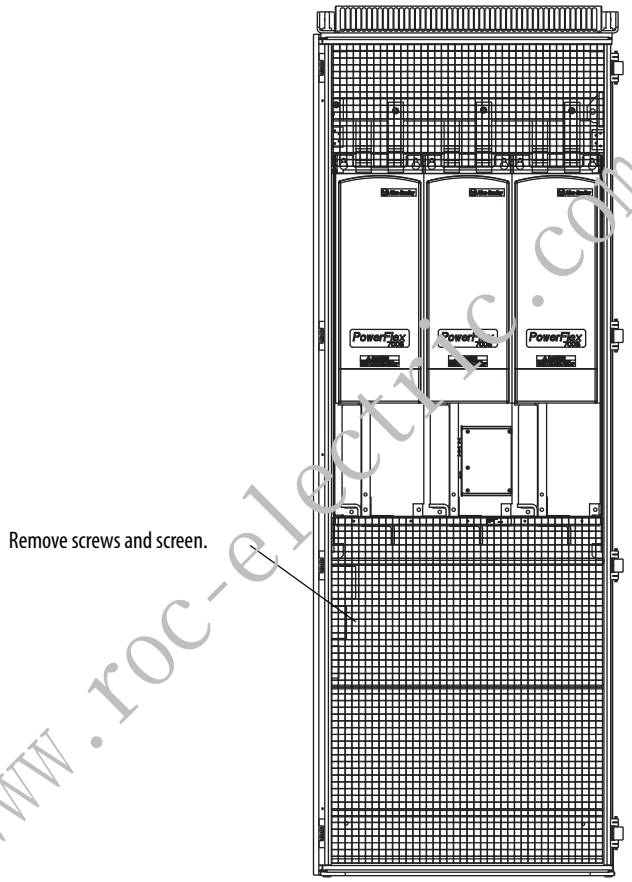


Remove the Protective Covers from the Inverter Unit

Remove 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).

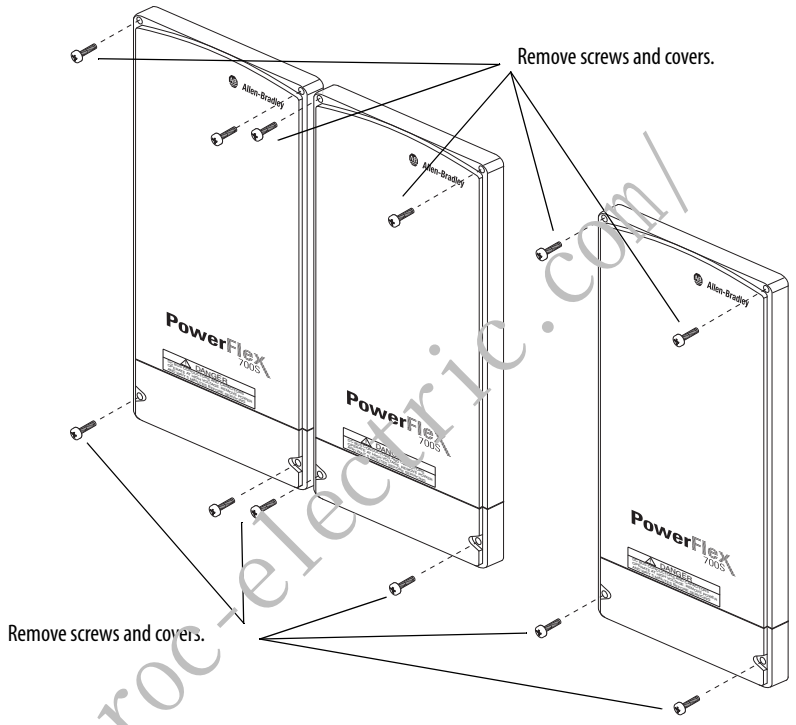
- Remove the screws that secure the lower protective screen to the right side enclosure only and remove the screen.



Remove the Protective Covers

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

- 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.



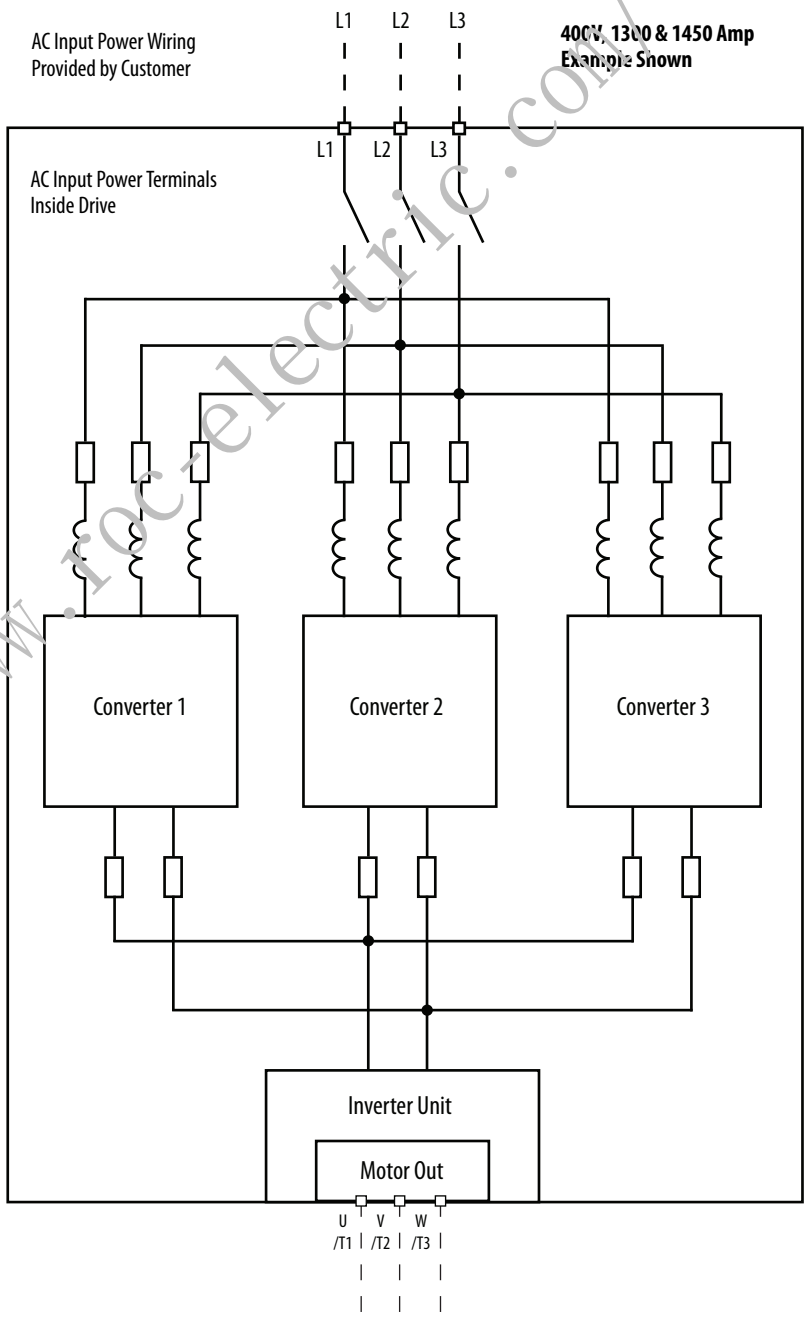
Power Wiring

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 51 - Frame 13 AC Wiring Example: Three Internal Fuses per Phase

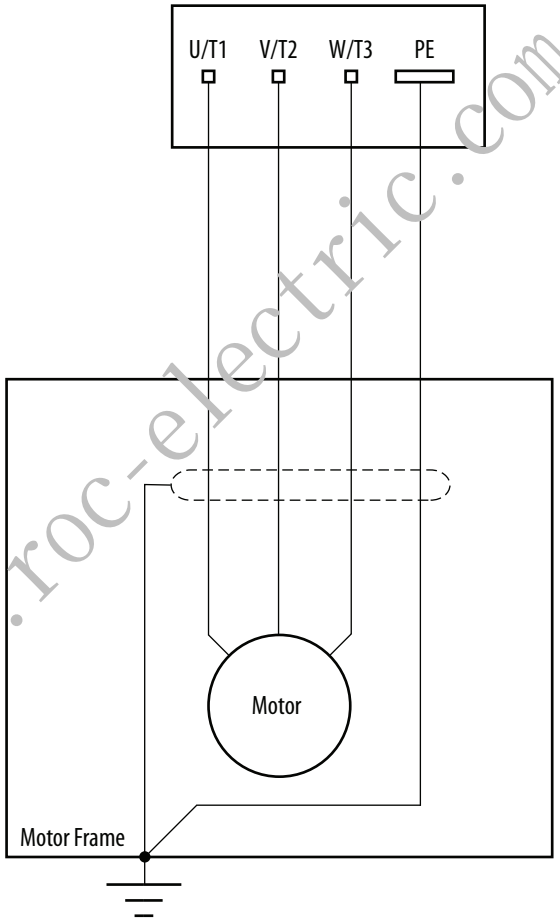


Output Power Wiring

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 52 - Frame 13 Motor Wiring Example



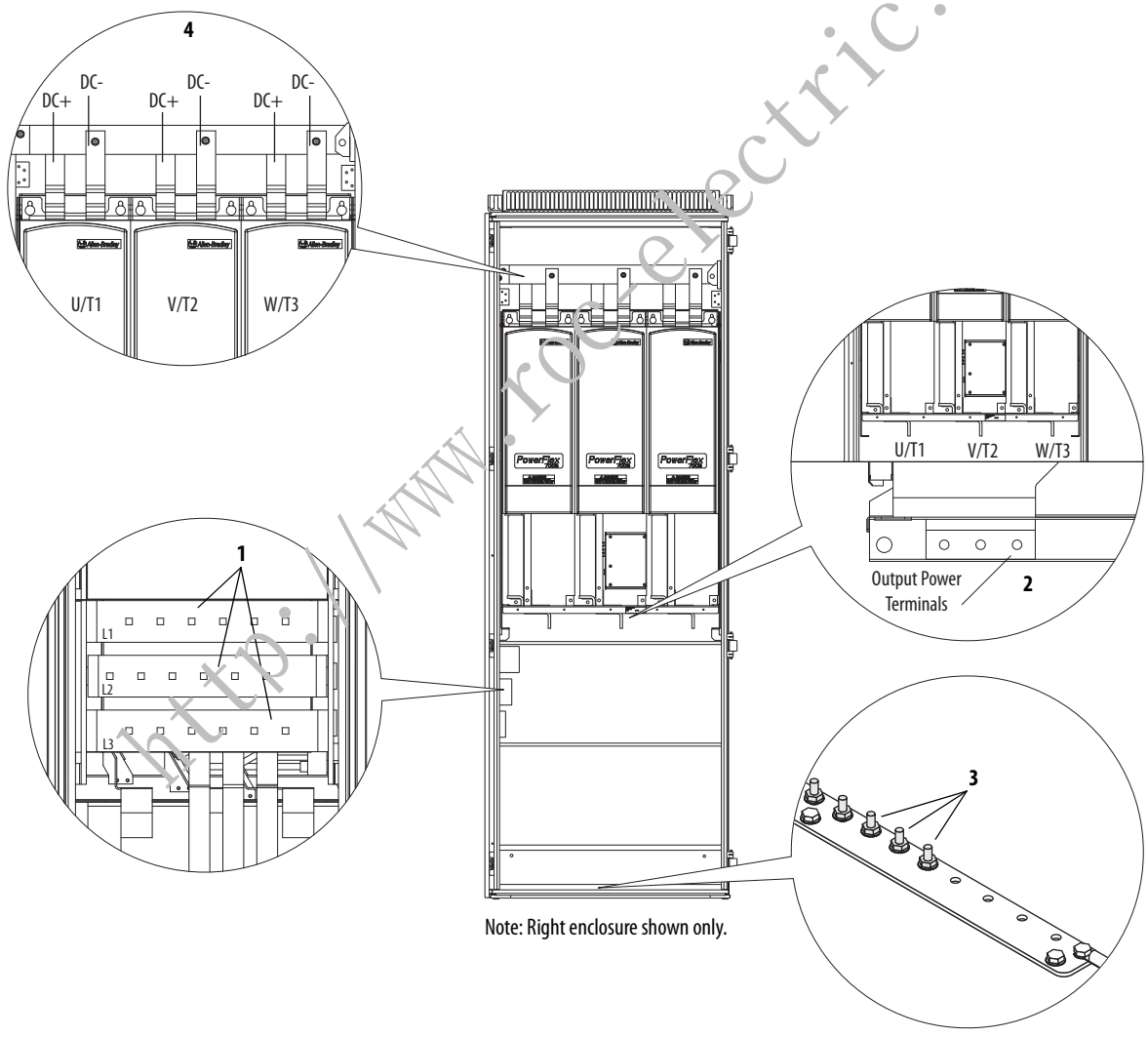
IMPORTANT Once power wiring has been completed, the protective covers must be installed before energizing the drive. Installation is in reverse order of removal (see Remove the Protective Covers from the Converter Unit on page 124 and Remove the Protective Covers from the Inverter Unit on page 128).

Table 29 - Power Terminal Specifications

No.	Name	Description	Wire Size Range [1][2]		Torque	Terminal Bolt Size [3][4]
			Maximum	Minimum	Recommended	
1	Input Power Terminal Block [1] L1, L2, L3	Input power	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N·m (354 lb·in)	M12
2	Output Power Terminal Block [3] U/T1, V/T2, W/T3	Motor connections	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N·m (354 lb·in)	M12
3	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
4	DC Bus [3] (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 53 - Power Terminal Locations

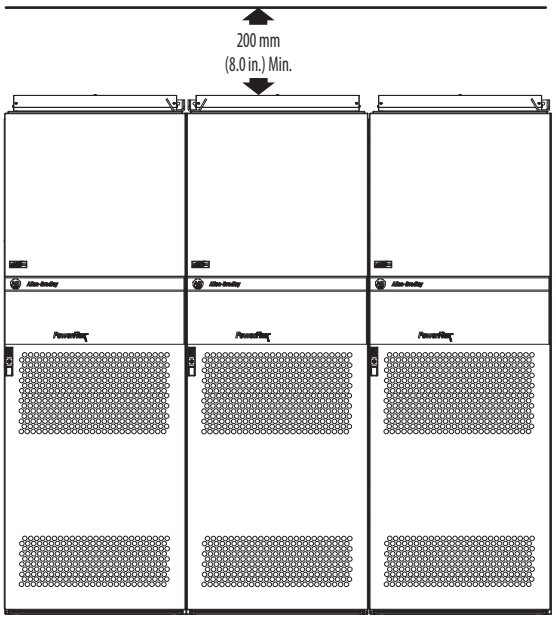


Frame 14 Mechanical Installation

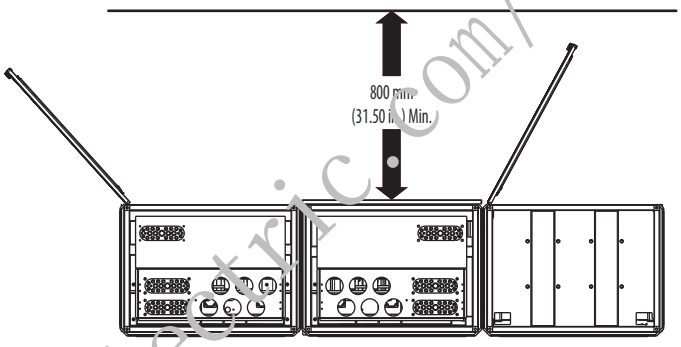
Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All information in Chapter 1 “General Installation Information” and in this chapter must be read and understood before the actual installation begins.

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…40° C (32…104° F)	0…40° C (32…104° F)
	600/690V AC (810/932V DC)	1500, 1900	0…40° C (32…104° F)	0…40° C (32…104° F)
	600/690V AC (810/932V DC)	2250	0…35° C (32…95° F)	0…35° C (32…95° F)
700S	600/690V AC (810/932V DC)	1500	0…40° C (32…104° F)	0…40° C (32…104° F)

Table 30 - 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 54 - 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).

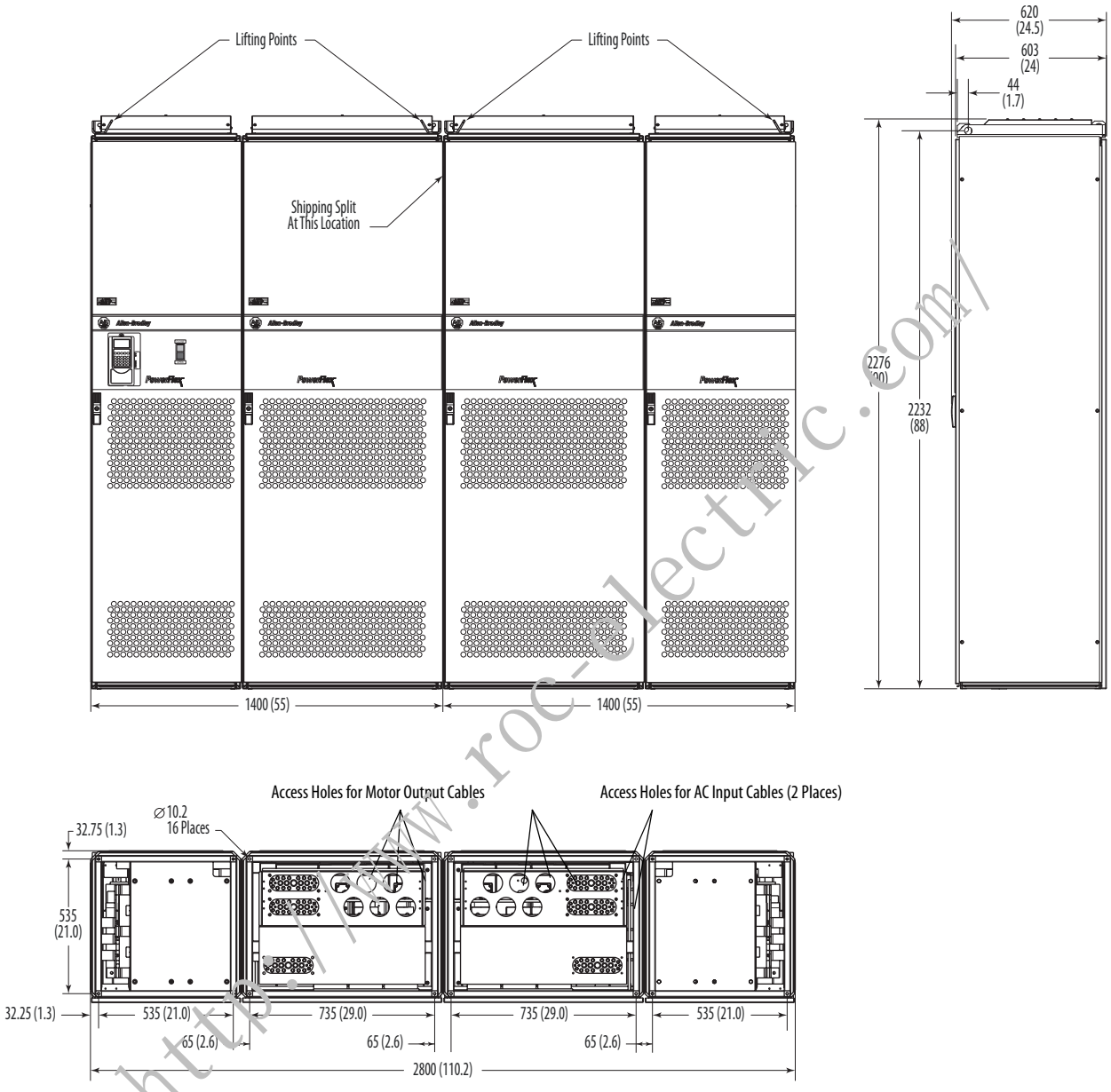


Figure 55 - Drives Above 1500 A 2800 mm Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/Conformal Coat)

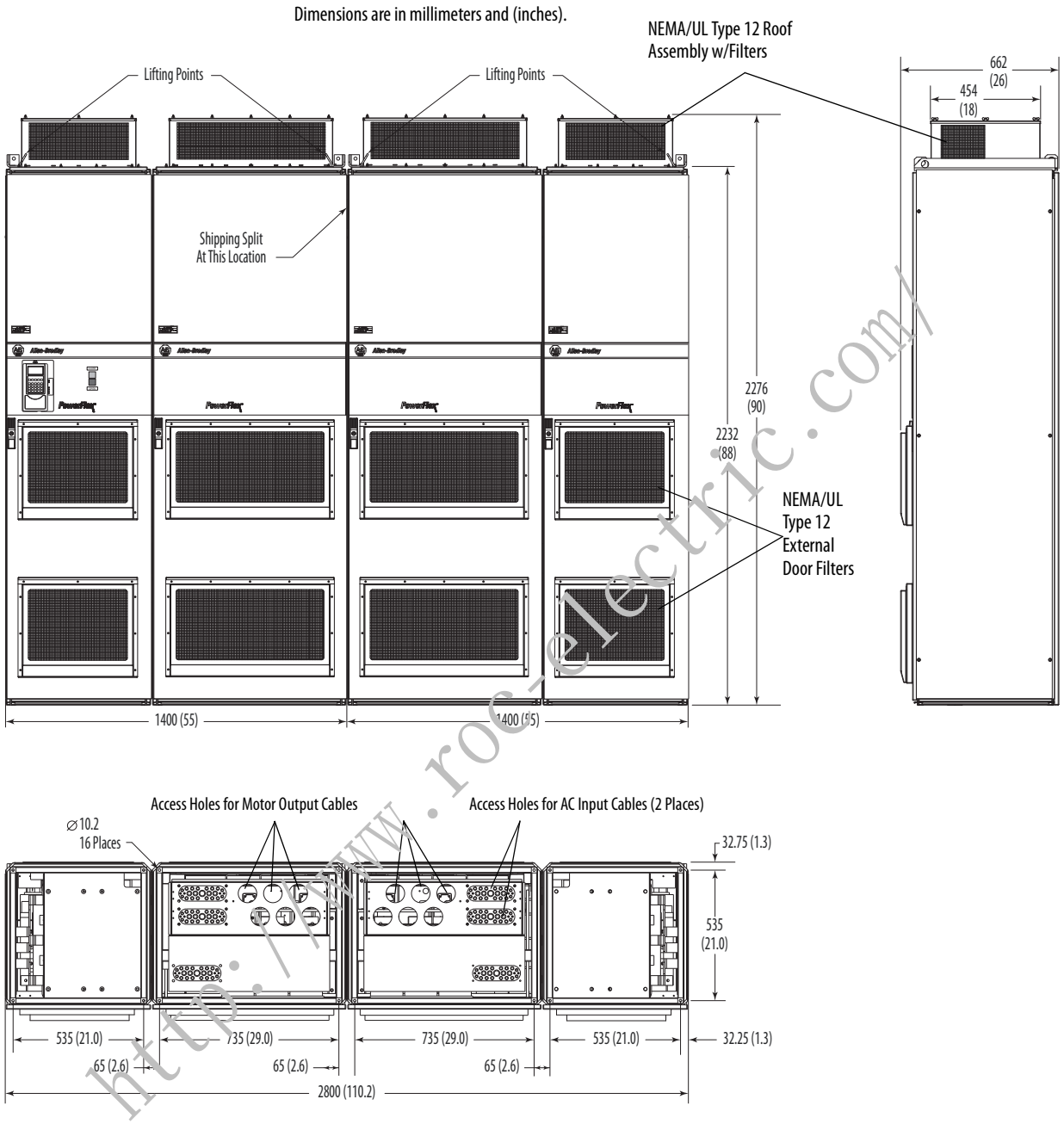


Figure 56 - 1500 A Drives 2400 mm Enclosure Code A (NEMA/UL Type 1, IP 21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)

Dimensions are in millimeters and (inches).

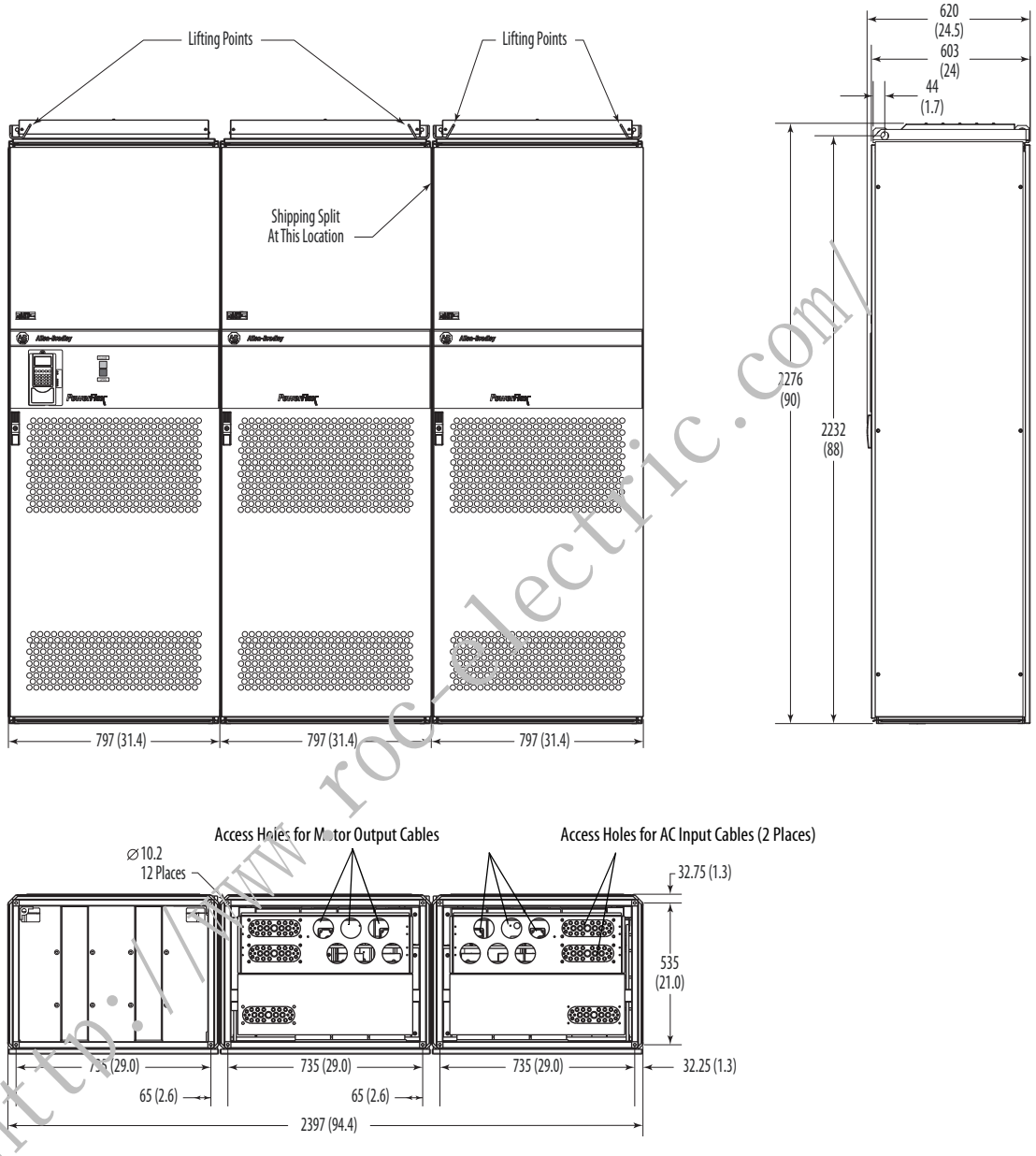


Figure 57 - 1500 A Drives 2400 mm Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/Conformal Coat)

Dimensions are in millimeters and (inches).

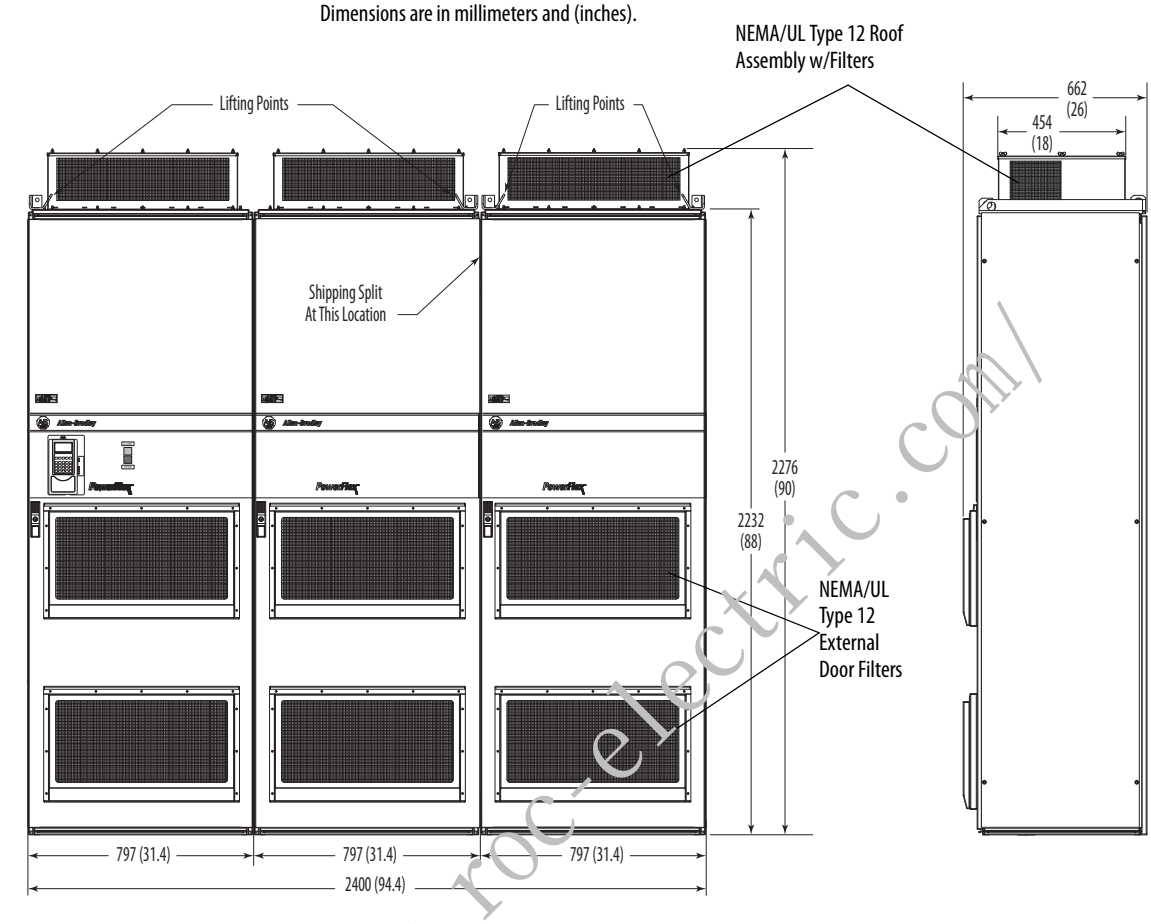
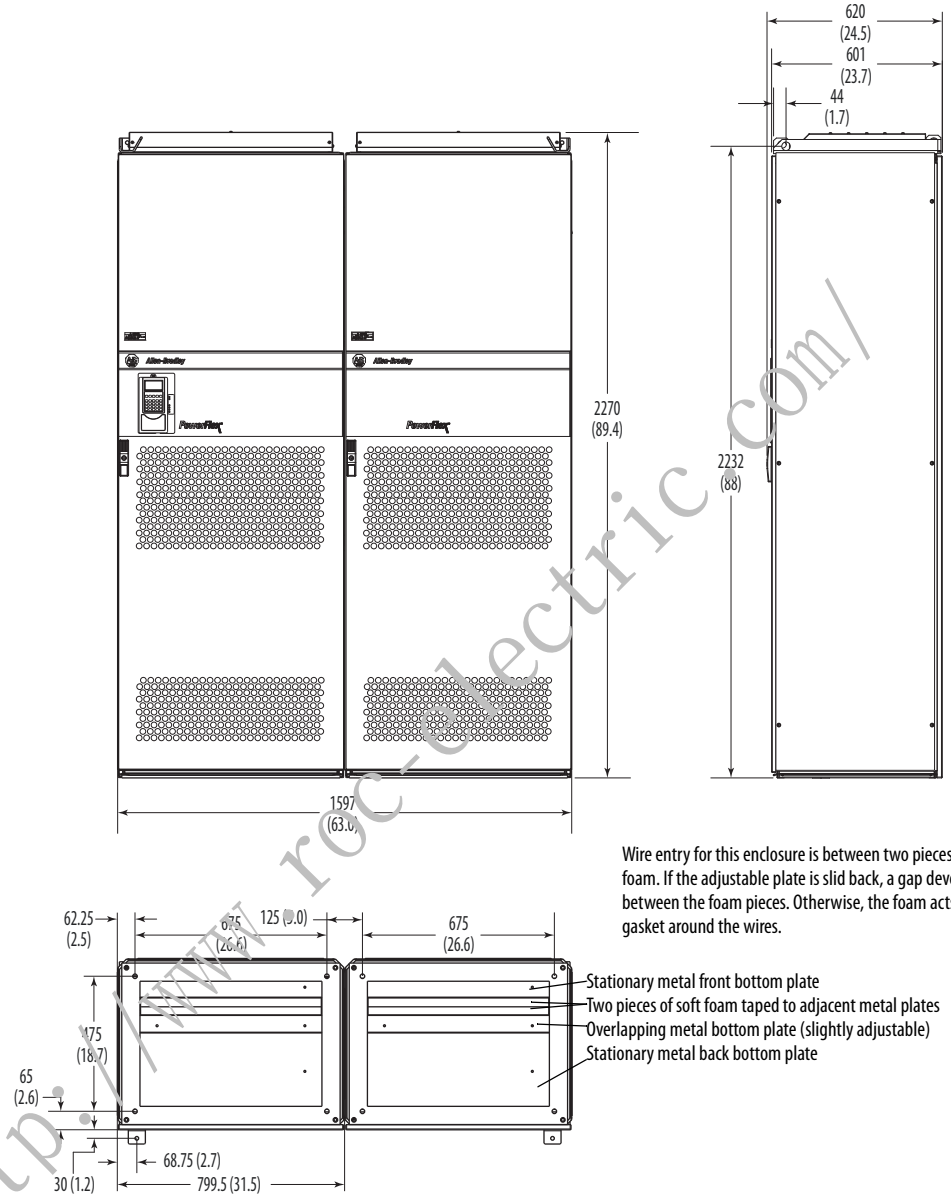


Figure 58 - DC Input Drive Enclosure Code A (NEMA/UL Type 1, IP 21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)

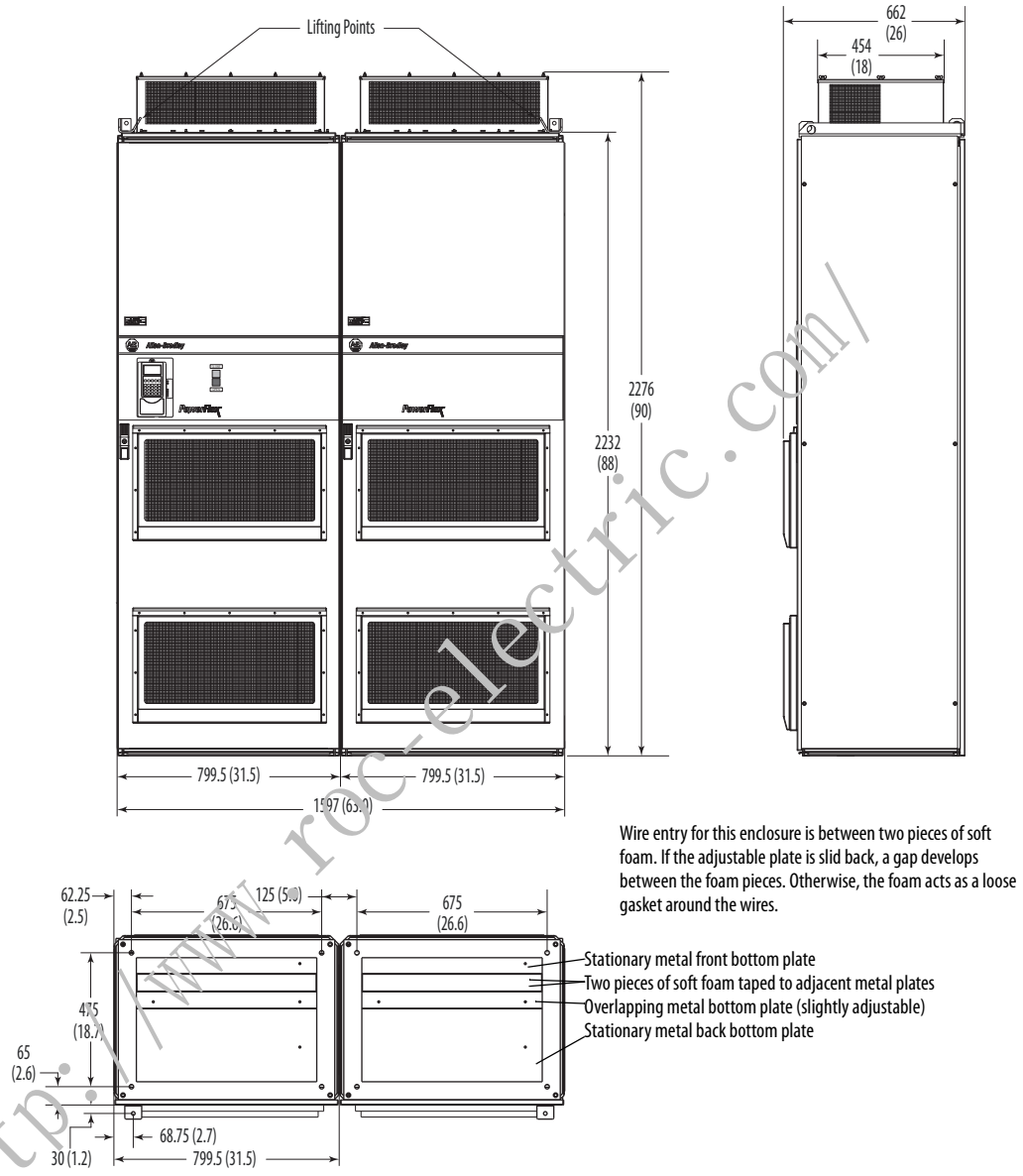
Dimensions are in millimeters and (inches).



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.

Figure 59 - 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.

See the Lifting and Mounting PowerFlex 700S and 700H Drives, Frames 10...14, Installation Instructions, publication PFLEX-IN005, for detailed instructions. These instructions are shipped with the drive. When you have completed the instructions in PFLEX-IN005, continue with the installation as directed below.

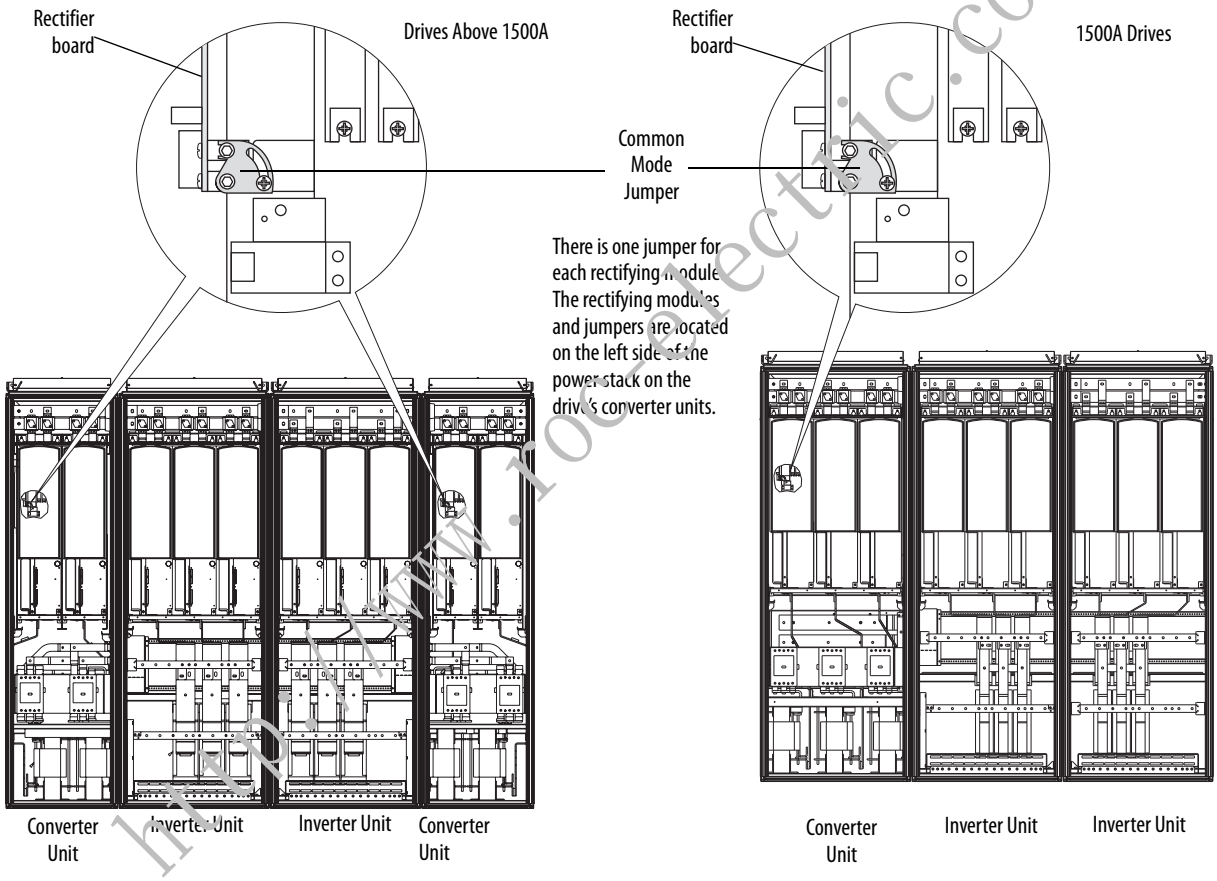
Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations

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: See 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 60 - Common Mode Jumper and Rectifier Circuit Board Location



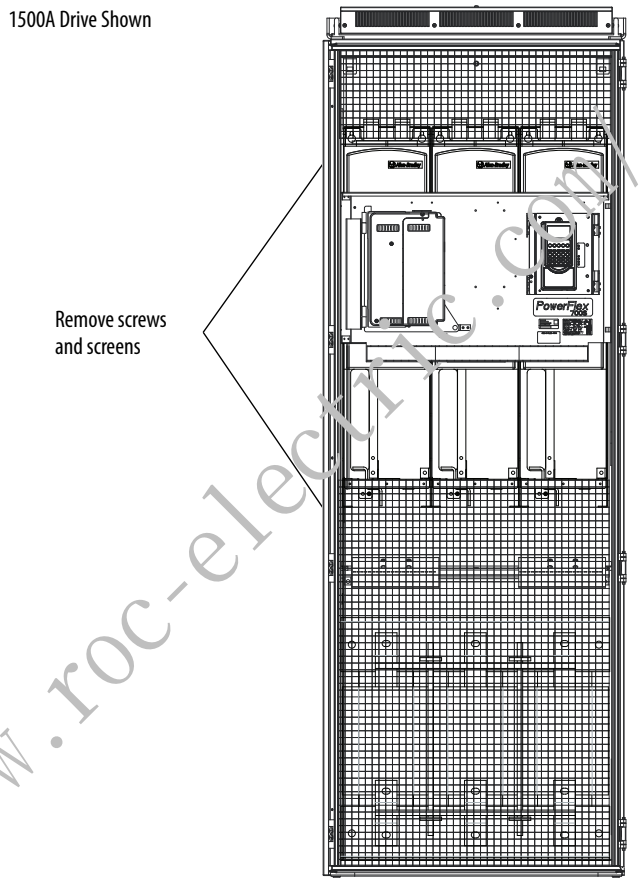
Control Frame not shown for clarity only

Remove the Protective Covers from the Converter Unit(s)

Remove the Protective Screens

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

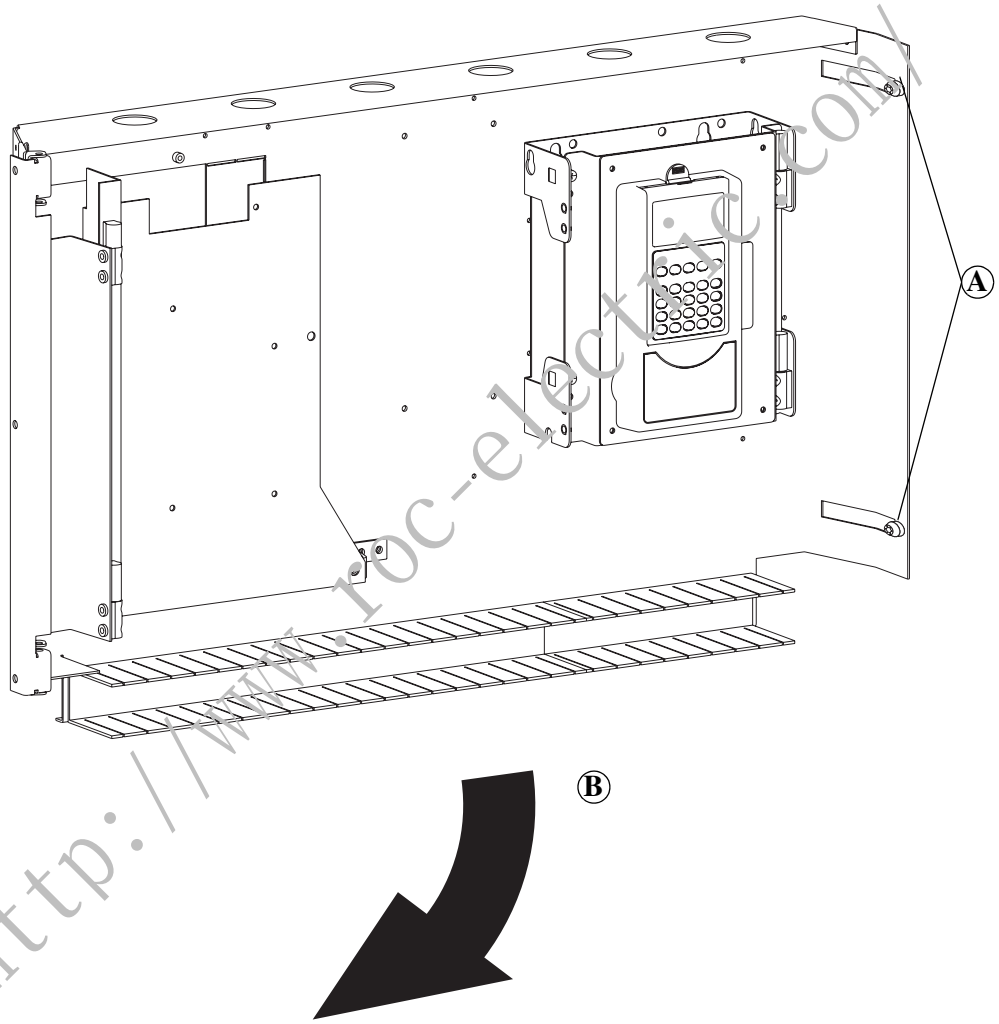
- Remove the screws that secure the protective screens to the converter unit(s) and remove the screens.



Move 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.

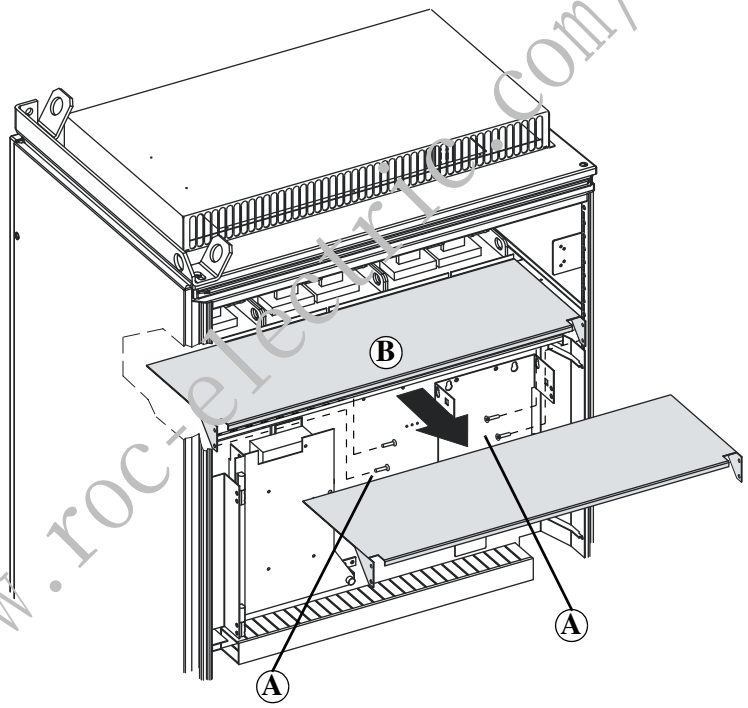


Remove the Airflow Plate(s)

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.

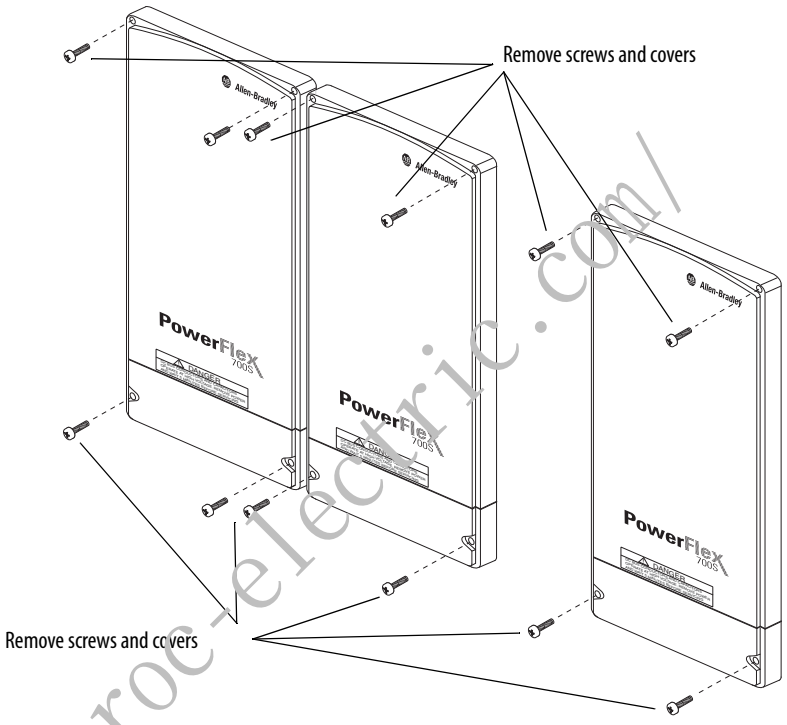
1500A Drive Shown



Remove the Protective Covers

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

- 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 - see Move the Common Mode Jumper(s) to the Disconnected Position on page 147.
- Should insulate terminal X4 on the Rectifier circuit board - see Insulate Terminal X4 on the Rectifier Circuit Board on page 148.

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 - see Move the Common Mode Jumper(s) to the Disconnected Position on page 147.
- Must insulate terminal X4 on the Rectifier circuit board - see Insulate Terminal X4 on the Rectifier Circuit Board on page 148.

Installation on a Grounded B Phase Delta System

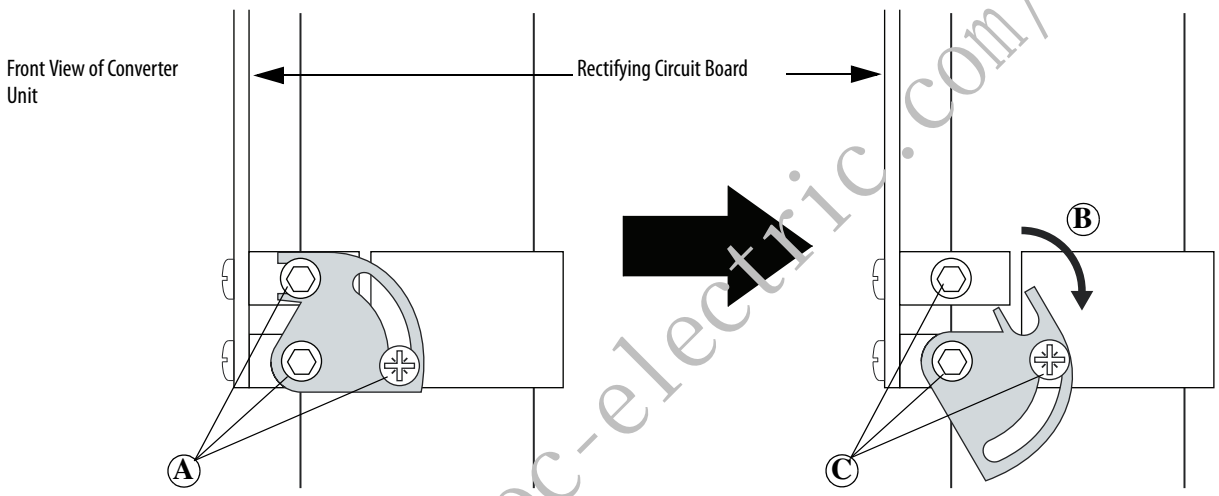
If you are installing a drive on a grounded B phase Delta system, you:

- Must move the common mode jumper(s) to the disconnected position - see Move the Common Mode Jumper(s) to the Disconnected Position on page 147.
- Must insulate terminal X4 on the Rectifier circuit board - see Insulate Terminal X4 on the Rectifier Circuit Board on page 148.

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

Follow the steps below to move the common mode jumper(s) to the disconnected position for each converter unit (see Figure 60 on page 141 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.

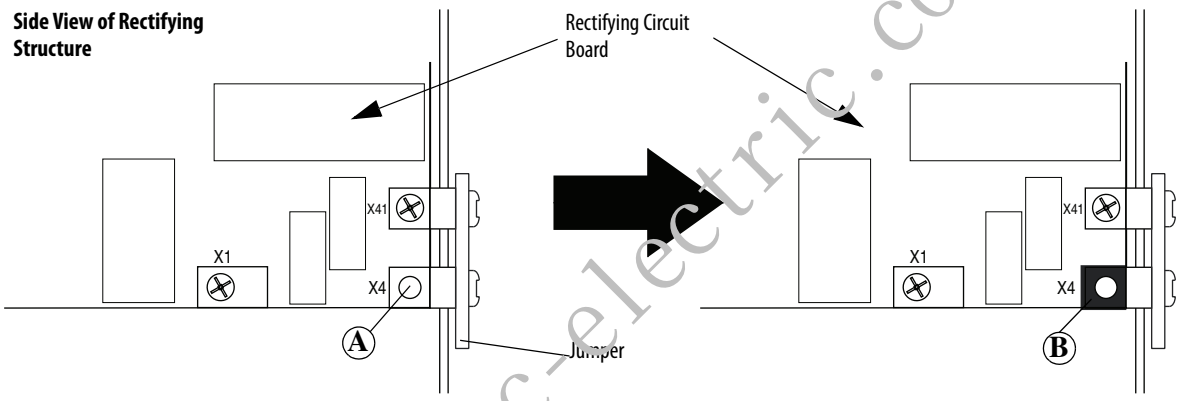


Insulate Terminal X4 on the Rectifier Circuit Board

Follow the steps below to insulate terminal X4 onFigure 60 on page 141 the rectifier circuit board for each converter unit (see 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

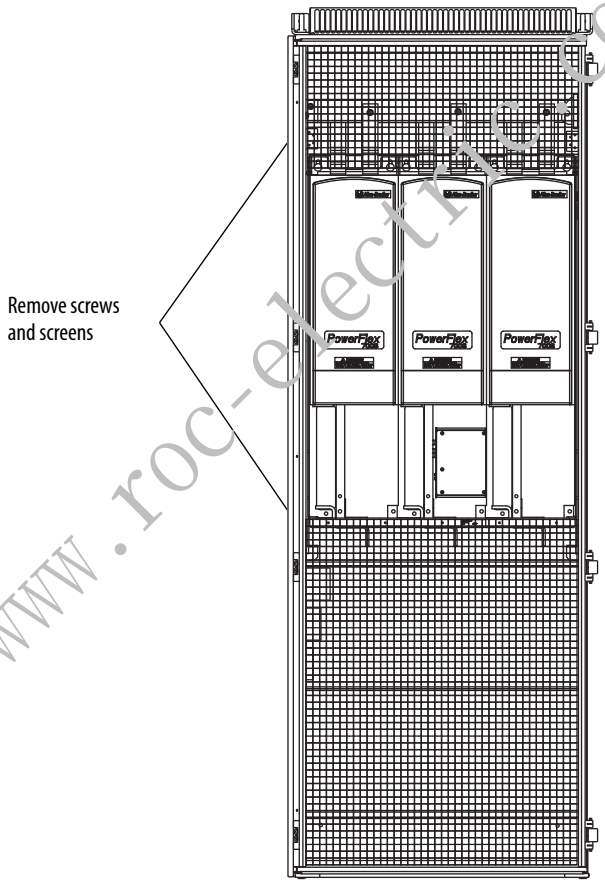
To access the power terminals, you must first remove the protective screens (on NEMA/UL Type 1 and Type 12 enclosures), air flow plate and protective covers from the inverter units. These steps are detailed below.

Remove the Protective Covers from the Inverter Units

Remove the Protective Screens

To access the power terminals, you must first remove the protective screens from the inverter units.

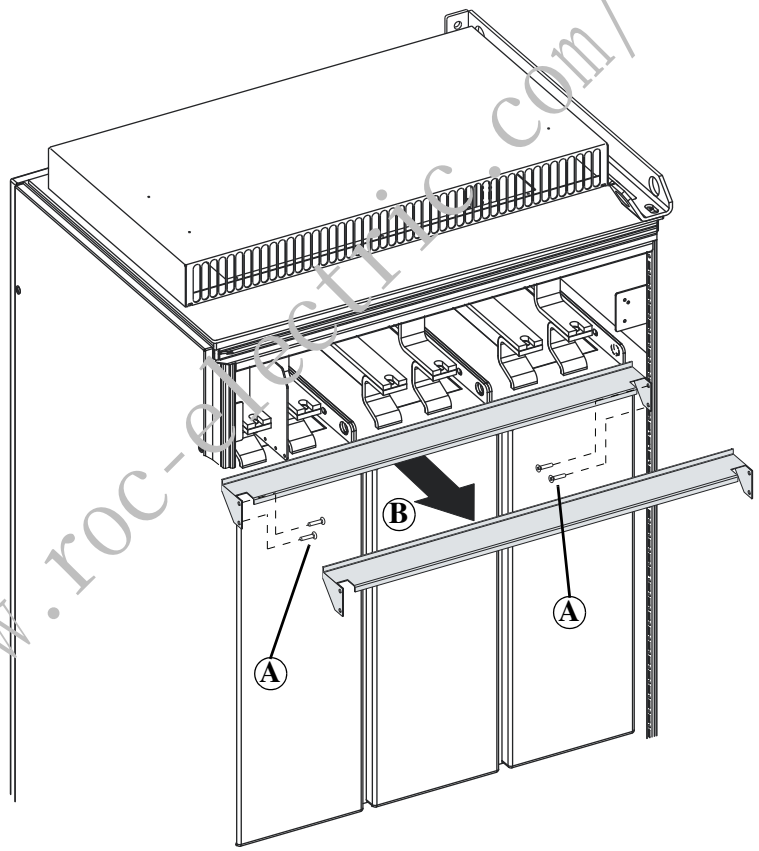
- Remove the screws that secure the protective screens to the inverter units and remove the screens.



Remove 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.

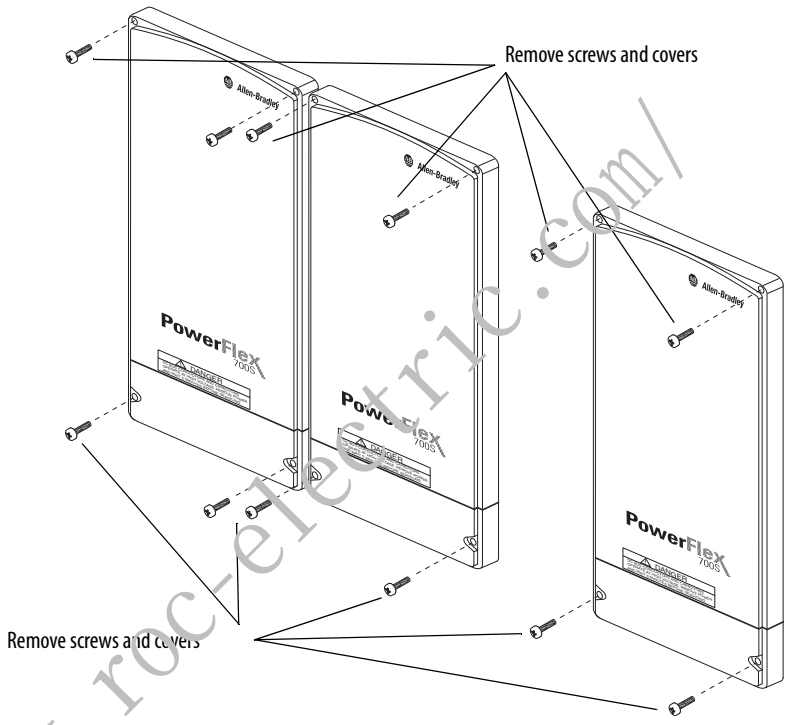
Task	Description
Ⓐ	Remove the T8 Torx-head screws that secure the airflow plates to the drive.
Ⓑ	Slide the airflow plates off of the drive.



Remove the Protective Covers

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

- 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.

See 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 61 - 1500A Drive AC Wiring Example:

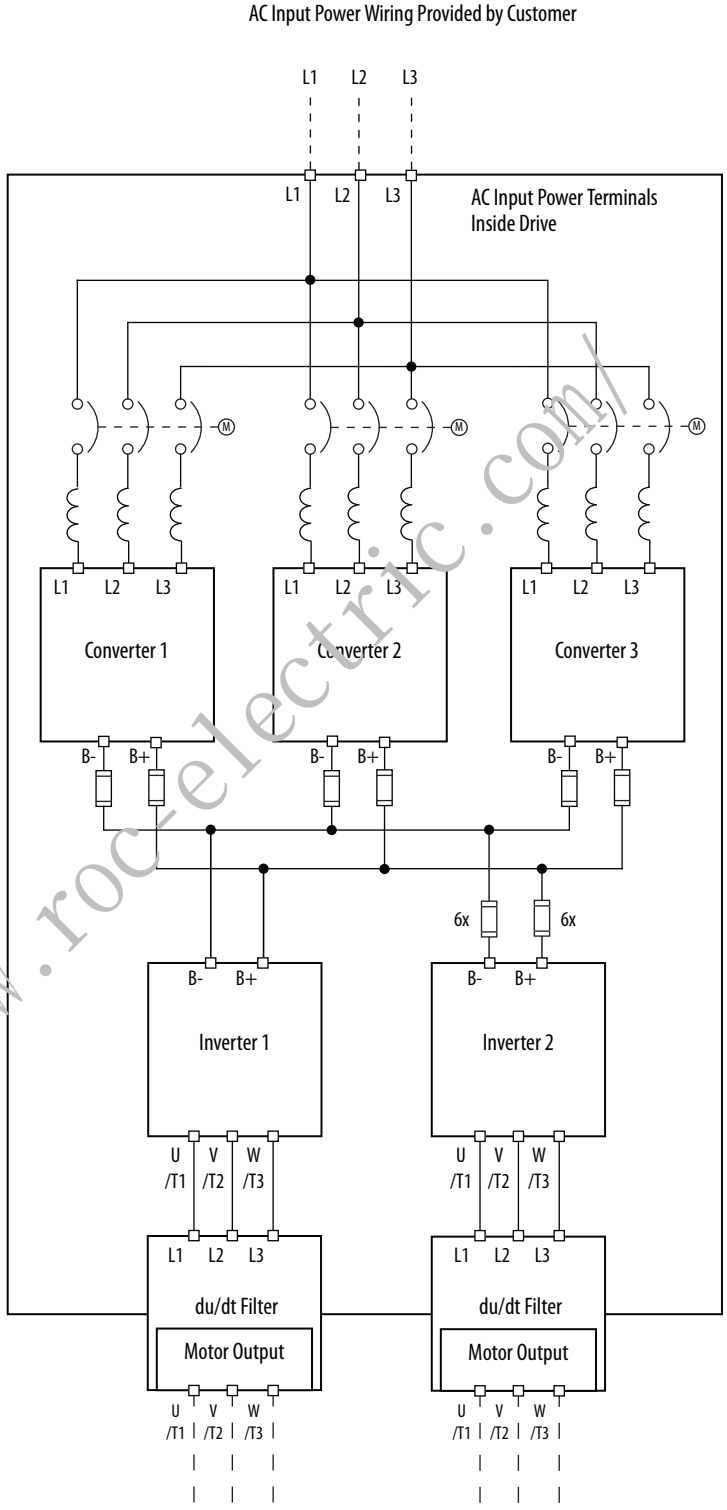
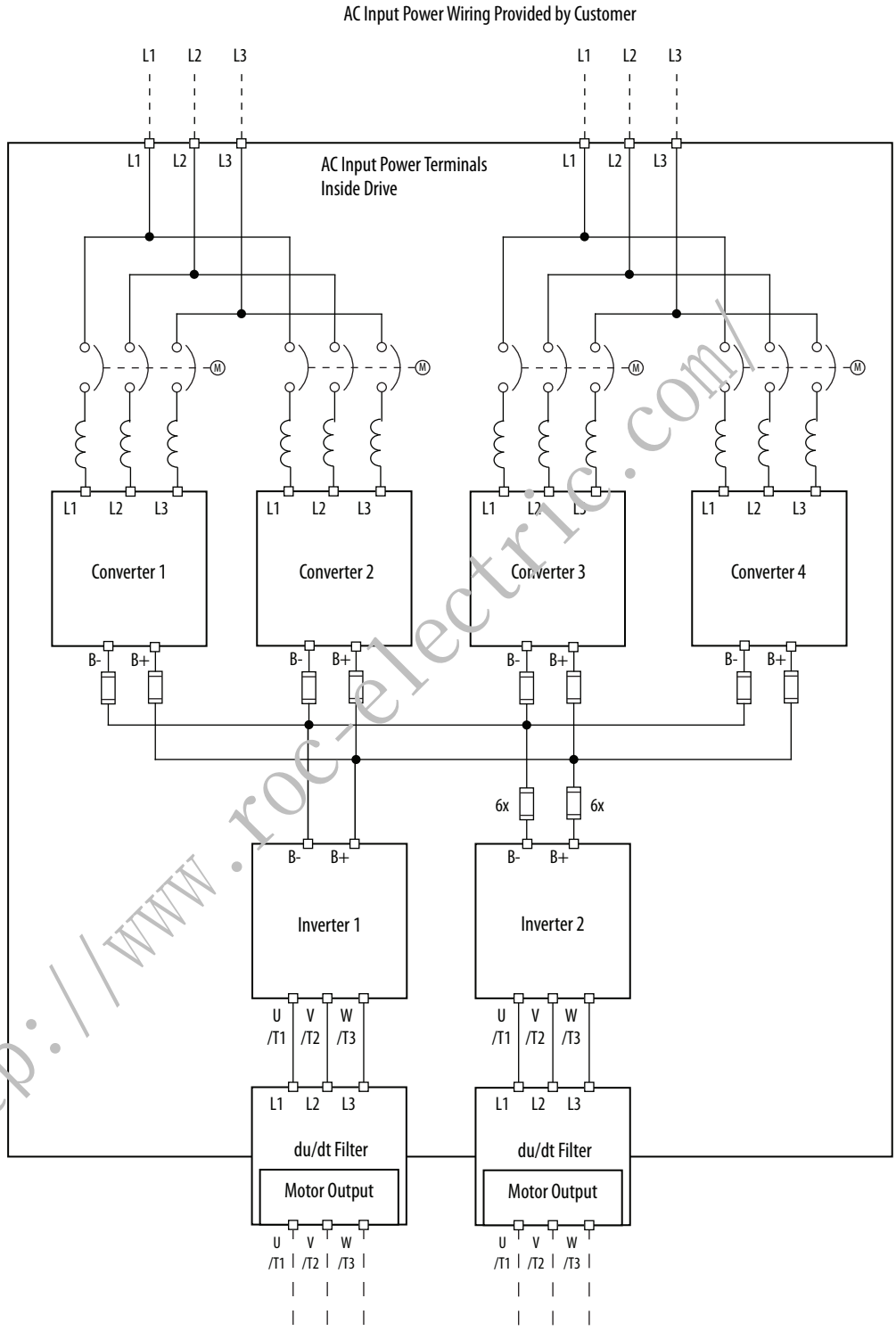


Figure 62 - Drives Above 1500A AC Wiring Example:



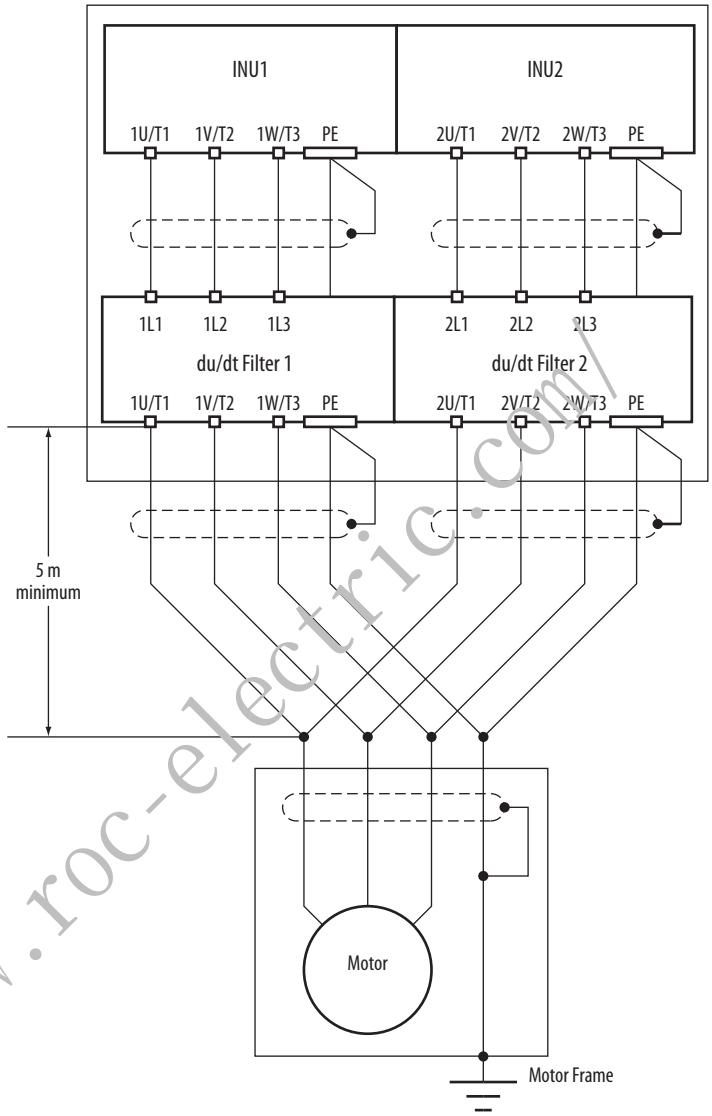
Output Power Wiring for Frame 14 Drives

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 5 m (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 63 - 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 (see Remove the Protective Covers from the Converter Unit(s) on page 142 and Remove the Protective Covers from the Inverter Units on page 149).

Table 31 - Power Terminal Specifications

No.	Name	Description	Wire Size Range (1)(2)		Torque	Terminal Bolt Size (3)(4)
			Maximum	Minimum	Recommended	
1	Input Power Terminal Block (1) L1, L2, L3	Input power	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
2	Output Power Terminal Block (3) U/T1, V/T2, W/T3	Motor connections	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
3	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
4	DC Bus (3) (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 64 - 1500A Drive Power Terminal Locations

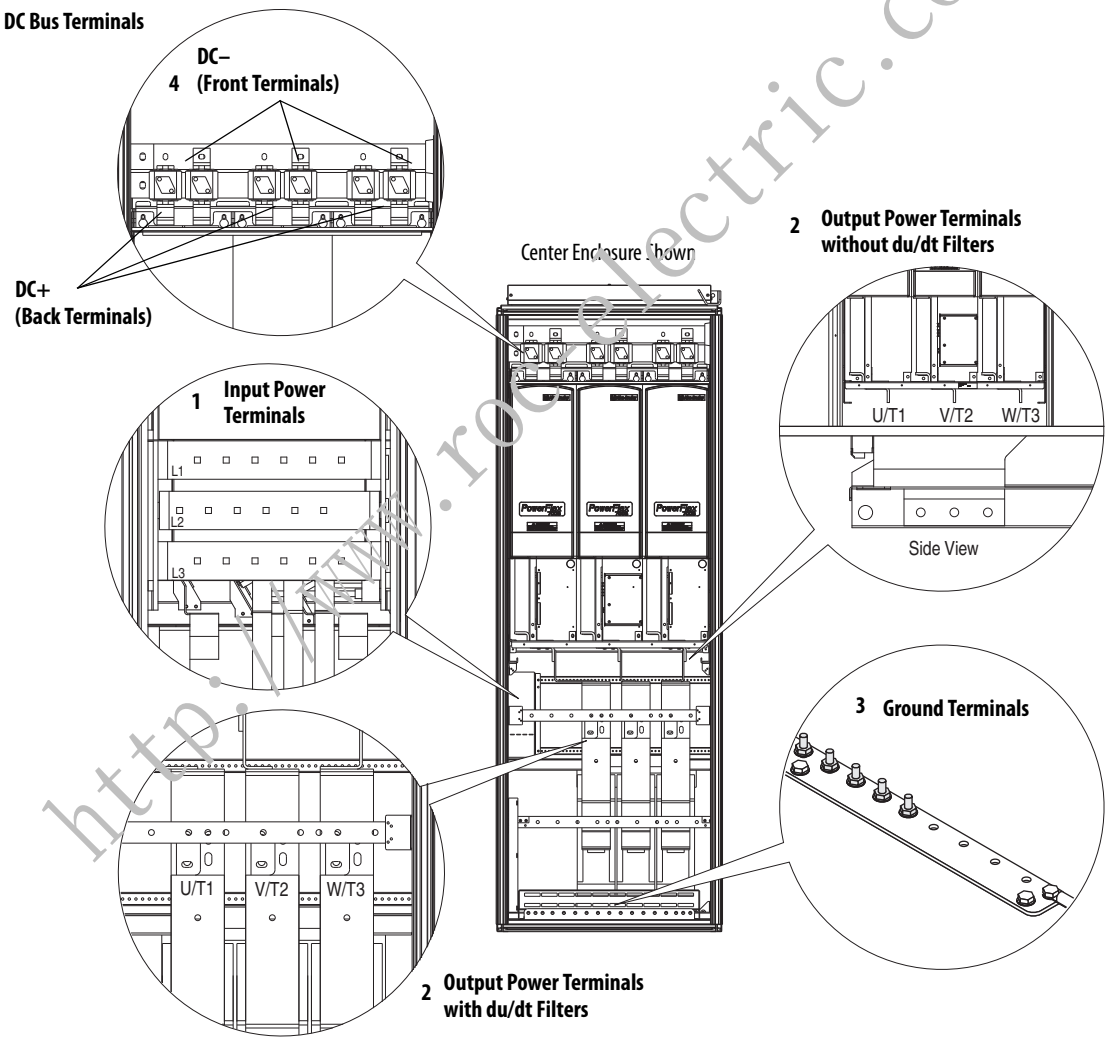
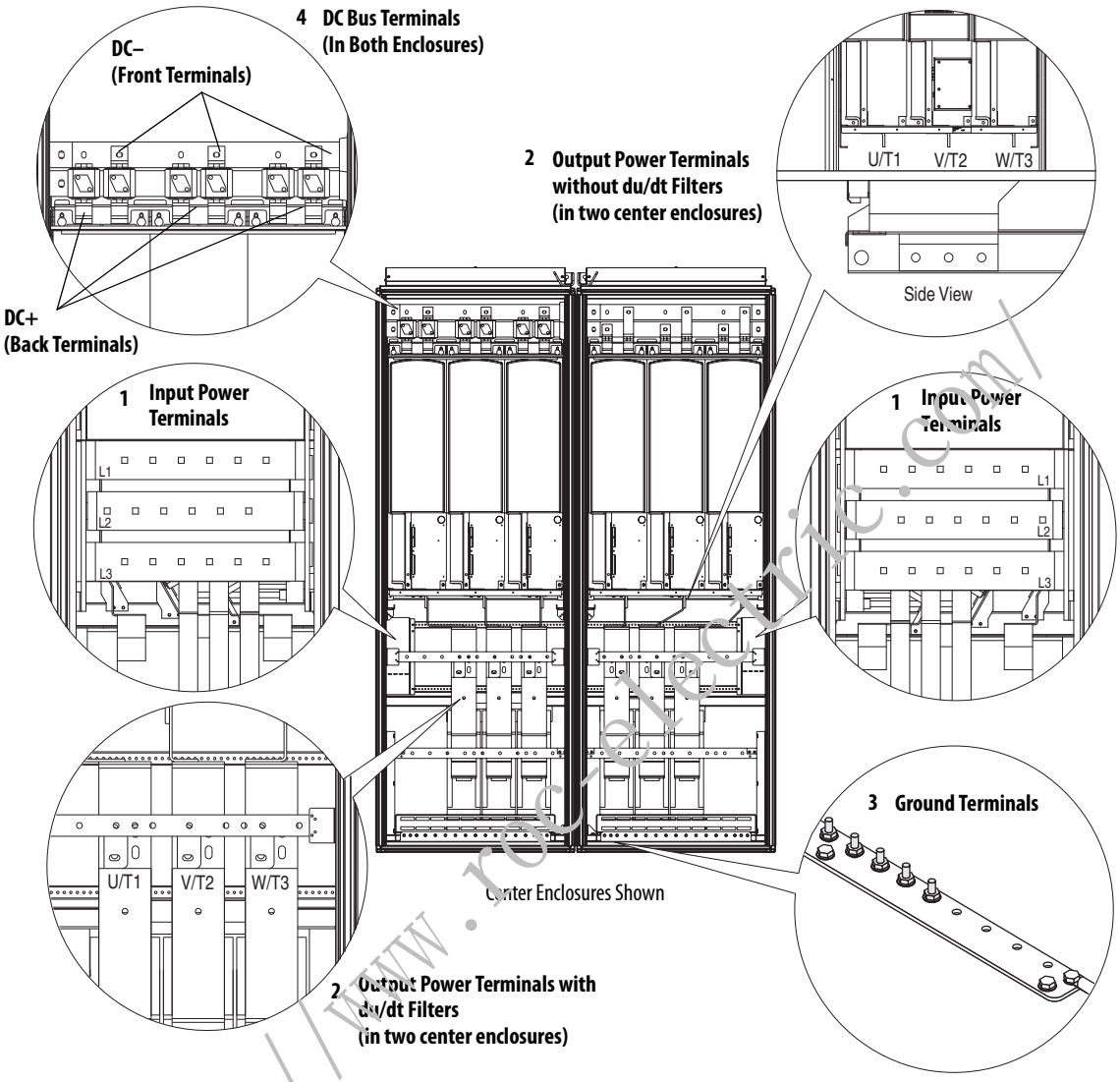
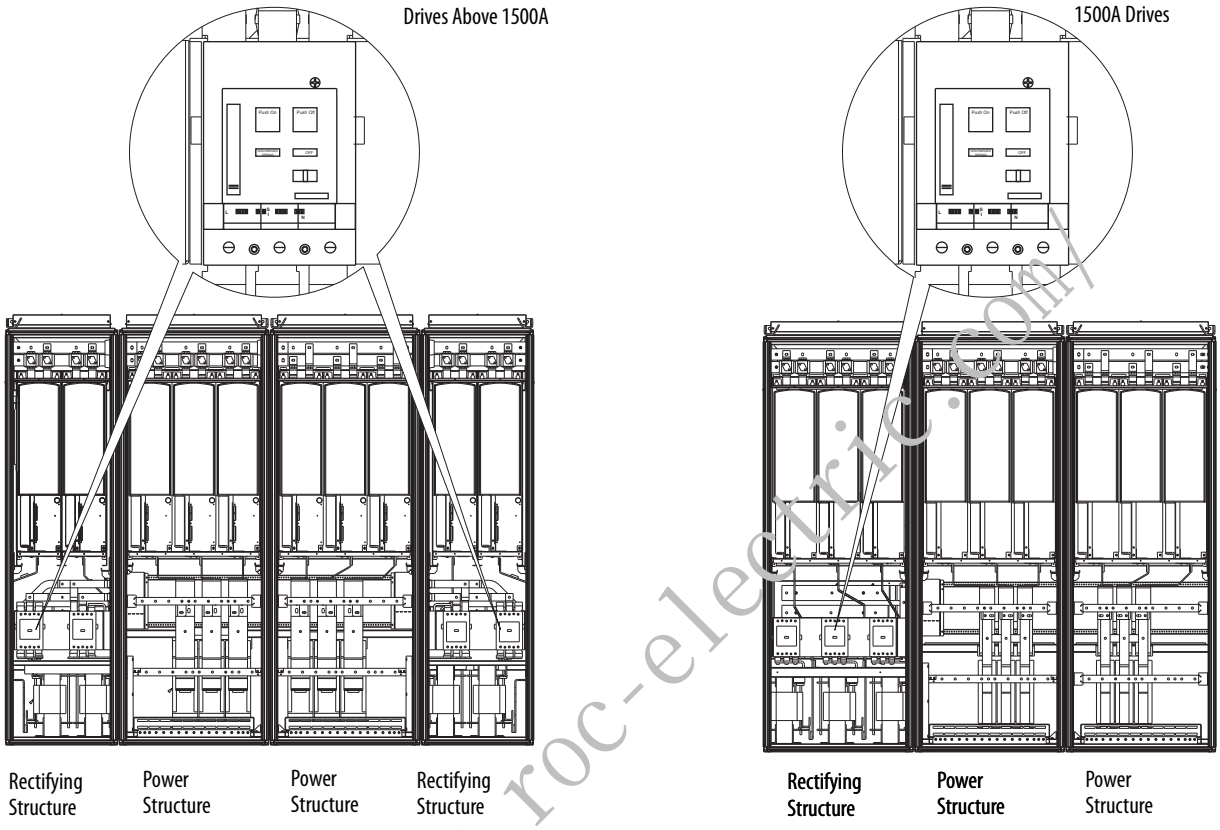


Figure 65 - Drives Above 1500A Power Terminal Locations



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

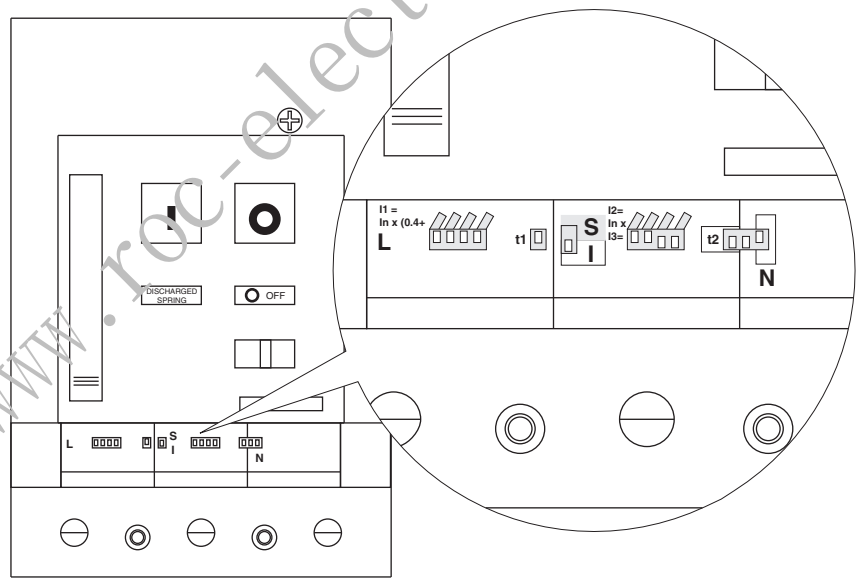
The DIP switches on the circuit breakers are configured to the correct settings at the factory. However, the settings detailed in Table 32 below should be verified before charging the circuit breaker motor operators and operating the drive.

Once the settings have been verified, continue with Charging the MCCB Motor Operators on page 160.

Table 32 - Circuit Breaker DIP Switch Settings

Voltage Class	Drive ND Continuous 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 66 - Circuit Breaker DIP Switches Location

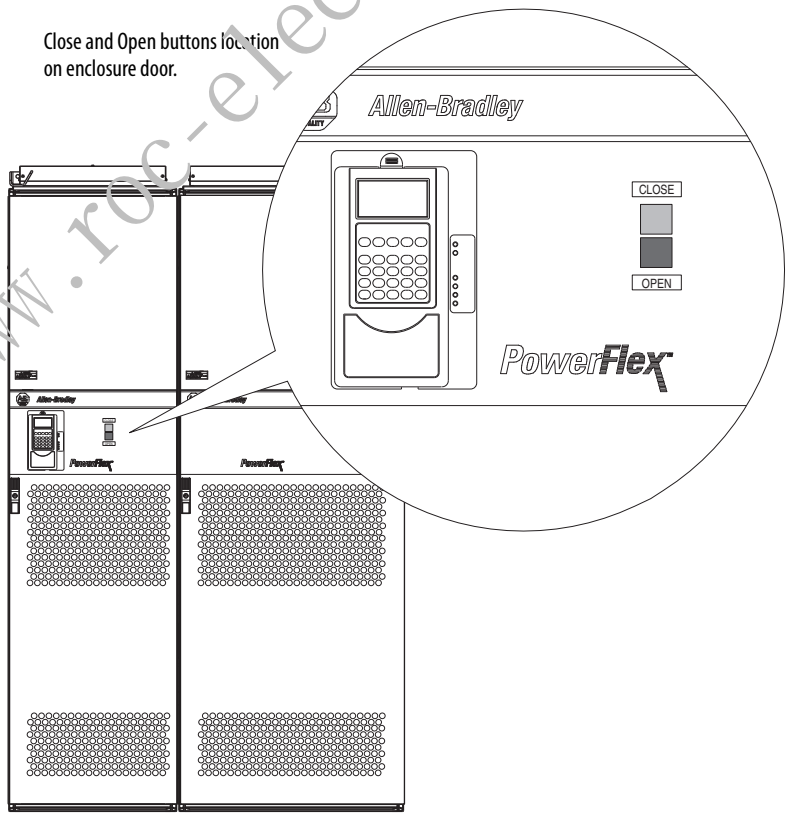


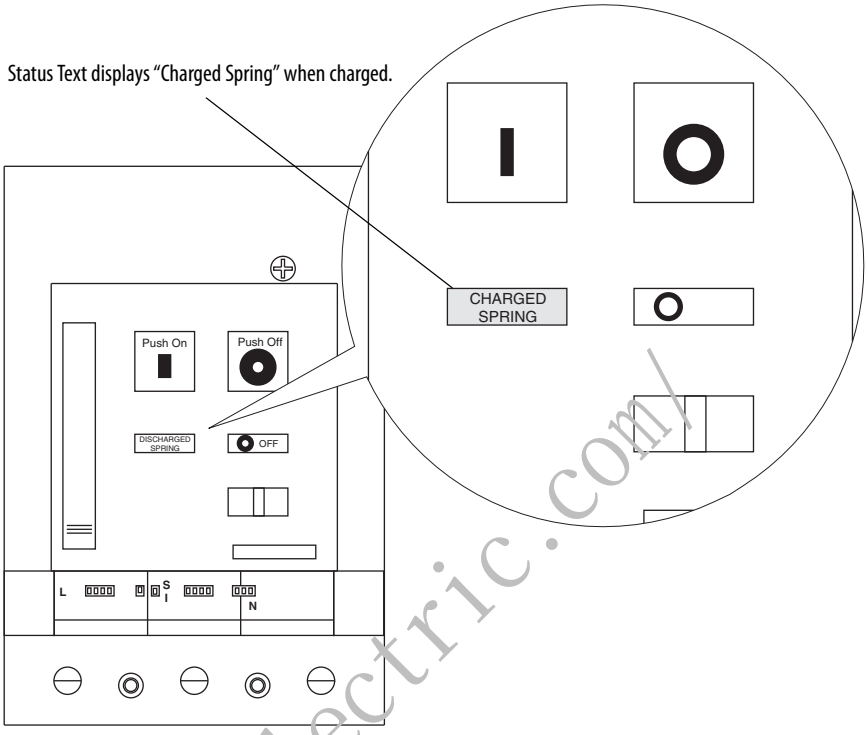
Charging the MCCB Motor Operators

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. Continue with Closing the Circuit Breakers and Energizing the Drive on page 161 below.

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, see Charging the MCCB Motor Operators on page 160.

Specifications

Category		PowerFlex 700H	PowerFlex 700S
Agency Certification		Listed to UL 508C and CAN/CSA-C2.2 No. 14-M91.	UL and cUL Listed to UL 508C and CAN/CSA - 22.2 No. 14-95.
		Marked for all applicable European Directives(1) EMC Directive (89/336/EEC) Emissions: • EN 61800-3 Adjustable Speed electrical power drive systems Low Voltage Directive (73/23/EEC) • EN 50178 Electronic Equipment for use in Power Installations	Marked for all applicable European Directives EMC Directive (89/336/EEC) Emissions: • EN 61800-3 Adjustable Speed electrical power drive systems Part 3 Low Voltage Directive (73/23/EEC) • EN 50178 Electronic Equipment for use in Power Installations
		Certified to AS/NZS, 1997 Group 1, Class A.	Certified to AS/NZS, 1997 Group 1, Class A.
		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 on page 203 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 Appendix E ATEX Approved PowerFlex 700S, Phase II Drives in Group II Category (2) Applications with ATEX Approved Motors, in publication 20D-PM001 for more information.
		(not applicable)	TUV functional safety report only (no FS mark on the label)
		The drive is also designed to meet the following specifications: • NFPA 70 - US National Electrical Code • NEMA ICS 7.1 - Safety standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems. • IEC 146 - International Electrical Code.	The drive is designed to meet applicable requirements of the following codes/ standards: • IEC 61800-2 Adjustable speed electrical power drive systems - General requirements • IEC 61800-5-1 Adjustable speed electrical power drive systems - Safety requirements • 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:	611V AC	611V AC	611V AC	806V AC	806V AC	675V AC	675V AC	675V AC	889V AC	889V AC
	AC Input Undervoltage Trip:	235VAC	235VAC	235VAC	326VAC	326VAC	Adjustable				
	Bus Overvoltage Trip:	911VDC	911VDC	911VDC	1200V DC	1200V DC	911VDC	911VDC	911VDC	1200V DC	1200V DC
	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 Software Overcurrent Trip: Hardware Overcurrent Trip: Instantaneous Current Limit:	 — 360% of rated Heavy Duty current (typical) —					 Calculated value, 105% of motor rated to 200% of drive rated 360% of rated Heavy Duty current (typical) —				
	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				
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 Ratings on page 167.					Based on drive rating, refer to Drive Ratings on page 167.				
	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: 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 EN50178 / EN60068-2-6					2 mm (0.0787 in.) displacement, 1G peak 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. Single-phase operation provides 50% of rated current.					Three-phase input provides full rating for all drives. 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 Settings: 2, 4, 6, 8, 10 kHz (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…320 Hz	0…400 Hz Note: For output frequencies above 320…400 Hz consult the factory.
	Frequency Accuracy Digital Input: Analog Input:	 Within ±0.01% of set output frequency. Within ±0.4% of maximum output frequency.	 – –
	Frequency Control:	Speed regulation - with Slip Compensation 0.5% of base speed across 40:1 speed range 40:1 operating range	–
	Speed Control:		Speed regulation - without feedback 0.1% of base speed across 120:1 speed range 120:1 operating range 50 rad/sec bandwidth
			Speed regulation - with feedback 0.001% of base speed across 120:1 speed range 1000:1 operating range 300 rad/sec bandwidth
	Torque Regulation:		Torque Regulation - without feedback ±10%, 60 rad/sec bandwidth
			Torque Regulation - with feedback ±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…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…4.0 seconds.
	Intermittent Overload:	110% Overload capability for up to 1 minute 150% Overload capability for up to 2 seconds	110% Overload capability for up to 1 minute 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:	Provides class 10 motor overload protection according to NEC article 430 and motor over-temperature protection according to NEC article 430.126 (A) (2). UL 508C File E59272.	Provides class 10 motor overload protection according to NEC article 430 and motor over-temperature protection according to NEC article 430.126 (A) (2). UL 508C File E59272.

<table>
<tr><th>Category</th><th>Specification</th><th>PowerFlex 700H</th><th>PowerFlex 700S</th></tr>
<tr><td rowspan="15">Feedback</td><td>Encoder Inputs (2):</td><td rowspan="15"></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
5V DC minimum high state voltage of 3.0V DC, maximum low state voltage at 0.4V DC
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>2ⁿ =</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>Refer to specifications on 185</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>Allen-Bradley PN: S94262912
Weidmuller PN: BL3.50/90/12BK</td></tr>
<tr><td>Resolver Option:</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="8">DriveLogix</td><td>User Available MemoryBase:
With Memory Expansion Board:</td><td rowspan="8"></td><td>256 kbytes
768 kbytes</td></tr>
<tr><td>Battery:</td><td>1756-BA1 (Allen-Bradley PN 94194801) 0.59g lithium</td></tr>
<tr><td rowspan="5">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>category 3 (2)</td></tr>
<tr><td>Flex I/O Connection:</td><td>Up to (8) modules</td></tr>
<tr><td>FLEXBUS Current Output:</td><td>640 mA maximum @ 5.1V DC</td></tr>
<tr><td>Cable:</td><td>4100-CCF3</td></tr>
</table>

Drive Catalog Number Designations

The first three characters of the drive catalog numbers in the drive ratings and protection devices 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 1 - 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 2 - 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	40	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 3 - 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 4 - 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 5 - 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 6 - 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 7 - 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 8 - 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	512	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. See Fusing and Circuit Breakers below for UL and IEC requirements. Sizes listed are the recommended sizes based on 40 °C (104 °F) and the U.S. NEC. Other country, state, or local codes can require different ratings. Tables with DC link fuse recommendations for DC input drives are also provided.

Fusing

The recommended fuse types are listed below. If available current ratings do not match those listed in the tables provided, choose the next higher fuse rating.

- IEC – BS88 (British Standard) Parts 1 & 2, EN60269-1, Parts 1 & 2[(1)], type gG or equivalent should be used.
- UL - UL requirements specify that UL Class CC, T, or J fuses must be used for all drives in this section.

Circuit Breakers

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

- IEC – Both types of circuit breakers are acceptable for IEC installations.
- UL – Only inverse time circuit breakers are acceptable for UL installations.

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

Table 9 - 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) 375 (2 per phs)	1300	750 (1 per phs) 375 (2 per phs)	1700	170M5813	1700	800
		-	250	524	700 (1 per phs) 350 (2 per phs)	1100	700 (1 per phs) 350 (2 per phs)	1500	170M5813	1500	700
20xC650	11	355	-	655	850 (1 per phs) 425 (2 per phs)	1400	850 (1 per phs) 425 (2 per phs)	1900	170M5813	1900	1000
		-	315	594	750 (1 per phs) 375 (2 per phs)	1300	750 (1 per phs) 375 (2 per phs)	1700	170M5813	1700	800
20xC730	11	400	-	735	1000 (1 per phs) 500 (2 per phs)	1600	1000 (1 per phs) 500 (2 per phs)	2100	170M5813	2100	1200
		-	355	655	850 (1 per phs) 425 (2 per phs)	1400	850 (1 per phs) 425 (2 per phs)	1900	170M5813	1900	1000
20xC820	12	450	-	826	1100 (1 per phs) 550 (2 per phs)	1800	1100 (1 per phs) 550 (2 per phs)	2400	170M8547	2400	1200
		-	400	735	1000 (1 per phs) 500 (2 per phs)	1600	1000 (1 per phs) 500 (2 per phs)	2100	170M8547	2100	1200
20xC920	12	500	-	927	1200 (1 per phs) 600 (2 per phs)	2000	1200 (1 per phs) 600 (2 per phs)	2700	170M8547	2700	1200
		-	450	826	1100 (1 per phs) 550 (2 per phs)	1800	1100 (1 per phs) 550 (2 per phs)	2400	170M8547	2400	1200
20xC1K0	12	560	-	1038	1350 (1 per phs) 700 (2 per phs)	2300	1350 (1 per phs) 700 (2 per phs)	3000	170M8547	3000	1400
		-	500	927	1200 (1 per phs) 600 (2 per phs)	2000	1200 (1 per phs) 600 (2 per phs)	2700	170M8547	2700	1200
20xC1K1	13	630	-	1158	1350 (1 per phs) 700 (2 per phs)	2300	1350 (1 per phs) 700 (2 per phs)	3000	170M6466[4]	3000	1400
		-	560	1038	1500 (1 per phs) 750 (2 per phs)	2500	1500 (1 per phs) 750 (2 per phs)	3400	170M6466[4]	3400	1500
20xC1K3	13	710	-	1310	1700 (1 per phs) 850 (2 per phs)	2900	1700 (1 per phs) 850 (2 per phs)	3900	170M6466[4]	3900	1700
		-	630	1158	1500 (1 per phs) 750 (2 per phs)	2500	1500 (1 per phs) 750 (2 per phs)	3400	170M6466[4]	3400	1500
20xC1K4	13	800	-	1461	1900 (1 per phs) 950 (2 per phs)	3000	1900 (1 per phs) 950 (2 per phs)	4300	170M6466[4]	4300	1900
		-	710	1209	1600 (1 per phs) 800 (2 per phs)	2700	1600 (1 per phs) 800 (2 per phs)	3600	170M6466[4]	3600	1600
20xC1K7[1]	14	1000	-	1783	2500 (1 per phs) 825 (3 per phs)	3900	2500 (1 per phs) 825 (3 per phs)	5300	170M6466	5300	2500
		-	900	1612	2100 (1 per phs) 700 (3 per phs)	3500	2100 (1 per phs) 700 (3 per phs)	4800	170M6466	4800	2100
20xC2K1[1]	14	1200	-	2166	3000 (1 per phs) 1000 (3 per phs)	4800	3000 (1 per phs) 1000 (3 per phs)	6400	170M6466	6400	3000
		-	1100	1954	2500 (1 per phs) 825 (3 per phs)	4300	2500 (1 per phs) 825 (3 per phs)	5800	170M6466	5800	2500
20xC2K7[1]	14	1600	-	2720	3500 (1 per phs) 1200 (3 per phs)	6000	3500 (1 per phs) 1200 (3 per phs)	8000	170M6466	8000	3500
		-	1300	2317	3000 (1 per phs) 1000 (3 per phs)	5000	3000 (1 per phs) 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 10 - 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) 375 (2 per phs)	1300	750 (1 per phs) 375 (2 per phs)	1700	170M5813	1700	800
		-	450	524	700 (1 per phs) 350 (2 per phs)	1100	700 (1 per phs) 350 (2 per phs)	1500	170M5813	1500	700
20xD650	11	500	-	628	800 (1 per phs) 400 (2 per phs)	1400	800 (1 per phs) 400 (2 per phs)	1900	170M5813	1900	800
		-	500	594	750 (1 per phs) 375 (2 per phs)	1300	750 (1 per phs) 375 (2 per phs)	1700	170M5813	1700	800
20xD730	11	600	-	705	900 (1 per phs) 450 (2 per phs)	1600	900 (1 per phs) 450 (2 per phs)	2100	170M5813	2100	900
		-	500	655	850 (1 per phs) 425 (2 per phs)	1400	850 (1 per phs) 425 (2 per phs)	1900	170M5813	1900	900
20xD820	12	700	-	792	1000 (1 per phs) 500 (2 per phs)	1800	1000 (1 per phs) 500 (2 per phs)	2400	170M8547	2400	1000
		-	600	735	900 (1 per phs) 475 (2 per phs)	1600	900 (1 per phs) 475 (2 per phs)	2100	170M8547	2100	1000
20xD920	12	800	-	888	1200 (1 per phs) 600 (2 per phs)	2000	1200 (1 per phs) 600 (2 per phs)	2700	170M8547	2700	1200
		-	700	826	1100 (1 per phs) 550 (2 per phs)	1800	1100 (1 per phs) 550 (2 per phs)	2400	170M8547	2400	1200
20xD1K0	12	900	-	994	1300 (1 per phs) 650 (2 per phs)	2300	1300 (1 per phs) 650 (2 per phs)	3000	170M8547	3000	1300
		-	800	927	1200 (1 per phs) 600 (2 per phs)	2000	1200 (1 per phs) 600 (2 per phs)	2700	170M8547	2700	1200
20xD1K1	13	1000	-	1110	1400 (1 per phs) 700 (2 per phs)	2500	1400 (1 per phs) 700 (2 per phs)	3400	170M6466 (4)	3400	1400
		-	900	994	1300 (1 per phs) 650 (2 per phs)	2300	1300 (1 per phs) 650 (2 per phs)	3000	170M6466 (4)	3000	1300
20xD1K3	13	1200	-	1255	1600 (1 per phs) 800 (2 per phs)	2900	1600 (1 per phs) 800 (2 per phs)	3900	170M6466 (4)	3900	1600
		-	1000	1110	1400 (1 per phs) 700 (2 per phs)	2500	1400 (1 per phs) 700 (2 per phs)	3400	170M6466 (4)	3400	1400
20xD1K4	13	1250	-	1400	1800 (1 per phs) 900 (2 per phs)	3200	1800 (1 per phs) 900 (2 per phs)	4300	170M6466 (4)	4300	1800
		-	1000	1158	1500 (1 per phs) 750 (2 per phs)	2700	1500 (1 per phs) 750 (2 per phs)	3600	170M6466 (4)	3600	1500
20xD1K7 (1)	14	1500	-	1709	2200 (1 per phs) 750 (3 per phs)	3800	2200 (1 per phs) 750 (3 per phs)	5300	170M6466	5300	2200
		-	1400	1545	2000 (1 per phs) 675 (3 per phs)	3600	2000 (1 per phs) 675 (3 per phs)	4800	170M6466	4800	2000
20xD2K1 (1)	14	1900	-	2076	2600 (1 per phs) 900 (3 per phs)	4800	2600 (1 per phs) 900 (3 per phs)	6400	170M6466	6400	2600
		-	1700	1873	2400 (1 per phs) 800 (3 per phs)	4300	2400 (1 per phs) 800 (3 per phs)	5800	170M6466	5800	2400
20xD2K7 (1)	14	2300	-	2607	3000 (1 per phs) 1100 (3 per phs)	6000	3000 (1 per phs) 1100 (3 per phs)	8000	170M6466	8000	3300
		-	2000	2220	2800 (1 per phs) 900 (3 per phs)	5000	2800 (1 per phs) 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 11 - 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) 300 (2 per phs)	1000	575 (1 per phs) 300 (2 per phs)	1300	170M8547	1300	600
		–	400	372	475 (1 per phs) 250 (2 per phs)	850	475 (1 per phs) 250 (2 per phs)	1100	170M8547	1100	500
20xE502	11	500	–	485	625 (1 per phs) 325 (2 per phs)	1100	625 (1 per phs) 325 (2 per phs)	1500	170M8547	1500	650
		–	500	444	575 (1 per phs) 300 (2 per phs)	1000	575 (1 per phs) 300 (2 per phs)	1300	170M8547	1300	600
20xE590	11	600	–	570	725 (1 per phs) 375(2 per phs)	1300	725 (1 per phs) 375(2 per phs)	1700	170M5813	1700	800
		–	500	485	625 (1 per phs) 325 (2 per phs)	1100	625 (1 per phs) 325 (2 per phs)	1500	170M5813	1500	700
20xE650	12	700	–	628	800 (1 per phs) 400 (2 per phs)	1400	800 (1 per phs) 400 (2 per phs)	1900	170M5813	1900	900
		–	650	570	725 (1 per phs) 375 (2 per phs)	1300	725 (1 per phs) 375 (2 per phs)	1700	170M5813	1700	800
20xE750	12	800	–	724	950 (1 per phs) 475 (2 per phs)	1600	950 (1 per phs) 475 (2 per phs)	2200	170M5813	2200	1000
		–	700	628	800 (1 per phs) 400 (2 per phs)	1400	800 (1 per phs) 400 (2 per phs)	1900	170M5813	1900	900
20xE820[1]	12	900	–	792	1000 (1 per phs) 500 (2 per phs)	1800	1000 (1 per phs) 500 (2 per phs)	2400	170M5813	2400	1100
		–	700	628	800 (1 per phs) 400 (2 per phs)	1400	800 (1 per phs) 400 (2 per phs)	1900	170M5813	1900	900
20xE920	13	1000	–	888	1200 (1 per phs) 600 (2 per phs)	2000	1200 (1 per phs) 600 (2 per phs)	2700	170M6466[5]	2700	1200
		–	900	792	1000 (1 per phs) 500 (2 per phs)	1800	1000 (1 per phs) 500 (2 per phs)	2400	170M6466[5]	2400	1100
20xE1K0	13	1100	–	994	1300 (1 per phs) 650 (2 per phs)	2300	1300 (1 per phs) 650 (2 per phs)	3000	170M6466[5]	3000	1300
		–	1000	888	1200 (1 per phs) 600 (2 per phs)	2000	1200 (1 per phs) 600 (2 per phs)	2700	170M6466[5]	2700	1200
20xE1K1	13	1300	–	1139	1500 (1 per phs) 750 (2 per phs)	2600	1500 (1 per phs) 750 (2 per phs)	3500	170M6466[5]	3500	1500
		–	1100	994	1300 (1 per phs) 650 (2 per phs)	2200	1300 (1 per phs) 650 (2 per phs)	3000	170M6466[5]	3000	1300
20xE1K5	14	1000	–	1448	1900 (1 per phs) 650 (3 per phs)	3300	1900 (1 per phs) 650 (3 per phs)	4500	170M6466	4500	1900
		–	900	1255	1600 (1 per phs) 550 (3 per phs)	2900	1600 (1 per phs) 550 (3 per phs)	3900	170M6466	3900	1700

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.
20xE1K9[2]	14	1100	–	1834	2300 (1 per phs) 800 (3 per phs)	4200	2300 (1 per phs) 800 (3 per phs)	5700	170M6466	5700	2400
		–	1000	1448	1900 (1 per phs) 650 (3 per phs)	3200	1900 (1 per phs) 650 (3 per phs)	4500	170M6466	4500	1900
20xE2K2[2]	14	1200	–	2172	2800 (1 per phs) 950 (3 per phs)	5000	2800 (1 per phs) 950 (3 per phs)	6700	170M6466	6700	2900
		–	1100	1834	2300 (1 per phs) 800 (3 per phs)	4200	2300 (1 per phs) 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 12 - 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) 300 (2 per phs)	1000	600 (1 per phs) 300 (2 per phs)	1300	170M8547	1300	600
		–	400	388	500 (1 per phs) 250 (2 per phs)	850	500 (1 per phs) 250 (2 per phs)	1100	170M8547	1100	500
20xF502	11	560	–	506	650 (1 per phs) 325 (2 per phs)	1100	650 (1 per phs) 325 (2 per phs)	1500	170M8547	1500	650
		–	500	463	600 (1 per phs) 300 (2 per phs)	1000	600 (1 per phs) 300 (2 per phs)	1300	170M8547	1300	600
20xF590	11	580	–	594	750 (1 per phs) 375 (2 per phs)	1300	750 (1 per phs) 375 (2 per phs)	1700	170M5813	1700	800
		–	560	506	650 (1 per phs) 325 (2 per phs)	1100	650 (1 per phs) 325 (2 per phs)	1500	170M5813	1500	700
20xF650	12	630	–	655	850 (1 per phs) 425 (2 per phs)	1400	850 (1 per phs) 425 (2 per phs)	1900	170M5813	1900	900
		–	560	594	750 (1 per phs) 375 (2 per phs)	1300	750 (1 per phs) 375 (2 per phs)	1700	170M5813	1700	800
20xF750	12	710	–	756	950 (1 per phs) 475 (2 per phs)	1600	950 (1 per phs) 475 (2 per phs)	2200	170M5813	2200	1000
		–	630	655	850 (1 per phs) 425 (2 per phs)	1400	850 (1 per phs) 425 (2 per phs)	1900	170M5813	1900	900
20xF820[1]	12	800	–	826	1100 (1 per phs) 550 (2 per phs)	1800	1100 (1 per phs) 550 (2 per phs)	2400	170M5813	2400	1100
		–	630	655	850 (1 per phs) 425 (2 per phs)	1400	850 (1 per phs) 425 (2 per phs)	1900	170M5813	1900	900
20xF920	13	900	–	927	1200 (1 per phs) 600 (2 per phs)	2000	1200 (1 per phs) 600 (2 per phs)	2700	170M6466[5]	2700	1200
		–	800	826	1100 (1 per phs) 550 (2 per phs)	1800	1100 (1 per phs) 550 (2 per phs)	2400	170M6466[5]	2400	1100

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.
20xF1K0	13	1000	–	1038	1300 (1 per phs) 650 (2 per phs)	2300	1300 (1 per phs) 650 (2 per phs)	3000	170M6466[5]	3000	1300
		–	900	927	1200 (1 per phs) 600 (2 per phs)	2000	1200 (1 per phs) 600 (2 per phs)	2700	170M6466[5]	2700	1200
20xF1K1	13	1100	–	1189	1500 (1 per phs) 750 (2 per phs)	2600	1500 (1 per phs) 750 (2 per phs)	3500	170M6466[5]	3500	1500
		–	1000	1038	1300 (1 per phs) 650 (2 per phs)	2300	1300 (1 per phs) 650 (2 per phs)	3000	170M6466[5]	3000	1300
20xF1K5	14	1500	–	1511	1900 (1 per phs) 650 (3 per phs)	3300	1900 (1 per phs) 650 (3 per phs)	4500	170M6466	4500	1900
		–	1300	1310	1700 (1 per phs) 575 (3 per phs)	2900	1700 (1 per phs) 575 (3 per phs)	3900	170M6466	3900	1700
20xF1K9[2]	14	1800	–	1914	2400 (1 per phs) 800 (3 per phs)	4200	2400 (1 per phs) 800 (3 per phs)	5700	170M6466	5700	2400
		–	1500	1511	1900 (1 per phs) 650 (3 per phs)	3200	1900 (1 per phs) 650 (3 per phs)	4500	170M6466	4500	1900
20xF2K2[2]	14	2000	–	2267	2900 (1 per phs) 950 (3 per phs)	5000	2900 (1 per phs) 950 (3 per phs)	6700	170M6466	6700	2900
		–	1800	1914	2400 (1 per phs) 800 (3 per phs)	4200	2400 (1 per phs) 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 13 - 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

Drive Catalog Number	Frame	kW Rating		DC Input Ratings	Fuse	Bussmann Style Fuse
		ND	HD	Amps		
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 14 - 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
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 15 - 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 16 - 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:

PowerFlex 700S Stegmann Hi-Resolution Encoder Feedback Option

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	90 m (295 ft)
Maximum Frequency (Encoder Speed)	12.5 µs/cycle (4687.5 RPM for encoders with 1024 sine cycles per revolution) (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: • Address • Command Number • Mode • Number of turns • Number of Sine/Cos cycles • Checksum

Supported Encoders

Table 17 below specifies which encoders are supported by the Stegmann Hi-Resolution Encoder Feedback Option card.

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 17 - 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.
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.

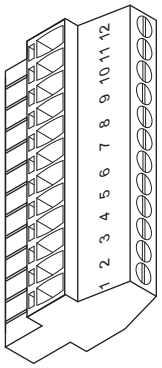
SINCOS®, SINCODER® and LINCODER® are registered trademarks of Stegmann Inc.

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.

Table 18 - Terminal Block Descriptions

	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 and Wiring Diagrams for the Stegmann Hi-Resolution Feedback Option Card

If you are using this motor and feedback device:	Use this cable:	See this wiring diagram:
Allen-Bradley MPL-A/B3xx, -A/B4xx, -A/B45xx, -A/B5xx, and -A/B6xx motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-CFBM7E7-CDAFXX	Figure 1 on page 187
Allen-Bradley MPL-A/B3xx, -A/B4xx, -A/B45xx, -A/B5xx, and -A/B6xx motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-CFMB7DF-CDAFXX	Figure 1 on page 187
HPK-Series motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-XXNFMF-SXX	Figure 2 on page 187
Allen-Bradley 1326AB-BXXXX-21ML and -21MKXL motors with embedded Stegmann rotary encoder	Allen-Bradley 1326-CECU-XXL-XXX	Figure 3 on page 187
Allen-Bradley 1326AB-BXXXX-M2L, -M2KXL, -S2L and -S2KXL motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-CDNFDMP-SXX	Figure 4 on page 188
Allen-Bradley MPL-A5xx and all MPL-Bxxx motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-CDNFDMP-SXX	Figure 4 on page 188
Allen-Bradley 1326AB-BXXXX-M2L, -M2KXL, -S2L and -S2KXL motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-XXNFMP-SXX	Figure 5 on page 188
Allen-Bradley MPL-A5xx and all MPL-Bxxx motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-XXNFMP-SXX	Figure 5 on page 188
Allen-Bradley MPL-A3xx - MPL-A45xx and all MPG series motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-XXNFMP-SXX	Figure 6 on page 188
Allen-Bradley MPL-A3xx - MPL-A45xx and all MPG series motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-UXNFDMP-SXX	Figure 7 on page 189
Any other motor with external Stegmann SHS-170 rotary encoder	Stegmann shielded twisted-pair cable with 12-pin DIN style connector	Figure 8 on page 189
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 9 on page 189
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 10 on page 190
Any other motor with external Stegmann SRS660 rotary encoder	Is available only with pre-attached Stegmann shielded twisted-pair cable of various lengths	Figure 11 on page 190

Connection Examples

Figure 1 - All MPL-A/B3xx, -A/B4xx, -A/B45xx, -A/B5xx, and -B6xx motors with 2090-CFBM7E7-CDAFXX or 2090-CFBM7DF-CDAFXX cable

Note: Thermal Switch cannot be accessed using 2090-CFBM7X7-CDAFXX cable.

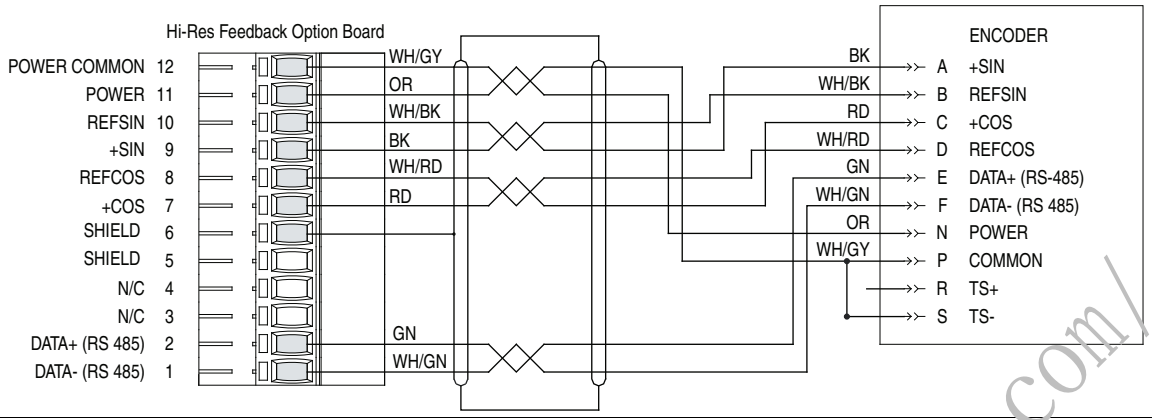


Figure 2 - HPK-Series motors with 2090-XXNFMF-SXX cable

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

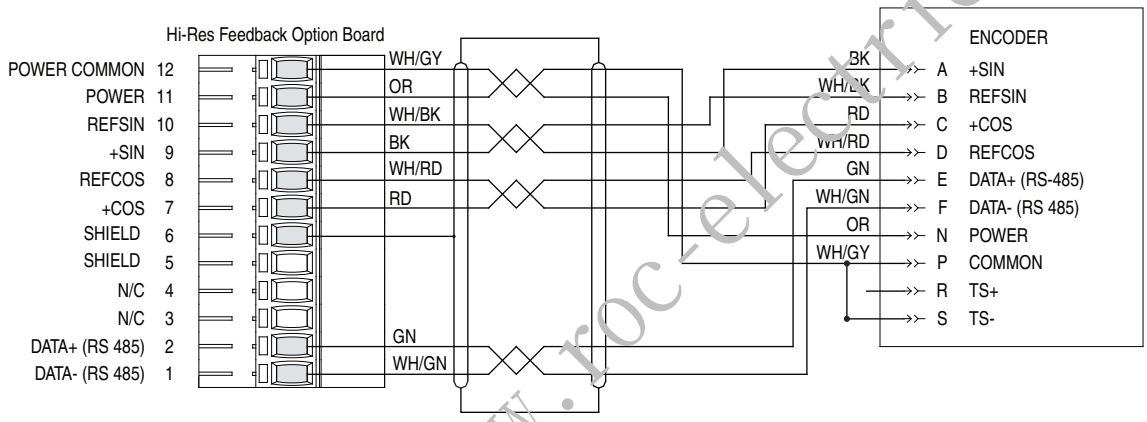
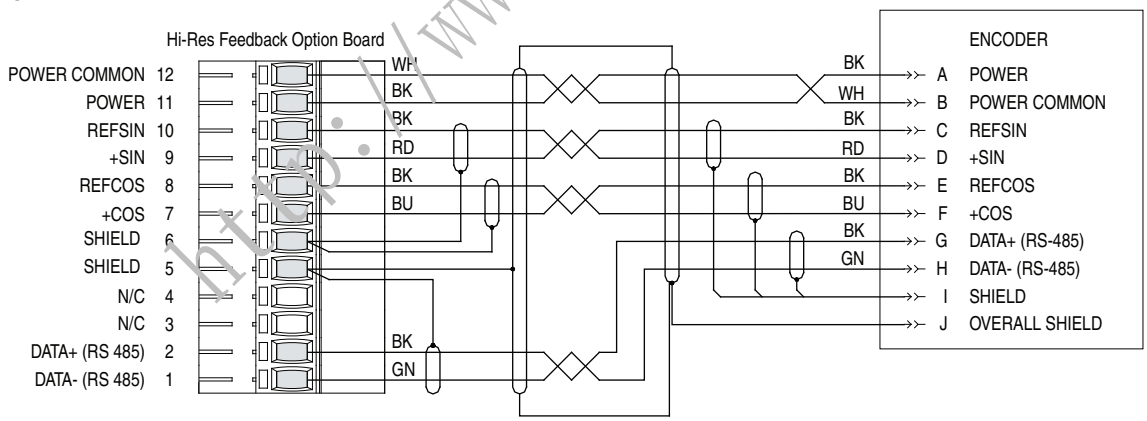


Figure 3 - 1326AB-BXXXX-21ML, and -21MKXL motors with a 1326-CECU-XXL-XXX cable



Connection Examples

Figure 4 - MPL-A5xx and all MPL-Bxxx motors or 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with 2090-CDNFDMP-SXX cable

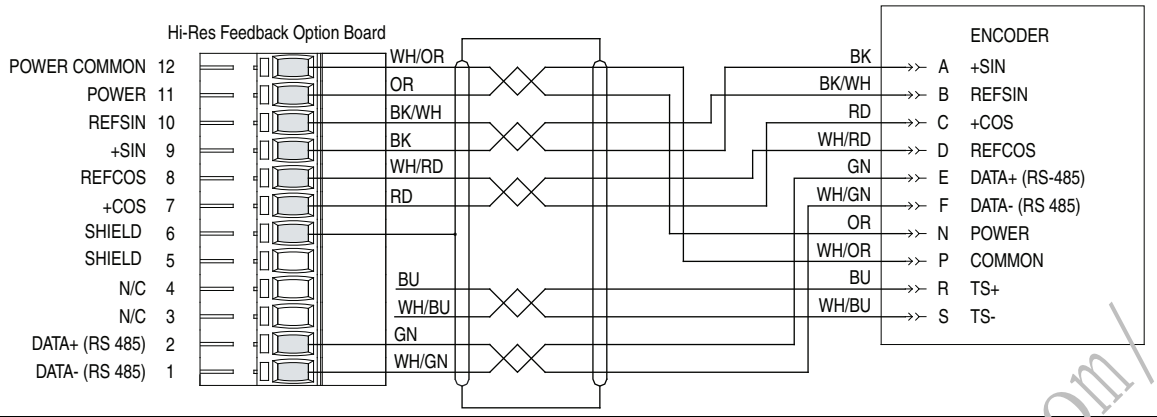


Figure 5 - MPL-A5xx and all MPL-Bxxx Motor or 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motor with 2090-XXNFMP-SXX cable

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

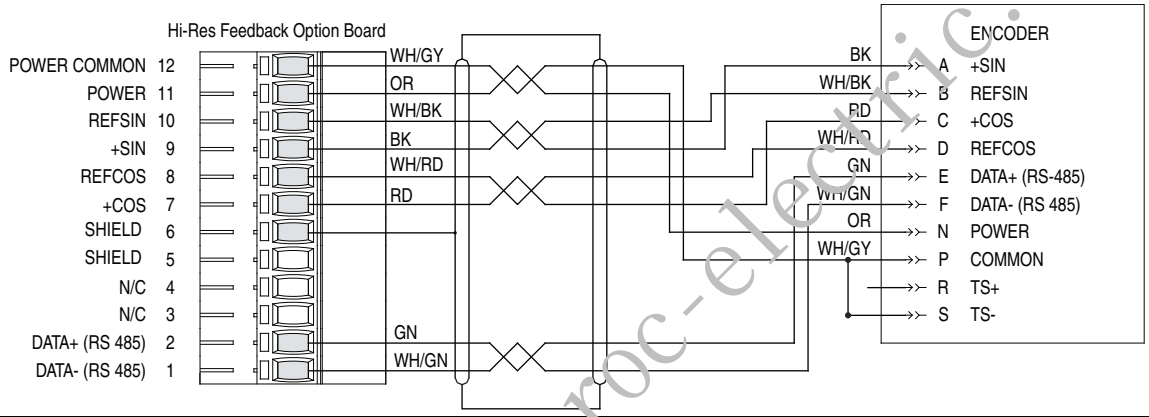
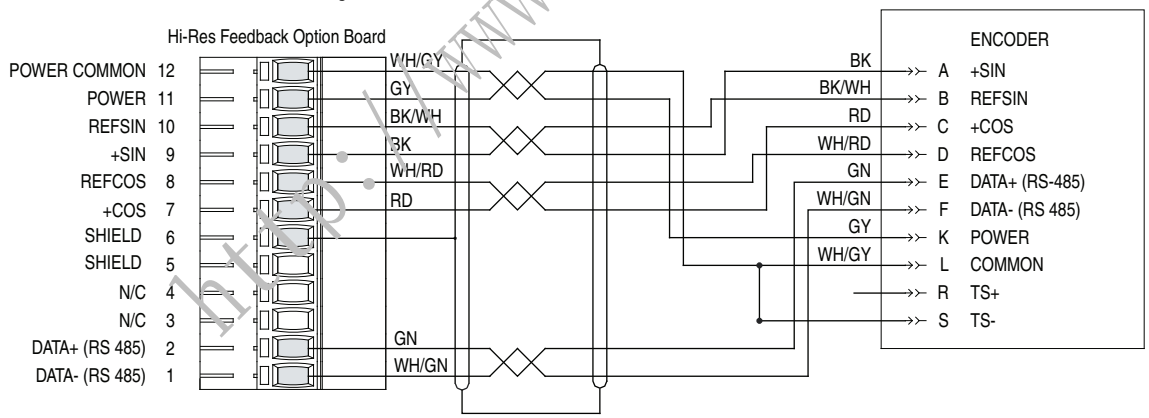


Figure 6 - MPL-A3xx - MPL-A45xx and all MPG series motors with 2090-XXNFMP-SXX cable

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



Connection Examples

Figure 7 - MPL-A3xx - MPL-A45xx and all MPG series motors with 2090-UXNFDMP-SXX cable

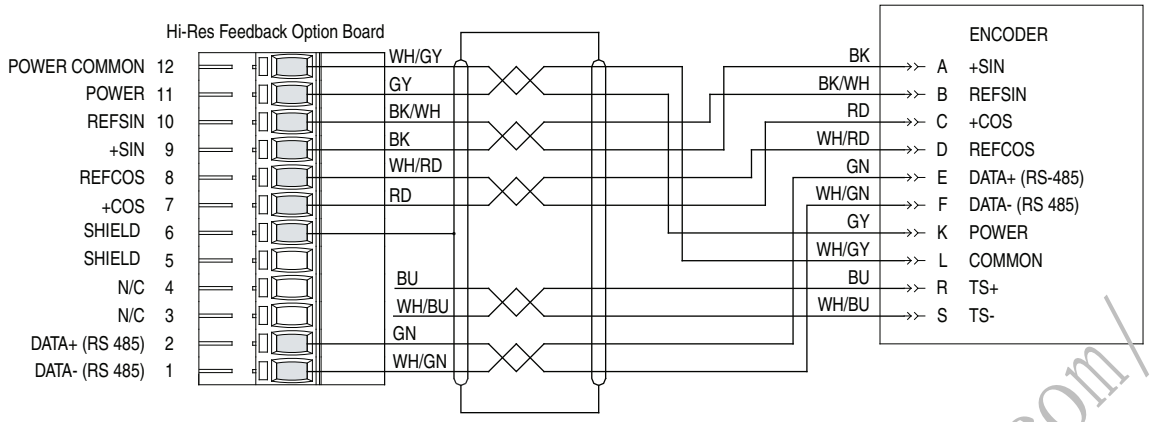


Figure 8 - Stegmann shielded twisted-pair cable with 12-pin DIN style connector

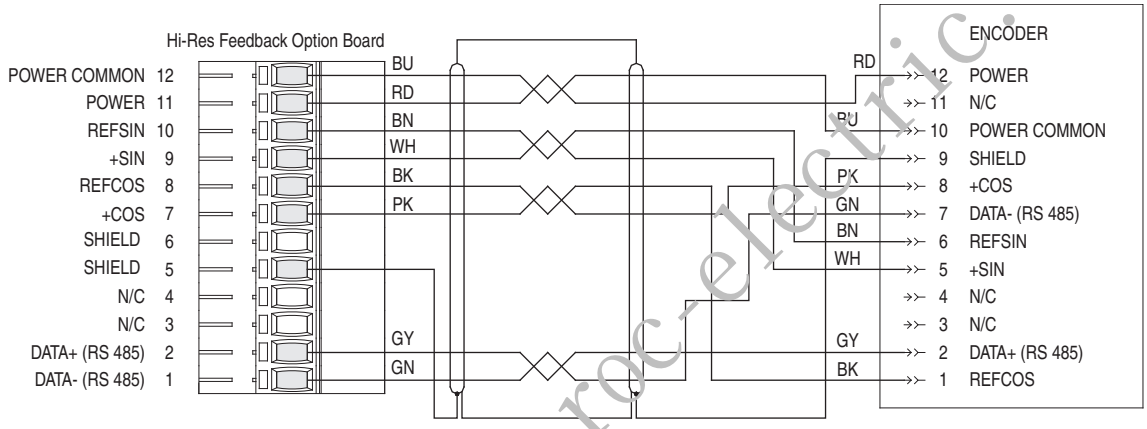
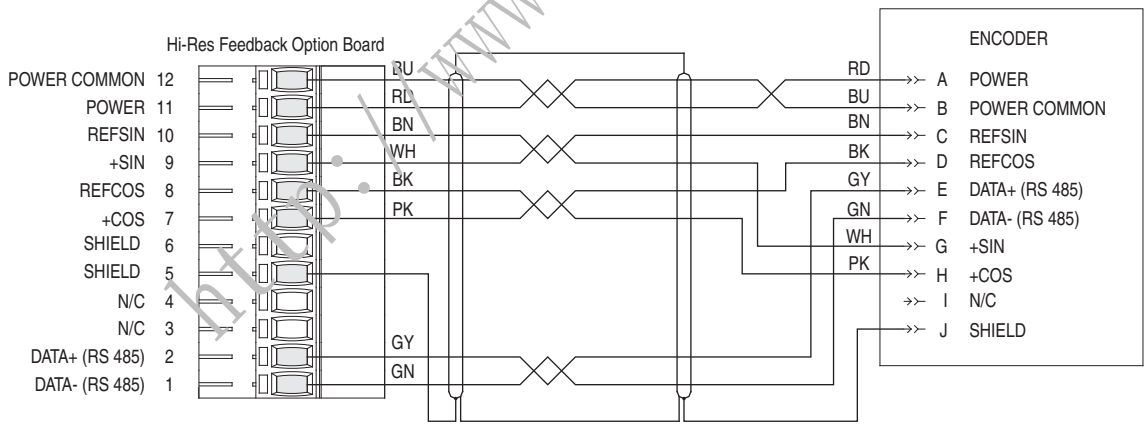


Figure 9 - Stegmann shielded twisted-pair cable with 10-pin MS style connector



Connection Examples

Figure 10 - Stegmann shielded twisted-pair cable with 8-pin Berg style connector

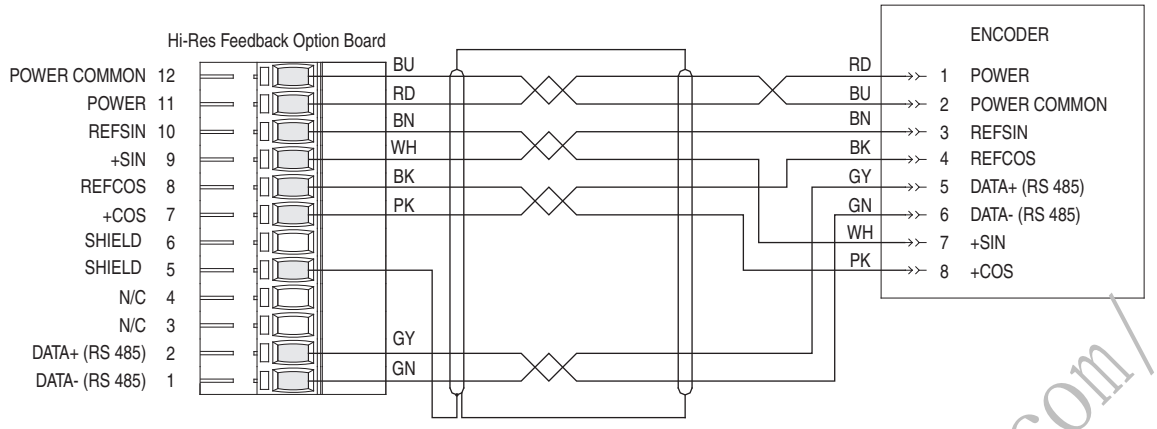
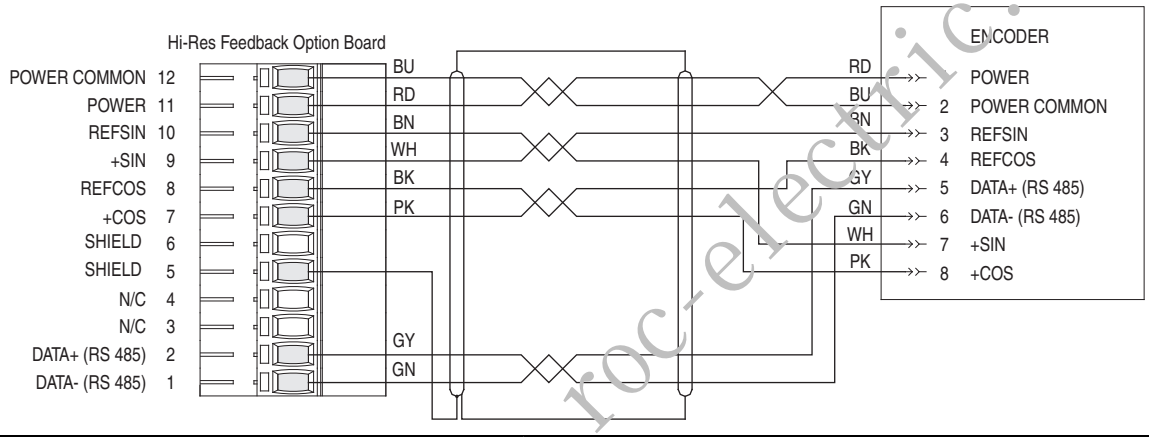


Figure 11 - Pre-attached Stegmann shielded twisted-pair cable



PowerFlex 700S Resolver Feedback Option Card

Option Card Specifications

Consideration	Description
Excitation Frequency	2381…9300 Hz
Excitation Voltage	8…26 Vrms
Resolver Feedback Voltage	2 Vrms ±300 mV

Compatible Resolvers

Table 19 below specifies which resolvers are supported by the Resolver Feedback Option card.

Table 19 - Compatible Resolvers

Manufacturer	Manufacturer Catalog Number	Parameter 277 [Reslvr0 Type Sel] Configuration	Notes
Tamagawa	TS-2014N181E32	1 - T2014/2087x1	x 1, flange-mounted enclosure
Tamagawa	TS-2014N182E32	2 - T2014/2087x2	x 2, flange-mounted enclosure
Tamagawa	TS-2014N185E32	3 - T2014/2087x2	x 5, flange-mounted enclosure
Tamagawa	TS-2087N12E9	2 - T2014/2087x2	x 2, HD foot-mounted enclosure, double shaft
Tamagawa	TS-2087N1E9	1 - T2014/2087x1	x 1, HD foot-mounted enclosure
Tamagawa	TS-2087N2E9	2 - T2014/2087x2	x 2, HD foot-mounted enclosure
Tamagawa	TS-2087N5E9	3 - T2014/2087x2	x 5, HD foot-mounted enclosure
Tamagawa	TS-2087N11E9	1 - T2014/2087x1	x 1, HD foot-mounted enclosure, double shaft
Advanced Micro Controls Inc. (AMCI)	R11X-C10/7	14 - AmciR11XC107	

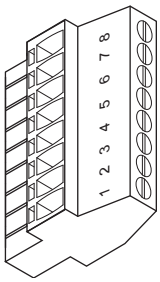
Allen-Bradley servo motors may be ordered with factory installed resolvers. Table 20 specifies which factory installed resolvers are supported by the Resolver Feedback Option card.

Table 20 - Compatible Factory Installed Resolvers

Motor / Resolver Type	Parameter 277 [Reslvr0 Type Sel] Configuration	Notes
1326 AB 460V Primary Resolver	9 - 1326Ax 460v	Transmitter type resolver - supported
1326 AB 460V Secondary Resolver	13 - Reserved	Secondary resolver is geared to motor - not intended for motor speed / position feedback Transmitter type resolver - supported
1326AH 460V Explosion Proof Motor Primary Resolver	9 - 1326Ax 460v	Transmitter type resolver - supported
1326AS 460V Rare Earth Primary Resolver	9 - 1326Ax 460v	Transmitter type resolver - supported
MPL 460V Primary Resolver	4 - MPL 460v	Transmitter type resolver - supported

Wiring the Resolver Feedback Option Card to a Resolver

Table 21 - Terminal Block Description

	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

Recommended Cable

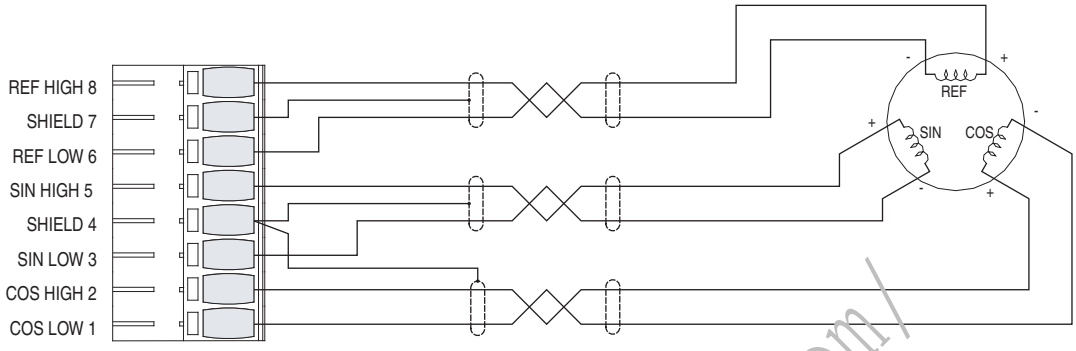
Rockwell Automation strongly recommends the use of Reliance Electric 417900-207CG or Belden 9730 cable for installation, or an equivalent cable that meets these specifications:

- 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 ft: 17.15 Ω ±10%
- Inductance per 1000 ft: 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.

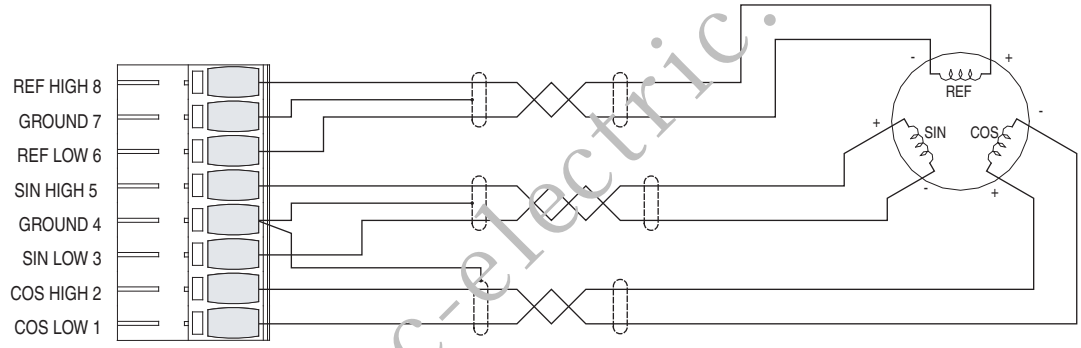
Figure 12 - Resolver Wiring Examples

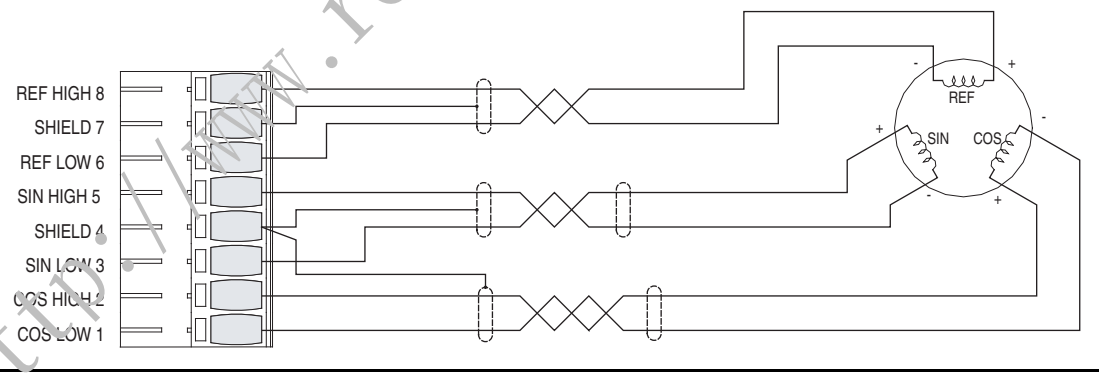
Connection Examples

Resolver Interface - Clockwise Rotation = Count Up



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





Notes:

PowerFlex 700S Multi-Device Interface (MDI) Option Card

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	90 m (295 ft)
Linear Encoder Maximum Cable Length	245 m (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: • Address • Command Number • Mode • Number of turns • Number of Sine/Cos cycles • Checksum
Registration Inputs	High speed 12…24V DC sinking digital inputs

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

Temposonics® is a registered trademark of MTS Systems Corporation.

Supported Rotary Encoders

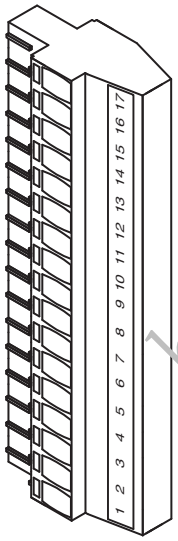
IMPORTANT Please note that encoders must be ordered as "Single Ended". This will ensure that the RS-485 channel has the proper termination network installed at the factory.

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.
Allen-Bradley 842HR	1024 sine cycles per revolution	Has built-in mechanical turns counter. IP65 Protection Class. Size 25 square flange mounting.

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

Wiring the MDI Option Card

Table 22 - Terminal Block Description



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

Recommended Cables and Wiring Diagrams for the MDI Option Card

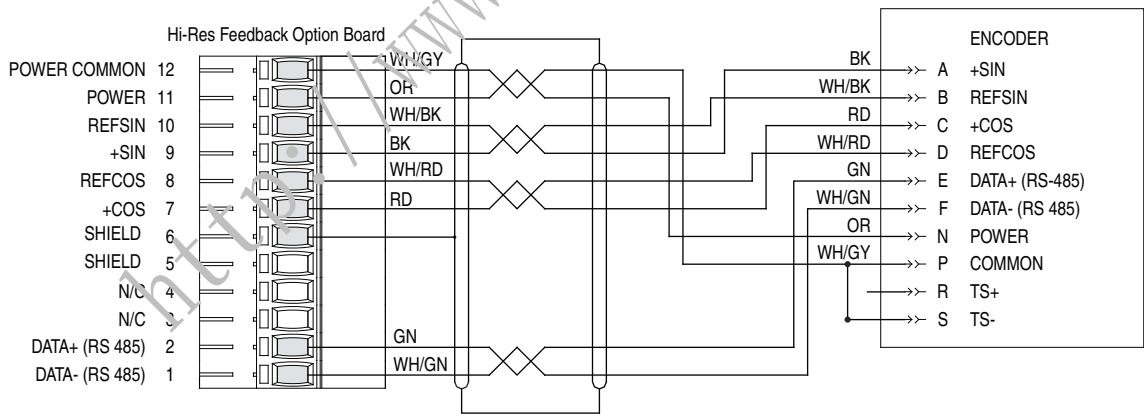
If you are using this motor and feedback device:	Use this cable:	See this wiring diagram:
Allen-Bradley MPL-A/B3xx, -A/B4xx, -A/B45xx, -A/B5xx, and -A/B6xx motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-CFBM7E7-CDAFXX	Figure 13 below
Allen-Bradley MPL-A/B3xx, -A/B4xx, -A/B45xx, -A/B5xx, and -A/B6xx motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-CFMB7DF-CDAFXX	Figure 13 on page 197
HPK-Series motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-XXNFMF-SXX	Figure 14 on page 198
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 15 on page 198
Allen-Bradley 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-CDNFDMP-SXX	Figure 16 on page 198
Allen-Bradley MPL-A5xx and MPL-Bxxx motors motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-CDNFDMP-SXX	Figure 16 on page 198
Allen-Bradley 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-XXNFMP-SXX	Figure 17 on page 199
Allen-Bradley MPL-A5xx and MPL-Bxxx motors motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-XXNFMP-SXX	Figure 17 on page 199
Allen-Bradley MPL-A3xx - MPL-A45xx and all MPG series motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-XXNFMP-SXX	Figure 18 on page 199
Allen-Bradley MPL-A3xx - MPL-A45xx and all MPG series motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-UXNFDMP-SXX	Figure 19 on page 199
Any other motor with external Stegmann SHS-170 rotary encoder	Stegmann shielded twisted-pair cable with 12-pin DIN style connector	Figure 20 on page 200
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 21 on page 200
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 22 on page 200
Any other motor with external Stegmann SRS660 rotary encoder	Is available only with pre-attached Stegmann shielded twisted-pair cable of various lengths	Figure 23 on page 201

Table 23 - Connection Examples

Example

Figure 13 - All MPL-A/B3xx, -A/B4xx, -A/B45xx, -A/B5xx, and -B6xx motors with 2090-CFBM7E7-CDAFXX or 2090-CFBM7DF-CDAFXX cable

Note: Thermal Switch cannot be accessed using 2090-CFBM7X7-CDAFXX cable.



Example

Figure 14 - HPK-Series motors with 2090-XXNFMF-SXX cable

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

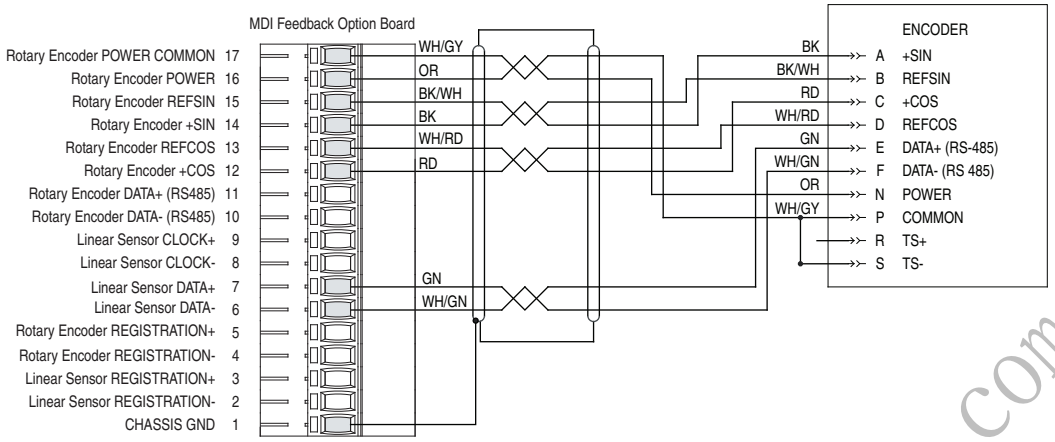


Figure 15 - Linear Sensor connections with MDI RG connector or P integral cable

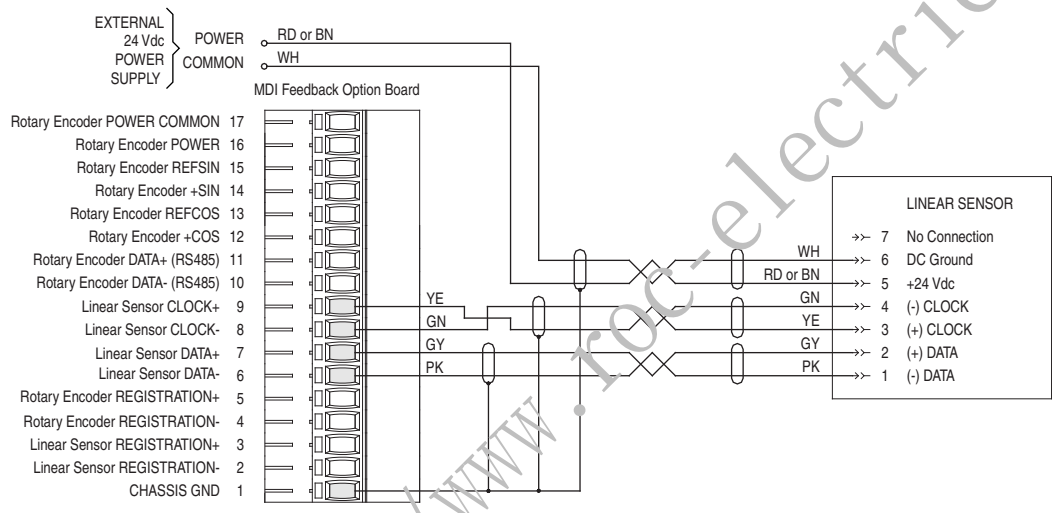
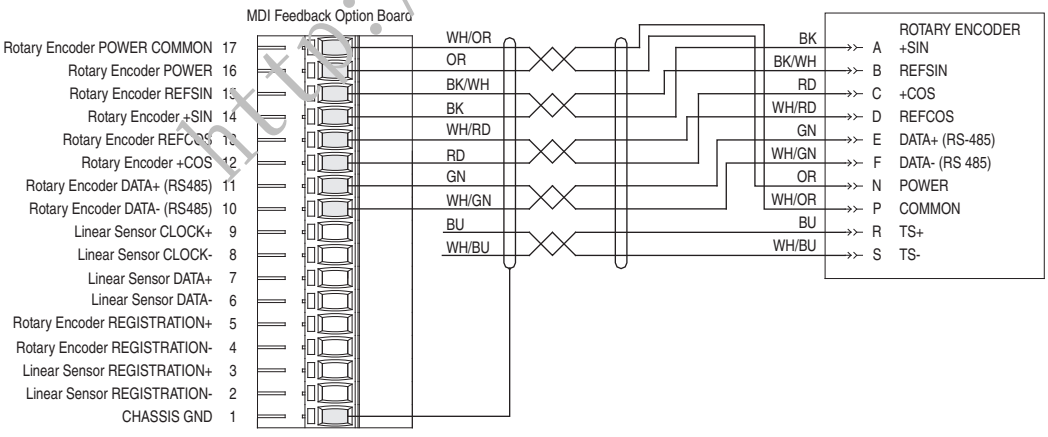


Figure 16 - Rotary Encoder connections for MPL-A5xx and MPL-Bxxx motors or 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with 2090-CDNFDMP-SXX cable



Example

Figure 17 - 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.

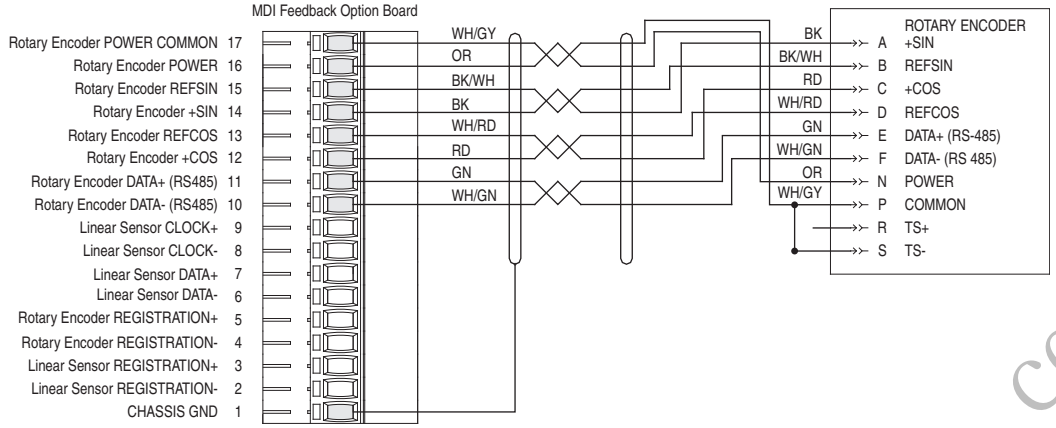


Figure 18 - Rotary Encoder connections for MPL-A3xx - MPL-A45xx and all MPG series motors with 2090-UXNFMP-SXX cable

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

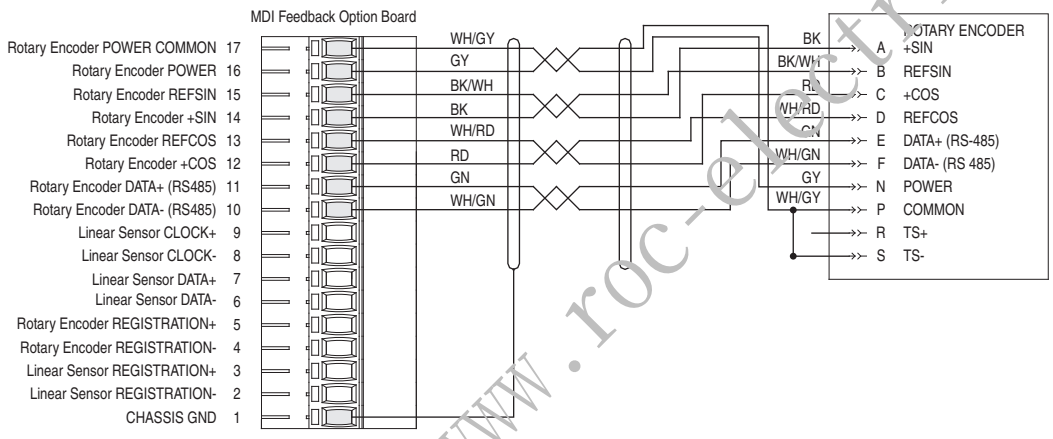
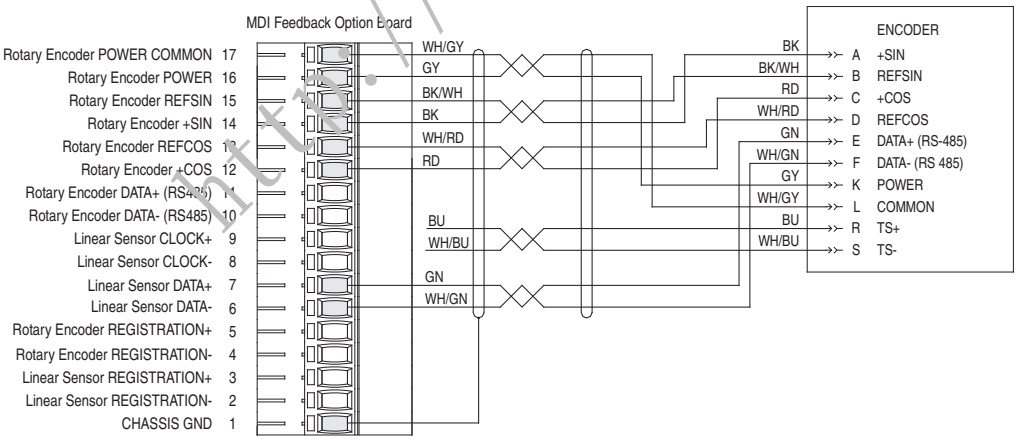


Figure 19 - Rotary Encoder connections for MPL-A3xx - MPL-A45xx and all MPG series motors with 2090-UXNFDMP-SXX cable



Example

Figure 20 - Stegmann shielded twisted-pair cable with 12-pin DIN style connector

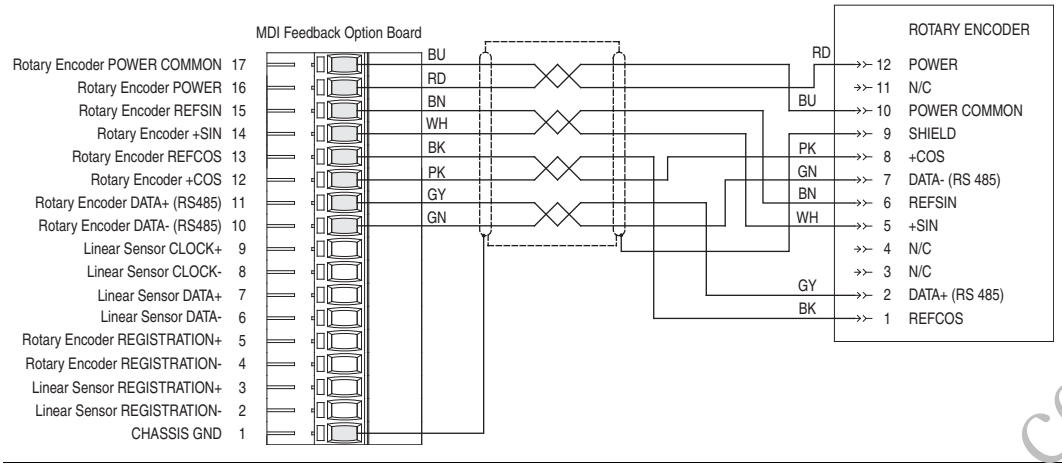


Figure 21 - Rotary Encoder connections with Stegmann shielded twisted-pair cable and 10-pin MS style connector

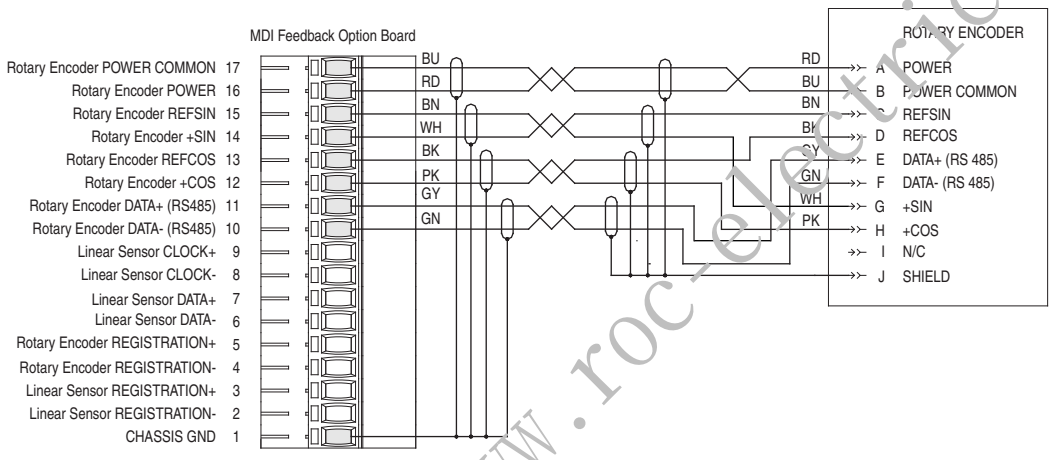
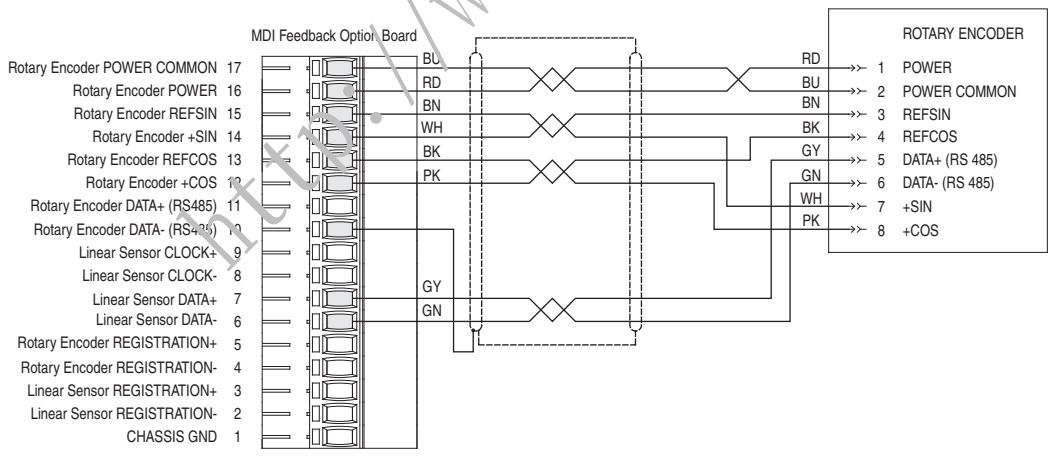


Figure 22 - Rotary Encoder connections with Stegmann shielded twisted-pair cable and 8-pin Berg style connector



Example

Figure 23 - Rotary Encoder connections with Stegmann pre-attached shielded twisted-pair cable

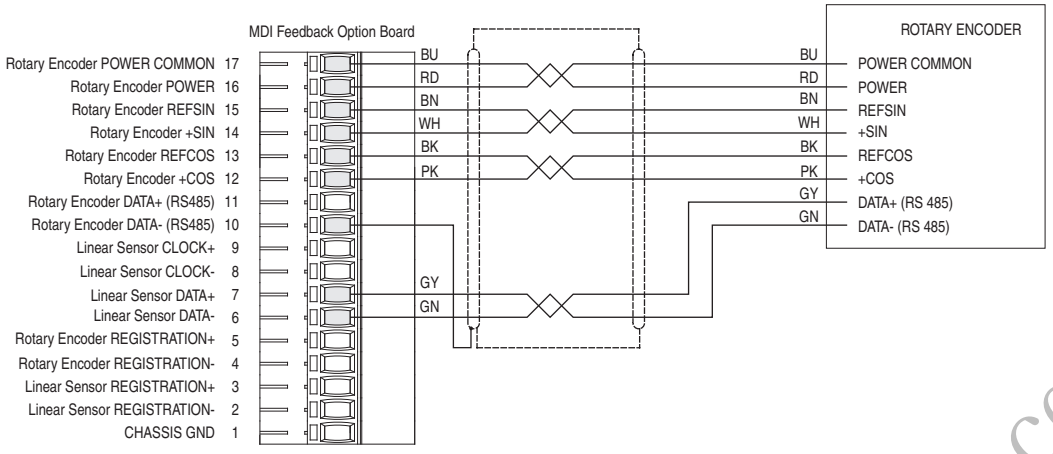
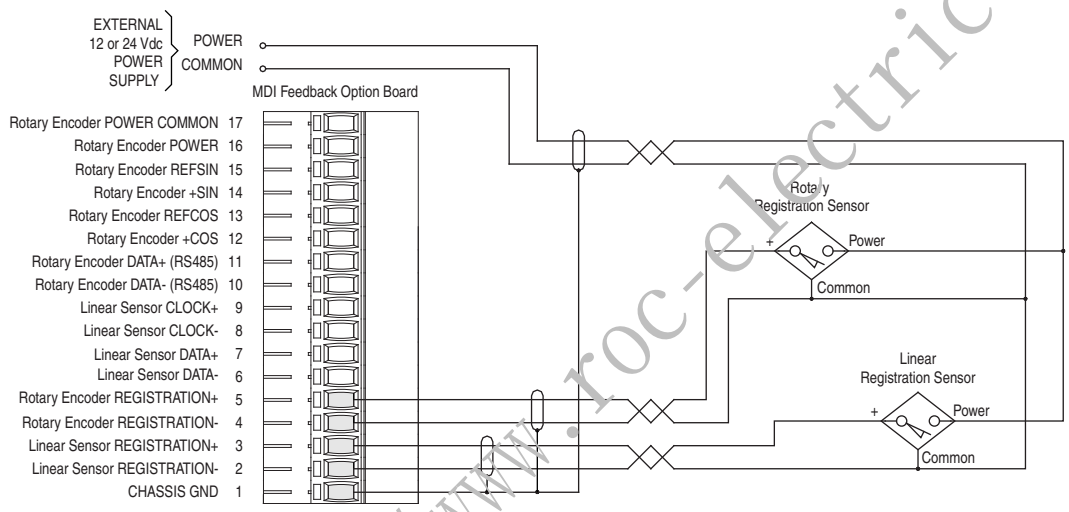


Figure 24 - Registration Sensor connection



Notes:

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. See 700H Control Circuit Board Designations on page 32 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).

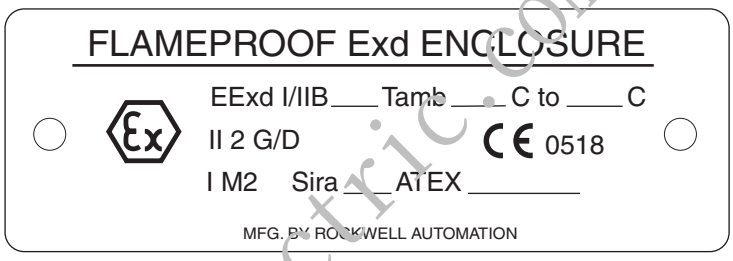
ATTENTION: Operation of this ATEX certified drive with an ATEX certified motor that is located in a hazardous environment requires additional installation, operation, and maintenance procedures beyond those stated in the standard user manual. Equipment damage and/or personal injury may result if all 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.
- See all product markings for additional cautions that may apply.
- Typical motor markings are contained on a motor certification nameplate similar to the sample below.

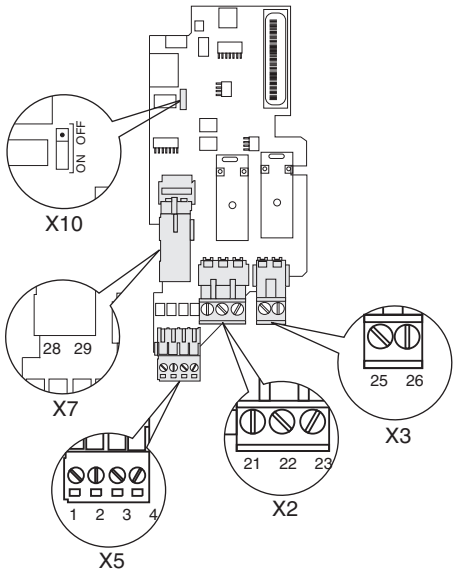


Drive Wiring

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. See Figure 6 on page 33 for wiring examples. Motor supplied contacts must have ratings compatible with the input circuit ratings and applied voltage level of the drive.

Table 24 - Terminal Descriptions



Term. Blk.	No.	Signal	Description
X5	1	SD1+	Isolated Disable input 1 +24V +/-20% 10... 15 mA
	2	SD1–	Virtual GND 1
	3	SD2+	Isolated Disable input 2 +24V +/-20% 10... 15 mA
	4	SD2–	Virtual GND 2
X2	21	Digital Out 1 - N.C.	Max. Resistive Load: 240V AC / 30V DC - 1200VA, 150 W Max. Current: 5 A, Min. Load: 10 mA Max. Inductive Load: 240V AC / 30V DC - 8400VA, 105 W Max. Current: 3.5 A, Min. Load: 10 mA
	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: $R_{trip} \geq 4.0$ kΩ(PTC)
	29	TI1–	

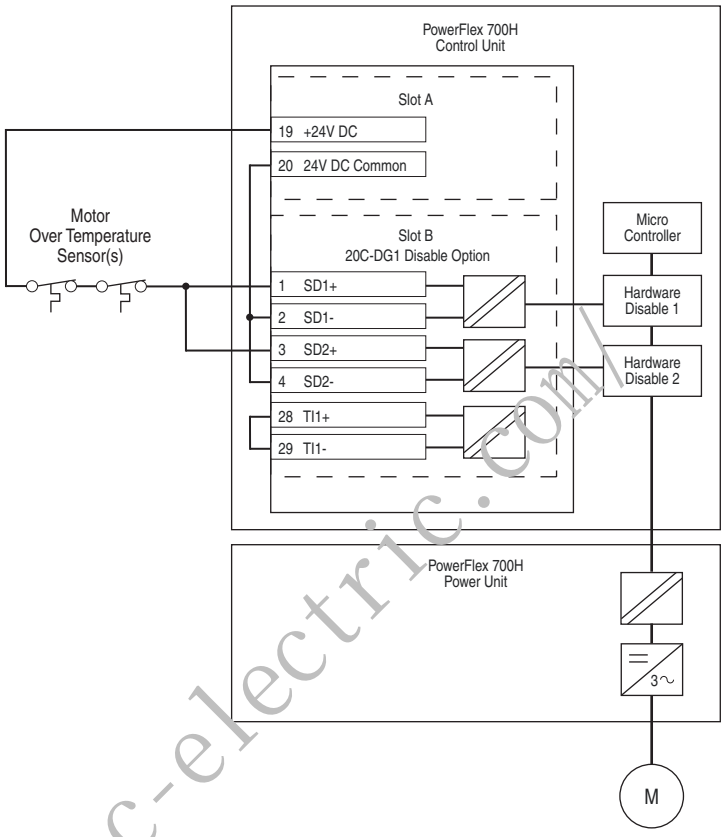
IMPORTANT The drive will not run unless one of the following conditions is met:

- 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 25 - 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. See Table 25 on page 208 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. See Table 25 on page 208 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. See Table 25 on page 208 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 25 - 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

History of Changes

This appendix briefly summarizes changes that have been made with revisions of this manual. Reference this appendix if you need information to determine what changes have been made across multiple revisions. This may be especially useful if you are deciding to upgrade your hardware or software based on information added with previous revisions of this manual.

PFLEX-IN006D-EN-P, March 2006

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

PFLEX-IN006C-EN-P, October 2004

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

Notes:

Numerics

A

B

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V

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