



**Allen-Bradley**

**PowerFlex<sup>®</sup>**

**Diode Bus Supply**

**User Manual**

[www.abpowerflex.com](http://www.abpowerflex.com)

**Rockwell  
Automation**

## Important User Information

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

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

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

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

Reproduction of the contents of this manual, in whole or in part, without written permission of Rockwell Automation, Inc. is prohibited.

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



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

---

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

---



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

---



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

---



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

---

## Summary of Changes

---

The information below summarizes the changes made to this manual since its last release (September 2004):

<b>Description of New or Updated Information</b>	<b>Page(s)</b>
In the "AC Supply Source Considerations" section, revised information in its "Input Power Conditioning" subsection.	<a href="#">1-3</a>
In the "Power Wiring" section, added a new "DC Bus Wiring Guidelines" subsection that refers to the <i>AC Drives In Common Bus Configurations</i> (Publication No. DRIVES-AT002...).	<a href="#">1-7</a>
Added new "Parallel Bus Supplies" section.	<a href="#">1-11</a>
Added new "Line Reactors" section.	<a href="#">A-5</a>



# Table of Contents

---

<b>Preface</b>	<b>Overview</b>	
	Who Should Use this Manual? . . . . .	P-1
	Reference Materials . . . . .	P-1
	Manual Conventions . . . . .	P-2
	General Precautions . . . . .	P-3
	Catalog Number Explanation. . . . .	P-4
	Description and Schematic Diagram . . . . .	P-5
<b>Chapter 1</b>	<b>Installation/Wiring</b>	
	Opening the Cover . . . . .	1-1
	Minimum Mounting Clearances . . . . .	1-2
	AC Supply Source Considerations. . . . .	1-2
	General Grounding Requirements . . . . .	1-4
	AC Input Fuses . . . . .	1-5
	Maximum Loading. . . . .	1-5
	Power Wiring . . . . .	1-6
	Control Wiring . . . . .	1-8
	Disconnecting MOVs and RFI-Filter Capacitors. . . . .	1-10
	Parallel Bus Supplies . . . . .	1-11
	CE Conformity . . . . .	1-12
<b>Chapter 2</b>	<b>Start Up/Troubleshooting</b>	
	Start-Up . . . . .	2-1
	Power On LED. . . . .	2-2
	Troubleshooting . . . . .	2-2
<b>Appendix A</b>	<b>Specifications</b>	
	PowerFlex Diode Bus Supply . . . . .	A-1
	Dimensions. . . . .	A-3
	Fuse Ratings . . . . .	A-4
	Line Reactors . . . . .	A-5



## Overview

The purpose of this manual is to provide you with the basic information needed to install, start-up and troubleshoot the PowerFlex Diode Bus Supply.

For information on ...	See page
<a href="#">Who Should Use this Manual?</a>	<a href="#">P-1</a>
<a href="#">Reference Materials</a>	<a href="#">P-1</a>
<a href="#">Manual Conventions</a>	<a href="#">P-2</a>
<a href="#">General Precautions</a>	<a href="#">P-3</a>
<a href="#">Catalog Number Explanation</a>	<a href="#">P-4</a>
<a href="#">Description and Schematic Diagram</a>	<a href="#">P-5</a>

## Who Should Use this Manual?

This manual is intended for personnel qualified in the installation, programming, and operation of adjustable Frequency Drives and their use in common DC bus systems.

## Reference Materials

The following manuals are recommended for general drive information:

Title	Publication	Available Online at ...
Wiring and Grounding Guidelines for PWM AC Drives	DRIVES-IN001...	<a href="http://www.rockwellautomation.com/literature">www.rockwellautomation.com/literature</a>
AC Drives in Common Bus Configurations	DRIVES-AT002...	
Preventive Maintenance of Industrial Control and Drive System Equipment	DRIVES-TD001...	
Safety Guidelines for the Application, Installation and Maintenance of Solid State Control	SGI-1.1	
A Global Reference Guide for Reading Schematic Diagrams	100-2.10	
Guarding Against Electrostatic Damage	8000-4.5.2	

For detailed PowerFlex 700 and PowerFlex 700S drive information including specifications:

Title	Publication	Available ...
PF 70/700 Reference Manual	PFLEX-RM001...	on the CD supplied with the drive or web site at
PF 700S Reference Manual	PFLEX-RM002...	
PowerFlex 700 User Manual	20B-UM001...	<a href="http://www.rockwellautomation.com/literature">www.rockwellautomation.com/literature</a>
PowerFlex 700S User Manual	20D-UM001...	<a href="#">literature</a>

For Allen-Bradley Drives Technical Support:

Title	Online at ...
Allen-Bradley Drives Technical Support	<a href="http://www.ab.com/support/abdrives">www.ab.com/support/abdrives</a>

## Manual Conventions

- In this manual we may also refer to the PowerFlex Diode Bus Supply as Diode Bus Supply or Bus Supply.
- The following words are used throughout the manual to describe an action:

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

---

## General Precautions

---



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



**ATTENTION:** An incorrectly applied or installed Bus Supply can result in component damage or a reduction in product life. Wiring or application errors, such as incorrect or inadequate AC supply, or excessive ambient temperatures may result in malfunction of the system.



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



**ATTENTION:** Only connect Rockwell Automation common DC bus AC drives with built-in precharge circuit to the Bus Supply’s common DC bus output. See [Appendix A](#) for available Drives.



**ATTENTION:** To avoid an electric shock hazard, verify that the voltage on the DC bus terminals (which are connected to the DC bus capacitors of the Inverter) has discharged before performing any work on the Bus Supply. Measure the DC bus voltage at the +DC and -DC terminal of the Output Power Terminals. The voltage must be zero.

---

## Catalog Number Explanation

			<i>Position Number</i>	
<i>1-3</i>	<i>4</i>	<i>5-7</i>	<i>8</i>	<i>9</i>
<b>20T</b>	<b>D</b>	<b>120</b>	<b>A</b>	<b>E</b>
<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>

<i>a</i>	
<b>Product</b>	
<b>Code</b>	<b>Type</b>
20T	PowerFlex Diode Bus Supply

<i>b</i>			
<b>Voltage Rating</b>			
<b>Code</b>	<b>Input Voltage</b>	<b>Phase</b>	<b>DC Output</b>
D	240 - 480V ac	3	325 - 650V dc
E	500 - 600V ac	3	675 - 810V dc

<i>c</i>		
<b>Current Rating</b>		
<b>Code</b>	<b>Output</b>	<b>Frame</b>
120	120.0 Amp	2

<i>d</i>	
<b>Enclosure</b>	
<b>Code</b>	<b>Rating</b>
A	NEMA Type 1 / IP20

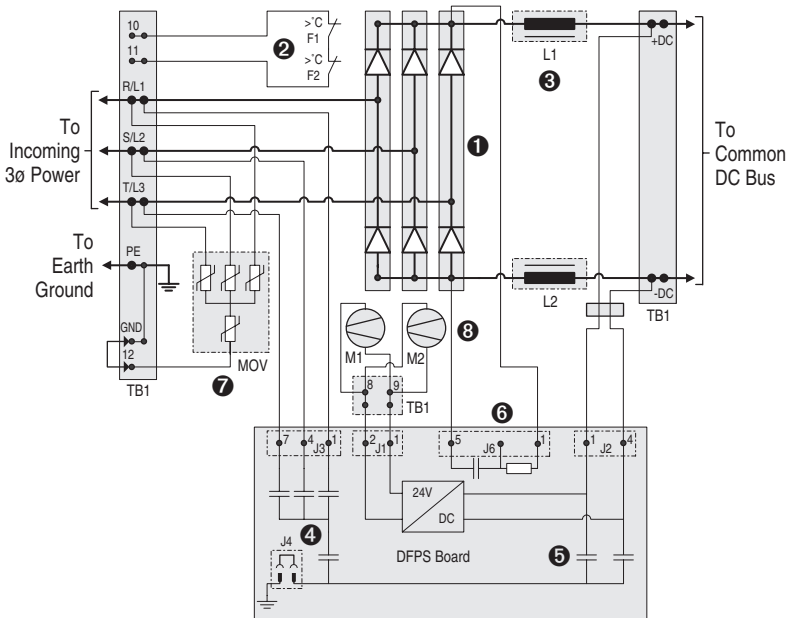
  

<i>e</i>		
<b>Documentation &amp; Shipping Carton</b>		
<b>Code</b>	<b>User Manual</b>	<b>Carton</b>
E	English	Yes

## Description and Schematic Diagram

The Diode Bus Supply is a single-direction power converter for the front end of common DC bus drive systems. It converts the incoming 3-phase AC line voltage to a common DC bus voltage.

Figure P.1 Diode Bus Supply Schematic Diagram



The primary electrical components for the Diode Bus Supply are:

Item	Description
①	<b>Six-Pulse, Full-Wave, 3-Phase Diode Bridge Rectifier Unit</b> directly connected to the three line input terminals.
②	<b>Bus Supply Overtemperature sensors</b> , located in the heat sink, are used for thermal protection of the diode-bridge rectifier.
③	<b>DC chokes (L1, L2)</b> to reduce conducted HF-emissions. They also reduce line harmonics and peak currents in the AC line and the bridge circuit.
④	<b>Input Filter Capacitors</b> connected to the three input phases to reduce conducted HF-emissions.
⑤	<b>Common Mode Capacitors</b> connected to the DC-bus to reduce conducted HF-emissions.
⑥	<b>DC-Bus Snubber circuit</b> for dampening and limiting overvoltages.
⑦	<b>MOV circuit</b> connected to the three input phases.
⑧	<b>Cooling Fans</b> connected to the 24V DC Supply on the <b>Power Supply Board (DFPS)</b> .

**Note:** Components ③, ④, and ⑤ compose a Radio Frequency Interference Filter (RFI), which meets the EMC requirements of Product Standard 61800-3 for industrial environments.

**Notes:**

## Installation/Wiring

This chapter provides information on the installation and wiring of the PowerFlex Diode Bus Supply.

For information on ...	See page
<a href="#">Opening the Cover</a>	1-1
<a href="#">Minimum Mounting Clearances</a>	1-2
<a href="#">AC Supply Source Considerations</a>	1-2
<a href="#">General Grounding Requirements</a>	1-4
<a href="#">AC Input Fuses, Maximum Loading</a>	1-5
<a href="#">Power Wiring</a>	1-6

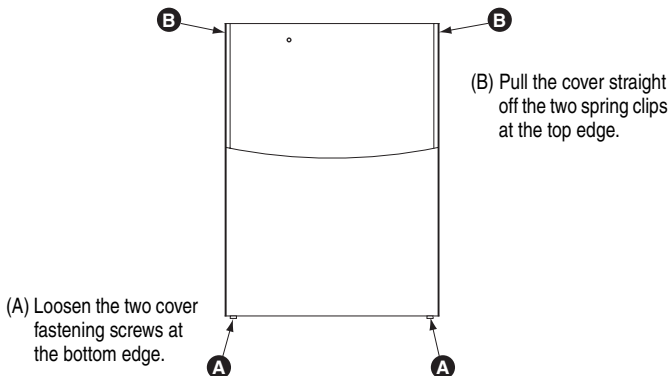
For information on ...	See page
<a href="#">Control Wiring</a>	1-8
<a href="#">Disconnecting MOVs and RFI-Filter Capacitors</a>	1-10
<a href="#">Parallel Bus Supplies</a>	1-11
<a href="#">CE Conformity</a>	1-12

Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All items must be read and understood before the actual installation begins.

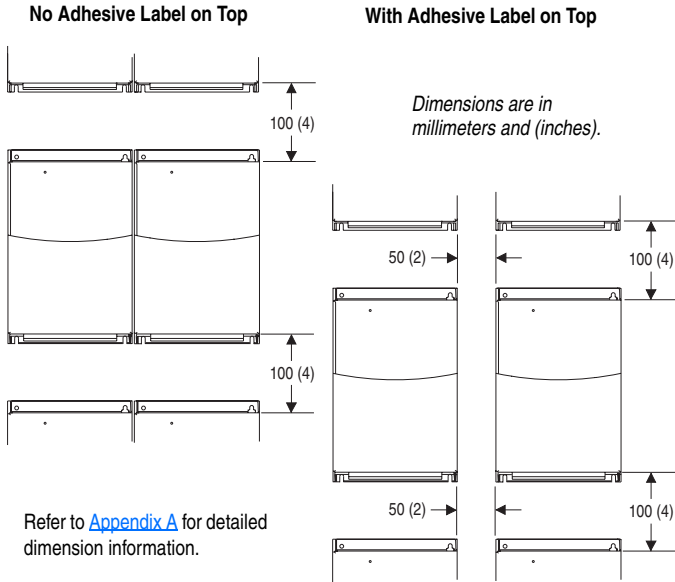


**ATTENTION:** The following information is merely a guide for proper installation. Rockwell Automation Inc. cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this product or associated equipment. A hazard of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

### Opening the Cover



## Minimum Mounting Clearances



## Ambient Operating Temperatures

The PowerFlex Diode Bus Supply is designed to operate at 0° to 40°C (32° to 104°F) ambient. Remove the label from the top to operate the Bus Supply in ambients 41°C up to 50°C (104°F up to 122°F).

**Important:** Removing the adhesive label changes the enclosure rating from NEMA Type 1 Enclosed to Open Type. This also changes the side-to-side mounting clearance requirement.

## AC Supply Source Considerations

The PowerFlex Diode Bus Supply is suitable for use on a circuit capable of delivering a short circuit rating up to a maximum of 200,000 rms symmetrical amperes, and a maximum of 600 volts.



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

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

### Unbalanced or Ungrounded Distribution Systems

Where the potential exists for abnormally high phase-to-ground voltages (in excess of 125% of nominal), or the supply system is ungrounded, refer to the *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives* (Publication No. DRIVES-IN001...).



---

**ATTENTION:** The PowerFlex Diode Bus Supply contains protective MOVs, and input filter and common mode capacitors that are referenced to ground. These devices should be disconnected from ground if the Bus Supply is installed on an ungrounded power distribution system. See [page 1-7](#) for jumper locations.

---

### Input Power Conditioning

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

- The power system has power factor correction capacitors switched in and out of the system, either by the user or by the power company.
- The power source has intermittent voltage spikes in excess of 6000 volts. These spikes could be caused by other equipment on the line or by events such as lightning strikes.
- The power source has frequent interruptions.
- The nearest supply transformer is larger than 1000 kVA.

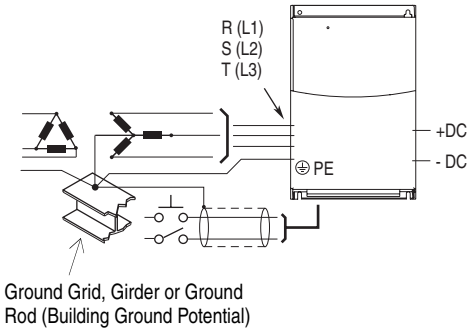
If any or all of these conditions exist, it is recommended that the user install a minimum amount of impedance between the drive and the source. This impedance could come from the supply transformer itself, the cable between the transformer and drive, or an additional transformer or reactor. For recommended line reactors, see [Line Reactors on page A-5](#).

## General Grounding Requirements

**The Safety Ground terminal (PE) must be connected to the building grounding scheme.** Ground impedance must conform to the requirements of national and local industrial safety regulations and/or electrical codes. The integrity of all ground connections should be periodically checked.

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

**Figure 1.1 Typical Grounding**



### Safety Ground Terminal - PE

The Bus Supply safety ground (PE) must be connected to the customer grounding scheme or earth ground. This is the safety ground for the Bus Supply that is required by code. This point must be connected to adjacent building steel (girder, joist), a floor ground rod, bus bar or building ground grid. Grounding points must comply with national and local industrial safety regulations and/or electrical codes.

### RFI Filter Grounding

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

redundant ground connections. The integrity of all connections should be periodically checked. Refer to the instructions supplied with the filter.

## AC Input Fuses

The PowerFlex Diode Bus Supply can be installed with delay type input fuses. National and local industrial safety regulations and/or electrical codes may determine additional requirements for these installations.



**ATTENTION:** The PowerFlex Diode Bus Supply does not provide branch short circuit protection. Specifications for the recommended fusing to provide protection against short circuits are provided in [Table A.A](#).

## Maximum Loading

To avoid overloading the Bus Supply, the following requirement applies:

The DC Input current sum (Normal Duty or Heavy Duty rating at 40°C/104°F) of the connected drive(s) must not exceed the Bus Supply continuous DC Bus output current rating of 120 amps at 40°C/104°F.

For the DC Input Current values of the drives, please refer to tables in Appendix A of the PowerFlex 700/700S User Manual. In addition, the guidelines provided in the PowerFlex 700/700S User Manual also apply.

Maximum Loading Examples for Diode Bus Supply (also, see [page 1-9](#))

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	109.4	120A	400V
650V	2 x 40 = 80 HP	2 x 55.7	111.4	120A	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	37 + 2 x 1.5 = 40 kW	95.1 + 2 x 5.3	105.7	120A	400V

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

## Power Wiring



---

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

---

### Cable Types Acceptable for 200-600 Volt Installations

A variety of cable types are acceptable for drive installations. For many installations, unshielded cable is adequate, provided it can be separated from sensitive circuits. As an approximate guide, allow a spacing of 0.3 meters (1 foot) for every 10 meters (33 feet) of length. In all cases, long parallel runs must be avoided. Do not use cable with an insulation thickness less than or equal to 15 mils (0.4 mm/0.015 in.). UL installations in 50°C (122°F) ambient must use 600V, 90°C (194°F) wire. UL installations in 40°C (104°F) ambient should use 600V, 75°C (168°F) wire.

#### Unshielded

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

#### EMC Compliance

Refer to [CE Conformity on page 1-12](#) for details.

#### Cable Trays and Conduit

If cable trays or large conduits are to be used, refer to guidelines presented in the *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives* (Publication No. DRIVES-IN001...).



---

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

---

## DC Bus Wiring Guidelines

For DC Bus wiring guidelines, refer to *AC Drives in Common Bus Configurations* (Pub No. DRIVES-AT002...).

## Bus Supply Terminals

Figure 1.2 Terminal and Jumper Locations

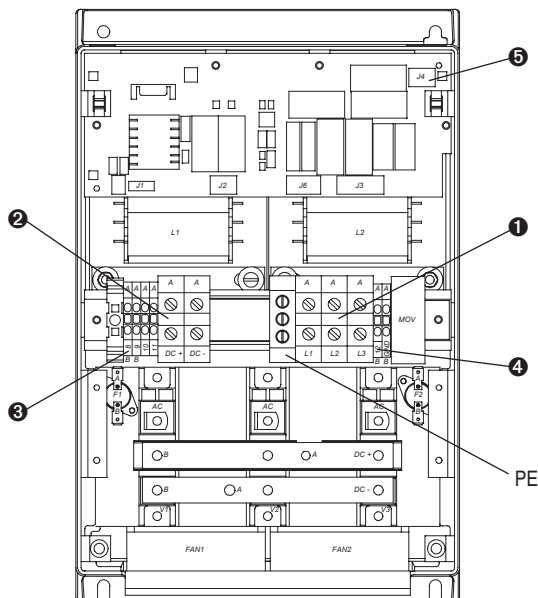


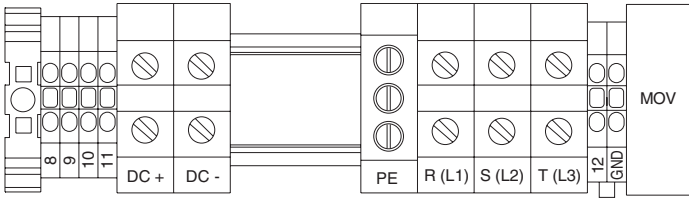
Table 1.A Terminal Specifications

Item	Name	Wire Size Range <sup>(1)</sup>		Torque
		Maximum	Minimum	
①	Input Power Terminals (L1, L2, L3)	35 mm <sup>2</sup> (2 AWG)	0.75 mm <sup>2</sup> (18 AWG)	3.3N-m (30 lb.-in.)
PE	Protective Earth Terminal			
②	DC Bus Terminals (DC +, DC -)	2.5 mm <sup>2</sup> (14 AWG)	0.25 mm <sup>2</sup> (22 AWG)	0.8N-m (7lb.-in.)
③	Control Terminals 8 - 11			
④	Control Terminals 12 and GND			

<sup>(1)</sup> Maximum/minimum sizes that the terminals will accept - these are not recommendations.

⑤ Jumper J4, see [Disconnecting MOVs and RFI-Filter Capacitors on page 1-10](#).

Figure 1.3 Power and Control Terminals



Terminal	Description	Notes
<b>Power Connections</b>		
DC +	DC Bus (+)	DC Bus Connection (+)
DC -	DC Bus (-)	DC Bus Connection (-)
PE	PE Ground	Safety Ground
R	R (L1)	AC Line Input Power
S	S (L2)	AC Line Input Power
T	T (L3)	AC Line Input Power
<b>Control Connections</b>		
8	24V Fan Supply	Internal connection to extend fan supply leads (Must be disconnected in case of fan replacement)
9		
10	NC Contact Output (F1, F2)	Opens at power stack overtemperature. (Refer to <a href="#">Appendix A</a> for contact ratings.)
11		
12	Jumper	Disconnects MOVs between phase and ground by removing this jumper. (Refer to <a href="#">page 1-10</a> for details.)
GND	MOVs to Ground	

## Control Wiring

Important points to remember about control wiring:

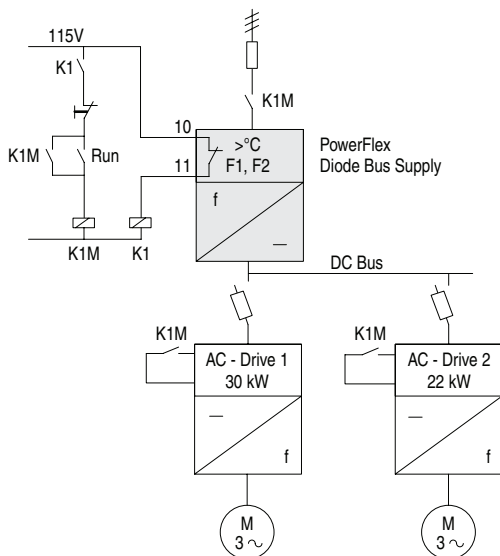
- Always use copper wire.
- Wire with an insulation rating of 600V or greater is recommended.
- Control wires outside the cabinet should be separated from power wires by at least 0.3 meters (1 foot).

## Drive Run Interlock

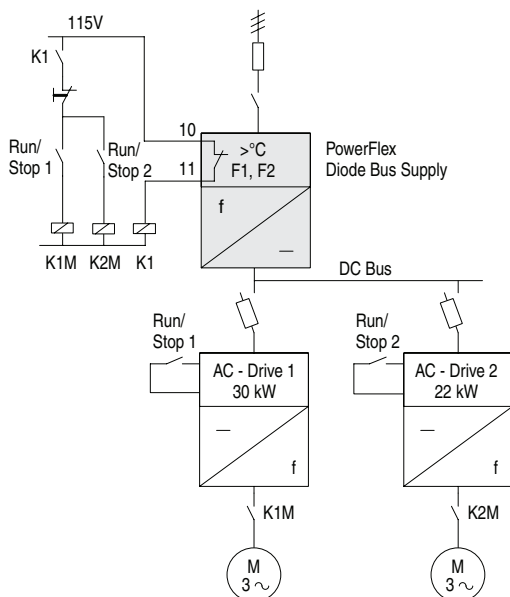
To protect the Bus Supply from Overtemperature, the normally closed contacts (Bus Supply Overtemperature - terminals 10 and 11) should be wired to either the AC line input contactor for the Bus Supply or the Run interlock circuit (enable input) of each connected drive. This ensures that the drives will be stopped in case of Bus Supply Overtemperature.

## Control Wiring Examples

### A. Multiple Drives, Running Simultaneously



### B. Multiple Drives, Running Independently (2-wire control)



Note: See [Appendix A](#) for Output Contact ratings.

## Disconnecting MOVs and RFI-Filter Capacitors

The PowerFlex Diode Bus Supply contains protective MOVs, and input filter and common mode capacitors that are referenced to ground. To prevent damage, these devices should be **disconnected if the Bus Supply is installed on an ungrounded distribution system** where the line-to-ground voltages on any phase could exceed 125% of the nominal line-to-line voltage. To disconnect these devices from ground, remove the jumpers shown in [Table 1.B](#). Jumpers can be removed by carefully pulling the jumper straight out. See *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives* (Publication DRIVES-UM001...) for more information on ungrounded system installation.



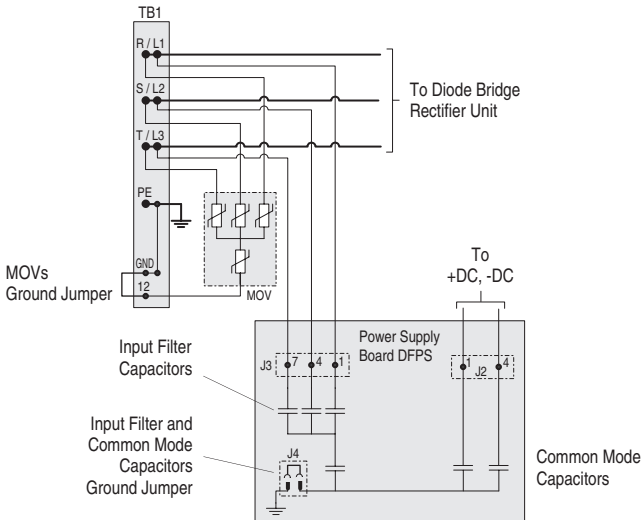
**ATTENTION:** To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before removing/installing jumpers. Measure the DC bus voltage at the DC + and DC - terminals of the Power Terminal Block. The voltage must be zero.

Table 1.B Jumper Removal <sup>(1)</sup>

Item	Jumper	Jumper Location (see <a href="#">Figure 1.2</a> )	Removes ...
④	12 - GND	Control Terminals	MOVs from Ground
⑤	J4	On DFPS Board	Capacitors from Ground

<sup>(1)</sup> **Important:** Do not remove jumpers if the distribution system is grounded.

Figure 1.4 Removing the Phase-to-Ground Jumpers for the MOV, Input Filter, and Common Mode Capacitors



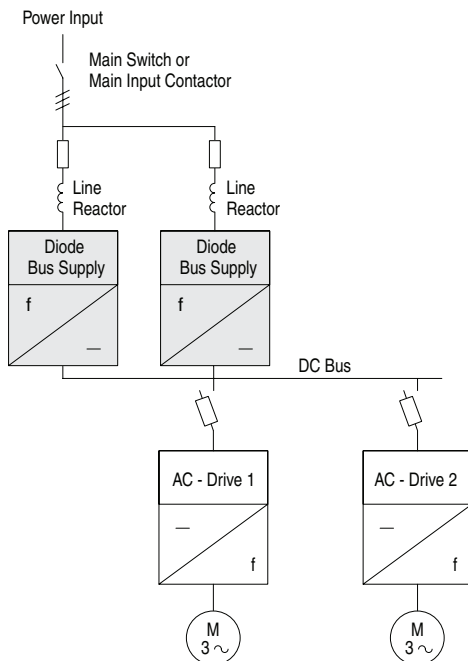
## Parallel Bus Supplies

Up to two PowerFlex Diode Bus Supplies can be paralleled for operation. To parallel PowerFlex Diode Bus Supplies, an AC line reactor must be used at the input of each Diode Bus Supply. One-percent reactors (1321-3R130-A) can be used, unless 3% reactors (1321-3R130-B) are required based on the maximum transformer size listed in [Line Reactors on page A-5](#).

When paralleling the Diode Bus Supplies, they must be derated 3%. This results in a DC Bus continuous output current rating of 233 Amps ( $0.97 \times 2 \times 120$ ).

When paralleling the Diode Bus Supplies, it is recommended to use AC line fuses with an open fuse indicator, such as the Ferraz Shawmut AJT150. See [Fuse Ratings on page A-4](#) for details on recommended fusing.

**Figure 1.5 Parallel Diode Bus Supplies**



## CE Conformity

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

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

### Low Voltage Directive (73/23/EEC)

- EN50178 Electronic equipment for use in power installations

### EMC Directive (89/336/EEC)

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

### Harmonic Emissions

Electronic converters such as the Bus Supply can cause conducted low frequency disturbances (harmonic emissions) to the supply network. The two inductors in the DC-bus circuit will substantially reduce the harmonics produced by the Bus Supply. However, the magnitude of the harmonic currents and resulting harmonic voltages also depends upon the network impedance at the point where the unit is connected to the network. Currently there are no mandatory harmonic emission limits related to CE compliance for equipment connected to private power networks. Upon request, Rockwell Automation can provide information regarding harmonic emissions from the Diode Bus Supply.

### General Notes

- If the adhesive label is removed from the top of the Bus Supply, it must be installed in an enclosure with side openings less than 12.5 mm (0.5 in.) and top openings less than 1.0 mm (0.04 in.) to maintain compliance with the LV Directive.
- The DC bus cable to the inverter(s) should be kept as short as possible to avoid electromagnetic emission and capacitive currents. Therefore the inverter(s) should be located in the same cabinet as the

Bus Supply Unit. If the connection leads between DC bus and inverter(s) are leaving the cabinet, shielded cables must be used.

- Use of line filters in ungrounded systems is not recommended.
- The PowerFlex Diode Bus Supply with its inherent high frequency filtering satisfies CE EMC emission limits for the industrial environment. If used in a residential or domestic environment it may cause radio interference. The user is required to take measures to prevent interference, in addition to the essential requirements for CE compliance listed below, if necessary.
- Conformity of the drive with CE EMC requirements does not guarantee an entire machine installation complies with CE EMC requirements. Many factors can influence total machine/installation compliance.

### Essential Requirements for CE Compliance

Conditions 1-3 listed below **must be** satisfied for the PowerFlex Diode Bus Supply to meet the requirements of **EN61800-3**.

1. Bus Supply and Drive must be PowerFlex type and CE compatible.
2. Grounding as described on [page 1-4](#).
3. Control wiring and DC bus wiring leaving the cabinet must be braided, shielded cable with a coverage of 75% or better, metal conduit or equivalent attenuation.

For additional conditions, refer to the *PowerFlex 700/700S Reference Manual*.

**Notes:**

# Start Up/Troubleshooting

This chapter provides the necessary information for the start up and troubleshooting of the PowerFlex Diode Bus Supply.

For information on ...	See page
<a href="#">Start-Up</a>	<a href="#">2-1</a>
<a href="#">Power On LED</a>	<a href="#">2-2</a>
<a href="#">Troubleshooting</a>	<a href="#">2-2</a>



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

## Start-Up

### Before Applying Power to the Bus Supply

1. Confirm that all inputs are connected to the correct terminals and are properly torqued.
2. Verify that AC line power at the disconnect device is within the rated value of the Bus Supply. See [Appendix A](#).
3. Verify the Bus Supply Overtemperature control circuit is correctly wired.

This normally closed contact output is used to stop the drive. Verify that this interlock has been wired correctly according to the user's specification. Refer to [Control Wiring Examples on page 1-9](#).

## Applying AC Power to the Bus Supply

- ❑ 1. Apply AC power to the Bus Supply. The green Power On LED should be on if power is applied to terminals R, S, T (L1, L2, L3).
- ❑ 2. If the green Power On LED is not on at this point, refer to [Table 2.A](#).

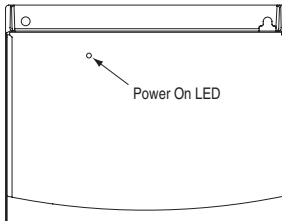
## Power On LED

The green Power On LED is visible through the front panel and will be illuminated if power is applied.



**ATTENTION:** The Power On LED is only operational when the unit is energized. Servicing energized equipment can be hazardous. Severe injury or death can result from electrical shock, burn, or unintended actuation of the controlled equipment. Follow safety related practices of NFPA 70E, Electrical Safety For Employee Workplaces. **DO NOT** work alone on energized equipment!

**Figure 2.1** Power On Indicator



## Troubleshooting

**Table 2.A** Possible Faults and Corrective Actions

Fault	Cause	Corrective Action
Heat sink Over Temperature	Heat sink temperature exceeds maximum rating.	1. Verify that maximum ambient temperature has not been exceeded.
		2. Check fans for correct operation.
DC Output Voltage Loss	Loss of DC Bus power and loss of 24V power	1. Check 3-phase AC incoming power for undervoltage or phase loss.
	Loss of 24V power only	2. Check 3-phase input circuit breaker or fusing.
		3. Contact your local RA sales office
		1. Check fans for correct operation.
		2. Check OverTemperature Switches.
		3. Contact your local RA sales office.



## Specifications

This appendix provides electrical, environmental, functional and physical specifications for the PowerFlex Diode Bus Supply, and selection tables for AC input devices.

For information on ...	See page
<a href="#">PowerFlex Diode Bus Supply</a>	<a href="#">A-1</a>
<a href="#">Dimensions</a>	<a href="#">A-3</a>
<a href="#">Fuse Ratings</a>	<a href="#">A-4</a>
<a href="#">Line Reactors</a>	<a href="#">A-5</a>

### PowerFlex Diode Bus Supply

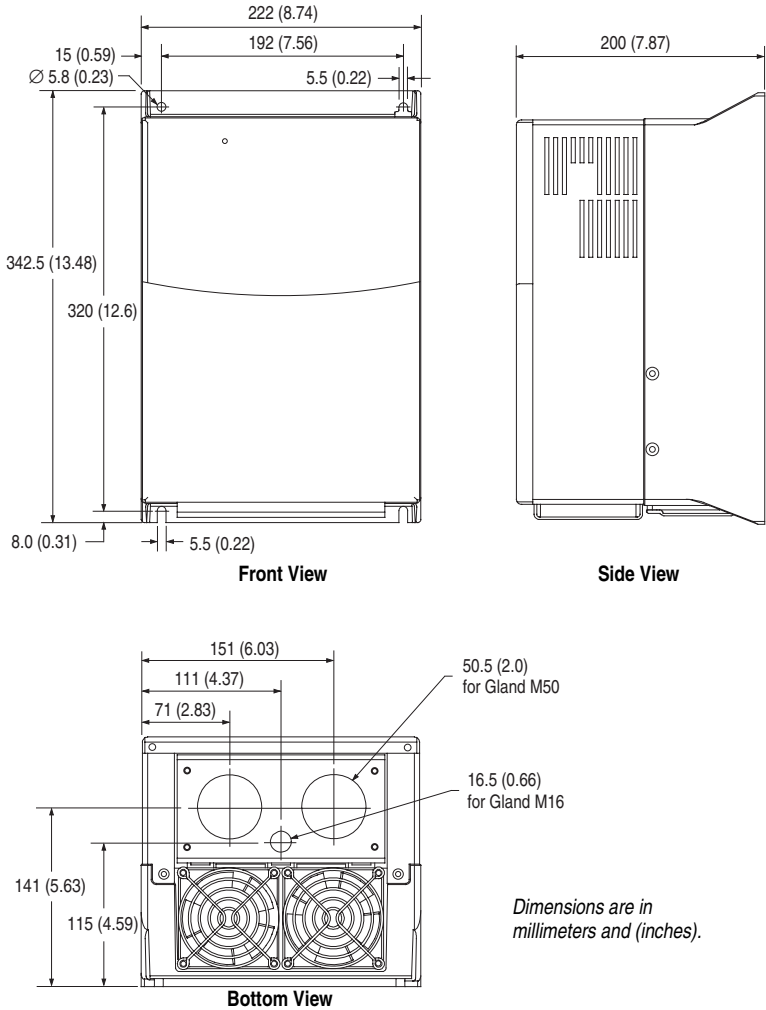
Category	Specification					
<b>Input/Output Ratings</b>	AC Input Voltage Range:	<b>200 - 480V Unit</b>	<b>500 - 600V Unit</b>			
	Nominal AC Input Voltage:	<b>240V</b>	<b>400V</b>	<b>480V</b>	<b>500V</b>	<b>600V</b>
	Nominal DC Bus Voltage:	325V	540V	648V	675V	810V
	Continuous rms AC Input Current:	105A	105A	105A	105A	105A
	Continuous DC Bus Current:	120A	120A	120A	120A	120A
	Voltage Tolerance:	-10% of minimum, +10% of maximum.				
	Frequency Tolerance:	47-63 Hz.				
	Displacement Power Factor:	0.92 lagging (entire speed range)				
	Efficiency:	99.5% at rated amps, nominal line volts.				
	Line Transients:	up to 6000 volts peak per IEEE C62.41-1991				
	Heat Dissipation:	500 W				
	Max. Short Circuit Current Rating: Using Recommended Fuse or Circuit Breaker Type	Maximum short circuit current rating to match specified fuse/circuit breaker capability.				
<b>Control Output</b>	Heat Sink Temperature Sensor:	The two temperature sensors trip if heat sink temperature exceeds 85°C				
	Contact Output Rating (Max.):	Resistive Rating: 15A at 125V AC, 10A at 250V AC, 7A at 24V DC  Inductive Rating: 10A at 125V AC, 6A at 250V AC				

Category	Specification	
<b>Approvals and Standards Compliance</b>	NFPA 70 - US National Electrical Code	
	NEMA ICS 3.1 - Safety standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.	
	NEMA 250 - Enclosures for Electrical Equipment	
	IEC 146 - International Electrical Code	
	 UL and cUL Listed to UL508C and CAN/CSA-C2.2 No. 14-M91	
	 Marked for all applicable European Directives: <ul style="list-style-type: none"> <li>• EMC Directive (89/336/EEC)</li> <li>• Emissions: EN 61800-3 Adjustable Speed electrical power drive systems Part 3</li> <li>• Immunity: EN 61800-3 Second Environment, Restricted Distribution</li> <li>• Low Voltage Directive (73/23/EEC)</li> <li>• EN 50178 Electronic Equipment for Use in Power Installations</li> </ul>	
<b>Environment</b>	Altitude:	1000 m (3300 ft) max. without derating. Above 1000 m, the derating for the output current is 1% per 100 m (330 ft.).
	Ambient Operating Temperature without Derating:	
	Open Type / IP00:	0 to 50°C (32 to 122°F)
	NEMA Type 1 / IP20:	0 to 40°C (32 to 104°F)
	Storage Temperature (all const.):	-40 to 70°C (-40 to 158°F)
	Relative Humidity:	5 to 95% non-condensing
	Shock:	15G peak for 11 ms duration (± 1.0 ms)
Vibration:	0.152 mm (0.006 in.) displacement, 1G peak	
<b>Compatible AC Drives</b>	Permitted AC Drives that can be connected to the Diode Bus Supply:	<ul style="list-style-type: none"> <li>• PowerFlex AC drives with built-in precharge circuit (for example, PowerFlex 700 and PowerFlex 700S)</li> <li>• 1336 AC drives</li> <li>• GV3000 AC drives</li> </ul>

## Dimensions

The overall dimensions and mounting holes of the PowerFlex Diode Bus Supply are shown in [Figure A.1](#), and are the same as those of the PowerFlex 700 Frame 2 Drive.

**Figure A.1 Diode Bus Supply Dimensions**



**Approximate Shipping Weight: 23 kg (50.7 lb)**

## Fuse Ratings

[Table A.A](#) below provides output ampere ratings for the Diode Bus Supply (including continuous, 1 minute, and 3 second) and recommended AC line input fusing information. The short circuit protection fuses are acceptable for UL and IEC requirements. Sizes listed are the recommended sizes based on 40°C (104°F) and the U.S. N.E.C. Other country, state or local codes may require different ratings.

### Fusing

Refer to the recommended types listed below.

- IEC – BS88 (British Standard) Parts 1 & 2 <sup>(1)</sup>, EN60269-1, Parts 1 & 2, type gG or equivalent should be used.
- UL – UL Class RK1 or J must be used. <sup>(2)</sup>

**Table A.A AC Input Current Ratings and Recommended Input Fusing**

Bus Supply Catalog Number	Frame	Input Ratings		Output Amps			Dual Element Time Delay Fuse Amps	
		Amps	kVA	Cont.	1 Min.	3 Sec.		
<b>240 Volt / 60 Hz AC Input</b>								
20TD120	2	105	44	120	180	240	125 IEC - gG or 150 UL - Class RK1 or J	
<b>400 Volt / 50 Hz AC Input</b>								
20TD120	2	105	73	120	180	240		
<b>480 Volt / 60 Hz AC Input</b>								
20TD120	2	105	87	120	180	240		
<b>500 Volt / 50 Hz AC Input</b>								
20TE120	2	105	91	120	180	240		
<b>600 Volt / 60 Hz AC Input</b>								
20TE120	2	105	109	120	180	240		

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

(2) For 600V, (Ferraz Shawmut) Class J: AJT150 (with open fuse indicator),  
Class RK1: A6D150R  
(Bussmann) Class J: LPJ-150SP,  
Class RK1: LPS-RK-150SP or equal

## Line Reactors

### 400V, 50 Hz Line Reactor Selection

Max. Transformer Size <sup>(1)</sup>	Inductance (μH)	Catalog No. 1321-
1000 kVA	200	3R130-B

<sup>(1)</sup> Without added line reactor.

### 480V, 60 Hz Line Reactor Selection

Max. Transformer Size <sup>(1)</sup>	Inductance (μH)	Catalog No. 1321-
1000 kVA	200	3R130-B

<sup>(1)</sup> Without added line reactor.

### 600V, 60 Hz Line Reactor Selection

Max. Transformer Size <sup>(1)</sup>	Inductance (μH)	Catalog No. 1321-
1400 kVA	200	3R130-B

<sup>(1)</sup> Without added line reactor.

**Notes:**



U.S. Allen-Bradley Drives Technical Support

Tel: (1) 262.512.8176, Fax: (1) 262.512.2222, Email: support@drives.ra.rockwell.com, Online: www.ab.com/support/abdrives

**[www.rockwellautomation.com](http://www.rockwellautomation.com)**

---

**Power, Control and Information Solutions Headquarters**

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Europe/Middle East/Africa: Rockwell Automation, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, Level 14, Core F Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 20FUM001C-EN-P - September 2006  
Supersedes 20FUM001B-EN-P - September 2004

Copyright © 2006 Rockwell Automation, Inc. All rights reserved. Printed in USA.