



PowerFlex DC Field Controller

Bulletin Number 23PFC

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Summary of Changes

This publication contains new and updated information as indicated in the following table.

Topic	Page
Removed the EAC mark from the sample Field Controller Nameplate Data label.	5
Removed the Isolation Transformers for 200V AC Input Field Controllers table from the Isolation Transformers section.	14
Updated the Install an SCR Overvoltage Protection Device section to include information about the voltage clamp kit (cat. no. 23P-FCOVPD-x-Fx).	15
Added Voltage Clamp Kits and Dampening Resistor (RB) Kit Selection selection tables	16
Changed the Factory Default in Terminal Block 1 from 1 "Volt Ref A" to 5 "Current Ref" in the I/O Terminal Block 1 Designations table.	34
Updated the first two rows of the Digital and Analog I/O Wiring Examples table.	36
Updated the waste statement and moved to back page.	42

Product Advisories

Qualified Personnel



ATTENTION: Allow only qualified personnel, familiar with DC drives, field controllers, motors and associated machinery, to plan or implement the installation, startup and subsequent maintenance of the system. Failure to comply can result in personal injury and equipment damage.

Product Safety



ATTENTION: An incorrectly applied or installed field controller can result in component damage or a reduction in product life. Installation or application errors, such as, an undersized field, incorrect or inadequate DC supply, or excessive air temperatures around the product can result in malfunction of the system.



ATTENTION: This product contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when you install, test, service, or repair this assembly. If ESD control procedures are not followed, component damage can result. Follow industry guidelines for static control precautions.

Class 1 Light-emitting Diode Product



ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into module ports or fiber-optic cable connectors.

Product Overview

The PowerFlex® DC Field Controller provides three-phase, four quadrant (reversing) DC motor or generator field control. The PowerFlex DC Field Controller can be used for standalone DC motor field control applications or with a PowerFlex DC Digital drive or PowerFlex DC Standalone Regulator (SAR). A fiber-optic interface option module or digital and analog I/O provides transmission of the reference, feedback, and status signals between the drive or regulator and the field controller.

In the standalone mode, the PowerFlex DC Field Controller provides power to a DC motor field with a fixed reference by using fixed I/O. The PowerFlex DC Field Controller can also be used to supply various DC non-motor loads (highly inductive loads) such as galvanic applications, electromagnets, synchronous motor excitation circuits, and more.

Catalog Number Explanation

Use the catalog number explanation to verify that the field controller you received matches the product you ordered.

Position
 1-5 6 7-9
23PFC B 017
 a b c

a	
Device	
Code	Type
23PFC	PowerFlex DC Field Controller

b	
Input Voltage	
Code	Voltage Range
B	60...200V AC, $\pm 10\%$, 3 Phase
D	230...500V AC, $\pm 10\%$, 3 Phase

c	
DC Output Amperage	
Code	Amps
017	17
060	60
120	120
245	245
365	365
570	570

Storage and Handling

It is recommended that you unpack and handle the PowerFlex DC Field Controller only when you are ready for installation. If it is necessary to store the field controller before installation, follow these storage guidelines to provide satisfactory operation at startup and to retain the product warranty coverage:

- After receipt and inspection, repack the field controller in its original shipping container and store in a clean, dry place.
- Store the packaged product where the ambient temperatures do not exceed -25°C (-13°F) or 55°C (131°F).
- Store the product where the range of relative air humidity does not exceed 5...95%, noncondensing.
- Store the packaged product at an altitude of less than 3,000 meters (10,000 ft.) above sea level.



ATTENTION: Remove all loose packing materials, including the containers of desiccants (if any), from the field controller enclosure before you mount and energize the field controller.

Required Tools/Components

This table contains the tools that are required to install the PowerFlex DC Field Controller.

Tool Description	Details
Crimp tools	For cable terminals
Flat-nose screwdriver	3 mm (0.12 in.), 5 mm (0.19 in.), 6.4 mm (0.25 in.)
Hexagonal socket wrench	5 mm, 8 mm 10 mm
Phillips screwdriver/bit	#1, #2
Torx screw driver/bit	T20, T25
Wire cutter	—

Required System Components

The following system components are required for PowerFlex DC Field Controller installations:

- When the PowerFlex DC Field Controller is used as a motor/generator field supply, an overvoltage protection device (voltage clamp) and dampening resistor must be installed on the field controller load. See page [15](#) for details.
- When the PowerFlex DC Field Controller is connected to a network, a communication adapter is required (20-COMM-x, 20-CXCOMM-PS1, 20-XCOMMDC-BASE, 1769-SM1, 1203-SNM, 1203-SSS, or 1203-UDB). See the PowerFlex Digital DC Drive Technical Data, publication [20P-TD001](#), for more information on these kits.

Optional System Components

When the PowerFlex DC Field Controller is used in applications with a PowerFlex DC drive (with firmware revision 7.001 or later) or PowerFlex Standalone Regulator (with firmware revision 7.001 or later), these optional kits can be purchased to provide fiber-optic communication:

- PowerFlex DC Fiber-optic Interface option module, cat. no. 20P-S5H781, and one of these fiber-optic cable kits:
 - Cat. no. SK-20P-2950, 3 m (9.8 ft.)
 - Cat. no. SK-20P-29501, 5 m (16.4 ft.)

Field Controller Nameplate Data

The PowerFlex DC Field Controller contains a data nameplate label on the side of each module. This nameplate identifies the specific model number, frame size, serial number, and applicable AC input power and DC output power data. Include this information when communicating with Rockwell Automation® personnel about this product.

Cat No. 23PFC017
UL Type OPEN/IP20

Input: 500 VAC max 50/60 Hz 14.0 A 3 Phase
Output: 520 VDC max 17.0 A Regen

Regulator Power: 115 / 230 VAC 50/60 Hz 1.0 / 0.5 A 1 Phase

Series: A
 I/O: 24VDC (Standard)
 Original Firmware V1.001

Frame: A
 Serial Number: J01A0001

AB Allen-Bradley
 Product of Italy

Rockwell Automation, 1201 S. 2nd St., Milwaukee, WI 53204, USA

Original Firmware Revision

Frame Size

Frame Sizes

Similar PowerFlex DC Field Controller ratings are grouped into two frame sizes (A and B) to make ordering spare parts and field controller dimensions simpler. The module frame size appears just below the certifications section on the right side of the data nameplate label. See the PowerFlex Digital DC Drive Technical Data, publication [20P-TD001](#), for a list of field controller catalog numbers and their respective frame sizes.

Firmware Revision

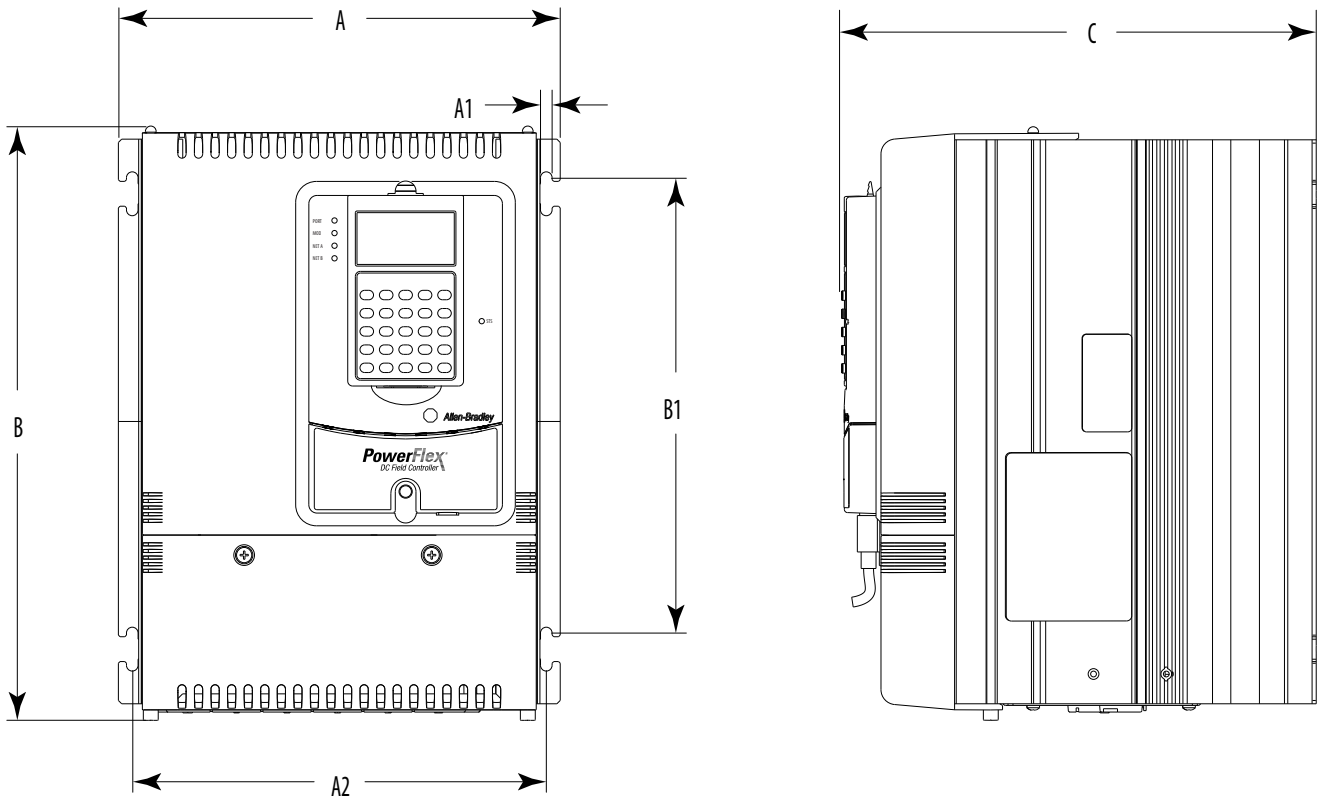
The original firmware revision of the field controller, as shipped from the factory, appears just below the series letter on the right side of the data nameplate label. If the firmware revision has been upgraded since the field controller was shipped, you can view the current version on the HIM (if installed). See the PowerFlex DC Field Controller Programming Manual, publication [23PFC-PM001](#), for details about the HIM.

Product Dimensions and Weights

This section contains the approximate dimensions and weights for frame A and frame B field controllers.

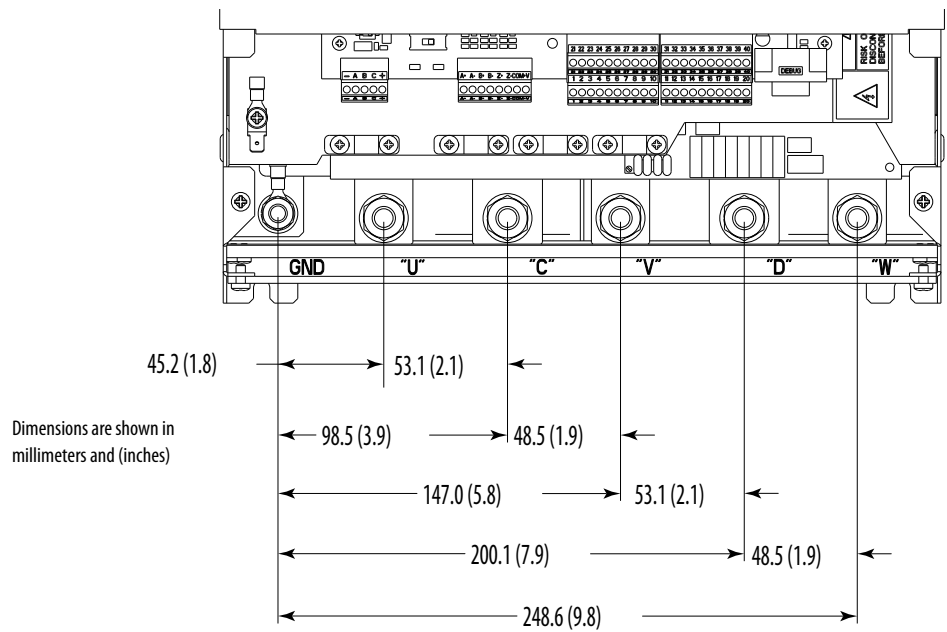
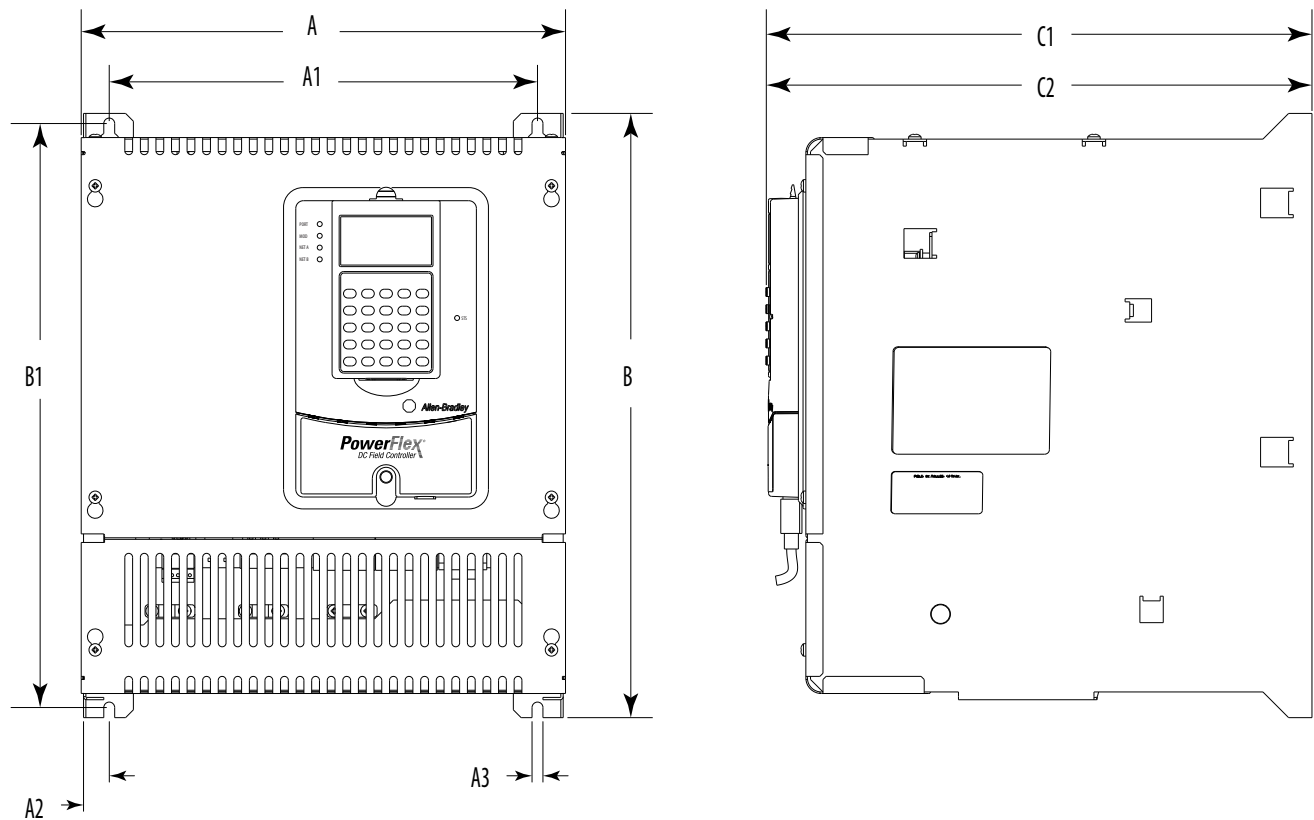
Frame Size	Cat. No.	Weight kg (lb)	Weight with Packaging kg (lb)	Dimensions
A	23PFCB017 and 23PFCD017	10.8 (23.8)	12.8 (28.2)	See Frame A Field Controller Dimensions on page 6
	23PFCB060 and 23PFCD060	11.3 (24.9)	13.3 (29.3)	
	23PFCB120 and 23PFCD120	11.8 (26.0)	13.8 (30.4)	
B	23PFCB245 and 23PFCD245	25.3 (55.8)	27.3 (60.2)	See Frame B Field Controller Dimensions on page 7
	23PFCB365 and 23PFCD365	29.3 (64.6)	31.3 (69.0)	
	23PFCB570 and 23PFCD570	31.8 (70.1)	33.8 (74.5)	

Frame A Field Controller Dimensions



A	B	C	A1	A2	B1
mm (in.)	mm (in.)	mm (in.)	mm (in.)	mm (in.)	mm (in.)
267 (10.5)	359 (14.0)	287 (11.3)	7 (0.3)	250 (9.8)	275 (10.8)

Frame B Field Controller Dimensions



A	A1	A2	A3	B	B1	C1	C2 ⁽¹⁾
mm (in.)	mm (in.)	mm (in.)	mm (in.)	mm (in.)	mm (in.)	mm (in.)	mm (in.)
311 (12.2)	275 (10.8)	16.5 (0.65)	7 (0.3)	388 (15.3)	375 (14.8)	350 (13.8)	380 (15.0)

(1) Frame B catalog numbers 23PFCEB570 and 23PFCEB570 only.



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

Enclosure Requirements

The PowerFlex DC Field Controller is available in an IP20, Open Type enclosure only. IP20, Open Type enclosures are intended for indoor use only, primarily to provide a degree of protection against contact with enclosed equipment. These enclosures offer no protection against airborne contaminants.

Site Requirements

- The controller must be mounted in a clean, dry, pollution degree 2 environment
- Contaminants such as oils, corrosive vapors, and abrasive debris must be kept out of the enclosure

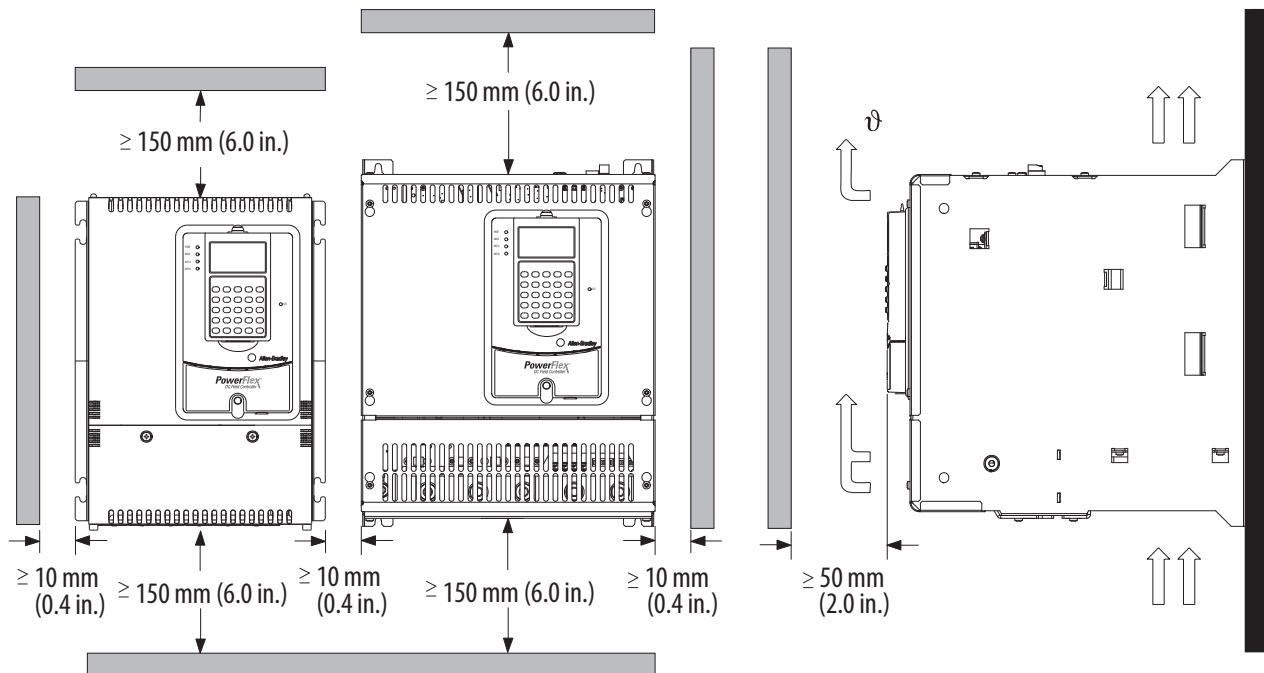
Maximum Surrounding Air Temperature

- 0...50 °C (32...122 °F), typical
- De-rate 1.25% for every 1 °C (1 °F) over 50 °C (122 °F), to 55 °C (131 °F)
- Additional air cooling is required for temperatures above 55 °C (131 °F)

Minimum Mounting Clearances

Minimum clearance requirements are intended to be from module to module. Other objects can occupy this space; however, reduced airflow can cause protection circuits to fault the field controller. The field controller must be mounted in a vertical orientation as shown here and must not be mounted at an angle greater than 30° from vertical. Intake air temperature must not exceed the product specification.

Field Controller Enclosure Minimum Mounting Clearances



CE Conformity

Compliance with the Low Voltage Directive and Electromagnetic Compatibility Directive has been demonstrated by using harmonized European Norm (EN) standards. The Official Journal of the European Communities publishes references to European Norm standards. PowerFlex DC Field Controllers comply with the EN standards listed here when installed according to this installation instruction.

EU Declarations of Conformity are available online at: <http://www.rockwellautomation.com/global/certification/overview.page>

Low Voltage Directive (LVD)

- EN 61800-5-1 Electronic equipment for use in power installations.

EMC Directive

- EN 61800-3 Adjustable speed electrical power drive systems Part 3: EMC product standard including specific test methods.

General Considerations

- For CE compliance, the field controller installation must satisfy requirements that are related to both EN 61800-5-1 and EN 61800-3 provided in this document.
- PowerFlex DC field controllers comply with the EMC requirements of EN 61800-3 when installed according to good EMC practices and the instructions that are provided in this document. However, many factors can influence the EMC compliance of an entire machine or installation, and compliance of the field controller itself does not confirm compliance of all applications.
- PowerFlex DC field controllers are not intended to be used on public low-voltage networks that supply domestic premises. Without additional mitigation, radio frequency interference is expected if used on such a network. The installer is responsible to take measures such as supplementary line filters and enclosures to help prevent interference and follow all installation requirements of this document.
- PowerFlex DC field controllers generate notching and harmonic current emissions on the AC supply system. When operated on a public low-voltage network, it is the responsibility of the installer or user to be sure that applicable requirements of the distribution network operator have been met.



ATTENTION: PowerFlex DC field controllers can produce DC current in the protective earthing conductor. This DC current can reduce the ability of residual current-operated protective devices (RCD) or residual current-operated monitoring devices (RCM), of type A or AC, to provide protection for other equipment in the installation.

Installation Requirements Related to the Low Voltage Directive

- PowerFlex DC field controllers are CE-compliant only if they are NOT connected to “corner-earthed” supply systems where one of the three phases of the supply system has been earthed.
- PowerFlex DC field controllers are compliant with the CE LV Directive when used at altitudes no greater than 2,000 m (6,562 ft).
- PowerFlex DC field controllers that are provided in enclosure type IP20 must be installed in a pollution degree 1 or 2 environment to be compliant with the CE LV Directive. Characteristics of the different pollution degree ratings are provided in the Pollution Degree Ratings according to EN 61800-5-1 table on page [10](#).
- PowerFlex DC field controllers can produce leakage current in the protective earthing conductor that exceeds 3.5 mA AC or 10 mA DC. The minimum size of the protective earthing (ground) conductor that is used in the application must comply with local safety regulations for high-protective earthing conductor current equipment.

Installation Requirements Related to EN 61800-3 and the EMC Directive

- The field controller must be earthed (grounded) as described in this Installation Instructions.
- PowerFlex DC field controllers require the use of an external EMC filter to comply with the EMC Directive and emission limits of EN 61800-3: 2004. PowerFlex DC field controllers have been tested and verified for compliance to the emission limits of EN 61800-3: 2004 by using only the specific input filters and motor cable lengths that are identified in the Standards and Limits for EMC Input Filters table.

Standards and Limits for EMC Input Filters

Field Controller Frame Catalog Number	Standard / Limits (Compliance with Any of the Limits in the Pollution Degree Ratings according to EN 61800-5-1 Table on Page 10 Satisfies RF Emission Requirements for the EMC Directive)				
	EN61800-3 Category C1 EN61000-6-3 CISPR 11 Group 1 Class B	EN61800-3 Category C2 EN61000-6-4 CISPR 11 Group 1 Class A...P ≤ 20 kVA	CISPR11 Group 1 Class A...P > 20 kVA	EN61800-3 Category C3...I ≤ 100 A	EN61800-3 Category C3...I > 100 A
Frame A 23PFCx017... 23PFCx120	Compliance may be possible with supplementary mitigation (Consult factory)	Compliance may be possible with supplementary mitigation (Consult factory)	RF line filter required ⁽²⁾ 50 m motor cable limit	RF line filter required ⁽²⁾ 50 m motor cable limit	RF line filter required ⁽²⁾ 50 m motor cable limit
Frame B 23PFCx245... 23PFCx570	Compliance may be possible with supplementary mitigation (Consult factory)	RF line filter required ⁽¹⁾ 50 m (164 ft) motor cable limit	RF line filter required ⁽¹⁾ 50 m (164 ft) motor cable limit	RF line filter required ⁽¹⁾ 50 m (164 ft) motor cable limit	RF line filter required ⁽¹⁾ 50 m (164 ft) motor cable limit
	More Stringent Limits ←				→ Less Stringent Limits

(1) Rasmi Electronics Ltd manufactures the RF 3xxx-MHU EMC filter. xxx designates filter current rating. See the manufacturer published literature for details.

(2) Rasmi Electronics Ltd manufactures the RF 3xxx-SIEI EMC filter. xxx designates filter current rating. See the manufacturer published literature for details.

IMPORTANT Use of EMC filters not listed in the Standards and Limits for EMC Input Filters table must be verified in the application. Additional filters are listed in the Alternate EMC Filters tables on page 11.

- Output power wiring to the load must employ one of the following solutions.
 - Cable with a braided shield providing 75% or greater coverage
 - Cables that are housed in metal conduit
 - Cables with equivalent shielding

Continuous shielding must be provided from the field controller enclosure to the load enclosure. Both ends of the load cable shield (or conduit) must terminate with a low-impedance connection to earth.

- The load-end cable shield or conduit must terminate in a shielded connector and be properly installed in an earthed wiring box that is attached to the load. The load wiring-box cover must be installed and earthed.
- All control (I/O) and signal wiring to the field controller must use one of the following solutions.
 - Cable with a braided shield providing 75% or greater coverage
 - Cables that are housed in metal conduit
 - Cables with equivalent shielding

When shielded cable is used, terminate only the field controller end of the cable shield to earth with a low-impedance connection.

- Load cables must be separated from control and signal wiring wherever possible.
- The maximum length of the load cable must not exceed the length that is specified in the Standards and Limits for EMC Input Filters table. The maximum length that is specified is required for compliance with radio frequency emission limits for the specific standard and installation environment.

Pollution Degree Ratings according to EN 61800-5-1

Pollution Degree	Description
1	No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.
2	Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity due to condensation can be expected, when the field controller is out of operation.
3	Conductive pollution or dry non-conductive pollution occurs, which becomes conductive due to condensation, which can be expected.
4	The pollution generates persistent conductivity that is caused, for example, by conductive dust, rain, or snow.

Alternate EMC Filters

The following recommended filters can be used in place of the Rasmi filters that are listed in the table in the Installation Requirements Related to EN 61800-3 and the EMC Directive section on page [10](#).

IMPORTANT Only the Rasmi RF 3xxx-MHU, Rasmi RF-3xxx-SIEI, and EPCOS B84143B Type S081 filters have been certified for use with the PowerFlex DC Field Controller. All other filters must be verified in the application.

Rasmi and Rasmi Alternative Filters

Frame	Field Controller Cat. No.	Voltage Class	Rasmi Filters	Rasmi Alternative Type Filters	
			Part Number	Part Number	Part Number
A	23PFCB017	200V	EMI-FFP-480-24, Code 8271 (was RF 3024-SIEI)	RF 3030-FTF, Code 8082 (Rasmi / EuroTek)	RF 3025-MHU
	23PFCB060		RF 3100-FLP, Code 8075 (Rasmi / EuroTek)	RF 3075-FTF, Code 7674 (Rasmi / EuroTek)	RF 3100-MHU
	23PFCB120		RF 3150-FLP, Code 8076 (Rasmi / EuroTek)	RF 3180-FTF, Code 7677 (Rasmi / EuroTek)	RF 3180-MHU
B	23PFCB245		RF 3320-MHU	—	—
	23PFCB365		RF 3600-MHU	—	—
	23PFCB570		RF 3800-MHU	—	—
A	23PFCD017	500V	EMI-FFP-480-24, Code 8271 (was RF 3024-SIEI)	RF 3030-FTF, Code 8082 (Rasmi / EuroTek)	RF 3025-MHU
	23PFCD060		RF 3100-FLP, Code 8075 (Rasmi / EuroTek)	RF 3075-FTF, Code 7674 (Rasmi / EuroTek)	RF 3100-MHU
	23PFCD120		RF 3150-FLP, Code 8076 (Rasmi / EuroTek)	RF 3130-FTF, Code 7676 (Rasmi / EuroTek)	RF 3130-MHU
B	23PFCD245		RF 3250-MHU	—	—
	23PFCD365		RF 3600-MHU	—	—
	23PFCD570		RF 3800-MHU	—	—

Schaffner and Schaffner Alternative Filters

Frame	Drive Current Rating Code	Voltage Class	Schaffner Filters	Schaffner Alternative Type Filters	
			Part Number	Part Number	Part Number
A	23PFCB017	200V	FN 258-30-33	FN 3258-30-33	FN 3270H-20-44
	23PFCB060		FN 258-75-34	FN 3258-75-34	FN 3270H-80-35
	23PFCB120		FN 258-180-40	FN 3258-180-40	FN 3270H-150-99
B	23PFCB245		FN 258-250-40	FN 3359-320-99	FN 3270H-320-99
	23PFCB365		—	FN 3359-400-99	FN 3270H-600-99
	23PFCB570		—	FN 3359-800-99	FN 3270H-800-99
A	23PFCD017	500V	FN 258HV-30-33	—	FN 3270H-20-44
	23PFCD060		FN 258HV-75-34	—	FN 3270H-80-35
	23PFCD120		FN 258HV-130-35	—	FN 3270H-150-99
B	23PFCD245		FN 3359HV-320-99	—	FN 3270H-250-99
	23PFCD365		FN 3359HV-400-99	—	FN 3270H-400-99
	23PFCD570		FN 3359HV-800-99	—	FN 3270H-800-99

Mount the PowerFlex DC Field Controller

The dimensions and weights that are specified in Product Dimensions and Weights on page 6 must be considered when mounting the device. The surface that the controller is mounted on must be constructed of heat resistant materials. The heat sink can reach a temperature of 90 °C (194 °F). When lifting and handling PowerFlex DC field controllers, follow all applicable local, national, and international codes, standards, regulations, or industry guidelines for safe practices.

IMPORTANT Verify that all mounting screws are properly tightened before and after field controller operation.

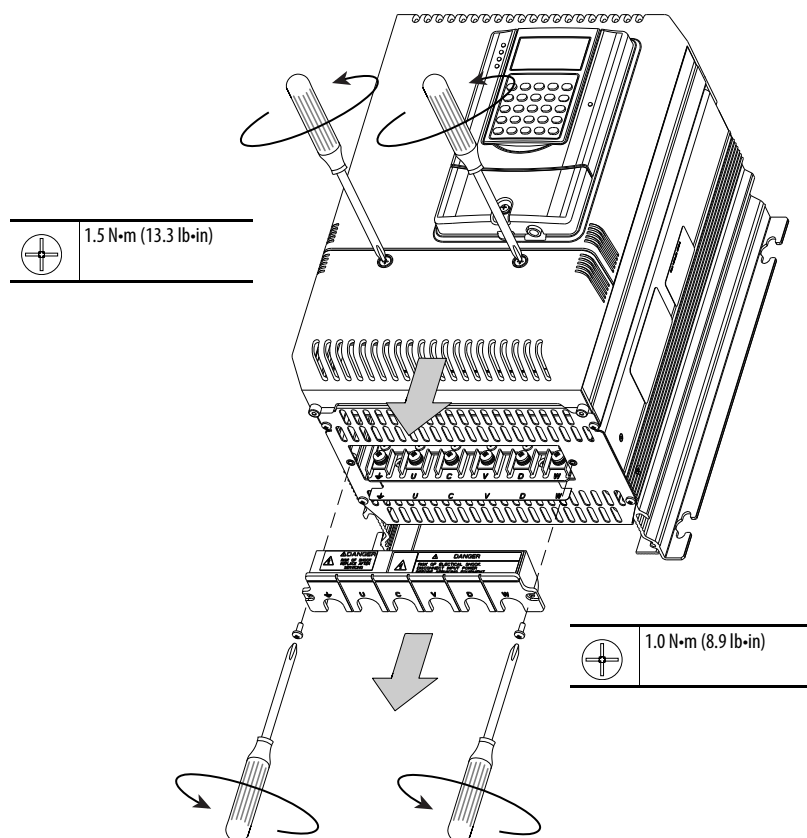
1. Verify the hole pattern on the panel on which you intend to mount the field controller. See Product Dimensions and Weights on page 6.
2. Install the mounting hardware. The bolts must be fully threaded into the panel before hanging the field controller.
 - For frame A field controllers, insert, but do not tighten, a bolt in each of the mounting holes in the panel.
 - For frame B field controllers, insert, but do not tighten, a bolt in each of the top mounting holes in the panel.
3. Lift the field controller into place onto the bolts that are installed in the panel.
4. Install and tighten the remaining bolts into the panel.

Remove the Covers

Some protective covers must be removed to provide access to the power and I/O terminals on the field controller. Remove the upper cover only to install an optional communication adapter or service the field controller.

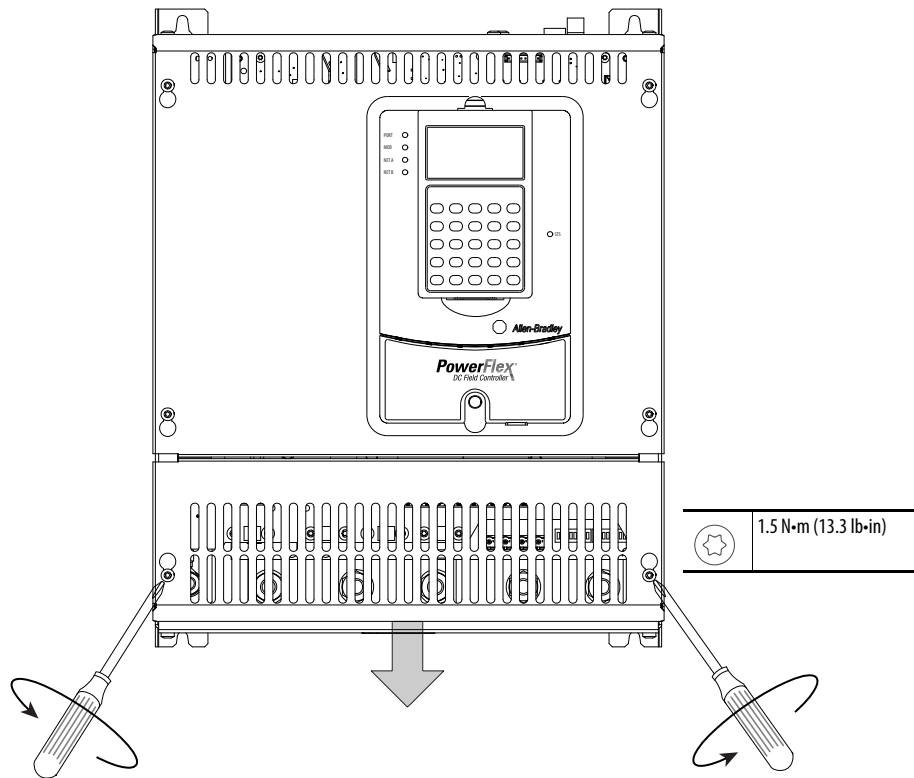
Remove Frame A Field Controller Lower and Terminal Covers

You must remove both the lower protective cover and the power terminal cover on frame A field controllers to access the power terminals.



Remove Frame B Field Controller Lower Cover

1. Loosen, but do not remove, the two screws that secure the lower cover.
2. Slide the cover down until the screw heads align with the key holes and lift the cover off the chassis.



Isolation Transformers / AC Input Line Reactors

When connecting the field controller directly to the main distribution system, an isolation transformer or 3...5% impedance AC line reactor must be used to guard against system disturbance. If the isolation transformer provides the required 3...5% impedance, a line reactor is not required.

The type of AC line reactor that is used depends upon the following:

- Current absorbed by the AC input
- AC input voltage
- Relative short circuit voltage
- AC input frequency

See Isolation Transformers on page [14](#) for a list of recommended isolation transformers. See AC Input Line Reactors and AC Contactors on page [14](#) for a list of recommended AC input line reactors.

Isolation Transformers

This section contains the recommended isolation transformers for use with the PowerFlex DC Field Controller.

A customer-supplied 200V AC Three Phase Secondary Isolation Transformer must be installed with a 200V AC PowerFlex DC field controller.

Isolation Transformers for 500V AC Input Field Controllers

Frame	Field Controller Cat. No.	Three Phase Primary Voltage		460V AC Three Phase Secondary
		kVA	Voltage	Isolation Transformer Cat. No.
A	23PFC017	14	230	1321-3TW014-AB
			460	1321-3TW014-BB
			575	1321-3TW014-CB
	23PFC060	51	230	1321-3TW051-AB
			460	1321-3TW051-BB
			575	1321-3TW051-CB
	23PFC120	93	230	1321-3TH093-AB
			460	1321-3TH093-BB
			575	1321-3TH093-CB
B	23PFC245	175	230	1321-3TH175-AB
			460	1321-3TH175-BB
			575	1321-3TH175-CB
	23PFC365	275	230	1321-3TH275-AB
			460	1321-3TH275-BB
			575	1321-3TH275-CB
	23PFC570	440	230	1321-3TH440-AB
			460	1321-3TH440-BB
			575	1321-3TH440-CB

AC Input Line Reactors and AC Contactors

These tables contain the recommended AC input line reactors and AC contactors for use with the PowerFlex DC Field Controller.

AC Input Line Reactors and AC Contactors for 200V AC Input Field Controllers

Frame	Field Controller Cat. No.	DC Amps	AC Line Amps	IP00 (Open Style) Line Reactor Cat No.	Line Reactor kW	AC Input Contactor Cat. No.
A	23PFCB017	17	14.45	1321-3R18-A	0.75...3.7	100-C23D10
	23PFCB060	60	51	1321-3R80-A	15	100-C60D10
	23PFCB120	120	102	1321-3R160-A	30...37	100-D140D11
B	23PFCB245	245	208	1321-3RB250-A	45...56	100-D250ED11
	23PFCB365	365	310	1321-3RB400-A	93	100-D420ED11
	23PFCB570	570	485	1321-3R600-A	149	100-D630ED11

AC Input Line Reactors and AC Contactors for 500V AC Input Field Controllers

Frame	Field Controller Cat. No.	DC Amps	AC Line Amps	IP00 (Open Style) Line Reactor Cat No.	Line Reactor kW	AC Input Contactor Cat. No.
A	23PFC017	17	14.45	1321-3R18-B	1.5...7.5	100-C23D10
	23PFC060	60	51	1321-3R80-B	30	100-C60D10
	23PFC120	120	102	1321-3R160-B	56...75	100-D110D11
B	23PFC245	245	208	1321-3RB250-B	93...112	100-D210ED11
	23PFC365	365	310	1321-3RB400-B	186.4	100-D420ED11
	23PFC570	570	485	1321-3R600-B	298.3	100-D630ED11

AC Input Contactor

When an AC input contactor is used, the IEC AC1 rating of the contactor must be equal to the rated thermal (RMS) current value at the main input of the field controller. See the AC Input Line Reactors and AC Contactors tables on page 14 for a list of recommended AC input contactors. Configuration for AC contactors is as follows (see Typical Power Wiring Diagram on page 24 for an example):

IMPORTANT An AC input contactor can only be installed when the field controller is used in standalone mode. When the field controller is connected to and controlled by a PowerFlex DC drive or SAR, an AC input contactor cannot be used with the field controller.

When an AC contactor is used:

- Set parameter 1391 [ContactorControl] to 1 “AC Cntcr” ⁽¹⁾
- Set one [Relay Out *x* Sel] parameter and one [Digital In*x* Sel] parameter to “Contactor” (default value for parameters 1392 [Relay Out 1 Sel] and 140 [Digital In8 Sel])

When a contactor is NOT used:

- Set parameter 1391 [ContactorControl] to “None” (default value) ⁽¹⁾
- Do NOT set either [Relay Out *x* Sel] parameter to “Contactor”
- Do NOT set any [Digital In*x* Sel] parameter to “Contactor”

⁽¹⁾ Par 1391 [ContactorControl] is contained in the “Advanced” parameter configuration group. See How Parameters are Organized in the PowerFlex DC Field Controller Programming Manual, publication [23PFC-PM001](#), for more information.

Install an SCR Overvoltage Protection Device

When the PowerFlex DC Field Controller is used to supply a very inductive load like a motor/generator field or an electromagnet, an overvoltage protection device (voltage clamp) and dampening resistor must be installed on the field controller load. The PowerFlex DC Field Controller Voltage Clamp (cat. no. 23P-FCOVPD-*x*-Fx) can be purchased separately from the field controller to provide overvoltage protection. See the PowerFlex DC Field Controller Voltage Clamp Installation Instructions, publication [23PFC-IN002](#), for details. See the [Voltage Clamp Kits](#) and [Dampening Resistor \(RB\) Kit Selection](#) selection tables for the correct parts for your PowerFlex DC Field Controller.

The purpose of the voltage clamp is to provide a means to let the DC output current to the load decay if the power is interrupted to the field controller. If the AC power to the connected field controller is interrupted, the current in the DC output to the field starts to decay rapidly. This rapid decay generates voltages that are in direct proportion to the rate of decay of the “field collapse.” These voltages can damage the field controller and/or the motor wire insulation. The voltage clamp is connected directly across the DC output power connections to the load and during normal operation it appears as an open circuit. See the Typical Power Wiring Diagram on page 24 for an illustration of the voltage clamp installation location.



ATTENTION: Do not remove AC power until the field controller output (load) current is zero. Equipment damage can occur.

Voltage Clamp Kits

Field Controller Specifications			
AC Input Voltage	Output Amp Rating	Frame Size	Voltage Clamp Cat. No.
200	17...120	A	23P-FCOVPD-B-FA
200	245...570	B	23P-FCOVPD-B-FB
500	17...120	A	23P-FCOVPD-D-FA
500	245...570	B	23P-FCOVPD-D-FB

Dampening Resistor (RB) Kit Selection

Field Controller			
AC Input Voltage Range (Vrms)	RB Resistor Value Ohms	RB Resistor Size Watts	RB Resistor Kit Cat. No. ⁽¹⁾
60...100V	220	930	23P-FC-RB100
101...200V	390	930	23P-FC-RB200
201...300V	680	930	23P-FC-RB300
301...400V	1000	930	23P-FC-RB400
401...500V	1200	930	23P-FC-RB500

(1) Resistor kits are IP00 / Open Type and must be installed in an enclosure.

Ground the PowerFlex DC Field Controller

The field controller Safety Ground (PE) must be connected to system ground. Ground impedance must conform to the requirements of national and local industrial safety regulations and electrical codes. Periodically check the integrity of all ground connections.

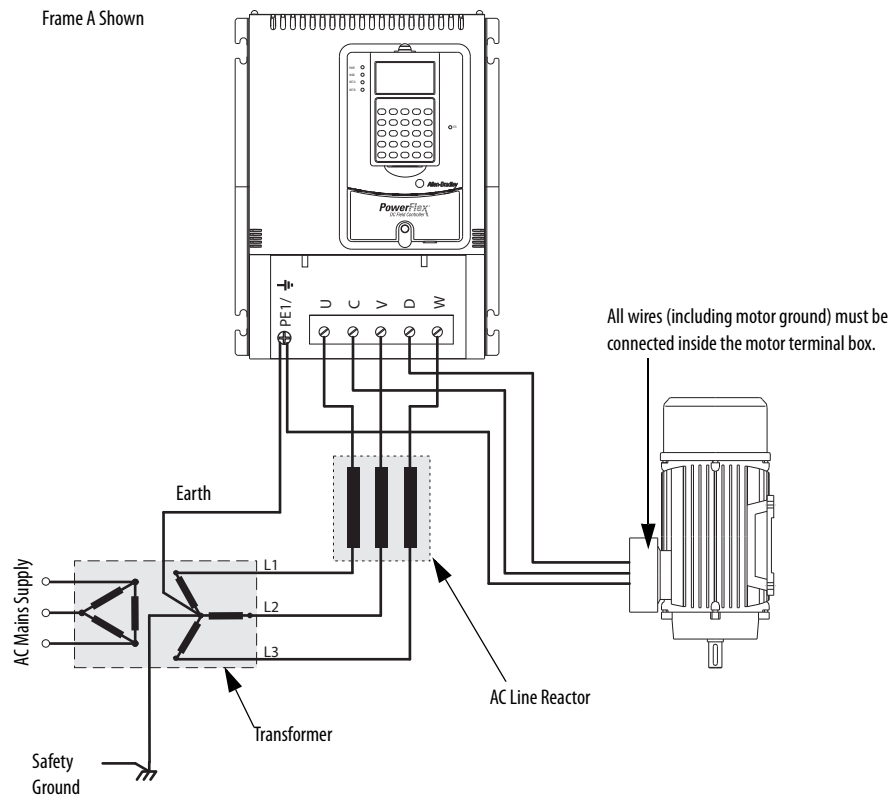
For installations within an enclosure, use a safety ground point or ground bus bar connected directly to structural steel. Ground all circuits, including the AC input ground conductor, independently and directly to this point/bar.

For installations in distribution systems that have ungrounded or high impedance, neutral connections or systems, see Grounding for Installations in an Ungrounded or High-impedance, Neutral Ground, or System on page [17](#).



ATTENTION: To comply with the essential requirements of the CE Low Voltage Directive 2006/95/EC, the PowerFlex DC Field Controller cannot be powered from a corner-earthed (TN with one phase earthed) supply system. When operating a PowerFlex DC Field Controller from an IT or impedance-earthed supply system, only temporary operation is permitted after an earth fault is detected in the power system.

Typical Ground Scheme



Safety Ground (PE)

The field controller Safety Ground-PE must be connected to adjacent structural steel (girder, joist), a floor ground rod, or bus bar (see Typical Ground Scheme). Ground points must comply with national and local industrial safety regulations and electrical codes.

IMPORTANT For PowerFlex DC Field Controllers, cat. no. 23PFC017, 23PFC060, and 23PFC120 only, conductors that are used for grounding at all protective earth (PE) terminals must be at least 10 mm².

Power Feeder

Each power feeder from the substation transformer to the field controller must be provided with properly sized ground cables. Bond the conduit or cable armor to the substation ground at both ends. Each transformer enclosure or frame must be bonded to ground at a minimum of two locations.

Grounding for Installations in an Ungrounded or High-impedance, Neutral Ground, or System

The PowerFlex DC Field Controller was designed to work in distribution systems where the isolation transformer wye neutral is connected to earth ground. PowerFlex DC Field Controllers are **not** designed to work in distribution systems that have ungrounded or high-impedance, neutral connections, or systems that have a phase that is referenced to earth. Symmetrical incoming power is required for correct operation.

The use of a grounded wye neutral is highly recommended to help prevent common-mode rejection problems with the feedback measurement circuits in the field controller. Possible field controller damage can occur because of inaccurate feedback measurements of the incoming AC voltage, armature voltage, or field current.

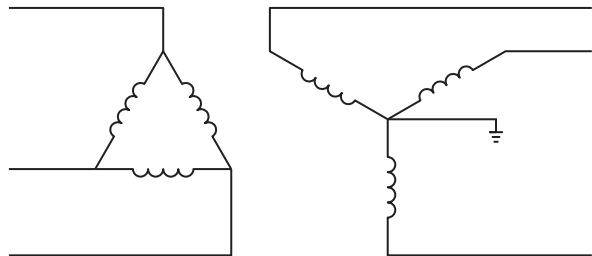
If the PowerFlex DC field controller is installed in a system with an ungrounded wye neutral or with an impedance ground connection, see Ungrounded Wye Neutral or Impedance Grounded Connections Modifications on page [18](#). The table contains the modifications that are required for proper installation.

Power Distribution

Rockwell Automation strongly recommends the use of grounded neutral systems for the following reasons:

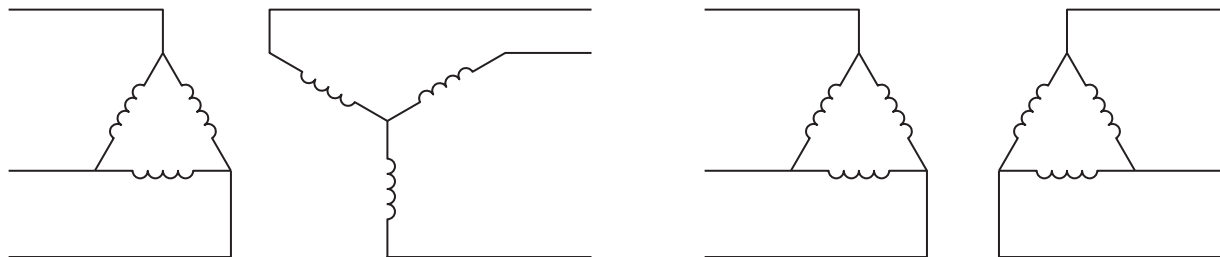
- Controlled path for common mode noise current
- Consistent line to ground voltage reference, which minimizes insulation stress
- Accommodation for system-surge protection schemes

Delta/Wye with Grounded Wye Neutral



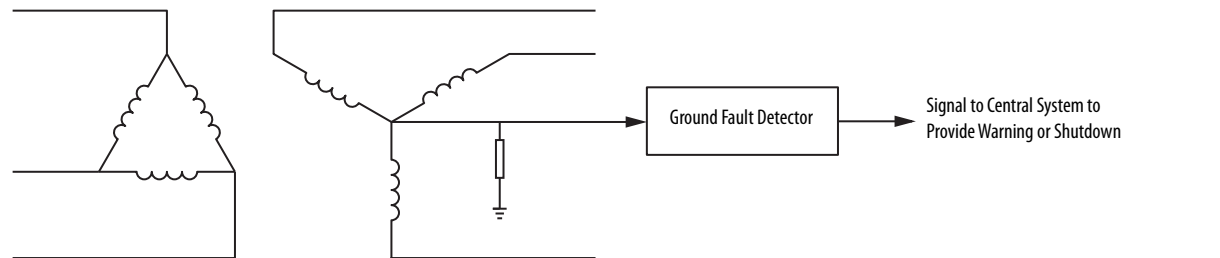
Grounding the transformer secondary is essential to the safety of personnel and safe operation of the field controller. A floating secondary can allow dangerously high voltages occur between the chassis of the field controller and the internal power-structure components.

Ungrounded Secondary



Grounding the wye secondary neutral through a resistor is an acceptable method of grounding. In this case, in a short-circuited secondary condition, none of the output phases to ground exceed the normal line to line voltage. If a resistor is used, a ground fault detection circuit must be used to signal a ground fault to the central system.

High-impedance Ground

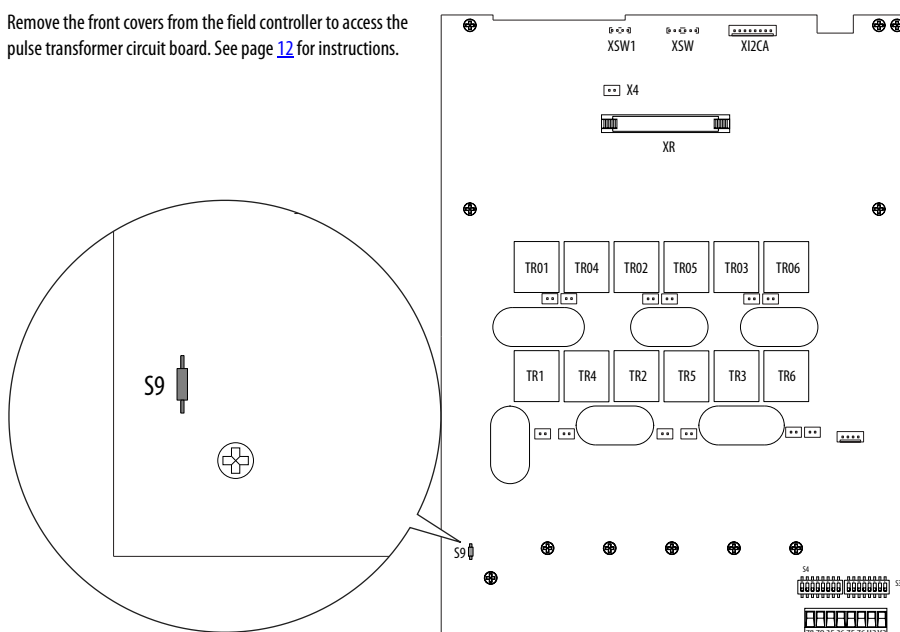


Ungrounded Wye Neutral or Impedance Grounded Connections Modifications

Frame	Modification	See
A	Remove the jumper S9 on the pulse transformer circuit board (FIR1-xx-FC)	Frame A Pulse Transformer Circuit Board S9 Jumper Location
B	Remove the jumper S9 on the pulse transformer circuit board (FIR1-xx-FC)	Frame B Pulse Transformer Circuit Board S9 Jumper Location

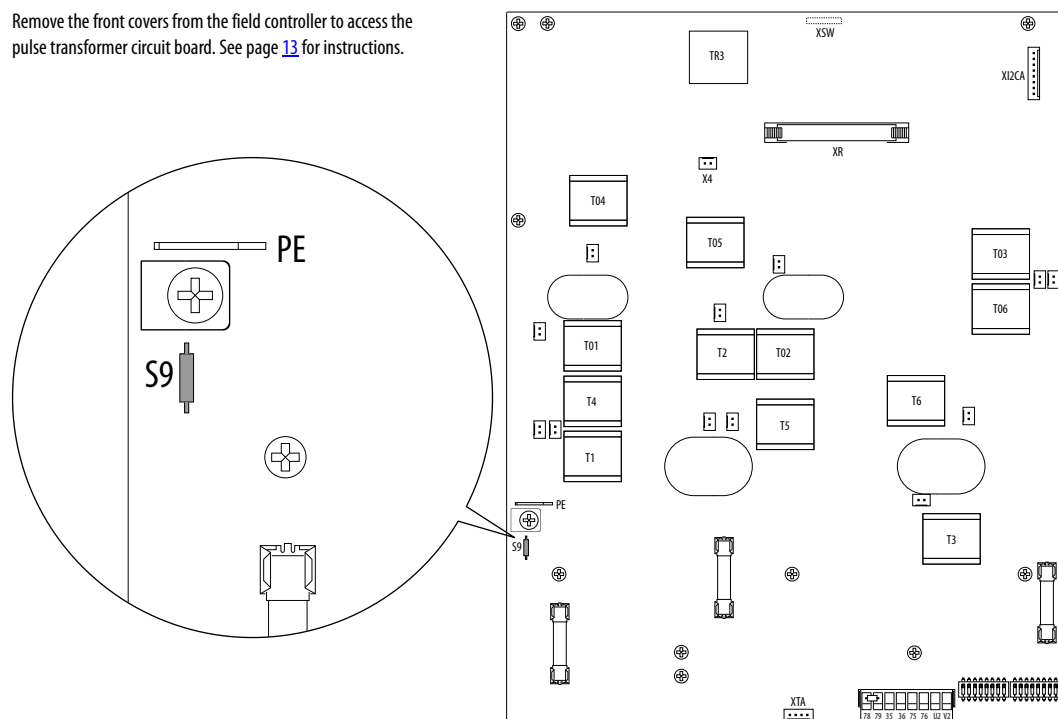
Frame A Pulse Transformer Circuit Board S9 Jumper Location

Remove the front covers from the field controller to access the pulse transformer circuit board. See page 12 for instructions.



Frame B Pulse Transformer Circuit Board S9 Jumper Location

Remove the front covers from the field controller to access the pulse transformer circuit board. See page 13 for instructions.



AC Input Voltages

PowerFlex DC Field Controllers are rated for the following AC input voltages at 50/60 Hz $\pm 5\%$:

Mains Circuit (Terminals U, V, W)

- Cat. No. 23PFCBxxx: 60...200V AC, $\pm 10\%$, 3Ph
- Cat. No. 23PFCDxxx: 230...500V AC, $\pm 10\%$, 3Ph

Control Circuit (Terminals U2, V2)

- 115V $\pm 15\%$ or 230V $\pm 15\%$, 1Ph

IMPORTANT For frame B field controllers only, a jumper must be placed between terminals SA-SB on the switching power supply circuit board for the control circuits to work with 115V AC input. See SA-SB Terminal Block Location on page [29](#) for terminal block location on frame B field controllers.

DC Output Voltages

The output voltages that are shown here include an AC input undervoltage within the stated tolerance limits and a voltage drop of 4% due to an AC input line reactor. It is the same as the rated armature voltage suggested for the connected load.

AC Input Voltage (Terminals U, V, W)	DC Output Voltage (Terminals C and D)
200V, $\pm 10\%$, 3Ph	210V
230V, $\pm 10\%$, 3Ph	240V
400V, $\pm 10\%$, 3Ph	420V ⁽¹⁾
440V, $\pm 10\%$, 3Ph	460V
460V, $\pm 10\%$, 3Ph	480V
480V $\pm 10\%$, 3Ph	500V
500V, $\pm 10\%$, 3Ph	520V ⁽¹⁾

(1) Voltage that is measured according to DIN 40 030 (09/93)

Input Power Circuit Protection

Fast-acting AC input fuses are required on all field controllers to help protect the field converter. All AC input fuses must be sourced separately and are mounted externally from the field converter. The required fuses are listed in the AC Input Fuses table.

AC Input Fuses

Cat. No.	Frame Size	DC Amps	AC Line Amps	Bussman		Mersen	
				Ferrule FWP Type	North American FWP Type	Ferrule A70QS Type	North American A70P / A70QS Type
23PFCx017	A	17	14	FWP-25A14F	FWP-25B	A70QS25-14F	A70P25-4
23PFCx060	A	60	49	FWP-80A22F	FWP-80B	A70QS80-22F	A70QS80-4
23PFCx120	A	120	98	-	FWP-150A	-	A70QS150-4K
23PFCx245	B	245	201	-	FWP-300A	-	A70QS300-4
23PFCx365	B	365	299	-	FWP-400A	-	A70QS400-4
23PFCx570	B	570	467	-	FWP-600A	-	A70QS600-4

Control Power Circuit Protection

The 115V / 230V AC control circuit power input terminals U2 and V2 are required to be short circuit protected. This protection can be provided by using standard time-delay fuses or a circuit breaker (device). Either protective device must survive the short circuit available current of the feeder source for this circuit and the inrush current of the field controller power supply.

Size the device to help protect the wiring between the fuses or circuit breaker connections to terminals U2 and V2, and not spurious trip or blow from the inrush current. This table lists the input current characteristics of the control power supply.

Control Power Circuit Protection

Frame	Control Power Supply					
	Circuit Board ID	Power	Rated Input Current		Inrush Input Current	
			115V AC	230V AC	115V AC	230V AC
A	SW1-31	60 W	1 A	0.5 A	20 A	10 A
B	SW2-32	110 W	1.2 A	0.7 A	15 A	7.5 A

Provide a power source for the control power input that is stabilized and buffered from the power system transients. The control power for multiple field controllers can be fed from one source, as long as proper distribution protection is provided.

Wire the PowerFlex DC Field Controller

Follow the guidance in this section for all power, control, and signal cable/wire connections to the PowerFlex DC Field Controller.

Cable and Wiring Recommendations

Use the following cable and space recommendations for all field controllers sizes:

					Minimum Spacing between Classes Steel Conduit/Tray					
Category	Wiring Class	Signal Definition	Signal Example	Cable Type	1	2/3/4	5/6	7/8	9/10/11	See Cable Spacing Notes, on Page 23
Power	1	AC Power (600V Or Greater)	2.3 kV 3/ph AC Lines	Per NEC and Local Codes	0	76/229 mm (3/9 in.)	76/229 mm (3/9 in.)	76/457 mm (3/18 in.)	See Note 6	1/2/5
	2	AC Power (Less Than 600V)	460V 3/ph AC Lines		76/229 mm (3/9 in.)	0	76/152 mm (3/6 in.)	76/305 mm (3/12 in.)	See Note 6	1/2/5
	4	DC Power	DC Motor Field							
Control	5	115V AC/DC Logic	Relay Logic/PLC I/O Motor Thermostat		76/229 mm (3/9 in.)	76/152 mm (3/6 in.)	0	76/229 mm (3/9 in.)	See Note 6	1/2/5
		115V AC Power	Power Supplies, Instruments							
	6	24V AC/DC Logic	PLC I/O							
Signal (Process)	7	Analog Signals, DC Supplies	Reference/Feedback Signal, 5 To 24V DC	Shielded Cable – Belden 8735, 8737, 8404	76/457 mm (3/18 in.)	76/305 mm (3/12 in.)	76/229 mm (3/9 in.)	0	25/76 mm (1/3 in.)	2/3/4/5
		Digital (Low Speed)	TTL							
	8	Digital (High Speed)	I/O, Encoder, Resolver, Count Pulse Tach	Shielded Cable – Belden 9728, 9730						
Signal (Comm.)	9	Serial Communication	RS-232 (20-COMM-R), 422 To Terminals/ printers	Shielded Cable – Belden RS-232 – 8735, 8737 RS-422 – 9729, 9730	See Note 6			25/76 mm (1/3 in.)	0	–
	11	Serial Communication (Greater Than 20k Baud)	PLC Remote I/O, PLC Data Highway	Twinaxial Cable – Belden 9463, A-B 1770-CD						

Example:

Space relationship between 480V AC incoming power leads and 24V DC logic leads:

- 480V AC leads are Class 2; 24V DC leads are Class 6
- For separate steel conduits, the conduits must be 76 mm (3 in.) apart
- In a cable tray, the two groups of leads are to be 152 mm (6 in.) apart

Category	Wiring Class	Signal Definition	Signal Example	Minimum Spacing between Classes Steel Conduit/Tray		
				1	2/3/4	5/6
Power	2	AC Power (less than 600V)	460V 3/Ph AC Lines			3/6 in. (76/152 mm)
Control	6	24V AC/DC Logic	PLC I/O		3/6 in. (76/152 mm)	

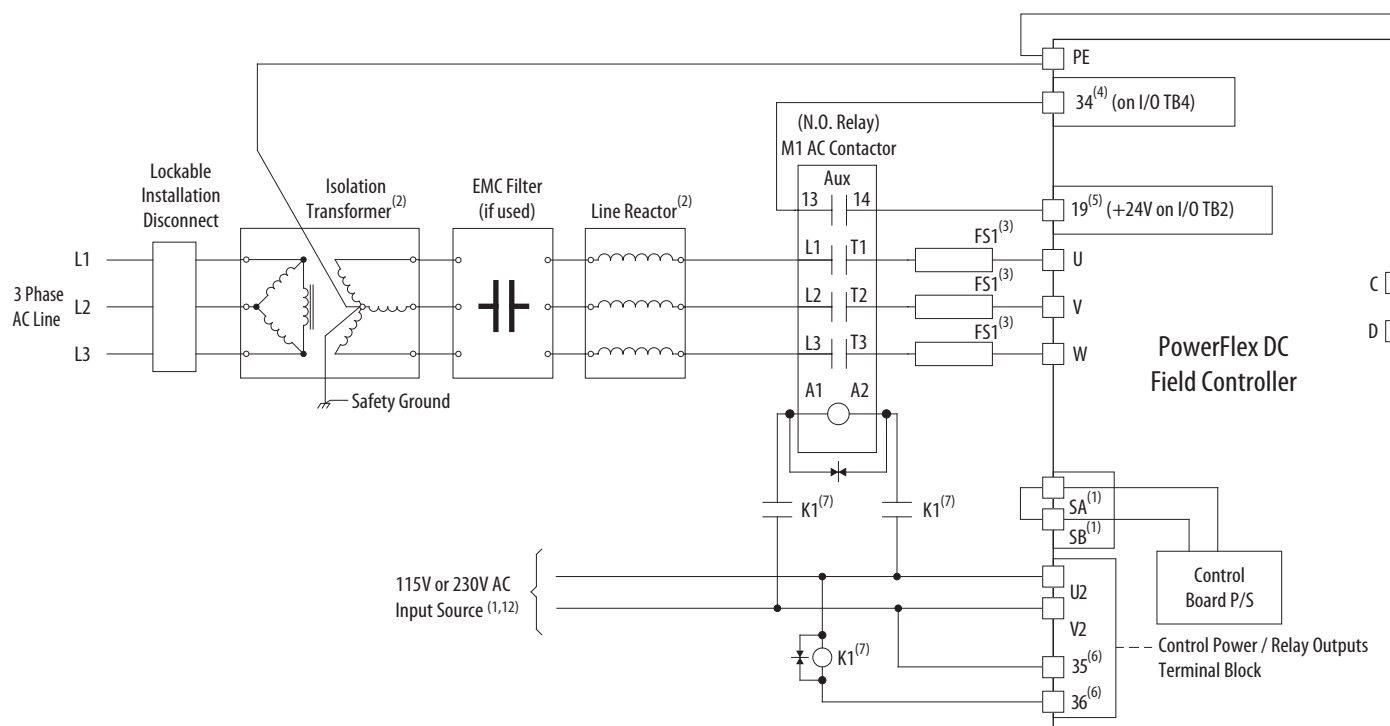
Cable Spacing Notes:

1. Both outgoing and return current-carrying conductors must be routed in the same conduit or laid next to each other in a cable tray.
2. Cables of the following classes can be grouped.
 - a. Class 1; Equal to or above 601V.
 - b. Classes 2, 3 and 4 can have their respective circuits that are routed in the same conduit or layered in the same tray.
 - c. Classes 5 and 6 can have their respective circuits that are routed in the same conduit or layered in the same tray. The bundle cannot exceed the conditions of NEC 310.
 - d. Classes 7 and 8 can have their respective circuits that are routed in the same conduit or layered in the same tray. Encoder cables that are run in a bundle can experience some amount of EMI coupling. The circuit application can dictate separate space requirements.
 - e. Classes 9, 10 and 11 can have their respective circuits that are routed in the same conduit or layered in the same tray. Communication cables that are run in a bundle can experience some amount of EMI coupling and associated communication faults. The application can dictate separate space requirements.
3. All wires of class 7...11 MUST be shielded per the recommendations.
4. In cable trays, steel separators are advisable between the class groupings.
5. If conduit is used, it must be continuous and composed of magnetic steel.
6. Space requirements for communication cables, classes 2...6 are listed in this table:

Conduit Spacing:	Through Air:
115V – 25 mm (1 in.)	115V – 51 mm (2 in.)
230V – 38 mm (1.5 in.)	230V – 01.5 mm (4 in.)
380/575V – 76 mm (3 in.)	380/575V – 203 mm (8 in.)
575V – proportional to 152 mm (6 in.) per 1000V.	575V – proportional to 305 mm (12 in.) per 1000V.

Typical Power Wiring Diagram

This illustration represents the recommended power wiring configuration for a standard PowerFlex DC Field Controller installation with an AC contactor.



Power Wiring Diagram Notes

1. For frame B field controllers only, a jumper is required between terminals SA and SB for 115V AC control input power. See Control Circuit Power Wiring and Connections on page 28 for more information.
2. An Isolation Transformer and/or 3...5% impedance Line Reactor is required. If the Isolation Transformer provides the required 3...5% impedance, a Line Reactor is not required. See the PowerFlex Digital DC Drive Technical Data, publication 20P-TD001, for recommendations. It is recommended that the isolation transformer has a grounded wye secondary neutral. If the PowerFlex DC Field Controller is installed in a system with an ungrounded wye neutral or with an impedance ground connection, see Grounding for Installations in an Ungrounded or High-impedance, Neutral Ground, or System on page 17 for more information.
3. AC input fuses (FS1) for the field converter are not provided with field controllers. See Input Power Circuit Protection on page 21 for fuse recommendations.
4. Par 140 [Digital In8 Sel] set to 31 "Contactor."
5. If the +24V internal power supply is used, terminal 18 (24V common) must be jumpered to terminal 35 (digital input common).
6. Par 1391 [ContactorControl] = 1 "AC Cntcr" and Par 1392 [Relay Out 1 Sel] = 25 "Contactor". Important: Terminals 35 and 36 are on the Control Power / Relay Outputs Terminal block, NOT the I/O terminal blocks. See Relay Outputs on page 26.
7. For frames B field controllers only, a pilot relay is required for the contactor coil.

Field Controller Power Wiring and Connections

This section contains the specifications and requirements for the AC input and DC output power wiring connections. See Frame A Field Controller Power Terminal Locations and Frame B Field Controller Terminal Locations on page 26 for terminal locations.

Connect the field controller power wiring to the following terminals:

Terminals	Description
U, V, W	Three-phase AC input power to the field controller
C, D	DC output power to an inductive load
PE	Safety ground

Field Controller Power and Safety Ground (PE) Terminal Specifications

Frame	Cat. No.	Terminals	Wire Size and Type	Terminal Bolt Size (mm)	Recommended Torque N•m (lb•in)
A	23PFCx017 and 23PFCx060	U, V, W, C, D, PE	See Cable and Wiring Recommendations on page 22	5	3 (26.6)
	23PFCx120			Terminal Block	12 (106)
B	All	U, V, W, C, D		10	25 (221)
		PE		8	12 (106.2)



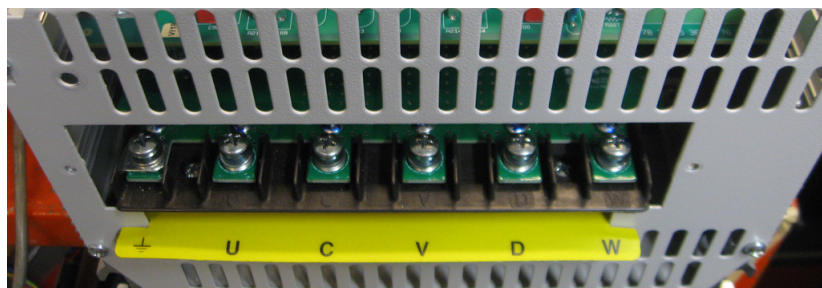
ATTENTION: Operation with the power terminal covers removed can result in a hazardous condition that could cause personal injury and/or equipment damage. Do not operate the field controller with the power terminal covers removed.

Frame A Field Controller Power Terminal Locations

17 A Field Controller Example

Bottom View

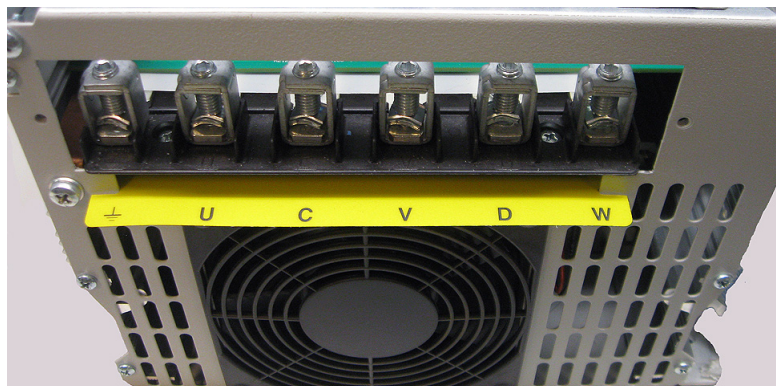
Protective Covers Shown Removed



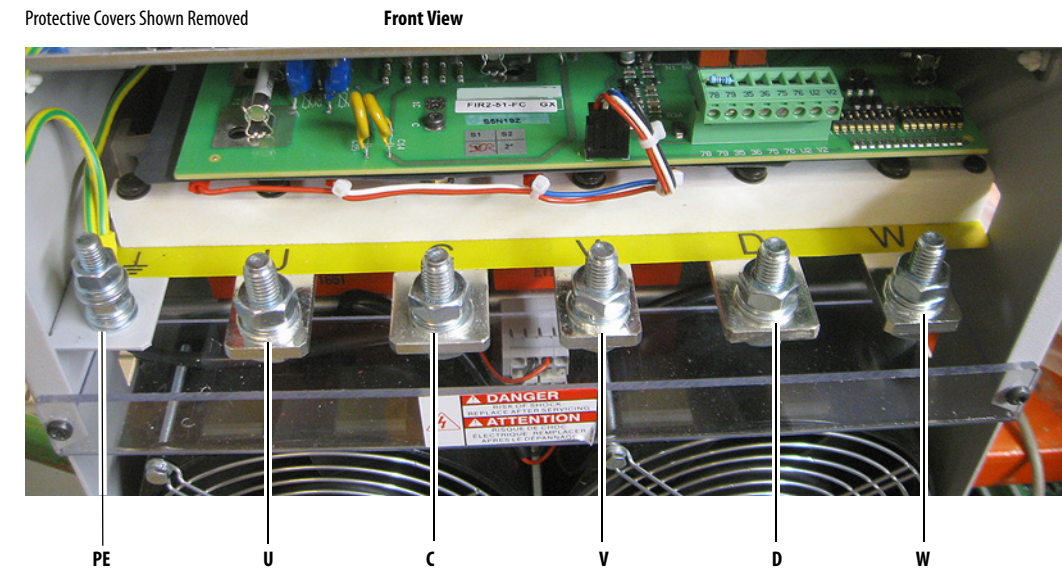
120 A Field Controller Example

Bottom View

Protective Covers Shown Removed



Frame B Field Controller Terminal Locations



Relay Outputs

Terminals 35 and 36 and 75 and 76 are N.O. relay outputs. The relay output between terminals 35 and 36 is configured with parameter 1392 [Relay Out 1 Sel]. The relay output between terminals 75 and 76 is configured with parameter 629 [Relay Out 2 Sel]. See AC Input Contactor on page 15 for more information.

Terminals	Description	Maximum Voltage	Maximum Current
35, 36	Normally open contact. Configured with parameter 1392 [Relay Out 1 Sel], set to 25 "Contactor" by default.	250V AC	1 A
75, 76	Normally open contact. Configured with parameter 629 [Relay Out 2 Sel], set to 5 "Ready" by default.		
78, 79	Motor thermistor (PTC) or thermal switch connections		

If external-contactor coil current ratings are greater than 1 amp, use an interposing relay between the field controller relay 1 or relay 2 output and the contactor coil.

Thermistors and Thermal Switches

To detect overheating and help protect the load from overloading, an external, user-supplied thermistor (PTC) or thermal switch must be connected to terminals 78 and 79. The response to a load over temperature fault is configured in parameter 365 [OverTemp Flt Cfg]. If a thermistor or thermal switch is not used, a 1 kΩ resistor must be connected between terminals 78 and 79 (installed at the factory). Follow the appropriate thermal sensor (thermistor or thermal switch) installation instructions.

Thermistors (PTC)

PTC thermistors that are installed in the load can be connected directly to the field controller via terminals 78 and 79. In this case, the 1 kΩ resistor is not required between terminals 78 and 79.

Thermal Switches (Klixon) in the Load Windings

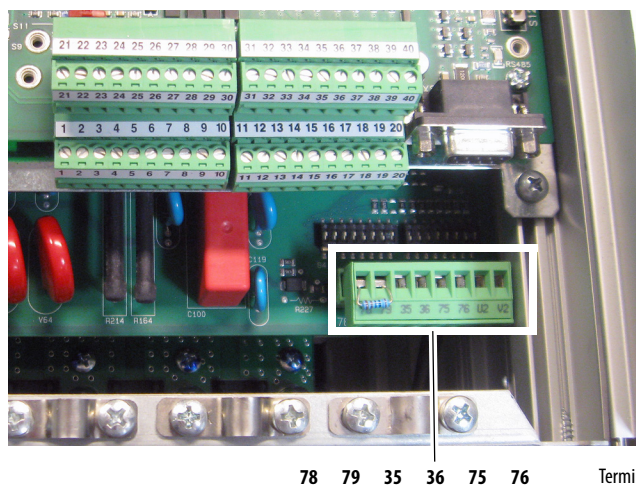
"Klixon" type temperature-dependent contacts can disconnect the field controller from the load via an external control or be configured as an external fault by using a field controller digital input. Though not recommended, a Klixon can also be connected to terminals 78 and 79 to indicate a field controller "PTC Over Temp" fault (F16). This connection can cause noise sensitivity of the current threshold circuitry. If a thermal switch is used, a 1 kΩ resistor must be placed in series between the switch and one of the terminals.

Relay Outputs and Thermistor/Thermal Switch Wire Sizes and Specifications

Signal Type	Terminals	Wire Size and Type ⁽¹⁾			Recommended Torque <i>N•m (lb•in)</i>
		Flexible (mm ²)	Multicore (mm ²)	AWG	
Relay Outputs	35 / 36 and 75 / 76	0.140...1.500	0.140...2.500	26...14	0.5 (4.4)
Thermistor and Thermal Switches	78 / 79				

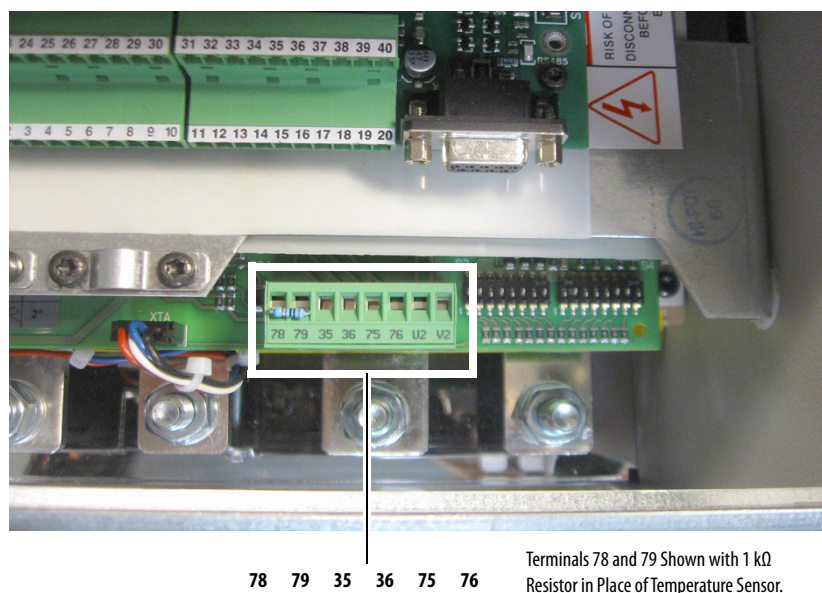
(1) See Cable and Wiring Recommendations on page 22 for more information.

Frame A Relay and Thermistor/Thermal Switch Terminal Block Locations



Terminals 78 and 79 Shown with 1 kΩ Resistor in Place of Temperature Sensor.

Frame B Relay and Thermistor/Thermal Switch Terminal Block Locations



Terminals 78 and 79 Shown with 1 kΩ Resistor in Place of Temperature Sensor.

Control Circuit Power Wiring and Connections

Use a clean, external 230V AC or 115V AC single-phase power supply only to energize the control circuit.

IMPORTANT For frame B field controllers only, a jumper wire is required between terminals SA and SB for 115V AC control input power. For frame B SA-SB terminal block location, see SA-SB Terminal Block Location on page 29.

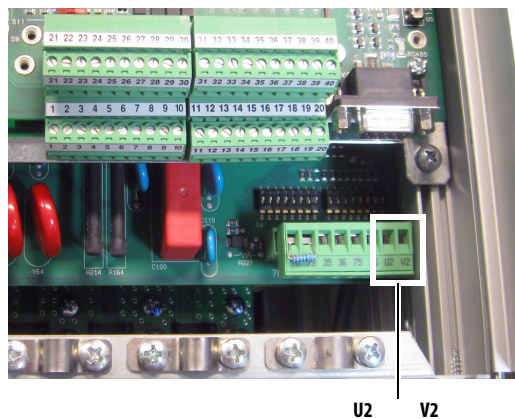
Terminals	Description	Location
U2, V2	Single phase AC power for the control circuits	See Frame A Control Circuit Terminal Block Location and Frame B Control Circuit Terminal Block Location
SA-SB	Frame B control circuit input power source configuration	See SA-SB Terminal Block Location on page 29

Control Circuit Wire Sizes and Terminal Specifications

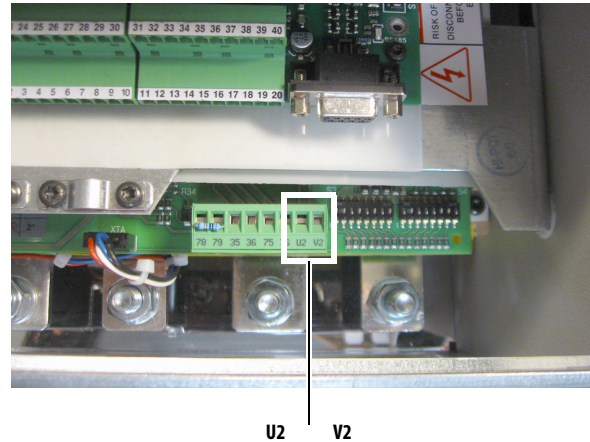
Terminals	Wire Size and Type ⁽¹⁾			Recommended Torque <i>N•m (lb•in)</i>
	Flexible <i>(mm²)</i>	Multi-core <i>(mm²)</i>	AWG	
U2, V2	0.14...1.5	0.14...2.5	26...14	0.5 (4.4)
SA-SB	0.8...1.5	0.8...2.5	18...14	0.5 (4.4)

(1) See Cable and Wiring Recommendations on page 22 for more information.

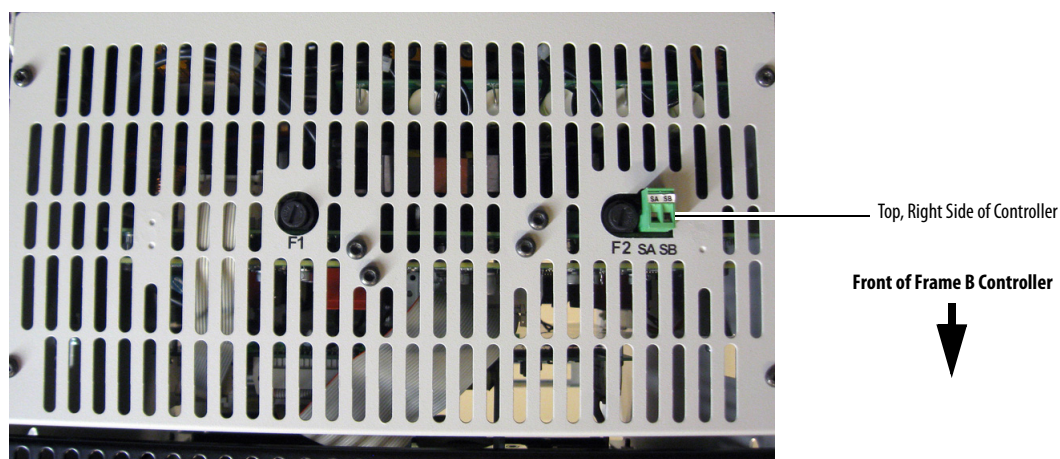
Frame A Control Circuit Terminal Block Location



Frame B Control Circuit Terminal Block Location



SA-SB Terminal Block Location



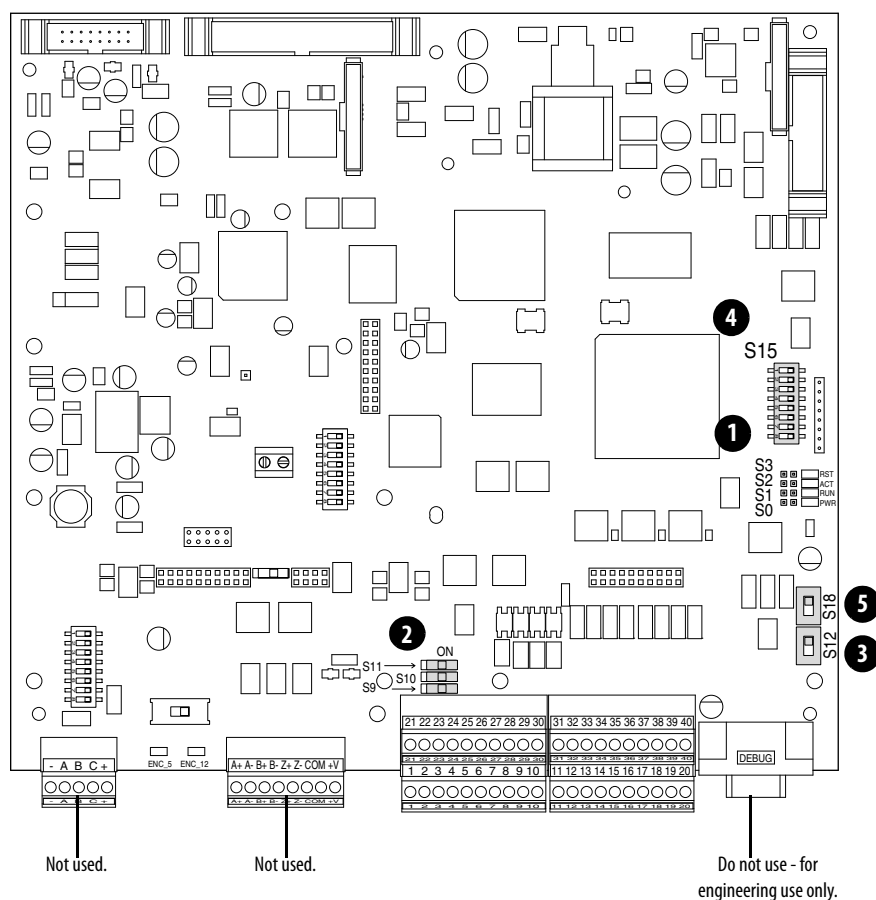
Main Control Circuit Board DIP Switch and Jumper Settings

DIP switches and jumpers on the control circuit board are used to configure the field controller for the following features:

- Firmware updates to the control board EEPROM
- Analog input signal sources
- Maximum field current

See Control Circuit Board Jumper and DIP Switch Settings on page [30](#) for descriptions that correspond to the ID numbers shown here.

Control Circuit Board DIP Switch and Jumper Locations



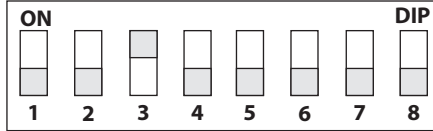
Control Circuit Board Jumper and DIP Switch Settings

ID	Jumper/ Switch	Function		Factory Default	Example
1	S0	For factory boot updating only. Leave set to the factory setting.		Jumper Off	 = ON  = OFF  =OFF
		Jumper On	Firmware boot		
		Jumper Off	Normal function		
	S1	For factory boot updating only. Leave set to the factory setting.		Jumper Off	
		Jumper On	Write firmware boot code		
		Jumper Off	Boot code on update is protected		
	S2	Not used. Leave set to the factory setting.		Jumper Off	
	S3	For factory boot updating only. Leave set to the factory setting.		Jumper Off	
		Jumper On	Reset		
		Jumper Off	Normal function		
2	S9	Configures the input signal of Analog Input 1 (terminals 1 and 2):		On	 = ON  = OFF
		Off Position	0...20 mA / 4...20 mA		
		On Position	0...10V / ±10V		
		Par 71 [Anlg In1 Config] must be programmed to match the input signal type that is selected with this switch.			
	S10	Configures the input signal of Analog Input 2 (terminal 3 and 4):		On	
		Off Position	0...20 mA / 4...20 mA		
		On Position	0...10V / ±10V		
		Par 76 [Anlg In2 Config] must be programmed to match the input signal type that is selected with this switch.			
	S11	Configures the input signal of Analog Input 3 (terminals 5 and 6):		On	
		Off Position	0...20 mA / 4...20 mA		
		On Position	0...10V / ±10V		
		Par 81 [Anlg In3 Config] must be programmed to match the input signal type that is selected with this switch.			
3	S12	Not used. Leave set to the factory setting.		Off	—
4	S15	Configuration of the control circuit board to the appropriate controller size. Leave set to the factory setting, unless the control board has been supplied as a spare part. See DIP Switch S15 Settings on page 31 for switch configuration that is based on field controller current-rating code.		Output current is based on the field controller size.	—
5	S18	Not used. Leave set to the factory setting.		Off	—

DIP Switch S15 Settings

DIP switch S15 is configured at the factory for the selected field controller catalog number and corresponding current rating. Do not change the settings unless you are installing a replacement control board.

Field Controller Size DIP Switch S15 Example



Illustration, for example only.

200V AC Input DIP Switch S15 Configuration

Frame	Field Controller Cat. No.	Current Rating (Amps)	S15-1	S15-2	S15-3	S15-4	S15-5	S15-6	S15-7	S15-8
A	23PFCB017	17	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	23PFCB060	60	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	23PFCB120	120	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
B	23PFCB245	245	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
	23PFCB365	365	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
	23PFCB570	570	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF

500V AC Input DIP Switch S15 Configuration

Frame	Field Controller Cat. No.	Current Rating (Amps)	S15-1	S15-2	S15-3	S15-4	S15-5	S15-6	S15-7	S15-8
A	23PFCD017	17	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
	23PFCD060	60	ON	OFF	OFF	OFF	OFF	OFF	ON	OFF
	23PFCD120	120	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF
B	23PFCD245	245	ON	ON	OFF	OFF	OFF	OFF	ON	OFF
	23PFCD365	365	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF
	23PFCD570	570	ON	OFF	ON	OFF	OFF	OFF	ON	OFF

Install the Fiber-optic Option Module

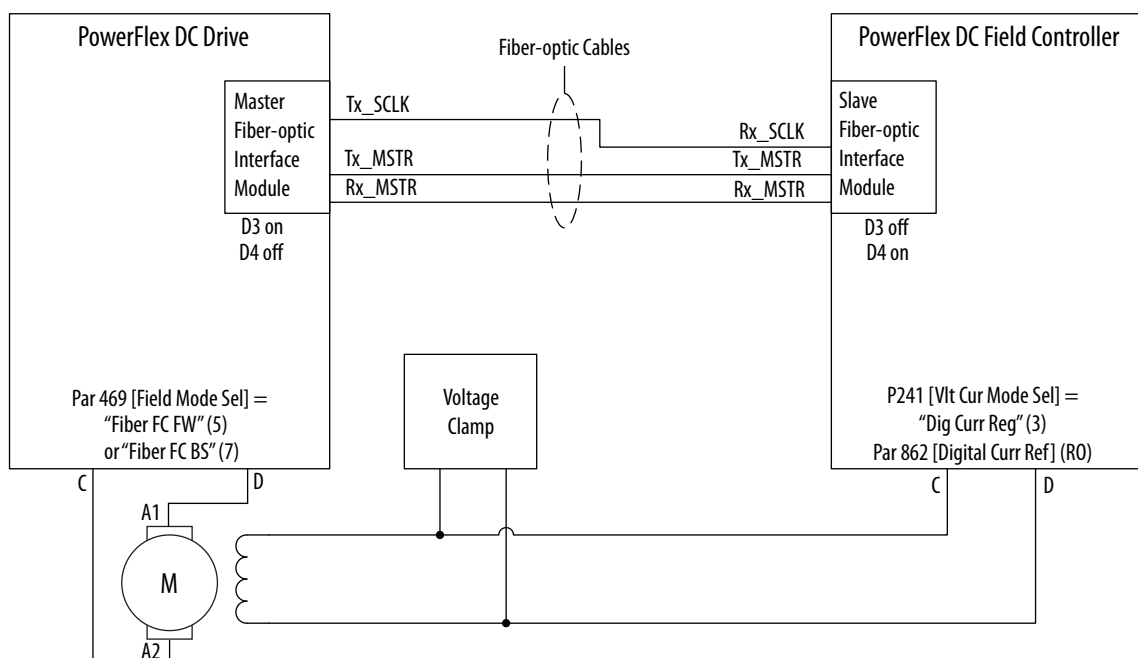
The Fiber-optic Interface option module (cat. no. 20P-S5H781) provides transmission of the reference, feedback, and status signals between a PowerFlex DC drive or PowerFlex DC Standalone Regulator (SAR) and the field controller.

For instructions on how to install and connect the fiber-optic interface option module into the PowerFlex DC Field Controller, see the PowerFlex DC Fiber-optic Interface Option-module Installation Instructions, publication [20P-IN078](#). For parameter configuration and startup information, see the PowerFlex DC Field Controller Programming Manual, publication [23PFC-PM001](#).

When a Fiber-optic Interface module is not used, you can use digital I/O to provide transmission of the reference, feedback, and status signals between a PowerFlex DC Field Controller and a PowerFlex DC drive or SAR. See Digital I/O Connections for PowerFlex DC Drive or SAR Interface with a Field Controller on page [36](#) for more information.

The PowerFlex DC drive or SAR and field controller are connected using the Fiber-optic Interface board and fiber-optic cables as shown in this illustration.

PowerFlex DC Drive to PowerFlex DC Field Controller Fiber-optic Connections



Install a Communication Adapter

For instructions on how to install a communication adapter, see Appendix E in the PowerFlex Digital DC Drive User Manual, publication [20P-UM001](#).

Install an Optional Analog and Digital I/O Expansion Circuit Board

For instructions on how to install an analog and digital I/O expansion circuit board, see Appendix F in the PowerFlex Digital DC Drive User Manual, publication [20P-UM001](#).

Install an Optional 115V AC to 24V DC I/O Converter Circuit Board

For instructions on how to install a 115V AC to 24V DC I/O converter circuit board, see Appendix G in the PowerFlex Digital DC Drive User Manual, publication [20P-UM001](#).

I/O Wiring

Observe the following points when installing I/O wiring:

- Use copper wire only.
- Wire with an insulation rating of 600V or greater is recommended.

IMPORTANT I/O terminals that are labeled “(–)” or “Common” are not referenced to earth ground and are designed to reduce common mode interference. Grounding these terminals can cause signal noise.



ATTENTION: An analog input that is configured for current operation and driven from a voltage source could cause component damage. Verify that the switch is properly configured before input signals are applied. See Main Control Circuit Board DIP Switch and Jumper Settings on page [29](#).

I/O Signal and Control Wiring

Eight digital inputs, four digital outputs, three analog inputs, and two analog outputs are available on the standard I/O terminal blocks that are provided with the field controller. One digital input (1...8) must be configured for “Enable” (digital input 4 by default = “Enable”). See [Install the Protective Covers and Route I/O and Control Wires on 39](#) for information on routing I/O signal and control wires.

When a Fiber-optic Interface module is not used, you can use digital I/O to provide transmission of the reference, feedback, and status signals between a PowerFlex DC Field Controller and a PowerFlex DC drive or SAR. See [Digital I/O Connections for PowerFlex DC Drive or SAR Interface with a Field Controller on page 36](#) for more information.

The optional analog and digital I/O expansion circuit board can be installed to provide an additional four digital inputs, four digital outputs, and two analog outputs. See Appendix F of the PowerFlex Digital DC Drive User Manual, publication [20P-UM001](#), for more information.

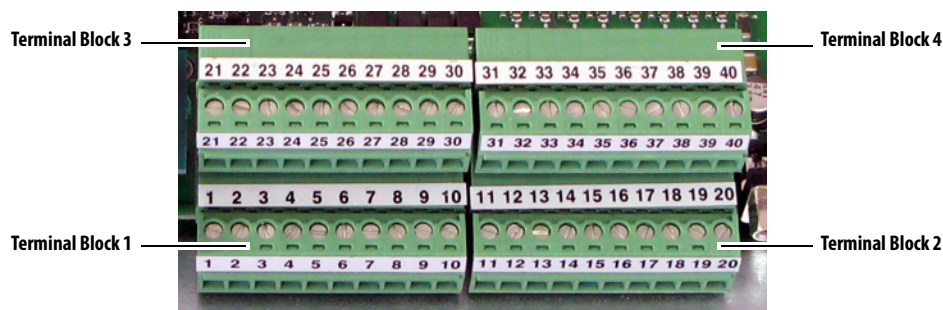
The optional 115V AC converter circuit board can be installed to convert 115V AC digital input signals to 24V DC digital inputs signals. This circuit board can be used to interface with the digital inputs on the standard I/O terminal blocks. See Appendix G in the PowerFlex Digital DC Drive User Manual, publication [20P-UM001](#), for more information.

Analog and Digital I/O Wire Sizes and Terminal Specifications

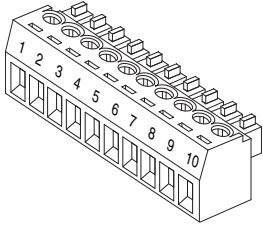
Terminal Block (Terminals)	Wire Size and Type ⁽¹⁾			Recommended Torque N·m (lb·in)
	Flexible (mm ²)	Multi-core (mm ²)	AWG	
TB1...4 (1...40)	0.14...1.50	0.14...1.50	26...16	0.4 (3.5)

(1) See Cable and Wiring Recommendations on page [22](#) for more information.

I/O Terminal Block Locations

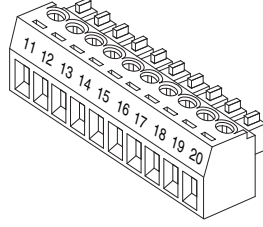


I/O Terminal Block 1 Designations

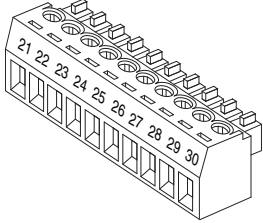
Terminal Block 1	No.	Signal	Description	Factory Default	Config. Parameter
	1	Analog Input 1 (+)	Isolated ⁽¹⁾ , bipolar, differential $\pm 10V / 0 \dots 20 \text{ mA}$ or $4 \dots 20 \text{ mA}$. Important: $0 \dots 20 \text{ mA}$ or $4 \dots 20 \text{ mA}$ operation requires that switch S9, S10, and S11 on the control board be in the "Off" position. Field controller damage can occur if the switch is not in the correct position for the input signal type. See Control Circuit Board Jumper and DIP Switch Settings on page 30. Max $\pm 10V$, Max 0.25 mA .	5 "Current Ref"	70 [Anlg In1 Sel]
	2	Analog Input 1 (-)		0 "Off"	75 [Anlg In2 Sel]
	3	Analog Input 2 (+)			
	4	Analog Input 2 (-)		0 "Off"	80 [Anlg In3 Sel]
	5	Analog Input 3 (+)			
	6	Analog Input 3 (-)			
	7	+10V Pot Reference	2...5 k Ω load. Max $\pm 10V$, 10 mA.	—	—
	8	–10V Pot Reference			
	9	Pot Common	For (+) and (–) 10V pot references.	—	—
	10	PE ground	PE ground to device chassis.	—	—

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

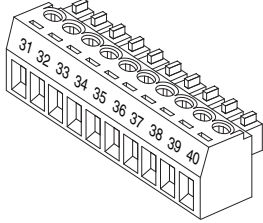
I/O Terminal Block 2 Designations

Terminal Block 2	No.	Signal	Description	Factory Default	Config. Parameter
	11	Internal 0V (Gnd)		—	—
	12	Digital Input 1	Max +30V, 15V/3.2 mA, 24V/5 mA, and 30V/6.4 mA. A digital input (1...8) must be configured for "Enable".	2 "Stop/CF"	133 [Digital In1 Sel]
	13	Digital Input 2		3 "Start"	134 [Digital In2 Sel]
	14	Digital Input 3		11 "Jog"	135 [Digital In3 Sel]
	15	Digital Input 4		1 "Enable"	136 [Digital In4 Sel]
	16	Digital Input Common	Important: When the internal +24V DC supply (terminal 19) is used for digital inputs 1...4, you must connect the digital input common (terminal 16) to the +24V supply common (terminal 18).	—	—
	17	Not Used		—	—
	18	24V Supply Common	Common for the internal power supply.	—	—
	19	Internal +24V DC Supply	Field controller supplied +24V DC I/O power. Max. +20...30V, 200 mA The total current draw is the sum of encoder power, digital outputs, and any other loads that are connected to terminal 19.	—	—
	20	PE ground	PE ground to device chassis.	—	—

I/O Terminal Block 3 Designations

Terminal Block 3	No.	Signal	Description	Factory Default	Config. Parameter
	21	Analog Output 1 (+)	Max. $\pm 10V$, 5 mA.	12 "Volt Fbk"	66 [Anlg Out1 Sel]
	22	Analog Output 1 (-)			
	23	Analog Output 2 (+)		13 "Output Curr"	67 [Anlg Out2 Sel]
	24	Analog Output 2 (-)			
	25	Digital Output Common		—	—
	26	Digital Output 1	Max. +30V, 50 mA	5 "Ready"	145 [Digital Out1 Sel]
	27	Digital Output 2		9 "Fault"	146 [Digital Out2 Sel]
	28	Digital Output 3		2 "Vlt Thresh"	147 [Digital Out3 Sel]
	29	Digital Output 4		4 "CurrentLimit"	148 [Digital Out4 Sel]
	30	Digital Output +24VDC Source	Tie point for the internal supply or customer supplied voltage for the digital outputs. See the Digital and Analog I/O Wiring Examples for sourcing digital outputs on page 36 for more information. Max. +30V DC, 80 mA. Important: When the internal +24V DC supply (terminal 19) is used for digital outputs 1...4, you must connect terminal 19 to terminal 30 and the digital output common (terminal 25) to the +24V supply common (terminal 18).	—	—

I/O Terminal Block 4 Designations

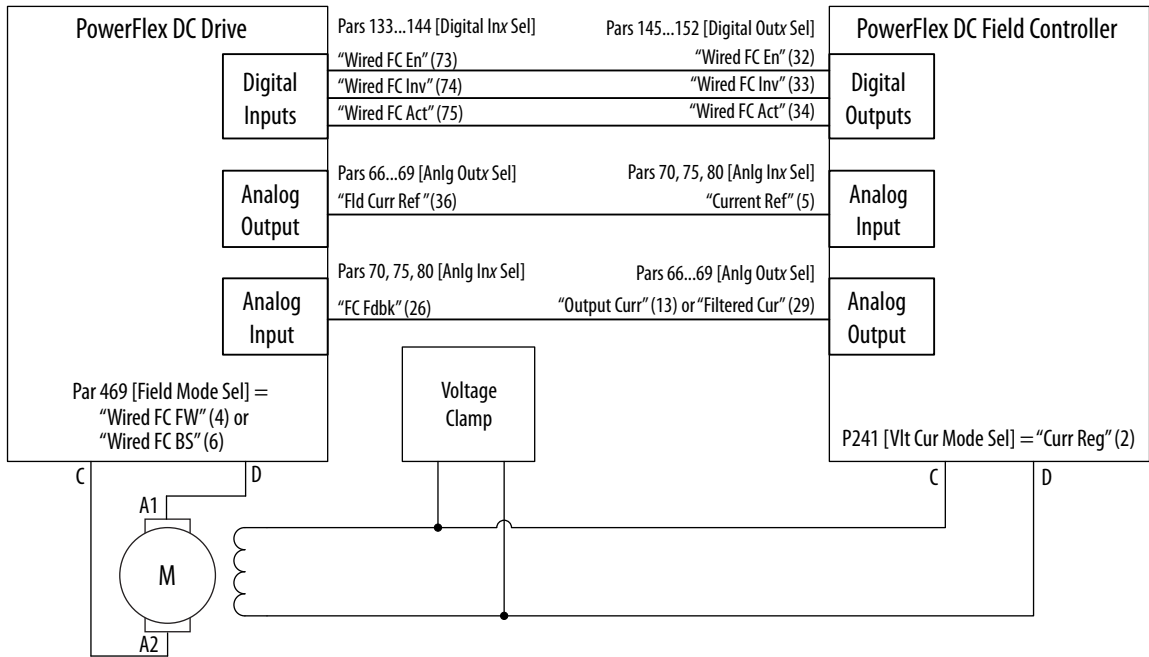
Terminal Block 4	No.	Signal	Description	Factory Default	Config. Parameter
	31	Digital Input 5	Max +30V, 15V/3.2 mA, 24V/5 mA, and 30V/6.4 mA. A digital input (1...8) must be configured for "Enable".	17 "Volt Sel 1"	137 [Digital In5 Sel]
	32	Digital Input 6		18 "Volt Sel 2"	138 [Digital In6 Sel]
	33	Digital Input 7		19 "Volt Sel 3"	139 [Digital In7 Sel]
	34	Digital Input 8		31 "Contactor"	140 [Digital In8 Sel]
	35	Digital Input Common	Important: When the internal +24V DC supply (terminal 19) is used for digital inputs 5...8, you must connect the digital input common (terminal 35) to the +24V supply common (terminal 18).	—	—
	36 ... 40	Not Used		—	—

Digital I/O Connections for PowerFlex DC Drive or SAR Interface with a Field Controller

The PowerFlex DC drive or SAR and field controller are connected using digital and analog I/O as shown in this illustration and by making these connections:

- Connect terminal 25 (TB3 - I/O common) on the PowerFlex DC Field Controller to terminal 25 (TB3 - I/O common) on the PowerFlex DC drive.
- Connect terminal 19 (TB2 - internal 24V DC supply) to terminal 30 (TB3 - digital output +24V DC source) on the PowerFlex DC Field Controller.

PowerFlex DC Drive to PowerFlex DC Field Controller I/O Connections



Digital and Analog I/O Wiring Examples

Input/output	Connection Example	Required Parameter Changes
Potentiometer Unipolar Reference 10 kΩ Pot. Recommended (2 kΩ Minimum)		• Adjust Scaling: Configure for Voltage or Current: 71 [Anlg In1 Config] 72 [Anlg In1 Scale] and 73 [Anlg1 Tune Scale] • View Signal Value: 1404 [Analog In1 Value] • View Signal Output: 385 [Volt Ref Out] Verify that DIP switch S9 is set to "On" (0...10V). See Control Circuit Board Jumper and DIP Switch Settings on page 30.

Digital and Analog I/O Wiring Examples (continued)

Input/output	Connection Example	Required Parameter Changes
Analog Input Unipolar Reference 0...10V Input, or 0...20 mA or 4...20 mA		- Configure for Voltage or Current: 71 [Anlg In1 Config] - Adjust Scaling: 72 [Anlg In1 Scale] and 73 [Anlg1 Tune Scale] - View Signal Value: 1404 [Analog In1 Value] - View Signal Output: 385 [Volt Ref Out] Verify that DIP switch S9 is set to "On" for 0...10V operation, or "Off" for 0...20 mA or 4...20 mA operation. See Control Circuit Board Jumper and DIP Switch Settings on page 30.
Analog Output Bipolar Signal ±10V Bipolar (based on the signal of the assigned input source - for example Analog Input 1), or 0...10V Unipolar (<i>shown</i>)		- Select Source Value: 66 [Anlg Out1 Sel] - Adjust Scaling: 62 [Anlg Out1 Scale]
Enable Input 24V DC internal supply		No Changes Required. If the digital input used for "Enable" is changed from the default setting of digital input 4, the wiring must be changed accordingly.
2-Wire Control Non-Reversing 24V DC internal supply Important: Programming inputs for 2-wire control deactivates the HIM Start and Jog buttons.		- Disable Digital Input 1: 133 [Digital In1 Sel] = 0 "Not Used" - Set Digital Input 2: 134 [Digital In2 Sel] = 5 "Run"
2-Wire Control Reversing 24V DC external supply Important: Programming inputs for 2-wire control deactivates the HIM Start and Jog buttons.		- Set Digital Input 1: 133 [Digital In1 Sel] = 6 "Run Forward" - Set Digital Input 2: 134 [Digital In2 Sel] = 7 "Run Reverse"

Digital and Analog I/O Wiring Examples (continued)

Input/output	Connection Example	Required Parameter Changes
3-Wire Control 24V DC internal supply		No Changes Required.
3-Wire Control 24V DC external supply Requires 3-wire functions only ([Digital In1 Sel]). Configuring 2-wire selections cause a type 2 alarm.		No Changes Required
Sourcing Digital Outputs Internal 24V DC supply		No Changes Required
Sourcing Digital Outputs External 24V DC supply		No Changes Required

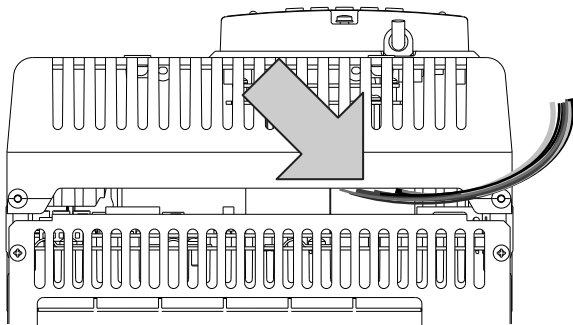
Install the Protective Covers and Route I/O and Control Wires



ATTENTION: Do not operate the field controller with the protective covers removed. Operation with the protective covers removed can result in a hazardous condition that could cause personal injury and/or equipment damage.

Install the protective covers on the field controller. See Remove the Covers on page 12. Route all I/O and control wires from the bottom of the field controller, between the lower front cover and the terminal cover.

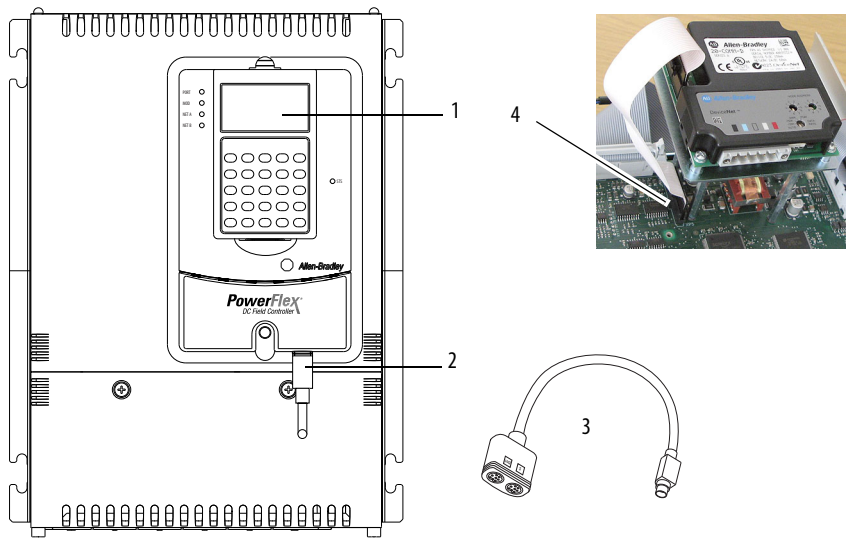
Frame A Shown



Connect the Human Interface Module

The human interface module (HIM) is ordered separately. See the PowerFlex Digital DC Drive Technical Data, [20P-TD001](#), for more information on HIM options and catalog numbers.

The PowerFlex DC Field Controller provides these HIM cable connection points (frame A shown).



No.	Connector	Description
1	DPI Port 1	HIM connection when installed in cover.
2	DPI Port 2	DPI cable connection for hand-held and remote options.
3	DPI Port 3 or 2	Splitter cable that is connected to DPI Port 2 provides additional port.
4	DPI Port 5	Cable connection for communication adapter (shown with front cover removed).

Remove and Install the HIM

The HIM can be removed or installed while the field controller is powered.

IMPORTANT HIM removal is only permissible in Auto mode. If the HIM is removed while in Manual mode or the HIM is the only remaining control device, a fault occurs. See the PowerFlex DC Field Controller Programming Manual, publication [20PFC-PM001](#), for more information on how to use the HIM and fault and alarm indications.

Step	Example Display
To remove the HIM, follow these steps. 1. Press ALT and then  (Remove). The 'Remove HIM' confirmation screen appears. 2. To confirm that you want to remove the HIM, press . 3. Remove the HIM from the cradle on the field controller. 4. To install the HIM, insert it into the cradle on the field controller or connect the DPI cable.	Remove Op Intrfc: Press Enter to Disconnect Op Intrfc? (Port 1 Control)

Additional Resources

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

Resource	Description
PowerFlex Digital DC Drive Technical Data, publication 20P-TD001	Provides detailed information on: • Basic product selection • Field controller specifications • Option specifications • Circuit protection
PowerFlex DC Fiber-optic Interface Option Module Installation Instructions, publication 20P-IN078	Provides installation instructions for the PowerFlex DC fiber-optic interface module.
PowerFlex DC Field Controller Voltage Clamp Installation Instructions, publication 23PFC-IN002	Provides Installation Instructions for the PowerFlex DC controller voltage clamp installation instructions.
PowerFlex DC Field Controller Programming Manual, publication 23PFC-PM001	Provides information on how to start up, program, and troubleshoot the PowerFlex DC Field Controller.
PowerFlex Digital DC Drive - Frame A Hardware Service Manual, publication 20P-TG001	Provides hardware test procedures and spare parts replacement instructions for Frame A PowerFlex DC drives and field controllers.
PowerFlex Digital DC Drive - Frame B Hardware Service Manual, publication 20P-TG002	Provides hardware test procedures and spare parts replacement instructions for Frame B PowerFlex DC drives and field controllers.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.rockwellautomation.com/global/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

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

Notes:

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	https://rockwellautomation.custhelp.com/
Local Technical Support Phone Numbers	Locate the phone number for your country.	http://www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	http://www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	http://www.rockwellautomation.com/global/literature-library/overview.page
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	http://www.rockwellautomation.com/global/support/pcdc.page

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At the end of its life, collect this equipment separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental information on its website at <http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page>.

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