

Bulletin 160 SSC Variable Speed Drives to PowerFlex 525 AC Drives



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.

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



SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.



BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.



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

This manual contains new and updated information.

New and Updated Information

This table contains the changes made to this revision.

Topic	Page
Added missing text in description for Chapter 2 in the Overview.	7
Updated the PowerFlex 525 drive data nameplate image.	18
Updated the PowerFlex 525 drive input protection devices tables.	26 . . . 27

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The purpose of this migration guide is to assist you in migrating a Bulletin 160 SSC™ variable speed drive to a PowerFlex® 525 AC drive. Use this migration guide to help you understand some basic migration requirements.

IMPORTANT This migration guide provides some initial migration guidelines. You also need to review the product literature listed in the Additional Resources section on page [10](#) to understand the technical similarities and differences between the Bulletin 160 and PowerFlex 525 drive, and to help you determine the proper solution for your migration.

Many sections of this migration guide direct you to additional details and information available in these additional publications.

Overview

This publication contains these chapters:

- Chapter 1: Drive Selection Considerations beginning on page [13](#)

This chapter provides comparisons of the specifications, features, dimensions and power and control terminals of the Bulletin 160 to the PowerFlex 525 drive.

- Chapter 2: Drive Configuration beginning on page [67](#).

This chapter provides comparisons of the drive configuration, control wiring, and parameters of the Bulletin 160 to the PowerFlex 525 drive.

- Chapter 3: Network Communication on page [79](#).

This chapter identifies the Bulletin 160 network options that can be migrated to the PowerFlex 525 drive. This section also provides overview information for velocity reference/feedback, I/O adaptors, and 16 bit-based processors (PLC-5®).

General Precautions

Be aware of the following general precautions when working with the drives. See the installation instructions for each drive, listed in Additional Resources on page [10](#), for additional precautions specific to each drive.

Qualified Personnel



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

Product Safety



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

Pre-Migration

Best Practices

Follow these best practices to be sure that your migration is successful.

- Upload and save the drive parameters via Connected Components Workbench™ software or DriveExecutive™ software. If you cannot connect to the drive online, manually record the drive parameter values.
- Record the motor nameplate data, and record and label all power, motor, and digital and analog I/O control wiring.
- Upload and save any network files and programmable logic controller (PLC) programs.

General Information

See the Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives Installation Instructions, publication [DRIVES-IN001](#), for information regarding the topics listed below.

Wire/Cable Type

- General
- Input power
- Output motor
- Discrete drive I/O
- Analog signal and encoder
- Communication

Power Distribution

- System configurations
- AC line voltage
- Surge protection MOVs and common mode capacitors
- AC line impedance
- PowerFlex drives used with regenerative units
- DC bus wiring guidelines

Grounding

- Safety grounds
- Noise related grounds

Installation Practices

- Mounting
- Conduit entry
- Ground connections
- Wire routing
- Conduit
- Cable trays
- Shield termination
- Conductor termination
- Moisture

Reflective Wave

- Description
- Effects on wire types
- Length restrictions for motor protection

Electromagnetic Interference

- Causes and containing common mode noise
- Causes and preventing/mitigating transient interference
- Enclosure lighting
- Bearing current

Motor Cable Length Tables

- 160
- PowerFlex 40 Drives

Note: Check for PowerFlex 525 data in a future release of this manual.

Additional Resources

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

Resource	Description
Bulletin 160 drives product literature	
160 SSC Variable Speed Controller (Series A) User Manual FRN 4.01, 4.04, 4.07, publication 0160-5.0	Provides installation and operation information.
160 SSC E Variable Speed Controller (Series B) User Manual, FRN 5.xx...6.xx, publication 0160-5.9	Provides installation and operation information.
160 SSC Variable Speed Drive (Series C) User Manual, FRN 7.03...7.06, publication 0160-5.17ML	Provides installation and operation information.
Bulletin 160 AC Drive Technical Data, publication 0160-TD001	Provides detailed drive and option specifications and ratings.
Bulletin 160 DeviceNet Communication Module User Manual, FRN 1.xx...2.xx, publication 0160-5.5	Provides information on installing, configuring and troubleshooting the Bulletin 160 SSC DeviceNet communication module.
DeviceNet Communication Module User Manual, FRN 3.xxx, publication 0160-5.18	Provides information on installing, configuring and troubleshooting the Bulletin 160 SSC DeviceNet communication module.
PowerFlex 525 Drives Product Literature	
PowerFlex 525 Adjustable Frequency AC Drive User Manual, publication 520-UM001	Provides information needed to install, start-up and troubleshoot the PowerFlex 525 adjustable frequency AC drive.
PowerFlex 525 AC Drive Specifications Technical Data, publication 520-TD001	Provides detailed drive and option specifications and ratings.
PowerFlex 525 AC Drive Sample Specification, publication 25B-SR001	Provides technical specifications for the drive and options.
PowerFlex 525 Embedded EtherNet/IP Adapter User Manual, publication 520COM-UM001	Provides information about the EtherNet/IP adapter embedded on the main control board in PowerFlex 525 drives, and how to use it for network communication.
PowerFlex 525 DeviceNet Adapter User Manual, publication 520COM-UM002	Provides information about the DeviceNet adapter and how to use it with PowerFlex 525 drives for network communication.
PowerFlex 25-COMM-E2P Dual-Port EtherNet/IP Adapter User Manual, publication 520COM-UM003	Provides information about the Dual-port EtherNet/IP adapter and how to use it with PowerFlex 520-series drives for network communication.
PowerFlex 520-Series Communication Adapters Installation Instructions, publication 520COM-IN001	Provides installation instructions for PowerFlex 520-Series communication adapters.

Resource	Description
Bulletin 160 to PowerFlex 520-Series Adapter Plate Installation Instructions, publication 520-IN001	Provides installation instructions for the Bulletin 160 to PowerFlex 520-Series adapter plate.
PowerFlex 520-Series Control and Power Module Installation Instructions, publication 520-IN002	Provides installation instructions for the PowerFlex 520-Series control and power module.
PowerFlex 520-Series Heatsink Fan Kit, publication 520-IN003	Provides installation instructions for the PowerFlex 520-Series heatsink fan kit.
PowerFlex 520-Series Control Module Fan Kit, publication 520-IN004	Provides installation instructions for the PowerFlex 520-Series control module fan kit.
PowerFlex 520-Series Replacement Power Terminal Guard, publication 520-IN005	Provides installation instructions for the PowerFlex 520-Series replacement power terminal guard.
PowerFlex 520-Series EMC Filter Installation Instructions, publication 520-IN006	Provides installation instructions for the PowerFlex 520-Series EMC filter.
PowerFlex 520-Series EMC Plate Installation Instructions, publication 520-IN007	Provides installation instructions for the PowerFlex 520-Series EMC plate.
PowerFlex 520-Series Incremental Encoder Input Installation Instructions, publication 520-IN009	Provides installation instructions for the PowerFlex 520-Series incremental encoder input.
General Literature	
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives Installation Instructions, publication DRIVES-IN001	Provides the basic information needed to properly wire and ground Pulse Width Modulated (PWM) AC drives.
PowerFlex AC Drives in Common Bus Configurations, publication DRIVES-AT002	Provides the necessary guidelines, considerations, and limitations for the proper application of PowerFlex drives used in common bus configurations.
Common DC Bus Selection Guide, publication DRIVES-SG001	Provides selection information for PowerFlex common DC bus products.
DeviceNet Network Configuration User Manual, publication DNET-UM004	Describes how you can use DeviceNet modules with your Logix5000 controller and communicate with various devices on the DeviceNet network.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

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

Follow these steps to view all available Bulletin 160 drives publications on the Rockwell Automation Literature Library.

1. On the Literature Library Home page, click Drives (Allen-Bradley).
2. Below Legacy Drive Products, click 160.

Follow these steps to view all available PowerFlex 525 drives publications on the Rockwell Automation Literature Library, on the Home page.

1. On the Literature Library Home page, click Drives (Allen-Bradley).
2. Below Component Class AC Drives, click PowerFlex 525.

Notes:

Drive Selection Considerations

To select a PowerFlex 525 drive to replace your Bulletin 160 SCC drive, you must consider the hardware and control differences between the two drives. This chapter describes some of the primary differences. Additional chapters provide in-depth drive comparisons.

Circuit Protection

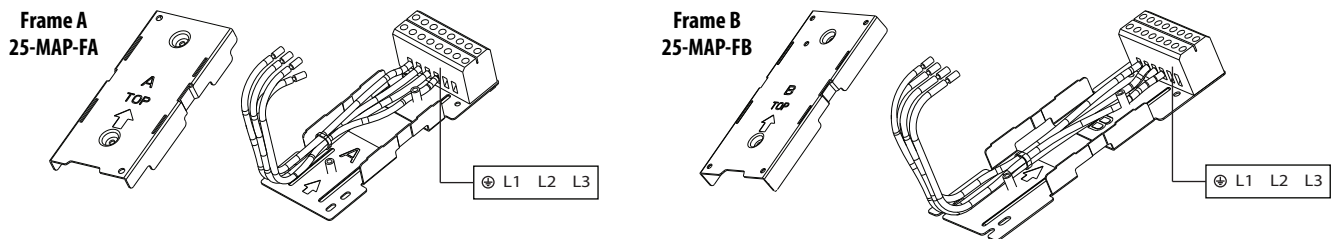
Protective device (fuses and circuit breakers) sizing can be different between equivalent Bulletin 160 SSC and PowerFlex 525 drives. Verify that you have chosen the correct sizes when selecting and installing a PowerFlex 525 drive.

Power Wiring

The Bulletin 160 SSC has feed-through wiring. The AC line is connected to the top of the drive and the motor is connected to the bottom of the drive.

Both the AC line and motor wiring is terminated at the bottom of a PowerFlex 525 drive.

Use the mounting adapter plate when replacing Bulletin 160 drives in an existing installation with a PowerFlex 525 drive. Select the catalog number based on the frame size of your Bulletin 160 drive.



Note: If the existing installation includes a Bulletin 160 line filter module, it is highly recommended that you replace the Bulletin 160 line filter module with a new PowerFlex 525 compatible EMC line filter. The Bulletin 160 line filter module has not been tested for use with a PowerFlex 525 drive.

The following factors must be taken into consideration when installing a new PowerFlex 525 drive and compatible EMC line filter in an existing Bulletin 160 drive and line filter module application:

- The PowerFlex 525 EMC line filter is larger than the Bulletin 160 line filter module and cannot fit into some existing Bulletin 160 installation configurations.
- The location of the mounting holes on the adapter plate (25-MAP-FA and 25-MAP-FB) do not match the location of the mounting holes on the Bulletin 160 line filter module.

Motor Rotation

The output phasing of Bulletin 160 SSC Series A and B drives is different than the output phasing of Bulletin 160 SSC Series C and PowerFlex 525 drives. Replacing a Bulletin 160 SSC Series A or B drive with a PowerFlex 525 drive by using the same U, V, and W (T1, T2, and T3) connections reverses the motor rotation. To keep the same direction of motor rotation, switch any two of the output wires connected to U, V, or W (T1, T2, or T3) at the PowerFlex 525 drive.

Motor Control

The Bulletin 160 SSC is a Volts per Hertz drive with adjustments for Boost and Slip Compensation. The PowerFlex 525 by default is in Sensorless Vector control, which achieves a higher level of torque response and speed accuracy. The PowerFlex 525 can be changed to Volts per Hertz control, if required.

Control Wiring

The Bulletin 160 SSC is supplied with an internal 12V supply. Dry contact or open collector inputs are required for discrete control inputs. If an external voltage is applied, component damage could occur. To use a PowerFlex 525 as a replacement drive and maintain the existing control wiring, you must set the Digital In (J5) jumper to the SNK (top) position. Inputs are active if pulled to DIG COM.

The 24V DC discrete input interface module mounts directly to the control interface terminal block (TB3) of the Bulletin 160 AC drive family. This module provides external 24V DC sourcing control logic for both the Analog Signal Follower (-SF1) and Preset Speed (-PS1) models. To use a PowerFlex 525 as a replacement drive and maintain the existing control wiring, you must set the Digital In (J5) jumper to the SRC (bottom) position. Inputs are active if pulled to +24V.

Leaf Technology Incorporated created two 120V AC interface modules for the Bulletin 160 AC drives family, one for the Preset Speed model (LT160-PS1-120V AC) and one for the Analog Signal Follower model (LT160-SF1-120V AC). The 120V AC interface attaches directly to the drive's control terminal block. Please see the Leaf Technology, Inc. website for reference materials: <http://www.leaftech.com/modules.htm>

IMPORTANT The PowerFlex 525 drive does not support 120V AC control inputs. Please consider installing a PowerFlex 70 drive with a 115V AC Digital Interface module for migration when using this control feature.

The PowerFlex 525 drive digital I/O has the ability to use an internal or external +24V DC supply. To replicate the wiring of the Bulletin 160 SSC, the wiring diagrams show the respective drives internally sourced (referenced to common) and externally sourced (+24V DC user supply), as examples.

Bipolar Speed Reference

The Bulletin 160 SSC can accept a bipolar (+/-10V DC) speed reference. The direction is set by the polarity of the speed reference. This feature is also available on the PowerFlex 525 drive.

Speed Presets

The Bulletin 160 SSC Preset Speed model has eight preset speeds set by three digital inputs.

The PowerFlex 525 has 16 preset frequencies set by four digital inputs.

DeviceNet

The Bulletin 160 SSC can be controlled and monitored over DeviceNet if an optional 160-DNx DeviceNet communication module is installed.

The PowerFlex 525 can also be controlled and monitored over DeviceNet by using the optional 25-COMM-D DeviceNet communication module. This module is mounted directly to the back of the control module of the drive. See the PowerFlex 525 DeviceNet Adapter User Manual, publication [520COM-UM002](#), for details.

The Bulletin 160 SSC has configurable input and output assemblies for DeviceNet control of the drive.

The PowerFlex 525 has fixed input and output assemblies. Logic changes can be made to control the PowerFlex 525 in the same manner.

Optional Accessory Installation

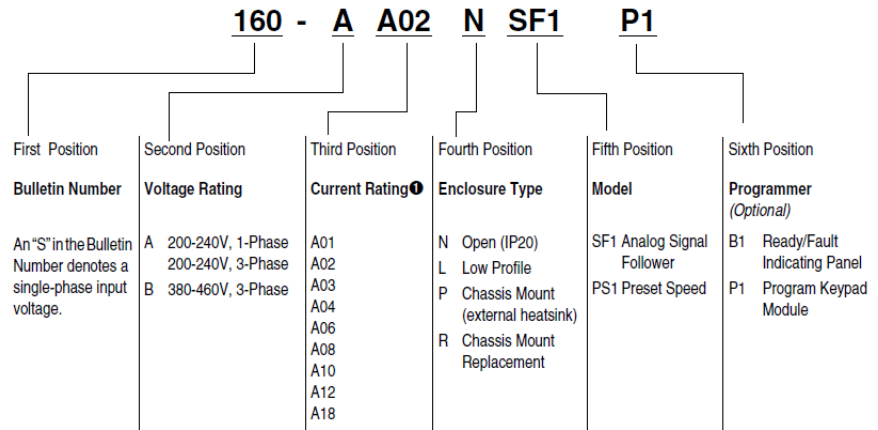
Optional accessories for the PowerFlex 525 drives are not installed at the factory. All optional accessories are installed by your qualified service personnel.

Specifications and Features Drive Catalog Number Explanations

Bulletin 160 SSC Drive

Figure 1 describes the catalog numbering scheme for the Bulletin 160 SSC.

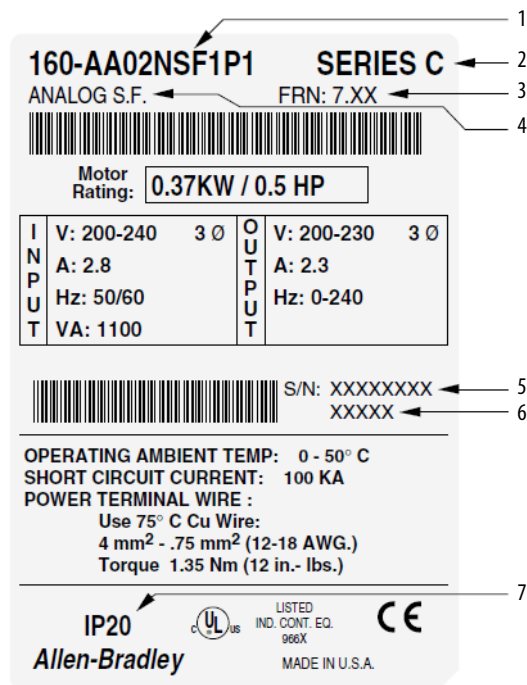
Figure 1 - Bulletin 160 SCC Catalog Number Code Explanation



① Amperage ratings vary based on voltage.

The drive data nameplate is on the side of the drive.

Figure 2 - Bulletin 160 SSC Drive Data Nameplate Information



1	Catalog Number
2	Series Letter
3	Firmware Version
4	Drive Model

5	Serial Number
6	Date Code
7	Enclosure Rating

PowerFlex 525 Drive

Figure 3 describes the catalog numbering scheme for the PowerFlex 525 drive.

Figure 3 - PowerFlex 525 Catalog Number Explanation

1-3	4	5	6-8	9	10	11	12	13	14
25B	–	B	2P5	N	1	1	4	–	–
Drive	Dash	Voltage Rating	Rating	Enclosure	Reserved	Emission Class	Reserved	Dash	Dash

Code	Type
25B	PowerFlex 525

Code	Voltage	Phase
V	120V AC	1
A	240V AC	1
B	240V AC	3
D	480V AC	3
E	600V AC	3

Code	Enclosure
N	IP20 NEMA / Open

Code	Interface Module
1	Standard

Code	EMC Filter
0	No Filter
1	Filter

Code	Braking
4	Standard

Code	Amps	Frame	ND		HD	
			Hp	kW	Hp	kW
2P5	2.5	A	0.5	0.4	0.5	0.4
4P8	4.8	B	1.0	0.75	1.0	0.75
6P0	6.0	B	1.5	1.1	1.5	1.1

Code	Amps	Frame	ND		HD	
			HP	kW	HP	kW
2P5	2.5	A	0.5	0.4	0.5	0.4
4P8	4.8	A	1.0	0.75	1.0	0.75
8P0	8.0	B	2.0	1.5	2.0	1.5
011	11.0	B	3.0	2.2	3.0	2.2

Code	Amps	Frame	ND		HD	
			Hp	kW	Hp	kW
2P5	2.5	A	0.5	0.4	0.5	0.4
5P0	5.0	A	1.0	0.75	1.0	0.75
8P0	8.0	A	2.0	1.5	2.0	1.5
011	11.0	A	3.0	2.2	3.0	2.2
017	17.5	B	5.0	4.0	5.0	4.0
024	24.0	C	7.5	5.5	7.5	5.5
032	32.2	D	10.0	7.5	10.0	7.5
048	48.3	E	15.0	11.0	15.0	11.0
062 ⁽¹⁾	62.1	E	20.0	15.0	15.0	11.0

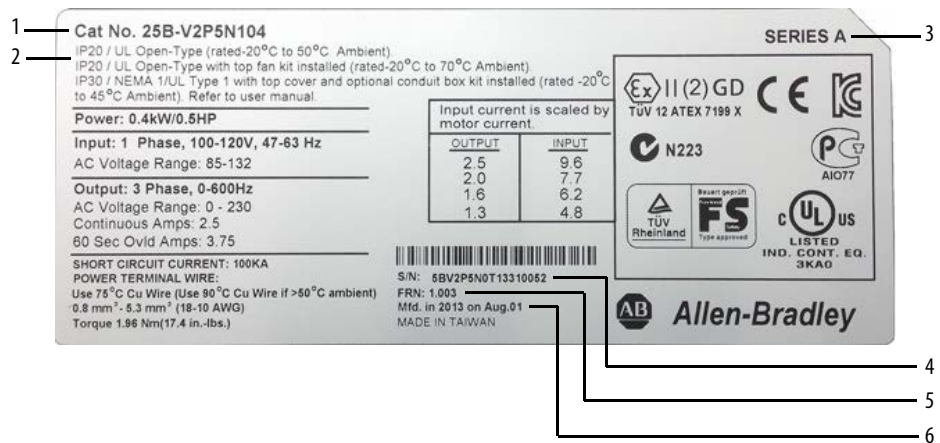
Code	Amps	Frame	ND		HD	
			Hp	kW	Hp	kW
1P4	1.4	A	0.5	0.4	0.5	0.4
2P3	2.3	A	1.0	0.75	1.0	0.75
4P0	4.0	A	2.0	1.5	2.0	1.5
6P0	6.0	A	3.0	2.2	3.0	2.2
010	10.5	B	5.0	4.0	5.0	4.0
013	13.0	C	7.5	5.5	7.5	5.5
017	17.0	C	10.0	7.5	10.0	7.5
024	24.0	D	15.0	11.0	15.0	11.0
030 ⁽¹⁾	30.0	D	20.0	15.0	15.0	11.0
037 ⁽¹⁾	37.0	E	25.0	18.5	20.0	15.0
043 ⁽¹⁾	43.0	E	30.0	22.0	25.0	18.5

Code	Amps	Frame	ND		HD	
			Hp	kW	Hp	kW
0P9	0.9	A	0.5	0.4	0.5	0.4
1P7	1.7	A	1.0	0.75	1.0	0.75
3P0	3.0	A	2.0	1.5	2.0	1.5
4P2	4.2	A	3.0	2.2	3.0	2.2
6P6	6.6	B	5.0	4.0	5.0	4.0
9P9	9.9	C	7.5	5.5	7.5	5.5
012	12.0	C	10.0	7.5	10.0	7.5
019	19.0	D	15.0	11.0	15.0	11.0
022 ⁽¹⁾	22.0	D	20.0	15.0	15.0	11.0
027 ⁽¹⁾	27.0	E	25.0	18.5	20.0	15.0
032 ⁽¹⁾	32.0	E	30.0	22.0	25.0	18.5

(1) Normal and Heavy Duty ratings are available for drives above 15 Hp / 11 kW.

The PowerFlex 525 drive data nameplate is on the side of the drive.

Figure 4 - PowerFlex 525 Drive Data Nameplate Information



1	Catalog Number
2	Enclosure Rating
3	Series Letter
4	Serial Number
5	Firmware Version
6	Date Code

Drive Ratings Comparisons

The following tables compare Bulletin 160 to PowerFlex 525 drive ratings to help you determine which PowerFlex 525 drive to choose for migration. See the table that corresponds to your existing Bulletin 160 drive. Both the Bulletin 160 SSC and PowerFlex 525 drives are rated for Heavy Duty.

Note: Bulletin 160 drives are NOT available in 120V AC or 600V AC.

Table 1 - 240V AC - Single Phase Drive Ratings

Bulletin 160 SSC					PowerFlex 525				
Rating Code	Output Amps	Hp	kW	Frame	Rating Code	Output Amps	Hp	kW	Frame
160S-AA02	2.3	0.5	0.37	na	25B-A2P5	2.5	0.5	0.4	A
160S-AA03	3	0.75	0.55	na	25B-A4P8	4.8	1	0.75	A
160S-AA04	4.5	1	0.75	na					
160S-AA08	8	2	1.5	na	25B-A8P0	8	2	1.5	B
					25B-A011	11	3	2.2	B

Table 2 - 240V AC - Three Phase Drive Ratings

Bulletin 160 SSC					PowerFlex 525				
Rating Code	Output Amps	Hp	kW	Frame	Rating Code	Output Amps	Hp	kW	Frame
160S-AA02	2.3	0.5	0.37	na	25B-B2P5	2.5	0.5	0.4	A
160S-AA03	3.0	0.75	0.55	na	25B-B5P0	5.0	1.0	0.75	A
160S-AA04	4.5	1.0	0.75	na					
160S-AA08	8.0	2.0	1.5	na	25B-B8P0	8.0	2.0	1.5	A
160S-AA12 ⁽¹⁾	12.0	3.0	2.2	na	25B-B011 ⁽¹⁾	11.0	3.0	2.2	A
160S-AA18 ⁽²⁾	18.0	5.0	4.0	na	25B-B017 ⁽²⁾	17.5	5.0	4.0	B
					25B-B024	24.0	7.5	5.5	C ⁽³⁾

(1) Please note that the continuous rated output current for these drives do not match. Consider the application requirements before choosing a replacement PowerFlex 525 drive.

(2) Please note that the continuous rated output current for these drives do not match. Consider the application requirements before choosing a replacement PowerFlex 525 drive.

(3) Mounting adapter plate does not exist for Frame C PowerFlex 525 drives.

Table 3 - 480V AC - Three Phase Drive Ratings

Bulletin 160 SSC					PowerFlex 525				
Rating Code	Output Amps	Hp	kW	Frame	Rating Code	Output Amps	Hp	kW	Frame
160S-BA01	1.2	0.5	0.37	na	25B-D1P4	1.4	0.5	0.4	A
160S-BA02	1.7	0.75	0.55	na	25B-D2P3	2.3	1.0	0.75	A
160S-BA03	2.3	1.0	0.75	na					
160S-BA04	4.0	2.0	1.5	na	25B-D4P0	4.0	2.0	1.5	A
160S-BA06	6.0	3.0	2.2	na	25B-D6P0	6.0	3.0	2.2	A
160S-BA10	10.5	5.0	4.0	na	25B-D010	10.5	5.0	4.0	B

Drive Dimensions Comparisons

Bulletin 160 SSC Drive Mounting Considerations

Mount drives on a flat, vertical and level surface. Maintain 12.5 mm (0.5 in.) clearance at the top, bottom and front of all drives.

Clearance requirements between units varies by model:

- 2.2 kW (3 Hp) 230V/460V drives - provide a minimum of 8.5 mm (0.33 in.) clearance between units.
- All other drive ratings - no clearance is required between units.

Bulletin 160 SSC Drive Dimensions and Weights

All dimensions listed in the following tables are in millimeters and (inches).
 All weights listed in the following tables are in kilograms and (pounds).

Figure 5 - Reference Diagram A

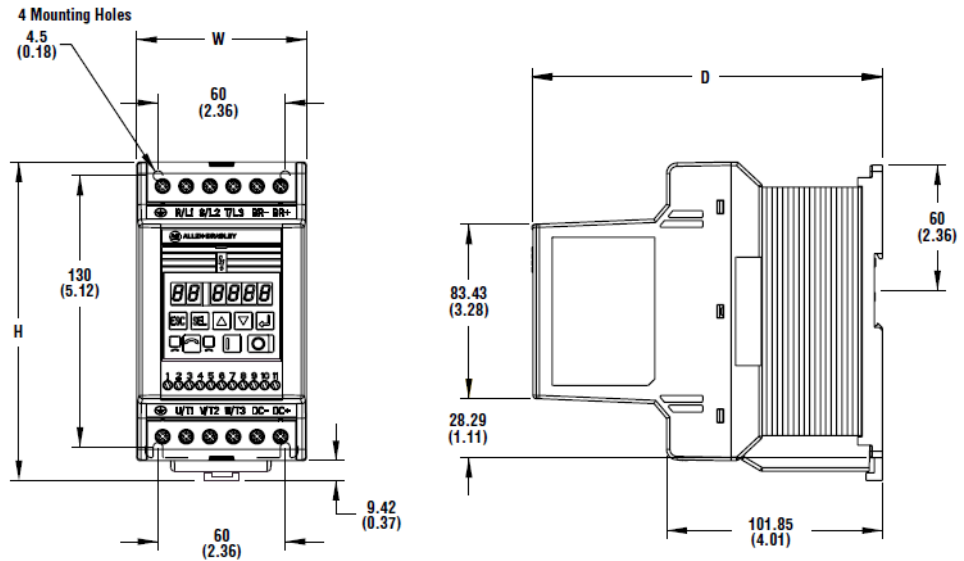


Table 4 - Drive Dimensions and Weights for Diagram A

Drive	Height	Width	Depth	Weight
200 ...240V AC - Single Phase				
160S-AA02	152 (6.00)	80 (3.15)	165 (6.51)	0.94 (2.07)
160S-AA03	152 (6.00)	80 (3.15)	165 (6.51)	0.94 (2.07)
160S-AA04	152 (6.00)	80 (3.15)	165 (6.51)	1.02 (2.24)
200 ...240V AC - Three Phase				
160-AA02	152 (6.00)	80 (3.15)	165 (6.51)	0.94 (2.07)
160-AA03	152 (6.00)	80 (3.15)	165 (6.51)	0.94 (2.07)
160-AA04	152 (6.00)	80 (3.15)	165 (6.51)	1.02 (2.24)
160-AA08	152 (6.00)	80 (3.15)	165 (6.51)	1.02 (2.24)
160-AA12	152 (6.00)	80 (3.15)	165 (6.51)	1.10 (2.43)
380 ...460V AC - Three Phase				
160-BA01	152 (6.00)	80 (3.15)	165 (6.51)	0.94 (2.07)
160-BA02	152 (6.00)	80 (3.15)	165 (6.51)	0.94 (2.07)
160-BA03	152 (6.00)	80 (3.15)	165 (6.51)	1.02 (2.24)
160-BA04	152 (6.00)	80 (3.15)	165 (6.51)	1.02 (2.24)
160-BA06	152 (6.00)	80 (3.15)	165 (6.51)	1.10 (2.43)

All dimensions listed in the following tables are in millimeters and (inches).
 All weights listed in the following tables are in kilograms and (pounds).

Figure 6 - Reference Diagram B

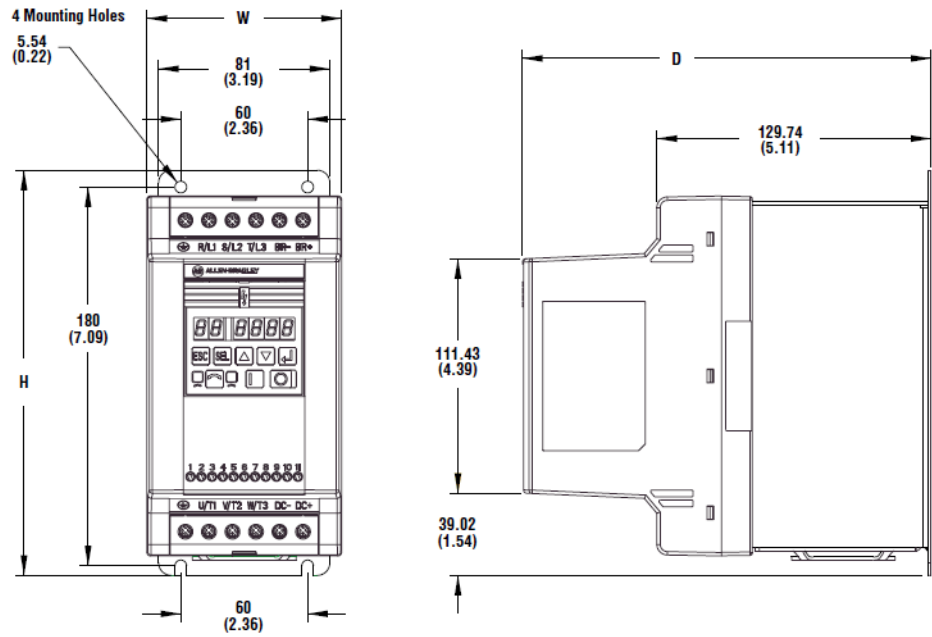


Table 5 - Drive Dimensions and Weights for Diagram B

Drive	Height	Width	Depth	Weight
200 ...240V AC - Single Phase				
160S-AA08	193 (7.58)	92 (3.62)	193 (7.61)	2.37 (5.23)
200 ...240V AC - Three Phase				
160-AA18	193 (7.58)	92 (3.62)	193 (7.61)	2.37 (5.23)
380 ...460V AC - Three Phase				
160-BA10	193 (7.58)	92 (3.62)	193 (7.61)	2.37 (5.23)

PowerFlex 525 Drive Mounting Considerations

Follow these mounting requirements:

- Mount the drive on a flat, vertical and level surface.
- Do not expose the drive to a corrosive atmosphere.
- Protect the drive from moisture and direct sunlight.
- Protect the cooling fan from dust or metallic particles.

Figure 7 - PowerFlex 525 Minimum Mounting Clearances

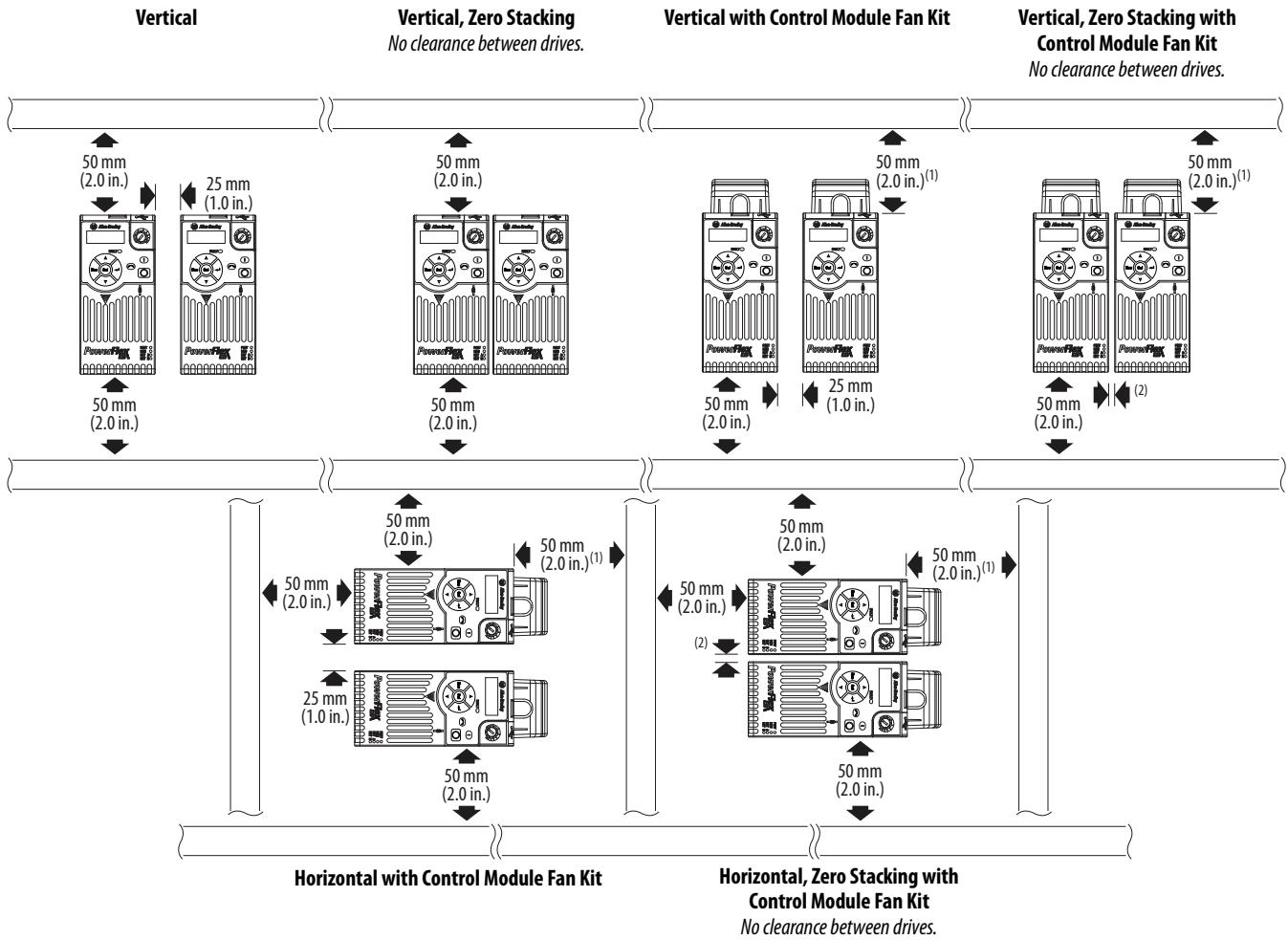


Table 6 - PowerFlex 525 Ambient Operating Temperatures

Mounting	Enclosure Rating ⁽¹⁾	Ambient Temperature			
		Minimum	Maximum (No Derate)	Maximum (Derate) ⁽²⁾	Maximum with Control Module Fan Kit (Derate) ⁽³⁾⁽⁵⁾
Vertical	IP 20/Open Type	-20 °C (-4 °F)	50 °C (122 °F)	60 °C (140 °F)	70 °C (158 °F)
	IP 30/NEMA 1/UL Type 1		45 °C (113 °F)	55 °C (131 °F)	–
Vertical, Zero Stacking	IP 20/Open Type		45 °C (113 °F)	55 °C (131 °F)	65 °C (149 °F)
	IP 30/NEMA 1/UL Type 1		40 °C (104 °F)	50 °C (122 °F)	–
Horizontal with Control Module Fan Kit ⁽⁴⁾⁽⁵⁾	IP 20/Open Type		50 °C (122 °F)	–	70 °C (158 °F)
Horizontal, Zero Stacking with Control Module Fan Kit ⁽⁴⁾⁽⁵⁾	IP 20/Open Type		45 °C (113 °F)	–	65 °C (149 °F)

- (1) IP 30/NEMA 1/UL Type 1 rating requires installation of the PowerFlex 520-Series IP 30/NEMA 1/UL Type 1 option kit, catalog number 25-JBAX.
- (2) For catalogs 25x-D1P4N104 and 25x-E0P9N104, the temperature listed under the Maximum (Derate) column is reduced by 5 °C (9 °F) for all mounting methods.
- (3) For catalogs 25x-D1P4N104 and 25x-E0P9N104, the temperature listed under the Maximum with Control Module Fan Kit (Derate) column is reduced by 10 °C (18 °F) for vertical and vertical with zero stacking mounting methods only.
- (4) Catalogs 25x-D1P4N104 and 25x-E0P9N104 cannot be mounted using either of the horizontal mounting methods.
- (5) Requires installation of the PowerFlex 520-Series Control Module Fan Kit, catalog number 25-FANx-70C.

PowerFlex 525 Drive Dimensions and Weights

Figure 8 - PowerFlex 525 Dimensions

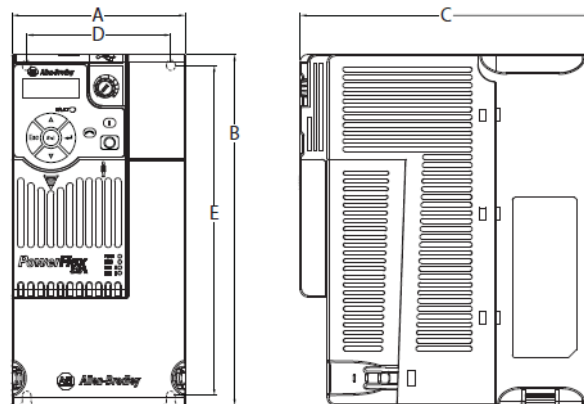


Table 7 - PowerFlex 525 Drive Dimensions and Weights

Frame	A mm (in.)	B mm (in.)	C mm (in.)	D mm (in.)	E mm (in.)	Weight kg (lb)
A	72.0 (2.83)	152.0 (5.98)	172.0 (6.77)	57.5 (2.26)	140.0 (5.51)	1.1 (2.4)
B	87.0 (3.43)	180.0 (7.09)	172.0 (6.77)	72.5 (2.85)	168.0 (6.61)	1.6 (3.5)
C	109.0 (4.29)	220.0 (8.66)	184.0 (7.24)	90.5 (3.56)	207.0 (8.15)	2.3 (5.0)

Fuse and Circuit Breaker Ratings

Bulletin 160 SSC Fusing

The Bulletin 160 SSC has been UL tested and approved for use with input fuses. The ratings in [Table 8](#) are the minimum recommended values for use with each drive rating. The devices listed in this table are provided to serve as a guide. Other devices that meet the requirements of UL508C and UL489 with similar trip characteristics can be used to meet local or national electrical codes.

Bulletin 140 Manual Motor Starters/UL489 Circuit Breakers for Bulletin 160 SSC Drives

When Bulletin 140 manual motor starters or UL489 rated circuit breakers are used, the following guidelines must be followed to meet the NEC requirements for branch circuit protection.

- Bulletin 140 manual motor starters can be used in single and group motor applications.
- In single motor applications, a fuse or UL489 rated circuit breaker is required ahead of the Bulletin 140 manual motor starter.
- In group motor installations, the Bulletin 140 manual motor starter can be used for protection of an individual motor within the group and one “set” of fuses or a UL489 rated circuit breaker serves as the branch circuit protective device for the entire “group” installation.
- Bulletin 140M manual motor starters can be used in single and group motor applications without additional short circuit protection. Refer to the technical support literature for the 140M for more details.

Table 8 - Minimum Recommended Branch Circuit Protective Devices for Bulletin 160 SSC Drives ⁽¹⁾

Voltage Rating	Drive Rating	Fuse Rating ⁽²⁾	UL489 Rated Circuit Breaker	Bulletin140/140M Manual Motor Starter
	Kw (Hp)		Amps	Amps
Single Phase 230V	0.37 (0.5)	6	16	16
	0.55 (0.75)	10	16	16
	0.75 (1).0	15	16	16
	1.5 (2.0)	30	20	20
Three Phase 230V	0.37 (0.5)	6	16	16
	0.55 (0.75)	6	16	16
	0.75 (1.0)	10	16	16
	1.5 (2.0)	15	16	16
	2.2 (3.0)	20	20	20
	4.0 (5.0)	30	30	30
Three Phase 460V	0.37 (0.5)	4	6	6
	0.55 (0.75)	4	6	6
	0.75 (1.0)	5	6	6
	1.5 (2.0)	8	16	16
	2.2 (3.0)	15	16	16
	4.0 (5.0)	20	20	20

(1) The maximum branch circuit protection rating is limited to four times the rated output current of the drive or 30A, whichever is less.

(2) Fuse class CC, J, BS88, VDE 06366/gG, IEC 269-1/gG, EN60269 part 1 and 2 type gG

PowerFlex 525 Drive

The PowerFlex 525 drive does not provide branch short circuit protection. Install this product with either input fuses or an input circuit breaker. National and local industrial safety regulations and/or electrical codes can determine additional requirements for these installations.

The tables found on pages [26...27](#) provide recommended AC line input fuse and circuit breaker information. See Fusing for PowerFlex 525 Drives and Circuit Breakers for PowerFlex 525 Drives below 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 can require different ratings.

Fusing for PowerFlex 525 Drives

The recommended fuse types are listed in the tables found on pages [26...27](#). If available current ratings do not match those listed in the tables provided, choose the next higher fuse rating.

- IEC – BS88 (British Standard) Parts 1 & 2⁽¹⁾, EN60269-1, Parts 1 & 2, type GG or equivalent can be used.
- UL – UL Class CC, T, RK1, or J can be used.

Circuit Breakers for PowerFlex 525 Drives

The “non-fuse” listings in the tables found on pages [26...27](#) include inverse time circuit breakers, instantaneous trip circuit breakers (motor circuit protectors) and 140M self-protected combination motor controllers. If one of these is chosen as the desired protection method, the following requirements apply:

- IEC – Both types of circuit breakers and 140M self-protected combination motor controllers are acceptable for IEC installations.
- UL – Only inverse time circuit breakers and the specified 140M self-protected combination motor controllers are acceptable for UL installations.

Bulletin 140M (Self-Protected Combination Controller)/UL489 Circuit Breakers for PowerFlex 525 Drives

When Bulletin 140M or UL489 rated circuit breakers are used, the guidelines listed below must be followed to meet the NEC requirements for branch circuit protection.

- Bulletin 140M can be used in single motor applications.

Bulletin 140M can be used up stream from the drive **without** the need for fuses.

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

Table 9 - 200...240V 1-Phase Input Protection Devices – PowerFlex 525, Frames A...B Drives

Catalog No.	Output Ratings				Input Ratings		IEC (Non-UL Applications)			UL Applications							
	Normal Duty		Heavy Duty		Amps	kVA	Max Amps ⁽¹⁾	Frame Size	Contactor Catalog No.	Fuses		Circuit Breakers					
	Hp	kW	Hp	kW						Min. Rating	Max. Rating	140U	140M	Class / Catalog No.	Circuit Breakers		
25B-A2P5N104	0.5	0.4	0.5	0.4	2.5	1.7	6.5	A	100-C09	10	15	140U-D6D2-C10	140M-C2E-C10	CLASS RK5, CC, J, or T / DLS-R-15	140U	140M ⁽²⁾⁽³⁾⁽⁴⁾	140M-C2E-C10
25B-A2P5N114	0.5	0.4	0.5	0.4	2.5	1.7	6.5	A	100-C09	10	15	140U-D6D2-C10	140M-C2E-C10	CLASS RK5, CC, J, or T / DLS-R-15	140U	140M ⁽²⁾⁽³⁾⁽⁴⁾	140M-C2E-C10
25B-A4P8N104	1.0	0.75	1.0	0.75	4.8	2.8	10.7	A	100-C12	15	25	140U-D6D2-C15	140M-C2E-C16	CLASS RK5, CC, J, or T / DLS-R-25	140U	140M ⁽²⁾⁽³⁾⁽⁴⁾	140M-C2E-C16
25B-A4P8N114	1.0	0.75	1.0	0.75	4.8	2.8	10.7	A	100-C12	15	25	140U-D6D2-C15	140M-C2E-C16	CLASS RK5, CC, J, or T / DLS-R-25	140U	140M ⁽²⁾⁽³⁾⁽⁴⁾	140M-C2E-C16
25B-A8P0N104	2.0	1.5	2.0	1.5	8.0	4.8	18.0	B	100-C23	25	40	140U-D6D2-C25	140M-F8E-C25	CLASS CC, J, or T / 40	140U	140M ⁽²⁾⁽³⁾⁽⁴⁾	140M-F8E-C25
25B-A8P0N114	2.0	1.5	2.0	1.5	8.0	4.8	18.0	B	100-C23	25	40	140U-D6D2-C25	140M-F8E-C25	CLASS CC, J, or T / 40	140U	140M ⁽²⁾⁽³⁾⁽⁴⁾	140M-F8E-C25
25B-A011N104	3.0	2.2	3.0	2.2	11.0	6.0	22.9	B	100-C37	30	50	–	–	CLASS CC, J, or T / 50	–	–	140M-F8E-C25
25B-A011N114	3.0	2.2	3.0	2.2	11.0	6.0	22.9	B	100-C37	30	50	–	–	CLASS CC, J, or T / 50	–	–	140M-F8E-C25

- (1) When the drive is controlling motors with lower amp ratings, refer to the drive nameplate for drive input current rating.
- (2) The AIC ratings of the Bulletin 140M Motor Protector Circuit Breakers can vary. See [Bulletin 140M Motor Protection Circuit Breakers Application Ratings](#).
- (3) Bulletin 140M devices with an adjustable current range must have the current trip set to the minimum value of the range so the device does not trip.
- (4) Manual Self-Protected (Type E) Combination Motor Controller, UL listed for 480V/277 and 600V/347 AC input. Not UL listed for use on 480V or 600V Delta/Delta, corner ground, or high-resistance ground systems.

Table 10 - 200...240V 3-Phase Input Protection Devices – PowerFlex 525 Frames A...C Drives

Catalog No.	Output Ratings				Input Ratings		IEC (Non-UL Applications)			UL Applications							
	Normal Duty		Heavy Duty		Amps	kVA	Max Amps ⁽¹⁾	Frame Size	Contactor Catalog No.	Fuses		Circuit Breakers					
	Hp	kW	Hp	kW						Min. Rating	Max. Rating	140U	140M	Class / Catalog No.	Circuit Breakers		
25B-B2P5N104	0.5	0.4	0.5	0.4	2.5	1.2	2.7	A	100-C07	6	6	140U-D6D3-B40	140M-C2E-B40	CLASS RK5, CC, J, or T / DLS-R-6	140U	140M ⁽²⁾⁽³⁾⁽⁴⁾	140M-C2E-B40
25B-B5P0N104	1.0	0.75	1.0	0.75	5.0	2.7	5.8	A	100-C09	10	15	140U-D6D3-B80	140M-C2E-B63	CLASS RK5, CC, J, or T / DLS-R-15	140U	140M ⁽²⁾⁽³⁾⁽⁴⁾	140M-C2E-B63
25B-B8P0N104	2.0	1.5	2.0	1.5	8.0	4.3	9.5	A	100-C12	15	20	140U-D6D3-C10	140M-C2E-C10	CLASS RK5, CC, J, or T / DLS-R-20	140U	140M ⁽²⁾⁽³⁾⁽⁴⁾	140M-C2E-C10
25B-B011N104	3.0	2.2	3.0	2.2	11.0	6.3	13.8	A	100-C23	20	30	140U-D6D3-C15	140M-C2E-C16	CLASS RK5, CC, J, or T / DLS-R-30	140U	140M ⁽²⁾⁽³⁾⁽⁴⁾	140M-C2E-C16
25B-B017N104	5.0	4.0	5.0	4.0	17.5	9.6	21.1	B	100-C23	30	45	140U-D6D3-C25	140M-F8E-C25	CLASS CC, J, or T / 45	140U	140M ⁽²⁾⁽³⁾⁽⁴⁾	140M-F8E-C25
25B-B024N104	7.5	5.5	7.5	5.5	24.0	12.2	26.6	C	100-C37	35	60	–	–	CLASS CC, J, or T / 60	–	–	140M-F8E-C32

- (1) When the drive is controlling motors with lower amp ratings, refer to the drive nameplate for drive input current rating.
- (2) The AIC ratings of the Bulletin 140M Motor Protector Circuit Breakers can vary. See [Bulletin 140M Motor Protection Circuit Breakers Application Ratings](#).
- (3) Bulletin 140M devices with an adjustable current range must have the current trip set to the minimum value of the range so the device does not trip.
- (4) Manual Self-Protected (Type E) Combination Motor Controller, UL listed for 480V/277 and 600V/347 AC input. Not UL listed for use on 480V or 600V Delta/Delta, corner ground, or high-resistance ground systems.

Table 11 - 380...480V 3-Phase Input Protection Devices – PowerFlex 525 Frames A...C Drives

Catalog No.	Output Ratings				Input Ratings			IEC (Non-UL Applications)				UL Applications					
	Normal Duty		Heavy Duty		Amps	kVA	Max Amps ⁽¹⁾	Frame Size	Contactor Catalog No.	Fuses		Circuit Breakers		Fuses (Max. Rating)		Circuit Breakers	
	Hp	kW	Hp	kW						Min. Rating	Max. Rating	140U	140M	Class / Catalog No.	140U	140M ⁽²⁾⁽³⁾⁽⁴⁾	
25B-D1P4N104	0.5	0.4	0.5	0.4	1.4	1.7	1.9	A	100-C07	3	6	140U-D6D3-B30	140M-CZE-B25	CLASS RK5, CC, J, or T / DLS-R-6	140U	140M	
25B-D1P4N114	0.5	0.4	0.5	0.4	1.4	1.7	1.9	A	100-C07	3	6	140U-D6D3-B30	140M-CZE-B25	CLASS RK5, CC, J, or T / DLS-R-6	–	140M-CZE-B25	
25B-D2P3N104	1.0	0.75	1.0	0.75	2.3	2.9	3.2	A	100-C07	6	10	140U-D6D3-B60	140M-CZE-B40	CLASS RK5, CC, J, or T / DLS-R-10	–	140M-CZE-B40	
25B-D2P3N114	1.0	0.75	1.0	0.75	2.3	2.9	3.2	A	100-C07	6	10	140U-D6D3-B60	140M-CZE-B40	CLASS RK5, CC, J, or T / DLS-R-10	–	140M-CZE-B40	
25B-D4P0N104	2.0	1.5	2.0	1.5	4.0	5.2	5.7	A	100-C09	10	15	140U-D6D3-B60	140M-CZE-B63	CLASS RK5, CC, J, or T / DLS-R-15	–	140M-CZE-B63	
25B-D4P0N114	2.0	1.5	2.0	1.5	4.0	5.2	5.7	A	100-C09	10	15	140U-D6D3-B60	140M-CZE-B63	CLASS RK5, CC, J, or T / DLS-R-15	–	140M-CZE-B63	
25B-D6P0N104	3.0	2.2	3.0	2.2	6.0	6.9	7.5	A	100-C09	10	15	140U-D6D3-C10	140M-CZE-C10	CLASS RK5, CC, J, or T / DLS-R-15	–	140M-CZE-C10	
25B-D6P0N114	3.0	2.2	3.0	2.2	6.0	6.9	7.5	A	100-C09	10	15	140U-D6D3-C10	140M-CZE-C10	CLASS RK5, CC, J, or T / DLS-R-15	–	140M-CZE-C10	
25B-D0T0N104	5.0	4.0	5.0	4.0	10.5	12.6	13.8	B	100-C23	20	30	140U-D6D3-C15	140M-CZE-C16	CLASS RK5, CC, J, or T / DLS-R-30	–	140M-CZE-C16	
25B-D0T0N114	5.0	4.0	5.0	4.0	10.5	12.6	13.8	B	100-C23	20	30	140U-D6D3-C15	140M-CZE-C16	CLASS RK5, CC, J, or T / DLS-R-30	–	140M-CZE-C16	

(1) When the drive is controlling motors with lower amp ratings, refer to the drive nameplate for drive input current rating.
 (2) The AIC ratings of the Bulletin 140M Motor Protector Circuit Breakers can vary. See [Bulletin 140M Motor Protection Circuit Breakers Application Ratings](#).
 (3) Bulletin 140M devices with an adjustable current range must have the current trip set to the minimum value of the range so the device does not trip.
 (4) Manual Self-Protected (Type E) Combination Motor Controller, UL listed for 480Y/277 and 600Y/347 AC input. Not UL listed for use on 480V or 600V Delta/Delta, corner ground, or high-resistance ground systems.

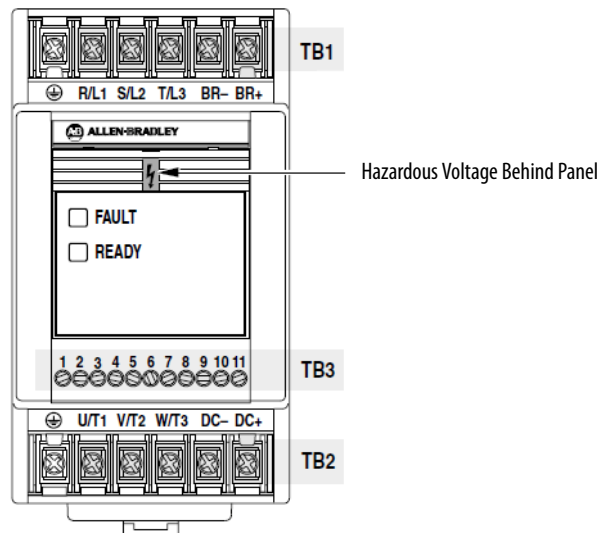
Power Terminal Comparisons

The following section provides a comparison of the power terminals for the Bulletin 160 SSC and PowerFlex 525 drives.

160 SCC Power Terminal Blocks

Terminal R (L1) is not present on single phase drives. Three phase unit terminal block configuration is depicted in [Figure 9](#).

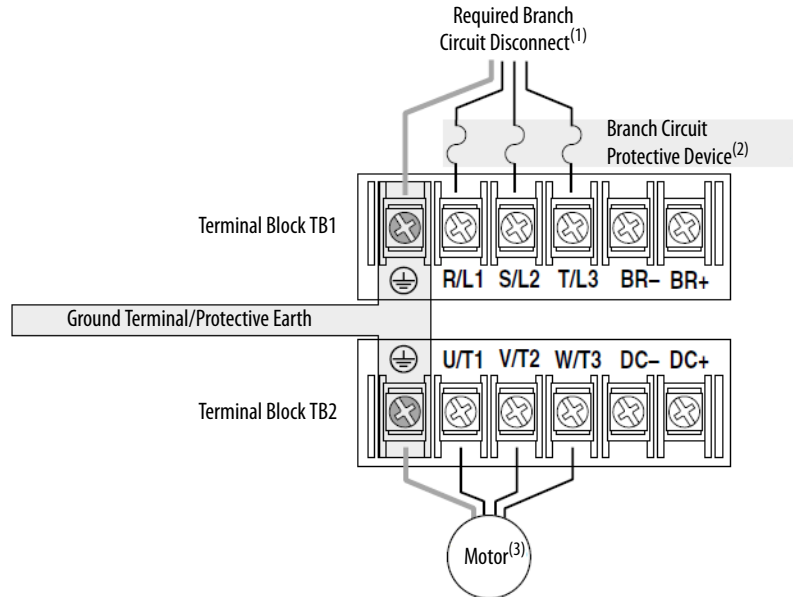
Figure 9 - 160 SCC Power Terminal Blocks



Designation	Description
TB1	Ground, Line Power & Dynamic Brake Module Wiring
TB2	Ground, Motor & Capacitor Module Wiring
TB3	Control Wiring

160 SCC Terminal Block Wiring

Figure 10 - 160 SCC Terminal Block Wiring Detail



- (1) For single phase input applications, connect the AC input power to input terminals S (L2) and T (L3).
- (2) For single phase input applications, connect the AC input power to input terminals S (L2) and T (L3).
- (3) Bulletin 160 drives are UL Listed as motor overload protective devices (IEC Class 10 overload). An external overload relay is not required for single motor applications as long as the Drive kW (Hp) rating is less than three times larger than the motor kW (Hp) rating.

Table 12 - 160 SSC Terminal Block TB1 and TB2 Wiring Specifications

Model	Screw Size	Max/Min Wire Size ⁽¹⁾	Max/Min Torque
		mm ² (AWG)	N·m (lb·in)
4.0 (5.0)	M4	5.26...3.31 (10...12)	1.35...0.90 (12...8)
All other ratings	M4	3.31... 0.82 (12...18)	1.35...0.90 (12...8)

(1) Each terminal supports up to two wires of approved gauge.

PowerFlex 525 Power Wiring

Motor Cable Types Acceptable for 100...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 m (1 ft) for every 10 m (32.8 ft) of length. In all cases, long parallel runs must be avoided. Do not use cable with an insulation thickness less than 15 mils (0.4 mm/0.015 in.). Do not route more than three sets of motor leads in a single conduit to minimize “cross talk”. If more than three drive/motor connections per conduit are required, shielded cable must be used.

UL installations above 50 °C ambient must use 600V, 90 °C wire.

UL installations in 50 °C ambient must use 600V, 75 °C or 90 °C wire.

UL installations in 40 °C ambient must use 600V, 75 °C or 90 °C wire.

Use copper wire only. Wire gauge requirements and recommendations are based on 75 °C. Do not reduce wire gauge when using higher temperature wire.

Unshielded

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



ATTENTION: Do not use THHN or similarly coated wire in wet areas.

Shielded/Armored Cable

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

Shielded cable can also help reduce shaft voltage and induced bearing currents for some applications. In addition, the increased impedance of shielded cable can help extend the distance the motor can be installed from the drive without the addition of motor protective devices such as terminator networks. Refer to Reflected Wave in “Wiring and Grounding Guide, (PWM) AC Drives,” publication [DRIVES-IN001](#).

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

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

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

Recommended Shielded Wire

Location	Rating/Type	Description
Standard (Option 1)	600V, 90 °C (194 °F) XHHW2/RHW-2 Anixter B209500-B209507, Belden 29501-29507, or equivalent	<ul style="list-style-type: none"> • Four tinned copper conductors with XLPE insulation. • Copper braid/aluminum foil combination shield and tinned copper drain wire. • PVC jacket.
Standard (Option 2)	Tray rated 600V, 90 °C (194 °F) RHH/RHW-2 Anixter OLF-7xxxx or equivalent	<ul style="list-style-type: none"> • Three tinned copper conductors with XLPE insulation. • 5 mil single helical copper tape (25% overlap min.) with three bare copper grounds in contact with shield. • PVC jacket.
Class I & II; Division I & II	Tray rated 600V, 90 °C (194 °F) RHH/RHW-2 Anixter 7V-7xxx-3G or equivalent	<ul style="list-style-type: none"> • Three bare copper conductors with XLPE insulation and impervious corrugated continuously welded aluminum armor. • Black sunlight resistant PVC jacket overall. • Three copper grounds on #10 AWG and smaller.

Reflected Wave Protection

Install the drive as close to the motor as possible. Installations with long motor cables can require the addition of external devices to limit voltage reflections at the motor (reflected wave phenomena). Refer to Reflected Wave in the Wiring and Grounding Guide, (PWM) AC Drives, publication [DRIVES-IN001](#).

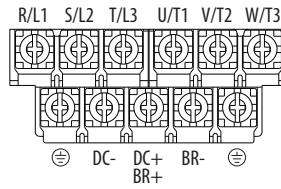
- The reflected wave data applies to all carrier frequencies 2...16 kHz.
- For 240V ratings and lower, reflected wave effects do not need to be considered.

Output Disconnect

The drive is designed to be commanded by control input signals that start and stop the motor. Do not use a device that routinely disconnects then reapplies output power to the motor for the purpose of starting and stopping the motor. If it is necessary to disconnect power to the motor with the drive outputting power, use an auxiliary contact to simultaneously disable drive (Aux Fault or Coast to Stop).

PowerFlex 525 Power Terminal Blocks

All Frames



Terminal	Description
R/L1, S/L2	1-Phase Input Line Voltage Connection
R/L1, S/L2, T/L3	3-Phase Input Line Voltage Connections
U/T1, V/T2, W/T3	Motor Phase Connections. Switch any two motor leads to change motor rotation direction.
DC+, DC-	DC Bus Connections
BR+, BR-	Dynamic Brake Resistor Connections
⊕	Safety Ground - PE Connection

IMPORTANT Terminal screws can become loose during shipment. Ensure that all terminal screws are tightened to the recommended torque before applying power to the drive.

Table 13 - PowerFlex 525 Power Terminal Block Wire Specifications

Frame	Maximum Wire Size ⁽¹⁾	Minimum Wire Size ⁽¹⁾	Torque
A	5.3 mm ² (10 AWG)	0.8 mm ² (18 AWG)	1.76...2.16 N•m (15.6...19.1 lb•in)
B	8.4 mm ² (8 AWG)	2.1 mm ² (14 AWG)	1.76...2.16 N•m (15.6...19.1 lb•in)
C	8.4 mm ² (8 AWG)	2.1 mm ² (14 AWG)	1.76...2.16 N•m (15.6...19.1 lb•in)

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

Control Terminal Comparisons

The following section provides a comparison of the control terminals for the Bulletin 160 SSC and PowerFlex 525 drives.

Bulletin 160 SCC Control Wiring Requirements

- Run all signal wiring in either a shielded cable or separate metal conduit.
- Connect shield wire only at TB3 Common terminals (3 and 7).
- Do not exceed control wiring length of 15 m (50 ft). Control signal cable length is highly dependent on electrical environment and installation practices. To improve noise immunity, the control terminal block Common must be connected to ground terminal/protective earth.
- Use Belden 8760 (or equivalent) — 18 AWG (0.75 mm²), twisted pair, shielded or 3 conductor.

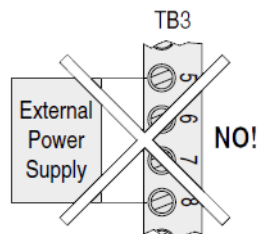
Table 14 - Bulletin 160 SSC Control Terminal Block TB3 Wiring Specifications

Terminal Block	Max/Min Wire Size	Max/Min Torque
	mm ² (AWG)	N·m (lb·in)
TB3	2.5... 0.5 (14...22)	0.8...0.4 (8...4)

Important Precautions



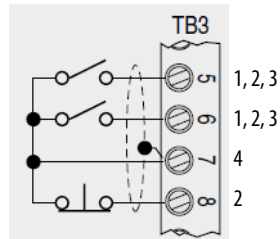
ATTENTION: The drive is supplied with an internal 12V supply. Dry contact or open collector inputs are required for discrete control inputs. If an external voltage is applied, component damage could occur.



ATTENTION: The drive start/stop control circuitry includes solid-state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional hardwired stop circuit is required to remove the AC line to the drive. When the AC line is removed, a loss of any inherent regenerative braking effect can occur and the motor coasts to a stop. In this case, use an auxiliary braking method. Alternatively, use the drive's safety input function.

Bulletin 160 SSC Control Wiring Considerations

The figure below lists the control wiring requirements for all two wire control input modes (P46 - [Input Mode] settings 1 and 4...9). The requirements specific to each input mode are shown separately for that mode.



- 1 Run input must be maintained. After a stop command, either a Run Forward or Run Reverse input must be toggled to start the drive.
- 2 Internal 12V supply. Contact closure or open collector input required.
- 3 If both Run Forward and Run Reverse inputs are closed at the same time, an undetermined state could occur.
- 4 Control signal cable length is highly dependent on electrical environment and installation practices. To improve noise immunity, TB3 Common must be connected to ground terminal/protective earth. For control wiring installations greater than 15 m (50 ft) in length, an optional 24V DC interface module is recommended.

Bulletin 160 SSC Control Methods

You can use P46 - [Input Mode] to select the control method for start, stop, and direction control. Control can be performed from the control terminal block (TB3) or the optional program keypad module or the remote programming adapter via cable to either a remote keypad or a copycat keypad depending on the P46 - [Input Mode] setting being used. The default setting is “0,” indicating that only the control terminal block is active for control. If any other input mode is needed (1...9) you must have a device for changing the input mode such as a Program Keypad module (160-P1). [Table 15](#) below is a guide to wiring diagrams associated with each P46 - [Input Mode] setting.

IMPORTANT After a Stop input, a Run command (either Run Forward, Run Reverse or Start) must be toggled to run again. This is true for all P46 - [Input Mode] settings except setting 3. See the Attention statement below.



ATTENTION: Hazard of injury exists due to unintended operation. When P46 - [Input Mode] is set to 3, and the Run input is maintained, the Run inputs do not need to be toggled after a Stop input for the drive to run again. A Stop function is provided only when the Stop input is active (open).

Table 15 - Bulletin 160 SSC Control Selection by Input Mode

P46 Setting	Description	Reference
0	Three-Wire control (factory default)	Figure 11 on page 35
1	Two-Wire Run Forward/Run Reverse control	Figure 12 on page 36
2 ⁽¹⁾	Program, Remote, CopyCat Keypad or Communication Module control	Figure 13 on page 36
3	Momentary Run Forward/Run Reverse control	Figure 14 on page 37
4	Two-Wire Accel/Decel control	Figure 15 on page 37
5	Two-Wire Enable control	Figure 16 on page 38
6 ⁽¹⁾	Two-Wire TB3 control/Keypad or Communication control	Figure 17 on page 38
7	Two-Wire Frequency Select control	Figure 18 on page 39
8	Two-Wire Preset control (Analog Signal Follower Models Only)	Figure 19 on page 39
9	Two-Wire PI control (Analog Signal Follower Models Only)	Figure 20 on page 40

(1) When using Firmware Versions FRN 7.05, 7.04 & 7.03, input modes 2 and 6 are the only modes that allow a serial option, such as 160-DN2 or 160-RS1, to command the drive to run or stop.

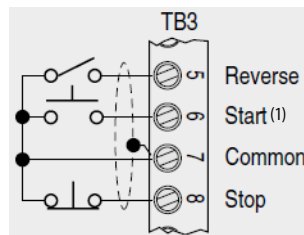
PI Control

Firmware version FRN 7.06 provides activation of PI control in P46 - [Input Mode] settings 0...7 and 9 listed in [Table 15](#). Users of firmware version FRN 7.05 and earlier can only use P46 - [Input Mode] setting 9 to activate PI control.

P46 Setting 0 - Three-Wire Control (Factory Default)

This input mode provides a typical three wire control function where a momentary start input commands the drive to start.

Figure 11 - Bulletin 160 SSC Three-Wire control – Factory Default



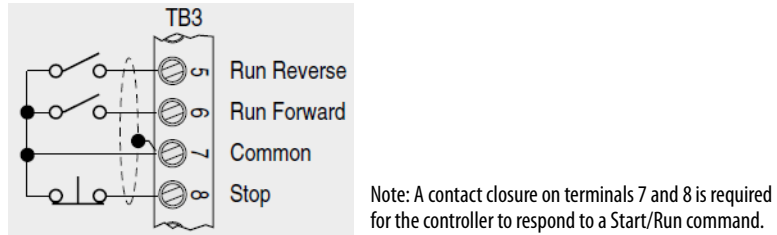
Note: A contact closure on terminals 7 and 8 is required for the controller to respond to a Start/Run command.

(1) Start input can be a momentary input.

P46 Setting 1 - Two-Wire Run Forward/Run Reverse Control

This input mode provides a typical two wire control function where a maintained Run Forward or Run Reverse input provides both a directional and start command to the drive. Opening the Run Forward or Run Reverse input commands the drive to stop in accordance with the P34 - [Stop Mode] setting. The stop switch (TB3, terminals 7 and 8) is not required but can be wired as an Auxiliary Stop if desired.

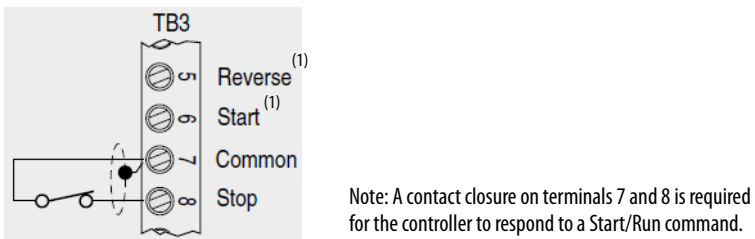
Figure 12 - Bulletin 160 SSC Two-Wire Run Forward/Run Reverse control



P46 Setting 2 - Program Keypad or Communication Module Control

This input mode activates the Start and Reverse functions from either the Program Keypad module (PKM), Remote Keypad module, CopyCat Keypad module or plug in communication modules and deactivates the Start and Reverse inputs on the control terminal block (TB3). Note: the frequency reference can be controlled from the keypad modules or communication modules by setting P59 - [Frequency Select] to a setting of “1”. In this case, the frequency is controlled by the value programmed into P58 - [Internal Frequency].

Figure 13 - Bulletin 160 SSC Program Keypad Module control



(1) When performing start and reverse operations from the Program Keypad module, Remote Keypad module, CopyCat Keypad module or plug-in communication modules, the Start and Reverse inputs from the control terminal block (TB3) are disabled.

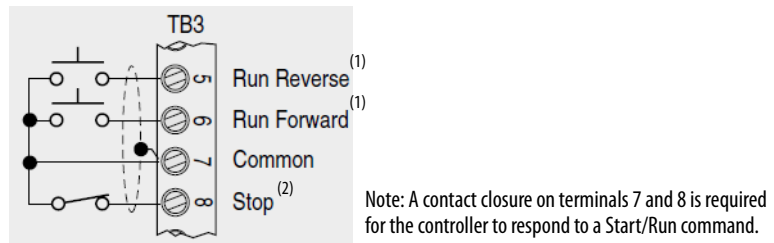
P46 Setting 3 - Momentary Run Forward/Run Reverse Control

This input mode lets the drive to respond to either a momentary or maintained Run Forward or Run Reverse input, but requires a stop input to TB3 terminals 7 and 8 to command the drive to stop. In addition, this is the only input mode that uses “level triggered” control logic, therefore once the stop command is removed or if power is lost and restored, the drive immediately restarts if a maintained Run command is present.



ATTENTION: Hazard of injury exists due to unintended operation. When P46 - [Input Mode] is set to “3,” and the Run input is maintained, the Run inputs do not need to be toggled after a Stop input for the drive to run again. A Stop function is provided only when the Stop input is active (open).

Figure 14 - Bulletin 160 SSC Momentary Run Fwd/Run Rev Control



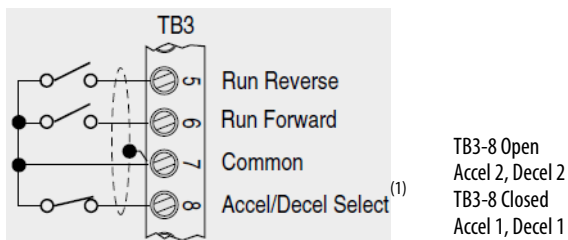
- (1) A momentary or maintained input can be used. If using maintained inputs, please read the Attention statement above.
- (2) A normally closed maintained input is recommended. See Attention statement above.

IMPORTANT Settings 4...9 provide additional flexibility of TB3 control input terminal 8.

P46 Setting 4 - Two-Wire Accel/Decel Control

This input mode is similar to Setting 1 except TB3 terminal 8 provides the function of switching from P30 - [Accel Time 1] and P31 - [Decel Time 1] to P69 - [Accel Time 2] and P70 - [Decel Time 2] for any commanded frequency reference.

Figure 15 - Bulletin 160 SSC Two-Wire Accel/Decel control

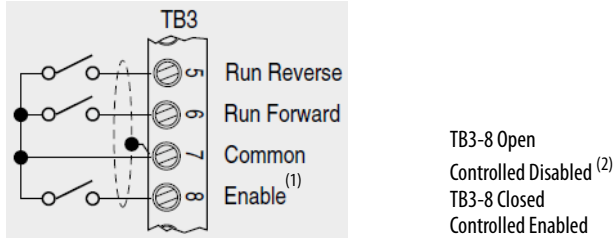


- (1) TB3 terminal 8 can be used to clear faults. See [Figure 21](#) on page 40 for details.

P46 Setting 5 - Two-Wire Enable Control

This input mode is similar to Setting 1 except TB3 terminal 8 provides the function of “enable” command. The “enable” input is required for the drive to operate and if opened during operation the programmed P34 - [Stop Mode] is overridden and the motor coasts to a stop.

Figure 16 - Bulletin 160 SSC Two-Wire Enable control

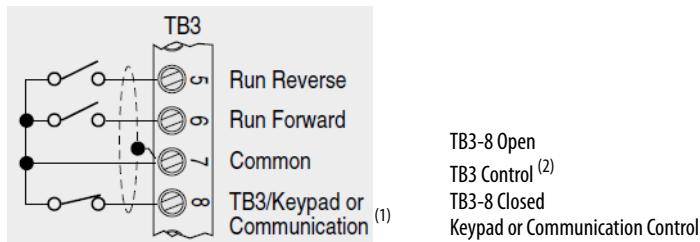


(1) TB3 terminal 8 can be used to clear faults. See Figure 21 on page 40 for details.
 (2) When this input is in an open state, the motor coasts to a stop.

P46 Setting 6 - Two-Wire TB3 Control/Keypad or Communication Control

This input mode is similar to setting 1 except TB3 terminal 8 provides the function of switching the start, reverse and speed reference from the Program Keypad Module, Remote Keypad Module, CopyCat Keypad Module, or Communication Module to the control terminal block (TB3).

Figure 17 - Bulletin 160 SSC Two-Wire TB3 control/Keypad or Communication control

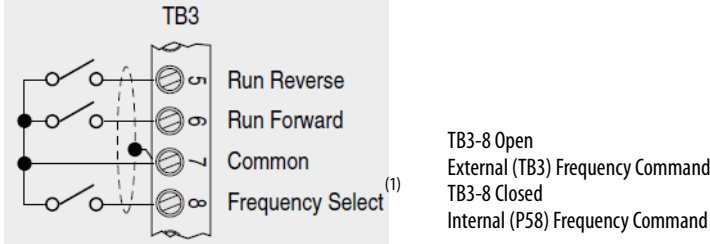


(1) TB3 terminal 8 can be used to clear faults. See Figure 21 on page 40 for details.
 (2) When this input is in an open state, the Frequency source is always from the terminal block regardless of the setting of P59 - [Frequency Select].

P46 Setting 7 - Two-Wire Frequency Select Control

This input mode is similar to Setting 1 except TB3 terminal 8 provides the function of switching the frequency reference from the control terminal block (TB3) to the frequency commanded by P58 - [Internal Frequency]. For Analog Signal Follower models this provides the ability to switch from analog control to one preset speed. For Preset Speed models this provides a ninth preset speed via P58 - [Internal Frequency].

Figure 18 - Bulletin 160 SSC Two-Wire Frequency Select control

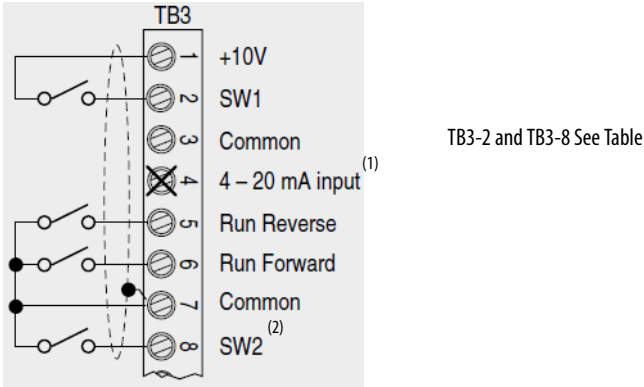


(1) TB3 terminal 8 can be used to clear faults. See Figure 21 on page 40 for details.

P46 Setting 8 - Two Wire Preset Speed Control (Analog Models Only)

This input mode is similar to Setting 1 except TB3 terminals 1, 2 and 8 provide the function of preset speeds. Note: All analog functionality is disabled when using this input mode setting.

Figure 19 - Bulletin 160 SSC Two-Wire Preset control



(1) Do not connect to TB3-4 in this mode.
 (2) TB3 terminal 8 can be used to clear faults. See Figure 21 on page 40 for details.

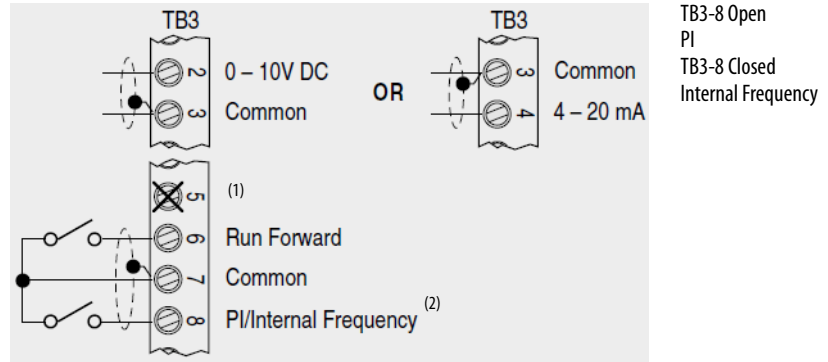
Table 16 - TB3 Terminal 2 and 8 Switch Definitions

SW2 Position TB3-8	SW1 Position TB3-2	Speed Reference	Accel Rate	Decel Rate
Open (0)	Open (0)	Parameter 61 (Preset 0)	Parameter 30	Parameter 31
Open (0)	Closed (1)	Parameter 62 (Preset 1)	Parameter 30	Parameter 31
Closed (1)	Open (0)	Parameter 65 (Preset 4)	Parameter 69	Parameter 70
Closed (1)	Closed (1)	Parameter 66 (Preset 5)	Parameter 69	Parameter 70

P46 Setting 9 - Two-Wire PI Control (Analog Models Only)

This input mode is similar to setting 1 except TB3 terminal 8 provides the function of PI Control.

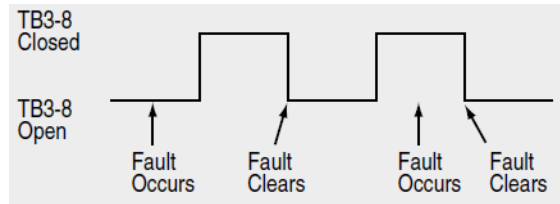
Figure 20 - Bulletin 160 SSC Two-Wire PI control



- (1) Do not connect to TB3-4 in this mode.
- (2) TB3 terminal 8 can be used to clear faults. See [Figure 21](#) on page 40 for details.

IMPORTANT For P46 - [Input Mode] settings 4 . . . 9, terminal TB3-8 is also used to clear faults. See figure below for details.

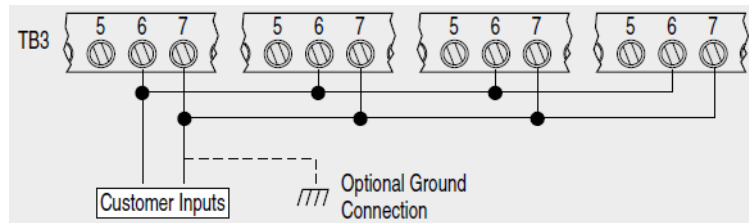
Figure 21 - TB3-8 – Clear Faults



IMPORTANT The system programmer is responsible for returning terminal TB3-8 to its original state if necessary.

When connecting a single input such as Run, Stop, Reverse or Preset Speeds to multiple drives, it is important to connect the commons (TB3-7) together for all drives. If they are to be tied into another common (such as earth ground or separate apparatus ground) connect only one point of the daisy chain of TB3-7. Predicting actual performance given the variety of installation possibilities is difficult, however, up to five drives with two meters of cable between have been tested without problems.

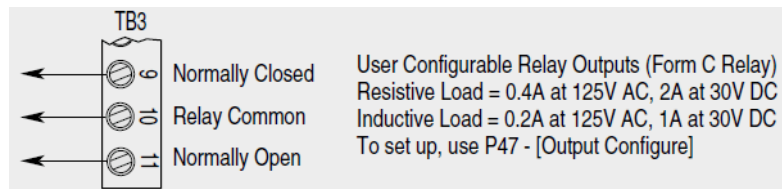
Figure 22 - Typical Multiple Drive Input Connections



Configurable Relay Output Contacts (P47 Settings)

You can configure the drive’s dry contact form C output relay to change state based on P47 - [Output Configure] setting and P48 - [Output Threshold] limits.

Figure 23 - Configurable Relay Output Contacts



Frequency Source Wiring

Analog Signal Follower Model

You can control the output frequency of the drive via the control terminal block (TB3) by using the following methods.

Analog Frequency Sources:

IMPORTANT Only one frequency source can be connected at a time. If more than one frequency reference is commanded at the same time, an undetermined frequency reference occurs.

Figure 24 - ±10V or 0 – 10V DC Frequency Control/Speed Control

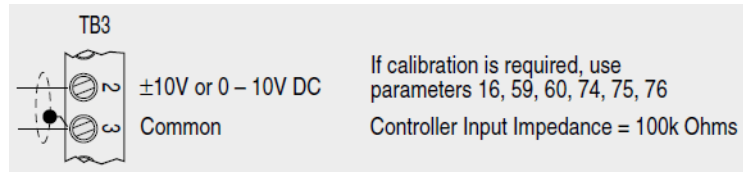


Figure 25 - 4 – 20 mA Frequency Control/Speed Control

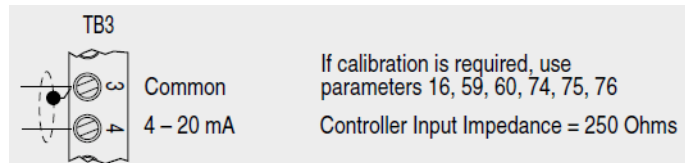
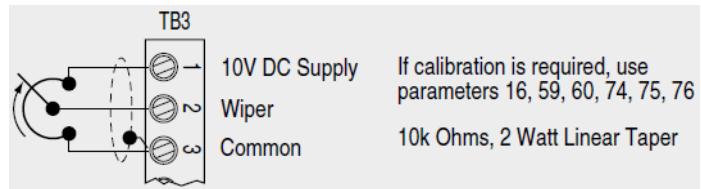
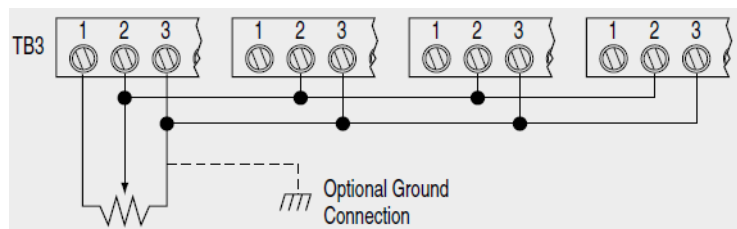


Figure 26 - Potentiometer Frequency Control/Speed Control



When connecting a single potentiometer to multiple drives it is important to connect commons (TB3-3) together for all drives. Daisy-chain TB3-3 (common) and TB3-2 (potentiometer wiper) to each drive. All drives must be powered up for the analog signal to be read correctly. Predicting actual performance given the variety of installation possibilities is difficult, however, up to five drives with two meters of cable between have been tested without problems.

Figure 27 - Typical Multiple Drive Analog Connection



Preset Frequency Sources:

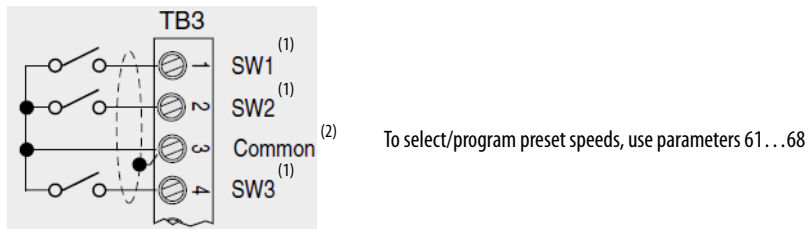
The Analog Signal Follower model has a special input mode, P46 setting 8 that lets the drive to be operated via preset speed inputs. See [Figure 19](#) on page [39](#) and [Table 16](#) on page [39](#) for details.

Preset Speed Model

You can control the output frequency of the drive via the control terminal block (TB3) by using dry contacts or open collector inputs to SW1, SW2, and SW3 (see [Figure 28](#) below).

IMPORTANT Refer to parameters 61...68 in Chapter 5 of the Bulletin 160 Variable Speed Drive (Series C) User Manual, publication [160-UM009](#), for the eight preset frequency factory default settings and switch configurations. A program keypad module is required to change the factory default settings.

Figure 28 - TB3 Control Wiring for Preset Speed Model



- (1) Internal 12V supply. Contact closure or open collector input required. Refer to Appendix A in the Bulletin 160 Variable Speed Drive (Series C) User Manual, publication [160-UM009](#), for solid state control input specifications.
- (2) Control signal cable length is highly dependent on electrical environment and installation practices. To improve noise immunity, TB3 Common must be connected to ground terminal/protective earth. For control wiring installations greater than 15 meters (50 feet) in length, an optional 24V DC interface module is recommended.

Analog and Preset Speed Models

Internal Frequency Source:

Both the Analog Signal Follower and Preset Speed models have the provision for frequency control via P58 - [Internal Frequency]. This is accomplished by setting P59 - [Frequency Select] to a value of 1. See Chapter 5 in the Bulletin 160 Variable Speed Drive (Series C) User Manual, publication [160-UM009](#), for a description of these parameters.

PowerFlex 525 I/O Wiring

PowerFlex 525 Motor Start/Stop Precautions



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

ATTENTION: The drive start/stop control circuitry includes solid-state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional hardwired stop circuit is required to remove the AC line to the drive. When the AC line is removed, a loss of any inherent regenerative braking effect can occur and the motor coasts to a stop. In this case, use an auxiliary braking method. Alternatively, use the drive's safety input function.

Important points to remember about I/O wiring:

- Always use copper wire.
- Wire with an insulation rating of 600V or greater is recommended.
- Separate control and signal wires from power wires by at least 0.3 m (1 ft).

IMPORTANT I/O terminals labeled “Common” are not referenced to the safety ground (PE) terminal and are designed to greatly reduce common mode interference.



ATTENTION: Driving the 4...20 mA analog input from a voltage source could cause component damage. Verify proper configuration prior to applying input signals.

PowerFlex 525 Signal and Control Wire Types

Recommendations are for 50 °C ambient temperature.
 75 °C wire must be used for 60 °C ambient temperature.
 90 °C wire must be used for 70 °C ambient temperature.

Table 17 - Recommended Signal Wire

Signal Type/ Where Used	Belden Wire Type(s) ⁽¹⁾ (or equivalent)	Description	Min. Insulation Rating
Analog I/O & PTC	8760/9460	0.750 mm ² (18 AWG), twisted pair, 100% shield with drain ⁽²⁾	300V, 60 °C (140 °F)
Remote Pot	8770	0.750 mm ² (18 AWG), 3 conductor, shielded	
Encoder/Pulse I/O	9728/9730	0.196 mm ² (24 AWG), individually shielded pairs	

(1) Stranded or solid wire.

(2) If the wires are short and contained within a cabinet with no sensitive circuits, shielded wire is not necessary, but is always recommended.

Table 18 - Recommended Control Wire for Digital I/O

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

PowerFlex 525 Maximum Control Wire Recommendations

Do not exceed control wiring length of 30 m (100 ft). Control signal cable length is highly dependent on electrical environment and installation practices. To improve noise immunity, connect the I/O terminal block to the ground terminal/protective earth. If using the RS485 (DSI) port, also connect I/O terminal C1 to ground terminal/protective earth. Additionally, communication noise immunity can also be improved by connecting I/O terminal C2 to ground terminal/protective earth.

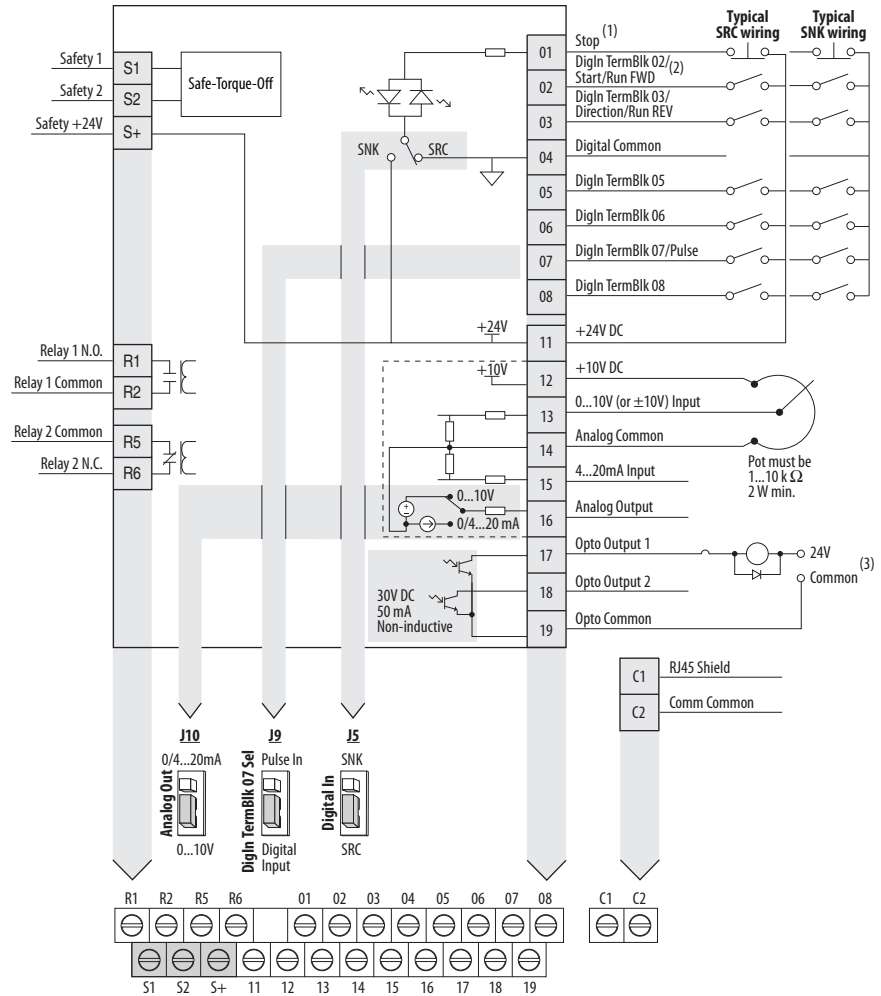
*PowerFlex 525 Control I/O Terminal Block***Table 19 - Control I/O Terminal Block Wire Specifications**

Frame	Maximum Wire Size ⁽¹⁾	Minimum Wire Size ⁽¹⁾	Torque
A...C	1.3 mm ² (16 AWG)	0.13 mm ² (26 AWG)	0.71...0.86 N·m (6.2...7.6 lb·in)

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

PowerFlex 525 Control I/O Terminal Block

Figure 29 - PowerFlex 525 Control I/O Wiring Block Diagram



PowerFlex 525 Control I/O Wiring Block Diagram Notes

(1) See Digital Input Selection Start Source in the PowerFlex 520-Series AC Drive User Manual, publication [520-UM001](#), for more information on configuring the digital inputs.

IMPORTANT I/O Terminal 01 is always a stop input. The stopping mode is determined by the drive setting. See the tables below for more information.

P046, P048, P050 [Start Source x]	Normal Stop	I/O Terminal 01 Stop
1 "Keypad"	Per P045 [Stop Mode]	Coast
2 "DigIn TrmBlk"		See t062, t063 [DigIn TermBlk xx] below
3 "Serial/DSI"		Coast
4 "Network Opt"		Per P045 [Stop Mode]
5 "EtherNet/IP"		Per P045 [Stop Mode]

t062, t063 [DigIn TermBlk xx]	Normal Stop	I/O Terminal 01 Stop
48 "2-Wire FWD"	Per P045 [Stop Mode]	See t064 [2-Wire Mode] below
49 "3-Wire Start"		Per P045 [Stop Mode]
50 "2-Wire REV"		See t064 [2-Wire Mode] below
51 "3-Wire Dir"		Per P045 [Stop Mode]

t064 [2-Wire Mode]	Normal Stop	I/O Terminal 01 Stop
0 "Edge Trigger"	Per P045 [Stop Mode]	Coast
1 "Level Sense"		Coast
2 "Hi-Spd Edge"		Coast
3 "Momentary"		Per P045 [Stop Mode]

IMPORTANT The drive is shipped with a jumper installed between I/O Terminals 01 and 11. Remove this jumper when using I/O Terminal 01 as a stop or enable input.

- (2) Two wire control shown. For three wire control use a momentary input on I/O Terminal 02 to command a start. Use a maintained input for I/O Terminal 03 to change direction.
- (3) When using an opto output with an inductive load such as a relay, install a recovery diode parallel to the relay as shown, to prevent damage to the output.

Control I/O Terminal Designations

No.	Signal	Default	Description	Parameter
R1	Relay 1 N.O.	Fault	Normally open contact for output relay.	t076
R2	Relay 1 Common	Fault	Common for output relay.	
R5	Relay 2 Common	Motor Running	Common for output relay.	t081
R6	Relay 2 N.C.	Motor Running	Normally closed contact for output relay.	
01	Stop	Coast	Three wire stop. However, it functions as a stop under all input modes and cannot be disabled.	P045 ⁽¹⁾
02	DigIn TermBlk 02/ Start/Run FWD	Run FWD	Used to initiate motion and also can be used as a programmable digital input. It can be programmed with t062 [DigIn TermBlk 02] as three wire (Start/Dir with Stop) or two wire (Run FWD/Run REV) control. Current consumption is 6 mA.	P045, P046, P048, P050, A544, t062
03	DigIn TermBlk 03/ Dir/Run REV	Run REV	Used to initiate motion and also can be used as a programmable digital input. It can be programmed with t063 [DigIn TermBlk 03] as three wire (Start/Dir with Stop) or two wire (Run FWD/Run REV) control. Current consumption is 6 mA.	t063
04	Digital Common	–	Return for digital I/O. Electrically isolated (along with the digital I/O) from the rest of the drive.	–
05	DigIn TermBlk 05	Preset Freq	Program with t065 [DigIn TermBlk 05]. Current consumption is 6 mA.	t065
06	DigIn TermBlk 06	Preset Freq	Program with t066 [DigIn TermBlk 06]. Current consumption is 6 mA.	t066
07	DigIn TermBlk 07/ Pulse In	Start Source 2 + Speed Reference2	Program with t067 [DigIn TermBlk 07]. Also functions as a Pulse Train input for reference or speed feedback. The maximum frequency is 100 kHz. Current consumption is 6 mA.	t067
08	DigIn TermBlk 08	Jog Forward	Program with t068 [DigIn TermBlk 08]. Current consumption is 6 mA.	t068
C1	C1	–	This terminal is tied to the RJ-45 port shield. Tie this terminal to a clean ground to improve noise immunity when using external communication peripherals.	–
C2	C2	–	This is the signal common for the communication signals.	–
S1	Safety 1	–	Safety input 1. Current consumption is 6 mA.	–
S2	Safety 2	–	Safety input 2. Current consumption is 6 mA.	–
S+	Safety +24V	–	+24V supply for safety circuit. Internally tied to the +24V DC source (Pin 11).	–

Control I/O Terminal Designations

No.	Signal	Default	Description	Parameter
11	+24V DC	–	Referenced to Digital Common. Drive supplied power for digital inputs. Maximum output current is 100 mA.	–
12	+10V DC	–	Referenced to Analog Common. Drive supplied power for 0...10V external potentiometer. Maximum output current is 15 mA.	P047, P049
13	±10V In	Not Active	For external 0...10V (unipolar) or ±10V (bipolar) input supply or potentiometer wiper. Input impedance: Voltage source = 100 kΩ Allowable potentiometer resistance range = 1...10 kΩ	P047, P049, t062, t063, t065, t066, t093, A459, A471
14	Analog Common	–	Return for the analog I/O. Electrically isolated (along with the analog I/O) from the rest of the drive.	–
15	4-20mA In	Not Active	For external 4...20 mA input supply. Input impedance = 250 Ω	P047, P049, t062, t063, t065, t066, A459, A471
16	Analog Output	OutFreq 0-10	The default analog output is 0...10V. To convert a current value, change the Analog Output jumper to 0-20 mA. Program with t088 [Analog Out Sel]. Maximum analog value can be scaled with t089 [Analog Out High]. Maximum Load: 4...20 mA = 525 Ω (10.5V) 0...10V = 1 kΩ (10 mA)	t088, t089
17	Opto Output 1	Motor Running	Program with t069 [Opto Out1 Sel]. Each Opto-Output is rated 30V DC 50 mA (Non-inductive).	t069, t070, t075
18	Opto Output 2	At Frequency	Program with t072 [Opto Out1 Sel]. Each Opto-Output is rated 30V DC 50 mA (Non-inductive).	t072, t073, t075
19	Opto Common	–	The emitters of the Optocoupler Outputs (1 and 2) are tied together at Optocoupler Common. Electrically isolated from the rest of the drive.	–

(1) See Footnote (1) on page 46.

Terminal Comparison Summary

Description	Terminal Designation	
	Bulletin 160 SSC Drive	PowerFlex 525 Drive
Input AC Line – R/L1	R/L1	R/L1
Input AC Line – S/L2	S/L2	S/L2
Input AC Line – T/L3	T/L3	T/L3
Motor – U/T1	U/T1	U/T1
Motor – V/T2	V/T2	V/T2
Motor – W/T3	W/T3	W/T3
Brake Resistor	BR+	BR+
Brake Resistor	BR–	BR–
DC Bus –	DC–	DC–
DC Bus +	DC+	DC+
Motor Ground	PE	PE
Drive Ground	PE	PE

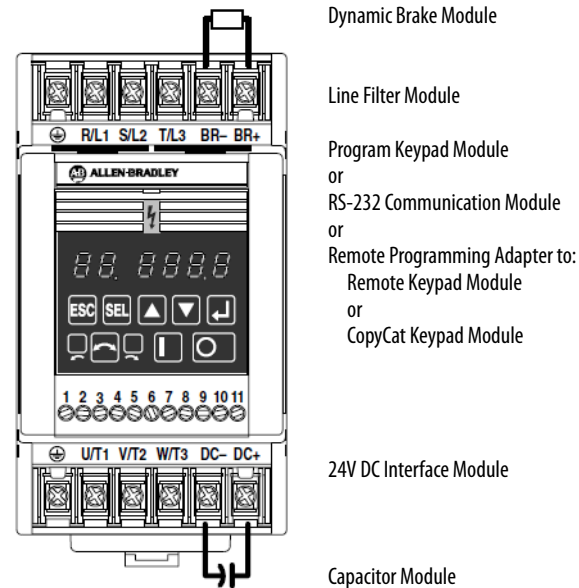
Description	Terminal Designation	
	Bulletin 160 SSC Drive	PowerFlex 525 Drive
Analog Shield	–	PE
Analog Input 1 Common	3	14
Analog Input 1	2 - (0...10V)	13 - (0...10V)
Analog Input 2 Common	3	14
Analog Input 2	4 - (4...20 mA)	15 - (4...20 mA)
Analog Output 1 (–)	–	–
Analog Output 1 (+)	–	16
Analog Output Common	–	14
+10V Reference	1	12
Reference Common	3	14
Encoder A	–	A (25-ENC-1 option card)
Encoder A (Not)	–	A- (25-ENC-1 option card)
Encoder B	–	B (25-ENC-1 option card)
Encoder B (Not)	–	B- (25-ENC-1 option card)
Encoder Reference (+)	–	+V (25-ENC-1 option card)
Encoder Reference (–)	–	Cm (25-ENC-1 option card)
Encoder Shield	–	PE (25-ENC-1 option card)
Relay Output 1 (N.O)	11	R1
Relay Output 1 Com.	10	R2
Relay Output 1 (N.C)	9	–
Relay Output 2 (N.O)	–	–
Relay Output 2 Com.	–	R5
Relay Output 2 (N.C)	–	R6
Opto Output 1	–	17
Opto Output 2	–	18
Opto Output Common	–	19
24V DC Source (+)	–	11
Digital Input Common	7	4
Digital Input 1	5	1
Digital Input 2	6	2
Digital Input 3	8	3
Digital Input 4	–	5
Digital Input 5	–	6
Digital Input 6	–	7
Digital Input 7	–	8
Drive Enable	8	2 - 4 & 5 - 8 (programmable)

Description	Terminal Designation	
	Bulletin 160 SSC Drive	PowerFlex 525 Drive
Safety 1	–	S1
Safety 2	–	S2
Safety +24V	–	S+
Comm. Shield	–	C1
Comm. Common	–	C2

Accessories**Bulletin 160 SCC Module Options**

The drive features identified in the figure below are optional.

Figure 30 - Optional Drive Features



- The **dynamic brake module** option lets you connect dynamic brake resistors. Not available on 0.37 or 0.55 kW (0.5 or 0.75 Hp) ratings.

IMPORTANT P52 - [DB Enable] must be enabled for proper operation.

- The **line filter module** option is available to reduce conductive emissions.
- The **program keypad module** option can be ordered separately and field installed, or as a factory installed option by adding “P1” to the end of the catalog number. See Chapter 3, Program Keypad Module, in the 160 SSC Variable Speed Drive (Series C), User Manual, publication [160-UM009](#), for a detailed explanation of functionality.
- The **DeviceNet communication module** option provides control and monitoring of parameters via a DeviceNet network.
- The **RS-232 communication module** option provides control and monitoring of parameters via a RS-232 network.
- The **remote programming adapter** option provides connection to remote keypad module or copycat keypad module via cable (1 to 3 meters).
- The **24V DC interface module** option lets you command the drive with 24V logic (sinking inputs).
- The **capacitor module** option lets you to connect an external capacitor module. Provides extended ride through capability and improved inherent braking performance.

Bulletin 160 SSC Accessories and Dimensions

The following tables list the accessories are available for Bulletin 160 SSC drives.

Table 20 - Bulletin 160 SSC Accessories

Drive Ratings			Dynamic Brake Module	3% Line Reactors Open Style	Line Filters		Fan Replacement Kit ⁽⁵⁾	Capacitor Module
Input Voltage	kW	Hp	Cat. No.	Cat. No. ⁽²⁾	Cat. No. ⁽³⁾	Cat. No. ⁽⁴⁾	Cat. No.	Cat. No.
200...240VAC 50/60 Hz 1-Phase	0.37	0.5	–	–	160S-LFA1	160S-RFA-9-A	–	160-CMA1
	0.55	0.75	–	–	160S-LFA1	160S-RFA-9-A	–	160-CMA1
	0.75	1	160-BMA1	–	160S-LFA1	160S-RFA-9-A	160-FRK2	160-CMA1
	1.5	2	160-BMA2	–	160S-LFA1	160S-RFA-16-B	160-FRK3	160-CMA1
200...230VAC 50/60 Hz 3-Phase	0.37	0.5	–	1321-3R4-B	160S-LFA1	160S-RFB-5-A	–	160-CMA1
	0.55	0.75	–	1321-3R4-A	160S-LFA1	160S-RFB-5-A	–	160-CMA1
	0.75	1	160-BMA1	1321-3R4-A	160S-LFA1	160S-RFB-5-A	160-FRK2	160-CMA1
	1.5	2	160-BMA2	1321-3R8-A	160S-LFA1	160S-RFB-14-A	160-FRK2	160-CMA1
	2.2	3	160-BMA2	1321-3R12-A	160S-LFA2	160S-RFB-14-A	160-FRK2	160-CMA1
	4.0	5	160-BMA2 ⁽¹⁾	1321-3R18-A	–	160S-RFB-22-B	160-FRK3	160-CMA1
380...460VAC 50/60 Hz 3-Phase	0.37	0.5	–	1321-3R2-B	160S-LFB1	160S-RFB-5-A	–	160-CMB1
	0.55	0.75	–	1321-3R2-A	160S-LFB1	160S-RFB-5-A	–	160-CMB1
	0.75	1	160-BMB1	1321-3R2-A	160S-LFB1	160S-RFB-5-A	160-FRK2	160-CMB1
	1.5	2	160-BMB2	1321-3R4-B	160S-LFB1	160S-RFB-5-A	160-FRK2	160-CMB1
	2.2	3	160-BMB2	1321-3R8-B	160S-LFB1	160S-RFB-14-A	160-FRK2	160-CMB1
	4.0	5	160-BMB2 ⁽¹⁾	1321-3R18-B	–	160S-RFB-14-B	160-FRK3	160-CMB1

- (1) Two in parallel required.
- (2) Catalog numbers listed are for 3% impedance open style units. NEMA/UL Type 1 and 5% impedance reactor types are also available. Refer to publication 1321-2.0 for detailed information.
- (3) 160-LF type filters have been tested with a maximum motor cable length of 75 meters (250 feet) for 230V units and 40 meters (133 feet) for 460V units.
- (4) 160-RF type filters have been tested with a maximum motor cable length of 25 meters (80 feet) for both 230V and 460V units. Listed filters are for Bulletin 160 Series C drives only.
- (5) The MTBF for the fan is 40,000 hours at 50°C.

Table 21 - Bulletin 160 SSC Optional Modules and Cables

Ready/Fault Panel	Program Keypad Module	DeviceNet Comm Module ⁽¹⁾	RS-232 Comm Module ⁽¹⁾	24V DC Interface ⁽²⁾	Remote Programming Adapter ⁽³⁾	Remote Keypad Module ⁽³⁾	CopyCat Keypad Module ⁽³⁾	Cable
Cat. No.	Cat. No.	Cat. No.	Cat. No.	Cat. No.	Cat. No.	Cat. No.	Cat. No.	Cat. No.
160-B1	160-P1	160-DN2	160-RS1	160-DM-SF1 (Analog) 160-DM-PS1 (Preset)	160-RPA	160-P2	160-P3	160-C10 (1 meter, non-locking each end) 160-C10R (1 meter, non-locking each end, right angle) 160-C30 (3 meter, locking each end) 160-C50 (5 meter, locking each end)

- (1) Compatible with Bulletin 160 Series A, Series B and Series C drives with firmware version FRN 4.07 or later.
- (2) Provides 24VDC sinking inputs. Bulletin 160 Series C drives must use a Series B, or later, 24V DC Interface module.
- (3) Compatible with Bulletin 160 Series C drives with firmware version FRN 7.03 or later.

Table 22 - Bulletin 160 SSC Dynamic Brake Resistors

Drive Rating			Minimum Resistance ⁽¹⁾ (Ω)	Resistance (Ω)	Cat. No.
Input Voltage	Hp	kW			
200...240V AC	1	0.75	88	188	160-BMA1
	2	1.5	88	94	160-BMA2
	3	2.2	63	94	160-BMA2
	5	4.0	47	47	160-BMA2 ⁽²⁾
380...460V AC	1	0.75	367	755	160-BMB1
	2	1.5	176	377	160-BMB2
	3	2.2	176	377	160-BMB2
	5	4.0	147	188	160-BMB2 ⁽²⁾

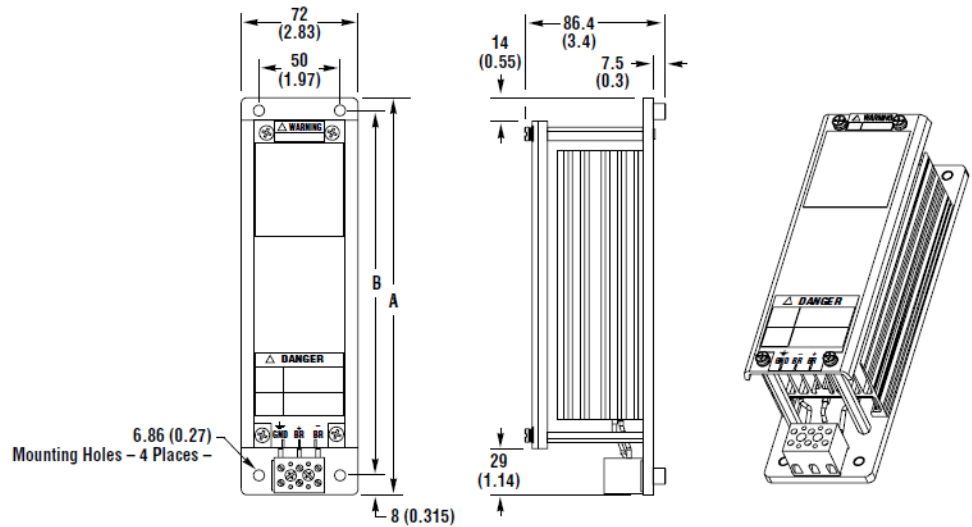
(1) The rated accuracy of the resistor must be 10% or greater.

(2) Two in parallel required.

See [Table 25](#) for a comparison of PowerFlex 525 brake resistor modules.

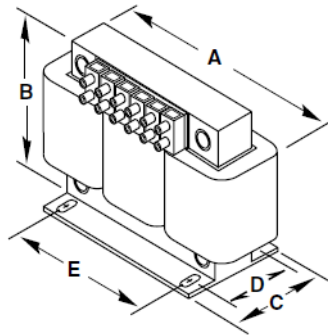
The following figures include the dimensions for the accessories listed in the tables above.

Figure 31 - Dynamic Brake Module Dimensions



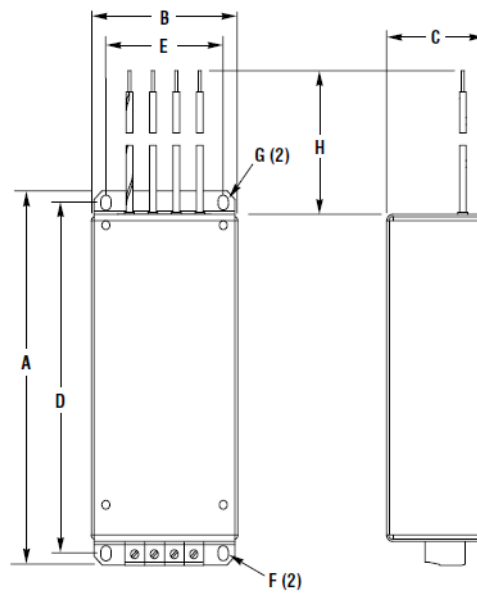
Cat. No.	A mm (in.)	B mm (in.)
160-BMA1 & 160-BMB1	245 (9.64)	225 (8.86)
160-BMA2 & 160-BMB2	334 (13.15)	314 (12.36)

Figure 32 - Bulletin 1321 Line Reactor Dimensions



Cat. No	A mm (in.)	B mm (in.)	C mm (in.)	D mm (in.)	E mm (in.)
1321-3R2-A	112 (4.4)	104 (4.1)	74 (2.9)	50 (2.0)	37 (1.44)
1321-3R2-B	112 (4.4)	104 (4.1)	74 (2.9)	50 (2.0)	37 (1.44)
1321-3R4-A	112 (4.4)	104 (4.1)	76 (3.0)	50 (2.0)	37 (1.44)
1321-3R4-B	112 (4.4)	104 (4.1)	76 (3.0)	50 (2.0)	37 (1.44)
1321-3R8-A	152 (6.0)	127 (5.0)	76 (3.0)	53 (2.1)	51 (2.0)
1321-3R8-B	152 (6.0)	127 (5.0)	76 (3.0)	53 (2.1)	51 (2.0)
1321-3R12-A	152 (6.0)	127 (5.0)	76 (3.0)	53 (2.1)	51 (2.0)
1321-3R18-A	152 (6.0)	133 (5.3)	79 (3.1)	51 (2.0)	51 (2.0)

Figure 33 - Line Filter Dimensions



Line Filter Cat. No.	A mm (in.)	B mm (in.)	C mm (in.)	D mm (in.)	E mm (in.)	F mm (in.)	G mm (in.)	H mm (in.)
160S-RFA-9-A	182.0 (7.17)	75.0 (2.95)	37.5 (1.47)	163.0 (6.42)	60.0 (2.36)	M4.5 x 6.5 (0.18 x 0.26) obround hole (2 places)	M4.5 x 6.5 (0.18 x 0.26) obround hole (2 places)	200 (7.87)
160-RFB-5-A								
160-RFB-14-A	182.0 (7.17)	75.0 (2.95)	47.5 (1.87)	163.0 (6.42)	60.0 (2.36)			
160S-RFA-16-B	227.0 (8.94)	87.0 (3.43)	55.5 (2.18)	212.0 (8.35)	60.0 (2.36)	M4.5 (0.18) slot (2 places)	M4.5 (0.18) (2 places)	
160-RFA-22-B								
160-RFB-14-B								
160 LF (All Types)	174.0 (6.85)	75.0 (2.95)	50.0 (1.97)	163.0 (6.42)	60.0 (2.36)	7.0 x 5.3 (0.28 x 0.21) hole dim.	6.9 x 5.25 (0.272 x 0.207) hole dim.	

Figure 34 - Capacitor Module Dimensions

All dimensions are in millimeters and (inches).

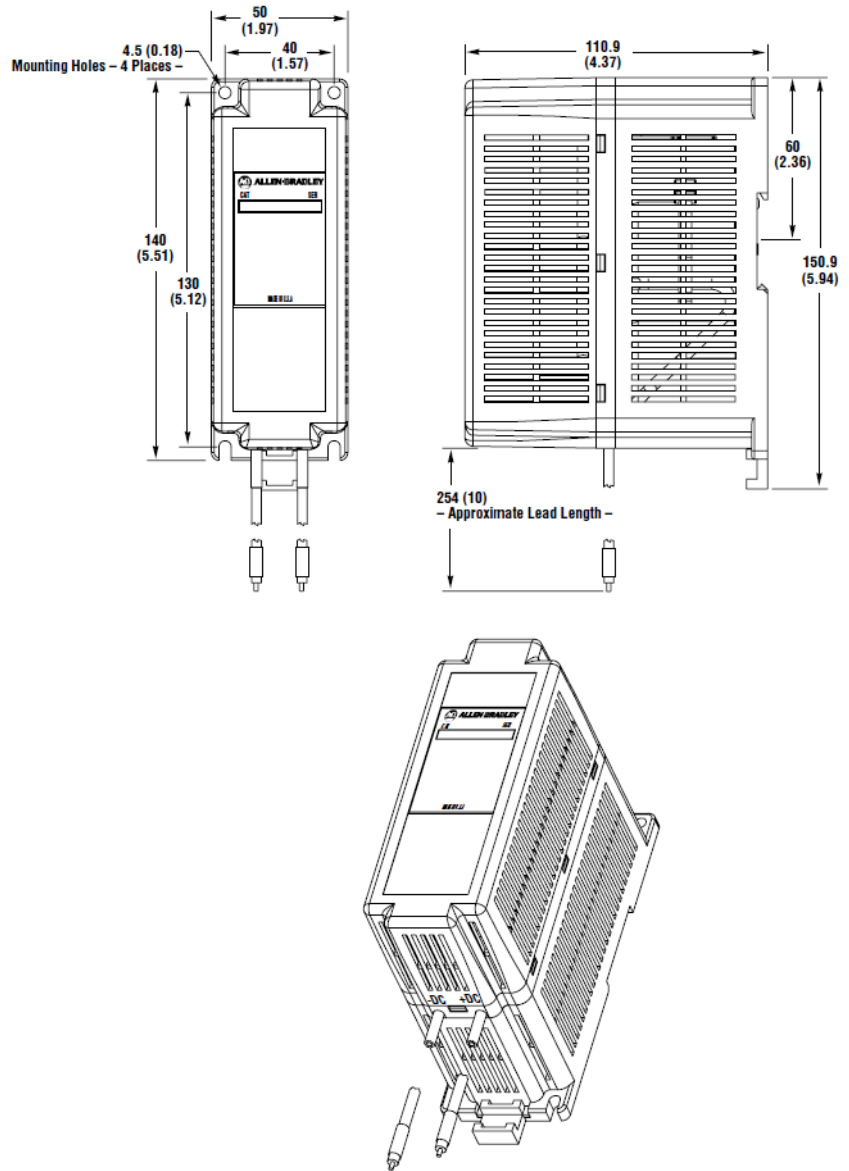


Figure 35 - DeviceNet or RS-232 Module Dimensions - Attached to Drive (DeviceNet Shown)

All dimensions are in millimeters and (inches).

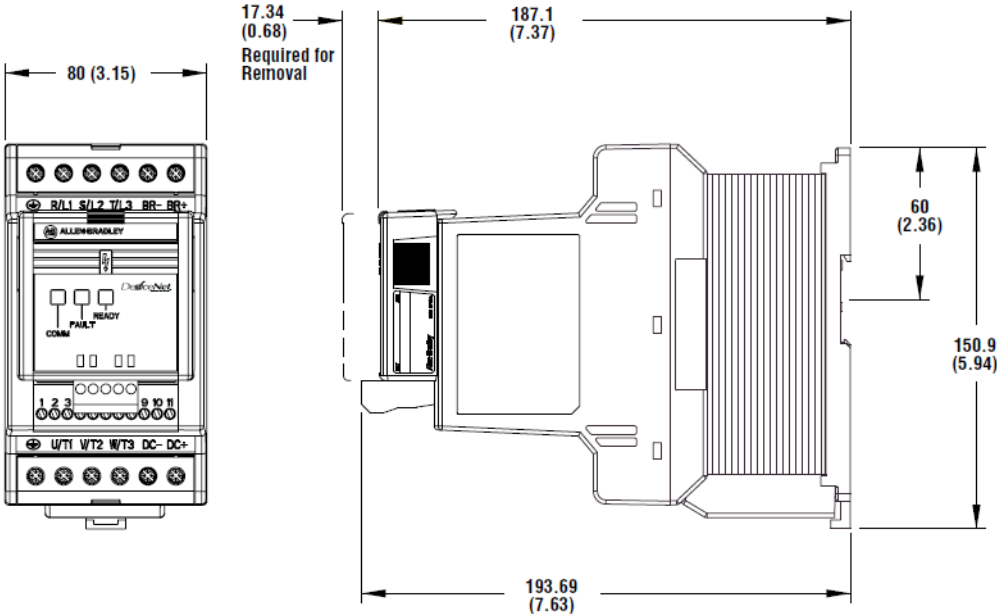
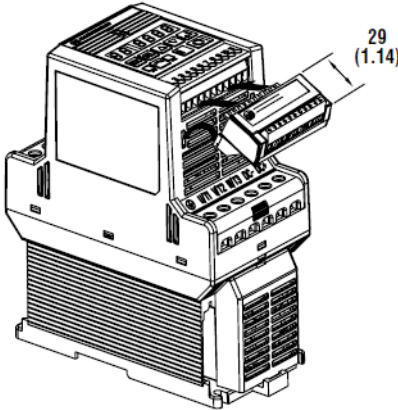


Figure 36 - 24V DC Interface Module Dimensions

All dimensions are in millimeters and (inches).



PowerFlex 525 Drive Accessories and Dimensions

Product Selection

Table 23 - Catalog Number Description

25B	-	V	2P5	N	1	0	4
Drive		Voltage Rating	Rating	Enclosure	HIM	Emission Class	Version

Table 24 - PowerFlex 525 Drive Ratings

Catalog No.	Output Ratings					Input Voltage Range	Frame Size
	Normal Duty		Heavy Duty		Output Current (A)		
	Hp	kW	Hp	kW			
200...240V AC (-15%, +10%) – 1-Phase Input, 0...230V 3-Phase Output							
25B-A2P5N104	0.5	0.4	0.5	0.4	2.5	170...264	A
25B-A4P8N104	1.0	0.75	1.0	0.75	4.8	170...264	A
25B-A8PON104	2.0	1.5	2.0	1.5	8.0	170...264	B
25B-A011N104	3.0	2.2	3.0	2.2	11.0	170...264	B
200...240V AC (-15%, +10%) – 1-Phase Input with EMC Filter, 0...230V 3-Phase Output							
25B-A2P5N114	0.5	0.4	0.5	0.4	2.5	170...264	A
25B-A4P8N114	1.0	0.75	1.0	0.75	4.8	170...264	A
25B-A8PON114	2.0	1.5	2.0	1.5	8.0	170...264	B
25B-A011N114	3.0	2.2	3.0	2.2	11.0	170...264	B
200...240V AC (-15%, +10%) – 3-Phase Input, 0...230V 3-Phase Output							
25B-B2P5N104	0.5	0.4	0.5	0.4	2.5	170...264	A
25B-B5PON104	1.0	0.75	1.0	0.75	5.0	170...264	A
25B-B8PON104	2.0	1.5	2.0	1.5	8.0	170...264	A
25B-B011N104	3.0	2.2	3.0	2.2	11.0	170...264	A
25B-B017N104	5.0	4.0	5.0	4.0	17.5	170...264	B
25B-B024N104	7.5	5.5	7.5	5.5	24.0	170...264	C
380...480V AC (-15%, +10%) – 3-Phase Input, 0...460V 3-Phase Output⁽¹⁾							
25B-D1P4N104	0.5	0.4	0.5	0.4	1.4	323...528	A
25B-D2P3N104	1.0	0.75	1.0	0.75	2.3	323...528	A
25B-D4PON104	2.0	1.5	2.0	1.5	4.0	323...528	A
25B-D6PON104	3.0	2.2	3.0	2.2	6.0	323...528	A
25B-D010N104	5.0	4.0	5.0	4.0	10.5	323...528	B
380...480V AC (-15%, +10%) – 3-Phase Input with EMC Filter, 0...460V 3-Phase Output							
25B-D1P4N114	0.5	0.4	0.5	0.4	1.4	323...528	A
25B-D2P3N114	1.0	0.75	1.0	0.75	2.3	323...528	A
25B-D4PON114	2.0	1.5	2.0	1.5	4.0	323...528	A
25B-D6PON114	3.0	2.2	3.0	2.2	6.0	323...528	A
25B-D010N114	5.0	4.0	5.0	4.0	10.5	323...528	B
25B-D013N114	7.5	5.5	7.5	5.5	13.0	323...528	C
25B-D017N114	10.0	7.5	10.0	7.5	17.0	323...528	C

(1) A non-filtered drive is not available for 380...480V AC 25 Hp (18.5 kW) and 30 Hp (22.0 kW) ratings. Filtered drives are available, however you must verify that the application supports a filtered drive.

Table 25 - PowerFlex 525 Dynamic Brake Resistors

Drive Ratings			Minimum Resistance $\Omega \pm 10\%$	Resistance $\Omega \pm 5\%$	Cat. No. ^{(1) (2)}
Input Voltage	Hp	kW			
200...240V, 50/60 Hz, 1-Phase	0.5	0.4	56	91	AK-R2-091P500
	1.0	0.75	56	91	AK-R2-091P500
	2.0	1.5	41	91	AK-R2-091P500
	3.0	2.2	32	47	AK-R2-047P500
200...240V, 50/60 Hz, 3-Phase	0.25	0.2	56	91	AK-R2-091P500
	0.5	0.4	56	91	AK-R2-091P500
	1.0	0.75	56	91	AK-R2-091P500
	2.0	1.5	41	91	AK-R2-091P500
	3.0	2.2	32	47	AK-R2-047P500
	5.0	4.0	18	47	AK-R2-047P500
	7.5	5.5	16	30	AK-R2-030P1K2
380...480V, 50/60 Hz, 3-Phase	0.5	0.4	89	360	AK-R2-360P500
	1.0	0.75	89	360	AK-R2-360P500
	2.0	1.5	89	360	AK-R2-360P500
	3.0	2.2	89	120	AK-R2-120P1K2
	5.0	4.0	47	120	AK-R2-120P1K2

- (1) The resistors listed in this tables are rated for 5% duty cycle.
- (2) Use of Rockwell Automation resistors is always recommended. The resistors listed have been carefully selected for optimizing performance in a variety of applications. Alternative resistors can be used, however, care must be taken when making a selection. See the PowerFlex Dynamic Braking Resistor Calculator, publication [PFLEX-AT001](#).

Figure 37 - PowerFlex 525 External Dynamic Brake Resistor Kit Dimensions

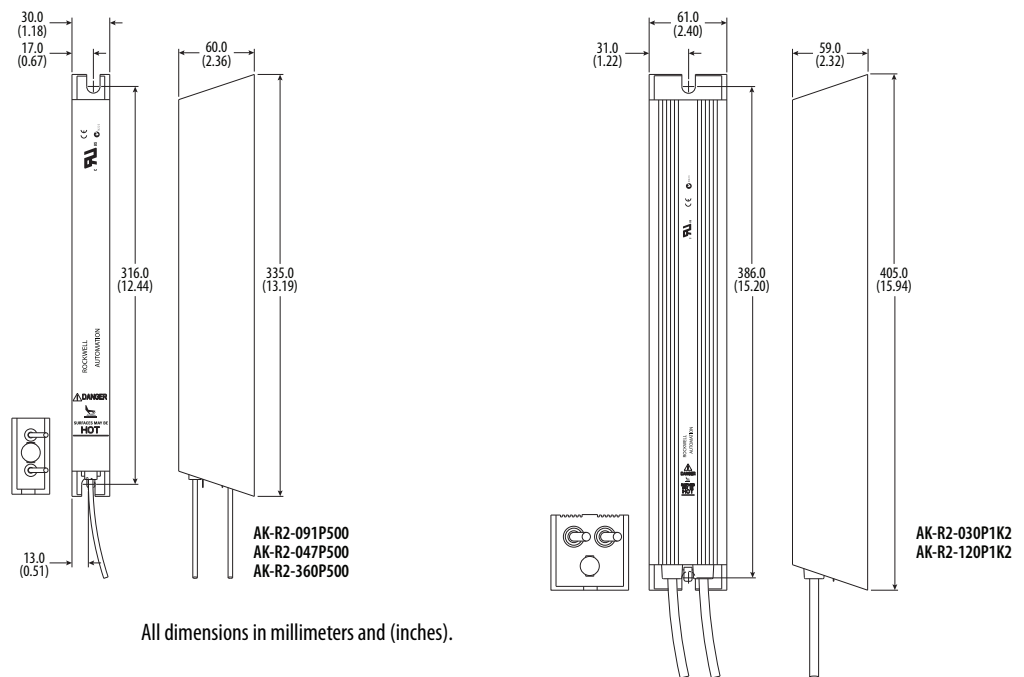


Table 26 - PowerFlex 525 EMC Line Filters

Drive Ratings				Frame Size	Catalog No.
Input Voltage	Hp	kW	Current (A)		
200...240V, 50/60 Hz, 1-Phase	0.25	0.2	1.6	A	25-RF011-AL
	0.5	0.4	2.5	A	25-RF011-AL
	1.0	0.75	4.8	A	25-RF011-AL
	2.0	1.5	8.0	B	25-RF023-BL
	3.0	2.2	11.0	B	25-RF023-BL
200...240V, 50/60 Hz, 3-Phase	0.25	0.2	1.6	A	25-RF014-AL
	0.5	0.4	2.5	A	25-RF014-AL
	1.0	0.75	5.0	A	25-RF014-AL
	2.0	1.5	8.0	A	25-RF014-AL
	3.0	2.2	11.0	A	25-RF014-AL
	5.0	4.0	17.5	B	25-RF021-BL
	7.5	5.5	24.0	C	25-RF027-CL
380...480V, 50/60 Hz, 3-Phase	0.5	0.4	1.4	A	25-RF7P5-AL
	1.0	0.75	2.3	A	25-RF7P5-AL
	2.0	1.5	4.0	A	25-RF7P5-AL
	3.0	2.2	6.0	A	25-RF7P5-AL
	5.0	4.0	10.5	B	25-RF014-BL

Figure 38 - PowerFlex 525 EMC Line Filters Dimensions

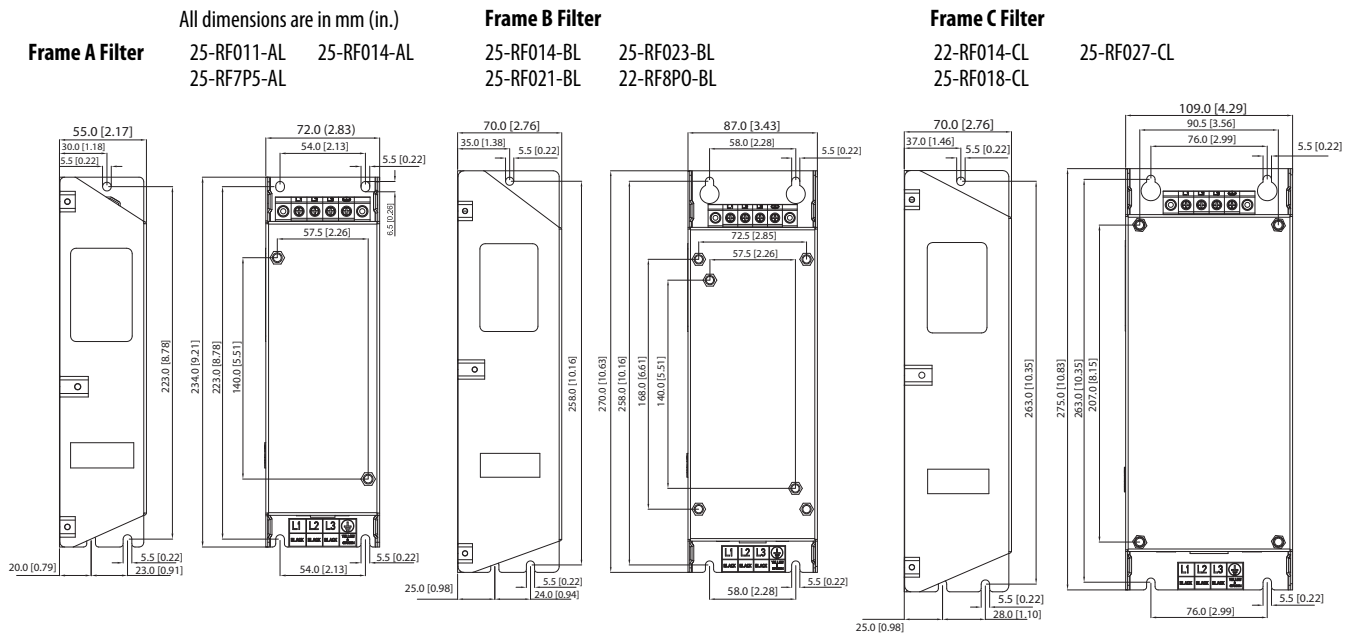
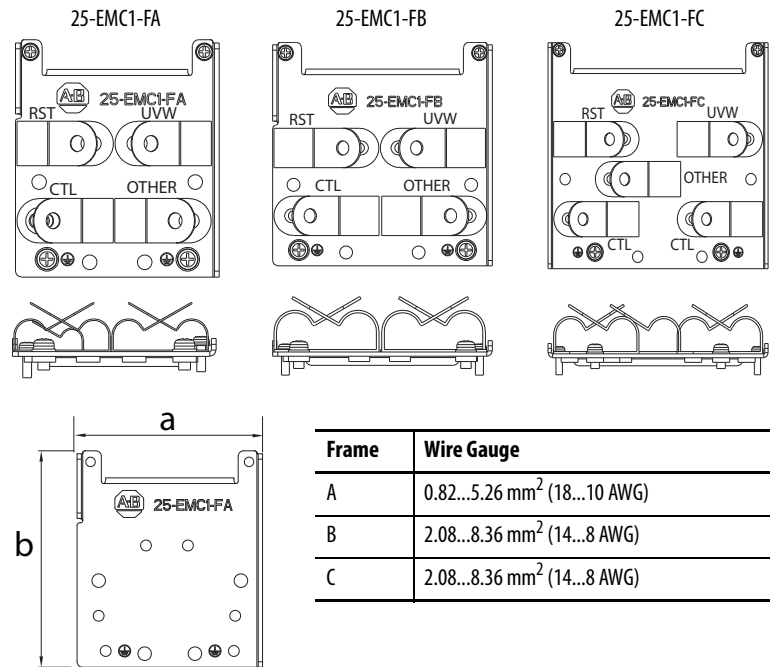


Table 27 - PowerFlex 525 EMC Plates

Item	Description	Frame Size	Catalog No.
EMC Plate	Optional grounding plate for shielded cables.	A	25-EMC1-FA
		B	25-EMC1-FB
		C	25-EMC1-FC

Figure 39 - PowerFlex 525 EMC Plate Dimensions



Frame	a mm (in.)	b mm (in.)
A	68.6 (2.70)	80.0 (3.15)
B	83.6 (3.29)	85.0 (3.35)
C	103.0 (4.06)	96.0 (3.78)

Note: All measurements are in mm (.in).

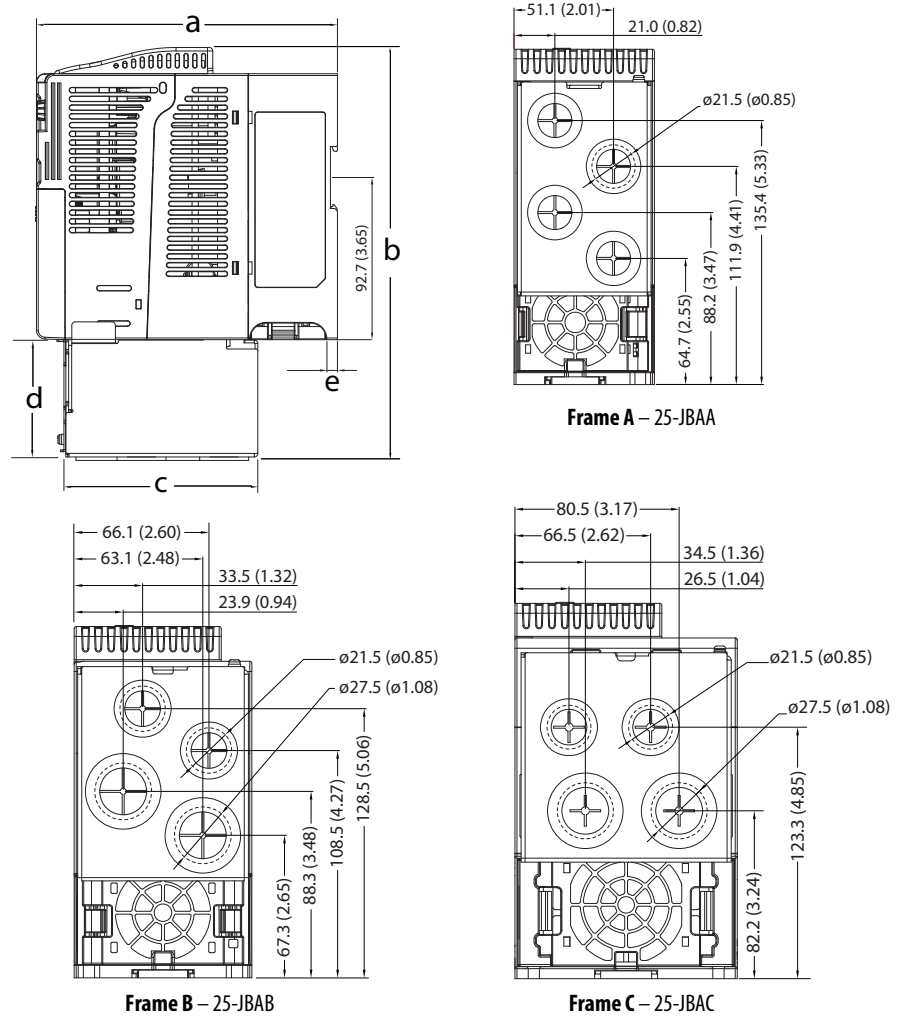
Table 28 - PowerFlex 525 Human Interface Module (HIM) Option Kits and Accessories

Item	Description	Catalog No.
LCD Display, Remote Panel Mount	Digital speed control CopyCat capable IP66 (NEMA Type 4X/12) indoor use only Includes 2.9 meter cable	22-HIM-C25
LCD Display, Remote Handheld	Digital speed control Full numeric keyboard CopyCat capable IP 30 (NEMA Type 1) Includes 1.0 meter cable Panel mount with optional Bezel Kit	22-HIM-A3
Bezel Kit	Panel mount for LCD Display, Remote Handheld unit, IP 30 (NEMA/UL Type 1) Includes 2.0 m DSI cable	22-HIM-B1
DSI HIM Cable (DSI HIM to RJ45 cable)	1.0 m (3.3 ft)	22-HIM-H10
	2.9 m (9.51 ft)	22-HIM-H30

Table 29 - PowerFlex 525 IP 30, NEMA/UL Type 1 Kit

Item	Description	Frame Size	Catalog No.
IP 30, NEMA/UL Type 1 Kit	Field installed kit. Converts drive to IP 30, NEMA/UL Type 1 enclosure. Includes conduit box with mounting screws and plastic top panel.	A	25-JBAA
		B	25-JBAB
		C	25-JBAC

Figure 40 - PowerFlex 525 IP 30, NEMA/UL Type 1 Kit Dimensions



Frame	a mm (in.)	b mm (in.)	c mm (in.)	d mm (in.)	e mm (in.)
A	172 (6.77)	234 (9.21)	110.8 (4.36)	67.0 (2.64)	6.0 (0.24)
B	172 (6.77)	233 (9.17)	103.4 (4.07)	38.0 (1.50)	6.1 (0.24)
C	184 (7.24)	270 (10.63)	102.7 (4.04)	35.0 (1.38)	6.0 (0.24)

Table 30 - PowerFlex 525 Control Module Fan Kit

Item	Description	Frame Size	Catalog No.
Control Module Fan Kit	For use with drive in environments with ambient temperatures up to 70 °C or horizontal mounting.	A...C	25-FAN1-70C

Table 31 - PowerFlex 525 Incremental Encoder Input Option

Item	Description	Catalog No.
Incremental Encoder	Incremental encoder input option board.	25-ENC-1

Table 32 - Bulletin 160 to PowerFlex 520-Series Mounting Adapter Plate

Item	Description	B160 Frame Size	Catalog No.
Mounting Adapter Plate	For use with drive when replacing Bulletin 160 drives in existing installations to a PowerFlex 520-Series drive. Select the catalog number based on the frame size of your Bulletin 160 drive.	A	25-MAP-FA
		B	25-MAP-FB

Notes: Frame C does not have a mounting adapter plate. See the note on page 13 for more information on adapter plate use with EMC line filters.

PowerFlex 525 Drive Replacement Parts

Table 33 - PowerFlex 520-Series Power Module

Item	Description
PowerFlex 520-Series Power Module	Replacement power module for use with PowerFlex 520-Series drives. Includes: <ul style="list-style-type: none"> • Power Module • Power Module Front Cover • Power Terminal Guard • Heatsink Fan

Output Ratings					Input Voltage Range	Frame Size	Catalog No.
Normal Duty		Heavy Duty		Output Current (A)			
HP	kW	HP	kW				
200...240V AC (-15%, +10%) – 1-Phase Input, 0...230V 3-Phase Output							
0.25	0.2	0.25	0.2	1.6	170...264	A	25-PM1-A1P6
0.5	0.4	0.5	0.4	2.5	170...264	A	25-PM1-A2P5
1.0	0.75	1.0	0.75	4.8	170...264	A	25-PM1-A4P8
2.0	1.5	2.0	1.5	8.0	170...264	B	25-PM1-A8P0
3.0	2.2	3.0	2.2	11.0	170...264	B	25-PM1-A011
200...240V AC (-15%, +10%) – 1-Phase Input with EMC Filter, 0...230V 3-Phase Output							
0.25	0.2	0.25	0.2	1.6	170...264	A	25-PM2-A1P6
0.5	0.4	0.5	0.4	2.5	170...264	A	25-PM2-A2P5
1.0	0.75	1.0	0.75	4.8	170...264	A	25-PM2-A4P8
2.0	1.5	2.0	1.5	8.0	170...264	B	25-PM2-A8P0
3.0	2.2	3.0	2.2	11.0	170...264	B	25-PM2-A011

Output Ratings					Input Voltage Range	Frame Size	Catalog No.
Normal Duty		Heavy Duty		Output Current (A)			
HP	kW	HP	kW				
200...240V AC (-15%, +10%) – 3-Phase Input, 0...230V 3-Phase Output							
0.25	0.2	0.25	0.2	1.6	170...264	A	25-PM1-B1P6
0.5	0.4	0.5	0.4	2.5	170...264	A	25-PM1-B2P5
1.0	0.75	1.0	0.75	5.0	170...264	A	25-PM1-B5P0
2.0	1.5	2.0	1.5	8.0	170...264	A	25-PM1-B8P0
3.0	2.2	3.0	2.2	11.0	170...264	A	25-PM1-B011
5.0	4.0	5.0	4.0	17.5	170...264	B	25-PM1-B017
7.5	5.5	7.5	5.5	24.0	170...264	C	25-PM1-B024
380...480V AC (-15%, +10%) – 3-Phase Input, 0...460V 3-Phase Output							
0.5	0.4	0.5	0.4	1.4	323...528	A	25-PM1-D1P4
1.0	0.75	1.0	0.75	2.3	323...528	A	25-PM1-D2P3
2.0	1.5	2.0	1.5	4.0	323...528	A	25-PM1-D4P0
3.0	2.2	3.0	2.2	6.0	323...528	A	25-PM1-D6P0
5.0	4.0	5.0	4.0	10.5	323...528	B	25-PM1-D010
380...480V AC (-15%, +10%) – 3-Phase Input with EMC Filter, 0...460V 3-Phase Output							
0.5	0.4	0.5	0.4	1.4	323...528	A	25-PM2-D1P4
1.0	0.75	1.0	0.75	2.3	323...528	A	25-PM2-D2P3
2.0	1.5	2.0	1.5	4.0	323...528	A	25-PM2-D4P0
3.0	2.2	3.0	2.2	6.0	323...528	A	25-PM2-D6P0
5.0	4.0	5.0	4.0	10.5	323...528	B	25-PM2-D010

Table 34 - PowerFlex 520-Series Control Module

Item	Description	Frame Size	Catalog No.
Control Module	Replacement control module for use with PowerFlex 520-Series drives. Includes: Control Module Control Module Front Cover	A...C	25B-CTM1

Table 35 - PowerFlex 525 Other Replacement Parts

Item	Description	Frame Size	Catalog No.
PowerFlex 525 Control Module Front Cover	Replacement cover for the control module I/O terminals, EtherNet/IP and DSI ports.	A . . . C	25B-CTMFC1
PowerFlex 520-Series Power Module Front Cover	Replacement cover for the PowerFlex 520-Series power module.	B	25-PMFC-FB
		C	25-PMFC-FC
PowerFlex 520-Series Power Terminal Guard	Replacement finger guard for power terminals.	A	25-PTG1-FA
		B	25-PTG1-FB
		C	25-PTG1-FC
PowerFlex 520-Series Heatsink Fan Kit	Replacement fan for drive power module.	A	25-FAN1-FA
		B	25-FAN1-FB
		C	25-FAN1-FC

Table 36 - PowerFlex 525 Communication Option Kits and Accessories

Item	Description	Catalog No.
Communication Adapters	Embedded communication options for use with the PowerFlex 520-Series drives: <ul style="list-style-type: none"> • DeviceNet™ • Dual Port EtherNet/IP™ • PROFIBUS™ DP-V1 	25-COMM-D 25-COMM-E2P 25-COMM-P
Compact I/O Module	Three channel	1769-SM2
Universal Serial Bus™ (USB) Converter Module	Provides serial communication with DF1 protocol for use with Connected Components Workbench software. Includes: <ul style="list-style-type: none"> • 2 meter USB cable (1) • 20-HIM-H10 cable (1) • 22-HIM-H10 cable (1) 	1203-USB
Serial Converter Module (RS485 to RS232)	Provides serial communication with DF1 protocol for use with Connected Components Workbench software. Includes: <ul style="list-style-type: none"> • DSI to RS232 serial converter (1) • 1203-SFC serial cable (1) • 22-RJ45CBL-C20 cable (1) 	22-SCM-232
DSI Cable	2.0 meter RJ45 to RJ45 cable, male to male connectors.	22-RJ45CBL-C20
Serial Cable	2.0 meter serial cable with a locking low profile connector to connect to the serial converter and a 9-pin sub-miniature D female connector to connect to a computer.	1203-SFC
Splitter Cable	RJ45 one to two port splitter cable (Modbus only)	AK-U0-RJ45-SC1
Terminating Resistors	RJ45 120 Ohm resistors (2 pieces)	AK-U0-RJ45-TR1
Terminal Block	RJ45 Two position terminal block (5 pieces)	AK-U0-RJ45-TB2P
Connected Components Workbench Software (Download or DVD-ROM)	Windows-based software packages for programming and configuring Allen-Bradley drives and other Rockwell Automation products. Compatibility: Windows XP, Windows Vista and Windows 7	http://ab.rockwellautomation.com/programmable-controllers/connected-components-workbench-software

Note: See publication [1321-TD001](#), 1321-3R and 3RA Series Line Reactors for illustrations and dimensions.

Table 37 - Bulletin 1321-3R Series Line Reactors

Output Ratings ⁽¹⁾				Input Line Reactor ⁽³⁾⁽⁴⁾		Output Line Reactor ⁽³⁾⁽⁴⁾	
Normal Duty ⁽²⁾		Heavy Duty		IP00 (Open Style)	IP11 (NEMA/UL Type 1)	IP00 (Open Style)	IP11 (NEMA/UL Type 1)
Hp	kW	Hp	kW	Cat. No.	Cat. No.	Cat. No.	Cat. No.
200...240V 50/60 Hz 3-Phase							
0.25	0.2	0.25	0.2	1321-3R2-A	1321-3R2-A	1321-3R2-A	1321-3R2-A
0.5	0.4	0.5	0.4	1321-3R2-D	1321-3RA2-D	1321-3R2-D	1321-3RA2-D
1.0	0.75	1.0	0.75	1321-3R4-A	1321-3RA4-A	1321-3R4-A	1321-3RA4-A
2.0	1.5	2.0	1.5	1321-3R8-A	1321-3RA8-A	1321-3R8-A	1321-3RA8-A
3.0	2.2	3.0	2.2	1321-3R12-A	1321-3RA12-A	1321-3R12-A	1321-3RA12-A
5.0	4.0	5.0	4.0	1321-3R18-A	1321-3RA18-A	1321-3R18-A	1321-3RA18-A
7.5	5.5	7.5	5.5	1321-3R25-A	1321-3RA25-A	1321-3R25-A	1321-3RA25-A
380...480V 50/60 Hz 3-Phase							
0.5	0.4	0.5	0.4	1321-3R1-C	1321-3RA1-C	1321-3R2-B	1321-3RA2-B
1.0	0.75	1.0	0.75	1321-3R2-A	1321-3RA2-A	1321-3R2-A	1321-3RA2-A
2.0	1.5	2.0	1.5	1321-3R4-B	1321-3RA4-B	1321-3R4-B	1321-3RA4-B
3.0	2.2	3.0	2.2	1321-3R8-C	1321-3RA8-C	1321-3R8-C	1321-3RA8-C
5.0	4.0	5.0	4.0	1321-3R8-B	1321-3RA8-B	1321-3R8-B	1321-3RA8-B

- (1) Normal Duty and Heavy Duty ratings for 15 HP / 11 kW and below are identical
- (2) Normal Duty ratings are only available for PowerFlex 525 drives.
- (3) Catalog numbers listed are for 3% impedance. 5% impedance reactor types are also available. See publication [1321-TD001](#).
- (4) Input line reactors were sized based on the NEC fundamental motor amps. Output line reactors were sized based on the VFD rated output currents.

Drive Configuration

This chapter contains information on wiring and terminal configurations for the Bulletin 160 SSC and PowerFlex 525 drives. Wiring and terminal comparisons include power, motor, I/O and feedback configurations.

Bulletin 160 SSC installations typically include the Analog Speed Follower or a Preset Speed module. Therefore, the conversion examples in this section are provided for following two categories:

- Analog Speed Follower
- Preset Speed

General Notes

The following notes apply to the PowerFlex 525 drive whether it's being used as an Analog Speed Follower or Preset Speed drive.

SNK/SRC DIP Switch

The PowerFlex 525 digital inputs can operate in sink or source mode. To replicate Bulletin 160 SSC functionality, the SNK/SRC DIP switch is set to:

- SNK - Inputs are active if pulled to DIG COM (internal)
- SRC - Inputs are active if pulled to +24V DC (internal or external)

Analog Speed Follower

The Bulletin 160 SSC Analog Speed Follower model accepts a speed reference from a potentiometer, ± 10 VDC source, 0...10V DC source, or 4...20 mA source. The Bulletin 160 SSC can be configured to accept various methods of Start/Stop/Direction control.

The examples on the following pages describe the Bulletin 160 SSC configured to use different speed reference inputs and Start/Stop/Direction control and equivalent PowerFlex 525 configurations.

3-Wire Control, Pot Speed Reference

The control method is 3-wire Start/Stop/Direction (factory default). The speed reference for the Bulletin 160 SSC Analog Speed Follower comes from a 10 k Ω , 2 W potentiometer wired to the drive's +10V DC power supply.

Figure 41 - 3-Wire Control (SNK), Pot Speed Reference Wiring Example

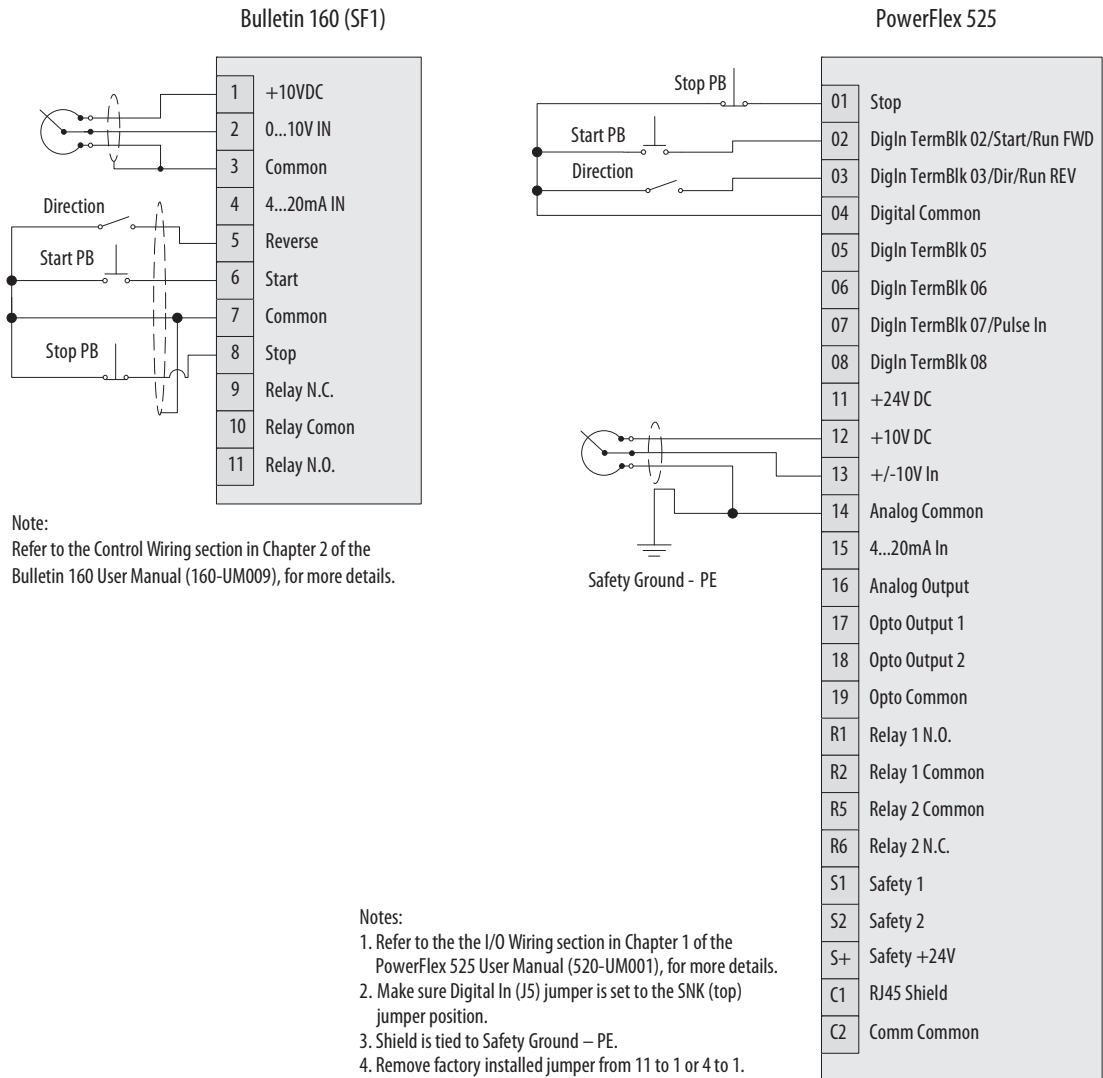
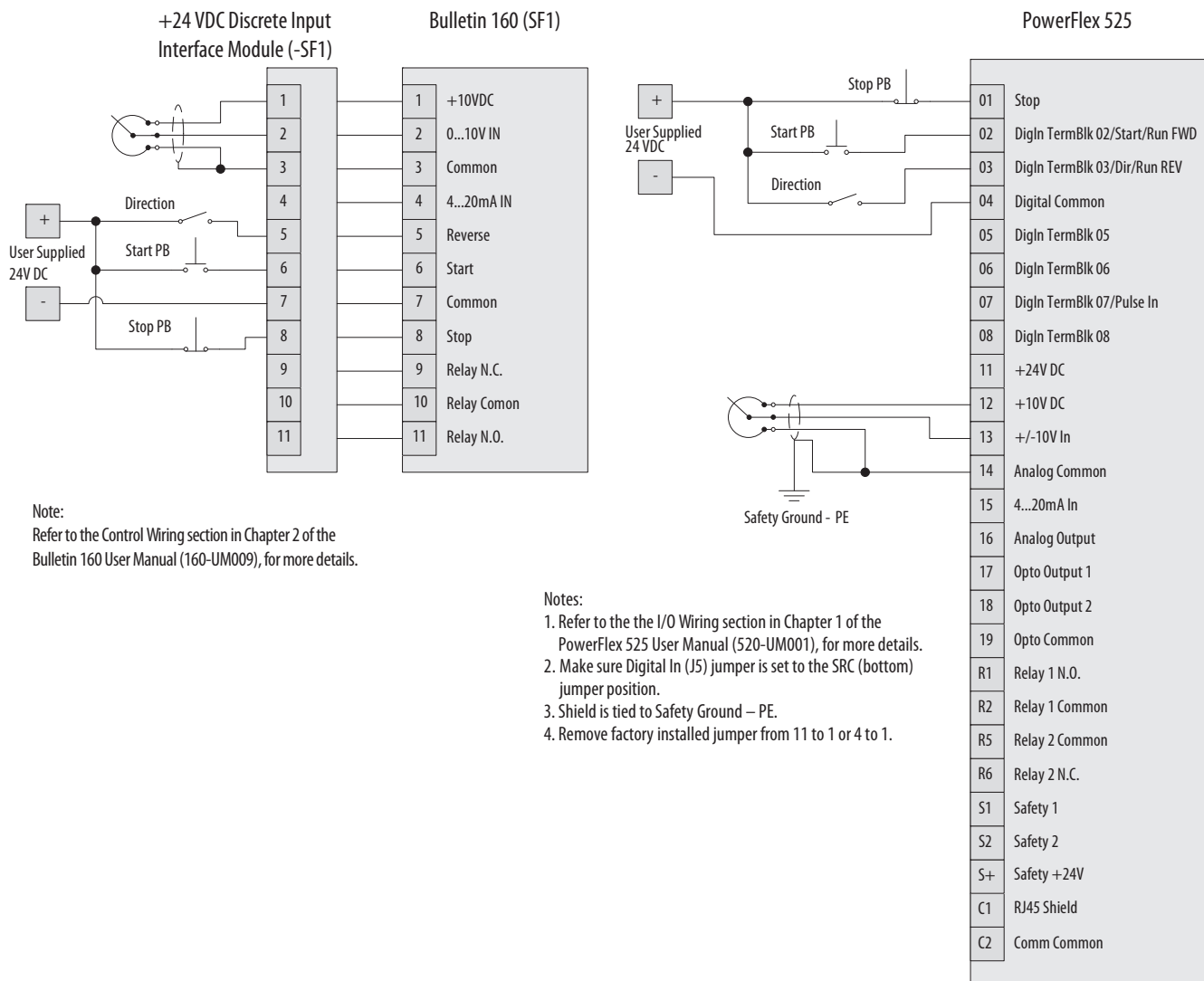


Figure 42 - 3-Wire Control (SRC), Pot Speed Reference Wiring Example



Parameter Comparison:

The parameters in [Table 38](#) on page [70](#) are the minimum required to configure a PowerFlex 525 for the motor attributes and to control it with a 3-wire Start/Stop/Direction method. The table provides a cross reference to the equivalent PowerFlex 40 and 40P parameters.

Note: This example uses a 5 Hp, 460V AC, 6.0 FLA, 60 Hz motor. PowerFlex 525 parameters 31...37, 39, and 40 are dependent on your motor. PowerFlex 525 Parameters 41...47, 62, 63, and 93 are dependent on your application, Start/Stop modes and Accel/Decel rates, etc.

Table 38 - 3 Wire Control - Pot Speed Reference Parameter Comparison

Bulletin 160 SSC Analog			PowerFlex 525 ⁽¹⁾		
No.	Parameter	Value	No.	Parameter	Value
36	Base Voltage	460 V	31	Motor NP Volts	460 V
35	Base Frequency	60 Hz	32	Motor NP Hertz	60 Hz
42	Motor OL Current	6.0 A	33	Motor OL Current	6.0 A
–	–	–	34	Motor NP FLA	6.0 A
–	–	–	35	Motor NP Poles	4
–	–	–	36	Motor NP RPM	1750
–	–	–	37	Motor NP Power	3.72 kW
–	–	–	39	Torque Perf Mode	1 "SVC"
–	–	–	40	Autotune	Rotate Tune is preferred
30	Accel Time 1	10.0 s	41	Accel Time 1	10.0 s
31	Decel Time 1	10.0 s	42	Decel Time 1	10.0 s
32	Minimum Frequency	0 Hz	43	Minimum Frequency	0 Hz
33	Maximum Frequency	60 Hz	44	Maximum Frequency	60 Hz
34	Stop Mode Select	0 = Ramp to Stop	45	Stop Mode	0 "Ramp CF"
46	Input Mode	0 = 3 Wire Control	46	Start Source 1	2 "DigIn TrmBlk"
59	Frequency Select	0 = TB3 Freq Input	47	Speed Reference 1	5 "0-10V Input"
–	–	–	62	DigIn TermBlk 02	49 "3-Wire Start"
–	–	–	63	DigIn TermBlk 03	51 "3-Wire Dir"
74	Analog Select	0 = Unipolar	93	10V Bipolar Enbl	0 "Uni-Polar In"

(1) It is possible that other parameters must be configured for your application.

2-Wire Control, Analog Input Speed Reference

The control method is 2-wire Run Fwd/Run Rev. The speed reference for the Bulletin 160 SSC Analog Speed Follower comes from a 4...20 mA, 0...10V DC or $\pm 10V$ DC input. The Stop push button shown in the examples is not required. The drives run while a Run Fwd or Run Rev input is on. If you eliminate the Stop push button you must have the external +24V DC applied to terminal 01 or internally jumper from terminal 11 to 01 on the PowerFlex 525.

Figure 43 - 2 Wire Control (SNK), Analog Input Reference Wiring Example

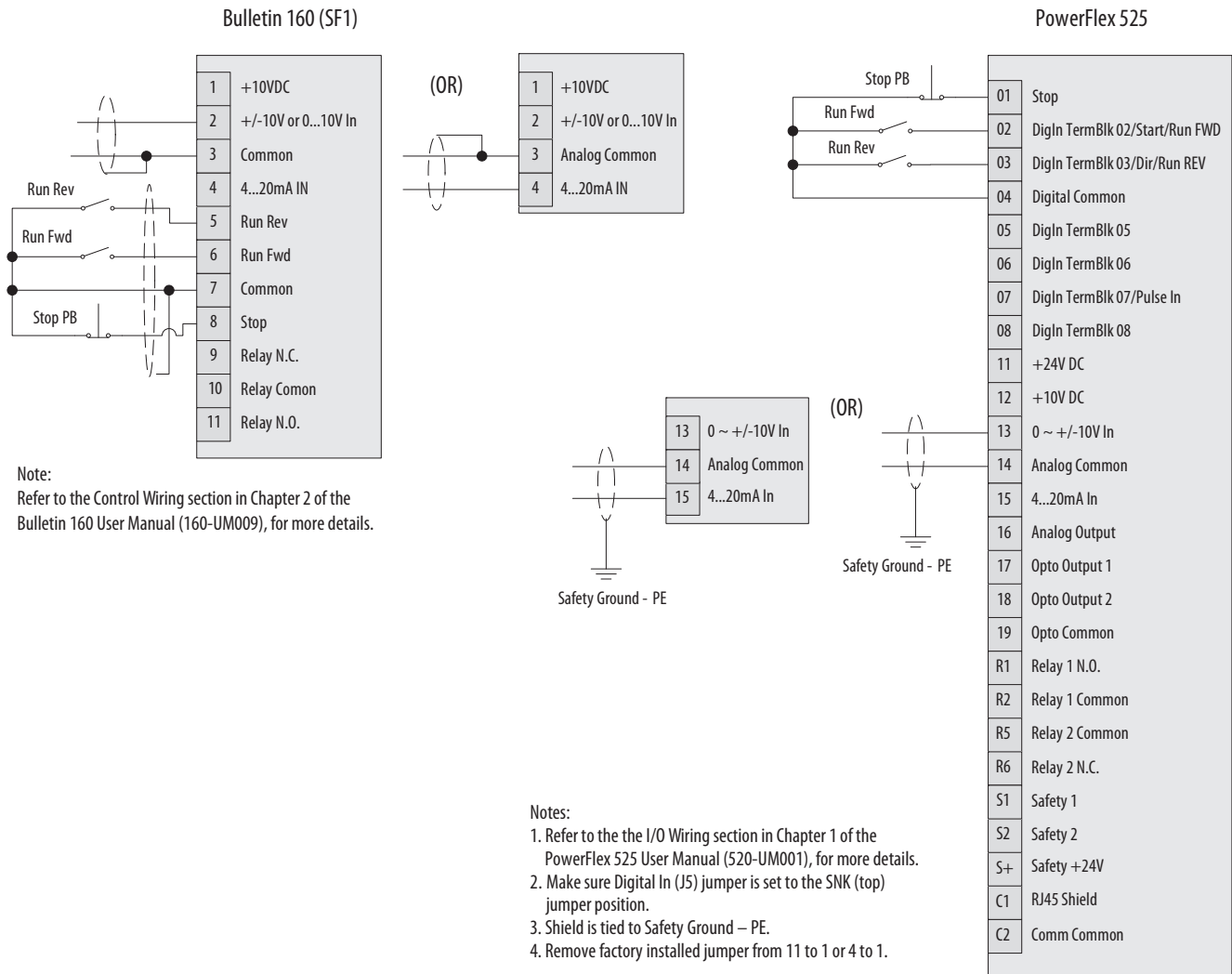
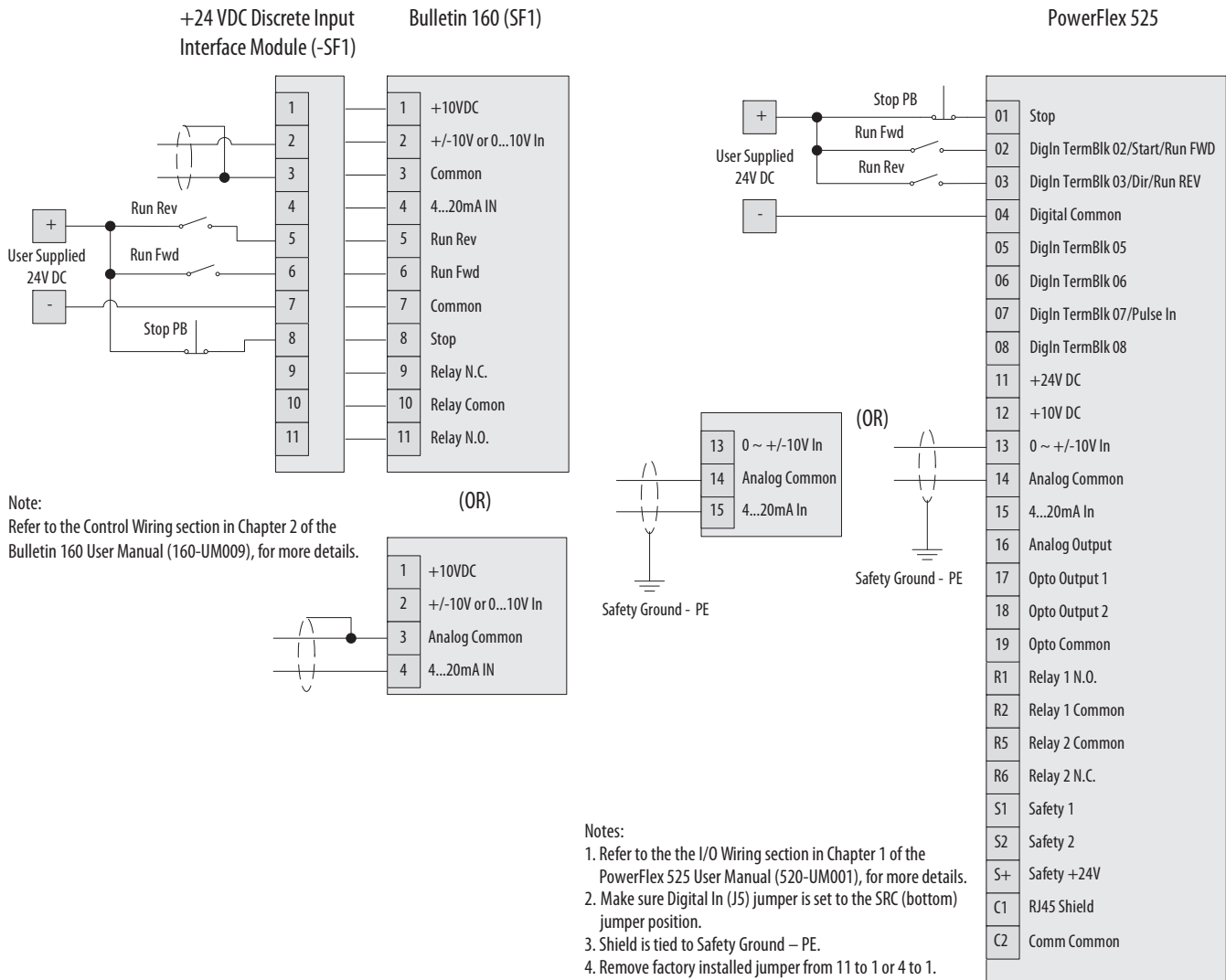


Figure 44 - 2 Wire Control (SRC), Analog Input Reference Wiring Example



Parameter Comparison:

The parameters in [Table 39](#) on page [73](#) are the minimum required to configure the PowerFlex 525 for the motor attributes and to control it with a 2-wire Run Fwd/Run Rev method. The table provides a cross reference to the equivalent Bulletin 160 SSC parameters.

Note: This example uses a 5 Hp, 460V AC, 6.0 FLA, 60 Hz motor. PowerFlex 525 parameters 31...37, 39, and 40 are dependent on your motor. PowerFlex 525 parameters 41...47, 62, 63, and 93 are dependent on your application, Start/Stop modes and Accel/Decel rates, etc.

Table 39 - 2-Wire Control - Analog Input Reference Parameter Comparison

Bulletin 160 SSC Analog			PowerFlex 525 ⁽¹⁾		
No.	Parameter	Value	No.	Parameter	Value
36	Base Voltage	460 V	31	Motor NP Volts	460 V
35	Base Frequency	60 Hz	32	Motor NP Hertz	60 Hz
42	Motor OL Current	6.0 A	33	Motor OL Current	6.0 A
–	–	–	34	Motor NP FLA	6.0 A
–	–	–	35	Motor NP Poles	4
–	–	–	36	Motor NP RPM	1750
–	–	–	37	Motor NP Power	3.72 kW
–	–	–	39	Torque Perf Mode	1 "SVC"
–	–	–	40	Autotune	Rotate Tune is preferred
30	Accel Time 1	10.0 s	41	Accel Time 1	10.0 s
31	Decel Time 1	10.0 s	42	Decel Time 1	10.0 s
32	Minimum Frequency	0 Hz	43	Minimum Frequency	0 Hz
33	Maximum Frequency	60 Hz	44	Maximum Frequency	60 Hz
34	Stop Mode Select	0 = Ramp to Stop	45	Stop Mode	0 "Ramp, CF"
46	Input Mode	1 = 2 Wire Control	46	Start Source 1	2 "DigIn TrmBlk"
59	Frequency Select	0 = TB3 Freq Input	47	Speed Reference 1	5 "0-10V Input," or 6 "4-20mA Input"
–	–	–	62	DigIn TermBlk 02	49 "2-Wire FWD"
–	–	–	63	DigIn TermBlk 03	51 "2-Wire REV"
74	Analog Select	0 = Unipolar	93	10V Bipolar Enbl	0 "Uni-Polar In"

(1) It is possible that other parameters must be configured for your application.

Preset Speed

The control method is 2-wire Run Fwd/Run Rev. The speed reference for the Bulletin 160 SSC Preset Speed model is selected with three digital inputs. The Bulletin 160 SSC is capable of eight preset speeds and the PowerFlex 525 is capable of 16 preset speeds.

Figure 45 - 2 Wire Control (SNK), Preset Speeds Wiring Example

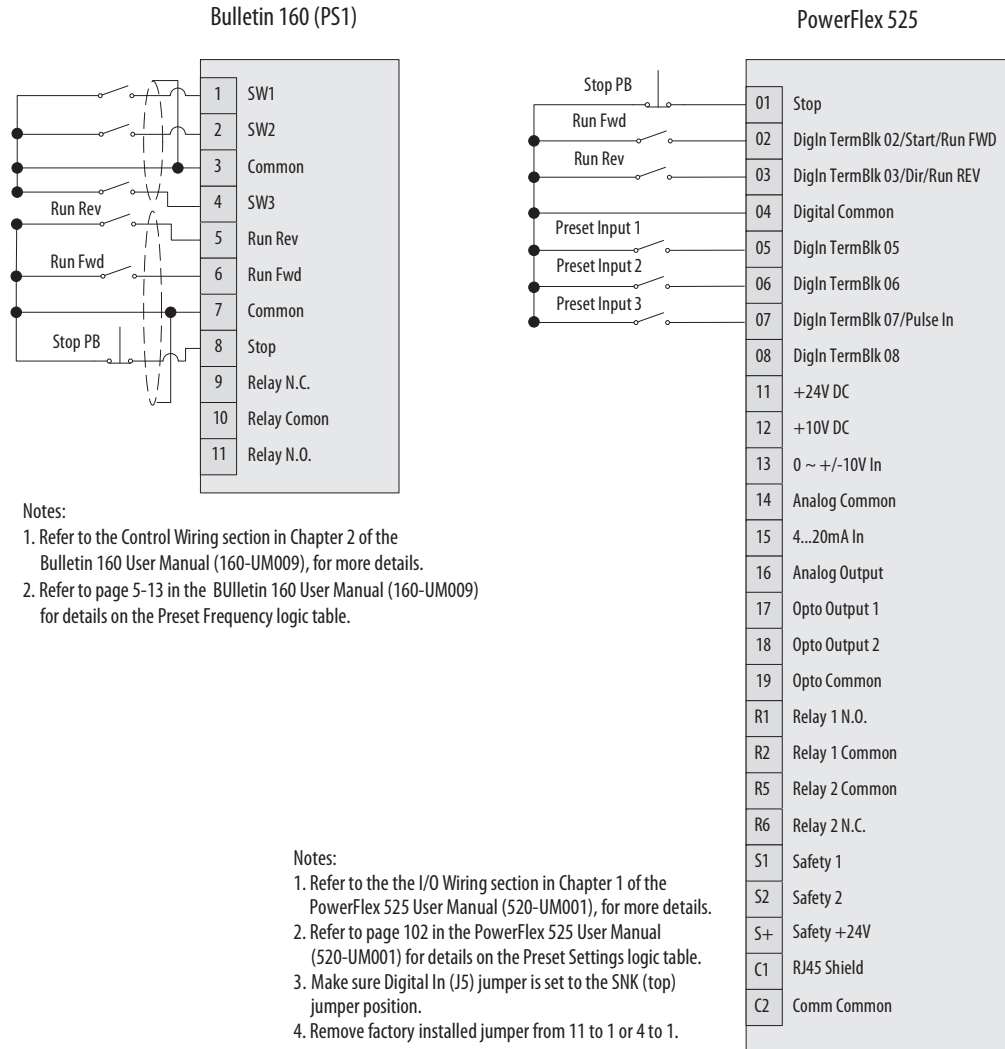
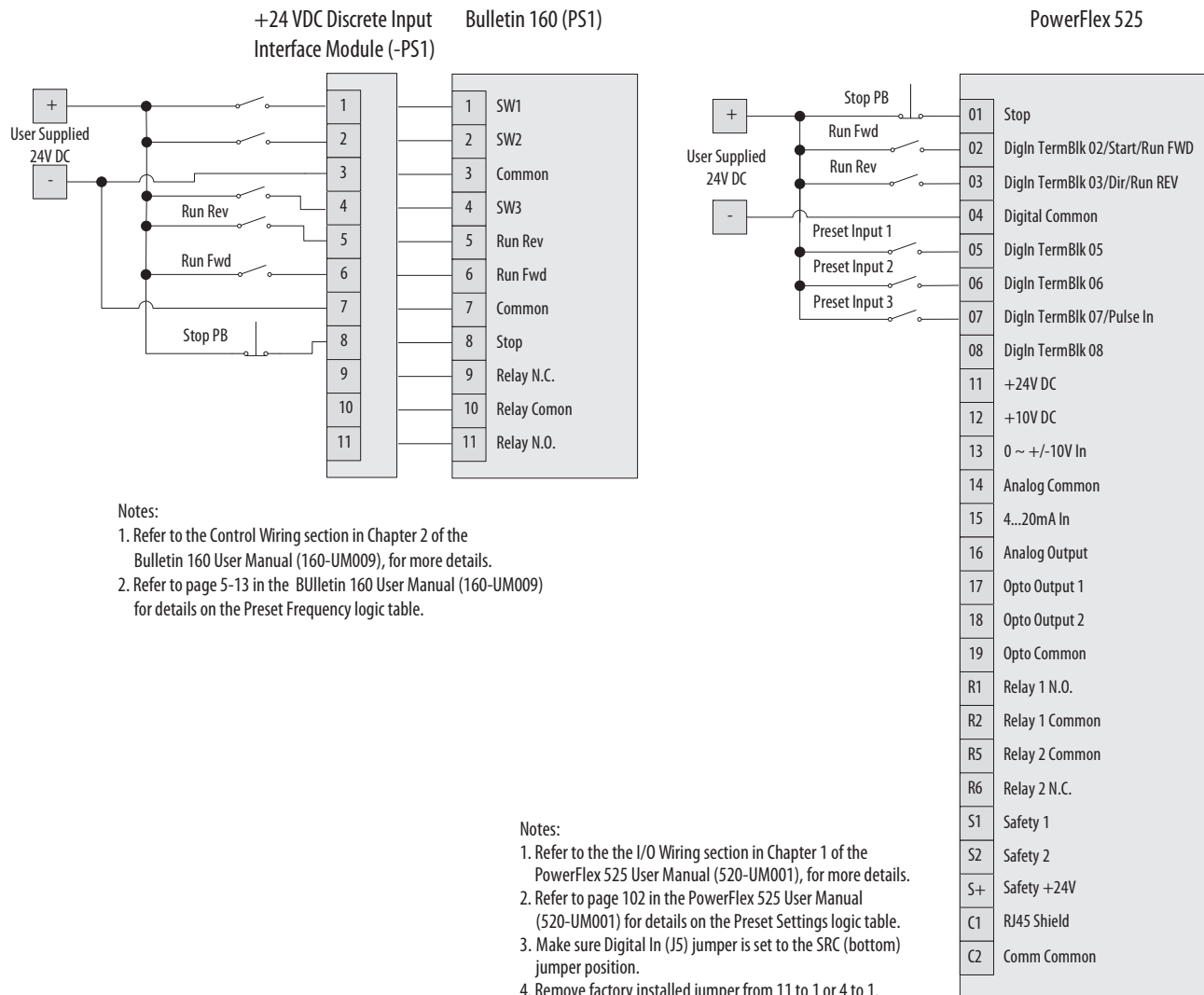


Figure 46 - 2 Wire Control (SRC), Preset Speeds Wiring Example



Parameter Comparison:

The parameters in [Table 40](#) on page [76](#) are the minimum required to configure a PowerFlex 525 for the motor attributes and to control it with a 2-wire Run Fwd/Run Rev method. The table provides a cross reference to the equivalent Bulletin 160 SSC parameters.

Note: This example uses a 5 Hp, 460V AC, 6.0 FLA, 60 Hz motor. PowerFlex 525 parameters 31...37, 39, and 40 are dependent on your motor. PowerFlex 525 parameters 41...47, 62, 63, 65...67, 410...417, 442, and 443 are dependent on your application, Start/Stop modes and Accel/Decel rates, etc.

[Table 41](#) on page [77](#) provides the parameter settings for the Bulletin 160 SSC preset speeds.

[Table 42](#) on page [78](#) provides the parameter settings for the PowerFlex 525 preset speeds.

Table 40 - 2 Wire Control - Preset Speed Parameter Comparison

Bulletin 160 SSC Analog			PowerFlex 525 ⁽¹⁾		
No.	Parameter	Value	No.	Parameter	Value
36	Base Voltage	460 V	31	Motor NP Volts	460 V
35	Base Frequency	60 Hz	32	Motor NP Hertz	60 Hz
42	Motor OL Current	6.0 A	33	Motor OL Current	6.0 A
–	–	–	34	Motor NP FLA	6.0 A
–	–	–	35	Motor NP Poles	4
–	–	–	36	Motor NP RPM	1750
–	–	–	37	Motor NP Power	3.72 kW
–	–	–	39	Torque Perf Mode	1 "SVC"
–	–	–	40	Autotune	Rotate Tune is preferred
30	Accel Time 1	10.0 s	41	Accel Time 1	10.0 s
31	Decel Time 1	10.0 s	42	Decel Time 1	10.0 s
69	Accel Time 2	10.0 s	442	Accel Time 2	10.0 s
70	Decel Time 2	10.0 s	443	Decel Time 2	10.0 s
32	Minimum Frequency	0 Hz	43	Minimum Frequency	0 Hz
33	Maximum Frequency	60 Hz	44	Maximum Frequency	60 Hz
34	Stop Mode Select	0 = Ramp to Stop	45	Stop Mode	0 "Ramp, CF"
46	Input Mode	1 = 2 Wire Control	46	Start Source 1	2 "DigIn TrmBlk"
59	Frequency Select	1 = Internal	47	Speed Reference 1	7 "Preset Freq"
–	–	–	62	DigIn TermBlk 02	49 "2-Wire FWD"
–	–	–	63	DigIn TermBlk 03	51 "2-Wire REV"
–	–	–	65	DigIn TermBlk 05	7 "Preset Freq"
–	–	–	66	DigIn TermBlk 06	7 "Preset Freq"
–	–	–	67	DigIn TermBlk 07	7 "Preset Freq"
61	Preset Freq 0	3.0 Hz	410	Preset Freq 0	0 Hz
62	Preset Freq 1	5.0 Hz	411	Preset Freq 1	5.0 Hz
63	Preset Freq 2	10.0 Hz	412	Preset Freq 2	10.0 Hz
64	Preset Freq 3	20.0 Hz	413	Preset Freq 3	20.0 Hz
65	Preset Freq 4	30.0 Hz	414	Preset Freq 4	30.0 Hz
66	Preset Freq 5	40.0 Hz	415	Preset Freq 5	40.0 Hz
67	Preset Freq 6	50.0 Hz	416	Preset Freq 6	50.0 Hz
68	Preset Freq 7	60.0 Hz	417	Preset Freq 7	60.0 Hz

(1) It is possible that other parameters must be configured for your application.

Table 41 - Bulletin 160 Preset Speed Logic

Program Group											
No.	Parameter Name/Description						Min/Max Range	Units	Factory Default		
	[Preset Frequency 0-7] The programmed value sets the frequency that the drive outputs when selected. Refer to Chapter 2, Figure 2.21 for the Preset Speed model control wiring diagram.						0.0/240.0	0.1 Hz	See Table Below		
	Preset Speed Model					Signal Follower Model (Input Mode 8)					
	Preset Freq.	Default	TB3-4 (SW3)	TB3-2 (SW2)	TB3-1 (SW1)	TB3-8 (SW2)	TB3-2 (SW1)	Accel ⁽¹⁾	Decel		
61	Preset 0	3.0 Hz	0	0	0	0	0	P30 [Accel Time 1]	P31 [Decel Time 1]		
62	Preset 1	20.0 Hz	0	0	1	0	1				
63	Preset 2	30.0 Hz	0	1	0	N/A	N/A				
64	Preset 3	40.0 Hz	0	1	1	N/A	N/A				
65	Preset 4	45.0 Hz	1	0	0	1	0	P69 [Accel Time 2]	P70 [Decel Time 2]		
66	Preset 5	50.0 Hz	1	0	1	1	1				
67	Preset 6	55.0 Hz	1	1	0	N/A	N/A				
68	Preset 7	60.0 Hz	1	1	1	N/A	N/A				
(1) When using P46 - [Input Mode] setting 4, the Accel and Decel times are selected by providing an input to TB3-8. See Chapter 2 (in 160-UM009), Figure 2.12 for additional information.											
	This parameter applies to only the Preset Speed model.										

Table 42 - PowerFlex 525 Preset Speed Logic

A410 [Preset Freq 0] A411 [Preset Freq 1]
 A412 [Preset Freq 2] A413 [Preset Freq 3]
 A414 [Preset Freq 4] A415 [Preset Freq 5]
 A416 [Preset Freq 6] A417 [Preset Freq 7]

 A418 [Preset Freq 8] A419 [Preset Freq 9]
 A420 [Preset Freq 10] A421 [Preset Freq 11]
 A422 [Preset Freq 12] A423 [Preset Freq 13]
 A424 [Preset Freq 14] A425 [Preset Freq 15]

Sets the frequency of the drive outputs to the programmed value when selected.

For PowerFlex 525					
	Default Accel/Decel Used	Preset Input 1 (DigIn TermBlk 05)	Preset Input 2 (DigIn TermBlk 06)	Preset Input 3 (DigIn TermBlk 07)	Preset Input 4 (DigIn TermBlk 08)
Preset Setting 0 ⁽¹⁾	1	0	0	0	0
Preset Setting 1	1	1	0	0	0
Preset Setting 2	2	0	1	0	0
Preset Setting 3	2	1	1	0	0
Preset Setting 4	1	0	0	1	0
Preset Setting 5	1	1	0	1	0
Preset Setting 6	2	0	1	1	0
Preset Setting 7	2	1	1	1	0
Preset Setting 8	1	0	0	0	1
Preset Setting 9	1	1	0	0	1
Preset Setting 10	2	0	1	0	1
Preset Setting 11	2	1	1	0	1
Preset Setting 12	1	0	0	1	1
Preset Setting 13	1	1	0	1	1
Preset Setting 14	2	0	1	1	1
Preset Setting 15	2	1	1	1	1

(1) Preset Setting 0 is only available if P047, P049 or P051 [Speed Reference] is set to 7 "Preset Freq".

Values	Defaults:
	Preset Freq 0: 0.00 Hz
	Preset Freq 1: 5.00 Hz
	Preset Freq 2: 10.00 HZ
	Preset Freq 3: 20.00 Hz
	Preset Freq 4: 30.00 Hz
	Preset Freq 5: 40.00 Hz
	Preset Freq 6: 50.00 Hz
	Preset Freq 7...15: 60.00 Hz
	Min/Max: 0.00/500.00 Hz
	Display: 0.01 Hz

Network Communication

Overview

A Bulletin 160 with a communication option card can be replaced with a PowerFlex 525 AC drive. The process to migrate can vary significantly depending upon the communication option in the Bulletin 160 and the controller type communicating to the drive.

This section explains which Bulletin 160 network options can be migrated to the PowerFlex 525 AC drive. Due to the wide variety of networks, processors, and drive options to consider, only guidelines for migration are provided, rather than step-by-step procedures.

IMPORTANT Please refer to the respective drive's and communication adapter's user manual. The manuals provide important configuration, installation, wiring, and programming processes required for proper operation. You can also utilize the DeviceNet section in the 160 SSC Variable Speed Drive to PowerFlex 4/4M/40 AC Drives Conversion Guide, publication [DRIVES-AP005](#), as a reference for programming examples.

25-COMM Adapters

The following communication adapters are supported by the PowerFlex 525 drive:

- 25-COMM-D: DeviceNet communication adapter
- 25-COMM-E2P: EtherNet/IP communication adapter - dual port
- 25-COMM-P: Profibus communication adapter

22-COMM Carrier Adapters

The following component-class (DSI) communication adapters are supported by the PowerFlex 525 drive:

- 22-COMM-D: DeviceNet™ communication adapter
- 22-COMM-E: EtherNet/IP™ communication adapter
- 22-COMM-P: Profibus™ communication adapter

Note: The PowerFlex 525 drive includes an embedded EtherNet/IP adapter on the main control circuit board. See PowerFlex 525 Embedded Ethernet/IP Adapter on page [81](#) for more information.

One of the following component-class communication modules are required for the modules listed above to function with the PowerFlex 525 drive:

- 20-XCOMM-AC-PS1: Optional 100...240V AC power supply for external DSI communication kit
- 22-XCOMM-DC-BASE: External mounting kit for 22-COMM communication adapters

The following component-class communication adapters are not supported by the PowerFlex 525 drive:

- 22-COMM-B: BACnet™ MS/TP RS485 adapter
- 22-COMM-C: ControlNet™ adapter
- 22-COMM-L: LonWorks® adapter

The following component-class peripheral devices are supported by the PowerFlex 525 drive:

- 1203-USB: Universal Serial Bus™ (USB) to DSI converter
- 1769-SM2: Compact I/O to DSI module
- 22-SCM-232: Serial converter module (RS485 to RS232)
- 22-HIM-A3: Remote handheld, LCD display, full numeric keypad HIM
- 22-HIM-C25: Remote (panel mount) LCD display, digital speed control HIM
- 22-WIM-Nx: Wireless interface module

PowerFlex 525 Embedded Ethernet/IP Adapter

This section contains only basic information to setup an EtherNet/IP connection with your PowerFlex 525 drive. For comprehensive information about EtherNet/IP (single and dual port) and how to use it, see the PowerFlex 525 Embedded EtherNet/IP Adapter User Manual, publication [520COM-UM001](#).

Establishing a Connection with Ethernet/IP

There are two methods for configuring the embedded EtherNet/IP adapter IP address:

- **BootP Server** - Use BootP if you prefer to control the IP addresses of devices using a server. The IP address, subnet mask, and gateway addresses are provided by the BootP server. BootP is enabled by default.
- **Adapter Parameters** - Use adapter parameters when you want more flexibility in setting up the IP address, or need to communicate outside the control network using a gateway. The IP address, subnet mask, and gateway addresses are set in the adapter parameters.

IMPORTANT If you are setting your network addresses manually using parameters, you must set C128 [EN Addr Sel] to 1 "Parameters".

IMPORTANT Regardless of the method used to set the adapter IP address, each node on the EtherNet/IP network must have a unique IP address. To change an IP address, you must set the new value and then remove and reapply power to (or reset) the adapter.

Software Versions

Some features in the PowerFlex 525 drive are not supported by older configuration software tools. It is strongly recommended that customers using such tools migrate to RSLogix™ 5000 software (version 17.0 or later) or Logix Designer application (version 21.0 or later) with an Add-On-Profile (AOP), or Connected Components Workbench™ software (version 5.0 or later) for full-featured configuration capabilities.

Description	Catalog Number/Release Version
Connected Components Workbench ⁽¹⁾	Version 5.0 or later
Logix Designer	Version 21.0 or later
RSLogix 5000	Version 17.0 or later
Built-in USB software tool	–
Serial Converter Module ⁽²⁾	22-SCM-232
USB Converter Module ⁽²⁾	1203-USB
Remote Panel Mount, LCD Display ⁽²⁾	22-HIM-C25
Remote Handheld, LCD Display ⁽²⁾	22-HIM-A3

(1) Available as a free download at <http://ab.rockwellautomation.com/programmable-controllers/connected-components-workbench-software>.

(2) Does not support the new dynamic parameter groups (AppView, CustomView), and CopyCat functionality is limited to the linear parameter list.

Using the Adapter I/O

The terms input and output are defined from the controller's point of view. Therefore, output I/O is data that is produced by the controller and consumed by the adapter. Input I/O is status data that is produced by the adapter and consumed as input by the controller. The I/O image can vary greatly depending on the communication adaptor and thus, the user should consult the "Using the I/O" section of the respective communication adaptor user manual.

Velocity Reference/Feedback

The Bulletin 160 velocity reference and feedback data is represented as scaled values. The scaling for the velocity and feedback is based on a range of 0...32767 where 32767 equals the value set by Parameter 33 - [Maximum Freq]. For example, a 16-bit INT reference value of 16383 with Parameter 33 [Maximum Freq] set to 60 Hz equals a reference of 30 Hz.

The PowerFlex 525 velocity reference and feedback 16-bit INT values represent drive speed. The scaling for the velocity reference and feedback is 0.01 Hz. For example, a 16-bit INT reference value of "3000" equals a reference of 30.00 Hz. Note that the commanded maximum speed can never exceed the value of parameter 044 - [Maximum Freq].

IMPORTANT Attempting to write a negative value to the Speed Reference results in the drive ramping to maximum speed due to overflow. The direction of the drive can only be controlled programmatically with the appropriate bits (4 and 5) in the Command Word.

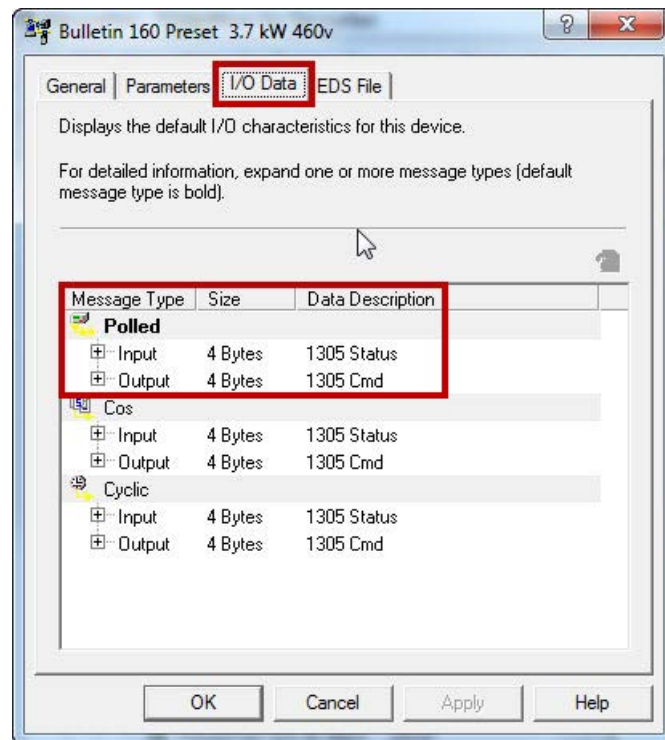
DeviceNet

The example below is based on the 1747-SDN SLC DeviceNet scanner module and provides some key points in regards to the DeviceNet communication differences between the Bulletin 160 and PowerFlex 525 drives.

Communication size

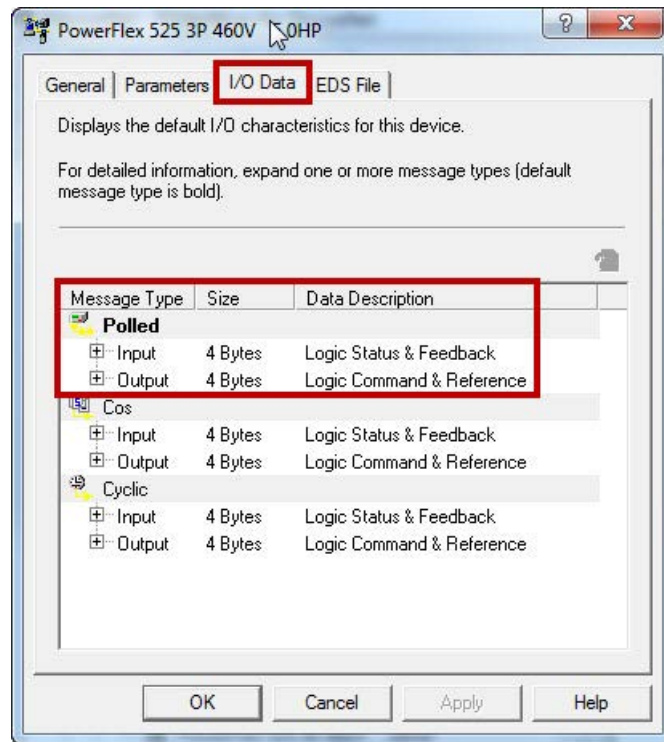
Note: The communication size between the Bulletin 160 and PowerFlex 525 drives is identical, as long as no datalinks are added to the PowerFlex 525 drive.

Table 43 - Bulletin 160 I/O Data Size



- 4 bytes (2 words) input assembly
 - 1 word: drive status
 - 1 word: speed feedback
- 4 bytes (2 words) output assembly
 - 1 word: drive command
 - 1 word: speed reference

Figure 47 - PowerFlex 525 I/O Data Size

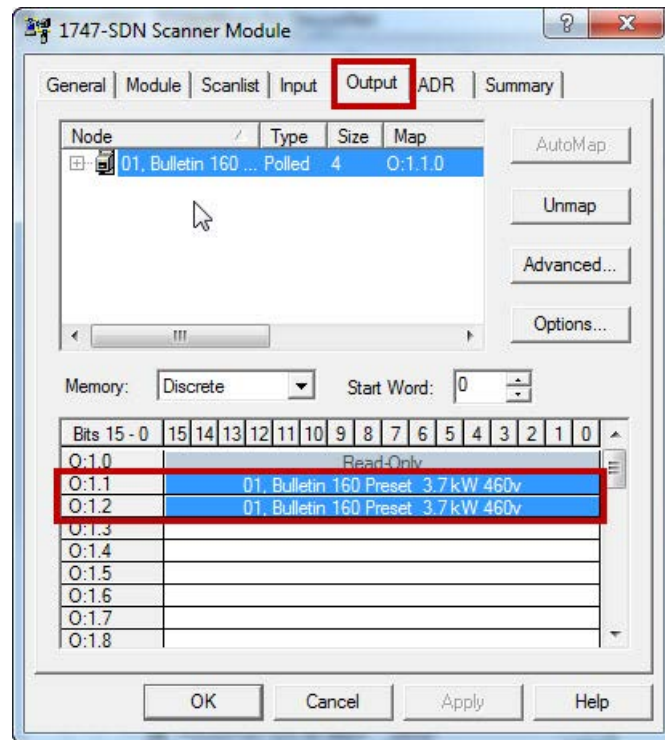


- 4 bytes (2 words) status & feedback
 - 1 word: drive status
 - 1 word: speed feedback
- 4 bytes (2 words) command & reference
 - 1 word: drive command
 - 1 word: speed reference

DeviceNet Scanner Output Mapping

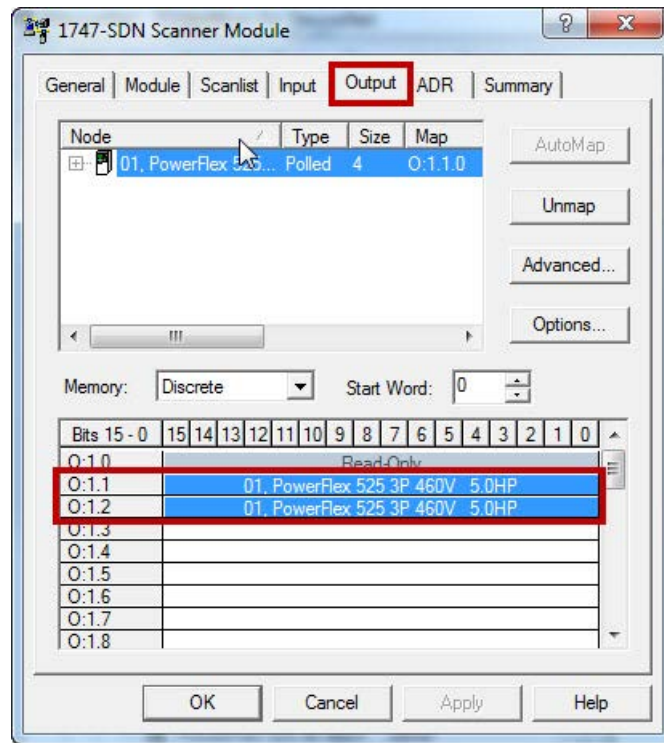
Note: The DeviceNet scanner output mapping between the Bulletin 160 and PowerFlex 525 drives is identical as long as no datalinks are added to the PowerFlex 525 drive.

Table 44 - Bulletin 160 DeviceNet Output Mapping Data



- Node 1 - Bulletin 160
 - O:1.1 Command word
 - O:1.2 Speed reference

Figure 48 - PowerFlex 525 DeviceNet Output Mapping Data

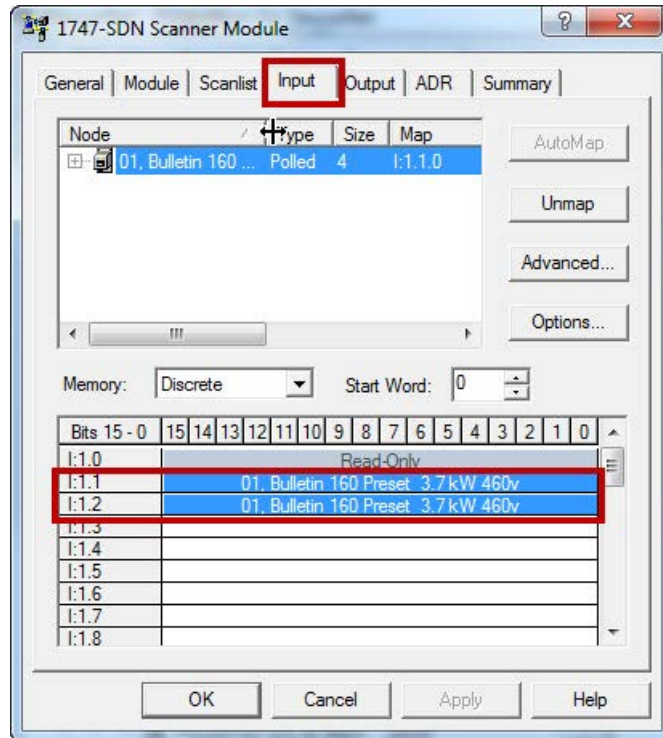


- Node 1 - PowerFlex 525
 - O:1.1 Command word
 - O:1.2 Speed reference

DeviceNet Scanner Input Mapping

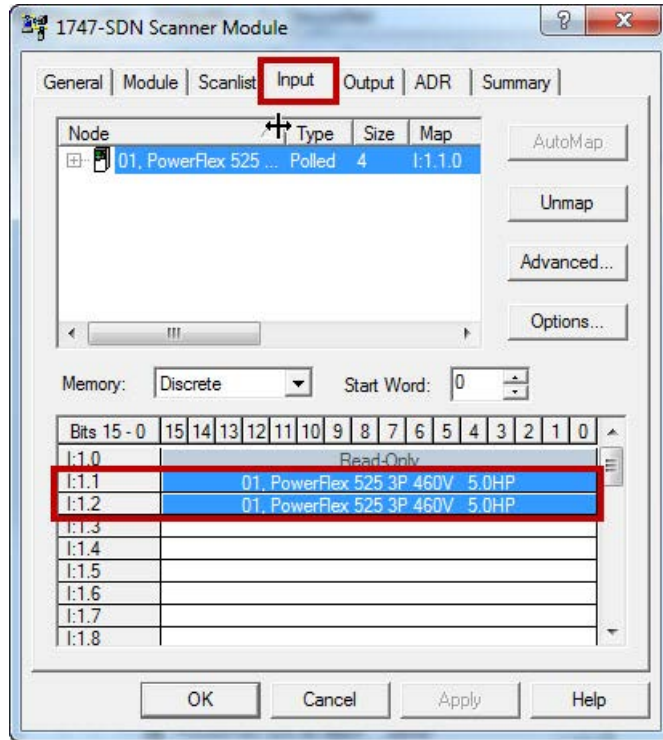
Note: The DeviceNet scanner input mapping between the Bulletin 160 and PowerFlex 525 drives is identical as long as no datalinks are added to the PowerFlex 525 drive.

Table 45 - Bulletin 160 DeviceNet Input Mapping Data



- Node 1 - Bulletin 160
 - I:1.1 Status word
 - I:1.2 Speed feedback

Figure 49 - PowerFlex 52 DeviceNet Input Mapping Data



- Node 1 - PowerFlex 525
 - I:1.1 Status word
 - I:1.2 Speed feedback

Command Word Format

The Bulletin 160 drive's output assembly instance is 103. This drive output assembly instance mirrors the 1305 and 1336 I/O format.

The following table shows the difference in bit designations of the command word. Bits 0, 1 and 3...5 highlight identical functions between the Bulletin 160 and PowerFlex 525 drives.

Bulletin 160 Output Assembly = 103																
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	N/A	ref sel	ref sel	ref sel	N/A	N/A	N/A	N/A	N/A	N/A	Direction	Direction	Clear Fault	N/A	Start	Stop
PowerFlex 525 Logic Command Word																
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Mop Dec	Ref Sel 3	Ref Sel 2	Ref Sel 1	Decel Time	Decel Time	Accel Time	Accel Time	MOP Inc	Keypad	Direction	Direction	Clear Fault	Jog	Start	Stop

Note: See Appendix D, Logic Command/Status Words: PowerFlex 525 Drives of the respective PowerFlex 525 Adapter User Manual for a definition of the Logic Command word.

The reference select bits (12...14) have the same location, but have slightly different functions as identified in this table:

Bit 14	Bit 13	Bit 12	Bulletin 160	PowerFlex 525
0	0	0	No command	No command
0	0	1	TB3 Control	Freq source = P047 - [Speed reference 1]
0	1	0	Network Control	Freq source = P049 - [Speed reference 2]
0	1	1	Preset 3	Freq source = P051 - [Speed reference 3]
1	0	0	Preset 4	A410 - [Preset Freq 0]
1	0	1	Preset 5	A411 - [Preset Freq 1]
1	1	0	Preset 6	A412 - [Preset Freq 2]
1	1	1	Preset 7	A413 - [Preset Freq 3]

Speed Reference Format

Bulletin 160

- Data format controller to drive (command)
- Data range 0...32767 (16 bit decimal value)
- 0 = 0 Hz, 32767 = Max frequency (P33)

The following table shows how the Bulletin 160 data is represented.

		Bulletin 160															
BIT	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
	Speed Reference - High byte								Speed Reference - Low byte								

PowerFlex 525

The speed reference value is sent (controller to drive) as a 16 bit integer value. The speed reference is a 16-bit value that represents drive speed in 0.01 Hz. For example, if the value sent to drive = 1235, then Output Frequency = 12.35 Hz.

Scaling is required for the speed reference. Convert to the new format speed reference for the PowerFlex 525 drive by using this formula:

$$(\text{Max Freq [P33]} \times \text{old format speed ref} \times 100) / 32767 = \text{new format speed reference to PowerFlex 525}$$

Note: Max frequency = Parameter 33 of the Bulletin 160

Status Word Format

The Bulletin 160 drive's input assembly instance is 103. This drive output assembly instance mirrors the 1305 I/O format.

The following table shows the difference in bit designations of the status word. The cells in green highlight the identical functions between bulletin 160 and PowerFlex 525.

Bulletin 160 Input Assembly = 104																
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Freq Source	Freq Source	Freq Source	Freq Source	Local	Local	Local	At Speed	Fault	N/A	Decelerating	Accelerating	Rot Dir	Cmd Dir	Running	Enabled
PowerFlex 525 Logic Status Word																
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Dig In 4 sts	Dig In 3 sts	Dig In 2 sts	Dig In 1 sts	Parameters	Operation Cmd.	Main Freq.	At Speed	Fault	Reserved	Decelerating	Accelerating	Act Dir	Cmd Dir	Active	Run Ready

Note: See Appendix D, Logic Command/Status Words: PowerFlex 525 Drives of the respective PowerFlex 525 Adapter User Manual for a definition of the Status word.

Speed Feedback Format

Bulletin 160

- Data format drive to controller (status)
- Data range 0...32767 (16 bit decimal value)
- 0 = 0Hz, 32767 = Max Frequency (P33)

The following table shows how the Bulletin 160 data is represented.

Bulletin 160																
BIT	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Speed Feedback - High byte								Speed Feedback - Low byte							

PowerFlex 525

The speed feedback value is received (drive to controller) as a 16 bit integer value. The speed reference is a 16-bit value that represents drive speed in 0.01 Hz. For example, if the value received from drive = 1235, then Output Frequency = 12.35 Hz.

Scaling is required for the speed feedback. Convert to the new format speed feedback for the PowerFlex 525 drive by using this formula:

$$(32767 / \text{Max Freq [P33]} \times \text{Speed feedback value from the PowerFlex 525} / 100) = \text{feedback value for SLC code}$$

Note: Max frequency = Parameter 33 of the Bulletin 160.

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At <http://www.rockwellautomation.com/support> you can find technical and application notes, sample code, and links to software service packs. You can also visit our Support Center at <https://rockwellautomation.custhelp.com/> for software updates, support chats and forums, technical information, FAQs, and to sign up for product notification updates.

In addition, we offer multiple support programs for installation, configuration, and troubleshooting. For more information, contact your local distributor or Rockwell Automation representative, or visit <http://www.rockwellautomation.com/services/online-phone>.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/rockwellautomation/support/overview.page , or contact your local Rockwell Automation representative.

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