Application Technique

Original Instructions

Drives in Common Bus Configurations

Allen-Bradley
by ROCKWELL AUTOMATION

Rockwell Automation

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.

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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.

These 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).

The following icon may appear in the text of this document.

Identifies information that is useful and can help to make a process easier to do or easier to understand.

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Summary of Changes

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

Topic	Page
Added a note to the Typical System Configurations figures stating that AC and DC circuit protection devices are required but not shown.	44, 45, 46, 47
Changed the recommended type of diode sharing modules.	119

About This Publication

An increasing number of drive systems in a wide range of applications and power ranges are being configured today in common bus configurations. These common bus drive system configurations provide significant advantages such as, design flexibility, higher efficiency, and cost savings. It is the objective of this publication to provide the necessary guidelines, considerations, and limitations for the proper application of PowerFlex® drives used in common bus configurations.

Download Firmware and Related Files

Use the Product Compatibility and Download Center at rok.auto/pcdc for the following:

- Download firmware and associated files, such as Add-on Profile (AOP), Electronic Data Sheet (EDS), and Device Type Manager (DTM)
- Access product release notes

Notes:

Introduction

An increasing number of drive systems in a wide range of applications and power ranges are being configured today in common bus configurations. These common bus drive system configurations provide significant advantages such as, design flexibility, higher efficiency, and cost savings.

It is the objective of this publication to provide the necessary guidelines, considerations, and limitations for the proper application of PowerFlex® drives used in common bus configurations.

Definitions of Common Bus Configurations

Common DC Bus—Non-regenerative

Three-phase diode, SCR bridge front-end, or a combination of these two. A single-direction power flow, full-wave bridge converts 3-phase AC voltage to a fixed DC bus voltage. One or more drives are connected through the DC bus.

Common DC Bus—Non-regenerative with Braking Chopper

Same as Non-regenerative, but with an added resistive braking module to dissipate excess regenerative DC bus energy.

Shared AC/DC Bus

Standalone drives fed by a common 3-phase AC voltage source with the DC bus of each drive connected together.

Shared AC/DC Bus—with Braking Chopper

Same as Shared AC/DC Bus, but with an added resistive braking module to dissipate excess regenerative DC bus energy.

Shared DC Bus (Piggy Back)

One standalone drive is used as the common converter section for multiple shared DC bus drives. The incoming AC power is fed to the drive used as the common converter only. The drive used as the common converter sources DC power to the smaller drive or drives through the DC link connections.

Shared DC Bus (Piggy Back)—with Braking Chopper

Same as Shared DC Bus, but with an added resistive braking module to dissipate excess regenerative DC bus energy.

Regenerative Bus Supply (Active Front End)

A Pulse Width Modulated (PWM) controlled IGBT converter enables regeneration to the AC line. One or more drives are connected to the DC bus. An Active Front End can be connected in parallel to a non-regenerative converter.

Regenerative Braking

A regenerative brake enables regeneration to the AC line. In this configuration, the drive has a connection to the AC line and draws the majority of the motoring power.

Shared Regenerative Braking

Similar to the Regenerative Braking configuration, except multiple drives are connected to a single regenerative unit. Steering diodes are used to control flow of current.

Parallel Regenerative Braking

Similar to the Regenerative Braking configuration, except multiple regenerative units are connected to a single drive.

General Considerations

DC Bus Wiring Guidelines

Drive Line-up

Generally, it is desirable to have the drive line-up match the machine layout. However, if there is a mix of drive frame sizes used in the line-up, the general system layout must have the largest drives located closest to the rectifier source. The rectifier source can be anywhere within the system line-up. Many times it is advantageous to put the rectifier in the middle of the line-up, minimizing the distances to the farthest loads. This is needed to minimize the energy stored in the parasitic inductance of the bus structure and thus lower peak bus voltages during transient operation.

The system must be contained in one contiguous line-up. The bus cannot be interrupted to go to another cabinet for the remainder of the system drives. This is needed to maintain low inductance.

DC Bus Connections

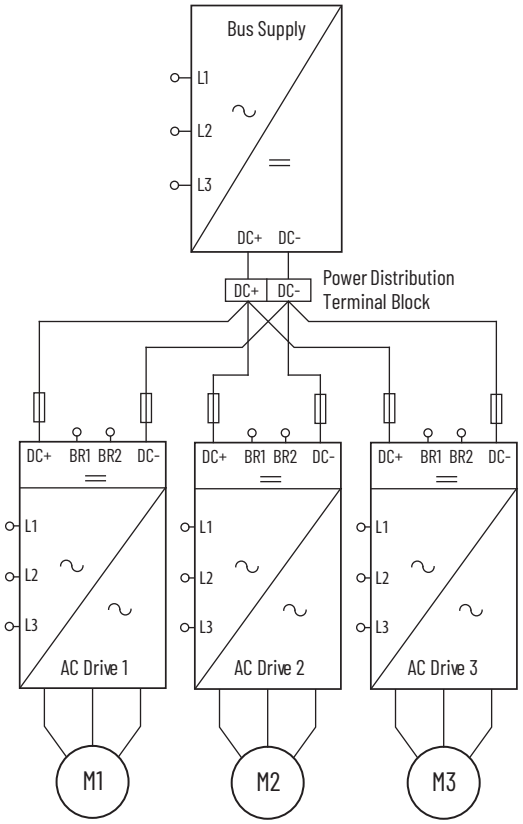
General

The interconnection of drives to the DC bus, and the inductance levels between the drives, must be kept to a minimum for reliable system operation.

Bus Bar versus Cable

- Bus bar is recommended.
- When bus bar cannot be used, adhere to the following guidelines for DC bus cables:
  - Keep the cable lengths as short as possible.
  - Twist cable where possible, approximately 1 twist per foot.
  - Use cable rated for the equivalent AC voltage rating. The peak AC voltage is equivalent to the DC voltage. For example, the peak AC voltage on a 480V AC system no load is 480 x 1.414 = 679 volts peak. The 679 volts peak corresponds to 679 volts DC at no load.
  - The DC bus connections cannot be 'daisy chained'. Use a 'star' configuration of the DC bus connections as shown in the following figure to enable proper fusing.

Figure 1 - Star Configuration of Common Bus Connections



Braking Chopper

Connection of the brake unit must be closest to the largest drive. If all are the same rating, then closest to the drive that regenerates the most.

The maximum wire length between the brake chopper and the highest power drive and between parallel brake choppers must be observed. See the respective braking product documentation for details.

An RC snubber can mitigate inductive voltage spike at brake off transitions.

Precharge

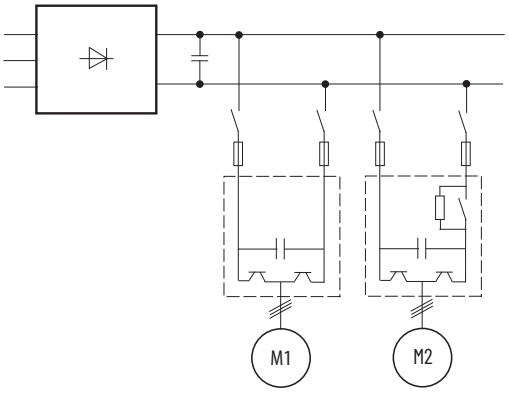
Precharge is the process through which the DC bus voltage of a drive is gradually increased. During this increase in DC bus voltage, the DC bus filtering capacitors are charged in a controlled manner. The precharge assembly can be part of the drive's design or provided and controlled externally by the user.

ATTENTION: An external source of power can be present. To avoid an electrical shock hazard, verify that the AC power supply has been removed prior to performing any maintenance.

If an external voltage source is being used to power the logic boards of the drives, precaution must be taken to control the precharge sequence. We recommend using the 'Precharge Enable' digital input on the drive for common bus operation. The logic input can be coordinated through a PLC or system-level control for precharge sequencing. This lets various horsepower drive charging time constants settle out before the precharge is closed. Generally, a 3 second delay after power application is acceptable.

When multiple drives are connected through disconnects to a common DC bus, it is generally necessary to provide an input to the drive that enables the precharge to close. Often this input is controlled by an auxiliary contact on the drive disconnect switch.

Figure 2 - Common DC Bus Example



The bus capacitors in the individual drives act as a low impedance voltage source. Extra care is needed when connecting individual drives to an energized bus.

ATTENTION: Kinetix® drives have no method for you to control the precharge sequence. To avoid severe drive and equipment damage due to uncontrolled precharge, do not connect Kinetix servo drives to an energized DC bus.

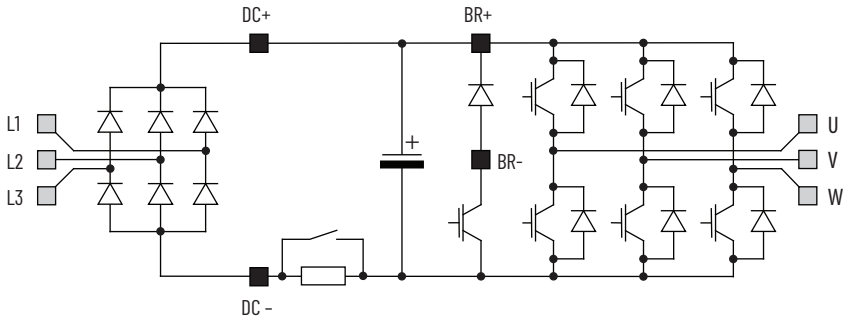
If 'Precharge Enable' is selected as a digital input, it must be energized to let the initial bus precharge complete. If it is de-energized, it is treated as a coast-to-stop command **and** it forces the drive to the initial bus precharge state. Fuse failure is probable unless coordination of precharge circuits in individual drives is implemented.

PowerFlex® 700 drives and PowerFlex 700 Series B drives must have firmware revision 2.001 or later (Standard or Vector Control) for use in common bus configurations. When Kinetix 6000 drives are used in common bus configurations with PowerFlex drives, they must have firmware revision 1.92 or later. Kinetix 6200/6500 drives with any firmware revision can be used.

PowerFlex 40P Frame B AC Drives

For PowerFlex 40P Frame B AC drives, the precharge hardware is located on the power circuit board. It is composed of a resistor in series with the negative DC bus, between the diode bridge and the bus capacitors. The resistor has a relay contact connected in parallel that closes when the bus precharge level has been reached, bypassing the precharge resistor. The precharge function operates the same way for either AC or DC input power.

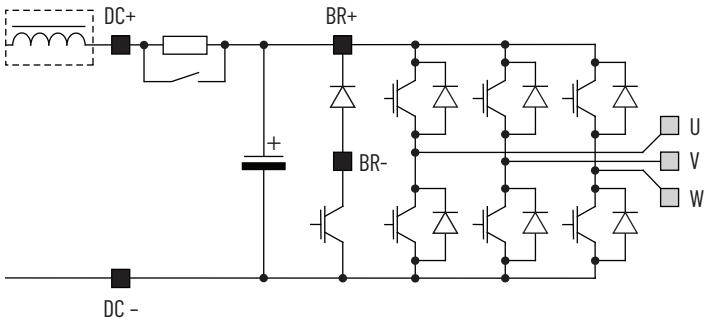
Figure 3 - AC and DC Input Schematic for PowerFlex 40P Frame B AC Drives



PowerFlex 40P Frame C AC Drives

For PowerFlex 40P Frame C AC drives, the precharge hardware is located on the power circuit board. It is composed of a resistor in series with the positive DC bus, between the diode bridge and the bus capacitors. An external DC link inductor can be installed in series between the diode bridge and the precharge resistor. The resistor has a relay contact connected in parallel that closes when the bus precharge level has been reached, bypassing the precharge resistor. The precharge function operates the same way for either AC or DC input power.

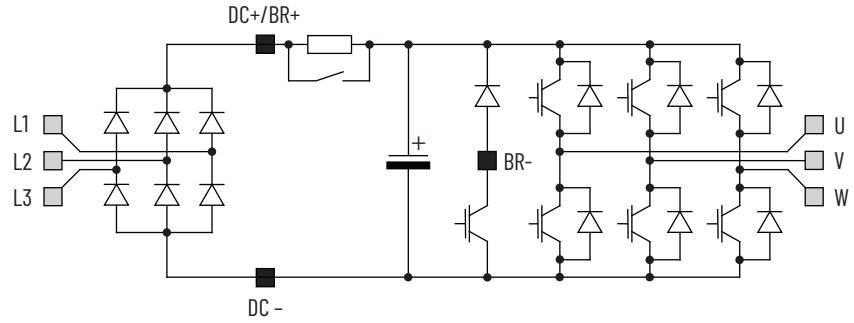
Figure 4 - AC and DC Input Schematic for PowerFlex 40P Frame C AC Drives



PowerFlex 520-Series Frame A, B, and C AC Drives

For the PowerFlex 520-Series Frame A, B, and C AC drives, the precharge hardware is located on the power circuit board. It is composed of a resistor in series with the positive DC bus, between the diode bridge and the bus capacitors. The resistor has a relay contact connected in parallel that closes when the bus precharge level has been reached, bypassing the precharge resistor. The precharge function operates the same way for either AC or DC input power.

Figure 5 - AC and DC Input Schematic for PowerFlex 520-Series Frame A, B, and C AC Drives

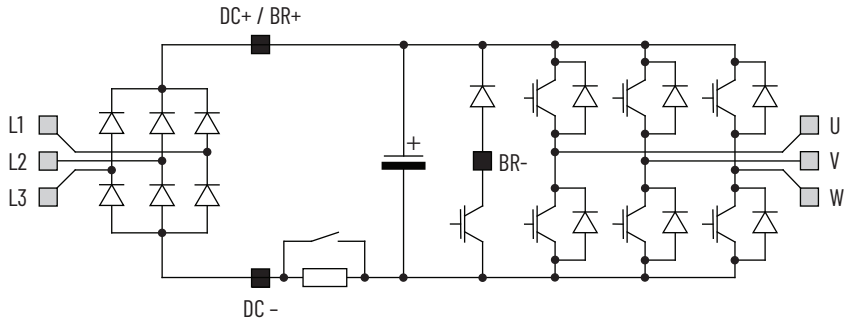


This schematic represents 3-phase input voltage PowerFlex 520-Series drives in the designated frame size.

PowerFlex 520-Series Frame D AC Drives

For the PowerFlex 520-Series Frame D AC drives, the precharge hardware is located on the power circuit board. It is composed of a resistor in series with the negative DC bus, betwreeen the diode bridge and the bus capacitors. The resistor has a relay contact connected in parallel that closes when the bus precharge level has been reached, bypassing the precharge resistor. The precharge function operates the same way for either AC or DC input power.

Figure 6 - AC and DC Input Schematic for PowelrFlex 520-Series Frame D AC Drives

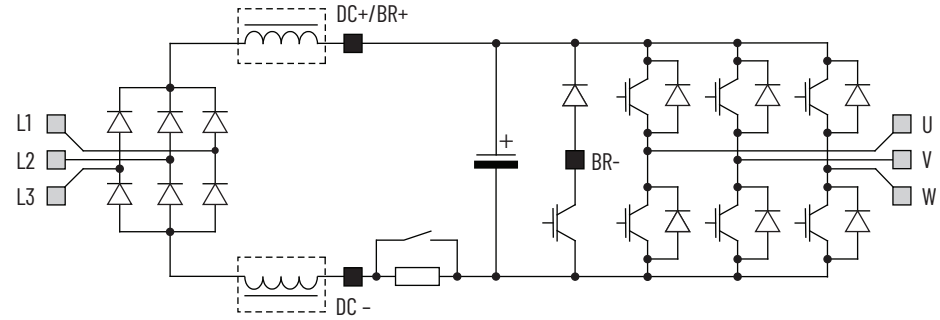


This schematic represents 3-phase input voltage PowerFlex 520-Series drives in the designated frame size.

PowerFlex 520-Series Frame E AC Drives

For the PowerFlex 520-Series Frame E AC drives, the precharge hardware is located on the power circuit board. It is composed of a resistor in series with the negative DC bus, between the DC link inductor and the bus capacitors. The resistor has a relay contact connected in parallel that closes when the bus precharge level has been reached, bypassing the precharge resistor. The precharge function operates the same way for either AC or DC input power.

Figure 7 - AC and DC Input Schematic for PowerFlex 520-Series Frame E AC Drives

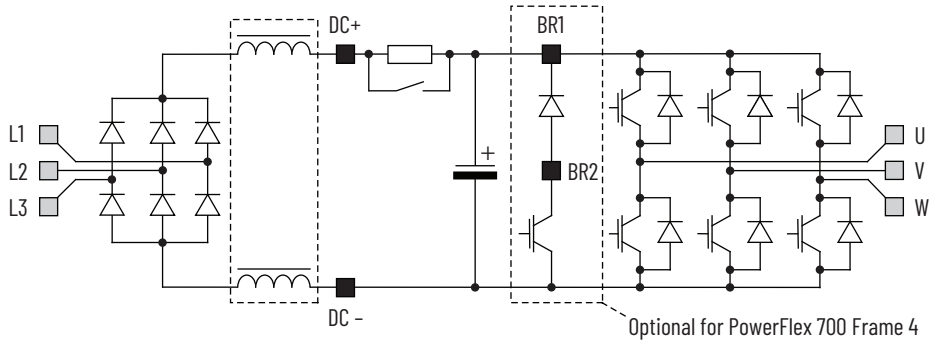


This schematic represents 3-phase input voltage PowerFlex 520-Series drives in the designated frame size.

PowerFlex 70 Frame E, PowerFlex 700/700S Frame 1...4, and PowerFlex 750-Series Frame 2...4 AC Drives

For PowerFlex 70 Frame E, PowerFlex 700/700S Frame 1...4, and PowerFlex 750-Series Frame 2...4 AC drives, the precharge hardware is located on the power circuit board. It is composed of a resistor in series with the positive DC bus, between the DC link and the bus capacitors. The resistor has a relay contact connected in parallel that closes when the bus precharge level has been reached, bypassing the precharge resistor. The precharge function operates the same way for either AC or DC input power.

Figure 8 - AC and DC Input Schematic for PowerFlex 70 Frame E, PowerFlex 700/700S Frame 1...4, and PowerFlex 750-Series Frame 2...4 AC Drives

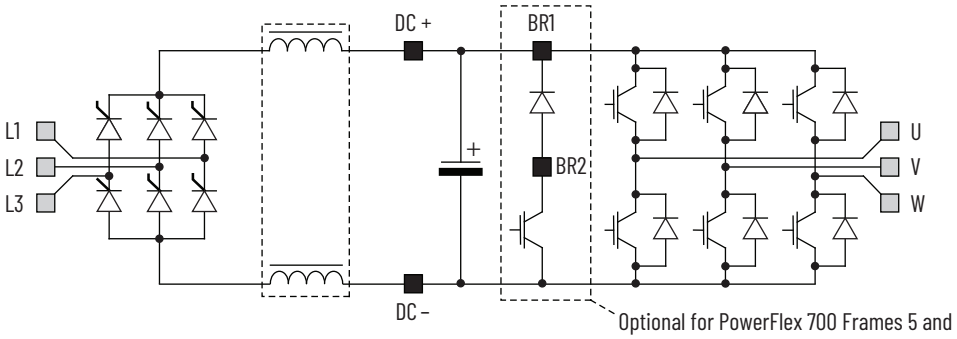


PowerFlex 700/700S Frame 5 and 6, and PowerFlex 700 Frame 7...10 AC Input 'Stand-alone' Drives

For PowerFlex 700/700S Frame 5 and 6, and PowerFlex 700 Frame 7...10 drives (AC Input), the precharge function is implemented with an SCR rectifier such that the SCRs are phase advanced to limit the inrush current into the bus capacitors. This phase-advanced precharge is not controlled by the drive and must normally be completed by the minimum precharge time required by the drive. The drive does not complete precharge until the bus voltage is stable and above the under voltage level. t

ATTENTION: PowerFlex 700/700S Frame 5 and 6 and PowerFlex 700 Frame 7...10 AC input drives, when connected to common DC bus, have no internal precharge circuit to control the precharge sequence. To avoid severe drive and equipment damage due to uncontrolled precharge, do not connect these drives to an energized DC bus.

Figure 9 - AC Input Schematic for PowerFlex 700/700S Frame 5 and 6 (Voltage Rating Catalog Codes B, C, D, E, and F), and PowerFlex 700 Frame 7...10 AC Drives

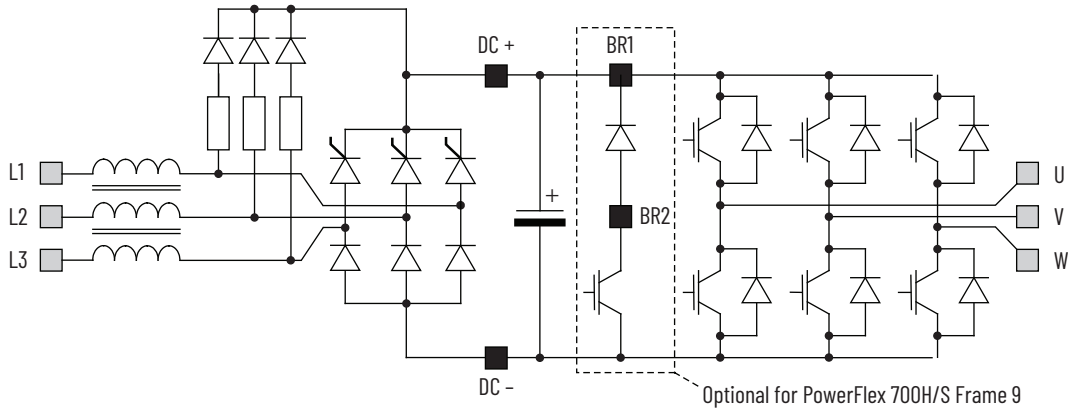


PowerFlex 700H/700S Frame 9...14 AC Input 'Stand-alone' Drives

During the precharge phase of PowerFlex 700H/700S Frame 9...14 drives, the three SCR switches of the front end rectifier are open and the bus capacitors are charged through the resistors and diodes from the AC side of the bridge. After the DC bus has reached precharge level, the SCRs when turned on bypass the diode/resistor configuration.

ATTENTION: PowerFlex 700H/700S Frame 9...14 AC input drives, when connected to common DC bus, have no internal precharge circuit to control the precharge sequence. To avoid severe drive and equipment damage due to uncontrolled precharge, do not connect these drives to an energized DC bus.

Figure 10 - AC Input Schematic for PowerFlex 700H/700S Frame 9...14 AC Drives (Voltage Rating Catalog Codes B, C, D, E, and F)

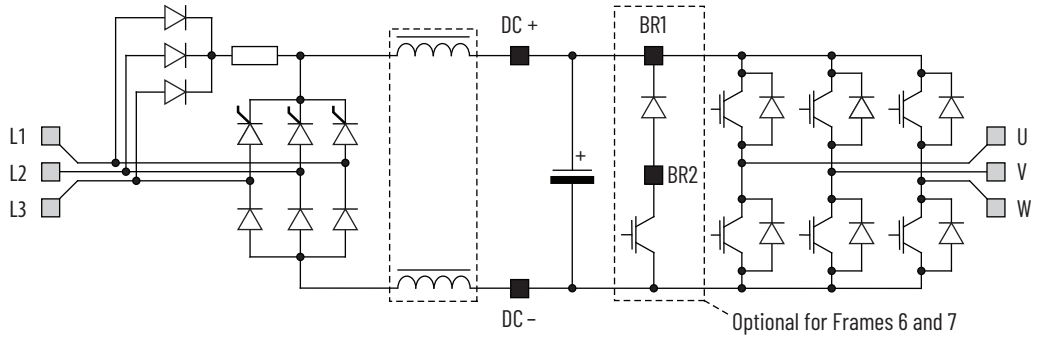


PowerFlex 750-Series Frame 5...7 AC Drives

When ordered as an AC input drive, DC terminals are not provided on Frames 6 and 7. During precharge, the SCRs of the front end rectifier are open and the bus capacitors are charged through the diodes and resistors from the AC input. After the DC bus has reached precharge level, the SCRs when turned on bypass the diode resistor configuration.

ATTENTION: PowerFlex 750-Series Frame 5...7 AC input drives, when connected to common DC bus, have no internal precharge circuit to control the precharge sequence. To avoid severe drive and equipment damage due to uncontrolled precharge, do not connect these drives to an energized DC bus.

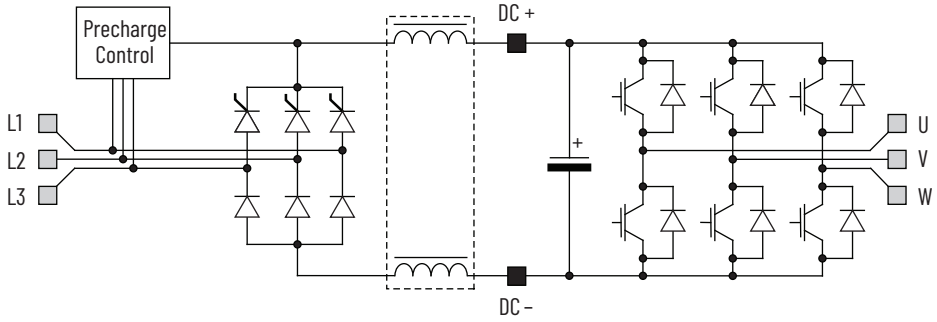
Figure 11 - AC Input Schematic for PowerFlex 750-Series Frame 5...7 AC Drives (Voltage Rating Catalog Codes 1 and A)



PowerFlex 750-Series Frame 8...10 AC Input 'Stand-alone' Drives

For PowerFlex 750-Series Frame 8...10 AC input drives, the precharge function is implemented with a diode/SCR rectifier such that the SCRs are phase advanced to limit the inrush current into the bus capacitors. This phase-advanced precharge is controlled by a converter firing board within the drive and must normally be completed by the minimum precharge time required by the drive.

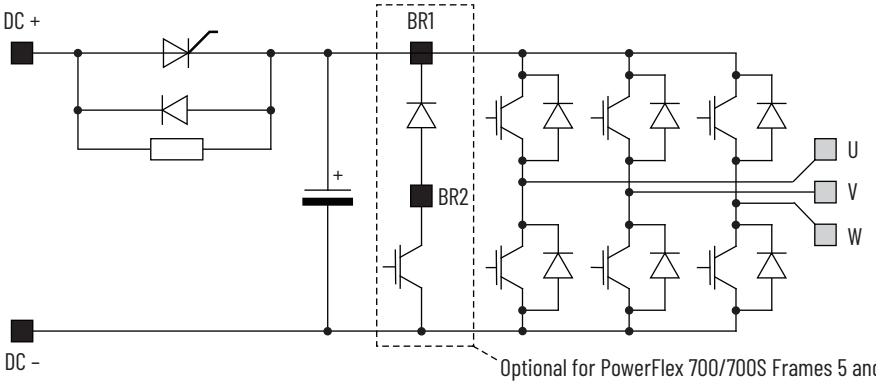
Figure 12 - AC Input Schematic for PowerFlex 750-Series Frame 8...10 AC Drives (Voltage Rating Catalog Codes 1 and A



PowerFlex 700/700S Frame 5 and 6, and PowerFlex 700 Frame 7...10 DC Input 'Common Bus' Drives

There are two versions of these DC Input or common bus drives. One version has a resistor in series with the positive DC bus, ahead of the bus capacitors. An SCR is connected in parallel and when gated on, it bypasses the resistor. PowerFlex 700/700S Frame 5 and 6, and PowerFlex 700 Frame 7...9 drives are available with this internal precharge.

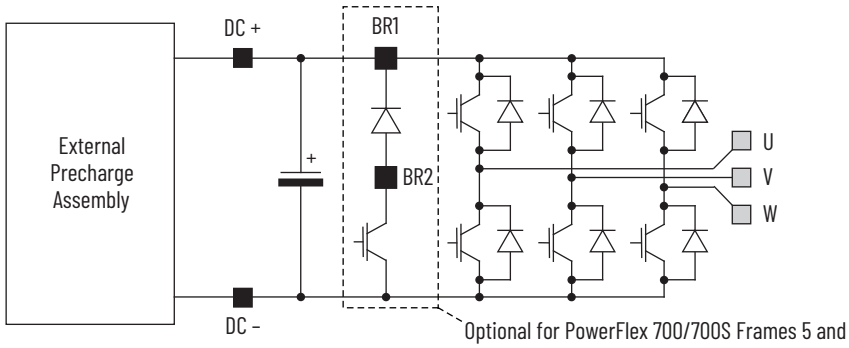
Figure 13 - DC Input Schematic for PowerFlex 700/700S Frame 5 and 6 (Voltage Rating Catalog Codes N, P, R, T, and W), and PowerFlex 700 Frame 7...9 DC Input Drives



PowerFlex 700/700S Frame 5 and 6, and PowerFlex 700 Frame 10 drives do not have an internal precharge option, which is intended for applications where the precharge hardware and control is provided by the user.

ATTENTION: PowerFlex 700/700S Frame 5 and 6 and PowerFlex 700 Frame 10 DC input drives, when connected to common DC bus, have no internal precharge circuit to control the precharge sequence. To avoid severe drive and equipment damage due to uncontrolled precharge, do not connect these drives to an energized DC bus.

Figure 14 - DC Input Schematic for PowerFlex 700/700S Frame 5 and 6 (Voltage Rating Catalog Codes H, J, K, and M), and PowerFlex 700 Frame 10 DC Input Drives

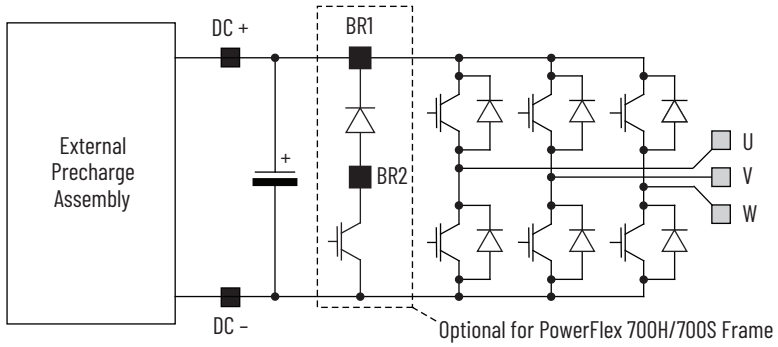


PowerFlex 700H/700S Frame 9...14 DC Input 'Common Bus' Drives

PowerFlex 700H/700S Frame 9...14 drives (DC Input) do not include internal precharge. Precharge must be provided by an external precharge assembly.

ATTENTION: PowerFlex 700H/700S Frame 9...14 DC input drives, when connected to common DC bus, have no internal precharge circuit to control the precharge sequence. To avoid severe drive and equipment damage due to uncontrolled precharge, do not connect these drives to an energized DC bus.

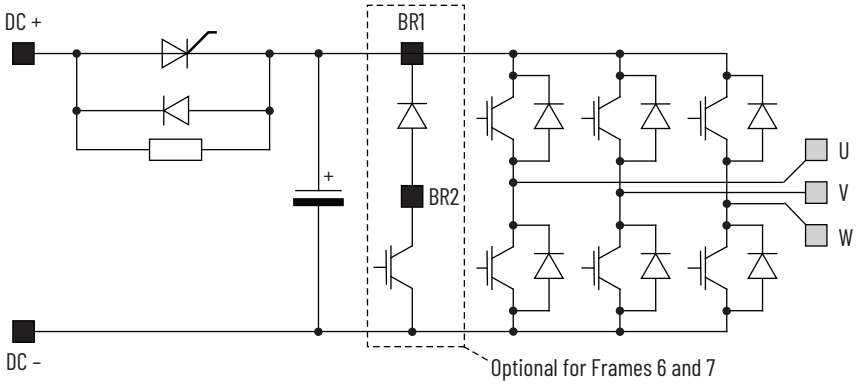
Figure 15 - DC Input Schematic for PowerFlex 700H/700S Frame 9...14 DC Input Drives (Voltage Rating Catalog Codes H, J, K, and M)



PowerFlex 750-Series Frame 5...7 DC Input 'Common Bus' Drives

The precharge has a resistor in series with the positive DC bus, ahead of the bus capacitors. An SCR is connected in parallel and when gated on, it bypasses the resistor.

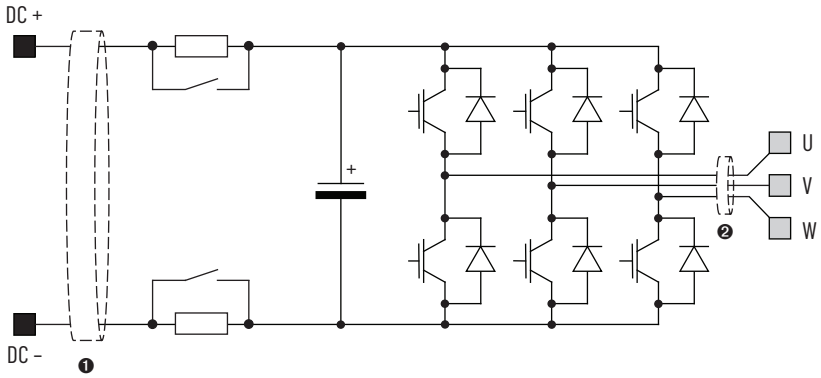
Figure 16 - DC Input Schematic for PowerFlex 750-Series Frame 5...7 DC Input Drives (Input Type Catalog Code 4)



PowerFlex 750-Series Frame 8...10 DC Input 'Common Bus' Drives

For PowerFlex 750-Series Frame 8...10 DC input drives, the precharge function is implemented with a resistor and bypass contactor in both the positive and negative DC bus between the DC input and the bus capacitors. When the DC bus precharge level has been reached, the contactor closes bypassing the resistor.

Figure 17 - DC Input Schematic for PowerFlex 750-Series Frame 8...10 DC Input Drives (Input Type Catalog Code 4)



? A common mode core is included when ordering a Catalog No. 21G drive with a 'P' or 'W' enclosure. A Common Mode Core is also included with any of the following IP00 Input Termination kits:

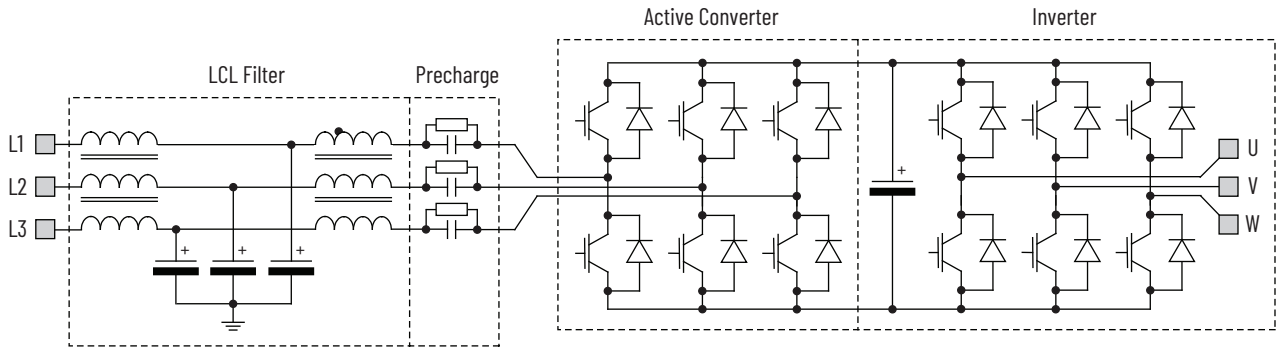
- 20-750-BUS5-F8
- 20-750-BUS5-F9
- 20-750-BUS5-F10

? A motor output common mode core is included in kit 20-750-EMCCM1-F8.

PowerFlex 700L Frame 2, 3A, and 3B AC Input 'Stand-alone' Drives

PowerFlex 700L Frame 2, 3A, and 3B AC input drives are regenerative drives with an active converter and input filter. The precharge circuit is connected between the input filter and the active converter. This is a 3-phase precharge with resistors in parallel with AC contactors. When the precharge is complete, the AC contactors close to bypass the resistors.

Figure 18 - AC Input Schematic for PowerFlex 700L Frame 2, 3A, and 3B AC Drives (Equipment Type Catalog Code A)

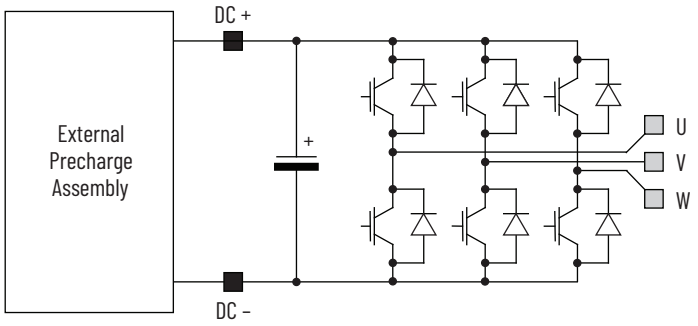


PowerFlex 700L Frame 3A and 3B DC Input 'Common Bus' Drives

PowerFlex 700L Frame 3A and 3B drives (DC Input) do not include internal precharge. Precharge must be provided by an external precharge assembly.

ATTENTION: PowerFlex 700L Frame 3A and 3B DC input drives, when connected to common DC bus, have no internal precharge circuit to control the precharge sequence. To avoid severe drive and equipment damage due to uncontrolled precharge, do not connect these drives to an energized DC bus.

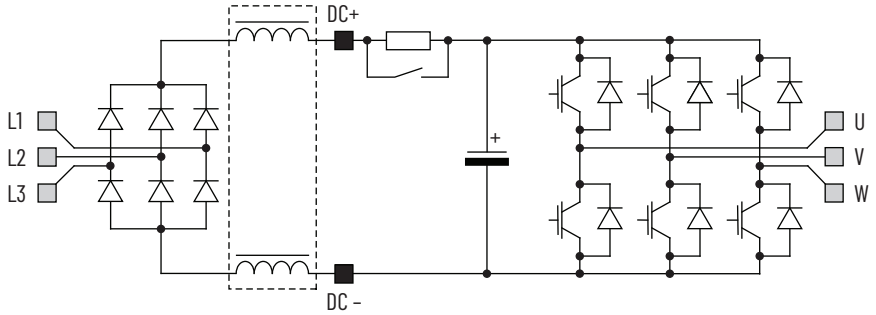
Figure 19 - DC Input Schematic for PowerFlex 700L Frame 3A and 3B DC Input Drives (Equipment Type Catalog Codes K and L)



Kinetix 7000 Catalog Number BM06...BM08 Servo Drives

For Kinetix 7000 servo drives, catalog numbers BM06...BM08, the precharge hardware is located on the power circuit board. It is composed of a resistor in series with the positive DC bus between the DC link and the bus capacitors. The resistor has a relay contact connected in parallel that closes when the bus precharge level has been reached, bypassing the precharge resistor. The precharge function operates the same way for either AC or DC power.

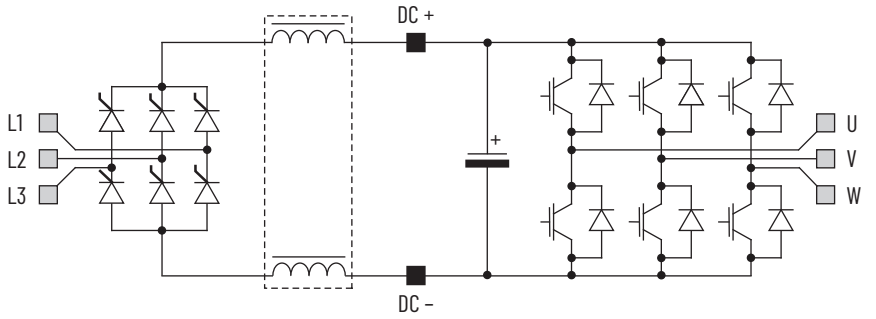
Figure 20 - AC and DC Input Schematic for Kinetix 7000 BM06...BM08 Servo Drives



Kinetix 7000 Catalog Number BM09...BM12 Servo Drives

For Kinetix 7000 servo drives, catalog numbers BM09...BM12, the precharge hardware is implemented with an SCR rectifier such that the SCRs are phase advanced to limit the inrush current into the bus capacitors. This phase-advanced precharge is not controlled by the drive and must normally be completed by the minimum precharge time required by the drive. The drive does not complete precharge until the bus voltage is stable and above the undervoltage level.

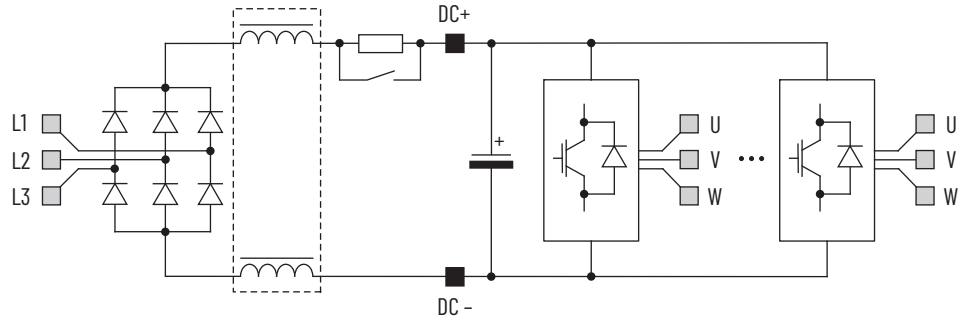
Figure 21 - AC Input Schematic for Kinetix 7000 BM09...BM12 Servo Drives



Kinetix 6000 Bxxx-Series and Kinetix 6200/6500 Multi-Axis Servo Drives

The Kinetix 6000 series and Kinetix 6200/6500 series is a packaged, highly configurable, common bus product with one converter module and multiple inverter modules mounted on a shared backplane. Precharge hardware, which consists of a resistor in series with a DC link inductor and the positive rail of the DC bus, is mounted in the converter module. In all recommended common bus configurations with PowerFlex drives, the converter is not used; therefore, three phase AC power should never be connected to the converter in mixed PowerFlex/Kinetix 6000 common bus configurations. An internal shunt module (braking chopper) is built into each inverter module. To be used in a common bus system with PowerFlex drives, the Kinetix system must be set to the common-bus follower condition with the shunt modules disabled.

Figure 22 - System Schematic for Kinetix 6000 Bxxx-Series and Kinetix 6200/6500 Multi-Axis Servo Drives



Common DC Bus Configuration—Non-Regenerative

System Characteristics

This system is characterized by a diode, an SCR rectifier front end, or a combination of these two, which converts the 3-phase AC line voltage into a non-filtered DC bus voltage. No provisions exist for line regeneration or power dissipation of any recovered energy from the motor/load system.

Supported Products

At the time of publication, the following non-regenerative DC Bus Supplies and PowerFlex® drives are supported.

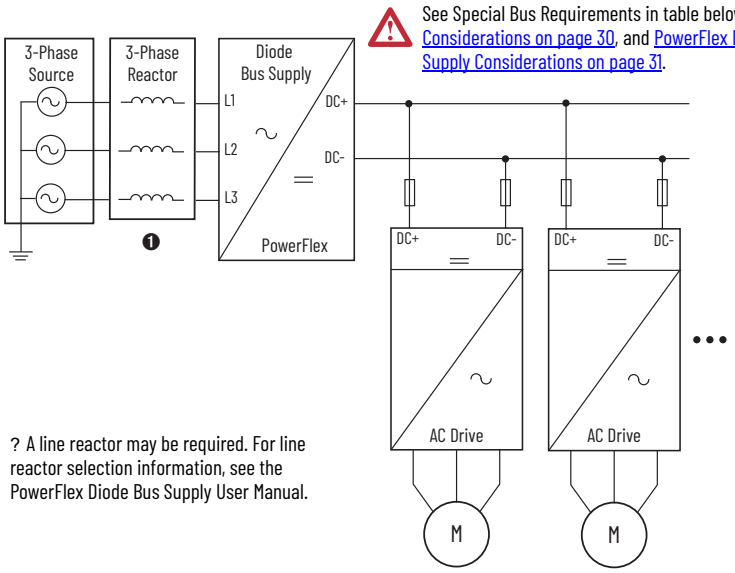
DC Bus Supply Products	Supported Drives
PowerFlex Diode Bus Supply 20T	PowerFlex 40P: All power ratings
	PowerFlex 520-Series: All power ratings - Three phase only
	PowerFlex 700 (1) / PowerFlex 700 Series B (1): Frames 0...4
	PowerFlex 700S: Frames 1...4 (2)
	PowerFlex 750-Series: Frames 2...4
	Kinetix® 7000: BM06...BM08
PowerFlex SCR Bus Supply 20S	PowerFlex 40P: All power ratings
	PowerFlex 520-Series: All power ratings - Three phase only
	PowerFlex 700 (1) / PowerFlex 700 Series B (1): All frame sizes (3)
	PowerFlex 700S: All frame sizes (3)
	PowerFlex 700H: All frame sizes (3)
	PowerFlex 700L: Frames 3A (4) and 3B (3)
	PowerFlex 750-Series: Frames 2...10 (5)
	Kinetix 7000: All power ratings
	Kinetix 6000 and Kinetix 6200/6500: All 460V configurations (6)

(1) These drives require firmware revision 2.001 or later (Standard and Vector Control).
(2) There is no Frame 0 for PowerFlex 700S drives.
(3) PowerFlex 700 Frame 5...10, PowerFlex 700S Frame 5 and 6 and Frame 9...14, PowerFlex 700H Frame 9...14, and PowerFlex 700L DC input drives are required when not connected to the AC source.
(4) Frame 3A dual inverter drives only.
(5) PowerFlex 750-Series Frame 5...7 DC input common bus drives that have a DC precharge are recommended.
(6) Kinetix 6000 configurations require firmware revision 1.92 or later.

Typical System Configuration

PowerFlex Diode Bus Supply

Figure 23 - Diode Bus Supply with Standalone AC Drives Connected in Common Bus Configuration



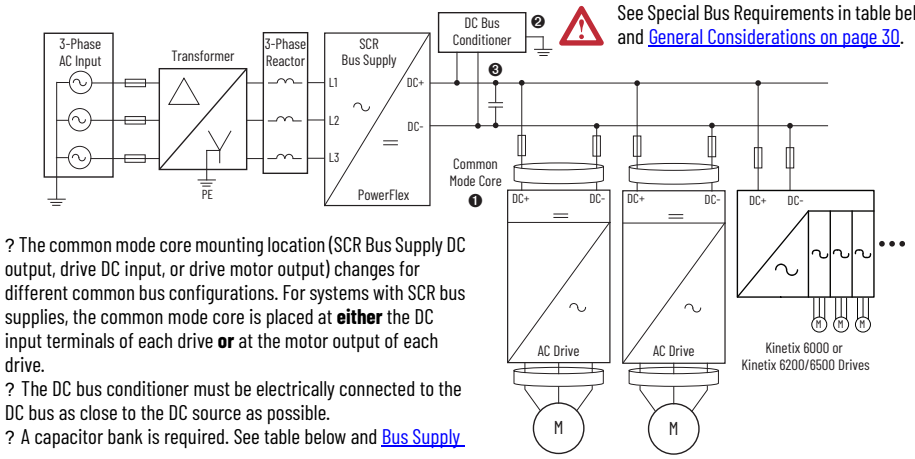
See Special Bus Requirements in table below, General Considerations on page 30, and PowerFlex Diode Bus Supply Considerations on page 31.

? A line reactor may be required. For line reactor selection information, see the PowerFlex Diode Bus Supply User Manual.

Drawing Designation	Supported Drives	Special Bus Requirements
AC Drive	PowerFlex 700/700S: Frames 0...4	None
	PowerFlex 750-Series: Frames 2...4	None
	Kinetix 7000: BM06...BM08	None
	PowerFlex 40P: All power ratings	**Important:** Do not use PowerFlex 40P or PowerFlex 520-Series drives on the same DC bus supply with PowerFlex 700/700S/750-Series drives or Kinetix 7000 drives. This is due to the difference in capacitance/amps of the PowerFlex 40P or PowerFlex 520-Series drives compared to the PowerFlex 700/700S/750-Series drives and Kinetix 7000 drives.
	PowerFlex 520-Series: All power ratings - Three phase only	

PowerFlex SCR Bus Supply in Solid Ground System

Figure 24 - SCR Bus Supply with Standalone AC Drives and Kinetix 6000 Drive System in a Common Bus Configuration



See Special Bus Requirements in table below and General Considerations on page 30.

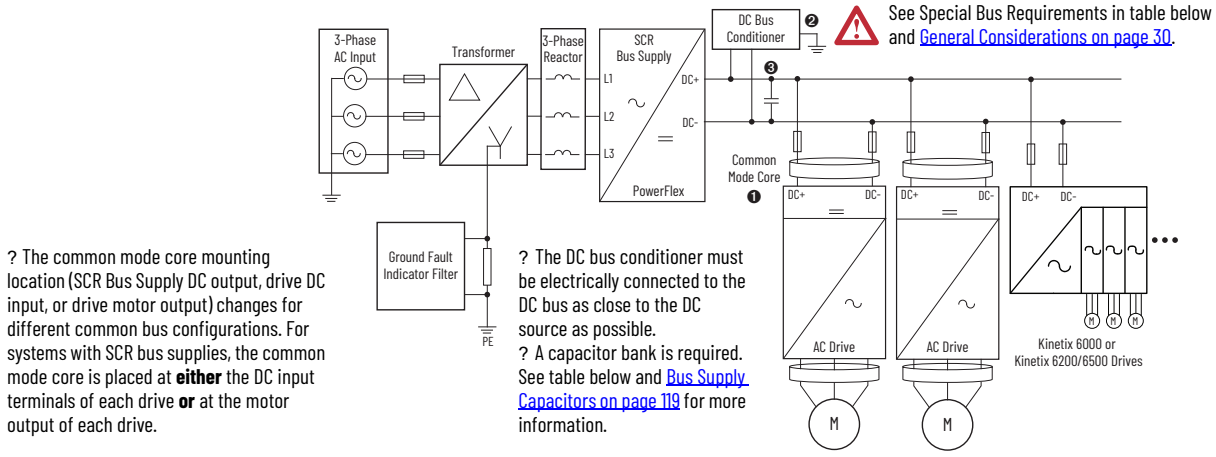
? The common mode core mounting location (SCR Bus Supply DC output, drive DC input, or drive motor output) changes for different common bus configurations. For systems with SCR bus supplies, the common mode core is placed at **either** the DC input terminals of each drive **or** at the motor output of each drive.
? The DC bus conditioner must be electrically connected to the DC bus as close to the DC source as possible.
? A capacitor bank is required. See table below and Bus Supply

Drawing Designation	System Ground Type	Supported Drives		Common Mode Core (1)	DC Bus Conditioner (2)
		Voltage	Type		
AC Drive	Solid	400/480	PowerFlex 700/700S: Frames 0...4	N/A	Design D (3)
		600		N/A	Design C
	Solid	400/480	PowerFlex 700/700S: Frames 5 and 6 (4) (5)	N/A	Design D (3)
		600/690		N/A	Design C
	Solid	400/480	PowerFlex 700: Frames 7...10 (6)	Contact technical support (7)	
		600/690			
	Solid	400/480	PowerFlex 700H/700S: Frames 9...14 (6)	Contact technical support for 30339-319-01	Design D (3)
		600/690			Design C
	Solid	400/480	PowerFlex 700L: Frames 3A (6) (8) and 3B (6)	Contact technical support (7)	
		600/690			
	Solid	400/480	PowerFlex 750-Series: Frames 2...4	Frames 2, 3: 1321-M048 Frame 4: 1321-M180	Design G (3)
		600	PowerFlex 750-Series: Frames 3 and 4		Design G
	Solid	400/480	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frame 7	Frame 5...6: 1321-M180 Frame 7: 30201-031-01 Frame 8...10: Included with drives of enclosure type 'P' or 'W' and input type 4. Also, see Note 1 on page 22 for catalog no. information.	Design G (3)
		600/690	PowerFlex 750-Series: Frames 8...10 (9) (10)		Design G
	Solid	400/480	Kinetix 7000: BM06...BM08	Contact technical support (7)	
	Solid	400/480	Kinetix 7000: BM09...BM12 (11)	Contact technical support (7)	
Kinetix 6000 and Kinetix 6200/6500	Solid	400/480	Kinetix 6000: Bxxx-Series (460V only) (12) Kinetix 6200/6500 Multi-Axis Servo Drives (460V only) (12)	Contact technical support (7)	

(1) One common mode core is required for each drive. See Note 1 in Figure 24 and Common Mode Core on page 121 for recommendations.
(2) One DC bus conditioner is required for each PowerFlex SCR Bus Supply.
(3) Only for systems with more than 20 drives; otherwise not required.
(4) Internal precharge option must be selected if a disconnect between the DC bus and the drive's DC input is used. Also, DC input 'common bus' drives are required—not AC standalone configuration.
(5) At 600 volts, PowerFlex 700/700S Frame 5 and 6 drives cannot be used on the same bus as PowerFlex 700/700S Frame 0...4 drives.
(6) Additional bus capacitance may be required; see General Considerations on page 30. External precharge must be provided if a disconnect between the DC bus and the drive's DC input is used. DC input 'common bus' drives are required—not AC standalone configuration.
(7) For any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.
(8) Frame 3A dual inverter drives only.
(9) DC input common bus drives that have a DC precharge are recommended.
(10) At 600 volts, PowerFlex 750-Series Frame 6...10 drives cannot be used on the same bus as PowerFlex 750-Series Frame 3...5 drives.
(11) External precharge must be provided if a disconnect between the DC bus and the drive's DC input is used.
(12) No internal precharge; see PowerFlex SCR Bus Supply Considerations on page 31. Drives must be placed in a common bus follower configuration.

PowerFlex SCR Bus Supply in High-resistance Ground System

Figure 25 - SCR Bus Supply with Standalone AC Drives and Kinetix 6000 Drive System in a Common Bus Configuration

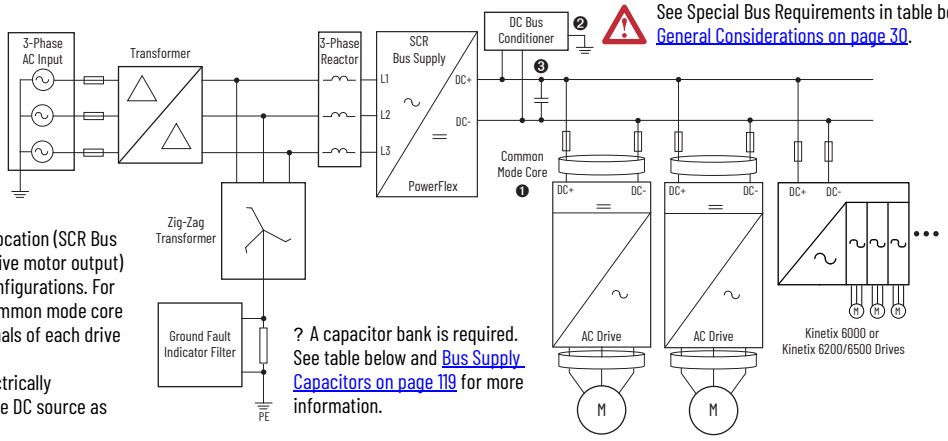


Drawing Designation	System Ground Type	Supported Drives		Common Mode Core (1)	DC Bus Conditioner (2)	Gnd. Fault Indicator Filter (3)
		Voltage	Type			
AC Drive	High-resistance Ground	400/480	PowerFlex 700/700S: Frames 0...4	N/A	Design E	Yes
		600		N/A	Design E	
	High-resistance Ground	400/480	PowerFlex 700/700S: Frames 5 and 6 (4) (5)	N/A	Design E	Yes
		600/690		N/A	Design E	
	High-resistance Ground	400/480	PowerFlex 700: Frames 7...10 (6)	Contact technical support (7)		
		600/690				
	High-resistance Ground	400/480	PowerFlex 700H/700S: Frames 9...14 (6)	Contact technical support for 30339-319-01	Design E	Yes
		600/690			Design E	
	High-resistance Ground	400/480	PowerFlex 700L: Frames 3A (6) (8) and 3B (6)	Contact technical support (7)		
		600/690				
	High-resistance Ground	400/480	PowerFlex 750-Series: Frames 2...4	Frames 2, 3: 1321-M048 Frame 4: 1321-M180	Design E	Yes
		600	PowerFlex 750-Series: Frames 3 and 4		Design E	
	High-resistance Ground	400/480	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frame 7 PowerFlex 750-Series: Frames 8...10 (9) (10)	Frames 5...6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: Included with drives of enclosure type 'P' or 'W' and input yype 4. Also, see Note 1 on page 22 for catalog no. information.	Design E	Yes
		600/690			Design E	
	High-resistance Ground	400/480	Kinetix 7000: BM06...BM08	Contact technical support (7)		
	High-resistance Ground	400/480	Kinetix 7000: BM09...BM12 (11)	Contact technical support (7)		
Kinetix 6000 and Kinetix 6200/6500	High-resistance Ground	400/480	Kinetix 6000: Bxxx-Series (460V only) (12) Kinetix 6200/6500 Multi-Axis Servo Drives (460V only) (12)	Contact technical support (7)		

(1) One common mode core is required for each drive. See Note 1 in Figure 25 and Common Mode Core on page 121 for recommendations.
(2) One DC bus conditioner is required for each PowerFlex SCR Bus Supply.
(3) See Ground Fault Indicator Filter on page 127 for recommendations.
(4) Internal precharge option must be selected if a disconnect between the DC bus and the drive's DC input is used. Also, DC input 'common bus' drives are required—not AC standalone configuration.
(5) At 600 volts, PowerFlex 700/700S Frame 5 and 6 drives cannot be used on the same bus as PowerFlex 700/700S Frame 0...4 drives.
(6) Additional bus capacitance may be required; see General Considerations on page 30. External precharge must be provided if a disconnect between the DC bus and the drive's DC input is used. DC input 'common bus' drives are required—not AC stand-alone configuration.
(7) For any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.
(8) Frame 3A dual inverter drives only.
(9) DC input common bus drives that have a DC precharge are recommended.
(10) At 600 volts, PowerFlex 750-Series Frame 6...10 drives cannot be used on the same bus as PowerFlex 750-Series Frame 3...5 drives.
(11) External precharge must be provided if a disconnect between the DC bus and the drive's DC input is used.
(12) No internal precharge; see PowerFlex SCR Bus Supply Considerations on page 31. Drives must be placed in a common bus follower configuration.

PowerFlex SCR Bus Supply in Ungrounded System

Figure 26 - SCR Bus Supply with Standalone AC Drives and Kinetix 6000 Drive System in a Common Bus Configuration



Drawing Designation	System Ground Type	Supported Drives		Common Mode Core (1)	DC Bus Conditioner (2)	Gnd. Fault Indicator Filter (3)	Zig Zag Transformer Required (4)
		Voltage	Type				
AC Drive	Ungrounded	400/480	PowerFlex 700/700S: Frames 0...4	N/A	Design E	Yes	Yes
		600		N/A	Design E		
	Ungrounded	400/480	PowerFlex 700/700S: Frames 5 and 6 (5) (6)	N/A	Design E	Yes	Yes
		600/690		N/A	Design E		
	Ungrounded	400/480	PowerFlex 700: Frames 7...10 (7)	Contact technical support (8)			
		600/690					
	Ungrounded	400/480	PowerFlex 700H/700S: Frames 9...14 (6)	Contact technical support for 30339-319-01	Design E	Yes	Yes
		600/690			Design E		
	Ungrounded	400/480	PowerFlex 700L: Frames 3A (6) (9) and 3B (6)	Contact technical support (7)			
		600/690					
	Ungrounded	400/480	PowerFlex 750-Series: Frames 2...4	Frames 2, 3: 1321-M048 Frame 4: 1321-M180	Design E	Yes	Yes
		600	PowerFlex 750-Series: Frames 3 and 4		Design E		
	Ungrounded	400/480	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frame 7 PowerFlex 750-Series: Frames 8...10 (10) (11)	Frames 5...6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: Included with drives of enclosure type 'P' or 'W' and input type 4. Also, see Note 1 on page 22 for catalog no. information.	Design E	Yes	Yes
		600/690			Design E		
	Ungrounded	400/480	Kinetix 7000: BM06...BM08	Contact technical support (7)			
	Ungrounded	400/480	Kinetix 7000: BM09...BM12 (12)	Contact technical support (7)			
Kinetix 6000 and Kinetix 6200/6500	Ungrounded	400/480	Kinetix 6000: Bxxx-Series (460V only) (13) Kinetix 6200/6500 Multi-Axis Servo Drives (460V only) (12)	Contact technical support (7)			

(1) One common mode core is required for each drive. See Note 1 in Figure 26 and Common Mode Core on page 121 for recommendations.
(2) One DC bus conditioner is required for each PowerFlex SCR Bus Supply.
(3) See Ground Fault Indicator Filter on page 127 for recommendations.
(4) See Zig-Zag Transformer on page 128 for recommendations.
(5) Internal precharge option must be selected if a disconnect between the DC bus and the drive's DC input is used. Also, DC input 'common bus' drives are required—not AC stand-alone configuration.
(6) At 600 volts, PowerFlex 700/700S Frame 5 and 6 drives cannot be used on the same bus as PowerFlex 700/700S Frame 0...4 drives.
(7) Additional bus capacitance may be required; see General Considerations on page 30. External precharge must be provided if a disconnect between the DC bus and the drive's DC input is used. DC input 'common bus' drives are required—not AC stand-alone configuration.
(8) For any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.
(9) Frame 3A dual inverter drives only.
(10) DC input common bus drives that have a DC precharge are recommended.
(11) At 600 volts, PowerFlex 750-Series Frame 6...10 drives cannot be used on the same bus as PowerFlex 750-Series Frame 3...5 drives.
(12) External precharge must be provided if a disconnect between the DC bus and the drive's DC input is used.
(13) No internal precharge; see PowerFlex SCR Bus Supply Considerations on page 31. Drives must be placed in a common bus follower configuration.

General Considerations

ATTENTION: The incorrect use or configuration of third party assemblies can result in reduced system reliability and drive damage.

1. All system components (Bus Supply, and PowerFlex and Kinetix Drives) must be selected for the same AC-line voltage.
2. A low inductance type DC bus must be used. See DC Bus Connections on page 13 for details.
3. Take every precaution to minimize the distance between drives and wire lengths. The mixture of different frame size drives in this arrangement can cause high ripple current in the smaller frame drives. In this case, place the larger power drives physically closer to the bus supply. This helps current sharing among the various drives on the bus.
4. If a disconnect switch between the common DC bus and the drive's input is used, an auxiliary contact on the disconnect switch must be connected to a digital input of the drive. The corresponding digital input must be set to 'PreCharge En'. This provides the proper precharge interlocking, guarding against possible damage to the drive when reconnecting the drive to an energized DC bus. Under this condition, the drives must have internal or externally-supplied precharge.

Drive	Parameter		Digital Input
	Number	Setting	
PowerFlex 40P	A051...A054	29 (PreCharge En)	1...4
PowerFlex 523	t062...t066	30 (PreCharge En)	2...6
PowerFlex 525	t062...t068	30 (PreCharge En)	2...8
PowerFlex 700	361...366	30 (PreCharge En)	1...6
PowerFlex 700L with vector control			
PowerFlex 700S	825...830	30 (PreCharge En)	1...6
PowerFlex 700L with 700S control			
PowerFlex 700H	361...366	30 (PreCharge En)	1...6
PowerFlex 750-Series	189 [DI Precharge]	See Drive Programming Manual for programming information.	

ATTENTION: The Kinetix family of drives have no external means of controlling the precharge; therefore, a DC disconnect must not be used.

5. If a drive from column A in the table below is mixed with a drive from column B, a capacitor bank is required. See Bus Supply Capacitors on page 119 for details.

Column A Drives	Column B Drives
PowerFlex 700/700S: Frames 0...5 PowerFlex 750-Series: Frames 2...10 Kinetix 6000 and Kinetix 6200/6500 Kinetix 7000	PowerFlex 700/700S: Frame 6 PowerFlex 700: Frames 8...10 PowerFlex 700H/700S: Frame 9 and up PowerFlex 700L: All Frames

6. PowerFlex 700 drives and PowerFlex 700 Series B drives must have firmware revision 2.001 or later (Standard and Vector Control).
7. For further assistance with this Common Bus configuration, contact technical support. See rok.auto/support for details.

PowerFlex Diode Bus Supply Considerations

The Diode Bus Supply can only be used with PowerFlex 700/700S Frame 0...4 drives, PowerFlex 750-Series Frame 2...4 drives, Kinetix 7000 BM06...BM08 drives, PowerFlex 40P drives (all power ratings), or PowerFlex 520-Series (all power ratings). This is because the Diode Bus Supply does not include precharge. The precharge function must be provided by the drives.

ATTENTION: Never connect Kinetix 7000 BM09...BM12 drives, Kinetix 6000-Series drives, or Kinetix 6200/6500 drives to a PowerFlex Diode Bus Supply in common bus configuration because there is no controlled, current-limited precharge of the DC bus capacitors, resulting in drive damage.

PowerFlex SCR Bus Supply Considerations

ATTENTION: The SCR Bus Supply includes precharge. The use of drives with precharge is not required if and only if power is removed and reconnected to the entire system, and if individual drives do not require to be isolated and reconnected to an energized bus through a disconnect switch. Failure to follow this recommendation results in drive damage.

1. To commission and test the SCR Bus Supply, a minimum capacitance is required. See Bus Supply Capacitors on page 119 for details.
2. AC line reactors for di/dt limitation and current sharing must be externally mounted for each PowerFlex SCR Bus Supply. See the PowerFlex SCR Bus Supply User Manual for line reactor information.

Sizing

To avoid overloading the Bus Supply, the following requirements apply:

- The DC Input current sum (Normal Duty or Heavy Duty rating at 40 °C / 104 °F) of the connected drives must not exceed the continuous DC Bus output current rating of the Bus Supply.
- For the DC Input Current values of the drives, see the tables in Appendix A. In addition, the guidelines provided in the product documentation also apply.
- For Kinetix product ratings, see the Kinetix Motion Control Selection Guide, and the Kinetix 6000 and 7000 User Manuals and Installation Instructions.

PowerFlex Diode Bus Supply

The following examples show maximum loading of the Diode Bus Supply.

a)Normal Duty ND

DC Input Rating of Connected Drives				Diode Bus Supply	
DC Voltage	ND Power	ND Currents	ND Current Sum	Rated Cont. DC Output Amps	AC Input Voltage
540V	30 + 22 = 52 kW	61.9 + 47.5 A	109.4 A	120 A	400V
650V	2 x 40 = 80 HP	2 x 55.7 A	111.4 A	120 A	480V

b)Heavy Duty HD

DC Input Rating of Connected Drives				Diode Bus Supply	
DC Voltage	HD Power	HD Currents	HD Current Sum	Rated Cont. DC Output Amps	AC Input Voltage
540V	2 x 15 = 30 kW	2 x 40.9 A	81.8 A	120 A	400V
650V	2 x 25 HP = 50 HP	2 x 42.9 A	85.8 A	120 A	480V

Total the DC Input currents for all drives connected to the DC bus. This total must be less than 120 A.

PowerFlex SCR Bus Supply

The following examples show maximum loading of the SCR Bus Supply.

a)Normal Duty ND, 110%, 1 minute; 150%, 3 seconds

DC Input Rating of Connected Drives				SCR Bus Supply (1)	
DC Voltage	ND Power	ND Currents	ND Current Sum	Maximum DC Output Amps	AC Input Voltage
540V	3 x 110 kW 1 x 45 kW	3 x 226 = 678 A 1 x 95 = 95 A	773 A	1000 A	400V
650V	3 x 60 HP 1 x 30 HP	3 x 84.5 = 253.5 A 1 x 42.9 = 42.9 A	297 A	400 A	480V

(1) No overload capability.

b)Heavy Duty HD, 150%, 1 minute; 200%, 3 seconds

DC Input Rating of Connected Drives				SCR Bus Supply (1)	
DC Voltage	HD Power	HD Currents	HD Current Sum	Maximum DC Output Amps	AC Input Voltage
540V	3 x 90 kW	3 x 192.3 A = 577 A	577 A	600 A	400V
650V	3 x 125 HP	3 x 171 A = 513 A	513 A	600A	480V

(1) No overload capability.

Fusing

DC Input Drives

See Appendix A for the recommended Common DC Bus drive fusing.

PowerFlex Diode Bus Supply

See the PowerFlex Diode Bus Supply User Manual for recommended AC input fusing.

PowerFlex SCR Bus Supply

The PowerFlex SCR Bus Supply has built-in AC line and DC bus fuses (on 400 A and 600 A units). The 1000 A unit has six in-path fuses, which simultaneously protect AC and DC paths. All units are equipped with fuse trip indicator switches. See the PowerFlex SCR Bus Supply User Manual for fusing information.

Common DC Bus Configuration—Non-Regenerative with Braking DC Bus Regulation

System Characteristics

This system is characterized by a diode, an SCR rectifier front end, or a combination of these two, which converts the 3-phase AC line voltage into a non-filtered DC bus voltage. This system uses a Braking Chopper, Dynamic Brake Unit, or the drive's internal IGBT with a braking resistor for power dissipation of excess regenerative energy. Rockwell Automation does not offer external braking products. Please contact our Encompass™ partners for these braking products.

Supported Products

At the time of publication, these non-regenerative DC Bus Supplies and drives are supported.

DC Bus Supply Products (1)	Supported Drives
PowerFlex® Diode Bus Supply 20T	PowerFlex® 40P: All power ratings
	PowerFlex 520-Series: All power ratings - Three phase only
	PowerFlex 700 (2) / PowerFlex 700 Series B (2): Frames 0...4
	PowerFlex 700S: Frames 1...4 (3)
	PowerFlex 750-Series: Frames 2...4
	Kinetix® 7000: BM06...BM08
PowerFlex SCR Bus Supply 20S	PowerFlex 40P: All power ratings
	PowerFlex 520-Series: All power ratings - Three phase only
	PowerFlex 700 (2) / PowerFlex 700 Series B (2): All frame sizes (4)
	PowerFlex 700S: All frame sizes (4)
	PowerFlex 700H: All frame sizes (4)
	PowerFlex 700L: Frame 3A (5) and 3B (4)
	PowerFlex 750-Series: Frames 2...10 (6)
	Kinetix 7000: All power ratings
	Kinetix 6000 and Kinetix 6200/6500: All 460V configurations (7)

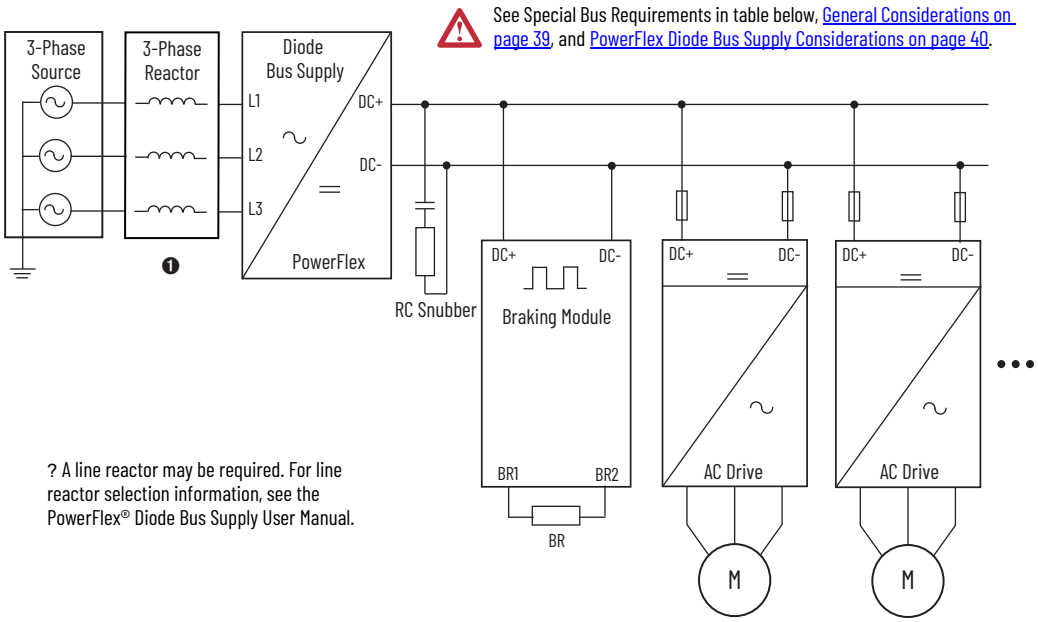
(1) For Bus Supply product details, see Chapter 3.
(2) These drives require firmware revision 2.001 or later (Standard and Vector Control).
(3) There is no Frame 0 for PowerFlex 700S drives.
(4) PowerFlex 700 Frame 5...10, PowerFlex 700S Frame 5 and 6 and Frame 9...14, PowerFlex 700H Frame 9...14, and PowerFlex 700L DC input drives are required when not connected to the AC source.
(5) Frame 3A dual inverter drives only.
(6) PowerFlex 750-Series Frame 5...7 DC input common bus drives that have a DC precharge are recommended.
(7) Kinetix 6000 configurations require firmware revision 1.92 or later.

Typical System Configurations

Brake Chopper Modules

Diode Bus Supply

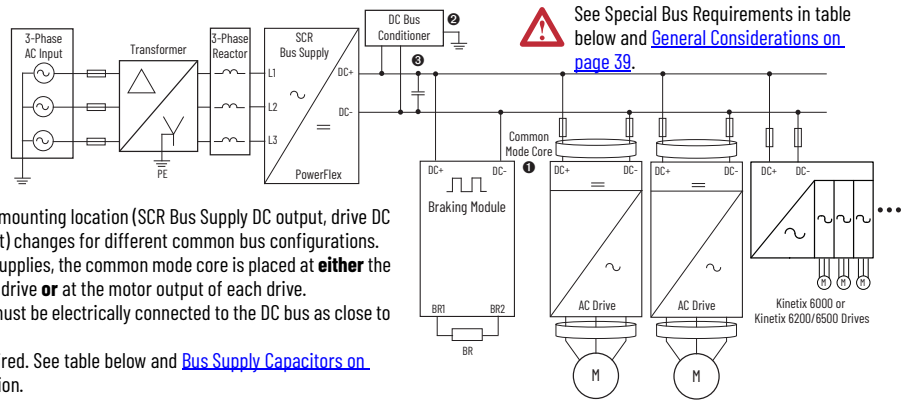
Figure 27 - Diode Bus Supply with Standalone AC Drives and Brake Chopper



Drawing Designation	Supported Drives	Special Bus Requirements
AC Drive	PowerFlex 700/700S: Frames 0...4	An RC snubber is required to limit DC bus voltage overshoot at power-on. See RC Snubber Circuit on page 121 for more information.
	PowerFlex 750-Series: Frames 2...4	
	Kinetix 7000: BM06...BM08	
	PowerFlex 40P: All power ratings	**Important:** Do not use PowerFlex 40P or PowerFlex 520-Series drives on the same DC bus supply with PowerFlex 700/700S/750-Series drives or Kinetix 7000 drives. This is due to the difference in capacitance/amps of the PowerFlex 40P or PowerFlex 520-Series drives compared to the PowerFlex 700/700S/750-Series drives and Kinetix 7000 drives.
	PowerFlex 520-Series: All power ratings - Three phase only	

SCR Bus Supply in Solid Ground System

Figure 28 - SCR Bus Supply with Standalone AC Drives, Kinetix 6000 Drive System, and Braking Module



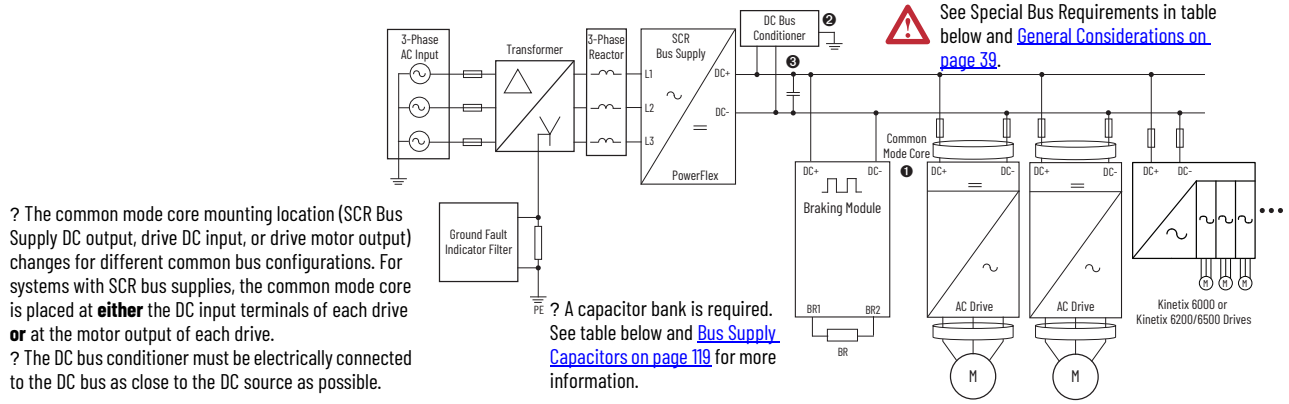
? The common mode core mounting location (SCR Bus Supply DC output, drive DC input, or drive motor output) changes for different common bus configurations. For systems with SCR bus supplies, the common mode core is placed at **either** the DC input terminals of each drive **or** at the motor output of each drive.
? The DC bus conditioner must be electrically connected to the DC bus as close to the DC source as possible.
? A capacitor bank is required. See table below and Bus Supply Capacitors on page 119 for more information.

Drawing Designation	System Ground Type	Supported Drives/Products		Common Mode Core (1)	DC Bus Conditioner (2)
		Voltage	Type		
AC Drive	Solid	400/480	PowerFlex 700/700S: Frames 0...4	N/A	Design D (3)
		600		N/A	Design C
	Solid	400/480	PowerFlex 700/700S: Frames 5 and 6 (4) (5)	N/A	Design D (3)
		600/690		N/A	Design C
	Solid	400/480	PowerFlex 700: Frames 7...10 (6)	Contact technical support (7)	
		600/690			
	Solid	400/480	PowerFlex 700H/700S: Frames 9...14 (6)	Contact technical support for 30339-319-01	Design D (3)
		600/690			Design C
	Solid	400/480	PowerFlex 700L: Frames 3A (6) (8) and 3B (6)	Contact technical support (7)	
		600/690			
	Solid	400/480	PowerFlex 750-Series: Frames 2...4	Fr. 2, 3:1321-M048 Fr. 4:1321-M180	Design G (3)
		600	PowerFlex 750-Series: Frames 3 and 4		Design G
	Solid	400/480	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frame 7 PowerFlex 750-Series: Frames 8...10 (9) (10)	Fr. 5...6:1321-M180 Fr. 7:30201-031-01 Fr. 8...10:Included with drives with enclosure 'P' or 'W' and Input Type 4. Also, see Note 1 on page 22 for catalog no. information.	Design G (3)
		600/690			Design G
	Solid	400/480	Kinetix 7000: BM06...BM08	Contact technical support (7)	
	Solid	400/480	Kinetix 7000: BM09...BM12 (11)	Contact technical support (7)	
Kinetix 6000 and Kinetix 6200/6500	Solid	400/480	Kinetix 6000 (460V only): Bxxx-Series (12) Kinetix 6200/6500 Multi-Axis Servo Drives (460V only) (12)	Contact technical support (7)	
Braking Module	Solid	—	Encompass Partner product (13)	N/A	N/A

(1) One common mode core is required for each drive. See Note 1 in Figure 28 and Common Mode Core on page 121 for recommendations.
(2) One DC bus conditioner is required for each PowerFlex SCR Bus Supply.
(3) Only for systems with more than 20 drives; otherwise not required.
(4) Internal precharge option must be selected if a disconnect between the DC bus and the drive's DC input is used. DC input 'common bus' drives are required—not AC standalone configurations.
(5) At 600 volts, PowerFlex 700/700S Frame 5 and 6 drives cannot be used on the same bus as PowerFlex 700/700S Frame 0...4 drives.
(6) Additional bus capacitance may be required; see General Considerations on page 39. External precharge must be provided if a disconnect between the DC bus and the drive's DC input is used. DC input 'common bus' drives are required—not AC standalone configuration.
(7) For any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.
(8) Frame 3A dual inverter drives only.
(9) DC input common bus drives that have a DC precharge are recommended.
(10) At 600 volts, PowerFlex 750-Series Frame 6...10 drives cannot be used on the same bus as PowerFlex 750-Series Frame 3...5 drives.
(11) External precharge must be provided if a disconnect between the DC bus and the drive's DC input is used.
(12) No internal precharge; see PowerFlex SCR Bus Supply Considerations on page 41. Drives must be placed in a common bus follower configuration.
(13) See PowerFlex SCR Bus Supply Considerations on page 41. If the instantaneous Brake Chopper current is larger than 150% of the DC input rating of the largest drive, a capacitor bank is required.

SCR Bus Supply in High-resistance Ground System

Figure 29 - SCR Bus Supply with Standalone AC Drives, Kinetix 6000 Drive System, and Braking Module



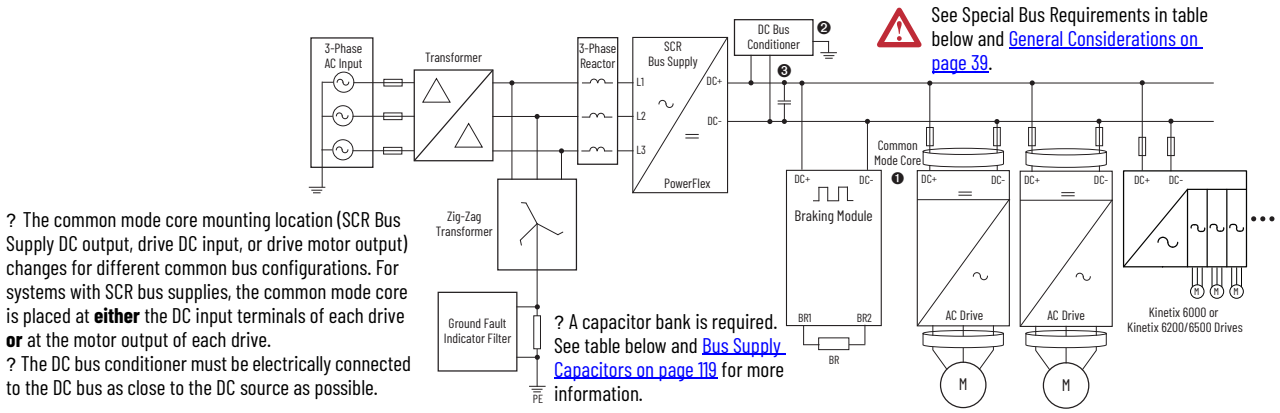
Drawing Designation	System Ground Type	Supported Drives/Products		Common Mode Core (10)	DC Bus Conditioner (12)	Gnd. Fault Indicator Filter (13)
		Voltage	Type			
AC Drive	High-resistance Ground	400/480	PowerFlex 700/700S: Frames 0...4	N/A	Design E	Yes
		600		N/A	Design E	
	High-resistance Ground	400/480	PowerFlex 700/700S: Frames 5 and 6 (1) (2)	N/A	Design E	Yes
		600/690		N/A	Design E	
	High-resistance Ground	400/480	PowerFlex 700: Frames 7...10 (3)	Contact technical support (11)		
		600/690				
	High-resistance Ground	400/480	PowerFlex 700H/700S: Frames 9...14 (6)	Contact technical support for 30339-319-01	Design E	Yes
		600/690			Design E	
	High-resistance Ground	400/480	PowerFlex 700L: Frames 3A (6) (4) and 3B (6)	Contact technical support (7)		
		600/690				
	High-resistance Ground	400/480	PowerFlex 750-Series: Frames 2...4	Frames 2, 3: 1321-M048 Frame 4: 1321-M180	Design E	Yes
		600	PowerFlex 750-Series: Frames 3 and 4		Design E	
	High-resistance Ground	400/480	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frame7 PowerFlex 750-Series: Frames 5...10 (5) (6)	Frames 5...6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: Included with drives of enclosure type 'P' or 'W' and input yype 4. Also, see Note 1 on page 22 for catalog no. information.	Design E	Yes
		600/690			Design E	
	High-resistance Ground	400/480	Kinetix 7000: BM06...BM08	Contact technical support (7)		
	High-resistance Ground	400/480	Kinetix 7000: BM09...BM12 (7)	Contact technical support (7)		
Kinetix 6000 and Kinetix 6200/6500	High-resistance Ground	400/480	Kinetix 6000 (460V only): Bxxx-Series (8) Kinetix 6200/6500 Multi-Axis Servo Drives (460V only) (12)	Contact technical support (7)		
Braking Module	High-resistance Ground	—	Encompass Partner product (9)	N/A	N/A	N/A

(1) Internal precharge option must be selected if a disconnect between the DC bus and the drive's DC input is used. DC input 'common bus' drives are required—not AC standalone configurations.
(2) At 600 volts, PowerFlex 700/700S Frame 5 and 6 drives cannot be used on the same bus as PowerFlex 700/700S Frame 0...4 drives.
(3) Additional bus capacitance may be required; see General Considerations on page 39. External precharge must be provided if a disconnect between the DC bus and the drive's DC input is used. DC input 'common bus' drives are required—not AC standalone configuration.
(4) Frame 3A dual inverter drives only.
(5) DC input common bus drives that have a DC precharge are recommended.
(6) At 600 volts, PowerFlex 750-Series Frame 6...10 drives cannot be used on the same bus as PowerFlex 750-Series Frame 3...5 drives.
(7) External precharge must be provided if a disconnect between the DC bus and the drive's DC input is used.
(8) No internal precharge; see PowerFlex SCR Bus Supply Considerations on page 41. Drives must be placed in a common bus follower configuration.

(9) See PowerFlex SCR Bus Supply Considerations on page 41. If the instantaneous Brake Chopper current is larger than 150% of the DC input rating of the largest drive, a capacitor bank is required.
(10) One common mode core is required for each drive. See Note 1 in Figure 29 and Common Mode Core on page 121 for recommendations.
(11) For any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.
(12) One DC bus conditioner is required for each PowerFlex SCR Bus Supply.
(13) See Ground Fault Indicator Filter on page 127 for recommendations.

SCR Bus Supply in Ungrounded System

Figure 30 - SCR Bus Supply with Standalone AC Drives, Kinetix 6000 Drive System, and Braking Module



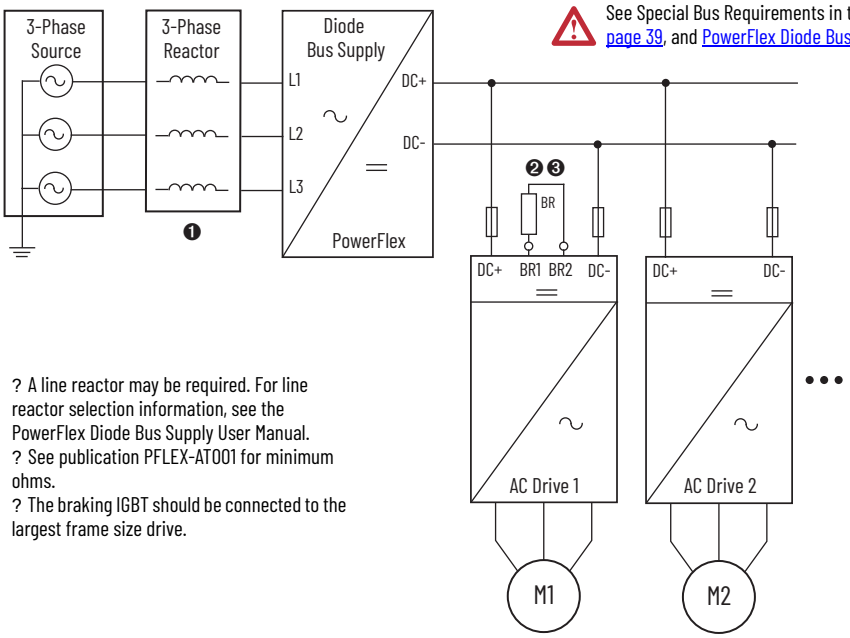
Drawing Designation	System Ground Type	Supported Drives/Products		Common Mode Core(1)	DC Bus Conditioner(2)	Gnd. Fault Indicator Filter(3)	Zig Zag Transformer Required(4)
		Voltage	Type				
AC Drive	Ungrounded	400/480	PowerFlex 700/700S: Frames 0...4	N/A	Design E	Yes	Yes
		600		N/A	Design E		
	Ungrounded	400/480	PowerFlex 700/700S: Frames 5 and 6 (5) (6)	N/A	Design E	Yes	Yes
		600/690		N/A	Design E		
	Ungrounded	400/480	PowerFlex 700: Frames 7...10 (7)	Contact technical support (8)			
		600/690					
	Ungrounded	400/480	PowerFlex 700H/700S: Frames 9...14 (6)	Contact technical support for 30339-319-01	Design E	Yes	Yes
		600/690			Design E		
	Ungrounded	400/480	PowerFlex 700L: Frames 3A (6) (9) and 3B (6)	Contact technical support (7)			
		600/690					
	Ungrounded	400/480	PowerFlex 750-Series: Frames 2...4	Frames 2, 3: 1321-M048 Frame 4: 1321-M180	Design E	Yes	Yes
		600	PowerFlex 750-Series: Frames 3 and 4		Design E		
	Ungrounded	400/480	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frame 7 PowerFlex 750-Series: Frames 8...10 (10) (11)	Frames 5, 6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: Included with drives of enclosure type 'P' or 'W' and input type 4. Also, see Note 1 on page 22 for catalog no. information.	Design E	Yes	Yes
		600/690			Design E		
	Ungrounded	400/480	Kinetix 7000: BM06...BM08	Contact technical support (7)			
	Ungrounded	400/480	Kinetix 7000: BM09...BM12 (12)	Contact technical support (7)			
Kinetix 6000 and Kinetix 6200/6500	Ungrounded	400/480	Kinetix 6000 (460V only): Bxxx-Series (13) Kinetix 6200/6500 Multi-Axis Servo Drives (460V only) (12)	Contact technical support (7)			
Braking Module	Ungrounded	—	Encompass Partner product (14)	N/A	N/A	N/A	N/A

(1) One common mode core is required for each drive. See Note 1 in Figure 30 and Common Mode Core on page 121 for recommendations.
(2) One DC bus conditioner is required for each PowerFlex SCR Bus Supply.
(3) See Ground Fault Indicator Filter on page 127 for recommendations.
(4) See Zig-Zag Transformer on page 128 for recommendations.
(5) Internal precharge option must be selected if a disconnect between the DC bus and the drive's DC input is used. DC input 'common bus' drives are required—not AC standalone configurations.
(6) At 600 volts, PowerFlex 700/700S Frame 5 and 6 drives cannot be used on the same bus as PowerFlex 700/700S Frame 0...4 drives.
(7) Additional bus capacitance may be required; see General Considerations on page 39. External precharge must be provided if a disconnect between the DC bus and the drive's DC input is used. DC input 'common bus' drives are required—not AC standalone configuration.
(8) For any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.
(9) Frame 3A dual inverter drives only.

(10) DC input common bus drives that have a DC precharge are recommended.
(11) At 600 volts, PowerFlex 750-Series Frame 6...10 drives cannot be used on the same bus as PowerFlex 750-Series Frame 3...5 drives.
(12) External precharge must be provided if a disconnect between the DC bus and the drive's DC input is used.
(13) No internal precharge; see PowerFlex SCR Bus Supply Considerations on page 41. Drives must be placed in a common bus follower configuration.
(14) See PowerFlex SCR Bus Supply Considerations on page 41. If the instantaneous Brake Chopper current is larger than 150% of the DC input rating of the largest drive, a capacitor bank is required.

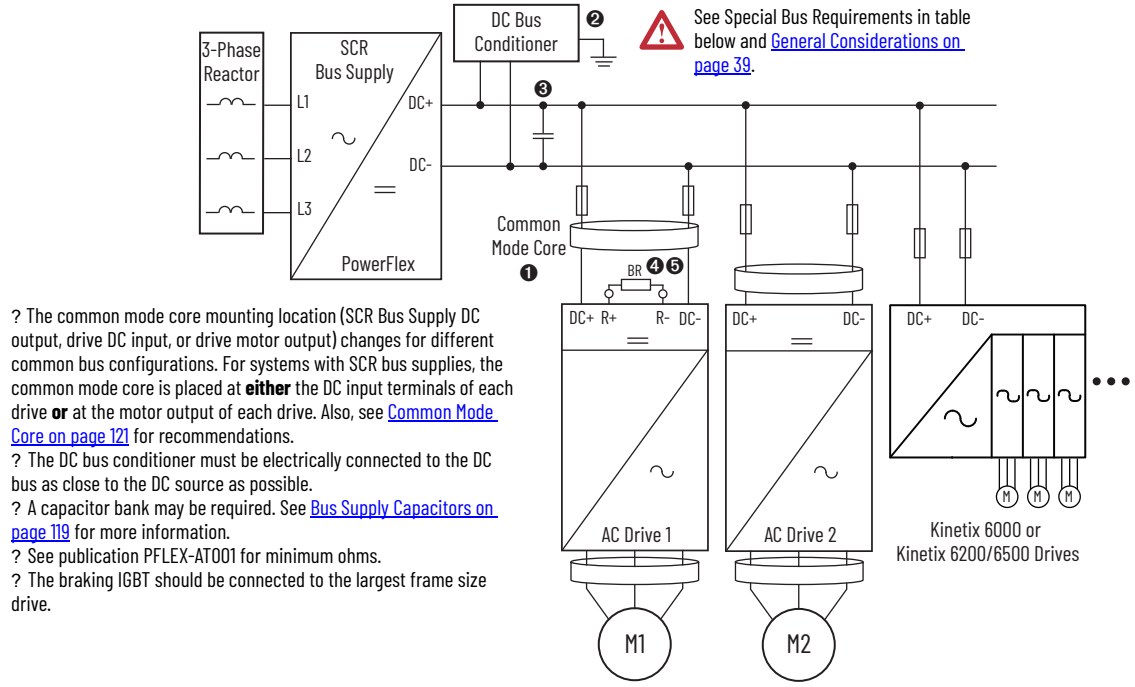
Drive Internal Brake IGBT

Figure 31 - Diode Bus Supply with Standalone AC Drives with Internal Brake IGBT



Drawing Designation	Supported Drives	Special Bus Requirements
AC Drive 1	PowerFlex 700/700S: Frames 0...4	None
	PowerFlex 750-Series: Frames 2...4	None
	PowerFlex 40P: All power ratings	**Important:** Do not use PowerFlex 40P or PowerFlex 520-Series drives on the same DC bus supply with PowerFlex 700/700S drives. This is due to the difference in capacitance/amps of the PowerFlex 40P or PowerFlex 520-Series drives compared to the PowerFlex 700/700S drives.
	PowerFlex 520-Series: All power ratings - Three phase only	
AC Drive 2	PowerFlex 700/700S: Frames 0...4	None
	PowerFlex 750-Series: Frames 2...4	None
	Kinetix 7000: BM06...BM08	None
	PowerFlex 40P: All power ratings	**Important:** Do not use PowerFlex 40P or PowerFlex 520-Series drives on the same DC bus supply with PowerFlex 750-Series drives or Kinetix 7000 drives. This is due to the difference in capacitance/amps of the PowerFlex 40P or PowerFlex 520-Series drives compared to the PowerFlex 750-Series drives and Kinetix 7000 drives.
	PowerFlex 520-Series: All power ratings - Three phase only	

Figure 32 - SCR Bus Supply with Standalone AC Drives with Internal Brake IGBT, and Kinetix 6000 Drive System



? The common mode core mounting location (SCR Bus Supply DC output, drive DC input, or drive motor output) changes for different common bus configurations. For systems with SCR bus supplies, the common mode core is placed at **either** the DC input terminals of each drive **or** at the motor output of each drive. Also, see Common Mode Core on page 121 for recommendations.
? The DC bus conditioner must be electrically connected to the DC bus as close to the DC source as possible.
? A capacitor bank may be required. See Bus Supply Capacitors on page 119 for more information.
? See publication PFLEX-AT001 for minimum ohms.
? The braking IGBT should be connected to the largest frame size drive.

For all ground systems (solid, high resistance ground, and ungrounded), the same guidelines as previously described on page 35, page 36, and page 37 apply. In addition, adhere to the following braking IGBT conditions:

- See publication PFLEX-AT001 for minimum ohms.
- The braking IGBT should be connected to the largest frame size drive.

General Considerations

ATTENTION: The incorrect use or configuration of third party assemblies can result in reduced system reliability and drive damage.

1. All system components (Bus Supply, PowerFlex and Kinetix Drives, and Braking Unit) must be selected for the same AC-line voltage.
2. A low inductance type DC bus must be used.
3. The braking chopper must be located next to the bus supply and the highest power drive.
4. A low inductance type DC bus must be used. See DC Bus Connections on page 13 for details.
5. The maximum wire length between the brake chopper and the highest power drive and between parallel brake choppers must be observed. See the respective braking product documentation for details.
6. If a disconnect switch between the common DC bus and the drive's input is used, an auxiliary contact on the disconnect switch must be connected to a digital input of the drive. The corresponding digital input must be set to 'PreCharge En'. This provides the proper precharge interlocking, guarding against possible damage to the drive when reconnecting the drive to an energized DC bus. Under this condition, the drives must have internal or externally-supplied precharge.

Drive	Parameter		Digital Input
	Number	Setting	
PowerFlex 40P	A051...A054	29 (PreCharge En)	1...4
PowerFlex 523	t062...t066	30 (PreCharge En)	2...6
PowerFlex 525	t062...t068	30 (PreCharge En)	2...8
PowerFlex 700	361...366	30 (PreCharge En)	1...6
PowerFlex 700L with vector control			
PowerFlex 700S	825...830	30 (PreCharge En)	1...6
PowerFlex 700L with 700S control			
PowerFlex 700H	361...366	30 (PreCharge En)	1...6
PowerFlex 750-Series	189 [DI Precharge]	See Drive Programming Manual for programming information.	

ATTENTION: The Kinetix family of drives have no external means of controlling the precharge; therefore, a DC disconnect must not be used.

7. If a drive from column A in the table below is mixed with a drive from column B, a capacitor bank is required. See Bus Supply Capacitors on page 119 for details.

Column A Drives	Column B Drives
PowerFlex 700/700S: Frames 0...5 PowerFlex 750-Series: Frames 2...10 Kinetix 6000 and Kinetix 6200/6500 Kinetix 7000	PowerFlex 700/700S: Frame 6 PowerFlex 700: Frames 8...10 PowerFlex 700H/700S: Frame 9 and up PowerFlex 700L: All Frames

8. PowerFlex 700 drives and PowerFlex 700 Series B drives must have firmware revision 2.001 or later (Standard and Vector Control).
9. For further assistance with this Common Bus configuration, contact technical support. See rok.auto/support for details.

PowerFlex Diode Bus Supply Considerations

The Diode Bus Supply can be used only with PowerFlex 700/700S Frame 0...4 drives, PowerFlex 750-Series Frame 2...4 drives, Kinetix 7000 BM06...BM08 drives, PowerFlex 40P drives (all power ratings), or PowerFlex 520-Series drives (all power ratings). This is because the Diode Bus Supply does not include precharge. The precharge function must be provided by the drives.

ATTENTION: Never connect Kinetix 7000 BM09...BM12 drives, Kinetix 6000-Series drives, or Kinetix 6200/6500 drives to a PowerFlex Diode Bus Supply in common bus configuration because there is no controlled, current-limited precharge of the DC bus capacitors, resulting in drive damage.

When using a PowerFlex Diode Bus Supply with the Brake Chopper, follow this additional recommendation:

An RC snubber circuit is required to prevent the DC bus voltage from exceeding the 1200V maximum Brake Chopper IGBT voltage. The RC snubber circuit must always be connected to the DC bus (located close to the braking chopper) to absorb the power-on voltage overshoot. See RC Snubber Circuit on page 121 for details.

PowerFlex SCR Bus Supply Considerations

ATTENTION: The SCR Bus Supply includes precharge. The use of drives with precharge is not required if and only if power is removed and reconnected to the entire system, and if individual drives do not require to be isolated and reconnected to an energized bus through a disconnect switch. Failure to follow this recommendation results in drive damage.

1. To commission and test the SCR Bus Supply, a minimum capacitance is required. See Bus Supply Capacitors on page 119 for details.
2. AC line reactors for di/dt limitation and current sharing must be externally mounted for each PowerFlex SCR Bus Supply. See the PowerFlex SCR Bus Supply User Manual for line reactor information.

When using a PowerFlex SCR Bus Supply with a Braking Unit, follow this additional recommendation:

If the instantaneous Brake Chopper current is larger than 150% of the DC input rating of the largest drive, a capacitor bank is required and must be located as close as possible to the brake chopper and the rectifier source.

- **Exception 1:** The capacitor is not required if at least one drive without internal precharge (PowerFlex 700 Frames 5 and up, only DC input, Catalog Codes H and J) is always connected to the common DC bus.
- **Exception 2:** If a PowerFlex 700H/700S Frame 9 and up drive is interconnected with PowerFlex 700/700S Frame 0...6 drives, or PowerFlex 750-Series Frame 2...10 drives, and a capacitor bank with appropriate capacitance is already used. See the subsection Connecting High-power Drives and Low-power Drives on the DC Bus on page 120 for details.

Sizing

Drive Internal Brake IGBT

See the PowerFlex Dynamic Braking Resistor Calculator, publication PFLEX-AT001, for minimum resistance values.

Bus Supplies

To avoid overloading the Bus Supply, the following requirements apply:

- The DC Input current sum (Normal Duty, Heavy Duty rating, or Light Duty at 40 °C/104 °F) of the connected drives must not exceed the continuous DC Bus output current rating of the Bus Supply.
- For the DC Input Current values of the drives, see the tables in Appendix A. In addition, the guidelines provided in the PowerFlex 700 User Manual, PowerFlex 700S/700H Installation Manual, or PowerFlex 750-Series Drive Technical Data also apply.

PowerFlex Diode Bus Supply

The following examples show maximum loading of the Diode Bus Supply.

a) Normal Duty ND

DC Input Rating of Connected Drives				Diode Bus Supply	
DC Voltage	ND Power	ND Currents	ND Current Sum	Rated Cont. DC Output Amps	AC Input Voltage
540V	30 + 22 = 52 kW	61.9 + 47.5 A	109.4 A	120 A	400V
650V	2 x 40 = 80 HP	2 x 55.7 A	111.4 A	120 A	480V

b)Heavy Duty HD

DC Input Rating of Connected Drives				Diode Bus Supply	
DC Voltage	HD Power	HD Currents	HD Current Sum	Rated Cont. DC Output Amps	AC Input Voltage
540V	2 x 15 = 30 kW	2 x 40.9 A	81.8 A	120 A	400V
650V	2 x 25 = 50 HP	2 x 42.9 A	85.8 A	120 A	480V

Total the DC Input currents for all drives connected to the DC bus. This total must be less than 120 A.

PowerFlex SCR Bus Supply

The following examples show maximum loading of the SCR Bus Supply.

a)Normal Duty ND, 110%, 1 minute; 150%, 3 seconds

DC Input Rating of Connected Drives				SCR Bus Supply (1)	
DC Voltage	ND Power	ND Currents	ND Current Sum	Maximum DC Output Amps	AC Input Voltage
540V	3 x 110 kW 1 x 45 kW	3 x 226 = 678 A 1 x 95 = 95 A	773 A	1000 A	400V
650V	3 x 60 HP 1 x 30 HP	3 x 84.5 = 253.5 A 1 x 42.9 = 42.9 A	297 A	400 A	480V

(1) No overload capability.

b)Heavy Duty HD, 150%, 1 minute; 200%, 3 seconds

DC Input Rating of Connected Drives				SCR Bus Supply (1)	
DC Voltage	HD Power	HD Currents	HD Current Sum	Maximum DC Output Amps	AC Input Voltage
540V	3 x 90 kW	3 x 192.3 A = 577 A	577 A	600 A	400V
650V	3 x 125 HP	3 x 171 A = 513 A	513 A	600 A	480V

(1) No overload capability.

Fusing

DC Input Drives

See Appendix A for the recommended Common DC Bus drive fusing.

PowerFlex Diode Bus Supply

See the PowerFlex Diode Bus Supply User Manual for recommended AC input fusing.

PowerFlex SCR Bus Supply

The PowerFlex SCR Bus Supply has built-in AC line and DC bus fuses (on 400 A and 600 A units). The 1000 A unit has six in-path fuses, which simultaneously protect AC and DC paths. All units are equipped with fuse trip indicator switches. See the PowerFlex SCR Bus Supply User Manual for fusing information.

Shared AC/DC Bus Configuration

System Characteristics

IMPORTANT Although there are guidelines to help with AC input current sharing between drives for this configuration, current sharing cannot be assured. Therefore, the configurations shown in Chapter 3 or Chapter 7 are preferred.

This system is characterized by the use of standalone drives fed by a common 3-phase voltage source and the DC bus of each drive connected together.

Supported Products

At the time of publication, the following drives can be used on a shared AC/DC bus configuration.

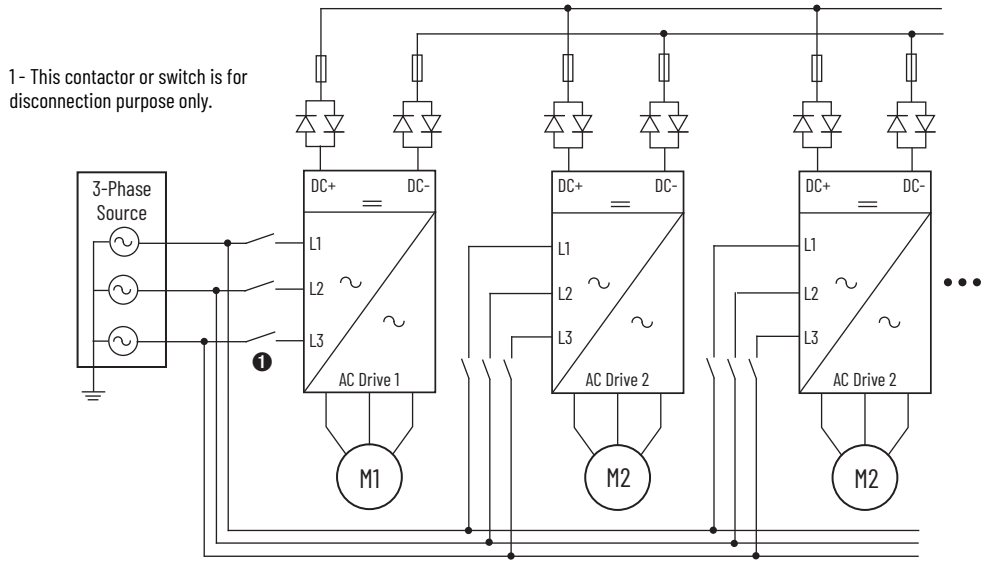
Supported Drives
PowerFlex® 40P: All power ratings
PowerFlex 520-Series: All power ratings - Three phase only
PowerFlex 700 (1) / PowerFlex 700 Series B (1): Frames 0...6 (2)
PowerFlex 700S: Frames 1...6 (2) (3)
PowerFlex 750-Series: Frames 2...10 (4)
Kinetix® 7000: BM06...BM12

(1) These drives require firmware revision 2.001 or later (Standard and Vector Control).
(2) PowerFlex 700 Frame 5 and 6, and PowerFlex 700S Frame 5 and 6 DC input drives are required when not connected to the AC source.
(3) There is no Frame 0 for PowerFlex 700S drives.
(4) A DC input terminal kit must be ordered for PowerFlex 750-Series Frame 6, 7, and 8 drives.

Typical System Configurations

AC Drives of Different Frame Sizes from the Same Product Line

Figure 33 - Different Frame Size Standalone AC Drives from the Same Product Line in a Shared AC/DC Bus Configuration



Configuration Notes

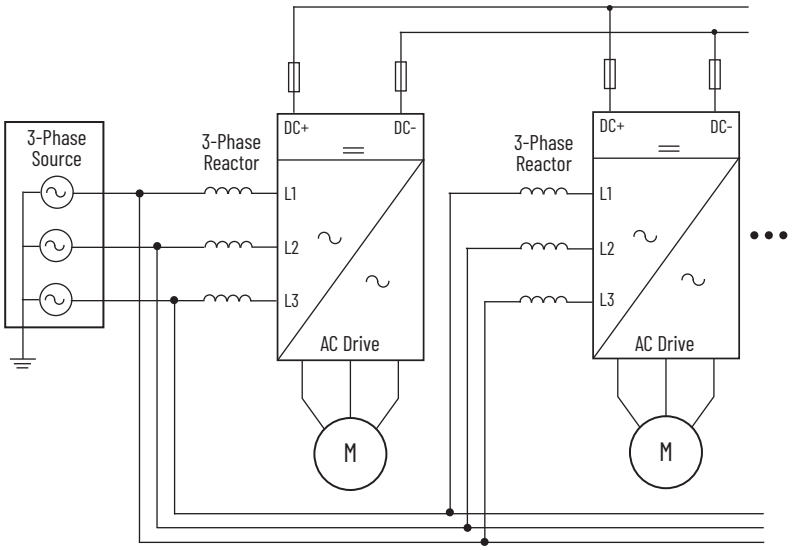
- See Special Bus Requirements in the table below, General Considerations on page 47, and Different Frame Size Drive Considerations on page 48.
- AC and DC circuit protection devices are required but not shown. See the technical data publication for your drive for guidance about circuit protection.

Drawing Designation	Supported Drives	Special Bus Requirements
AC Drive 1	PowerFlex 700/700S: Frames 5 and 6 Kinetix 7000: BM09...BM12	• Back-to-back diodes are required for proportional current sharing in a shared AC/DC configuration with different size drives. See Back-to-back Diodes (Shared AC/DC Configurations) on page 119 for more information. • At 600 volts, PowerFlex 700/700S Frame 0...4 drives cannot be used on the same bus as PowerFlex 700/700S Frame 5 and 6 drives.
	PowerFlex 750-Series: Frames 5...10	• Back-to-back diodes are required for proportional current sharing in a shared AC/DC configuration with different size drives. See Back-to-back Diodes (Shared AC/DC Configurations) on page 119 for more information. • A DC input terminal kit must be ordered for Frames 6 and 7.
	PowerFlex 750-Series: Frames 6...10	• At 600 volts, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives.
AC Drive 2	PowerFlex 700/700S: Frames 0...4 PowerFlex 750-Series: Frames 2...4 Kinetix 7000: BM06...BM08	• An individual or common contactor is required if AC bus is shared with PowerFlex 700/700S Frame 5 and 6 drives, or Kinetix 7000 BM09...BM12 drives. • At 600 volts, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives. • Back-to-back diodes are required for proportional current sharing in a shared AC/DC configuration with different size drives. See Back-to-back Diodes (Shared AC/DC Configurations) on page 119 for more information.

Same Frame Size AC Drives from Same Product Line

Using AC Input Reactors

Figure 34 - Same Frame Size Standalone AC Drives from Same Product Line in a Shared AC/DC Bus Configuration with AC Input Reactors for Proportional Current Sharing



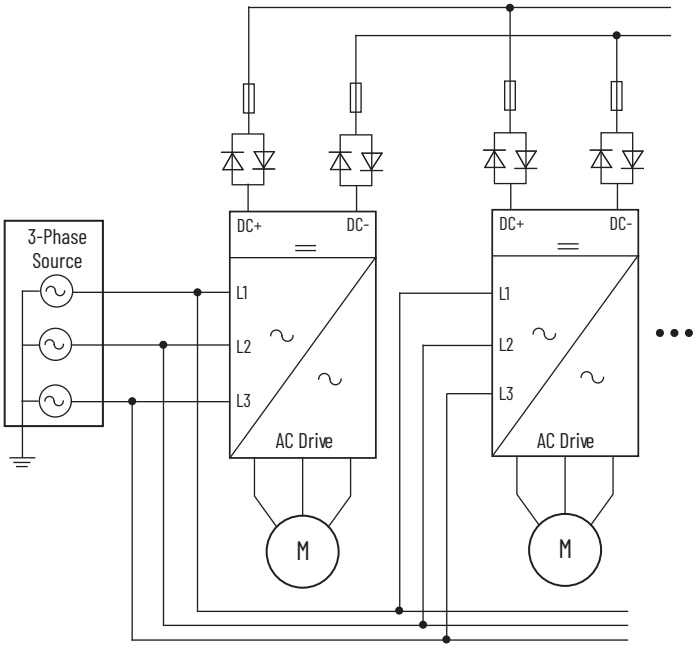
Configuration Notes

- See Special Bus Requirements in the table below, General Considerations on page 47, and Different Frame Size Drive Considerations on page 48.
- AC and DC circuit protection devices are required but not shown. See the technical data publication for your drive for guidance about circuit protection.

Drawing Designation	Supported Drives	Special Bus Requirements
AC Drive	PowerFlex 700/700S: Frames 0...6	3-Phase line reactors are required for proportional current sharing. See Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-UM001, for additional information.
	Kinetix 7000: BM06...BM12	
	PowerFlex 750-Series: Frames 2...10	• 3-Phase line reactors are required for proportional current sharing. See Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-UM001, for additional information. • A DC input terminal kit must be ordered for Frames 6, 7, and 8.

Using Back-to-Back Diodes

Figure 35 - Same Frame Size Standalone AC Drives from Same Product Line in a Shared AC/DC Bus Configuration with Back-to-back Diodes for Proportional Current Sharing



Configuration Notes

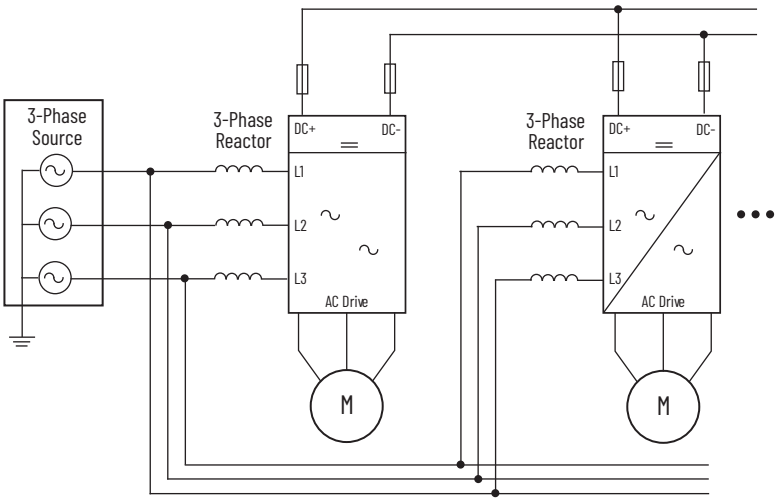
- See Special Bus Requirements in the table below, General Considerations on page 47, and Different Frame Size Drive Considerations on page 48.
- AC and DC circuit protection devices are required but not shown. See the technical data publication for your drive for guidance about circuit protection.

Drawing Designation	Supported Drives	Special Bus Requirements
AC Drive	PowerFlex 700/700S: Frames 0...6	Back-to-back diodes are required for proportional current sharing.
	Kinetix 7000: BM06...BM12	
	PowerFlex 750-Series: Frames 2...7 (1)	• Back-to-back diodes are required for proportional current sharing. • A DC input terminal kit must be ordered for Frames 6, 7, and 8.

(1) Back-to-back diodes are not supported on PowerFlex 750-Series Frame 8...10 drives.

PowerFlex 40P or PowerFlex 520-Series Drives

Figure 36 - PowerFlex 40P or PowerFlex 520-Series Drives in a Shared AC/DC Bus Configuration with AC Input Reactors for Proportional Current Sharing



Configuration Notes

- See Special Bus Requirements in the table below, General Considerations on page 47, and Different Frame Size Drive Considerations on page 48.
- AC and DC circuit protection devices are required but not shown. See the technical data publication for your drive for guidance about circuit protection.

Drawing Designation	Supported Drives	Special Bus Requirements
AC Drive	PowerFlex 40P: All power ratings	See PowerFlex 40P or PowerFlex 520-Series Drive Considerations on page 49.
	PowerFlex 520-Series: All power ratings - Three phase only	

General Considerations

ATTENTION: The incorrect use or configuration of third-party assemblies can result in reduced system reliability and drive damage.

1. Minimizing bus inductance is imperative. Drives must be mounted physically as close to each other as possible with all power wiring 'tied' together to minimize loop area.
2. If AC power is removed from one drive in a shared AC/DC bus, that drive can still be energized through the DC bus of another drive. Therefore, AC power to all of the drives in a shared AC/DC bus must be provided through a common disconnect switch or circuit breaker.
3. PowerFlex 700 drives and PowerFlex 700 Series B drives must have firmware revision 2.001 or later (Standard and Vector Control).

Different Frame Size Drive Considerations

When the Shared AC/DC Bus line-up is composed of different frame size drives, two system phases must be taken into account. These are the precharge and loading phases of the drives within this configuration.

Precharge

Due to the difference in the precharge circuitry between PowerFlex 700/700S Frame 0...4 drives and PowerFlex 750-Series Frame 2...7 drives when compared to PowerFlex 700/700S Frame 5 and 6 drives or PowerFlex 750-Series Frame 8...10 drives, the following considerations must be followed:

- An individual or a common contactor on the AC-side must be used for PowerFlex 700/700S Frame 0...4 drives or PowerFlex 750-Series Frame 2...7 drives. If PowerFlex 700/700S Frame 0...4 drives or PowerFlex 750-Series Frame 2...7 drives are not kept isolated from the AC power during precharge, the following drives precharge through the diode front end of the PowerFlex 700/700S Frame 0...4 drives or PowerFlex 750-Series Frame 2...7 drives:
  - PowerFlex 700/700S Frame 5 and 6 drives
  - PowerFlex 700VC Frame 7...10 drives
  - PowerFlex 700H/S Frame 9...14 drives
  - PowerFlex 750-Series Frame 8...10 drives

  This can result in diode front end or precharge resistor damage. See Figure 33 on page 44.
- Kinetix 7000 BM06...BM08 drives have the same precharge as PowerFlex 700/700S Frame 0...4 drives. Similarly, Kinetix 7000 BM09...BM12 drives have the same precharge as PowerFlex 700 Frame 5 drives. The same rules as described in the preceding bulleted text apply.

Loading

When the larger power frame drive—or the sum of the power for the larger frame drives relative to the smallest power frame drives in the lineup—is loaded, the current through the small frame drive can exceed its current rating. To prevent this condition, these considerations must be followed.

1. **Diodes** - Back-to-back (dual pack) diodes with fuses must be used in the DC link of each drive to enable proportional sharing of input current by the converter section of each drive. **Failure to do so can result in drive damage**. See Back-to-back Diodes (Shared AC/DC Configurations) on page 119 for recommended part numbers.
2. The wiring and interconnection distances to the Common AC Bus must be minimized to prevent large variations of the input impedances between the drive inverters.

Same Frame Size Drive Considerations

1. Individual line reactors for each drive or back-to-back diodes must be used for proportional current sharing. For line reactor information, see Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-UM001. For recommended diodes, see Back-to-back Diodes (Shared AC/DC Configurations) on page 119.
2. The wiring and interconnection distances to the Common AC Bus must be minimized to prevent large variations of the input impedances between the drive inverters.

PowerFlex 40P or PowerFlex 520-Series Drive Considerations

When using PowerFlex 40P or PowerFlex 520-Series drives in a shared bus configuration, the loading must be taken into account.

When the larger power frame drive—or the sum of the power for the larger frame drives relative to the smallest power frame drives in the lineup—is loaded, the current through the small frame drive can exceed its current rating. To prevent this condition, these guidelines must be followed.

1. Individual line reactors for each drive must be used for proportional current sharing. For line reactor information, see Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-UM001.
2. The wiring and interconnection distances to the Common AC Bus must be minimized to prevent large variations of the input impedances between the drive inverters.
3. Only multiple same size and type of drives on a shared AC/DC bus are recommended in the system configuration shown in Figure 36 on page 47. PowerFlex 40P or PowerFlex 520-Series drives **must not be combined** with PowerFlex 700/700S/750-Series drives on the same shared AC/DC bus.

Sizing

Each drive must be sized for the motor load connected to it.

Fusing

Drives **must not be** 'daisy chained'. Configure the shared DC bus in a 'star' configuration to enable proper fusing. Fast semiconductor fuses must be used in the DC links to minimize destructive energy in the event of a part or control malfunction. The fuses must be sized to handle large peak currents at the end of precharge.

See Appendix A for the recommended Common DC Bus drive fusing.

Notes:

Shared AC/DC Bus Configuration—with Braking DC Bus Regulation

System Characteristics

IMPORTANT Although there are guidelines to help with AC input current sharing between drives for this configuration, current sharing cannot be assured. Therefore, the configurations shown in Chapter 4 or Chapter 8 are preferred.

This system is characterized by the use of standalone drives that are fed by a common 3-phase voltage source and the DC bus of each drive connected together. In addition, a Braking Chopper, Dynamic Braking Unit, or the drive's internal IGBT with a braking resistor for power dissipation of regenerative energy is also used. Rockwell Automation does not offer external braking products. Contact our Encompass™ partners for these braking products.

Supported Products

At the time of publication, the following products are supported.

Products	Supported Drives
Brake Chopper Module	PowerFlex® 40P: All power ratings
	PowerFlex 520-Series: All power ratings - Three phase only
	PowerFlex 700 (1) / PowerFlex 700 Series B (1): Frames 0...6 (2)
	PowerFlex 700S: Frames 1...6 (2) (3)
	PowerFlex 750-Series: Frames 2...10 (4)
	Kinetix® 7000: BM06...BM12
Heavy-duty Dynamic Brake Unit	PowerFlex 40P: All power ratings
	PowerFlex 520-Series: All power ratings - Three phase only
	PowerFlex 700 (1) / PowerFlex 700 Series B (1): Frames 0...6 (2)
	PowerFlex 700S: Frames 1...6 (2) (3)
	PowerFlex 750-Series: Frames 2...10 (4)
	Kinetix 7000: BM06...BM12

(1) These drives require firmware revision 2.001 or later (Standard and Vector Control).
(2) PowerFlex 700 Frame 5 and 6 and PowerFlex 700S Frame 5 and 6 DC input drives are required when not connected to the AC source.
(3) There is no Frame 0 for PowerFlex 700S drives.
(4) A DC input terminal kit must be ordered for PowerFlex 750-Series Frame 6 and 7 drives.

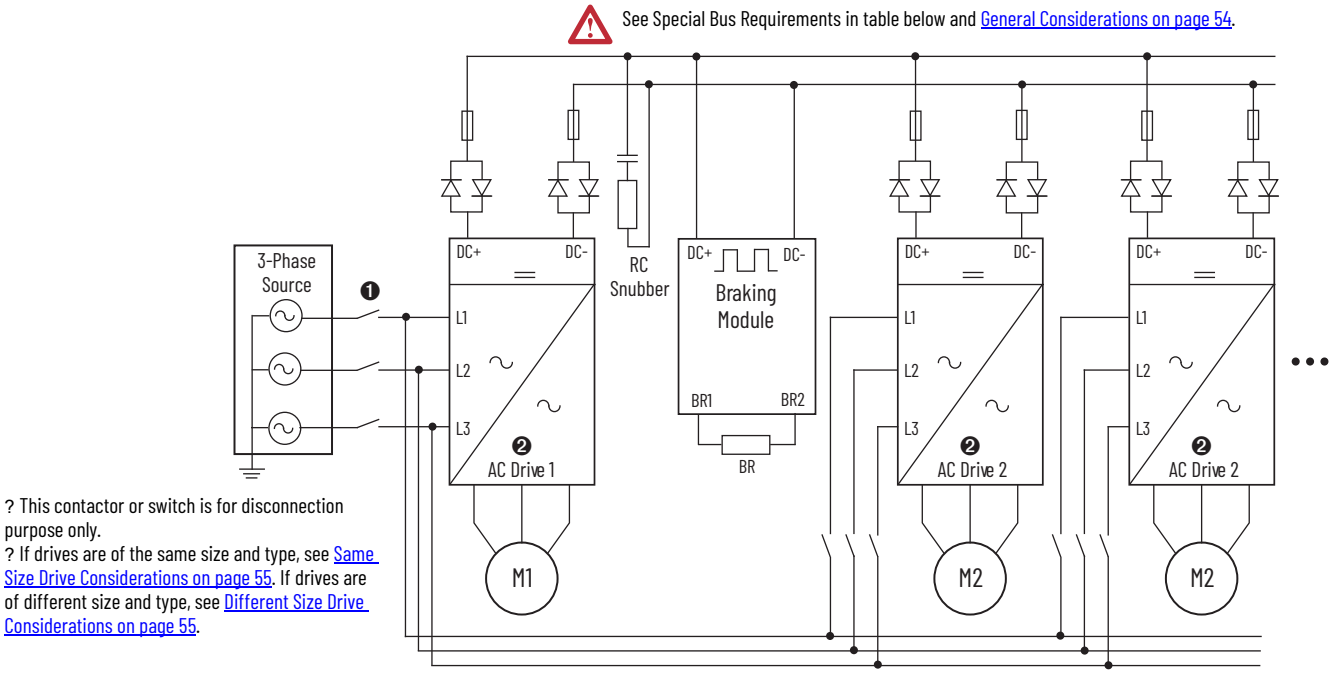
When applicable and within the power limitation, the drive's internal IGBT can also be used.

Drive	Internal Brake IGBT
PowerFlex 40P	Standard on all power ratings
PowerFlex 520-Series	Standard on all power ratings
PowerFlex 700	Standard on Frames 0...3; optional on Frames 4...6
PowerFlex 700S	Standard on Frames 1...3; optional on Frames 4...6, and 9
PowerFlex 750-Series	Standard on Frames 2...5; optional on Frames 6 and 7
Kinetix® 7000	No internal brake IGBT
Kinetix 6000 and Kinetix 6200/6500	Internal bus regulation cannot be used.

ATTENTION: The internal IGBT in a Kinetix 6000 Multi-Axis Servo Drive is disabled in 'Common Bus Follower' mode.

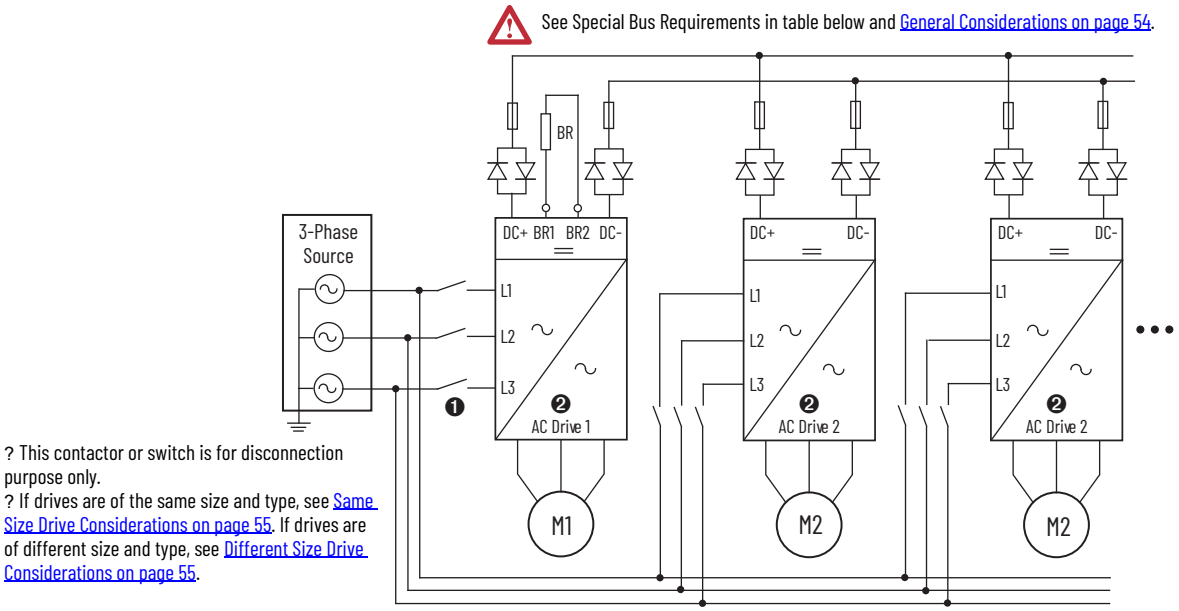
Typical System Configurations

Figure 37 - Standalone AC Drives with a Braking Module in a Shared AC/DC Bus Configuration



Drawing Designation	Supported Drives/Products	Special Bus Requirements
AC Drive 1	PowerFlex 700/700S: Frames 5 and 6 Kinetix 7000: BM09...BM12	• Back-to-back diodes are required for proportional current sharing in a shared AC/DC configuration with different size drives. See Back-to-back Diodes (Shared AC/DC Configurations) on page 119 for more information. • At 600 volts, PowerFlex 700/700S Frame 0...4 drives cannot be used on the same bus as PowerFlex 700/700S Frame 5 and 6 drives.
	PowerFlex 750-Series: Frames 5...10	• Back-to-back diodes are required for proportional current sharing in a shared AC/DC configuration with different size drives. See Back-to-back Diodes (Shared AC/DC Configurations) on page 119 for more information. • A DC input terminal kit must be ordered for Frames 6, 7, and 8.
	PowerFlex 750-Series: Frames 6...10	• At 600 volts, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives.
AC Drive 2	PowerFlex 700/700S: Frames 0...4 PowerFlex 750-Series: Frames 2...4 Kinetix 7000: BM06...BM08	• An individual or common contactor is required if the AC bus is shared with PowerFlex 700/700S Frame 5 and 6 drives or Kinetix 7000 BM09...BM12 drives. • At 600 volts, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives. • Back-to-back diodes are required for proportional current sharing in a shared AC/DC configuration with different size drives. See Back-to-back Diodes (Shared AC/DC Configurations) on page 119 for more information.
Braking Module	Encompass Partner product	An RC Snubber is required to limit DC bus voltage overshoot at power-on. See RC Snubber Circuit on page 121 for more information.

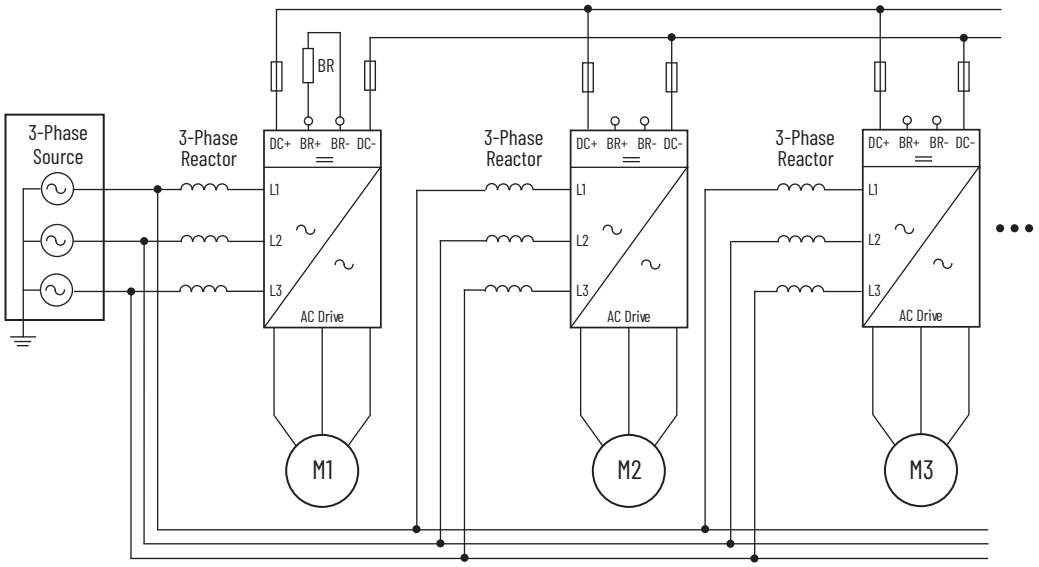
Figure 38 - Standalone AC Drives with an Internal Brake IGBT in a Shared AC/DC Bus Configuration



Drawing Designation	Supported Drives	Special Bus Requirements
AC Drive 1	PowerFlex 700/700S: Frames 5 and 6	• Back-to-back diodes are required for proportional current sharing in a shared AC/DC configuration with different size drives. See Back-to-back Diodes (Shared AC/DC Configurations) on page 119 for more information. • At 600 volts, PowerFlex 700/700S Frame 0...4 drives cannot be used on the same bus as PowerFlex 700/700S Frame 5 and 6 drives. • A Kinetix 7000 BM09...BM12 drive does not have an internal brake IGBT so it cannot be used to internally regulate the DC bus.
	Kinetix 7000: BM09...BM12	
	PowerFlex 750-Series: Frames 5...10	• Back-to-back diodes are required for proportional current sharing in a shared AC/DC configuration with different size drives. See Back-to-back Diodes (Shared AC/DC Configurations) on page 119 for more information. • A DC input terminal kit must be ordered for Frames 6, 7, and 8.
	PowerFlex 750-Series: Frames 6...10	• At 600 volts, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives.
AC Drive 2	PowerFlex 700/700S: Frames 0...4	• Back-to-back diodes are required for proportional current sharing in a shared AC/DC configuration with different size drives. See Back-to-back Diodes (Shared AC/DC Configurations) on page 119 for more information. • An individual or common contactor is required if AC bus is shared with PowerFlex 700/700S Frame 5 or 6 drives. • At 600 volts, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives. • A Kinetix 7000 BM06...BM08 drive does not have an internal brake IGBT so it cannot be used to internally regulate the DC bus.
	PowerFlex 750-Series: Frames 2...4	
	Kinetix 7000: BM06...BM08	

Figure 39 - Standalone PowerFlex 40P Drives (all Power Ratings) with Internal Brake IGBT in a Shared AC/DC Bus Configuration

See PowerFlex 40P or PowerFlex 520-Series Drive Considerations on page 55.



Drawing Designation	Supported Drives	Special Bus Requirements
AC Drive	PowerFlex 40P: All power ratings	See PowerFlex 40P or PowerFlex 520-Series Drive Considerations on page 55.
	PowerFlex 520-Series: All power ratings - Three phase only	

General Considerations

ATTENTION: The incorrect use or configuration of third-party assemblies can result in reduced system reliability and drive damage.

1. Connection of the braking resistor must be on the highest power drive. If all are the same rating, then closest to the drive that regenerates the most. Minimizing DC bus inductance is imperative. Drives must be mounted physically as close to each other as possible with all power wiring 'tied' together to minimize loop area. If minimizing the physical distance between the units is not possible, a capacitor bank is required which must be located closest to the drive with the braking resistor.
2. An RC Snubber circuit must be used in a shared AC/DC Bus Configuration when a PowerFlex 700/700S Frame 0...4 drive, PowerFlex 750-Series Frame 2...10 drive, Kinetix 7000 BM06...BM08 drive, PowerFlex 40 drive, or PowerFlex 520-Series drive is used with a Brake Chopper. See RC Snubber Circuit on page 121 for more information.
3. If AC power is removed from one drive in a shared AC/DC bus, that drive can still be energized through the DC bus of another drive. Therefore, AC power to all of the drives in a shared AC/DC bus must be provided through a common disconnect switch or circuit breaker.
4. PowerFlex 700 drives and PowerFlex 700 Series B drives must have firmware revision 2.001 or later (Standard and Vector Control).

Different Size Drive Considerations

When the Shared AC/DC Bus line-up is composed of different frame size drives, two system phases must be taken into account. These are the precharge and loading phases of the drives within this configuration.

Precharge

Due to the difference in the precharge circuitry between PowerFlex 700/700S Frame 0...4 drives and PowerFlex 750-Series Frame 2...7 drives when compared to PowerFlex 700/700S Frame 5 and 6 drives or PowerFlex 750-Series Frame 8...10 drives, the following considerations must be followed:

- An individual or a common contactor on the AC-side must be used for PowerFlex 700/700S Frame 0...4 drives or PowerFlex 750-Series Frame 2...7 drives. If PowerFlex 700/700S Frame 0...4 drives or PowerFlex 750-Series Frame 2...7 drives are not kept isolated from the AC power during precharge, the following drives precharge through the diode front end of the PowerFlex 700/700S Frame 0...4 drives or PowerFlex 750-Series Frame 2...7 drives.
  - PowerFlex 700/700S Frame 5 and 6 drives
  - PowerFlex 700VC Frame 7...10 drives
  - PowerFlex 700H/S Frame 9...14 drives
  - PowerFlex 750-Series Frame 8...10 drives

  This can result in diode front end damage. See Figure 37 on page 52 and Figure 39 on page 54.
- Kinetix 7000 BM06...BM08 drives have the same precharge as PowerFlex 700/700S Frame 0...4 drives. Similarly, Kinetix 7000 BM09...BM12 drives have the same precharge as PowerFlex 700 Frame 5 drives. The same rules as described in the preceding bulleted text apply.

Loading

When the larger power frame drive—or the sum of the power for the larger frame drives relative to the smallest power frame drives in the lineup—is loaded, the current through the small frame drive can exceed its current rating. To prevent this condition, comply with the following considerations.

1. **Diodes** - Back-to-back (dual pack) diodes with fuses must be used in the DC link of each drive to enable proportional sharing of input current by the converter section of each drive. **Failure to do so can result in drive damage**. See Back-to-back Diodes (Shared AC/DC Configurations) on page 119 for recommended part numbers.
2. The wiring and interconnection distances to the AC input connections must be minimized to prevent large variations of the input impedances between the drives.
3. If a 3-phase line reactor is used, the Common AC must be drawn from the load side of the reactor (see Figure 37 on page 52).

Same Size Drive Considerations

1. Individual line reactors for each drive or back-to-back diodes must be used for proportional current sharing. For line reactor information, see Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-UM001. For recommended diodes, see Back-to-back Diodes (Shared AC/DC Configurations) on page 119.
2. The wiring and interconnection distances to the Common AC Bus must be minimized to prevent large variations of the input impedances between the drive inverters.

PowerFlex 40P or PowerFlex 520-Series Drive Considerations

When using PowerFlex 40P or PowerFlex 520-Series drives in a shared bus configuration, the loading must be taken into account.

When the larger power frame drive—or the sum of the power for the larger frame drives relative to the smallest power frame drives in the lineup—is loaded, the current through the small frame drive can exceed its current rating. To prevent this condition, these guidelines must be followed.

1. Individual line reactors for each drive must be used for proportional current sharing. For line reactor information, see Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-UM001.
2. The wiring and interconnection distances to the Common AC Bus must be minimized to prevent large variations of the input impedances between the drive inverters.

3. Only multiple same size and type of drives on a shared AC/DC bus are recommended in the system configuration shown in Figure 39 on page 54. PowerFlex 40P or PowerFlex 520-Series drives **must not be combined** with PowerFlex 700/700S/750-Series drives on the same shared AC/DC bus.

Sizing

Each drive must be sized for the motor load connected to it.

Fusing

Drives **must not be** 'daisy chained'. Configure the shared DC bus in a 'star' configuration to enable proper fusing. Fast semiconductor fuses must be used in the DC links to minimize destructive energy in the event of a part or control malfunction. The fuses must be sized to handle large peak currents at the end of precharge.

See Appendix A for the recommended Common Bus DC drive fusing.

Shared DC Bus Configuration (Piggy Back)

System Characteristics

This system is characterized by the use of one standalone drive as the converter and additional common DC bus drives used in a shared DC bus configuration.

Supported Products

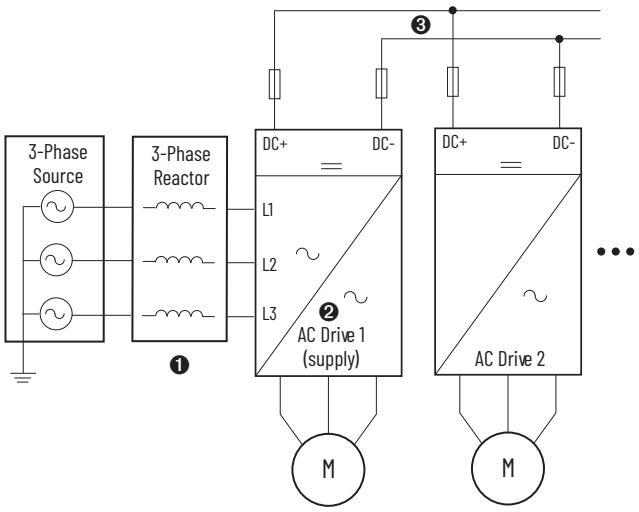
At the time of publication, the following drives are supported when used on a shared DC bus configuration.

Supported Drives
PowerFlex® 40P: All power ratings
PowerFlex 520-Series: All power ratings - Three phase only
PowerFlex 700 (1) / PowerFlex 700 Series B (1): Frames 0...10 (2)
PowerFlex 700S: All frame sizes (2)
PowerFlex 700H: All frame sizes (2)
PowerFlex 700L: All frame sizes (2)
PowerFlex 750-Series: Frames 2...10 (3)
Kinetix® 7000: BM06...BM12
Kinetix 6000 and Kinetix 6200/6500: B-Series Configurations

(1) These drives require firmware revision 2.001 or later (Standard and Vector Control).
(2) PowerFlex 700 Frame 5...10, PowerFlex 700S Frame 5 and 6 and Frame 9...14, PowerFlex 700H Frame 9...14, and PowerFlex 700L DC input drives are required when not connected to the AC source.
(3) A DC input terminal kit must be ordered for PowerFlex 750-Series Frame 6 and 7 drives.

Typical System Configurations

Figure 40 - Standalone AC Drives in a Shared DC Bus Configuration



See Special Bus Requirements footnotes in table below and General Considerations on page 59.

? A 3-Phase line reactor is only required for special line considerations. See Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-UM001, for additional information.
? Supply drive must be sized to source current to all connected drives during all modes of operation that are encountered.
? At 600 volts, PowerFlex® 700/700S Frame 0...4 drives cannot be used on the same bus as PowerFlex 700/700S Frame 5 and 6 drives. Also, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives.

Drive Compatibility Matrix

Special Bus Requirements

			AC Drive 1 (Supply)											
			PowerFlex									Kinetix		
			40P	520-Series	700/700S Frames 0...4	700/700S Frames 5...6	700 Frames 7...10	700H/700S Frames 9...14	700L Frames 2, 3A, and 3B	750-Series Frames 2...4	750-Series Frames 5...10	BM06...BM08	BM09...BM12	6000 & 6200/6500 (460V)
AC Drive 2	PowerFlex	40P	Yes (1)	Yes (1)										
		520-Series	Yes (1)	Yes (1)										
		700/700S Frames 0...4			Yes	Yes (2)	Yes	Yes (3)	Yes (3)			Yes	Yes	
		700/700S Frames 5...6				Yes (4)	Yes (4)	Yes (4) (3)	Yes (4) (3)				Yes (4)	
		700 Frames 7...10					Yes (4)							
		750-Series Frames 2...4								Yes (5)	Yes (5) (6)			
		750-Series Frames 5...10									Yes (5) (6)			
		700H/700S Frames 9...14						Yes (4) (3)						
		700L Frames 3A and 3B							Yes (4) (3)					
	Kinetix	BM06...BM08			Yes	Yes		Yes (3)				Yes	Yes	
		BM09...BM12				Yes		Yes (3)					Yes	
		6000 and 6200/6500 (460V)				Yes		Yes (3)					Yes	

(1) See PowerFlex 40P or PowerFlex 520-Series Drive Considerations on page 59.
(2) At 600 volts, PowerFlex 700/700S Frame 0...4 drives cannot be used on the same bus as PowerFlex 700/700S Frame 5 and 6 drives.
(3) Total capacitance of externally connected drives must not exceed the maximum allowable external capacitance of the supply drive or the precharge resistors will overheat. The maximum allowable external capacitance for each drive is listed in related tables in Appendix A.
(4) DC input 'Common Bus' drives are required when not connected to an AC source.
(5) At 600 volts, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives.
(6) A DC input terminal kit must be ordered for PowerFlex 750-Series Frame 6, 7, and 8 drives.

General Considerations

ATTENTION: The incorrect use or configuration of third party assemblies can result in reduced system reliability and drive damage.

1. Minimizing bus inductance is imperative. Drives must be mounted physically as close to each other as possible with all power wiring 'tied' together to minimize loop area.
2. For further assistance with this Common Bus configuration, contact technical support. See rok.auto/support for details.

PowerFlex 40P or PowerFlex 520-Series Drive Considerations

PowerFlex 40P or PowerFlex 520-Series drives **must not be used** on the same DC bus supply as PowerFlex 700/700S/700H/700L/750-Series drives. This is due to the difference in capacitance/amps of the PowerFlex 40P or PowerFlex 520-Series drives compared to the PowerFlex 700/700S/700H/700L/750-Series drives.

Sizing

The total motoring load must not exceed the rated load for the drive sourcing the DC power. Each DC-fed drive must be sized for the motor load connected to it.

Fusing

Drives **must not be** 'daisy chained'. Configure the shared DC bus in a 'star' configuration to enable proper fusing. Fast semiconductor fuses must be used in the DC links to minimize destructive energy in the event of a part or control malfunction. The fuses must be sized to handle large peak currents at the end of precharge.

See Appendix A for the recommended Common DC Bus drive fusing.

Notes:

Shared DC Bus Configuration (Piggy Back)—with Braking Chopper

System Characteristics

This system is characterized by the use of one standalone drive as the converter and additional common DC bus drives used in a shared DC bus configuration. In addition, a Braking Chopper, Dynamic Braking Unit, or the drive's internal IGBT with a braking resistor for power dissipation of regenerative energy is also used.

Supported Products

At the time of publication, the following products are supported.

Products	Supported Drives
Brake Chopper Module	PowerFlex® 40P: All power ratings
	PowerFlex 520-Series: All power ratings - Three phase only
	PowerFlex 700 (1) / PowerFlex 700 Series B (1): Frames 0...10 (2)
	PowerFlex 700S: All frame sizes (2)
	PowerFlex 700H: All frame sizes (2)
	PowerFlex 700L: All frame sizes (2)
	PowerFlex 750-Series: Frames 2...10 (3)
	Kinetix® 7000: BM06...BM12
	Kinetix 6000 and Kinetix® 6200/6500 – All 460V configurations (4)
Heavy Duty Dynamic Brake Unit	PowerFlex 40P: All power ratings
	PowerFlex 520-Series: All power ratings - Three phase only
	PowerFlex 700 (1) / PowerFlex 700 Series B (1): Frames 0...10 (2)
	PowerFlex 700S: All frame sizes (2)
	PowerFlex 700H: All frame sizes (2)
	PowerFlex 700L: All frame sizes (2)
	PowerFlex 750-Series: Frames 2...10 (3)
	Kinetix 7000: BM06...BM12
	Kinetix 6000 and Kinetix 6200/6500: All 460V configurations (4)

(1) These drives require firmware revision 2.001 or later (Standard and Vector Control).
(2) PowerFlex 700 Frame 5...10, PowerFlex 700S Frame 5 and 6 and Frame 9...14, PowerFlex 700H Frame 9...14, and PowerFlex 700L DC input drives are required when not connected to the AC source.
(3) A DC input terminal kit must be ordered for PowerFlex 750-Series Frame 6 and 7 drives.
(4) Kinetix 6000 configurations require firmware revision 1.92 or later.

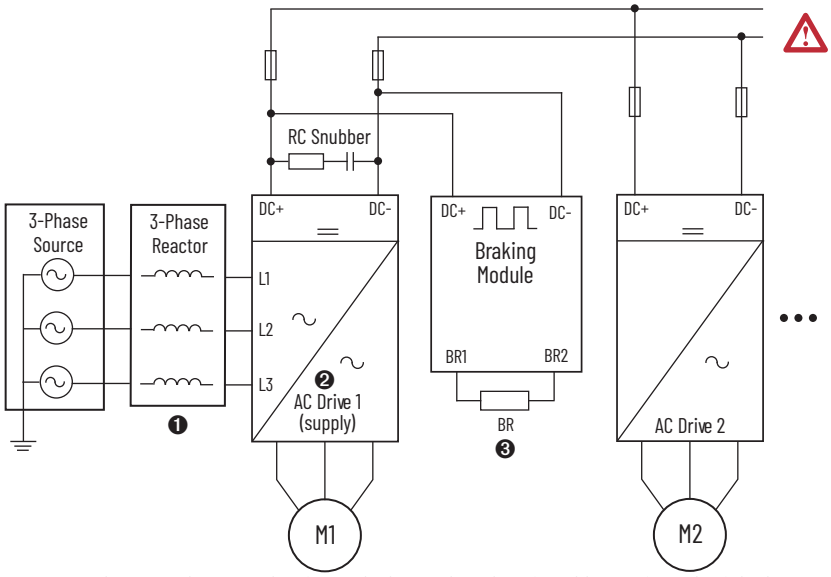
When applicable, the drive's internal IGBT can also be used.

Drive	Internal Brake IGBT
PowerFlex 40P	Standard on all power ratings
PowerFlex 520-Series	Standard on all power ratings
PowerFlex 700	Standard on Frames 0...3; optional on Frames 4...6
PowerFlex 700S	Standard on Frames 1...3; optional on Frames 4...6, and 9
PowerFlex 700H	Optional in Frame 9 only
PowerFlex 750-Series	Standard on Frames 2...5; optional on Frames 6 and 7; Frames 8...10 have no internal brake IGBT
Kinetix 7000	No internal brake IGBT
Kinetix 6000 and Kinetix 6200/6500	Internal bus regulation cannot be used

ATTENTION: The internal IGBT in a Kinetix 6000 Multi-Axis Servo Drive is disabled in 'Common Bus Follower' mode.

Typical System Configurations

Figure 41 - AC Drives with a Braking Module in a Shared DC Bus Configuration



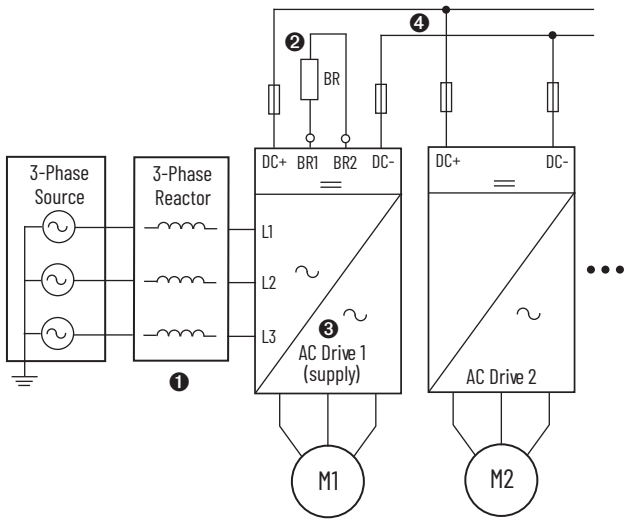
? A 3-Phase line reactor is only required for special line considerations. See Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-UM001, for additional information.
? Supply drive must be able to source current to all connected drives during all modes of operation that are encountered.
? The brake module must be connected closest to the supply drive. The brake and resistor must be sized no bigger than the capacity of the supply drive.

Drawing Designation	Supported Drives/Product	Special Bus Requirements
AC Drive 1 (supply)	See the Drive Compatibility Matrix on page 63 for supported drives and special bus requirements.	
AC Drive 2		
Braking Module	Encompass™ partner product	An RC Snubber is required when supply drive is a PowerFlex 700/700S Frame 0...4, PowerFlex 750-Series Frame 2...10 drive, or a Kinetix 7000 BM06...BM08 drive. See RC Snubber Circuit on page 121 for more information.

Figure 42 - AC Drives Using an Internal Braking IGBT in a Shared DC Bus Configuration

See Special Bus Requirements footnotes in table below and General Considerations on page 64.

? A 3-Phase line reactor is only required for special line considerations. See Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-UM001, for additional information.
? Only drives listed in the table on page 62 have internal brake IGBTs. See publication PFLEX-AT001 for minimum resistance.
? Supply drive must be able to source current to all connected drives during all modes of operation that are encountered.
? At 600 volts, PowerFlex 700/700S Frame 0...4 drives cannot be used on the same bus as PowerFlex 700/700S Frame 5 and 6 drives. Also, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives.



Drive Compatibility Matrix

			AC Drive 1 (Supply)										
			PowerFlex							Kinetix			
			40P	520-Series	700/700S Frames 0...4	700/700S Frames 5...6	700H/700S Frame 9	750-Series Frames 2...4	750-Series Frames 5...10	BM06...BM08	BM09...BM12	6000 & 6200/6500 (460V)
AC Drive 2	PowerFlex	40P	Yes (1)	Yes (1)								
		520-Series	Yes (1)	Yes (1)								
		700/700S Frames 0...4			Yes	Yes (2)	Yes (4)			Yes	Yes	
		700/700S Frames 5...6				Yes (3)	Yes (3) (4)				Yes (3)	
		750-Series Frames 2...4						Yes (5)	Yes (5) (6)			
		750-Series Frames 5...10							Yes (5) (6)			
		700H/700S Frame 9					Yes (3) (4)					
	Kinetix	BM06...BM08			Yes	Yes	Yes (4)			Yes	Yes	
		BM09...BM12				Yes	Yes (4)				Yes	
		6000 and 6200/6500 (460V)				Yes	Yes (4)				Yes	

Special Bus Requirements

(1) See PowerFlex 40P or PowerFlex 520-Series Drive Considerations on page 64.
(2) At 600 volts, PowerFlex 700/700S Frame 0...4 drives cannot be used on the same bus as PowerFlex 700/700S Frame 5 and 6 drives.
(3) DC input 'Common Bus' drives are required when not connected to an AC source.
(4) Total capacitance of externally connected drives must not exceed the maximum allowable external capacitance of the supply drive or the precharge resistors will overheat. The maximum allowable external capacitance for each drive is listed in related tables in Appendix A.
(5) At 600 volts, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives.
(6) A DC input terminal kit must be ordered for PowerFlex 750-Series Frame 6, 7, and 8 drives.

General Considerations

ATTENTION: The incorrect use or configuration of third-party assemblies can result in reduced system reliability and drive damage.

1. The brake unit must be connected to the terminals of the drive used as the converter. The brake module and resistor must be sized no bigger than the capacity of the supply drive. This enables the drives to regenerate power to the large drive capacitor bank at current limit values if necessary. The large drive can then dump large amounts of peak power to a properly sized brake unit without stressing the small drives.
2. Minimizing bus inductance is imperative. Drives must be mounted physically as close to each other as possible with all power wiring 'tied' together to minimize loop area.
3. An R-C Snubber circuit must be used in a Shared DC Bus configuration when the main drive is a PowerFlex 700/700S Frame 0...4, PowerFlex 750-Series Frame 2...10, PowerFlex 40P, or PowerFlex 520-Series drive, and a Brake Chopper is used. See RC Snubber Circuit on page 121 for more information.
4. For further assistance with this Common Bus configuration, contact technical support. See rok.auto/support for details.

PowerFlex 40P or PowerFlex 520-Series Drive Considerations

PowerFlex 40P or PowerFlex 520-Series drives **must not be used** on the same DC bus supply as PowerFlex 700/700S/700H/700L/750-Series drives. This is due to the difference in capacitance/amps of the PowerFlex 40P or PowerFlex 520-Series drives compared to the PowerFlex 700/700S/700H/700L/750-Series drives.

Sizing

The total motoring load must not exceed the rated load for the drive sourcing the DC power. Each DC-fed drive must be sized for the motor load connected to it.

Fusing

Drives **must not be** 'daisy chained'. Configure the shared DC bus in a 'star' configuration to enable proper fusing. Fast semiconductor fuses must be used in the DC links to minimize destructive energy in the event of a part or control malfunction. The fuses must be sized to handle large peak currents at the end of precharge.

See Appendix A for the recommended Common DC Bus drive fusing.

Regenerative Bus Supply Configuration

System Characteristics

This system is characterized by a PWM-controlled IGBT converter for full regeneration of power to the AC line. The regenerative bus supply puts energy back onto the distribution system instead of dissipating energy with resistor braking technology. This configuration provides low AC line harmonics and can be used to meet IEEE-519 when used with the appropriate filtering.

Supported Products

At the time of publication, the following products are supported.

Products	Supported Drives
PowerFlex® Active Front End	PowerFlex® 40P: All power ratings
	PowerFlex 700 (1) / PowerFlex 700 Series B (1): All frame sizes (2)
	PowerFlex 700S: All frame sizes (2)
	PowerFlex 700H: All frame sizes (2)
	PowerFlex 750-Series: Frames 2...10 (3)
	Kinetix® 7000: BM06...BM12
	Kinetix 6000 and Kinetix 6200/6500: All 460V configurations

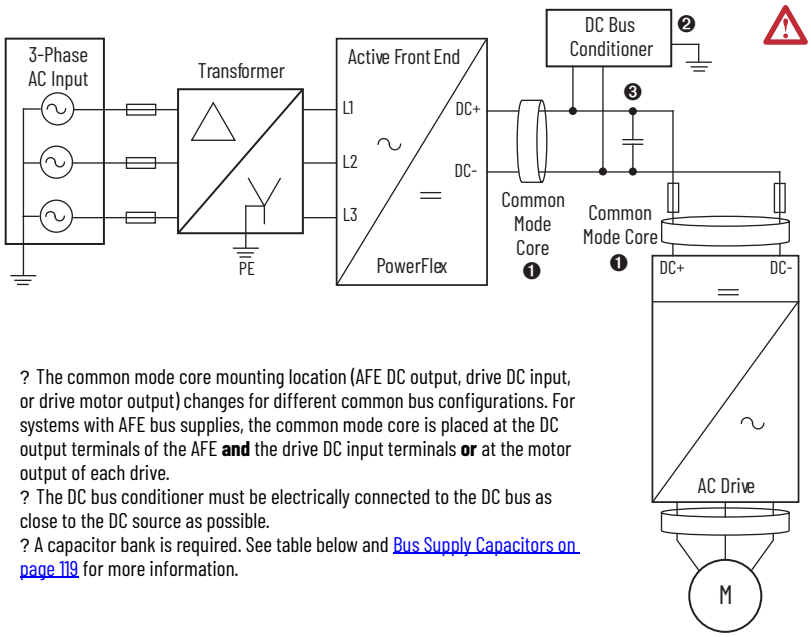
(1) These drives require firmware revision 2.001 or later (Standard and Vector Control).
(2) PowerFlex 700 Frame 5...10, PowerFlex 700S Frame 5 and 6 and Frame 9...14, PowerFlex 700H Frame 9...14, and PowerFlex 700L DC input drives are required when not connected to the AC source.
(3) PowerFlex 750-Series Frame 5...7 DC input common bus drives that have a DC precharge are recommended.

Typical System Configurations

This section is categorized by type of grounding (solid ground, high-resistance ground, or ungrounded), a single AFE providing power to a single drive, and a single AFE providing power to multiple drives.

Solid Ground System with Single AFE and Single AC Drive

Figure 43 - Solid Ground System with Single AFE and Single AC Drive



See Special Bus Requirements in table below and General Considerations on page 72.

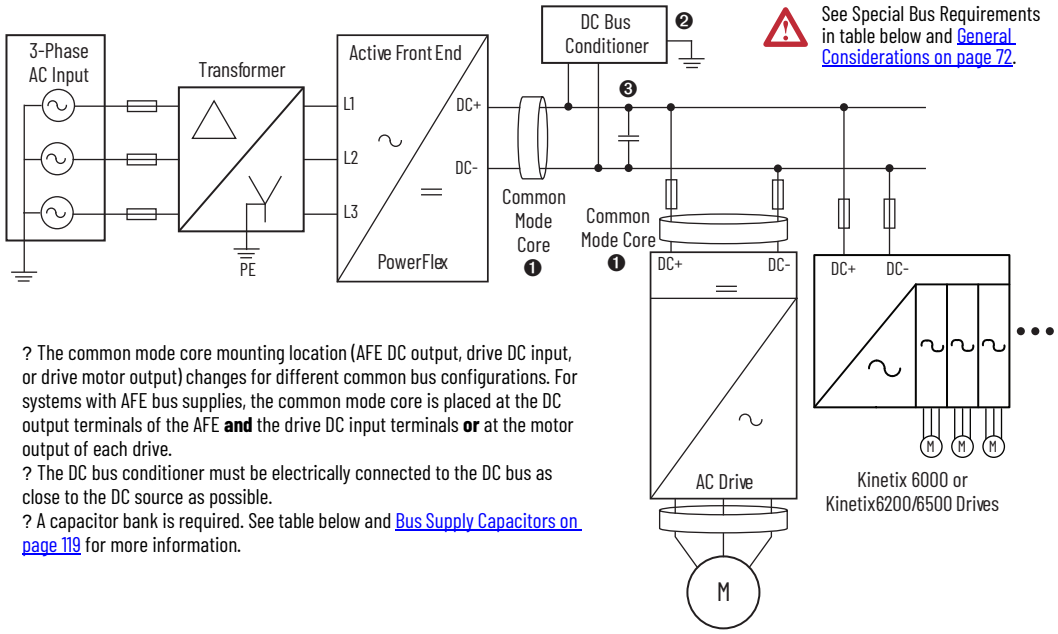
? The common mode core mounting location (AFE DC output, drive DC input, or drive motor output) changes for different common bus configurations. For systems with AFE bus supplies, the common mode core is placed at the DC output terminals of the AFE **and** the drive DC input terminals **or** at the motor output of each drive.
? The DC bus conditioner must be electrically connected to the DC bus as close to the DC source as possible.
? A capacitor bank is required. See table below and Bus Supply Capacitors on page 119 for more information.

System		AFE		Drive		Common Mode Core (1)	DC Bus Conditioner (2)
Ground Type	Voltage	Qty	Frame Size	Qty	Type		
Solid	400/480	1	10 (3) or 13 (4)	1	PowerFlex 750-Series: Frames 2...4	Frames 2, 3: 1321-M048 Frame 4: 1321-M180	Design G
	600				PowerFlex 750-Series: Frames 3 and 4		Design G
Solid	400/480	1	10 (3) or 13 (4)	1	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frames 7 PowerFlex 750-Series: Frames 8...10	Frames 5, 6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: Included with drives of enclosure type 'P' or 'W' and input type 4. Also, see Note 1 on page 22 for catalog no. information.	Design G
	600/690						Design G
Solid	400/480	1	10 (3) or 13 (4)	1	PowerFlex 700H/700S: Frames 9...14	Contact technical support for 30339-319-01 (5) or 30201-031-01/1321-M670 (6)	Design E
	600/690						Design E
Solid	400/480	1	10 (3) or 13 (4)	1	Any other non-listed PowerFlex drive	Contact technical support (7)	
	600/690						

(1) One common mode core is required on each PowerFlex AFE output. See Note 1 in Figure 43 and Common Mode Core on page 121 for recommendations.
(2) One DC bus conditioner is required for each PowerFlex AFE. See DC Bus Conditioner—Designs A, B, C, D, or E on page 124 for details.
(3) For PowerFlex AFE Frame 10, use common mode core 30339-320-01 at the AFE output terminals.
(4) For PowerFlex AFE Frame 13, use common mode core 30339-319-01 at the AFE output terminals.
(5) Drive DC input common mode core.
(6) Drive motor output common mode core.
(7) For any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.

Solid Ground System with Single AFE and Multiple AC Drives

Figure 44 - Solid Ground System with Single AFE and Multiple AC Drives



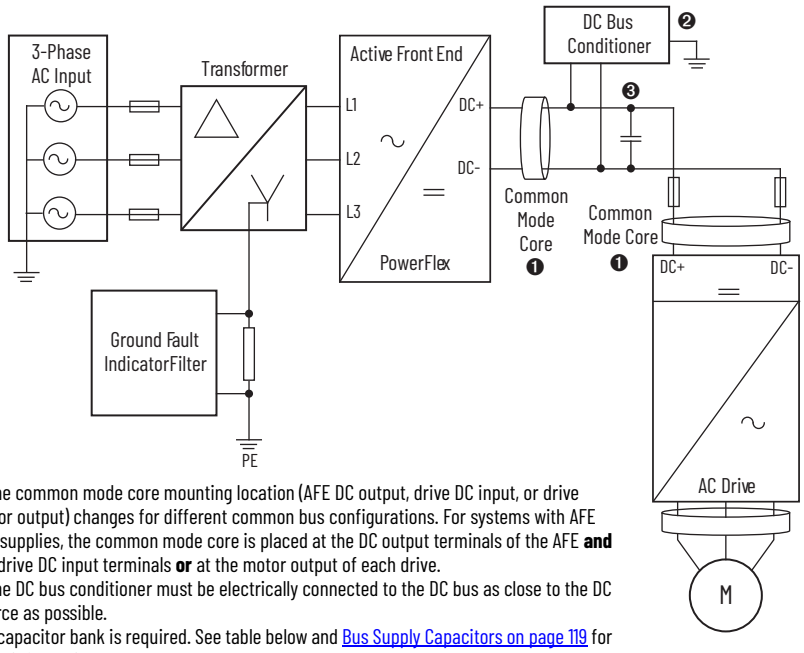
? The common mode core mounting location (AFE DC output, drive DC input, or drive motor output) changes for different common bus configurations. For systems with AFE bus supplies, the common mode core is placed at the DC output terminals of the AFE **and** the drive DC input terminals **or** at the motor output of each drive.
? The DC bus conditioner must be electrically connected to the DC bus as close to the DC source as possible.
? A capacitor bank is required. See table below and Bus Supply Capacitors on page 119 for more information.

System		AFE		Drive		Common Mode Core (1)	DC Bus Conditioner (2)
Ground Type	Voltage	Qty	Frame Size	Qty	Type		
Solid	400/480	1	10 (3) or 13 (4)	2...20 (5)	PowerFlex 750-Series: Frames 2...4	Frames 2, 3: 1321-M048 Frame 4: 1321-M180	Design G
	600 (6)				PowerFlex 750-Series: Frames 3 and 4		Design G
Solid	400/480	1	10 (3) or 13 (4)	2...20 (5)	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frames 7 PowerFlex 750-Series: Frames 8...10	Frames 5...6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: Included with drives of enclosure type 'P' or 'W' and input type 4. Also, see Note 1 on page 22 for catalog no. information.	Design G
	600/690 (6)						Design G
Solid	400/480	1	10 (3) or 13 (4)	2...20 (5)	PowerFlex 700H/700S: Frames 9...14	Contact technical support for 30339-319-01 (7) or 30201-031-01/1321-M670 (8)	Design E
	600/690						Design E
Solid	400/480	1	10 (3) or 13 (4)	2...20 (5)	Any other non-listed PowerFlex drive	Contact technical support (5)	
	600/690						

(1) One common mode core is required on each PowerFlex AFE output. See Note 1 in Figure 44 and Common Mode Core on page 121 for recommendations.
(2) One DC bus conditioner is required for each PowerFlex AFE. See DC Bus Conditioner—Designs A, B, C, D, or E on page 124 for details.
(3) For PowerFlex AFE Frame 10, use common mode core 30339-320-01 at the AFE output terminals.
(4) For PowerFlex AFE Frame 13, use common mode core 30339-319-01 at the AFE output terminals.
(5) For more than 20 drives, or for any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.
(6) At 600 volts, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives.
(7) Drive DC input common mode core.
(8) Drive motor output common mode core.

High-resistance Ground System with Single AFE and Single AC Drive

Figure 45 - High-resistance Ground System with Single AFE and Single AC Drive



See Special Bus Requirements in table below and General Considerations on page 72.

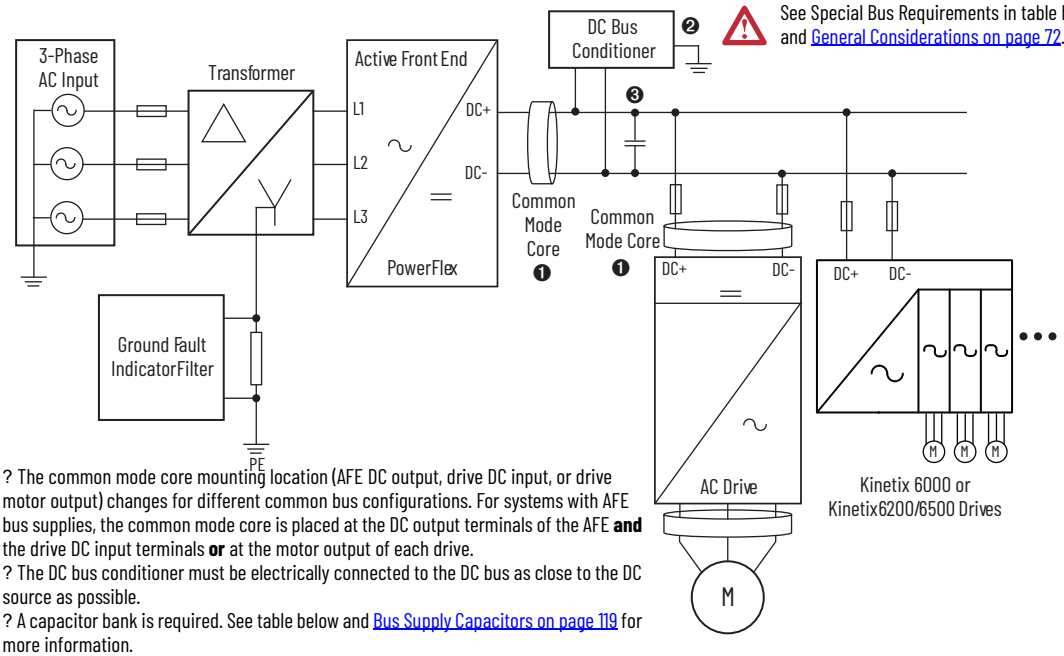
? The common mode core mounting location (AFE DC output, drive DC input, or drive motor output) changes for different common bus configurations. For systems with AFE bus supplies, the common mode core is placed at the DC output terminals of the AFE **and** the drive DC input terminals **or** at the motor output of each drive.
? The DC bus conditioner must be electrically connected to the DC bus as close to the DC source as possible.
? A capacitor bank is required. See table below and Bus Supply Capacitors on page 119 for more information.

System		AFE		Drive		Common Mode Core (1)	DC Bus Conditioner (2)	Gnd. Fault Indicator Filter (3)
Ground Type	Voltage	Qty	Frame Size	Qty	Type			
High-resistance Ground	400/480	1	10 (4) or 13 (5)	1	PowerFlex 750-Series: Frames 2...4	Frames 2, 3: 1321-M048 Frame 4: 1321-M180	Design E	Yes
	600				PowerFlex 750-Series: Frames 3 and 4			
High-resistance Ground	400/480	1	10 (4) or 13 (5)	1	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frames 7 PowerFlex 750-Series: Frames 8...10	Frames 5, 6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: Included with drives of enclosure type 'P' or 'W' and input type 4. Also, see Note 1 on page 22 for catalog no. information.	Design E	Yes
	600/690							
High-resistance Ground	400/480	1	10 (4) or 13 (5)	1	PowerFlex 700H/700S: Frames 9...14	Contact technical support for 30339-319-01 (6) or 30201-031-01/1321-M670 (7)	Design E	Yes
	600/690							
High-resistance Ground	400/480	1	10 (4) or 13 (5)	1	Any other non-listed PowerFlex drive	Contact technical support (8)		
	600/690							

(1) One common mode core is required on each PowerFlex AFE output. See Note 1 in Figure 45 and Common Mode Core on page 121 for recommendations.
(2) One DC bus conditioner is required for each PowerFlex AFE. See DC Bus Conditioner—Designs A, B, C, D, or E on page 124 for details.
(3) See Ground Fault Indicator Filter on page 127 for recommendations.
(4) For PowerFlex AFE Frame 10, use common mode core 30339-320-01 at the AFE output terminals.
(5) For PowerFlex AFE Frame 13, use common mode core 30339-319-01 at the AFE output terminals.
(6) Drive DC input common mode core.
(7) Drive motor output common mode core.
(8) For any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.

High-resistance Ground System with Single AFE and Multiple AC Drives

Figure 46 - High-resistance Ground System with Single AFE and Multiple AC Drives



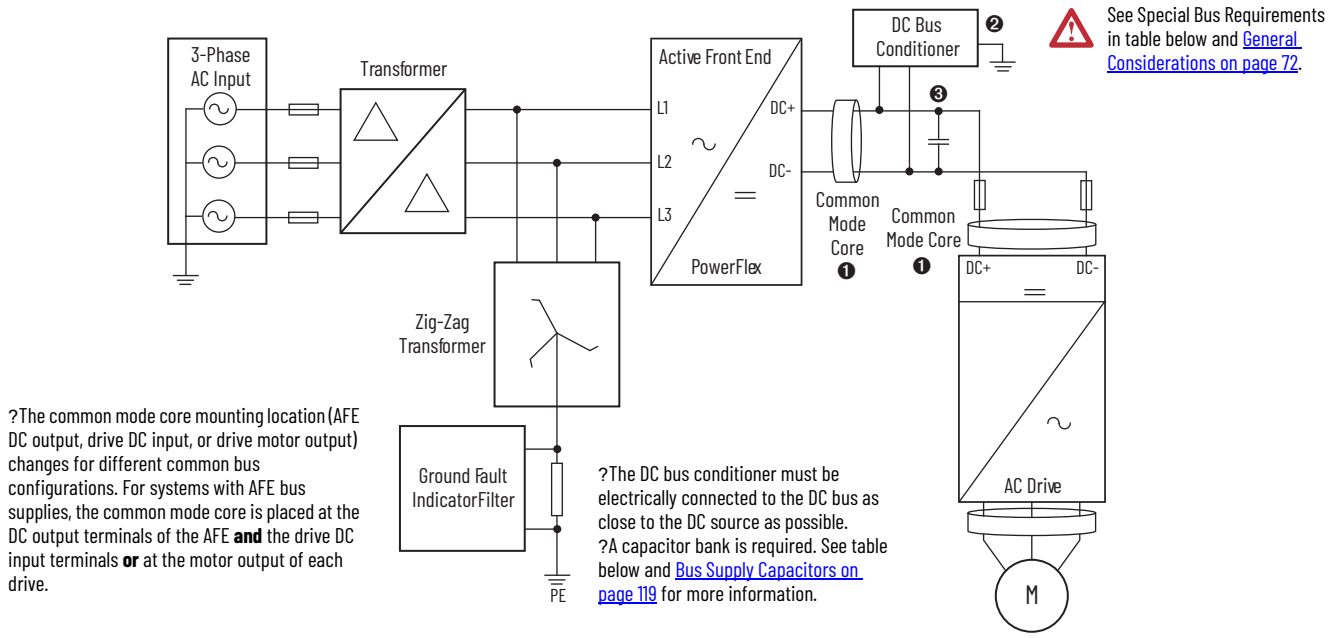
? The common mode core mounting location (AFE DC output, drive DC input, or drive motor output) changes for different common bus configurations. For systems with AFE bus supplies, the common mode core is placed at the DC output terminals of the AFE **and** the drive DC input terminals **or** at the motor output of each drive.
? The DC bus conditioner must be electrically connected to the DC bus as close to the DC source as possible.
? A capacitor bank is required. See table below and Bus Supply Capacitors on page 119 for more information.

System		AFE		Drive		Common Mode Core (1)	DC Bus Conditioner (2)	Gnd. Fault Indicator Filter (3)
Ground Type	Voltage	Qty	Frame Size	Qty	Type			
High-resistance Ground	400/480	1	10 (4) or 13 (5)	2...20 (6)	PowerFlex 750-Series: Frames 2...4	Frames 2, 3: 1321-M048 Frame 4: 1321-M180	Design E	Yes
	600 (7)				PowerFlex 750-Series: Frames 3 and 4			
High-resistance Ground	400/480	1	10 (4)or 13 (5)	2...20 (6)	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frames 7 PowerFlex 750-Series: Frames 8...10	Frames 5, 6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: Included with drives enclosure type 'P' or 'W' and input type 4. Also, see Note 1 on page 22 for catalog no. information.	Design E	Yes
	600/690 (7)							
High-resistance Ground	400/480	1	10 (4)or 13 (5)	2...20 (6)	PowerFlex 700H/700S: Frames 9...14	Contact technical support for 30339-319-01 (8) or 30201-031-01/ 1321-M670 (9)	Design E	Yes
	600/690							
High-resistance Ground	400/480	1	10 (4)or 13 (5)	2...20 (6)	Any other non-listed PowerFlex drive	Contact technical support (6)		
	600/690							

(1) One common mode core is required on each PowerFlex AFE output. See Note 1 in Figure 46 and Common Mode Core on page 121 for recommendations.
(2) One DC bus conditioner is required for each PowerFlex AFE. See DC Bus Conditioner—Designs A, B, C, D, or E on page 124 for details.
(3) See Ground Fault Indicator Filter on page 127 for recommendations.
(4) For PowerFlex AFE Frame 10, use common mode core 30339-320-01 at the AFE output terminals.
(5) For PowerFlex AFE Frame 13, use common mode core 30339-319-01 at the AFE output terminals.
(6) For more than 20 drives, or for any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.
(7) At 600 volts, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives.
(8) Drive DC input common mode core.
(9) Drive motor output common mode core.

Ungrounded System with Single AFE and Single AC Drive

Figure 47 - Ungrounded System with Single AFE and Single AC Drive

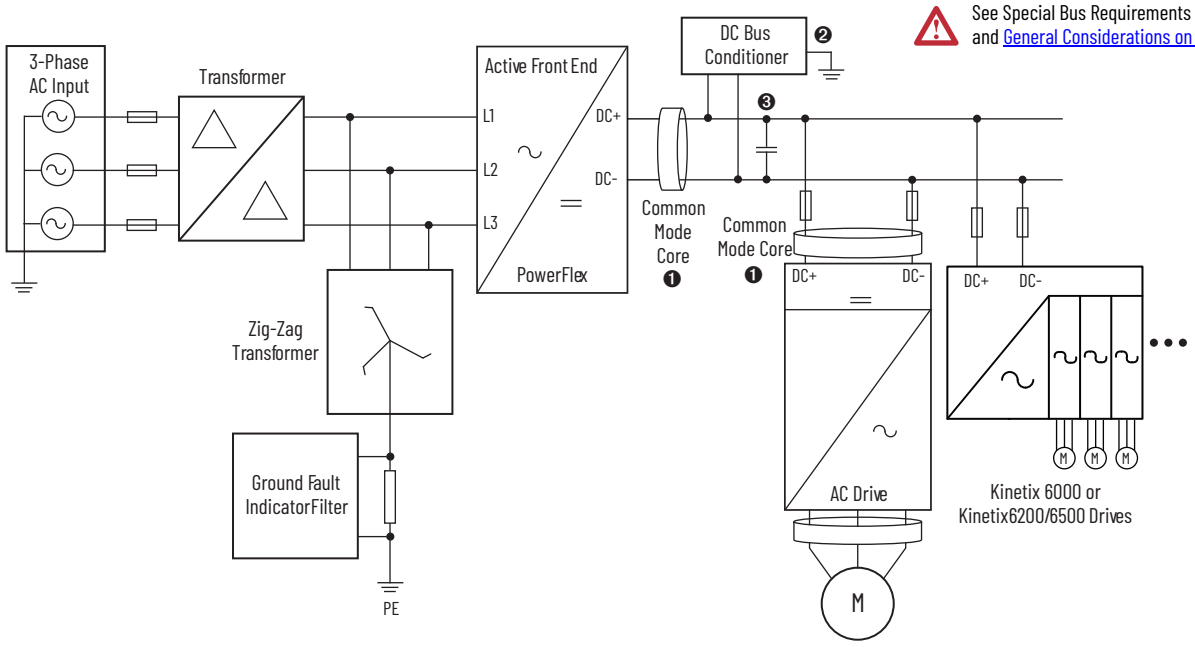


System		AFE		Drive		Common Mode Core (1)	DC Bus Conditioner (2)	Gnd. Fault Indicator Filter (3)	Zig Zag Transformer Required (4)
Ground Type	Voltage	Qty	Frame Size	Qty	Type				
Ungrounded	400/480 600	1	10 (5) or 13 (6)	1	PowerFlex 750-Series: Frames 2...4 PowerFlex 750-Series: Frames 3 and 4	Frames 2, 3: 1321-M048 Frame 4: 1321-M180	Design E	Yes	Yes
Ungrounded	400/480 600/690	1	10 (5) or 13 (6)	1	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frames 7 PowerFlex 750-Series: Frames 8...10	Frames 5, 6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: Included with drives of enclosure type 'P' or 'W' and input type 4. Also, see Note 1 on page 22 for catalog no. information.	Design E	Yes	Yes
Ungrounded	400/480 600/690	1	10 (5) or 13 (6)	1	PowerFlex 700H/700S: Frames 9...14	Contact technical support for 30339-319-01 (7) or 30201-031-01/1321-M670 (8)	Design E	Yes	Yes
Ungrounded	400/480 600/690	1	10 (5) or 13 (6)	1	Any other non-listed PowerFlex drive	Contact technical support (9)			

(1) One common mode core is required on each PowerFlex AFE output. See Note 1 in Figure 47 and Common Mode Core on page 121 for recommendations.
(2) One DC bus conditioner is required for each PowerFlex AFE. See DC Bus Conditioner—Designs A, B, C, D, or E on page 124 for details.
(3) See Ground Fault Indicator Filter on page 127 for recommendations.
(4) See Zig-Zag Transformer on page 128 for recommendations.
(5) For PowerFlex AFE Frame 10, use common mode core 30339-320-01 at the AFE output terminals.
(6) For PowerFlex AFE Frame 13, use common mode core 30339-319-01 at the AFE output terminals.
(7) Drive DC input common mode core.
(8) Drive motor output common mode core.
(9) For any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.

Ungrounded System with Single AFE and Multiple AC Drives

Figure 48 - Ungrounded System with Single AFE and Multiple AC Drives



? The common mode core mounting location (AFE DC output, drive DC input, or drive motor output) changes for different common bus configurations. For systems with AFE bus supplies, the common mode core is placed at the DC output terminals of the AFE **and** the drive DC input terminals **or** at the motor output of each drive.

? The DC bus conditioner must be electrically connected to the DC bus as close to the DC source as possible.
? A capacitor bank is required. See table below and Bus Supply Capacitors on page 119 for more information.

System		AFE		Drive		Common Mode Core (1)	DC Bus Conditioner (2)	Gnd. Fault Indicator Filter (3)	Zig Zag Transformer Required (4)
Ground Type	Voltage	Qty	Frame Size	Qty	Type				
Ungrounded	400/480 600 (8)	1	10 (5) or 13 (6)	2...20 (7)	PowerFlex 750-Series: Frames 2...4 PowerFlex 750-Series: Frames 3 and 4	Frames 2, 3: 1321-M048 Frame 4: 1321-M180	Design E	Yes	Yes
Ungrounded	400/480 600/690 (8)	1	10 (5) or 13 (6)	2...20 (7)	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frames 7 PowerFlex 750-Series: Frames 8...10	Frames 5, 6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: Included with drives of enclosure type 'P' or 'W' and input type 4. Also, see Note 1 on page 22 for catalog no. information.	Design E	Yes	Yes
Ungrounded	400/480 600/690	1	10 (5) or 13 (6)	2...20 (7)	PowerFlex 700H/700S: Frames 9...14	Contact technical support for 30339-319-01 (9) or 30201-031-01/1321-M670 (10)	Design E	Yes	Yes
Ungrounded	400/480 600/690	1	10 (5) or 13 (6)	2...20 (7)	Any other non-listed PowerFlex drive	Contact technical support (7)			

(1) One common mode core required on each PowerFlex AFE output. See Note 1 in Figure 48 and Common Mode Core on page 121 for recommendations.
(2) One conditioner required for each PowerFlex AFE.
(3) See Ground Fault Indicator Filter on page 127 for recommendations.
(4) See Zig-Zag Transformer on page 128 for recommendations.
(5) For PowerFlex AFE Frame 10, use common mode core 30339-320-01 at the AFE output terminals.
(6) For PowerFlex AFE Frame 13, use common mode core 30339-319-01 at the AFE output terminals.
(7) For more than 20 drives, or for any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.
(8) At 600 volts, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives.
(9) Drive DC input common mode core.
(10) Drive motor output common mode core.

General Considerations

1. Disconnect the common mode capacitors from the drives when using a regenerative module. See the drive's documentation for instructions on disconnecting the common mode capacitors.
2. All system components (Bus Supply and PowerFlex Drives) must be selected for the same AC-line voltage.
3. A low inductance type DC bus must be used. See DC Bus Connections on page 13 for details.
4. If a drive from column A in the table below is mixed with a drive from column B, a capacitor bank is required. See Bus Supply Capacitors on page 119 for details.

Column A Drives	Column B Drives
PowerFlex 700/700S: Frames 0...5 PowerFlex 750-Series: Frames 2...10 Kinetix 6000 and Kinetix 6200/6500 Kinetix 7000	PowerFlex 700/700S: Frame 6 PowerFlex 700: Frames 8...10 PowerFlex 700H/700S: Frame 9 and up PowerFlex 700L: All Frames

5. If a disconnect switch between the common DC bus and the drive's input is used, an auxiliary contact on the disconnect switch must be connected to a digital input of the drive. The corresponding digital input must be set to 'Precharge Enable'. This provides the proper precharge interlocking, guarding against possible damage to the drive when reconnecting the drive to an energized DC bus. Under this condition, the drives must have an internal or externally-supplied precharge.

Drive	Parameter		Digital Input
	Number	Setting	
PowerFlex 40P	A051...A054	29 (PreCharge En)	1...4
PowerFlex 700	361...366	30 (PreCharge En)	1...6
PowerFlex 700L with vector control			
PowerFlex 700S	825...830	30 (PreCharge En)	1...6
PowerFlex 700L with 700S control			
PowerFlex 700H	361...366	30 (PreCharge En)	1...6
PowerFlex 750-Series	189 [DI Precharge]	See Drive Programming Manual for programming information.	

Sizing

See the drive documentation for sizing information. In addition, when paralleling PowerFlex AFE units, they must be derated by 5% of their rated power.

Fusing

DC Input Drives

See Appendix A for the recommended Common DC Bus drive fusing.

PowerFlex Active Front End

See the PowerFlex Active Front End User Manual for recommended fusing.

Multiple Regenerative Bus Supply Configurations

System Characteristics

The power of the AFE input group can be increased by connecting several groups in parallel. Paralleling refers to AFE units connected on the same input transformer and the same DC bus. The regenerative bus supply puts energy back onto the distribution system instead of dissipating energy with resistor braking technology. This configuration provides low AC line harmonics and can be used to meet IEEE-519 when used with the appropriate filtering.

Paralleling is typically used when the power range of a single frame size is not sufficient, or when redundancy is needed.

Supported Products

At the time of publication, the following Regenerative Bus Supplies and PowerFlex® drives are supported.

Product	Voltage Class (VAC)	Supported Drives	DC Bus Overvoltage Trip (1)
PowerFlex Active Front End	400/480	480V AC PowerFlex 700 (2) / PowerFlex 700 Series B (2): All Frames (3)	810V DC
		480V AC PowerFlex 700S: Frames 1...6 (3)	810V DC
		480V AC PowerFlex 750-Series: Frames 2...10 (4)	810V DC
		480V AC PowerFlex 700H/700S: Frames 9...14 (3)	911V DC
	600/690	600V AC PowerFlex 750-Series: Frames 3...5	1013V DC
		600V AC PowerFlex 700 (2) / PowerFlex 700 Series B (2): Frames 0...4	1013V DC
		600/690V AC PowerFlex 700 (2) / PowerFlex 700 Series B (2): Frames 5 and 6 (3)	1162V DC
		600/690V AC PowerFlex 700/700S: Frames 5 and 6 (3)	1162V DC
		600/690V AC PowerFlex 750-Series: Frame 6...10	1172V DC
		690V AC PowerFlex 700H/700S: Frames 9...14 (3)	1200V DC

(1) The regenerative limit for the PowerFlex 700AFE must be less than the DC Bus Overload Trip voltage of the drive with the lowest DC Bus Overload Trip voltage.
(2) These drives require firmware revision 2.001 or later (Standard and Vector Control).
(3) PowerFlex 700 Frame 5...10, PowerFlex 700S Frame 5 and 6 and Frame 9...14, and PowerFlex 700H Frame 9...14 DC input drives are required when not connected to the AC source.
(4) PowerFlex 750-Series Frame 5...7 DC input common bus drives that have a DC precharge are recommended.

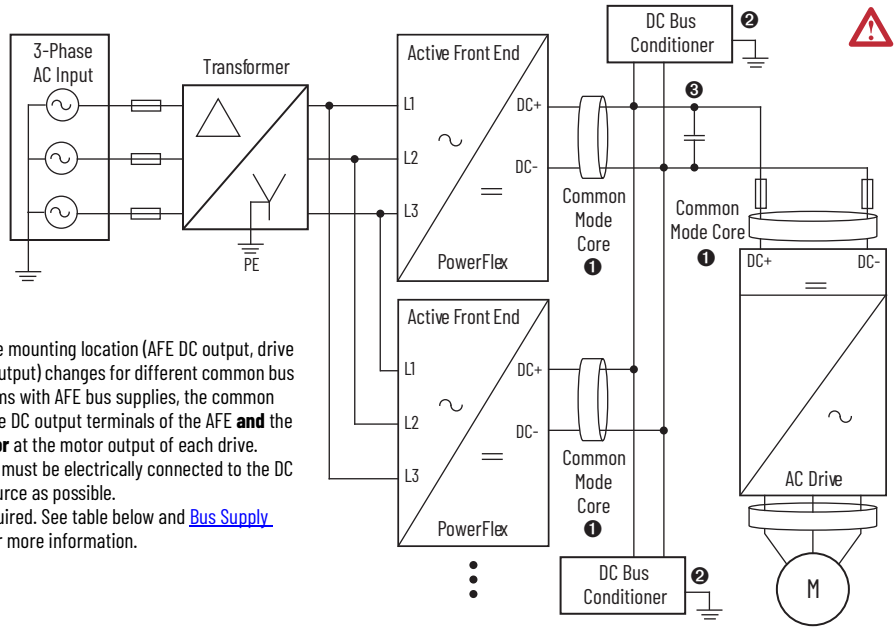
When the PowerFlex AFE is paralleled, the DC bus voltage at regeneration is 5% higher than with a single AFE due to the 5% droop.

Typical System Configuration

This section is categorized by type of grounding (solid ground, high-resistance ground, or ungrounded), multiple AFEs providing power to a single drive, and multiple AFEs providing power to multiple drives.

Solid Ground System with Multiple AFEs and Single AC Drive

Figure 49 - Solid Ground System with Multiple AFEs and Single AC Drive



See Special Bus Requirements in table below and General Considerations on page 80.

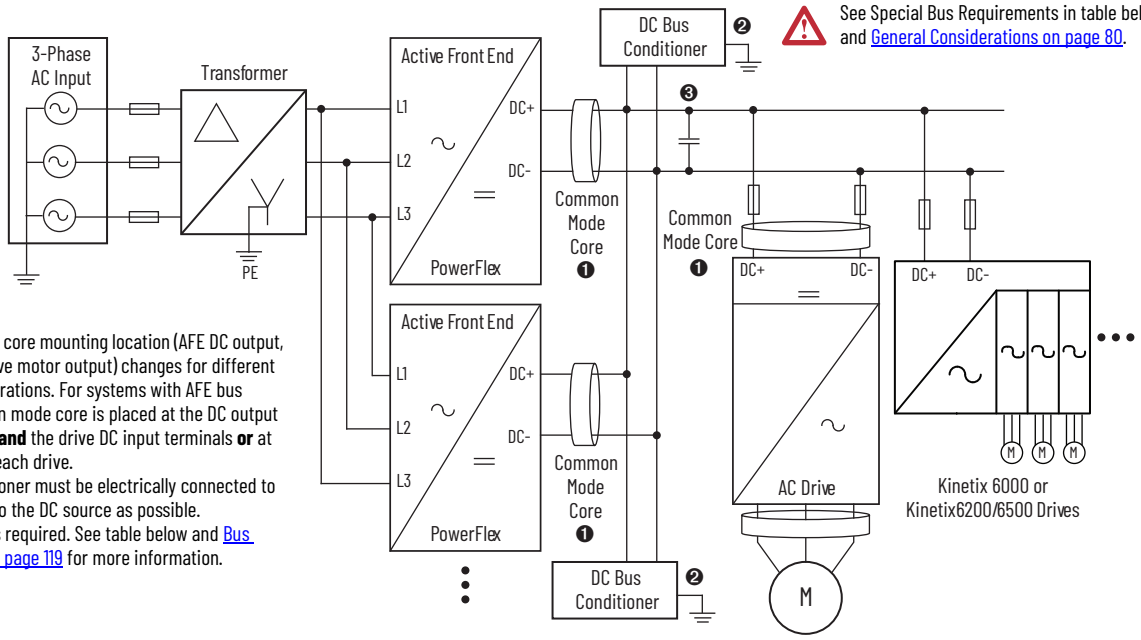
? The common mode core mounting location (AFE DC output, drive DC input, or drive motor output) changes for different common bus configurations. For systems with AFE bus supplies, the common mode core is placed at the DC output terminals of the AFE **and** the drive DC input terminals **or** at the motor output of each drive.
? The DC bus conditioner must be electrically connected to the DC bus as close to the DC source as possible.
? A capacitor bank is required. See table below and Bus Supply Capacitors on page 119 for more information.

System		AFE		Drive		Common Mode Core (1)	DC Bus Conditioner (2)
Ground Type	Voltage	Qty (3)	Frame Size	Qty	Type		
Solid	400/480	2	10 (4) or 13 (5)	1	PowerFlex 750-Series: Frames 2...4	Frames 2, 3: 1321-M048 Frame 4: 1321-M180	Design G
	600				PowerFlex 750-Series: Frames 3 and 4		Design G
Solid	400/480	2	10 (4) or 13 (5)	1	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frames 7 PowerFlex 750-Series: Frames 8...10	Frames 5, 6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: Included with drives of enclosure type 'P' or 'W' and input type 4. Also, see Note 1 on page 22 for catalog no. information.	Design G
	600/690						Design G
Solid	400/480	2	10 (4) or 13 (5)	1	PowerFlex 700H/700S: Frames 9...14	Contact technical support for 30339-319-01 or 30201-031-01/1321-M670 (6)	Design E
	600/690						Design E
Solid	400/480	2	10 (4) or 13 (5)	1	Any other non-listed PowerFlex drive	Contact technical support (7)	
	600/690						

(1) One common mode core is required on each PowerFlex AFE output. See Note 1 in Figure 49 and Common Mode Core on page 121 for recommendations.
(2) One DC bus conditioner is required for each PowerFlex AFE. See DC Bus Conditioner—Designs A, B, C, D, or E on page 124 for details.
(3) For quantities greater than 2, contact technical support.
(4) For PowerFlex AFE Frame 10, use common mode core 30339-320-01 at the AFE output terminals.
(5) For PowerFlex AFE Frame 13, use common mode core 30339-319-01 at the AFE output terminals.
(6) Drive motor output common mode core.
(7) For any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.

Solid Ground System with Multiple AFEs and Multiple AC Drives

Figure 50 - Solid Ground System with Multiple AFEs and Multiple AC Drives



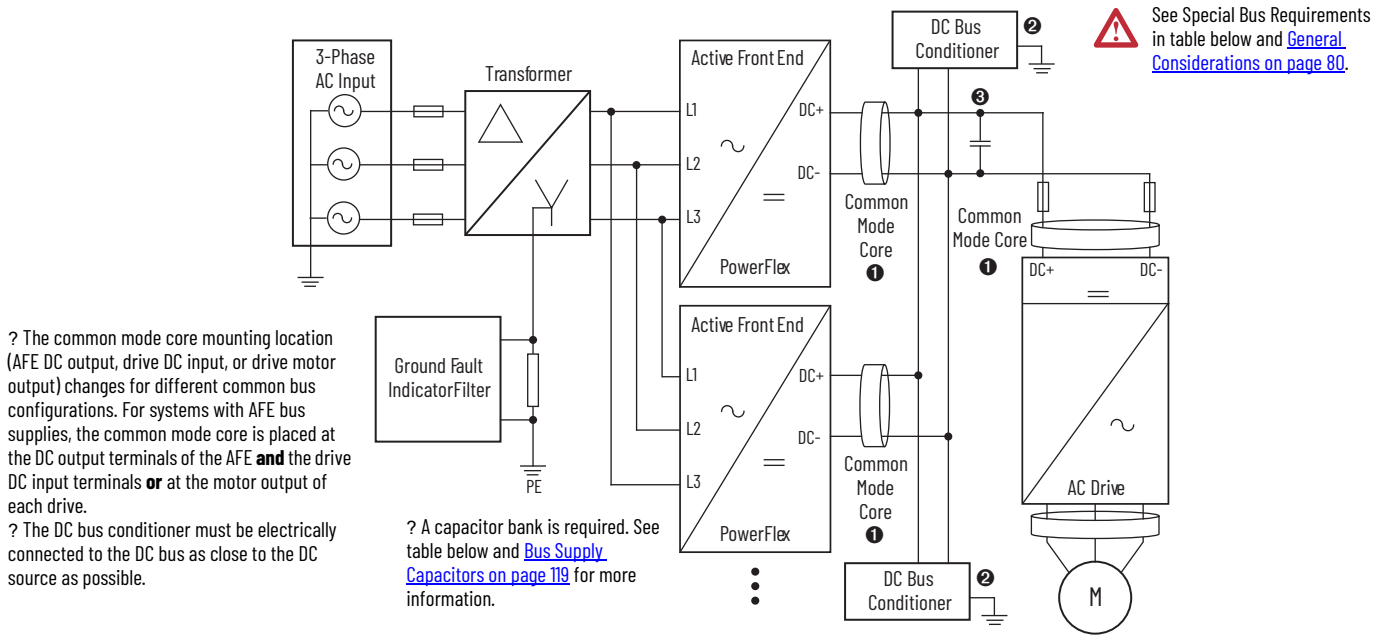
? The common mode core mounting location (AFE DC output, drive DC input, or drive motor output) changes for different common bus configurations. For systems with AFE bus supplies, the common mode core is placed at the DC output terminals of the AFE **and** the drive DC input terminals **or** at the motor output of each drive.
? The DC bus conditioner must be electrically connected to the DC bus as close to the DC source as possible.
? A capacitor bank is required. See table below and Bus Supply Capacitors on page 119 for more information.

System		AFE		Drive		Common Mode Core (1)	DC Bus Conditioner (2)
Ground Type	Voltage	Qty (3)	Frame Size	Qty	Type		
Solid	400/480	2	10 (4) or 13 (5)	2...20 (6)	PowerFlex 750-Series: Frames 2...4	Frame 2, 3: 1321-M048 Frame 4: 1321-M180	Design G
	600 (7)				PowerFlex 750-Series: Frames 3 and 4		Design G
Solid	400/480	2	10 (4) or 13 (5)	2...20 (6)	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frames 7 PowerFlex 750-Series: Frames 8...10	Frames 5...6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: Included with drives of enclosure type 'P' or 'W' and input type 4. Also, see Note 1 on page 22 for catalog no. information.	Design G
	600/690 (7)						Design G
Solid	400/480	2	10 (4) or 13 (5)	2...20 (6)	PowerFlex 700H/700S: Frames 9...14	Contact technical support for 30339-319-01 or 30201-031-01/1321-M670 (8)	Design E
	600/690						Design E
Solid	400/480	2	10 (4) or 13 (5)	2...20 (6)	Any other non-listed PowerFlex drive	Contact technical support (6)	
	600/690						

(1) One common mode core is required on each PowerFlex AFE output. See Note 1 in Figure 50 and Common Mode Core on page 121 for recommendations.
(2) One DC bus conditioner is required for each PowerFlex AFE. See DC Bus Conditioner—Designs A, B, C, D, or E on page 124 for details.
(3) For quantities greater than 2, contact technical support.
(4) For PowerFlex AFE Frame 10, use common mode core 30339-320-01 at the AFE output terminals.
(5) For PowerFlex AFE Frame 13, use common mode core 30339-319-01 at the AFE output terminals.
(6) For more than 20 drives, or for any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.
(7) At 600 volts, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives.
(8) Drive motor output common mode core.

High-resistance Ground System with Multiple AFEs and Single AC Drive

Figure 51 - High-resistance Ground System with Multiple AFEs and Single AC Drive

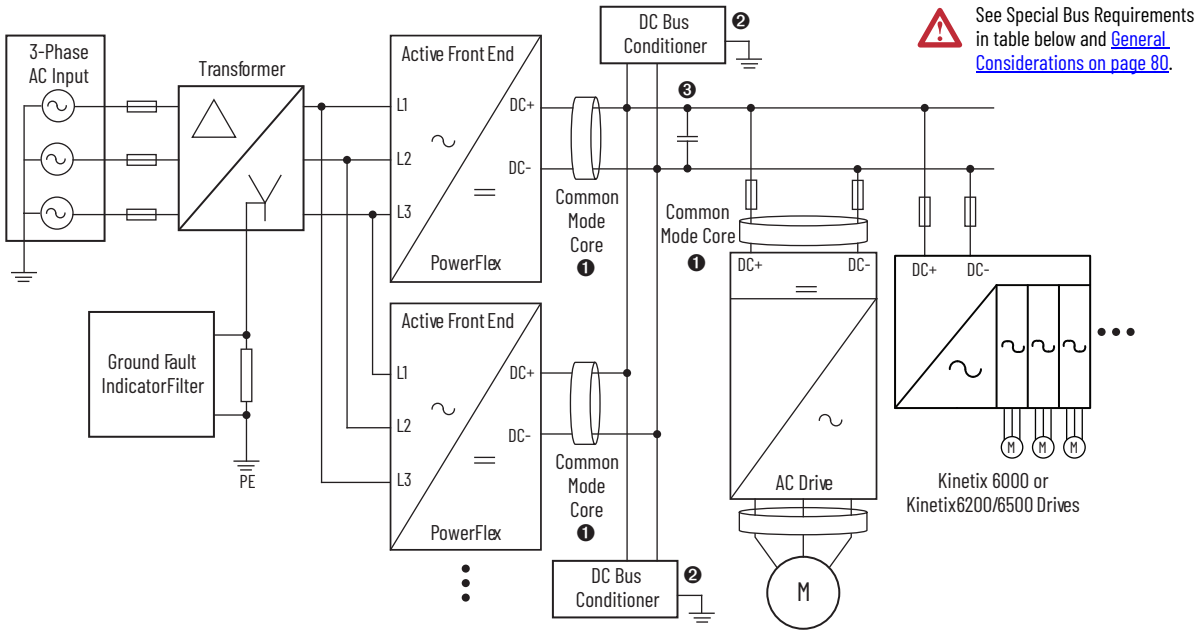


System		AFE		Drive		Common Mode Core (1)	DC Bus Conditioner (2)	Gnd. Fault Indicator Filter (3)
Ground Type	Voltage	Qty (4)	Frame Size	Qty	Type			
High-resistance Ground	400/480	2	10 (5) or 13 (6)	1	PowerFlex 750-Series: Frames 2...4	Frames 2, 3: 1321-M048 Frames 4: 1321-M180	Design E	Yes
	600				PowerFlex 750-Series: Frames 3 and 4			
High-resistance Ground	400/480	2	10 (5) or 13 (6)	1	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frames 7 PowerFlex 750-Series: Frames 8...10	Frames 5...6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: Included with drives of enclosure type 'P' or 'W' and input type 4. Also, see Note 1 on page 22 for catalog no. information.	Design E	Yes
	600/690							
High-resistance Ground	400/480	2	10 (5) or 13 (6)	1	PowerFlex 700H/700S: Frames 9...14	Contact technical support for 30339-319-01 (7) or 30201-031-01/ 1321-M670 (8)	Design E	Yes
	600/690							
High-resistance Ground	400/480	2	10 (5) or 13 (6)	1	Any other non-listed PowerFlex drive	Contact technical support (9)		
	600/690							

(1) One common mode core is required on each PowerFlex AFE output. See Note 1 in Figure 51 and Common Mode Core on page 121 for recommendations.
(2) One DC bus conditioner is required for each PowerFlex AFE. See DC Bus Conditioner—Designs A, B, C, D, or E on page 124 for details.
(3) See Ground Fault Indicator Filter on page 127 for recommendations.
(4) For quantities greater than 2, contact technical support.
(5) For PowerFlex AFE Frame 10, use common mode core 30339-320-01 at the AFE output terminals.
(6) For PowerFlex AFE Frame 13, use common mode core 30339-319-01 at the AFE output terminals.
(7) Drive DC input common mode core.
(8) Drive motor output common mode core.
(9) For any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.

High-resistance Ground System with Multiple AFEs and Multiple AC Drives

Figure 52 - High-resistance Ground System with Multiple AFEs and Multiple AC Drives



? The common mode core mounting location (AFE DC output, drive DC input, or drive motor output) changes for different common bus configurations. For systems with AFE bus supplies, the common mode core is placed at the DC output terminals of the AFE **and** the drive DC input terminals **or** at the motor output of each drive.

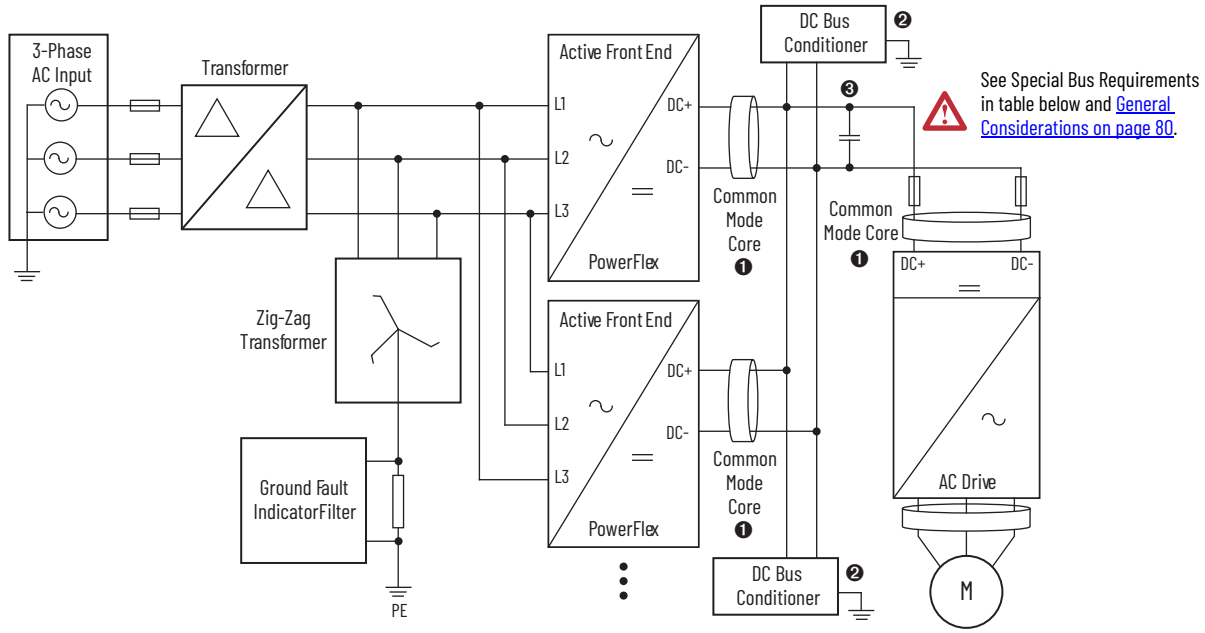
? The DC bus conditioner must be electrically connected to the DC bus as close to the DC source as possible.
? A capacitor bank is required. See table below and Bus Supply Capacitors on page 119 for more information.

System		AFE		Drive		Common Mode Core (1)	DC Bus Conditioner (2)	Gnd. Fault Indicator Filter (3)
Ground Type	Voltage	Qty (4)	Frame Size	Qty	Type			
High-resistance Ground	400/480 600 (8)	2	10 (5) or 13 (6)	2...20 (7)	PowerFlex 750-Series: Frames 2...4 PowerFlex 750-Series: Frames 3 and 4	Frames 2, 3: 1321-M048 Frame 4: 1321-M180	Design E	Yes
High-resistance Ground	400/480 600/690 (8)	2	10 (5) or 13 (6)	2...20 (6)	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frames 7 PowerFlex 750-Series: Frames 8...10	Frames 5...6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: Included with drives of enclosure type 'P' or 'W' and input type 4. Also, see Note 1 on page 22 for catalog no. information.	Design E	Yes
High-resistance Ground	400/480 600/690	2	10 (5) or 13 (6)	2...20 (6)	PowerFlex 700H/700S: Frames 9...14	Contact technical support for 30339-319-01 (9) or 30201-031-01/1321-M670 (10)	Design E	Yes
High-resistance Ground	400/480 600/690	2	10 (5) or 13 (6)	2...20 (6)	Any other non-listed PowerFlex drive	Contact technical support (6)		

(1) One common mode core is required on each PowerFlex AFE output. See Note 1 in Figure 52 and Common Mode Core on page 121 for recommendations.
(2) One DC bus conditioner is required for each PowerFlex AFE. See DC Bus Conditioner—Designs A, B, C, D, or E on page 124 for details.
(3) See Ground Fault Indicator Filter on page 127 for recommendations.
(4) For quantities greater than 2, contact technical support.
(5) For PowerFlex AFE Frame 10, use common mode core 30339-320-01 at the AFE output terminals.
(6) For PowerFlex AFE Frame 13, use common mode core 30339-319-01 at the AFE output terminals.
(7) For more than 20 drives, or for any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.
(8) At 600 volts, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives.
(9) Drive DC input common mode core.
(10) Drive motor output common mode core.

Ungrounded System with Multiple AFEs and Single AC Drive

Figure 53 - Ungrounded System with Multiple AFEs and Single AC Drive



? The common mode core mounting location (AFE DC output, drive DC input, or drive motor output) changes for different common bus configurations. For systems with AFE bus supplies, the common mode core is placed at the DC output terminals of the AFE **and** the drive DC input terminals **or** at the motor output of each drive.

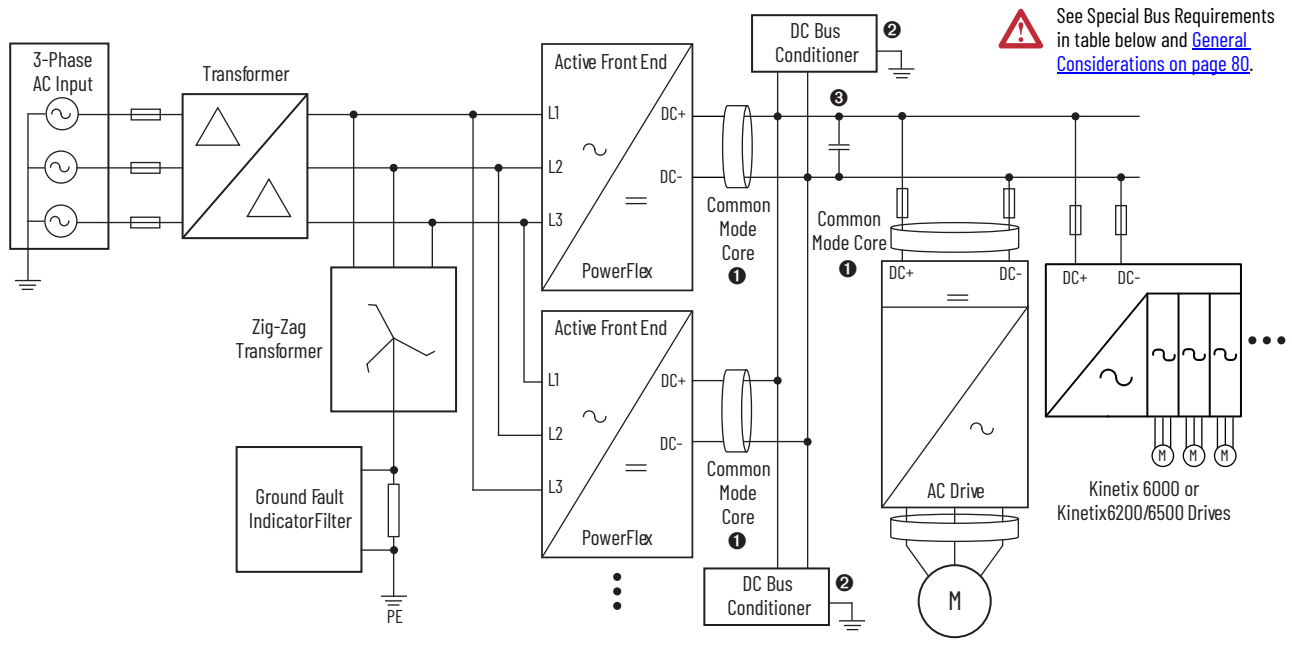
? The DC bus conditioner must be electrically connected to the DC bus as close to the DC source as possible.
? A capacitor bank is required. See table below and Bus Supply Capacitors on page 119 for more information.

System		AFE		Drive		Common Mode Core (1)	DC Bus Conditioner (2)	Gnd. Fault Indicator Filter (3)	Zig Zag Transformer Required (4)
Ground Type	Voltage	Qty (5)	Frame Size	Qty	Type				
Ungrounded	400/480 600	2	10 (6) or 13 (7)	1	PowerFlex 750-Series: Frames 2...4 PowerFlex 750-Series: Frames 3 and 4	Frames 2, 3: 1321-M048 Frame 4: 1321-M180	Design E	Yes	Yes
Ungrounded	400/480 600/690	2	10 (6) or 13 (7)	1	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frames 7 PowerFlex 750-Series: Frames 8...10	Frames 5...6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: Included with drives of enclosure type 'P' or 'W' and input type 4. Also, see Note 1 on page 22 for catalog no. information.	Design E	Yes	Yes
Ungrounded	400/480 600/690	2	10 (6) or 13 (7)	1	PowerFlex 700H/700S: Frames 9...14	Contact technical support for 30339-319-01 (8) or 30201-031-01/1321-M670 (9)	Design E	Yes	Yes
Ungrounded	400/480 600/690	2	10 (6) or 13 (7)	1	Any other non-listed PowerFlex drive	Contact technical support (10)			

(1) One common mode core is required on each PowerFlex AFE output. See Note 1 in Figure 53 and Common Mode Core on page 121 for recommendations.
(2) One DC bus conditioner is required for each PowerFlex AFE. See DC Bus Conditioner—Designs A, B, C, D, or E on page 124 for details.
(3) See Ground Fault Indicator Filter on page 127 for recommendations.
(4) See Zig-Zag Transformer on page 128 for recommendations.
(5) For quantities greater than 2, contact technical support.
(6) For PowerFlex AFE Frame 10, use common mode core 30339-320-01 at the AFE output terminals.
(7) For PowerFlex AFE Frame 13, use common mode core 30339-319-01 at the AFE output terminals.
(8) Drive DC input common mode core.
(9) Drive motor output common mode core.
(10) For any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.

Ungrounded System with Multiple AFEs and Multiple AC Drives

Figure 54 - Ungrounded System with Multiple AFEs and Multiple AC Drives



? The common mode core mounting location (AFE DC output, drive DC input, or drive motor output) changes for different common bus configurations. For systems with AFE bus supplies, the common mode core is placed at the DC output terminals of the AFE **and** the drive DC input terminals **or** at the motor output of each drive.

? The DC bus conditioner must be electrically connected to the DC bus as close to the DC source as possible.
? A capacitor bank is required. See table below and Bus Supply Capacitors on page 119 for more information.

System		AFE		Drive		Common Mode Core (1)	DC Bus Conditioner (2)	Gnd. Fault Indicator Filter (3)	Zig Zag Transformer Required (4)
Ground Type	Voltage	Qty (5)	Frame Size	Qty	Type				
Ungrounded	400/480 600 (9)	2	10 (6) or 13 (7)	2...20 (8)	PowerFlex 750-Series: Frames 2...4 PowerFlex 750-Series: Frames 3 and 4	Frames 2, 3: 1321-M048 Frame 4: 1321-M180	Design e	Yes	Yes
Ungrounded	400/480 600/690 (9)	2	10 (6) or 13 (7)	2...20 (6)	PowerFlex 750-Series: Frames 5 and 6 PowerFlex 750-Series: Frames 7 PowerFlex 750-Series: Frames 8...10	Frames 5...6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: Included with drives of enclosure type 'P' or 'W' and input type 4. Also, see Note 1 on page 22 for catalog no. information.	Design E	Yes	Yes
Ungrounded	400/480 600/690	2	10 (6) or 13 (7)	2...20 (6)	PowerFlex 700H/700S: Frames 9...14	Contact technical support for 30339-319-01 (10) or 30201-031-01/1321-M670 (11)	Design E	Yes	Yes
Ungrounded	400/480 600/690	2	10 (6) or 13 (7)	2...20 (6)	Any other non-listed PowerFlex drive	Contact technical support (6)			

(1) One common mode core is required on each PowerFlex AFE output. See Note 1 in Figure 54 and Common Mode Core on page 121 for recommendations.
(2) One DC bus conditioner is required for each PowerFlex AFE. See DC Bus Conditioner—Designs A, B, C, D, or E on page 124 for details.
(3) See Ground Fault Indicator Filter on page 127 for recommendations.
(4) See Zig-Zag Transformer on page 128 for recommendations.
(5) For quantities greater than 2, contact technical support.
(6) for PowerFlex AFE Frame 10, use common mode core 30339-320-01 at the AFE output terminals.
(7) for PowerFlex AFE Frame 13, use common mode core 30339-319-01 at the AFE output terminals.
(8) For more than 20 drives, or for any non-listed PowerFlex drive, contact technical support. See rok.auto/support for details.
(9) At 600 volts, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750 Series Frame 6...10 drives.
(10) Drive DC input common mode core.
(11) Drive motor output common mode core.

PowerFlex Active Front End Considerations

See the PowerFlex Active Front End User Manual for AFE considerations.

General Considerations

1. Disconnect the common mode capacitors from the drives when using a regenerative module. See the drive's documentation for instructions on disconnecting the common mode capacitors.
2. All system components (Bus Supply and PowerFlex Drives) must be selected for the same AC-line voltage.
3. A low inductance type DC bus must be used. See DC Bus Connections on page 13 for details.
4. If a disconnect switch between the common DC bus and the drive's input is used, an auxiliary contact on the disconnect switch must be connected to a digital input of the drive. The corresponding digital input must be set to 'Precharge Enable'. This provides the proper precharge interlocking, guarding against possible damage to the drive when reconnecting the drive to an energized DC bus. Under this condition, the drives must have internal or externally-supplied precharge.

Drive	Parameter		Digital Input
	Number	Setting	
PowerFlex 40P	A051...A054	29 (PreCharge En)	1...4
PowerFlex 700	361...366	30 (PreCharge En)	1...6
PowerFlex 700L with vector control			
PowerFlex 700S	825...830	30 (PreCharge En)	1...6
PowerFlex 700L with 700S control			
PowerFlex 700H	361...366	30 (PreCharge En)	1...6
PowerFlex 750-Series	189 [DI Precharge]	See Drive Programming Manual for programming information.	

5. If a drive from column A in the table below is mixed with a drive from column B, a capacitor bank is required. See Bus Supply Capacitors on page 119 for details.

Column A Drives	Column B Drives
PowerFlex 700/700S: Frames 0...5 PowerFlex 750-Series: Frames 2...10 Kinetix® 6000 and Kinetix 6200/6500 Kinetix 7000	PowerFlex 700/700S: Frame 6 PowerFlex 700: Frames 8...10 PowerFlex 700H/700S: Frame 9 and up PowerFlex 700L: All Frames

Sizing

See the drive documentation for sizing information. In addition, when paralleling PowerFlex 700AFE units, they must be derated by 5% of their power rating.

Fusing

DC Input Drives

See Appendix A for the recommended Common DC Bus drive fusing.

PowerFlex Active Front End

See the PowerFlex Active Front End User Manual for recommended fusing.

Paralleling Regenerative Bus Supplies (AFEs) with One or More Non-Regenerative PowerFlex SCR Bus Supplies

System Characteristics

One or more AFEs can be paralleled with one or more PowerFlex® SCR Bus Supplies for applications that require partial regeneration capacity.

The AFE component of this system is characterized by a PWM-controlled IGBT converter for full regeneration of power to the AC line. The regenerative bus supply puts energy back onto the distribution system instead of dissipating energy with resistor braking technology. This configuration provides low AC line harmonics and can be used to meet IEEE-519 when used with the appropriate filtering.

The SCR bus supply component of this system is characterized by an SCR rectifier front end, which converts the 3-phase AC line voltage into a non-filtered DC bus voltage.

Supported Products

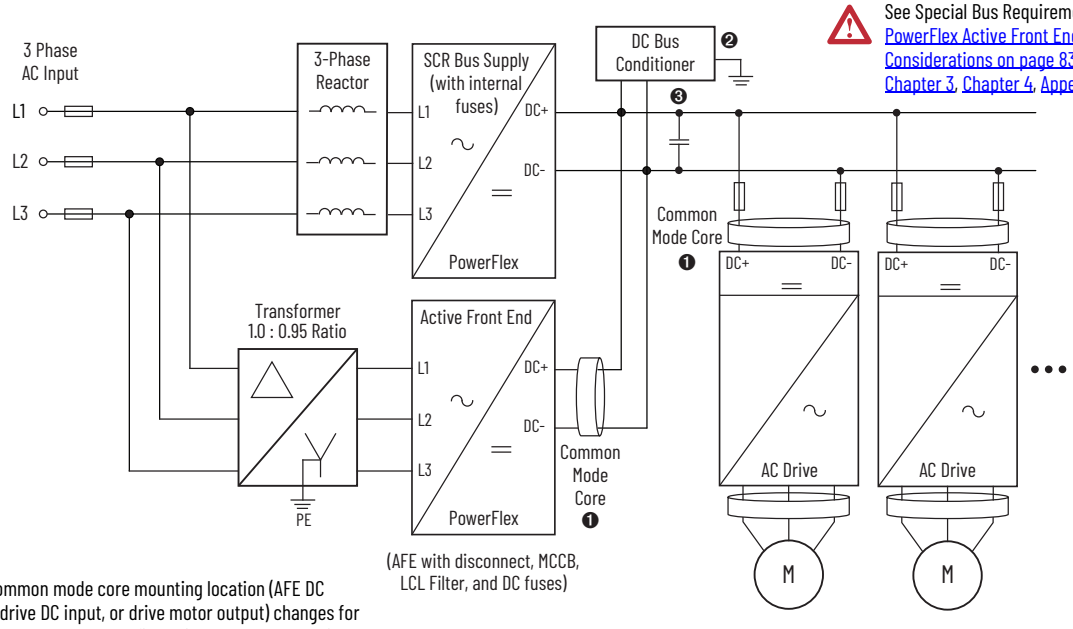
At the time of publication, the following products are supported.

Products	Supported Drives
PowerFlex® Active Front End in parallel with PowerFlex SCR Bus Supply	PowerFlex 700 (1) / PowerFlex 700 Series B (1): All frame sizes (2)
	PowerFlex 700S: All frame sizes (2)
	PowerFlex 700H: All frame sizes (2)
	PowerFlex 700L: Frames 3A (3) and 3B (2)
	PowerFlex 750-Series: Frames 2...10 (4)
	Kinetix® 7000: BM06...BM12
	Kinetix 6000 and Kinetix® 6200/6500: All 460V configurations

(1) These drives require firmware revision 2.001 or later (Standard and Vector Control).
(2) PowerFlex 700 Frame 5...10, PowerFlex 700S Frame 5 and 6 and Frame 9...14, PowerFlex 700H Frame 9...14, and PowerFlex 700L DC input drives are required when not connected to the AC source.
(3) Frame 3A dual inverter drives only.
(4) PowerFlex 750-Series Frame 5...7 DC input common bus drives that have a DC precharge are recommended.

Typical System Configuration

Figure 55 - AFE in Parallel with PowerFlex SCR Bus Supply with AC Drives



See Special Bus Requirements in table below and PowerFlex Active Front End and PowerFlex SCR Bus Supply Considerations on page 83. Also, see all information in Chapter 3, Chapter 4, Appendix 9, and Chapter 10.

?The common mode core mounting location (AFE DC output, drive DC input, or drive motor output) changes for different common bus configurations. For systems with AFE bus supplies, the common mode core is placed at the DC output terminals of the AFE **and** the drive DC input terminals **or** at the motor output of each drive.

?The DC bus conditioner must be electrically connected to the DC bus as close to the DC source as possible. See DC Bus Conditioner—Designs A, B, C, D, or E on page 124 for details.
?A capacitor bank is required. See table below and Bus Supply Capacitors on page 119 for more information.

Drawing Designation	Supported Drives	Special Bus Requirements
AC Drive	PowerFlex 700/700S: Frames 0...4	At 600 volts, PowerFlex 700/700S Frame 0...4 drives cannot be used on the same bus as PowerFlex 700/700S Frame 5 and 6 drives.
	PowerFlex 750-Series: Frames 2...4	At 600 volts, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives.
	PowerFlex 700/700S: Frames 5 and 6	• Internal precharge option must be selected if a disconnect between the DC bus and the drive's DC input is used. • At 600 volts, PowerFlex 700/700S Frame 0...4 drives cannot be used on the same bus as PowerFlex 700/700S Frame 5 and 6 drives. • DC input 'common bus' drives are required—not AC standalone configuration.
	PowerFlex 700: Frames 7...10	• Additional bus capacitance may be required. See General Considerations on page 83. • External precharge must be provided if a disconnect between the DC bus and the drive's DC input is used. • DC input 'common bus' drives are required—not AC standalone configuration.
	PowerFlex 700H/700S: Frames 9...14	
	PowerFlex 700L: Frames 3A (1) and 3B	
	PowerFlex 750-Series: Frames 5...10	• At 600 volts, PowerFlex 750-Series Frame 3...5 drives cannot be used on the same bus as PowerFlex 750-Series Frame 6...10 drives. • DC input common bus drives that have a DC precharge are recommended (input type code = 4).
	Kinetix 7000: BM06...BM08	None
	Kinetix 7000: BM09...BM12	External precharge must be provided if a disconnect between the DC bus and the drive's DC input is used.

(1) Frame 3A dual inverter drives only.

PowerFlex Active Front End and PowerFlex SCR Bus Supply Considerations

- An isolating delta Y transformer with the secondary center tap ungrounded must be used on the input of the AFE (see Figure 55 on page 82). This minimizes circulating currents and avoids nuisance ground faults in the AFE.
- The transformer kVA must be equal to or greater than the AFE input kVA.
- The system impedance must be less than 10%.
- The isolating transformer on the input of the AFE must be tapped 5% below the input voltage for the PowerFlex SCR Bus Supply. This provides proper sharing of the load between the AFE and SCR Bus Supply during motoring operation.
- An input reactor must be used on the input of each PowerFlex SCR Bus Supply. See the PowerFlex SCR Bus Supply User Manual for details.
- Set SCR Bus Supply jumper to 'AFE' mode. See SCR Bus Supply User Manual, publication 20S-UM001 for details.
- Let the PowerFlex SCR Bus Supply precharge the DC bus of the system before letting the AFE complete its precharge and close its MCCB. See the PowerFlex SCR Bus Supply User Manual for details on setting up the precharge rate.
- Parameter 75 - [Motor Power Lmt] of the AFE must be set to 10% to limit the motoring current that the AFE can supply and avoid overload faults on the AFE.

General Considerations

1. Disconnect the common mode capacitors from the drives when using a regenerative module. See the drive's documentation for instructions on disconnecting the common mode capacitors.
2. All system components (Bus Supply and PowerFlex Drives) must be selected for the same AC-line voltage.
3. A low inductance type DC bus must be used. See for DC Bus Connections on page 13 details.
4. If a disconnect switch between the common DC bus and the drive's input is used, an auxiliary contact on the disconnect switch must be connected to a digital input of the drive. The corresponding digital input must be set to 'Precharge Enable'. This provides the proper precharge interlocking, guarding against possible damage to the drive when reconnecting the drive to an energized DC bus. Under this condition, the drives must have internal or externally supplied precharge.

Drive	Parameter		Digital Input
	Number	Setting	
PowerFlex 700	361...366	30 (PreCharge En)	1...6
PowerFlex 700L with vector control			
PowerFlex 700S	825...830	30 (PreCharge En)	1...6
PowerFlex 700L with 700S control			
PowerFlex 700H	361...366	30 (PreCharge En)	1...6
PowerFlex 750-Series	189 [DI Precharge]	See Drive Programming Manual for programming information.	

5. If a drive from column A in the table below is mixed with a drive from column B, a capacitor bank is required. See Bus Supply Capacitors on page 119 for details.

Column A Drives	Column B Drives
PowerFlex 700/700S: Frames 0...5 PowerFlex 750-Series: Frames 2...10 Kinetix 6000 and Kinetix 6200/6500 Kinetix 7000	PowerFlex 700/700S: Frame 6 PowerFlex 700: Frames 8...10 PowerFlex 700H/700S: Frame 9 and up PowerFlex 700L: All Frames

Sizing

See the drive documentation for sizing the AFE. See Chapter 3 for sizing the SCR Bus Supply. In addition, the AFE must be sized for the regenerative power only, and the SCR Bus Supply must be sized to handle all of the motoring power because the AFE is programmed for a 10% [Motor Power Lmt].

Fusing

DC Input Drives

See Appendix A for the recommended Common DC Bus drive fusing.

PowerFlex SCR Bus Supply

The PowerFlex SCR Bus Supply has built-in AC line and DC bus fuses (on 400 A and 600 A units). The 1000 A unit has six in-path fuses, which simultaneously protect AC and DC paths. All units are equipped with fuse trip indicator switches. See the PowerFlex SCR Bus Supply User Manual, publication 20S-UM001-EN-P, for fusing information.

PowerFlex Active Front End

See the PowerFlex Active Front End User Manual, publication 20Y-UM001-EN-P, for recommended fusing.

PowerFlex Drive Ratings, Recommended DC Bus Fuses, and Drive DC Bus Capacitance

The tables on the following pages provide drive ratings (including DC input currents), recommended DC input fuses (Manufacturer Catalog No.), and internal drive DC bus capacitance. The sizes listed are the recommended sizes based on 40 °C (104 °F). If available amp ratings do not match the tables provided, the closest fuse rating that exceeds the drive rating should be chosen.

325 Volt DC Input Fuses

Table 1 - PowerFlex® 40P Drives, 325V DC Input Fuses

Drive Cat. No. 22D...	HP Rating	DC Input Amps	Non-Time Delay Fuse (1)		Drive DC Bus Capacitance (µF)
			Amps	Catalog No.	
B2P3	0.5	2.1	6	Bussmann JKS-6 (2)	270
B5P0	1	4.5	10	Bussmann JKS-10 (2)	560
B8P0	2	8.1	20	Mersen HSJ20 (3)	940
B012	3	12.1	25	Mersen HSJ25 (3)	1120
B017	5	18.3	40	Mersen HSJ40 (3)	2000
B024	7.5	25.4	50	Mersen HSJ50 (3)	2800
B033	10	35.4	70	Mersen HSJ70 (3)	3920

(1) The power source to Common Bus inverters must be derived from AC voltages 600V or less, as defined in NFPA70; Art 430-18 (NEC). Battery supplies or MG sets are not included. The following devices were validated to break current of the derived power DC Bus: *Disconnects*: Allen-Allen-Bradley® Bulletin No. 1494, 30 to 400 A; Bulletin No. 194, 30 to 400 A, or ABB: OESA, 600 & 800 A; OESL, all sizes. *Fuses:* Mersen Type HSJ, all sizes. For any other devices, please contact technical support.

(2) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.

(3) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 1336 PLUS™ drives, and so forth. The criteria for acceptance was:
- 600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
- Time constant minimum 3 milliseconds (maximum 15 milliseconds).
- No overload protection required.
- Let thru must be less than rating of the conductors.
- This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

Table 2 - PowerFlex 520-Series Drives, 325V DC Input Fuses

Drive Cat. No. 25x (1)	HP Rating		DC Input Amps	Non-Time Delay Fuse (2)		Drive DC Bus Capacitance (µF)
	ND	HD		Amps	Catalog No.	
B1P6 (3)	0.25	0.25	1.5	3	Bussmann JKS-3 (4)	150
B2P5	0.5	0.5	2.3	6	Bussmann JKS-6 (4)	270
B5P0	1.0	1.0	4.6	10	Bussmann JKS-10 (4)	470
B8P0	2.0	2.0	8.2	20	Mersen HSJ20 (5)	776
B011	3.0	3.0	11.3	25	Mersen HSJ25 (5)	1122
B017	5.0	5.0	18.6	40	Mersen HSJ40 (5)	1680
B024	7.5	7.5	25.9	50	Mersen HSJ50 (5)	2232
B032	10.0	10.0	35.1	70	Mersen HSJ70 (5)	3349
B048	15.0	15.0	53.3	80	Mersen HSJ80 (5)	3912
B062	20.0	15.0	69.3	100	Mersen HSJ100 (5)	5030

(1) The drive catalog number prefix is 25A for PowerFlex 523 drives, and 25B for PowerFlex 525 drives.
(2) The power source to Common Bus inverters must be derived from AC voltages 600V or less, as defined in NFPA70; Art 430-18 (NEC). Battery supplies or MG sets are not included. The following devices were validated to break current of the derived power DC Bus: *Disconnects:* Allen-Bradley Bulletin No. 1494, 30 to 400 A; Bulletin No. 194, 30 to 400 A, or ABB: OESA, 600 & 800 A; OESL, all sizes. *Fuses:* Mersen Type HSJ, all sizes. For any other devices, please contact technical support.
(3) PowerFlex 523 drive only.
(4) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.
(5) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
- 600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
- Time constant minimum 3 milliseconds (maximum 15 milliseconds).
- No overload protection required.
- Let thru must be less than rating of the conductors.
- This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

Table 3 - PowerFlex 700/700S Drives — Frames 0...6, 325V DC Input Fuses

Drive Cat. No. 20B... / 20D...	Frame Size	HP Rating		DC Input Rating	Non-Time Delay Fuse (1)		Drive DC Bus Capacitance (µF)
		ND	HD	Amps	Amps	Catalog No.	
B2P2	0	0.5	0.33	2.0	6	Bussmann JKS-6 (2)	440
B4P2	0/1	1	0.75	3.8	8	Bussmann JKS-8 (2)	440
B6P8	1	2	1.5	6.9	15	Mersen HSJ15 (3)	1120
B9P6	1	3	2	9.7	20	Mersen HSJ20 (3)	1120
B015	1	5	3	16	30	Mersen HSJ30 (3)	2000
B022	1	7.5	5	23.3	45	Mersen HSJ45 (3)	2000
B028	2	10	7.5	30	60	Mersen HSJ60 (3)	3000
B042	3	15	10	45	90	Mersen HSJ90 (3)	4800
B052	3	20	15	55	100	Mersen HSJ100 (3)	4800
B070	4	25	20	75.3	150	Mersen HSJ150 (3)	7000
B080	4	30	25	85.8	175	Mersen HSJ175 (3)	7000
N104 (4)	5	40	30	114.1	225	Mersen HSJ225 (3)	9000
N130 (1)	5	50	40	142.6	250	Mersen HSJ250 (3)	12,000
N154 (1)	6	60	50	169	300	Mersen HSJ300 (3)	13,800
N192 (1)	6	75	60	210.6	400	Mersen HSJ400 (3)	16,800
N260 (1)	6	100	75	272.1	400	Mersen HSJ400 (3)	16,800

(1) The power source to Common Bus inverters must be derived from AC voltages 600V or less, as defined in NFPA70; Art 430-18 (NEC). Battery supplies or MG sets are not included. The following devices were validated to break current of the derived power DC Bus: *Disconnects*: Allen-Bradley Bulletin No. 1494, 30 to 400 A; Bulletin No. 194, 30 to 400 A, or ABB: OESA, 600 & 800 A; OESL, all sizes. *Fuses:* Mersen Type HSJ, all sizes. For any other devices, please contact technical support.

(2) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.

(3) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
- 600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
- Time constant minimum 3 milliseconds (maximum 15 milliseconds).
- No overload protection required.
- Let thru must be less than rating of the conductors.
- This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

(4) Catalog number corresponds to drives with precharge only.

540 Volt DC Input Fuses

Table 4 - PowerFlex 40P Drives, 540V DC Input Fuses

Drive Cat. No. 22D...	kW Rating	DC Input Amps	Non-Time Delay Fuse		Drive DC Bus Capacitance (µF)
			Amps	Catalog No.	
D1P4	0.4	1.4	3	Bussmann JKS-3 (1)	90
D2P3	0.75	2.2	6	Bussmann JKS-6 (1)	135
D4P0	1.5	4.1	10	Bussmann JKS-10 (1)	235
D6P0	2.2	6.4	15	Mersen HSJ15 (2)	280
D010	4	11.6	25	Mersen HSJ25 (2)	600
D012	5.5	13.4	25	Mersen HSJ25 (2)	705
D017	7.5	19.4	40	Mersen HSJ40 (2)	940
D024	11	28.0	50	Mersen HSJ50 (2)	1120

(1) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.

(2) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
- 600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
- Time constant minimum 3 milliseconds (maximum 15 milliseconds).
- No overload protection required.
- Let thru must be less than rating of the conductors.
- This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

Table 5 - PowerFlex 520-Series Drives, 540V DC Input Fuses

Drive Cat. No. 25x (1)	kW Rating		DC Input Amps	Non-Time Delay Fuse		Drive DC Bus Capacitance (µF)
	ND	HD		Amps	Catalog No.	
D1P4	0.4	0.4	1.3	3	Bussmann JKS-3 (2)	74
D2P3	0.75	0.75	2.2	6	Bussmann JKS-6 (2)	108
D4P0	1.5	1.5	3.8	8	Bussmann JKS-8 (2)	192
D6P0	2.2	2.2	5.7	15	Mersen HSJ15 (3)	282
D010	4.0	4.0	11.1	25	Mersen HSJ25 (3)	557
D013	5.5	5.5	13.8	30	Mersen HSJ30 (3)	676
D017	7.5	7.5	18.7	40	Mersen HSJ40 (3)	816
D024	11.0	11.0	26.7	50	Mersen HSJ50 (3)	1200
D030	15.0	11.0	33.7	50	Mersen HSJ50 (3)	1500
D037	18.5	15.0	42.1	70	Mersen HSJ70 (3)	1399
D043	22.0	18.5	49.5	80	Mersen HSJ80 (3)	1699

(1) The drive catalog number prefix is 25A for PowerFlex 523 drives, and 25B for PowerFlex 525 drives.

(2) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.

(3) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
- 600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
- Time constant minimum 3 milliseconds (maximum 15 milliseconds).
- No overoverload protection required.
- Let thru must be less than rating of the conductors.
- This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

Table 6 - PowerFlex 700/700S Drives — Frames 0...6, 540V DC Input Fuses

Drive Cat. No. 20B... / 20D...	Frame Size	kW Rating		DC Input Rating	Non-Time Delay Fuse(1)		Drive DC Bus Capacitance (µF)
		ND	HD	Amps	Amps	Catalog No.	
C1P3	0	0.37	0.25	1.3	3	Bussmann JKS-3 (2)	110
C2P1	0/1	0.75	0.55	2.1	6	Bussmann JKS-6 (2)	110
C3P5	0/1	1.5	1.1	3.7	8	Bussmann JKS-8 (2)	165
C5P0	0/1	2.2	1.5	5.3	10	Bussmann JKS-10 (2)	280
C8P7	0/1	4	3.0	9.3	15	Mersen HSJ15 (3)	330
C011	0/1	5.5	4	12.6	20	Mersen HSJ20 (3)	560
C015	1	7.5	5.5	16.8	25	Mersen HSJ25 (3)	680
C022	1	11	7.5	24	40	Mersen HSJ40 (3)	1000
C030	2	15	11	33.2	50	Mersen HSJ50 (3)	1200
C037	2	18.5	15	40.9	70	Mersen HSJ70 (3)	1500
C043	3	22	18.5	47.5	90	Mersen HSJ90 (3)	1800
C056	3	30	22	61.9	100	Mersen HSJ100 (3)	2400
C072	3	37	30	80.5	125	Mersen HSJ125 (3)	3000
C085	4	45	37	95.1	150	Mersen HSJ150 (3)	3500
H105 (4)	5	55	—	120.2	175	Mersen HSJ175 (3)	4500
		—	45	95.1	175	Mersen HSJ175 (3)	
H125 (4)	5	55	—	120.2	200	Mersen HSJ200 (3)	6000
		—	45	95.1	200	Mersen HSJ200 (3)	
H140 (4)	5	75	—	159	250	Mersen HSJ250 (3)	6000
		—	55	120.2	250	Mersen HSJ250 (3)	
H170 (4)	6	90	—	192	350	Mersen HSJ350 (3)	6900
		—	75	159	350	Mersen HSJ350 (3)	
H205 (4)	6	110	—	226	350	Mersen HSJ350 (3)	8400
		—	90	192	350	Mersen HSJ350 (3)	
H260 (4)	6	132	—	298	400	Mersen HSJ400 (3)	8400
		—	110	226	400	Mersen HSJ400 (3)	

(1) The power source to Common Bus inverters must be derived from AC voltages 600V or less, as defined in NFPA70; Art 430-18 (NEC). Battery supplies or MG sets are not included. The following devices were validated to break current of the derived power DC Bus: *Disconnects*: Allen-Bradley Bulletin No. 1494, 30 to 400 A; Bulletin No. 194, 30 to 400 A, or ABB: OESA, 600 & 800 A; OESL, all sizes. *Fuses*: Bussmann Type JKS, all sizes; Type 170M, Case Sizes 1, 2 and 3, or Mersen Type HSJ, all sizes. For any other devices, please contact technical support.

(2) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.

(3) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
- 600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
- Time constant minimum 3 milliseconds (maximum 15 milliseconds).
- No overoverload protection required.
- Let thru must be less than rating of the conductors.
- This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

(4) Also applies to 'P' voltage class. Fuses must be applied in the (+) leg and (-) leg of the DC Common Bus.

Table 7 - PowerFlex 700 Drives — Frames 7...10, 540V DC Input Fuses

Drive Cat. No. 20B...	Frame Size	kW Rating		DC Input Rating		Non-Time Delay Fuse		Drive DC Bus Capacitance (µF)
		ND	HD	Amps	kW	Amps	Catalog No.	
P292	7	160	—	342	185	630	Bussmann 170M6608 (1)	15,000
		—	150	309	166	630	Bussmann 170M6608 (1)	
P325	7	180	—	381	206	800	Bussmann 170M6612 (1)	15,000
		—	180	381	206	800	Bussmann 170M6612 (1)	
P365	8	200	—	428	231	800	Bussmann 170M6612 (1)	20,700
		—	180	381	206	800	Bussmann 170M6612 (1)	
P415	8	240	—	487	262	800	Bussmann 170M6612 (1)	20,700
		—	200	428	231	800	Bussmann 170M6612 (1)	
P481	8	280	—	564	304	900	Bussmann 170M6613 (1)	20,700
		—	240	487	262	900	Bussmann 170M6613 (1)	
P535	8	300	—	627	338	1000	Bussmann 170M6614 (1)	20,700
		—	280	564	304	1000	Bussmann 170M6614 (1)	
P600	8	350	—	703	379	1200 (2)	Bussmann 170M6616 (1)	20,700
		—	300	627	338	1200 (2)	Bussmann 170M6616 (1)	
P730	9	400	—	855	461	1400 (3)	Bussmann 170M6617 (1)	20,700
		—	350	703	379	1400	Bussmann 170M6617 (1)	
H875 No Precharge	10	500	—	1025	553	2 x 800	Bussmann 170M6612 (1)	29,900
		—	400	820	443	2 x 800	Bussmann 170M6612 (1)	

(1) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.
(2) Two 630A Bussmann 170M6608 fuses can also be used.
(3) Two 700A Bussmann 170M6611 fuses can also be used.

Table 8 - PowerFlex 750-Series Drives — Frames 2...7, 540V DC Input Fuses

Drive Cat. No. 20F.../20G...	Frame Size	kW Rating		DC Input Rating		Non-Time Delay Fuse		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	kW	Amps	Catalog No.		
C2P1	2	0.75	—	2.1	1.1	6	Bussmann JKS-6	705	41.25
		—	0.75	2.1	1.1	6	Bussmann JKS-6		
C3P5	2	1.5	—	3.7	2	8	Bussmann JKS-8	705	41.25
		—	1.5	3.7	2	8	Bussmann JKS-8		
C5P0	2	2.2	—	5.3	2.9	10	Bussmann JKS-10	705	41.25
		—	2.2	5.3	2.9	10	Bussmann JKS-10		
C8P7	2	4	—	9.3	5	15	Mersen HSJ15	705	41.25
		—	4	9.3	5	15	Mersen HSJ15		
C011	2	5.5	—	12.6	6.8	20	Mersen HSJ20	705	41.25
		—	5.5	12.6	6.8	20	Mersen HSJ20		
C015	2	7.5	—	17.0	9.2	25	Mersen HSJ25 (1)	705	41.25
		—	5.5	12.6	6.8	20	Mersen HSJ20		
C022	2	11	—	24.6	13.3	40	Mersen HSJ40 (2)	1020	255
		—	7.5	17.0	9.2	25	Mersen HSJ25 (1)		
C030	3	15	—	33.6	18.1	50	Mersen HSJ50 (1)	1200	300
		—	11	24.6	13.3	40	Mersen HSJ40 (1)		
C037	3	18.5	—	41.4	22.3	70	Mersen HSJ70 (1)	1500	375
		—	15	33.6	18.1	50	Mersen HSJ50 (1)		
C043	3	22	—	48.1	26.0	90	Mersen HSJ90 (1)	1800	450
		—	18.5	41.4	22.3	70	Mersen HSJ70 (1)		
C060	4	30	—	67.1	36.2	100	Mersen HSJ100 (1)	2400	600
		—	22	48.1	26.0	90	Mersen HSJ90 (1)		
C072	4	37	—	82.4	44.5	125	Mersen HSJ125 (1)	3000	750
		—	30	67.1	36.2	100	Mersen HSJ100 (1)		
C072	5	37	—	82.4	44.5	125	Mersen HSJ125 (1)	3600	900
		—	30	67.1	36.2	100	Mersen HSJ100 (1)		
C085	5	45	—	97.3	52.5	150	Mersen HSJ150 (1)	3600	900
		—	37	82.4	44.5	125	Mersen HSJ125 (1)		
C104	5	55	—	120.2	64.9	175	Mersen HSJ175 (1)	4500	1125
		—	45	97.3	52.5	150	Mersen HSJ150 (1)		
C104	6	55		120.2	64.9	175	Mersen HSJ175 (1)	4600	1150
			45	97.3	52.5	150	Mersen HSJ150 (1)		
C140	6	75	—	160.3	86.5	250	Mersen HSJ250 (1)	4600	1150
		—	55	120.2	64.9	175	Mersen HSJ175 (1)		
C170	6	90	—	194.6	105.1	350	Mersen HSJ350 (1)	9200	2300
		—	75	160.3	86.5	250	Mersen HSJ250 (1)		
C205	6	110	—	234.7	126.7	350	Mersen HSJ350	9200	2300
		—	90	194.6	105.1	350	Mersen HSJ350 (1)		
C260	6	132	—	297.7	160.7	400	Mersen HSJ400 (1)	9200	2300
		—	110	234.7	126.7	350	Mersen HSJ350 (1)		
C260	7	132	—	297.7	160.8	400	Mersen HSJ450 (1)	13800	3450
		—	110	234.7	126.7	350	Mersen HSJ350 (1)		
C302	7	160	—	345.7	186.7	630	Bussmann 170M6608 (3)	13800	3450
		—	132	297.7	160.7	400	Mersen HSJ450 (1)		

Table 8 - PowerFlex 750-Series Drives — Frames 2...7, 540V DC Input Fuses (Continued)

Drive Cat. No. 20F.../20G...	Frame Size	kW Rating		DC Input Rating		Non-Time Delay Fuse		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	kW	Amps	Catalog No.		
C367	7	200	—	420.2	226.9	800	Bussmann 170M6612 (3)	13800	3450
		—	160	345.7	186.7	630	Bussmann 170M6608 (3)		
C456	7	250	—	522.0	281.9	900	Bussmann 170M6613 (3)	18400	4600
		—	200	420.2	226.9	800	Bussmann 170M6612 (3)		
C477	7	270	—	546	294.8	900	Bussmann 170M6613 (3)	18400	4600
		—	200	420.2	226.9	800	Bussmann 170M6612 (3)		

(1) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
Time constant minimum 3 milliseconds (maximum 15 milliseconds).
No overoverload protection required.
Let thru must be less than rating of the conductors.
This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

(2) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
- 600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
- Time constant minimum 3 milliseconds (maximum 15 milliseconds).
- No overoverload protection required.
- Let thru must be less than rating of the conductors.
- This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

(3) See Fuse Certification and Test Data on page 129 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.

Table 9 - PowerFlex 750-Series Drives — Frames 8...10, 540V DC Input Fuses

Drive Cat. No. 20G...[1]	Frame Size	kW Rating		DC Input Rating		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	kW		
C460	8	250	—	529	285.7	23,700	65,175
		—	200	443	239.2		
C540	8	315	—	621	335.3	23,700	65,175
		—	250	525	283.5		
C567	8	315	—	652	352.1	23,700	65,175
		—	250	543	293.2		
C650	8	355	—	748	403.9	35,550	97,762.5
		—	315	621	335.3		
C750	8	400	—	863	466.0	35,550	97,762.5
		—	315	673	363.4		
C770	8	400	—	886	478.4	35,550	97,762.5
		—	355	739	399.1		
C910	9	500	—	1047	565.4	47,400	41,475
		—	400	863	466.0		
C1K0	9	560	—	1197	646.4	47,400	41,475
		—	500	1013	547.0		
C1K1	9	630	—	1254	677.2	47,400	41,475
		—	500	1047	565.4		
C1K2	9	710	—	1352	730.1	71,100	62,212.5
		—	560	1197	646.4		
C1K4	9	800	—	1686	910.4	71,100	62,212.5
		—	630	1254	677.2		
C1K5	9	850	—	1703	919.6	71,100	62,212.5
		—	710	1352	730.1		
C1K6	10	900	—	1830	988.2	71,100	62,212.5
		—	710	1525	823.5		
C2K1	10	1250	—	2474	1336.0	106,650	26,662.5
		—	1000	2071	1118.3		

(1) These drives have factory-installed fusing.

Table 10 - PowerFlex 700H/700S Drives — Frames 9...14, 540V DC Input Fuses

Drive Cat. No. 20C... / 20D...	Frame Size	kW Rating		DC Input Rating	Fuse		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	Amps	Catalog No.		
H261	9	132	—	307	500	Bussmann 170M6608 (1)	6600	0
		—	110	241	500	Bussmann 170M6608 (1)		
H300	9	160	—	353	630	Bussmann 170M6610 (1)	6600	0
		—	132	288	630	Bussmann 170M6610 (1)		
H385	10	200	—	453	700	Bussmann 170M6611 (1)	9900	26,400
		—	160	353	700	Bussmann 170M6611 (1)		
H460	10	250	—	541	900	Bussmann 170M6613 (1)	9900	26,400
		—	200	453	900	Bussmann 170M6613 (1)		
H500	10	250	—	589	500 (2 per phase)	Bussmann 170M6608 (1)	9900	26,400
		—	250	494	500 (2 per phase)	Bussmann 170M6608 (1)		
H590	11	315	—	695	550 (2 per phase)	Bussmann 170M6609 (1)	14,850	21,450
		—	250	612	550 (2 per phase)	Bussmann 170M6609 (1)		
H650	11	355	—	765	630 (2 per phase)	Bussmann 170M6610 (1)	14,850	21,450
		—	315	695	630 (2 per phase)	Bussmann 170M6610 (1)		
H730	11	400	—	859	700 (2 per phase)	Bussmann 170M6611 (1)	14,850	21,450
		—	355	765	700 (2 per phase)	Bussmann 170M6611 (1)		
H820	12	450	—	965	700 (2 per phase)	Bussmann 170M6611 (1)	19,800	16,500
		—	400	859	700 (2 per phase)	Bussmann 170M6611 (1)		
H920	12	500	—	1083	550 (3 per phase)	Bussmann 170M6609 (1)	19,800	16,500
		—	450	965	550 (3 per phase)	Bussmann 170M6609 (1)		
H1K0	12	560	—	1213	630 (3 per phase)	Bussmann 170M6610 (1)	19,800	16,500
		—	500	1083	630 (3 per phase)	Bussmann 170M6610 (1)		
H1K1	13	630	—	1354	2400	Bussmann 170M7107 (1)	29,700 (2)	0
		—	560	1213	2400	Bussmann 170M7107 (1)		
H1K3	13	710	—	1530	2400	Bussmann 170M7107 (1)	29,700 (2)	0
		—	630	1354	2400	Bussmann 170M7107 (1)		
H1K4	13	800	—	1707	2400	Bussmann 170M7107 (1)	29,700 (2)	0
		—	710	1413	2400	Bussmann 170M7107 (1)		
H1K7	14	1000	—	2084	—	Bussmann 170M8610 (1)	50,400 (3)	0
		—	900	1883	—	Bussmann 170M8610 (1)		
H2K1	14	1200	—	2531	—	Bussmann 170M8610 (1)	50,400 (3)	0
		—	1100	2284	—	Bussmann 170M8610 (1)		
H2K7	14	1600	—	3178	—	Bussmann 170M8610 (1)	50,400 (3)	0
		—	1300	2708	—	Bussmann 170M8610 (1)		

(1) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.
(2) This listed capacitance is for Frame 13 Series B DC fed drives. For Frame 13 Series A DC fed drives, the capacitance is 50,400 µF. For Frame 13 Series B AC fed drives, the capacitance is 36,300 µF.
(3) The listed capacitance is for Frame 14 DC fed drives. For Frame 14 AC fed drives, the capacitance is 72,600 µF.

Table 11 - PowerFlex 700L Drives — Frames 2, 3A, and 3B, 540V DC Input Fuses

Drive Cat. No. 20L...	Frame Size	kW Rating		DC Input Rating	Fuse		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	Amps	Catalog No.		
C360	2	200	150	N/A (1)	N/A (1)	N/A (1)	13,500	21,850
C650	3A	370	270	1250 (2)	2000	Bussmann 170M6621 (3) (4)	16,200	19,150 (5)
C1K2	3B	715	525	1250	2000	Bussmann 170M6621 (3) (4)	34,400 (6)	38,301 (5)

(1) The PowerFlex 700L Frame 2 is not available as a DC input inverter.
(2) Only the Dual Inverter for PowerFlex 700L Frame 3A is available as a DC input inverter.
(3) Two 1000A Bussmann 170M6614 fuses per phase can also be used.
(4) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.
(5) This value applies to the precharge of the Frame 3A and 3B complete regenerative drives. There is a field-installed input filter precharge resistor kit (20L-RESPRE-A1) for the Frame 3A and 3B complete drives that can be used to increase the maximum external DC bus capacitance. For details, see publication 20L-IN010.
(6) This 34,400 µF is the drive DC bus capacitance for a complete Frame 3B drive. For a Frame 3B common bus inverter, the bus capacitance is 16,200 µF.

650 Volt DC Input Fuses

Table 12 - PowerFlex 40P Drives, 650V DC Input Fuses

Drive Cat. No. 22D...	HP Rating	DC Input Amps	Non-Time Delay Fuse		Drive DC Bus Capacitance (µF)
			Amps	Catalog No.	
D1P4	0.5	1.3	3	Bussmann JKS-3 (1)	90
D2P3	1	2.1	6	Bussmann JKS-6 (1)	135
D4P0	2	3.6	8	Bussmann JKS-8 (1)	235
D6P0	3	5.4	15	Mersen HSJ15 (2)	280
D010	5	10.6	25	Mersen HSJ25 (2)	600
D012	7.5	12.1	25	Mersen HSJ25 (2)	705
D017	10	17.8	40	Mersen HSJ40 (2)	940
D024	15	25.4	50	Mersen HSJ50 (2)	1120

(1) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.
(2) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
- 600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
- Time constant minimum 3 milliseconds (maximum 15 milliseconds).
- No overoverload protection required.
- Let thru must be less than rating of the conductors.
- This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

Table 13 - PowerFlex 520-Series Drives, 650V DC Input Fuses

Drive Cat. No. 25x (1)	HP Rating		DC Input Amps	Non-Time Delay Fuse		Drive DC Bus Capacitance (µF)
	ND	HD		Amps	Catalog No.	
D1P4	0.5	0.5	1.3	3	Bussmann JKS-3 (2)	74
D2P3	1.0	1.0	2.1	6	Bussmann JKS-6 (2)	108
D4P0	2.0	2.0	3.7	8	Bussmann JKS-8 (2)	192
D6P0	3.0	3.0	5.5	15	Mersen HSJ15 (3)	282
D010	5.0	5.0	10.6	20	Mersen HSJ20 (3)	557
D013	7.5	7.5	13.2	25	Mersen HSJ25 (3)	676
D017	10.0	10.0	17.9	40	Mersen HSJ40 (3)	816
D024	15.0	15.0	25.6	50	Mersen HSJ50 (3)	1200
D030	20.0	15.0	32.3	50	Mersen HSJ50 (3)	1500
D037	25.0	20.0	40.3	60	Mersen HSJ60 (3)	1399
D043	30.0	25.0	47.4	80	Mersen HSJ80 (3)	1699

(1) The drive catalog number prefix is 25A for PowerFlex 523 drives, and 25B for PowerFlex 525 drives.
(2) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.
(3) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
- 600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
- Time constant minimum 3 milliseconds (maximum 15 milliseconds).
- No overload protection required.
- Let thru must be less than rating of the conductors.
- This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

Table 14 - PowerFlex 700/700S Drives — Frames 0...6, 650V DC Input Fuses

Drive Cat. No. 20B... / 20D...	Frame Size	HP Rating		DC Input Ratings	Non-Time Delay Fuse (1)		Drive DC Bus Capacitance (µF)
		ND	HD	Amps	Amps	Catalog No.	
D1P1	0	0.5	0.33	1.0	3	Bussmann JKS-3 (2)	110
D2P1	0/1	1	0.75	1.9	6	Bussmann JKS-6 (2)	110
D3P4	0/1	2	1.5	3.0	6	Bussmann JKS-6 (2)	165
D5P0	0/1	3	2	4.5	10	Bussmann JKS-10 (2)	280
D8P0	0/1	5	3	8.1	15	Mersen HSJ15 (3)	330
D011	0/1	7.5	5	11.1	20	Mersen HSJ20 (3)	560
D014	1	10	7.5	14.6	30	Mersen HSJ30 (3)	680
D022	1	15	10	23.3	40	Mersen HSJ40 (3)	1000
D027	2	20	15	28.9	50	Mersen HSJ50 (3)	1200
D034	2	25	20	36.4	60	Mersen HSJ60 (3)	1500
D040	3	30	25	42.9	80	Mersen HSJ80 (3)	1800
D052	3	40	30	55.7	90	Mersen HSJ90 (3)	2400
D065	3	50	40	69.6	100	Mersen HSJ100 (3)	3000
D077	4	60	50	84.5	150	Mersen HSJ150 (3)	3500
J096 (4)	5	75	—	105.3	175	Mersen HSJ175 (3)	4500
		—	60	84.5	175	Mersen HSJ175 (3)	
J125 (4)	5	100	—	137.1	200	Mersen HSJ200 (3)	6000
		—	75	105.3	200	Mersen HSJ200 (3)	
J140 (4)	5	100	—	137	250	Mersen HSJ250 (3)	6000
		—	75	105.3	250	Mersen HSJ250 (3)	
J156 (4)	6	125	—	171	300	Mersen HSJ300 (3)	6900
		—	100	137.1	300	Mersen HSJ300 (3)	
J180 (4)	6	150	—	198	400	Mersen HSJ400 (3)	8400
		—	125	171.2	400	Mersen HSJ400 (3)	
J248 (4)	6	200	—	272	400	Mersen HSJ400 (3)	8400
		—	150	198	400	Mersen HSJ400 (3)	

(1) The power source to Common Bus inverters must be derived from AC voltages 600V or less, as defined in NFPA70; Art 430-18 (NEC). Battery supplies or MG sets are not included. The following devices were validated to break current of the derived power DC Bus: *Disconnects*: Allen-Bradley Bulletin No. 1494, 30 to 400 A; Bulletin No. 194, 30 to 400 A, or ABB: OESA, 600 & 800 A; OESL, all sizes. *Fuses*: Bussmann Type JKS, all sizes; Type 170M, Case Sizes 1, 2 and 3, or Mersen Type HSJ, all sizes. For any other devices, please contact technical support.

(2) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.

(3) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
- 600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
- Time constant minimum 3 milliseconds (maximum 15 milliseconds).
- No overload protection required.
- Let thru must be less than rating of the conductors.
- This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

(4) Also applies to 'R' voltage class. Fuses must be applied in the (+) leg and (-) leg of the DC Common Bus.

Table 15 - PowerFlex 700 Drives — Frames 7...10, 650V DC Input Fuses

Drive Cat. No. 20B...	Frame Size	HP Rating		DC Input Rating		Non-Time Delay Fuse		Drive DC Bus Capacitance (µF)
		ND	HD	Amps	kW	Amps	Catalog No.	
R292	7	250	—	328	212	630	Bussmann 170M6608 (1)	15,000
		—	200	296	191	630	Bussmann 170M6608 (1)	
R325	7	250	—	365	236	800	Bussmann 170M6612 (1)	15,000
		—	250	365	236	800	Bussmann 170M6612 (1)	
R365	8	300	—	410	265	800	Bussmann 170M6612 (1)	20,700
		—	250	365	236	800	Bussmann 170M6612 (1)	
R415	8	350	—	466	302	800	Bussmann 170M6612 (1)	20,700
		—	300	410	265	800	Bussmann 170M6612 (1)	
R481	8	400	—	540	350	900	Bussmann 170M6613 (1)	20,700
		—	350	466	302	900	Bussmann 170M6613 (1)	
R535	8	450	—	601	389	1000	Bussmann 170M6614 (1)	20,700
		—	400	540	350	1000	Bussmann 170M6614 (1)	
R600	8	500	—	674	436	1200 (2)	Bussmann 170M6616 (1)	20,700
		—	450	601	389	1200 (2)	Bussmann 170M6616 (1)	
R730	9	600	—	820	533	1400 (3)	Bussmann 170M6617 (1)	20,700
		—	500	674	436	1400	Bussmann 170M6617 (1)	
J875 No precharge	10	700	—	983	636	2 x 800	Bussmann 170M6612 (1)	29,900
		—	600	786	509	2 x 800	Bussmann 170M6612 (1)	

(1) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.
(2) Two 630A Bussmann 170M6608 fuses can also be used.
(3) Two 700A Bussmann 170M6611 fuses can also be used.

Table 16 - PowerFlex 700H/700S Drives — Frames 9...14, 650V DC Input Fuses

Drive Cat. No. 20C... / 20D...	Frame Size	HP Rating		DC Input Rating	Fuse		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	Amps	Catalog No.		
J261	9	200	–	294	500	Bussmann 170M6608 (1)	6600	0
		–	150	231	500	Bussmann 170M6608 (1)		
J300	9	250	–	338	630	Bussmann 170M6610 (1)	6600	0
		–	200	294	630	Bussmann 170M6610 (1)		
J385	10	300	–	434	700	Bussmann 170M6611 (1)	9900	26,400
		–	250	338	700	Bussmann 170M6611 (1)		
J460	10	350	–	519	900	Bussmann 170M6613 (1)	9900	26,400
		–	300	434	900	Bussmann 170M6613 (1)		
J500	10	450	–	564	500 (2 per phase)	Bussmann 170M6608 (1)	9900	26,400
		–	350	474	500 (2 per phase)	Bussmann 170M6608 (1)		
J590	11	500	–	666	550 (2 per phase)	Bussmann 170M6609 (1)	14,850	21,450
		–	450	587	550 (2 per phase)	Bussmann 170M6609 (1)		
J650	11	500	–	733	630 (2 per phase)	Bussmann 170M6610 (1)	14,850	21,450
		–	500	666	630 (2 per phase)	Bussmann 170M6610 (1)		
J730	11	600	–	824	700 (2 per phase)	Bussmann 170M6611 (1)	14,850	21,450
		–	500	733	700 (2 per phase)	Bussmann 170M6611 (1)		
J820	12	700	–	925	700 (2 per phase)	Bussmann 170M6611 (1)	19,800	16,500
		–	600	824	700 (2 per phase)	Bussmann 170M6611 (1)		
J920	12	800	–	1038	550 (3 per phase)	Bussmann 170M6609 (1)	19,800	16,500
		–	700	925	550 (3 per phase)	Bussmann 170M6609 (1)		
J1K0	12	900	–	1162	630 (3 per phase)	Bussmann 170M6610 (1)	19,800	16,500
		–	800	1038	630 (3 per phase)	Bussmann 170M6610 (1)		
J1K1	13	1000	–	1297	2400	Bussmann 170M7107 (1)	29,700 (2)	0
		–	900	1162	2400	Bussmann 170M7107 (1)		
J1K3	13	1200	–	1467	2400	Bussmann 170M7107 (1)	29,700 (2)	0
		–	1000	1297	2400	Bussmann 170M7107 (1)		
J1K4	13	1250	–	1636	2400	Bussmann 170M7107 (1)	29,700 (2)	0
		–	1000	1354	2400	Bussmann 170M7107 (1)		
J1K7	14	1500	–	1997	–	Bussmann 170M8610 (1)	50,400 (3)	0
		–	1400	1805	–	Bussmann 170M8610 (1)		
J2K1	14	1900	–	2425	–	Bussmann 170M8610 (1)	50,400 (3)	0
		–	1700	2189	–	Bussmann 170M8610 (1)		
J2K7	14	2300	–	3046	–	Bussmann 170M8610 (1)	50,400 (3)	0
		–	2000	2595	–	Bussmann 170M8610 (1)		

(1) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.
(2) This listed capacitance is for Frame 13 Series B DC fed drives. For Frame 13 Series A DC fed drives, the capacitance is 50,400 µF. For Frame 13 Series B AC fed drives, the capacitance is 36,300 µF.
(3) The listed capacitance is for Frame 14 DC fed drives. For Frame 14 AC fed drives, the capacitance is 72,600 µF.

Table 17 - PowerFlex 700L Drives — Frames 2, 3A, and 3B, 650V DC Input Fuses

Drive Cat. No. 20L...	Frame Size	HP Rating		DC Input Rating	Fuse		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	Amps	Catalog No.		
D360	2	300	235	N/A (1)	N/A (1)	N/A (1)	13,500	11,049
D650	3A	600	440	1250 (2)	2000	Bussmann 170M6621 (3) (4)	16,200	8,349 (5)
D1K2	3B	1150	845	1250	2000	Bussmann 170M6621 (3) (4)	34,400 (6)	16,698 (5)

(1) The PowerFlex 700L Frame 2 is not available as a DC input inverter.
(2) Only the Dual Inverter for PowerFlex 700L Frame 3A is available as a DC input inverter.
(3) Two 1000A Bussmann 170M6614 fuses per phase can also be used.
(4) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.
(5) This value applies to the precharge of the Frame 3A and 3B complete regenerative drives. There is a field-installed input filter precharge resistor kit (20L-RESPRE-A1) for the Frame 3A and 3B complete drives that can be used to increase the maximum external DC bus capacitance. For details, see publication 20L-IN010.
(6) This 34,400 µF is the drive DC bus capacitance for a complete Frame 3B drive. The Frame 3B DC input inverter bus capacitance is 16,200 µF.

Table 18 - PowerFlex 750-Series Drives — Frames 2...7, 650V DC Input Fuses

Drive Cat. No. 20F.../20G...	Frame Size	HP Rating		DC Input Rating		Non-Time Delay Fuse		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	kW	Amps	Catalog No.		
D2P1	2	1.0	—	1.9	1.2	6	Bussmann JKS-6	705	176
		—	1.0	1.9	1.2	6	Bussmann JKS-6		
D3P4	2	2.0	—	3	2	6	Bussmann JKS-6	705	176
		—	2.0	3	2	6	Bussmann JKS-6		
D5P0	2	3.0		4.5	2.9	10	Bussmann JKS-10	705	176
			3.0	4.5	2.9	10	Bussmann JKS-10		
D8P0	2	5.0		8.1	5.3	15	Mersen HSJ15	705	176
			5.0	4.5	2.9	15	Mersen HSJ15		
D011	2	7.5		11.1	7.2	20	Mersen HSJ20	705	176
			7.5	11.1	7.2	20	Mersen HSJ20		
D014	2	10		14.7	9.5	30	Mersen HSJ30	705	176
			7.5	11.1	7.2	20	Mersen HSJ20		
D022	2	15	—	23.3	15.1	40	Mersen HSJ40 (1)	1020	255
		—	10	14.7	9.5	30	Mersen HSJ30 (1)		
D027	3	20	—	28.9	18.8	50	Mersen HSJ50 (1)	1230	308
		—	15	23.3	15.1	40	Mersen HSJ40 (1)		
D034	3	25	—	36.4	23.6	60	Mersen HSJ60 (1)	1500	375
		—	20	28.9	18.8	50	Mersen HSJ50 (1)		
D040	3	30	—	42.9	27.8	80	Mersen HSJ80 (1)	1800	450
		—	25	36.4	23.6	60	Mersen HSJ60 (1)		
D052	4	40	—	55.7	36.1	90	Mersen HSJ90 (1)	2400	600
		—	30	42.9	27.8	80	Mersen HSJ80 (1)		
D065	4	50	—	69.7	45.1	100	Mersen HSJ100 (1)	3000	750
		—	40	55.7	36.1	90	Mersen HSJ90 (1)		
D065	5	50	—	69.7	45.3	100	Mersen HSJ100 (1)	3600	900
		—	40	55.7	36.2	90	Mersen HSJ90 (1)		
D077	5	60	—	84.5	54.7	150	Mersen HSJ150 (1)	3600	900
		—	50	69.7	45.1	100	Mersen HSJ100 (1)		
D096	5	75	—	105.3	68.3	175	Mersen HSJ175 (1)	4500	1125
		—	60	84.5	54.7	150	Mersen HSJ150 (1)		
D096	6	75	—	105.3	68.4	175	Mersen HSJ175 (1)	4600	1150
		—	60	84.5	54.9	150	Mersen HSJ150 (1)		
D125	6	100	—	137.1	88.9	200	Mersen HSJ200 (1)	4600	1150
		—	75	105.3	68.3	175	Mersen HSJ175 (1)		
D156	6	125	—	171.2	110.9	300	Mersen HSJ300 (1)	9200	2300
		—	100	137.1	88.9	200	Mersen HSJ200 (1)		
D186	6	150	—	204.1	132.2	400	Mersen HSJ400 (1)	9200	2300
		—	125	171.2	110.9	300	Mersen HSJ300 (1)		
D248	6	200	—	272.1	176.3	400	Mersen HSJ400 (1)	9200	2300
		—	150	204.1	132.2	400	Mersen HSJ400 (1)		
D248	7	200	—	272.1	176.9	400	Mersen HSJ400 (1)	13800	3450
		—	150	204.1	132.7	400	Mersen HSJ400 (1)		
D302	7	250	—	331.3	214.7	630	Bussmann 170M6608 (2)	13800	3450
		—	200	272.1	176.3	400	Mersen HSJ400 (1)		

Table 18 - PowerFlex 750-Series Drives — Frames 2...7, 650V DC Input Fuses (Continued)

Drive Cat. No. 20F.../20G...	Frame Size	HP Rating		DC Input Rating		Non-Time Delay Fuse		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	kW	Amps	Catalog No.		
D361	7	300	—	396.1	256.6	800	Bussmann 170M6612 (2)	13800	3450
		—	250	331.3	214.7	630	Bussmann 170M6608 (2)		
D415	7	350	—	455.3	295.0	900	Bussmann 170M6613 (2)	18400	4600
		—	300	396.1	256.6	800	Bussmann 170M6612 (2)		
D415	7	400	—	523.3	340.1	900	Bussmann 170M6613 (2)	18400	4600
		—	300	396.1	257.5	800	Bussmann 170M6612 (2)		

(1) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
- 600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
- Time constant minimum 3 milliseconds (maximum 15 milliseconds).
- No overoverload protection required.
- Let thru must be less than rating of the conductors.
- This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

(2) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing..

Table 19 - PowerFlex 750-Series Drives — Frames 8...10, 650V DC Input Fuses

Drive Cat. No. 20G...[1]	Frame Size	HP Rating		DC Input Rating		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	kW		
D430	8	350	—	473	307.5	23,700	65,175
		—	300	407	264.6		
D485	8	400	—	533	346.5	23,700	65,175
		—	350	455	295.8		
D545	8	450	—	599	389.4	23,700	65,175
		—	350	499	324.4		
D617	8	500	—	678	440.7	35,550	97,762.5
		—	400	533	346.5		
D710	8	600	—	781	507.7	35,550	97,762.5
		—	450	599	389.4		
D740	8	650	—	814	529.1	35,550	97,762.5
		—	500	678	440.7		
D800	9	700	—	880	572.0	47,400	41,475
		—	600	781	507.7		
D960	9	800	—	1055	685.8	47,400	41,475
		—	700	874	568.1		
D1K0	9	900	—	1149	746.9	47,400	41,475
		—	750	880	572.0		
D1K2	9	1000	—	1248	811.2	71,100	17,775
		—	800	1055	685.8		
D1K3	9	1100	—	1501	975.7	71,100	17,775
		—	900	1149	746.9		
D1K4	9	1250	—	1561	1014.7	71,100	17,775
		—	1000	1248	811.2		
D1K5	10	1350	—	1677	1090.1	71,100	17,775
		—	1100	1396	907.4		
D2K0	10	1750	—	2276	1479.4	106,650	26,662.5
		—	1650	1902	1236.3		

(1) These drives have factory-installed fusing.

810 Volt DC Input Fuses

Table 20 - PowerFlex 40P Drives, 810V DC Input Fuses

Drive Cat. No. 22D...	HP Rating	DC Input Amps	Non-Time Delay Fuse		Drive DC Bus Capacitance (µF)
			Amps	Catalog No.	
E1P7	1	1.5	6	Bussmann JKS-6 (1)	75
E3P0	2	2.7	6	Bussmann JKS-6 (1)	110
E4P2	3	3.8	10	Bussmann JKS-10 (1)	135
E6P6	5	6.7	15	Mersen HSJ15 (2)	280
E9P9	7.5	10.0	20	Mersen HSJ20 (2)	330
E012	10	12.8	25	Mersen HSJ25 (2)	440
E019	15	20.1	40	Mersen HSJ40 (2)	440

(1) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.

(2) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
- 600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
- Time constant minimum 3 milliseconds (maximum 15 milliseconds).
- No overload protection required.
- Let thru must be less than rating of the conductors.
- This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

Table 21 - PowerFlex 520-Series Drives, 810V DC Input Fuses

Drive Cat. No. 25x (1)	HP Rating		DC Input Amps	Non-Time Delay Fuse		Drive DC Bus Capacitance (µF)
	ND	HD		Amps	Catalog No.	
E0P9	0.5	0.5	0.8	3	Bussmann JKS-3 (2)	50
E1P7	1.0	1.0	1.6	6	Bussmann JKS-6 (2)	75
E3P0	2.0	2.0	2.8	6	Bussmann JKS-6 (2)	111
E4P2	3.0	3.0	3.9	8	Bussmann JKS-8 (2)	134
E6P6	5.0	5.0	6.8	15	Mersen HSJ15 (3)	218
E9P9	7.5	7.5	10.1	20	Mersen HSJ20 (3)	327
E012	10.0	10.0	12.6	25	Mersen HSJ25 (3)	396
E019	15.0	15.0	20.1	40	Mersen HSJ40 (3)	589
E022	20.0	15.0	23.6	40	Mersen HSJ40 (3)	836
E027	25.0	20.0	29.3	50	Mersen HSJ50 (3)	783
E032	30.0	25.0	35.1	60	Mersen HSJ60 (3)	960

(1) The drive catalog number prefix is 25A for PowerFlex 523 drives, and 25B for PowerFlex 525 drives.

(2) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.

(3) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
- 600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
- Time constant minimum 3 milliseconds (maximum 15 milliseconds).
- No overload protection required.
- Let thru must be less than rating of the conductors.
- This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

Table 22 - PowerFlex 700/700S Drives — Frames 1...6, 810V DC Input Fuses

Drive Cat. No. 20B... / 20D...	Frame Size	HP Rating		DC Input Rating	Non-Time Delay Fuse (1)		Drive DC Bus Capacitance (µF)
		ND	HD	Amps	Amps	Catalog No.	
E1P7	0/1	1	0.75	1.5	3	Bussmann JKS-3 (2)	195
E2P7	0/1	2	1.5	2.4	6	Bussmann JKS-6 (2)	195
E3P9	0/1	3	2	3.5	6	Bussmann JKS-6 (2)	195
E6P1	0/1	5	3	6.2	10	Bussmann JKS-10 (2)	390
E9P0	0/1	7.5	5	9.1	15	Mersen HSJ15 (3)	390
E011	1	10	7.5	11.5	20	Mersen HSJ20 (3)	560
E017	1	15	10	18	30	Mersen HSJ30 (3)	560
E022	2	20	15	23.6	40	Mersen HSJ40 (3)	1000
E027	2	25	20	29	50	Mersen HSJ50 (3)	1200
E032	3	30	25	34.3	60	Mersen HSJ60 (3)	1400
E041	3	40	30	43.9	70	Mersen HSJ70 (3)	1800
E052	3	50	40	55.7	90	Mersen HSJ90 (3)	2400
E062	4	60	50	68.0	125	Mersen HSJ125 (3)	2400
T099	5	100	—	108.6	150	Mersen HSJ150 (3)	3500
		—	75	84.5	150	Mersen HSJ150 (3)	
T144	6	150	—	158	200	Mersen HSJ200 (3)	5000
		—	125	137.1	200	Mersen HSJ200 (3)	

(1) The power source to Common Bus inverters must be derived from AC voltages 600V or less, as defined in NFPA70; Art 430-18 (NEC). Battery supplies or MG sets are not included. The following devices were validated to break current of the derived power DC Bus: *Disconnects*: Allen-Bradley Bulletin No. 1494, 30 to 400 A; Bulletin No. 194, 30 to 400 A, or ABB: OESA, 600 & 800 A; OESL, all sizes. *Fuses*: Bussmann Type JKS, all sizes; Type 170M, Case Sizes 1, 2 and 3, or Mersen Type HSJ, all sizes. For any other devices, please contact technical support.

(2) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.

(3) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
- 600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
- Time constant minimum 3 milliseconds (maximum 15 milliseconds).
- No overload protection required.
- Let thru must be less than rating of the conductors.
- This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

Table 23 - PowerFlex 700H/700S Drives — Frames 9...14, 810V DC Input Fuses

Drive Cat. No. 20C... / 20D...	Frame Size	HP Rating		DC Input Rating	Fuse		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	Amps	Catalog No.		
K170	9	150	–	192	400	Bussmann 170M5608 (1)	3600	0
		–	150	162	400	Bussmann 170M5608 (1)		
K208	9	200	–	235	450	Bussmann 170M5609 (1)	3600	0
		–	150	192	450	Bussmann 170M5609 (1)		
K261	10	250	–	294	450	Bussmann 170M5609 (1)	7467	19,333
		–	200	235	450	Bussmann 170M5609 (1)		
K325	10	350	–	367	550	Bussmann 170M6609 (1)	7467	19,333
		–	250	294	550	Bussmann 170M6609 (1)		
K385	10	400	–	434	700	Bussmann 170M6611 (1)	7467	19,333
		–	350	367	700	Bussmann 170M6611 (1)		
K416	10	450	–	469	800	Bussmann 170M6612 (1)	7467	19,333
		–	350	367	800	Bussmann 170M6612 (1)		
K460	11	500	–	519	450 (2 per phase)	Bussmann 170M5609 (1)	11,200	15,600
		–	400	434	450 (2 per phase)	Bussmann 170M5609 (1)		
K502	11	500	–	566	500 (2 per phase)	Bussmann 170M6608 (1)	11,200	15,600
		–	500	519	500 (2 per phase)	Bussmann 170M6608 (1)		
K590	11	600	–	666	500 (2 per phase)	Bussmann 170M6608 (1)	11,200	15,600
		–	500	566	500 (2 per phase)	Bussmann 170M6608 (1)		
K650	12	700	–	733	500 (2 per phase)	Bussmann 170M6608 (1)	14,933	11,867
		–	650	666	500 (2 per phase)	Bussmann 170M6608 (1)		
K750	12	800	–	846	630 (2 per phase)	Bussmann 170M6610 (1)	14,933	11,867
		–	700	733	630 (2 per phase)	Bussmann 170M6610 (1)		
K820 (2)	12	900	–	925	630 (2 per phase)	Bussmann 170M6610 (1)	14,933	11,867
		–	700	733	630 (2 per phase)	Bussmann 170M6610 (1)		
K920	13	1000	–	1038	2400	Bussmann 170M7107 (1)	22,400 (3)	0
		–	900	925	2400	Bussmann 170M7107 (1)		
K1K0	13	1100	–	1162	2400	Bussmann 170M7107 (1)	22,400 (3)	0
		–	1000	1038	2400	Bussmann 170M7107 (1)		
K1K1	13	1300	–	1331	2400	Bussmann 170M7107 (1)	22,400 (3)	0
		–	1100	1162	2400	Bussmann 170M7107 (1)		
K1K5	14	1600	–	1692	–	Bussmann 170M8610 (1)	44,800 (4)	0
		–	1400	1467	–	Bussmann 170M8610 (1)		
K1K9	14	2000	–	2143	–	Bussmann 170M8610 (1)	44,800 (4)	0
		–	1600	1692	–	Bussmann 170M8610 (1)		
K2K2	14	2400	–	2538	–	Bussmann 170M8610 (1)	44,800 (4)	0
		–	2000	2143	–	Bussmann 170M8610 (1)		

(1) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.
(2) 20DK820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.
(3) This listed capacitance is for Frame 13 DC fed drives. For Frame 13 AC fed drives, the capacitance is 26,800 µF.
(4) The listed capacitance is for Frame 14 DC fed drives. For Frame 14 AC fed drives, the capacitance is 53,600 µF.

Table 24 - PowerFlex 700L Drives — Frames 3A and 3B, 810V DC Input Fuses

Drive Cat. No. 20L...	Frame Size	HP Rating		DC Input Rating	Fuse		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	Amps	Catalog No.		
E425	3A	465	345	850 (1)	1400	Bussmann 170M6701 (2) (3)	10,800	4,911 (4)
E800	3B	870	640	800	1250	Bussmann 170M6700 (3) (5)	21,600 (6)	9823 (4)
E1K1	3B	1275	935	1175	900 (2 per phase)	Bussmann 170M6697 (3)	21,600 (6)	9823 (4)

(1) Only the Dual Inverter for PowerFlex 700L Frame 3A is available as a DC input inverter.
(2) Two 700A Bussmann 170M6695 fuses per phase can also be used.
(3) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.
(4) This value applies to the precharge of the Frame 3A and 3B complete regenerative drives. There is a field-installed input filter precharge resistor kit (20L-RESPRE-A1) for the Frame 3A and 3B complete drives that can be used to increase the maximum external DC bus capacitance. For details, see publication 20L-IN010.
(5) Two 630A Bussmann 170M6694 fuses per phase can also be used.
(6) This 21,600 µF is the drive DC bus capacitance for a complete Frame 3B drive. The Frame 3B DC input inverter bus capacitance is 10,800 µF.

Table 25 - PowerFlex 750-Series Drives — Frames 3...7, 810V DC Input Fuses

Drive Cat. No. 20F.../20G...	Frame Size	HP Rating		DC Input Rating		Non-Time Delay Fuse		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	kW	Amps	Catalog No.		
E1P7	3	1	—	1.9	1.5	4	Bussmann JKS-4 (1)	1500	375
		—	0.5	1.0	0.8	2	Bussmann JKS-2 (1)		
E2P7	3	2	—	3.0	2.4	5	Bussmann JKS-5 (1)	1500	375
		—	1	1.9	1.5	4	Bussmann JKS-4 (1)		
E3P9	3	3	—	4.3	3.5	8	Bussmann JKS-8 (1)	1500	375
		—	2	3.0	2.4	5	Bussmann JKS-5 (1)		
E6P1	3	5	—	6.7	5.4	10	Bussmann JKS-10 (1)	1500	375
		—	3	4.3	3.5	8	Bussmann JKS-8 (1)		
E9P0	3	7.5	—	9.9	8.0	15	Mersen HSJ15 (2)	1500	375
		—	5	6.7	5.4	10	Mersen HSJ15 (2)		
E011	3	10	—	12.0	9.7	20	Mersen HSJ20 (2)	1500	375
		—	7.5	9.9	8.0	15	Mersen HSJ15 (2)		
E012	6	10	—	13.1	10.6	20	Mersen HSJ20 (2)	2600	650
		—	7.5	10.0	8.1	15	Mersen HSJ15 (2)		
E017	3	15	—	18.6	15.1	30	Mersen HSJ30 (2)	1500	375
		—	10	12.0	9.7	20	Mersen HSJ20 (2)		
E018	6	15	—	19.7	16.0	30	Mersen HSJ30 (2)	2600	650
		—	10	13.1	10.6	20	Mersen HSJ20 (2)		
E022	3	20	—	24.1	19.5	40	Mersen HSJ40 (2)	1500	375
		—	15	18.6	15.1	30	Mersen HSJ30 (2)		
E023	6	20	—	25.2	20.4	40	Mersen HSJ40 (2)	2600	650
		—	15	19.7	16.0	30	Mersen HSJ30 (2)		
E024	6	20	—	26.3	21.3	40	Mersen HSJ40 (2)	2600	650
		—	20	24.1	19.5	40	Mersen HSJ40 (2)		
E027	4	25	—	29.6	24.0	50	Mersen HSJ50 (2)	1800	450
		—	20	24.1	19.5	40	Mersen HSJ40 (2)		
E028	6	25	—	30.7	24.9	50	Mersen HSJ50 (2)	2600	650
		—	20	25.2	20.4	40	Mersen HSJ40 (2)		
E032	4	30	—	35.0	28.4	60	Mersen HSJ60 (2)	1800	450
		—	25	29.6	24.0	50	Mersen HSJ50 (2)		

Table 25 - PowerFlex 750-Series Drives — Frames 3...7, 810V DC Input Fuses (Continued)

Drive Cat. No. 20F.../ 20G...	Frame Size	HP Rating		DC Input Rating		Non-Time Delay Fuse		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	kW	Amps	Catalog No.		
E033	6	30	—	36.1	29.2	60	Mersen HSJ60 (2)	2600	650
		—	25	30.7	24.9	50	Mersen HSJ50 (2)		
E041	5	40	—	44.9	36.4	70	Mersen HSJ70 (2)	3600	900
		—	30	35.0	28.4	60	Mersen HSJ60 (2)		
E042	6	40	—	46.0	37.3	70	Mersen HSJ70 (2)	2600	650
		—	30	36.1	29.2	60	Mersen HSJ60 (2)		
E052	5	50	—	56.9	46.1	90	Mersen HSJ90 (2)	3600	900
		—	40	44.9	36.4	70	Mersen HSJ70 (2)		
E053	6	50	—	58.0	47.0	90	Mersen HSJ90 (2)	2600	650
		—	40	46.0	37.3	70	Mersen HSJ70 (2)		
E063	6	60	—	69.0	55.9	110	Mersen HSJ110 (2)	5200	1300
		—	50	58.0	47.0	90	Mersen HSJ90 (2)		
E077	6	75	—	84.3	68.3	150	Mersen HSJ150 (2)	5200	1300
		—	60	69.0	55.9	110	Mersen HSJ110 (2)		
E099	6	100	—	108.4	87.8	175	Mersen HSJ175 (2)	5200	1300
		—	75	84.3	68.3	150	Mersen HSJ150 (2)		
E125	6	125	—	136.8	110.8	225	Mersen HSJ225 (2)	5200	1300
		—	100	108.4	87.8	175	Mersen HSJ175 (2)		
E144	6	150	—	157.6	127.7	250	Mersen HSJ250 (2)	5200	1300
		—	125	136.8	110.8	225	Mersen HSJ225 (2)		
E192	7	200	—	210.2	170.3	350	Mersen HSJ350 (2)	11,700	2925
		—	150	157.6	127.7	250	Mersen HSJ250 (2)		
E242	7	250	—	264.9	214.6	400	Mersen HSJ400 (2)	11,700	2925
		—	200	210.2	170.3	350	Mersen HSJ350 (2)		
E289	7	300	—	316.4	256.3	500	Mersen HSJ500 (2)	11,700	2925
		—	250	264.9	214.6	400	Mersen HSJ400 (2)		

(1) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.

(2) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
Time constant minimum 3 milliseconds (maximum 15 milliseconds).
No overload protection required.
Let through must be less than rating of the conductors.
This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

Table 26 - PowerFlex 750-Series Drives — Frames 8...10, 810V DC Input Fuses

Drive Cat. No. 20G...[1]	Frame Size	HP Rating		DC Input Rating		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	kW		
E295	8	300	—	325	263.3	16,800	46,200
		—	250	300	243.0		
E355	8	350	—	391	316.7	16,800	46,200
		—	300	325	263.3		
E395	8	400	—	436	353.2	16,800	46,200
		—	350	363	294.0		
E435	8	450	—	480	388.8	25,200	69,300
		—	350	391	316.7		
E460	8	500	—	507	410.7	25,200	69,300
		—	400	436	353.2		
E510	8	500	—	562	455.2	25,200	69,300
		—	450	469	379.9		
E595	9	600	—	656	531.4	33,600	29,400
		—	500	562	455.2		
E630	9	700	—	695	563.0	33,600	29,400
		—	600	656	531.4		
E760	9	800	—	838	678.8	33,600	29,400
		—	700	695	563.0		
E825	9	900	—	910	737.1	50,400	44,100
		—	750	772	625.3		
E900	9	950	—	993	804.3	50,400	44,100
		—	800	838	678.8		
E980	9	1000	—	1081	875.6	50,400	44,100
		—	900	899	728.2		
E1K1	10	1100	—	1224	991.4	50,400	12,600
		—	1000	1015	822.2		
E1K4	10	1400	—	1577	1277.4	75,600	18,900
		—	1250	1312	1062.7		

(1) These drives have factory-installed fusing.

932 Volt DC Input Fuses

Table 27 - PowerFlex 700/700S Drives — Frames 5 and 6, 932V DC Input Fuses

Drive Cat. No. 20B... / 20D...	Frame Size	kW Rating		DC Input Rating	Non-Time Delay Fuse(1)		Drive DC Bus Capacitance (µF)
		ND	HD	Amps	Amps	Catalog No.	
W098	5	90	—	92.3	160	Mersen HSJ160 (2)	3500
		—	75	92.3	160	Mersen HSJ160 (2)	
W142	6	132	—	162.2	250	Mersen HSJ250 (2)	5000
		—	110	134.9	250	Mersen HSJ250 (2)	

(1) The power source to Common Bus inverters must be derived from AC voltages 600V or less, as defined in NFPA70; Art 430-18 (NEC). Battery supplies or MG sets are not included. The following devices were validated to break current of the derived power DC Bus: *Disconnects*: Allen-Bradley Bulletin No. 1494, 30 to 400 A; Bulletin No. 194, 30 to 400 A, or ABB: OESA, 600 & 800 A; OESL, all sizes. *Fuses*: Bussmann Type JKS, all sizes; Type 170M, Case Sizes 1, 2 and 3, or Mersen Type HSJ, all sizes. For any other devices, please contact technical support.

(2) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
- 600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
- Time constant minimum 3 milliseconds (maximum 15 milliseconds).
- No overload protection required.
- Let thru must be less than rating of the conductors.
- This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

Table 28 - PowerFlex 700H/700S Drives — Frames 9...14, 932V DC Input Fuses

Drive Cat. No. 20C... / 20D...	Frame Size	kW Rating		DC Input Rating	Fuse		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	Amps	Catalog No.		
M170	9	160	–	200	315	Bussmann 170M3746 (1)	3600	0
		–	132	170	315	Bussmann 170M3746 (1)		
M208	9	200	–	245	400	Bussmann 170M5742 (1)	3600	0
		–	160	200	400	Bussmann 170M5742 (1)		
M261	10	250	–	307	500	Bussmann 170M5744 (1)	7467	19,333
		–	200	245	500	Bussmann 170M5744 (1)		
M325	10	315	–	383	630	Bussmann 170M5746 (1)	7467	19,333
		–	250	307	630	Bussmann 170M5746 (1)		
M385	10	355	–	453	700	Bussmann 170M6745 (1)	7467	19,333
		–	315	383	700	Bussmann 170M6745 (1)		
M416	10	400	–	490	700	Bussmann 170M6745 (1)	7467	19,333
		–	315	383	700	Bussmann 170M6745 (1)		
M460	11	450	–	542	450 (2 per phase)	Bussmann 170M5743 (1)	11,200	15,600
		–	355	453	450 (2 per phase)	Bussmann 170M5743 (1)		
M502	11	500	–	591	500 (2 per phase)	Bussmann 170M5744 (1)	11,200	15,600
		–	400	542	500 (2 per phase)	Bussmann 170M5744 (1)		
M590	11	560	–	695	500 (2 per phase)	Bussmann 170M5744 (1)	11,200	15,600
		–	500	591	500 (2 per phase)	Bussmann 170M5744 (1)		
M650	12	630	–	765	550 (2 per phase)	Bussmann 170M5745 (1)	14,933	11,867
		–	560	695	550 (2 per phase)	Bussmann 170M5745 (1)		
M750	12	710	–	883	630 (2 per phase)	Bussmann 170M5746 (1)	14,933	11,867
		–	630	765	630 (2 per phase)	Bussmann 170M5746 (1)		
M820 (2)	12	800	–	965	630 (2 per phase)	Bussmann 170M5746 (1)	14,933	11,867
		–	630	765	630 (2 per phase)	Bussmann 170M5746 (1)		
M920	13	900	–	1038	2400	Bussmann 170M7107 (1)	22,400 (3)	0
		–	800	925	2400	Bussmann 170M7107 (1)		
M1K0	13	1000	–	1162	2400	Bussmann 170M7107 (1)	22,400 (3)	0
		–	900	1038	2400	Bussmann 170M7107 (1)		
M1K1	13	1100	–	1331	2400	Bussmann 170M7107 (1)	22,400 (3)	0
		–	1000	1162	2400	Bussmann 170M7107 (1)		
M1K5	14	1500	–	1766	–	Bussmann 170M8610 (1)	44,800 (4)	0
		–	1300	1530	–	Bussmann 170M8610 (1)		
M1K9	14	1800	–	2237	–	Bussmann 170M8610 (1)	44,800 (4)	0
		–	1500	1766	–	Bussmann 170M8610 (1)		
M2K2	14	2000	–	2649	–	Bussmann 170M8610 (1)	44,800 (4)	0
		–	1800	2237	–	Bussmann 170M8610 (1)		

(1) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.
(2) 20DM820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.
(3) This listed capacitance is for Frame 13 DC fed drives. For Frame 13 AC fed drives, the capacitance is 26,800 µF
(4) The listed capacitance is for Frame 14 DC fed drives. For Frame 14 AC fed drives, the capacitance is 53,600 µF.

Table 29 - PowerFlex 700L Drives — Frames 3A and 3B, 932V DC Input Fuses

Drive Cat. No. 20L...	Frame Size	kW Rating		DC Input Rating	Fuse		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	Amps	Catalog No.		
F380	3A	355	260	760 (1)	1250	Bussmann 170M6700 (2) (3)	10,800	1080 (4)
F705	3B	657	485	705	1100	Bussmann 170M6699 (3) (5)	21,600 (6)	2160 (4)
F1K0	3B	980	720	1050	800 (2 per phase)	Bussmann 170M6696 (3)	21,600 (6)	2160 (4)

(1) Only the Dual Inverter for PowerFlex 700L Frame 3A is available as a DC input inverter.
(2) Two 630A Bussmann 170M6694 fuses per phase can also be used.
(3) See Fuse Certification and Test Data on page 115 for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.
(4) This value applies to the precharge of the Frame 3A and 3B complete regenerative drives. There is a field-installed input filter precharge resistor kit (20L-RESPRE-A1) for the Frame 3A and 3B complete drives that can be used to increase the maximum external DC bus capacitance. For details, see publication 20L-IN010.
(5) Two 550A Bussmann 170M6693 fuses per phase can also be used.
(6) This 21,600 µF is the drive DC bus capacitance for a complete Frame 3B drive. The Frame 3B DC input inverter bus capacitance is 10,800 µF.

Table 30 - PowerFlex 750-Series Drives — Frames 6 and 7, 932V DC Input Fuses

Drive Cat. No. 20F…/ 20G…	Frame Size	kW Rating		DC Input Rating		Non-Time Delay Fuse		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	kW	Amps	Catalog No.		
F012	6	7.5	—	13.2	12.3	20	Mersen HSJ20 (1)	2600	650
		—	5.5	9.9	9.2	15	Mersen HSJ15 (1)		
F015	6	11	—	16.5	15.4	25	Mersen HSJ25 (1)	2600	650
		—	7.5	13.2	12.3	20	Mersen HSJ20 (1)		
F020	6	15	—	21.9	20.4	35	Mersen HSJ35 (1)	2600	650
		—	11	16.5	15.4	25	Mersen HSJ25 (1)		
F023	6	18.5	—	25.2	23.5	40	Mersen HSJ40 (1)	2600	650
		—	15	21.9	20.4	35	Mersen HSJ35 (1)		
F030	6	22	—	32.9	30.7	50	Mersen HSJ50 (1)	2600	650
		—	18.5	25.2	23.5	40	Mersen HSJ40 (1)		
F034	6	30	—	37.3	34.8	60	Mersen HSJ60 (1)	2600	650
		—	22	32.9	30.7	50	Mersen HSJ50 (1)		
F046	6	37	—	50.5	47.1	80	Mersen HSJ80 (1)	2600	650
		—	30	37.5	34.8	60	Mersen HSJ60 (1)		
F050	6	45	—	54.8	51.1	90	Mersen HSJ90 (1)	2600	650
		—	37	50.5	47.1	80	Mersen HSJ80 (1)		
F061	6	55	—	66.9	62.4	100	Mersen HSJ100 (1)	5200	1300
		—	45	54.8	51.1	90	Mersen HSJ90 (1)		
F082	6	75	—	89.9	83.8	150	Mersen HSJ150 (1)	5200	1300
		—	55	66.9	62.4	100	Mersen HSJ100 (1)		
F098	6	90	—	107.5	100.2	175	Mersen HSJ175 (1)	5200	1300
		—	75	89.9	83.8	150	Mersen HSJ150 (1)		
F119	6	110	—	130.5	121.6	200	Mersen HSJ200 (1)	5200	1300
		—	90	107.5	100.2	175	Mersen HSJ175 (1)		
F142	6	132	—	155.7	145.1	250	Mersen HSJ250 (1)	5200	1300
		—	110	130.5	121.6	200	Mersen HSJ200 (1)		
F171	7	160	—	187.5	174.8	300	Mersen HSJ300 (1)	11700	2925
		—	132	155.7	145.1	250	Mersen HSJ250 (1)		
F212	7	200	—	232.5	216.7	350	Mersen HSJ350 (1)	11700	2925
		—	160	187.5	174.8	300	Mersen HSJ300 (1)		
F263	7	250	—	288.4	268.8	500	Mersen HSJ500 (1)	11700	2925
		—	200	232.5	216.7	350	Mersen HSJ350 (1)		

(1) A test program was developed to confirm that the HSJ (High Speed J) fuses can meet or exceed the requirements set forth by Allen-Bradley for the fuses on the common DC bus for all Allen-Bradley PowerFlex drives, 1336 Plus drives, and so forth. The criteria for acceptance was:
- 600V AC rectified, 810V DC average, fuses located at (+) and (-) leg. Short circuit test at 65 kVA.
- Time constant minimum 3 milliseconds (maximum 15 milliseconds).
- No overload protection required.
- Let thru must be less than rating of the conductors.
- This testing is listed in UL file E2137 Vol2 Sec 31 page 1 and in CSA report 1662646.

Table 31 - PowerFlex 750-Series Drives — Frames 8...10, 932V DC Input Fuses

Drive Cat. No. 20G...[1]	Frame Size	kW Rating		DC Input Rating		Drive DC Bus Capacitance (µF)	Maximum External DC Bus Capacitance (µF)
		ND	HD	Amps	kW		
F265	8	250	—	292	272.1	16,800	46,200
		—	200	237	220.9		
F330	8	315	—	363	338.3	16,800	46,200
		—	250	292	272.1		
F370	8	355	—	407	379.3	16,800	46,200
		—	300	339	315.9		
F415	8	400	—	457	425.9	25,200	69,300
		—	355	407	379.3		
F460	8	450	—	506	471.6	25,200	69,300
		—	375	413	384.9		
F500	8	500	—	550	512.6	25,200	69,300
		—	400	454	423.1		
F590	9	560	—	649	604.9	33,600	29,400
		—	450	506	471.6		
F650	9	630	—	715	666.4	33,600	29,400
		—	500	550	512.6		
F710	9	710	—	781	727.9	33,600	29,400
		—	590	649	604.9		
F765	9	750	—	842	784.7	50,400	44,100
		—	630	715	666.4		
F795	9	800	—	875	815.5	50,400	44,100
		—	710	825	768.9		
F960	9	900	—	1056	984.2	50,400	44,100
		—	800	875	815.5		
F1K0	10	1000	—	1144	1066.2	50,400	12,600
		—	900	952	887.3		
F1K4	10	1400	—	1540	1435.3	75,600	18,900
		—	1120	1276	1189.2		

(1) These drives have factory-installed fusing.

Fuse Certification and Test Data

The following are copies of self-certification letters and test data for JKS and 170M fuses recommended in the previous tables in this appendix for DC input fusing.

Configuration A indicates one fuse in the (+) leg and one fuse in the (-) leg of the DC bus.

JKS Fuses

Cooper Bussmann
P. O. Box 14460
St. Louis, MO 63178-4460

January 25, 2002

Sr. Project Engineer
Rockwell Automation
6400 West Enterprise Drive
P.O. Box 760
Mequon, WI 53092

Subject: DC Testing for JKS Fuses

Dear Mr.

Per Rockwell Automation's request, Bussmann has completed the DC testing for the JKS fuses and is pleased to present the attached information indicating successful 'Self Certification DC Rating' on all subject fuses.

Bussmann tested fuses to the following parameters specified by Rockwell Automation:

Short Circuit Current = 65 kA

Voltage = 810V DC

Time Constant ≥ 0.4 ms

Additional tests were performed for acceptability.

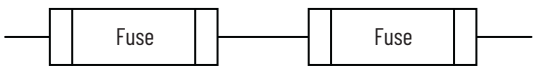
Short Circuit Current ≅ 30 times fuse amperage

Voltage = 810V DC

Time Constant ≥ 0.4 ms

The attached table identifies the fuses tested, the actual circuit parameters and the circuit configuration. In the attached table, the Interrupting Amps column specifies the fuses minimum and maximum amps the fuse will safely clear at 810V DC.

Circuit Configuration A



By way of this correspondence, Cooper Bussmann self-certifies the above fuses in end-user applications to the above parameters and the attached data sheet. Should you have any questions regarding this correspondence, please contact me at the listed address and numbers below.

Regards,

Strategic OEM Accounts Manager
Cooper Bussmann

Cooper Bussmann JKS DC Fuse Test for Rockwell Automation

Fuse	Results	Circuit Parameters				
		Interrupting Amps		Volts DC	Time Constant	Circuit Configuration
		Min	Max			
JKS-(3A...15A)	Acceptable	–	69.6 kA	810	2.78 ms	Configuration A
JKS-(3A...15A)	Acceptable	375 A	–	810	0.55 ms	Configuration A
JKS-(20A...30A)	Acceptable	–	69.6 kA	816	2.78 ms	Configuration A
JKS-(20A...30A)	Acceptable	920 A	–	812	0.4 ms	Configuration A
JKS-(35A...60A)	Acceptable	–	69.6 kA	816	2.78 ms	Configuration A
JKS-(35A...60A)	Acceptable	1820 A	–	812	0.5 ms	Configuration A
JKS-(70A...100A)	Acceptable	–	69.6 kA	816	2.78 ms	Configuration A
JKS-(70A...100A)	Acceptable	2950 A	–	812	0.86 ms	Configuration A
JKS-(110A...200A)	Acceptable	–	69.6 kA	816	2.78 ms	Configuration A
JKS-(110A...200A)	Acceptable	5960 A	–	810	3.34 ms	Configuration A
JKS-(225A...400A)	Acceptable	–	69.6 kA	816	2.78 ms	Configuration A
JKS-(225A...400A)	Acceptable	11.5 kA	–	812	2.92 ms	Configuration A
JKS-(450A...600A)	Acceptable	–	69.6 kA	816	2.78 ms	Configuration A
JKS-(450A...600A)	Acceptable	15.5 kA	–	810	0.4 ms	Configuration A

170M Fuses

Cooper Bussmann
P. O. Box 14460
St. Louis, MO 63178-4460

May 15, 2002

Sr. Project Engineer
Rockwell Automation
6400 West Enterprise Drive
P.O. Box 760
Mequon, WI 53092

Subject: DC Testing for 170M Fuses

Dear Mr.

Per Rockwell Automation's request, Bussmann has completed the DC testing for the 170M fuses and is pleased to present the attached information indicating successful 'Self Certification DC Rating' on all subject fuses.

Bussmann tested fuses to the following parameters specified by Rockwell Automation:

Short Circuit Current = 65 kA and 100 kA

Voltage = 810V DC

Time Constant ≥ 0.4 ms

Additional tests were performed for acceptability.

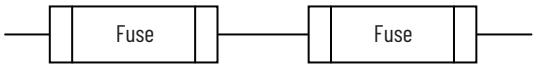
Short Circuit Current ≅ 30 times fuse amperage as minimum current interrupting rating or as tested

Voltage = 810V DC

Time Constant ≥ 0.4 ms

The attached table identifies the fuses tested, the actual circuit parameters and the circuit configuration. In the attached table, the Interrupting Amps column specifies the fuses minimum and maximum amps the fuse will safely clear at 810V DC.

Circuit Configuration A



By way of this correspondence, Cooper Bussmann self-certifies the above fuses in end-user applications to the above parameters and the attached data sheet. Should you have any questions regarding this correspondence, please contact me at the listed address and numbers below.

Regards,

Strategic OEM Accounts Manager
Cooper Bussmann

Cooper Bussmann 170M DC Fuse Test for Rockwell Automation

Fuse	Results	Circuit Parameters				
		Interrupting Amps		Volts DC	Time Constant	Circuit Configuration
		Min	Max			
170M6646	Acceptable	–	69.8 kA	812	2 ms	Configuration A
170M6646	Acceptable	10.2 kA	–	812	1.66 ms	Configuration A
170M6650	Acceptable	–	69.6 kA	812	2 ms	Configuration A
170M6650	Acceptable	21.1 kA	–	812	1.2 ms	Configuration A
170M7510		–	65 kA	810	2 ms	
170M7510		20 kA	–	810	2 ms	
170M6792		–	65 kA	810	2 ms	
170M6792		19 kA	–	810	2 ms	
170M6793		–	65 kA	810	2 ms	
170M6793		23 kA	–	810	2 ms	
170M6794		–	65 kA	810	2 ms	
170M6794		27.5 kA	–	810	2 ms	
170M6828		–	65 kA	810	2 ms	
170M6828		37 kA	–	810	2 ms	
170M6934	Acceptable	–	105.4 kA	810	1.8 ms	Configuration A
170M6934	Acceptable	45.2 kA	–	810	1.12 ms	Configuration A
170M7560		–	100 kA	810	2 ms	
170M7560		60 kA	–	810	2 ms	

Power Component Accessories

Back-to-back Diodes (Shared AC/DC Configurations)

Considerations

Consider the following information when selecting the back-to-back diodes:

- Size back-to-back diodes to 125% of the drive's DC input Amps
- Thermal impedance of panel to air
- Ambient temperature
- Any existing thermal compound between diodes and panel affecting thermal drop between the diodes and panel
- Consult diode vendor for proper diode installation

Diode Sharing Modules

Diode sharing modules are used in the shared regenerative braking configuration shown in Figure 33 on page 44, Figure 35 on page 46, Figure 37 on page 52, and Figure 38 on page 53.

We recommend Bonitron M3345CBM diode sharing modules. Select the appropriate model of M3345CBM diode sharing module for the specifications of your system: Bonitron | Solutions for AC Drives - Common Bus Diodes.

HF Filter (SCR Bus Supply)

When the 20S-RFC filter is used, the HF emission limits for class A, group 2* (EN55011) in the second environment (industrial supply network) according to the product standard EN61800-3 are met, and the Bus Supply fulfills CE conformity.

Description	Cat. No.
HF Filter, 690V	20S-RFC

Bus Supply Capacitors

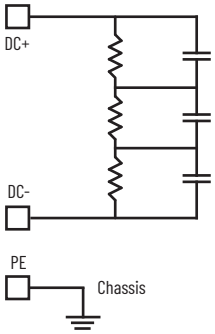
SCR Bus Supply Minimum Capacitance

A minimum capacitance is required to commission and test the SCR bus supply. If this minimum capacitance is not present, the bus supply internal fault detection circuit interprets the condition as a DC bus short and stops pulse firing. This minimum capacitance can be provided by a drive as long as it remains connected to the DC bus, or by a capacitor bank of at least 110 µF per SCR Bus Supply.

Connecting High-power Drives and Low-power Drives on the DC Bus

IMPORTANT When the DC bus system is comprised of drives from the same product family and the same frame size, no additional capacitance is required. However, if drives from different product families or frame sizes are intermixed, the drive bus capacitance per amp ratio must be reviewed for compatibility.

All drives have a DC bus capacitance that is proportional to the drives power rating. When used in a common DC bus configuration, these capacitors are directly connected in parallel resulting in the DC bus ripple being shared proportionally to the power rating of the drive. When the ratio of the capacitance to the drive rated current is consistent, the best DC bus ripple sharing is promoted. The target ratio is 40 µF/A or greater.



Therefore it is important to evaluate every common DC bus drive system for any mismatch. When a mismatch is found, the use of an external capacitor bank is required. The capacitor bank must be connected closest to the DC bus terminals of the largest drive.

Calculate the capacitance (µF) per drive current rating (Amp) using Equation 1 below, where the DC input current and drive capacitance values are found in Appendix A.

Equation 1

$$\text{Capacitance Ratio} = \frac{\text{Drive Capacitance in Microfarads (µF)}}{\text{Drive DC Input Current in Amps (A)}}$$

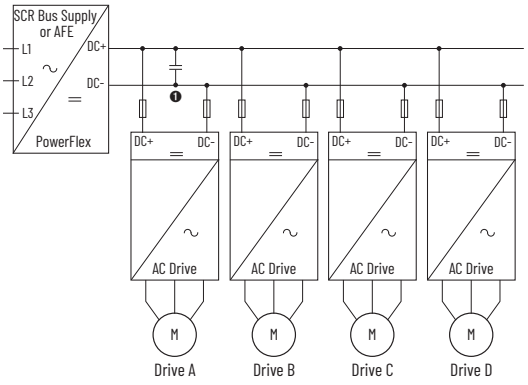
If the ratio is below 40 µF/A, then additional capacitance is required and can be calculated using the following Equation 2.

Equation 2
Additional Capacitance = 40 µF x DC Input Amps - Drive DC Bus Capacitance

Fuse protection with diagnostic feedback is recommended and may be located internal or external to the capacitor bank. Follow the manufacturer's recommendation regarding wire length and mounting of the capacitor bank.

IMPORTANT The capacitor quantity and configuration will vary based on the total capacitance and DC bus voltage rating.

Here are some example calculations.



? If a capacitor bank is required, place the capacitor bank as close as possible to the largest drive.

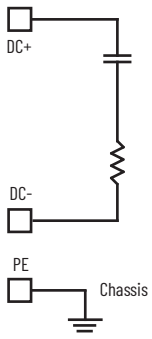
Example 1: 650V DC	Drive A	Drive B	Drive C	Drive D
Product Family and Frame Size	PowerFlex® 750-Series Frame 8	PowerFlex 750-Series Frame 6	PowerFlex 750-Series Frame 3	PowerFlex 750-Series Frame 2
Cat. No.	D545...	D248...	D034...	D022...
DC Current (from Appendix A)	599 A	272.1 A	36.4 A	23.3 A
DC Bus Capacitance (from Appendix A)	23,700 µF	9200 µF	1500 µF	1000 µF
µF/A Ratio (use Equation 1)	39.5	33.8	41.2	42.9
Additional Capacitance Required	No	Yes	No	No
Additional Capacitance µF Value (use Equation 2)	n/a	1648 µF	n/a	n/a

Example 2: 650V DC	Drive A	Drive B	Drive C	Drive D
Product Family and Frame Size	PowerFlex 700S Frame 13	PowerFlex 700S Frame 6	PowerFlex 700S Frame 5	PowerFlex 700S Frame 5
Cat. No.	J1K0...	J248...	J140...	J140...
DC Current (from Appendix A)	1162 A	272 A	137A	137 A
DC Bus Capacitance (from Appendix A)	19,800 µF	8400 µF	6000 µF	6000 µF
µF/A Ratio (use Equation 1)	17.0	30.8	43.7	43.7
Additional Capacitance Required	Yes	Yes	No	No
Additional Capacitance µF Value (use Equation 2)	26,680 µF	2480 µF	n/a	n/a

Supplier Reference: Contact technical support for part number 30339-304-x or contact a capacitor bank manufacturer for recommendations.

RC Snubber Circuit

Fuse protection with diagnostic feedback is recommended and may be internal or external to the RC snubber. Follow the manufacturer's recommendation when mounting the RC snubber regarding wire length and thermal constraints due to the wattage rated components.



The specifications for the snubber are:

R = 10 ohm, 100 W, low inductance (less than 50 µH)

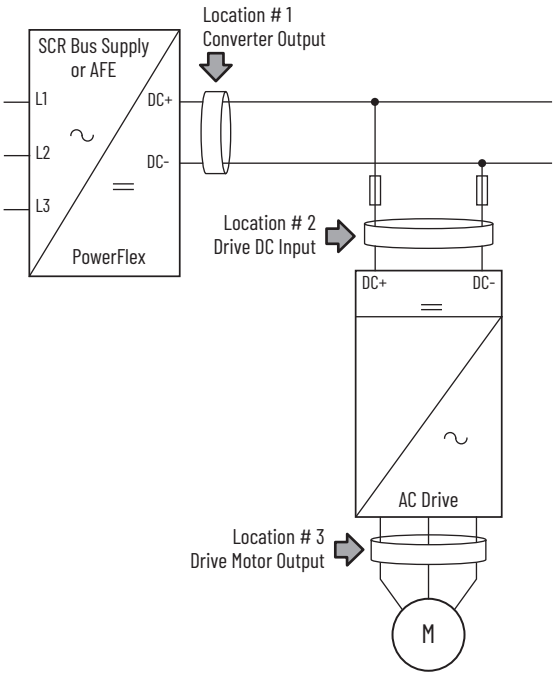
C = 20 µF, 2000V

Contact Bonitron for an RC snubber circuit at www.bonitron.com.

Common Mode Core

The common mode core (CMC) is a passive ring or disk shaped filter compromised of ferrite material that is designed to attenuate any high frequency transient or disturbance on the wire or cable passing through it, minimizing the risk of common mode interference to other circuitry. The common mode core can be installed in one of three locations and are shown in Figure 56.

Figure 56 - Common Mode Core Locations



Usage With SCR Bus Supply

The common mode core mounting location (SCR Bus Supply DC output, drive DC input, or drive motor output) changes for different common bus configurations. For systems with SCR bus supplies, the common mode core is placed at **either** the DC input terminals of each drive **or** at the motor output of each drive. See Figure 56 for the mounting locations.

Drive Product Family	SCR Bus Supply DC Output Location # 1	Drive DC Input Location # 2 (1)	Drive Motor Output Location # 3 (2)
PowerFlex 750-Series	N/A	A common mode core is included for use on the AC line input when ordering a Catalog No. 21G drive with a 'P' or 'W' enclosure. A Common Mode Core is also included with any of the following IP00 Input Termination kits: • 20-750-BUS5-F8 • 20-750-BUS5-F9 • 20-750-BUS5-F10	Frames 2, 3: 1321-M048 Frames 4...6: 1321-M180 Fr.ame 7: 30201-031-01 Frames 8...10: 20-750-EMCCM1-F8
PowerFlex 700H/PowerFlex 700S Frames 9...14	N/A	30339-319-01	N/A
PowerFlex 700/PowerFlex 700S Frames 0...6	N/A	N/A	N/A
Other drives	Contact Factory	Contact Factory	Contact Factory

(1) One common mode core at each drive DC input
(2) One common mode core at each drive motor output.

Usage With AFE

The common mode core mounting location (AFE DC output, drive DC input, or drive motor output) changes for different common bus configurations. For systems with AFE bus supplies, the common mode core is placed at the DC output terminals of each AFE **and** drive DC input terminals **or** at the motor output of each drive. See Figure 56 for the mounting locations.

Drive Product Family	AFE DC Output Location # 1 (1)	Drive DC Input Location # 2 (2)	Drive Motor Output Location # 3 (3)
PowerFlex 750-Series	AFE Frame 10: 30201-031-01 AFE Frame 13: 30339-319-01	A common mode core is included for use on the AC line input when ordering a Catalog No. 21G drive with a 'P' or 'W' enclosure. A Common Mode Core is also included with any of the following IP00 Input Termination kits: • 20-750-BUS5-F8 • 20-750-BUS5-F9 • 20-750-BUS5-F10	Frames 2, 3: 1321-M048 Frames 4...6: 1321-M180 Frame 7: 30201-031-01 Frames 8...10: 20-750-EMCCM1-F8 (4)
PowerFlex 700H/PowerFlex 700S Frames 9...14 (5)(6)	AFE Frame 10: 30201-031-01 AFE Frame 13: 30339-319-01	30339-319-01	Frames 9...13: 30201-031-01 or 1321-M670
PowerFlex 700/PowerFlex 700S Frames 0...6	AFE Frame 10: 30201-031-01 AFE Frame 13: 30339-319-01	N/A	N/A
Other drives	Contact Factory	Contact Factory	Contact Factory

(1) One common mode core at each AFE DC output.
(2) One common mode core at each drive DC input.
(3) One common mode core at each drive motor output unless an output reactor dv/dt filter is used.
(4) For a single PowerFlex 750-Series Frame 8 drive, the AFE DC output common mode core is not required if a common mode core is installed at the DC input of the PowerFlex 750-Series Frame 8 drive.
(5) For a single PowerFlex 700H/700S Frame 9...14 drive, the AFE DC output common mode core is not required if a common mode core is installed at the DC input of the PowerFlex 700H/700S Frame 9...14 drive—however, the drive motor output common mode core is always required.
(6) For multiple PowerFlex 700H/700S Frame 9...14 drives, the AFE DC output common mode core is required and either the common mode core on the drive DC input or the drive motor output of the PowerFlex 700H/700S Frame 9...14 drive is always required.

A variety of core shapes are available to allow various arrangements of wire diameters and turns ratios.

External Drive Options

The following external common mode core options are available.

Option	Part No.	Additional Resources
1	1321-M048	See publication 1321-IN001 or publication 1321-TD001 for more information
2	1321-M180	
3	1321-M670	
4	30201-031-01	Contact factory for more information. See Figure 57 for design details.
5	30339-319-01	Contact factory for more information. See Figure 58 for design details.
6	30339-320-01	

Figure 57 - Drive Common Mode Core Option 4 (30201-031-01) Mounting Dimensions

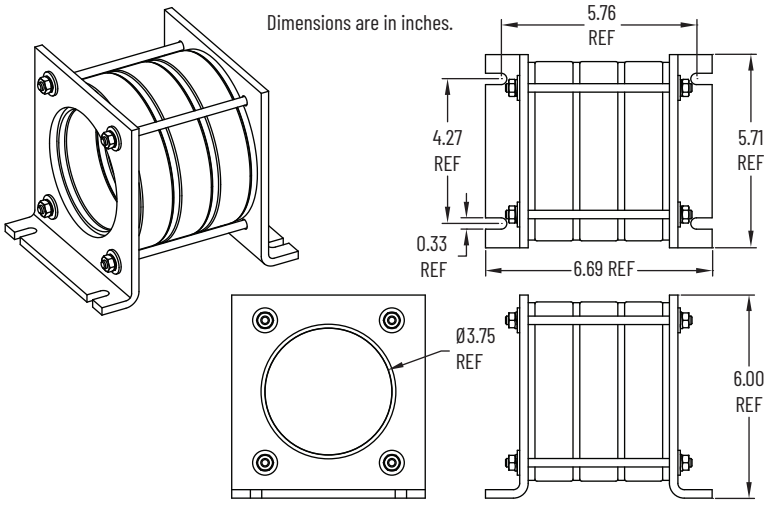
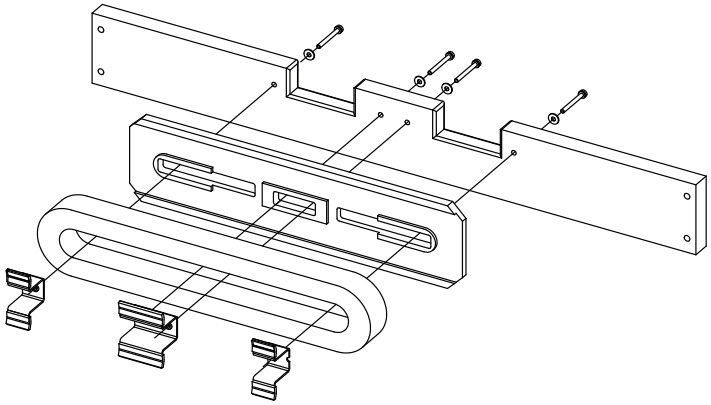


Figure 58 - Drive Common Mode Core Options 5 and 6 (30339-319-01 and 30339-320-01) Exploded View



Internal Drive Options

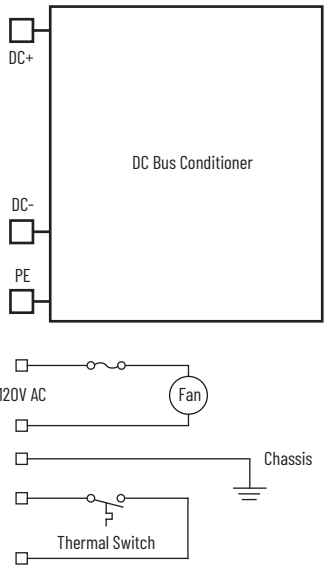
The following internal common mode core options are available.

Option	PowerFlex 750-Series Drive	Voltage	Part No.	Additional Resources
6	Frame Size 2	400/480	20-750-EMC1-F2	See PowerFlex 750-Series EMC Plate and Cores - Frames 1...7 Installation Instructions, publication 750-IN006, for more details.
7	Frame Size 3	400/480	20-750-EMC1-F3	
		600/690	20-750-EMC3-F3	
8	Frame Size 4	400/480	20-750-EMC1-F4	
		600/690	20-750-EMC3-F4	
9	Frame Size 5	400/480	20-750-EMC1-F5	
		600/690	20-750-EMC3-F5	
10	Frame Size 6 in IP20 Enclosure	600/690 (1)	20-750-EMC3-F6	
	Frame 6 in IP54 Enclosure		20-750-EMC5-F6	
11	Frame Size 7 in IP20 Enclosure	600/690 (1)	20-750-EMC3-F7	
	Frame 7 in IP54 Enclosure		20-750-EMC5-F7	
12	Frame Size 8	For Frames 8, 9, and 10 with enclosure code 'P' or 'W', the common mode core is included. For enclosure code 'T', the common mode core is included with termination kit 20-750-BUS5-F*. See publication 750-IN020 for more details.		
13	Frame Size 9			
14	Frame Size 10			

(1) Internal common mode core is not available for 400/480 volt products.

DC Bus Conditioner—Designs A, B, C, D, or E

The DC bus conditioner is a device that is electrically connected across the +/- DC bus terminals and PE ground. A 120V AC internal fan provides internal circulating air to assist in thermal dissipation. An internal thermal switch provides overtemperature protection.



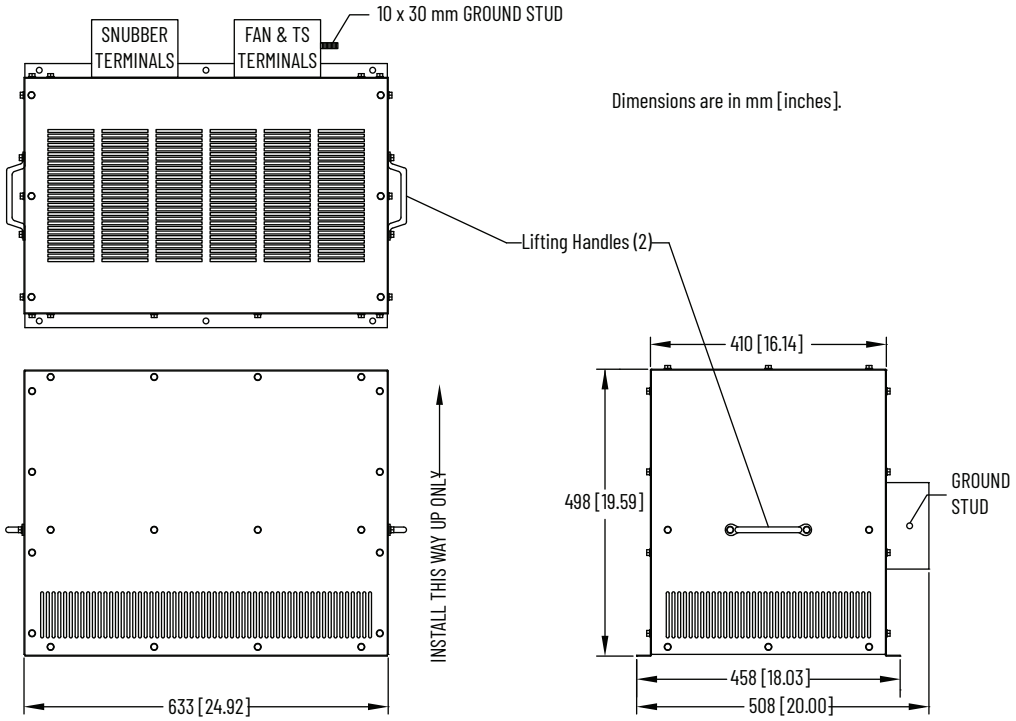
IMPORTANT Fuse protection with diagnostic feedback is recommended (100A, 1000V) and may be internal or external to the bus conditioner.

Follow the manufacturer's recommendation when mounting the DC bus conditioner regarding wire length and thermal constraints due to the high wattage rated components.

A warning label should be affixed to the bus conditioner similar to the one below.

WARNING: This conditioner is directly connected to the system's common DC Bus. The drive's disconnect switch will NOT disconnect power to this conditioner. Disconnect the DC source and the 120V AC source for the fan circuitry. Then measure the system DC bus voltage and the fan and thermal interlock system. They must be at zero before servicing this equipment.

The following example shows a DC bus conditioner.



Design A

DC Bus Conditioner—600/690V, 20 µF, 6800 W

The NEMA 1 enclosure is 633 mm wide x 498 mm high x 508 mm deep and has a connection terminal box included. The 47 kg enclosure is designed to be externally mounted on top of the cabinet lineup.

Supplier Reference: Contact technical support for PN-184456 or Byrne and Schaefer for SN-101204.

NOTE: This product has been replaced with Design E.

Design B

DC Bus Conditioner—400/480V, 20 µF, 6800 W

The NEMA 1 enclosure is 633 mm wide x 498 mm high x 508 mm deep and has a connection terminal box included. The 43 kg enclosure is designed to be externally mounted on top of the cabinet lineup.

Supplier Reference: Contact technical support for PN-184460 or Bryne & Schaefer for SN-101203.

NOTE: This product has been replaced with Design E.

Design C

DC Bus Conditioner—600/690V, 20 µF, 2000 W

The NEMA 1 enclosure is 453 mm wide x 465 mm high x 424 mm deep and has a connection terminal box included. The 30 kg enclosure is designed to be internal to the cabinet or externally mounted on top of the cabinet lineup.

Supplier Reference: Contact technical support for PN-184462 or Bryne & Schaefer for SN-101202.

Design D

DC Bus Conditioner—400/480V, 6 µF, 2000 W

The NEMA 1 enclosure is 453 mm wide x 465 mm high x 424 mm deep and has a connection terminal box included. The 29 kg enclosure is designed to be internal to the cabinet or externally mounted on top of the cabinet lineup.

Supplier Reference: Contact technical support for PN-184465 or Bryne & Schaefer for SN-101201.

Design E

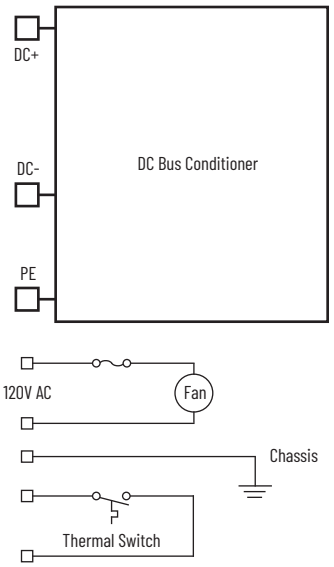
DC Bus Conditioner—480/575/600/690V, 20 µF, 6800 W

The NEMA 1 enclosure is 633 mm wide x 498 mm high x 508 mm deep and has a connection terminal box included. The 47 kg enclosure is designed to be externally mounted on top of the cabinet lineup.

Supplier Reference: Contact technical support for PN-225798 or Bryne & Schaefer for SN-101260.

DC Bus Clamp—Design F or G

The DC bus clamp is a device that is electrically connected across the +/- DC bus terminals and PE ground. A 120V AC internal fan provides internal circulating air to assist in thermal dissipation. An internal thermal switch provides overtemperature protection.



IMPORTANT	Fuse protection with diagnostic feedback is recommended (100A, 1000V) and may be internal or external to the bus clamp.

IMPORTANT	Fuse protection with diagnostic feedback is recommended (100 A, 1000V) and may be internal or external to the bus clamp.

Follow the manufacturer's recommendation when mounting the bus clamp regarding wire length and thermal constraints due to the high wattage rated components.

A warning label should be affixed to the bus clamp similar to the following.

WARNING: This conditioner is directly connected to the system's common DC Bus. The drive's disconnect switch will NOT disconnect power to this conditioner. Disconnect the DC source and the 120V AC source for the fan circuitry. Then measure the system DC bus voltage and the fan and thermal interlock system. They must be at zero before servicing this equipment.

Design F

DC Bus Clamp—400/480/600/690V, 5000 W

The NEMA 1 enclosure is 453 mm wide x 465 mm high x 424 mm deep and has a connection terminal box included. The 27 kg enclosure is designed to be externally mounted on top of the cabinet lineup.

Supplier Reference: Contact factory for PN-179166 or Bryne & Schaefer for SN-101206.

NOTE: This product has been replaced with Design G.

Design G

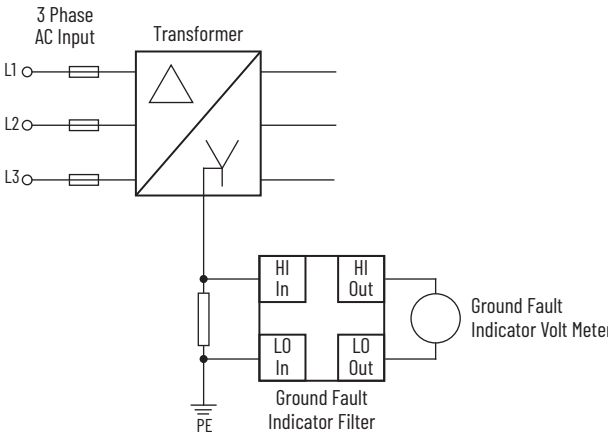
DC Bus Clamp—480/575/600/690V, 5 µF, 3000 W

The NEMA 1 enclosure is 453 mm wide x 465 mm high x 424 mm deep and has a connection terminal box included. The 27 kg enclosure is designed to be externally mounted on top of the cabinet lineup.

Supplier Reference: Contact factory for PN-239300 or Bryne & Schaefer for SN-101268.

Ground Fault Indicator Filter

A ground fault occurs when there is an imbalance of current in a system. The sum of the currents entering the node must equal the sum leaving the node. The largest cause of the error is the leakage current through power devices and other high impedance paths to ground.



In high resistance or ungrounded systems, a ground fault sensor is placed across the resistor to sense or detect these currents. When the threshold has been exceeded, the sensor will provide an alarm output that can engage safety circuitry to disable a system.

The current waveform associated with a drive has a harmonic-rich current signature, which can cause the ground fault indicator filter to trip. This filter is designed to average this signature, while still providing protection.

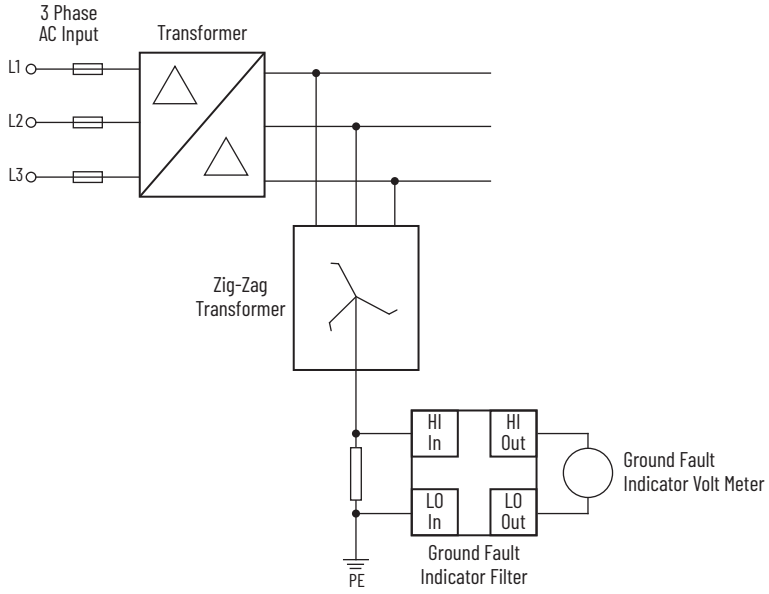
Follow the manufacturer's recommendation when mounting the ground fault indicator filter.

The NEMA 1 enclosure is 335 mm wide x 226 mm high x 335 mm deep, and weighs 26 kg.

Supplier Reference: Contact factory for PN-50085 or Bryne & Schaefer for ER-101011.

Zig-Zag Transformer

When an ungrounded system is used for power distribution, a zig-zag transformer can be used to create an artificial neutral for sensing ground faults. A typical ground fault detection arrangement is with a zig-zag transformer sourcing a neutral resistor with a ground fault indicator filter sense circuit.



Contact technical support or a transformer manufacturer for recommendations.

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation. You can view or download publications at rok.auto/literature.

Resource Table

Resource	Description
Allen-Bradley 1336/1336VT/1336 PLUS/PLUSII/FORCE/IMPACT Chopper Module Installation Instructions, publication 1336-5.65	Provides information to select, configure, and install dynamic braking.
Allen-Bradley 1336/1336VT/1336 PLUS/PLUS II/IMPACT 1336 FORCE Drives Dynamic Braking Installation Data, publication 1336-5.64	Describes Dynamic Brake Module operation and explains how to calculate the data needed to correctly select, configure, and install a Heavy Duty Dynamic Brake Module.
Allen Bradley AK DBU-Dynamic Braking Unit 600/690 VAC User Manual, publication AKDBU-UM001-EN-P	Provide the necessary information for the installation, start-up, and trouble shooting of the AK Dynamic Braking Unit.
PowerFlex SCR Bus Supply User Manual, publication 20S-UM001-EN-P	Provides information needed to install, start up, and troubleshoot the PowerFlex SCR Bus Supply.
PowerFlex Diode Bus Supply User Manual, publication 20T-UM001-EN-P	Provides the information needed to install, start up, and troubleshoot the PowerFlex Diode Bus Supply.
PowerFlex Adjustable Frequency AC Drive User Manual, publication 22D-UM001-EN-E	Provides the information needed to install, start-up, and troubleshoot the PowerFlex 40P Adjustable Frequency AC Drive.
PowerFlex 520-Series Adjustable Frequency AC Drive User Manual, publication 520-UM001-EN-E	Provides the information that is needed to install, startup, and troubleshoot the PowerFlex 520-Series Adjustable Frequency AC Drive.
PowerFlex 700 AC Drives – Series A, Frames 0...6 User Manual, publication 20B-UM001-EN-P	Provide the information needed to install, start-up, and troubleshoot the PowerFlex 700 Adjustable Frequency AC Drive.
PowerFlex 700 AC Drives – Frames 0...10, Vector Control Firmware 4.001 and Up User Manual, publication 20B-UM002-EN-P	Provides the information needed to program and troubleshoot the PowerFlex 700 Adjustable Frequency AC Drive with Vector Control.
PowerFlex 70/PowerFlex 700 Adjustable Frequency AC Drives Reference Manual, publication PFLEX-RM001-EN-E	Provides detailed drive information including operation, parameter descriptions, and programming.
PowerFlex 70EC/700VC Reference Manual, publication PFLEX-RM004-EN-E	Provides detailed drive information including operation, parameter descriptions, and programming.
PowerFlex 700 Adjustable Frequency AC Drive Technical Data, publication 20B-TD001-EN-P	Provides technical data about the PowerFlex 700 Adjustable Frequency AC Drive.
PowerFlex Dynamic Braking Resistor Calculator Application Technique, publication PFLEX-AT001-EN-P	Provides information about calculating dynamic braking resistance.
PowerFlex 700H Adjustable Frequency AC Drive and PowerFlex 700S High Performance AC Drive Installation Instructions, publication PFLEX-IN006-EN-P	Provides information on mechanical installation and connecting incoming power, motor, and basic I/O to frames 9...14 PowerFlex 700H and 700S AC drives.
PowerFlex 700H Adjustable Frequency AC Drive Programming Manual, publication 20C-PM001-EN-P	Provides information needed to start-up, program, and troubleshoot the PowerFlex 700H adjustable frequency AC drive.
PowerFlex 700H AC Drive Technical Data, publication 20C-TD001-EN-P	Provides technical data about the PowerFlex 700H AC Drive.
PowerFlex 700H Adjustable Frequency AC Drive and PowerFlex 700S High Performance AC Drive, publication PFLEX-IN006-EN-P	Provides information on mechanical installation and connecting incoming power, motor, and basic I/O to frame 9...14 PowerFlex 700H and 700S AC drives.
PowerFlex 700S High Performance AC Drive Phase I Control User Manual, publication 20D-UM001	Provides information needed to install, start-up, and troubleshoot the PowerFlex 700S Adjustable Frequency AC Drive, Frames 1-6.
PowerFlex 700S with Phase I Control Reference Manual, publication PFLEX-RM002	Provides detailed drive programming and operation information.
PowerFlex 700S Adjustable Frequency Drive - Phase II Control Installation Instructions, publication 20D-IN024	Provides information on mechanical installation and connecting incoming power, motor, and basic I/O to the PowerFlex 700S adjustable frequency AC drive with Phase II control.
PowerFlex 700H Adjustable Frequency AC Drive and PowerFlex 700S High Performance AC Drive Installation Instructions, publication PFLEX-IN006	Provides information on mechanical installation and connecting incoming power, motor, and basic I/O to frames 9...14 PowerFlex 700H and 700S AC drives.
PowerFlex 700S High Performance AC Drive -Phase II Control Programming Manual, publication 20D-PM001	Provides with the information needed to start-up, program, and troubleshoot PowerFlex 700S Phase II Adjustable Frequency AC drives.
PowerFlex 700S AC Drives Phase II Control Reference Manual, publication PFLEX-RM003	Provides detailed drive programming and operation information.
PowerFlex 700S with Phase II Control Technical Data, publication 20D-TD002	Provides technical data about the PowerFlex 700S with Phase II Control Drive.
PowerFlex 700L Liquid-Cooled Adjustable Frequency AC Drive User Manual, publication 20L-UM001	Provides the basic information needed to install, start-up, and troubleshoot the PowerFlex 700L Liquid-Cooled AC Drive.
PowerFlex 700L Active Converter Power Module User Manual, publication PFLEX-UM002D	Provides information needed to wire and operate the PowerFlex 700 Active Converter Power Module.
PowerFlex 750-Series AC Drives Installation Instructions, publication 750-IN001	Explains the basic steps for mechanical installation and for connecting incoming power, the motor, and basic I/O to the PowerFlex 750-Series Adjustable Frequency AC drive.

Resource	Description
PowerFlex 750-Series EMC Plate and Core(s) - Frames 1...7 Installation Instructions, publication 750-IN006-MU-P	Provides information on installing PowerFlex 750-Series EMC Plate and Cores, Frames 1...7.
PowerFlex 755 AC Drives EMC Cores - Frames 8...10 Installation Instructions, publication 750-IN024-EN-P	Provides information on installing PowerFlex 750-Series EMC Plate and Cores, Frames 8...10.
PowerFlex 750-Series Drive Programming Manual, publication 750-PM001-EN-P	Provides information required to install, startup, and troubleshoot PowerFlex 750-Series Adjustable Frequency AC Drives.
PowerFlex 750-Series AC Drives Technical Data, publication 750-TD001-EN-P	Provides technical data about PowerFlex 750-Series AC Drives.
PowerFlex Active Front End User Manual, publication 20Y-UM001-EN-P	Provide information to install, startup, and troubleshoot the PowerFlex Active Front End (AFE).
1336 REGEN Line Regeneration Package User Manual, publication 1336 REGEN-5.0	Provides layout, sizing, wiring, startup and diagnostic information for the 1336 REGEN Line Regeneration Package, including Converter, Precharge Unit, 1321 Line Reactor, and Line Filter (when required).
1321 Power Conditioning Products Technical Data, publication 1321-TD001-EN-P	Provides technical data about 1321 Power Conditioning Products.
1321-Mxxxx Common Mode Chokes Installation Instructions, publication 1321-IN001-EN-P	Provides information to install a 1321-Mxxx Open Style Common Mode choke.
Kinetix 7000 High Power Servo Drive User Manual, publication 2099-UM001-EN-P	Provides information on installing, configuring, startup, troubleshooting, and applications for your Kinetix servo drive system.
Kinetix 6000 Multi-axis Servo Drives User Manual, publication 2094-UM001-EN-P	
Kinetix 6200 and Kinetix 6500 Modular Multi-axis Servo Drives, publication 2094-UM002H-EN-P	
EtherNet/IP Network Devices User Manual, ENET-UM006	Describes how to configure and use EtherNet/IP devices to communicate on the EtherNet/IP network.
Ethernet Reference Manual, ENET-RM002	Describes basic Ethernet concepts, infrastructure components, and infrastructure features.
System Security Design Guidelines Reference Manual, SECURE-RM001	Provides guidance on how to conduct security assessments, implement Rockwell Automation products in a secure system, harden the control system, manage user access, and dispose of equipment.
UL Standards Listing for Industrial Control Products, publication CMPNTS-SR002	Assists original equipment manufacturers (OEMs) with construction of panels, to help ensure that they conform to the requirements of Underwriters Laboratories.
American Standards, Configurations, and Ratings: Introduction to Motor Circuit Design, publication IC-AT001	Provides an overview of American motor circuit design based on methods that are outlined in the NEC.
Industrial Components Preventive Maintenance, Enclosures, and Contact Ratings Specifications, publication IC-TD002	Provides a quick reference tool for Allen-Bradley industrial automation controls and assemblies.
Safety Guidelines for the Application, Installation, and Maintenance of Solid-state Control, publication SGI-1.1	Designed to harmonize with NEMA Standards Publication No. ICS 1.1-1987 and 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.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications.	Provides declarations of conformity, certificates, and other certification details.

Notes:

Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, Knowledgebase, and product notification updates.	rok.auto/support
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Technical Documentation Center	Quickly access and download technical specifications, installation instructions, and user manuals.	rok.auto/techdocs
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	rok.auto/pcdc

Documentation Feedback

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