Installation Instructions

PowerFlex® 700 Adjustable Frequency AC Drive

Frames 7…10
160…500 kW (250…700 Hp)

When reading this document, look for this symbol " **Step x** " to guide you through the 5 BASIC STEPS needed to install and perform a Basic Start-Up of the PowerFlex 700 Frames 7…10. A Human Interface Module (HIM) is required to perform the Basic Start-Up routine covered in this manual.

The information provided Does Not replace the User Manual and is intended for qualified drive service personnel only.

For detailed PowerFlex 700 information including advanced start-up routines, programming, application considerations and related precautions, refer to the following publications online at **www.rockwellautomation.com/literature**:

Title	Publication
PowerFlex 700 Series B User Manual	20B-UM002
PowerFlex Comm Adapter Manuals	20COMM-UM
PowerFlex 70 Enhanced Control and PowerFlex 700 Vector Control Reference Manual	PFLEX-RM004
Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives	DRIVES-IN001

To order paper copies of technical documentation, contact your local Rockwell Automation distributor or sales representative.

To find your local Rockwell Automation distributor, visit **www.rockwellautomation.com/locations**

Allen-Bradley Drives Technical Support

Use the contacts below for PowerFlex 700 technical support including spare parts information.

Online at...	By Email at...	By Telephone at...
www.ab.com/support/abdrives	support@drives.ra.rockwell.com	262-512-8176

Rockwell Automation

Documentation in Other Languages

User Manuals are available in multiple languages at:
http://www.rockwellautomation.com/literature.

Select publication language and type “20B-UM002” in the search field.

Table of Contents

Catalog Number Explanation

Position	1-3	4	5-7	8	9	10	11	12	13	14	15	16	17-18	19-20
	20B	D	325	A	3	A	N	N	N	R	C	0		
	a	b	c	d	e	f	g	h	i	j	k	l	m	n

a

Drive	
Code	**Type**
20B	PowerFlex 700

b

Voltage Rating				
Code	**Voltage**	**Ph.**	**Prechg.**	**Frames**
C	400V AC	3	-	7…10
D	480V AC	3	-	7…10
H	540V DC	-	N	10
J	650V DC	-	N	10
P	540V DC	-	Y	7…9
R	650V DC	-	Y	7…9

c

ND Rating §			
400/480V, 60 Hz Input			
Code	**Amps**	**Hp**	**Frame**
292	292	250	7
325	325	250	7
365	365	300	8
415	415	350	8
481	481	400	8
535	535	450	8
600	600	500	8
730	730	600	9
875	875	700	10

§ Refer to the Rating Tables for further information.

d

Enclosure	
Code	**Enclosure**
A	IP20, NEMA/UL Type 1
N	Open/Flange Mount Front: IP00, NEMA/UL Type Open Back/Heatsink: IP54, NEMA 12
U	Roll-In Front: IP00, NEMA/UL Type Open Back/Heatsink: IP54, NEMA 12 Frames 8 & 9 Only

e

HIM	
Code	**Operator Interface**
0	Blank Cover
3	Full Numeric LCD - Drive Mounted
5	Prog. Only LCD - Drive Mounted

f

Documentation	
Code	**Type**
A	Manual
N	No Manual
Q	No Shipping Package (Internal Use Only)

g

Brake	
Code	**w/Brake IGBT ❄**
N	No

❄ Not available on Frames 7-10.

h

Internal Braking Resistor	
Code	**w/Resistor ❄**
N	No

❄ Not available on Frames 7-10.

i

Emission		
Code	**CE Filter ‡**	**CM Choke**
N	No	No

‡ Frames 7…10, 400/480V AC drives (Voltage Rating codes "C" and "D") meet CE certification requirements when installed per recommendations on page 7.

j

Comm Slot	
Code	**Network Type**
B	BACnet MS/TP
C	ControlNet (Coax)
D	DeviceNet
E	EtherNet/IP
R	Remote I/O
S	RS-485 DF1
N	None

k

Control & I/O		
Code	**Control**	**I/O Volts**
C	Vector ♣	24V DC
D	Vector ♣	115V AC

♣ Vector Control Option utilizes DPI Only.

l

Feedback	
Code	**Type**
0	None
1	Encoder, 12V/5V

m

Future Use

n

Future Use

Step 1 Read the Precautions and General Information

Qualified Personnel

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

Personal Safety

ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the +DC and –DC terminals of the Power Terminal Block (refer to pages 8 through 12 for location). The voltage must be zero.

ATTENTION: Risk of injury or equipment damage exists. DPI or SCANport host products must not be directly connected together via 1202 cables. Unpredictable behavior can result if two or more devices are connected in this manner.

ATTENTION: The drive start/stop/enable control circuitry includes solid state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional hardwired stop circuit may be required to remove the AC line to the drive. An auxiliary braking method may be required.

ATTENTION: Loss of control in suspended load applications can cause personal injury and/or equipment damage. Loads must always be controlled by the drive or a mechanical brake. Parameters 600…611 are designed for lifting/torque proving applications. It is the responsibility of the engineer and/or end user to configure drive parameters, test any lifting functionality and meet safety requirements in accordance with all applicable codes and standards.

Product Safety

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

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

ATTENTION: An incorrectly applied or installed bypass system can result in component damage or reduction in product life. The most common causes are:

- Wiring AC line to drive output or control terminals.
- Improper bypass or output circuits not approved by Allen-Bradley.
- Output circuits which do not connect directly to the motor.

Contact Allen-Bradley for assistance with application or wiring.

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

ATTENTION: The “adjust freq” portion of the bus regulator function is extremely useful for preventing nuisance overvoltage faults resulting from aggressive decelerations, overhauling loads, and eccentric loads. It forces the output frequency to be greater than commanded frequency while the drive's bus voltage is increasing towards levels that would otherwise cause a fault. However, it can also cause either of the following two conditions to occur.

1. Fast positive changes in input voltage (more than a 10% increase within 6 minutes) can cause uncommanded positive speed changes. However an “OverSpeed Limit” fault (F25) will occur if the speed reaches [Maximum Speed] + [Overspeed Limit], (parameters 82 and 83). If this condition is unacceptable, action should be taken to 1) limit supply voltages within the specification of the drive and, 2) limit fast positive input voltage changes to less than 10%. Without taking such actions, if this operation is unacceptable, the “adjust freq” portion of the bus regulator function must be disabled (see parameters 161 and 162).
2. Actual deceleration times can be longer than commanded deceleration times. However, a “Decel Inhibit” fault (F24) is generated if the drive stops decelerating altogether. If this condition is unacceptable, the “adjust freq” portion of the bus regulator must be disabled (see parameters 161 and 162). In addition, installing a properly sized dynamic brake resistor will provide equal or better performance in most cases.

   Important: These faults are not instantaneous. Test results have shown that they can take between 2…12 seconds to occur.

ATTENTION: To guard against drive damage when using output contactors, the following information must be read and understood. One or more output contactors may be installed between the drive and motor(s) for the purpose of disconnecting or isolating certain motors/loads. If a contactor is opened while the drive is operating, power will be removed from the respective motor, but the drive will continue to produce voltage at the output terminals. In addition, reconnecting a motor to an active drive (by closing the contactor) could produce excessive current that may cause the drive to fault. If any of these conditions are determined to be undesirable or unsafe, an auxiliary contact on the output contactor should be wired to a drive digital input that is programmed as "Enable." This will cause the drive to execute a coast-to-stop (cease output) whenever an output contactor is opened.

EMC Compliance

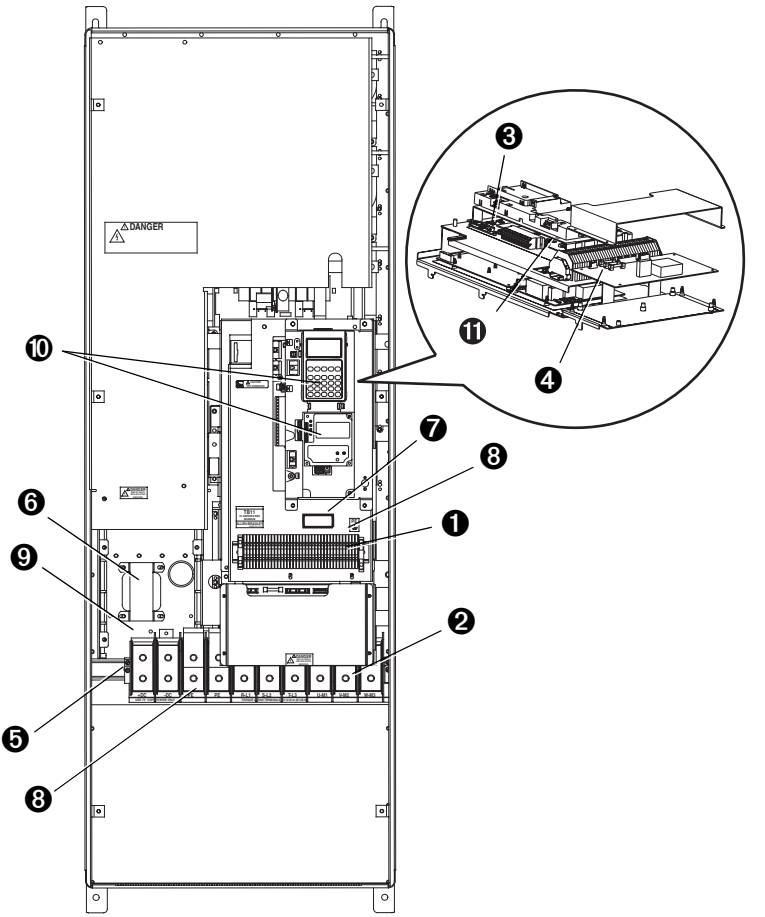
Frame 7…10 drives are CE Certified for use with 400V AC and 480V AC center grounded neutral power supply systems only.

The "General Grounding Requirements" (refer to page 33) must be followed for CE Compliance.

It is strongly recommended that the *PowerFlex 700 User Manual* (publication 20B-UM002) and the *Wiring and Grounding Guidelines for PWM Drives* (publication DRIVES-IN001) be referenced to assure CE EMC compliance.

Component Locations

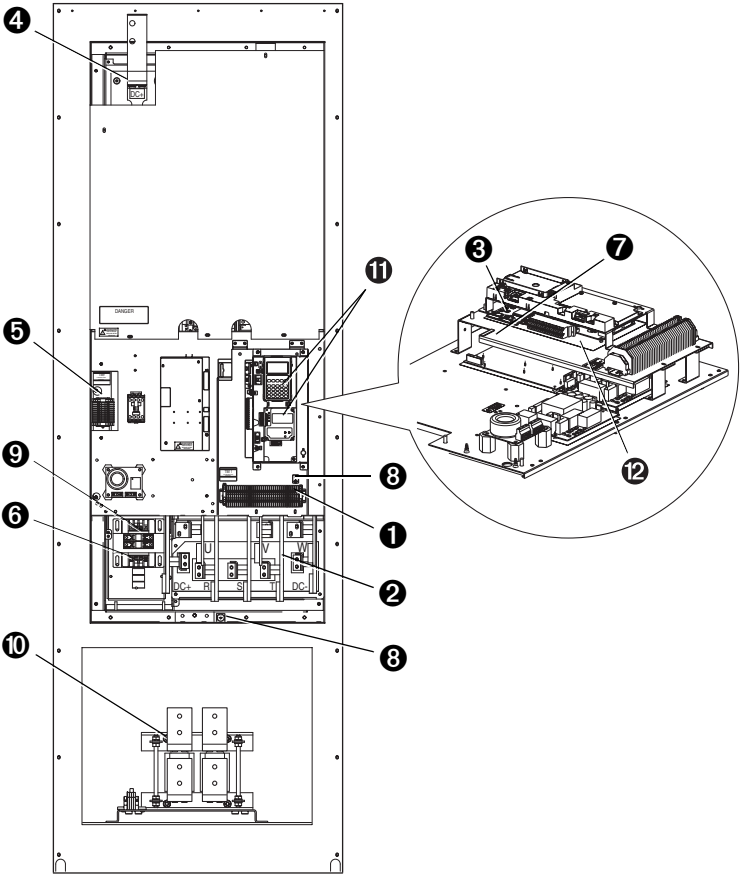
Frame 7 Component Locations



No.	Component
❶	I/O & Auxiliary Control Voltage - TB11
❷	Power Terminal Block
❸	Main Control Board
❹	Precharge Board
❺	Fan Terminal Block (DC input only)
❻	Fan Transformer (AC input only)

No.	Component
❼	Nameplate
❽	PE Ground
❾	MOV
❿	HIM/Comm Module (Optional)
❶❶	Encoder Feedback Board (Optional)

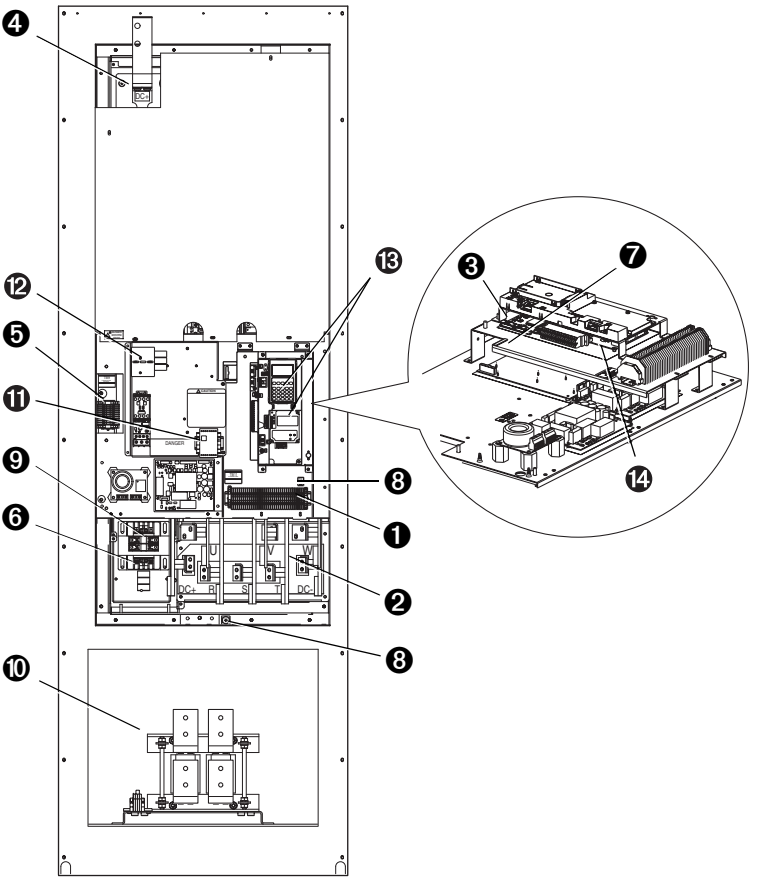
Frame 8 Component Locations



No.	Component
❶	I/O & Auxiliary Control Voltage - TB11
❷	Power Terminals
❸	Main Control Board
❹	DC Bus/Brake Terminals
❺	Fan Terminal Block - TB9
❻	Fan Transformer (AC input only)

No.	Component
❼	Nameplate
❽	PE Ground (and MOV wire)
❾	MOV (located under boards)
❿	DC Link Choke (AC input only)
⓫	HIM/Comm Module (Optional)
⓬	Encoder Feedback Board (Optional)

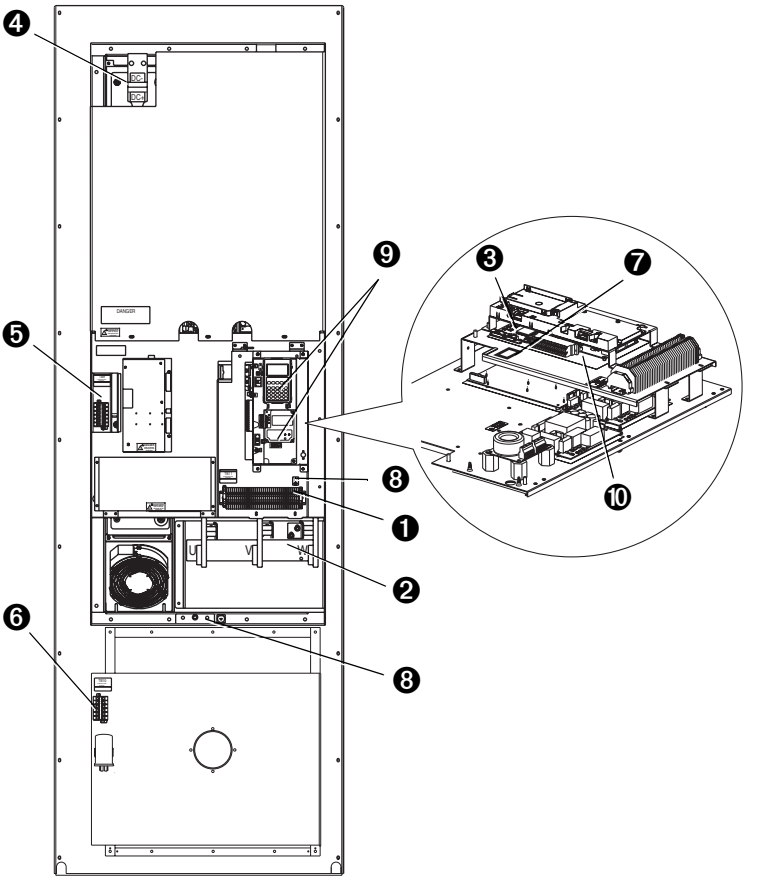
Frames 9 Component Locations



No.	Component
❶	I/O & Auxiliary Control Voltage - TB11
❷	Power Terminals
❸	Main Control Board
❹	DC Bus/Brake Terminals
❺	Fan Terminal Block (cap. fan) - TB9
❻	Fan Transformer (cap. fan) - AC input only
❼	Nameplate

No.	Component
❽	PE Ground (and MOV wire)
❾	MOV (located under boards)
❿	DC Link Choke (AC input only)
⓫	Phase Monitor
⓬	Blower Terminal Block (three-phase)
⓭	HIM/Comm Module (Optional)
⓮	Encoder Feedback Board (Optional)

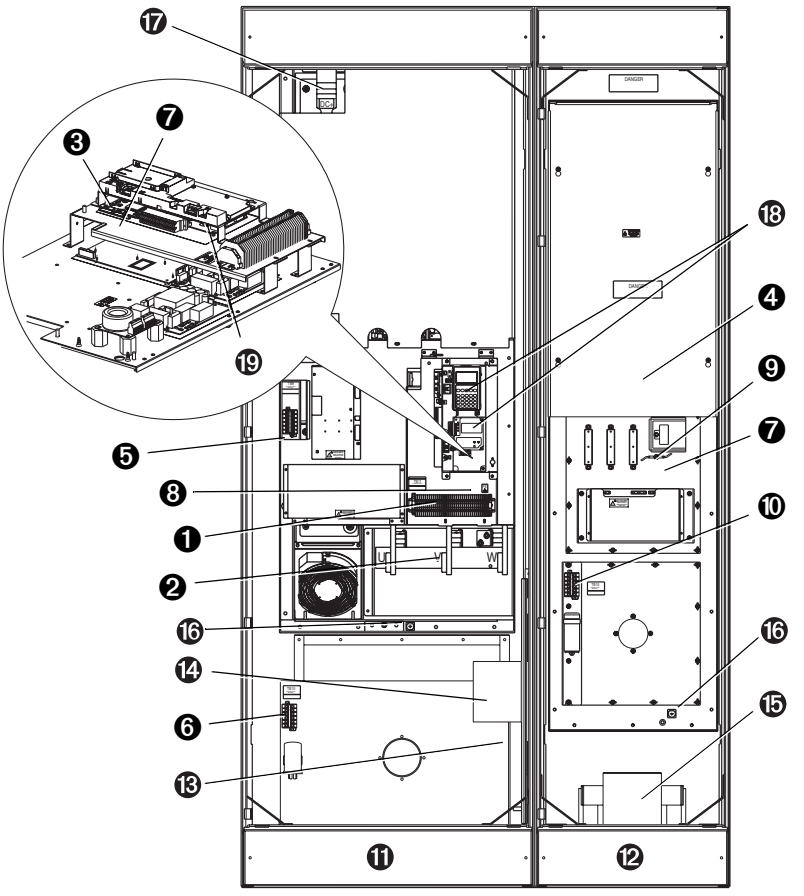
Frame 10 DC Input Component Locations



No.	Component
❶	I/O & Auxiliary Control Voltage - TB11
❷	Motor Terminal Block
❸	Main Control Board
❹	DC Bus/Brake Terminals
❺	Fan Terminal Block - TB9 (Capacitor Assembly Fan)

No.	Component
❻	Fan Terminal Block - TB10 (Heatsink Fan)
❼	Nameplate
❽	PE Ground
❾	HIM/Comm Module (Optional)
❿	Encoder Feedback Board (Optional)

Frame 10 AC Input Component Locations



No.	Component
❶	I/O & Auxiliary Control Voltage - TB11
❷	Motor Terminal Block
❸	Main Control Board
❹	AC Input Terminals (Behind Shield)
❺	Fan Terminal Block - TB9 (Capacitor Assembly Fan)
❻	Fan Terminal Block - TB10 (Heatsink Fan)
❼	Nameplate
❽	PE Ground
❾	MOV Jumper
❿	Fan Terminal Block - TB12 (Heatsink Fan)

No.	Component
⓫	Inverter Section
⓬	Converter Section
⓭	PE Bus Bar (IP20 Only)
⓮	Fan Transformer (IP20 Only)
⓯	DC Link Choke (AC input only, supplied loose for IP00)
⓰	PE Connection Point (IP00)
⓱	DC Bus/Brake Terminals
⓲	HIM/Comm Module (Optional)
⓳	Encoder Feedback Board (Optional)

Step 2 Lifting and Mounting the Drive

Lifting

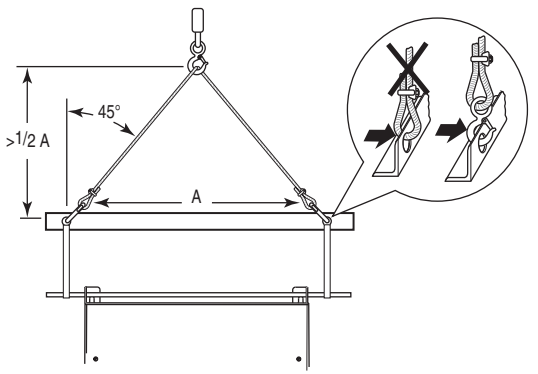
ATTENTION: To guard against possible personal injury and/or equipment damage...

- Do Not allow any part of the drive or lifting mechanism to make contact with electrically charged conductors or components.
- At no time should a person or their limbs be directly underneath the items being lifted.
- Do not subject the load to high rates of acceleration or deceleration.
- Inspect all lifting hardware for proper attachment before lifting drive unit.

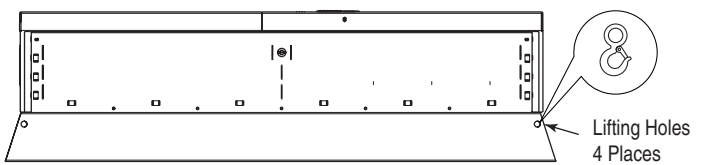
Important: Braces attached to the front of Frame 8, 9 or 10 IP20, NEMA/UL Type 1 drives are required for structural integrity. If necessary, the braces can be removed for wiring, but must be replaced upon completion.

Frame 7 Lifting

IP00, NEMA/UL Type Open	
Approximate Weight	147 kg (324 lbs.) + 26 kg (58 lbs.) for shipping materials

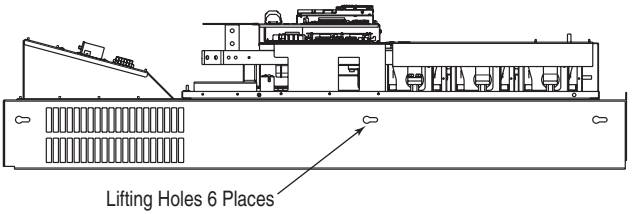


IP20, NEMA/UL Type 1	
Approximate Weight	170 kg (375 lbs.) + 26 kg (58 lbs.) for shipping materials

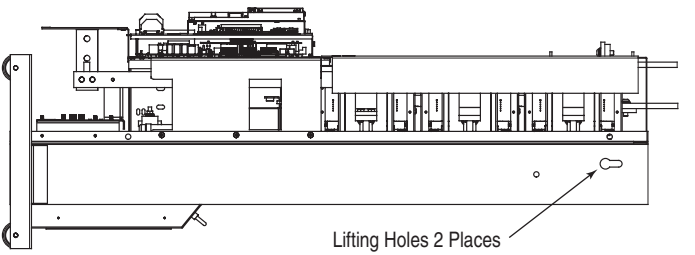


Frames 8, 9 and 10 Lifting

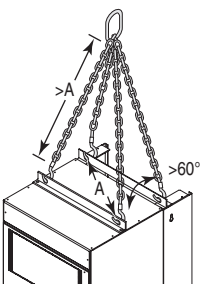
IP00, NEMA/UL Type Open			
Approximate Weight	Frame 8	–	384 kg (847 lbs.) + 47 kg (103 lbs.) for shipping materials
	Frame 9	–	401 kg (884 lbs.) + 47 kg (103 lbs.) for shipping materials
	Frame 10	DC Input	305 kg (672 lbs.) + 47 kg (103 lbs.) for shipping materials
		AC input	532 kg (1172 lbs.) + 91 kg (200 lbs.) for shipping materials



IP00, NEMA/UL Type Open Roll-In			
Approximate Weight	Frame 8	–	250 kg (552 lbs.) + 47 kg (103 lbs.) for shipping materials
	Frame 9	–	267 kg (589 lbs.) + 47 kg (103 lbs.) for shipping materials



IP20, NEMA/UL Type 1			
Approximate Weight	Frame 8	–	509 kg (1122 lbs.) + 47 kg (103 lbs.) for shipping materials
	Frame 9	–	526 kg (1159 lbs.) + 47 kg (103 lbs.) for shipping materials
	Frame 10	DC Input	468 kg (1032 lbs.) + 47 kg (103 lbs.) for shipping materials
		AC input	867 kg (1912 lbs.) + 91 kg (200 lbs.) for shipping materials



Important: a lifting angle must be used. Do Not use the lifting holes on the side of the cabinet

Mounting Considerations

Operating Temperatures

PowerFlex 700 drives are designed to operate at 0…40 °C ambient.

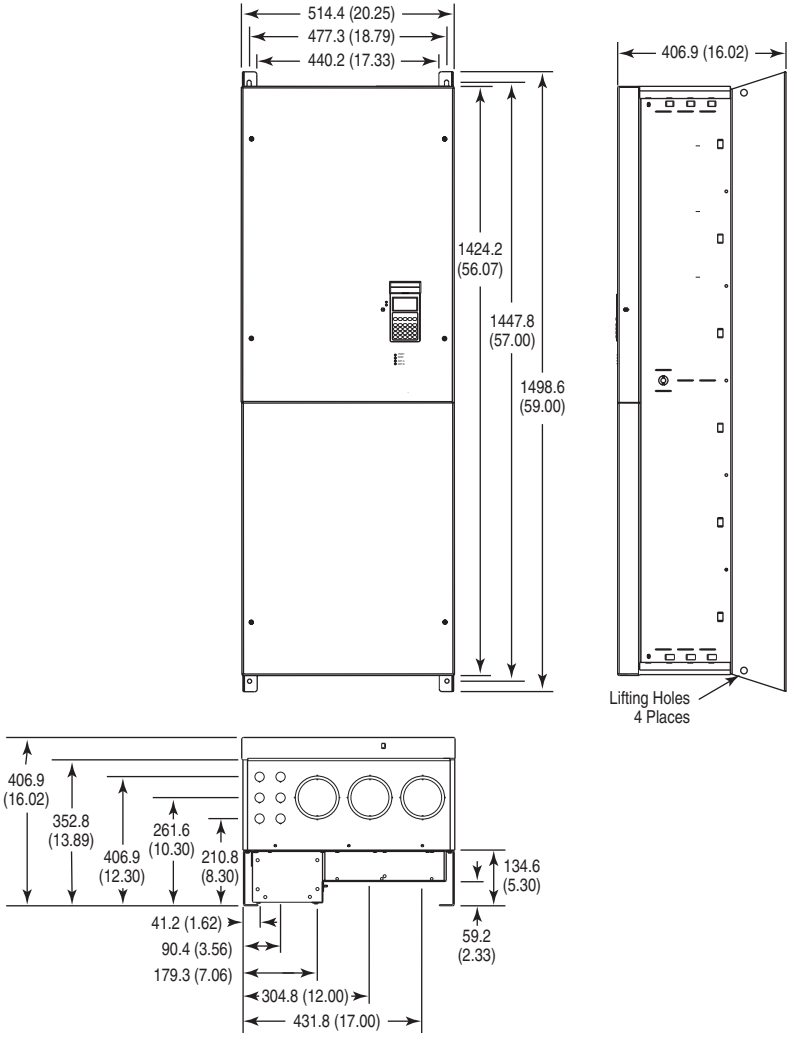
Minimum Mounting Clearances & Heat Dissipation

The drive must be mounted with sufficient space at the top, sides, and front of the cabinet to allow for proper heat dissipation.

Frame	Recommendations
7	Allow a minimum of 152 mm (6.0 in.) at the top and bottom of the enclosure and 102 mm (4.0 in.) on the sides. Flange Mount - Allow a minimum of 152 mm (6.0 in.) at the back of the enclosure (from flange mount surface to wall).
8…10	Allow a minimum of 152 mm (6.0 in.) at the top of the enclosure. Additionally, allow a minimum of 102 mm (4.0 in.) on each side OR 152 mm (6.0 in.) in the back.

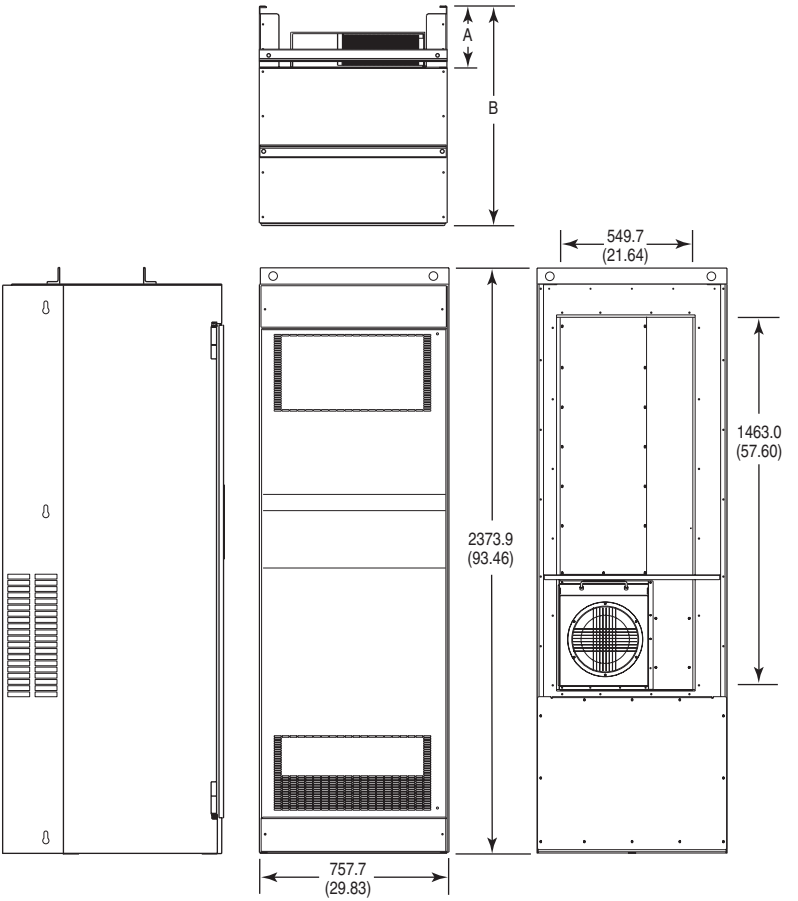
Dimensions

IP20, NEMA/UL Type 1 – Frame 7



Dimensions are in millimeters and (inches) – See page 13 for weights.

IP20, NEMA/UL Type 1 – Frames 8 & 9

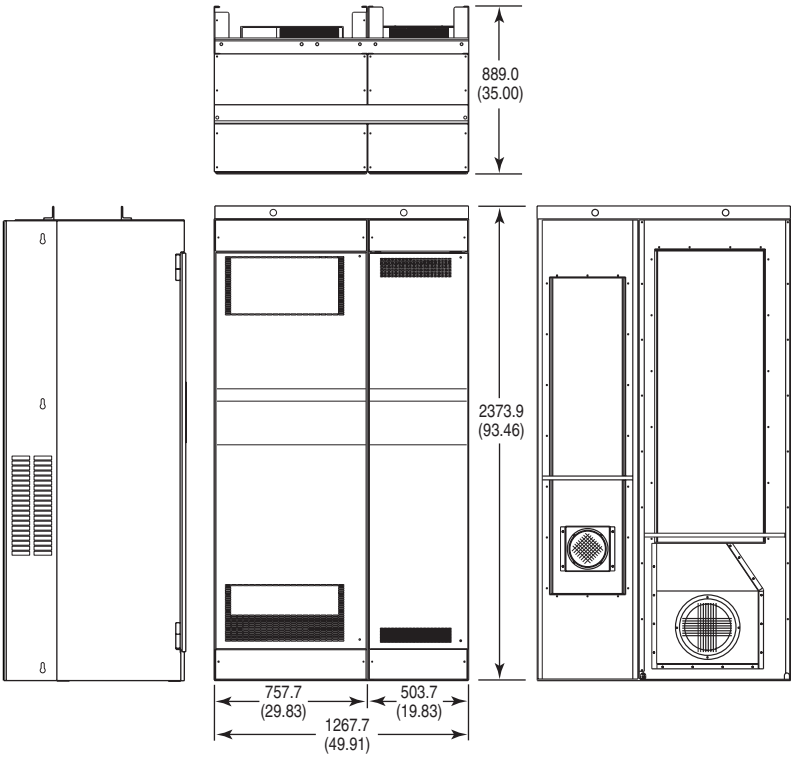


Depth		
Drive Catalog No.	**A** *(Behind Backplane)*	**B** *(Total Depth)*
20Bx365, 415, 481	254.0 (10.00)	889.0 (35.00)
20Bx535, 600, 730	381.0 (15.00)	1016.0 (40.00)

Dimensions are in millimeters and (inches) – See page 14 for weights.

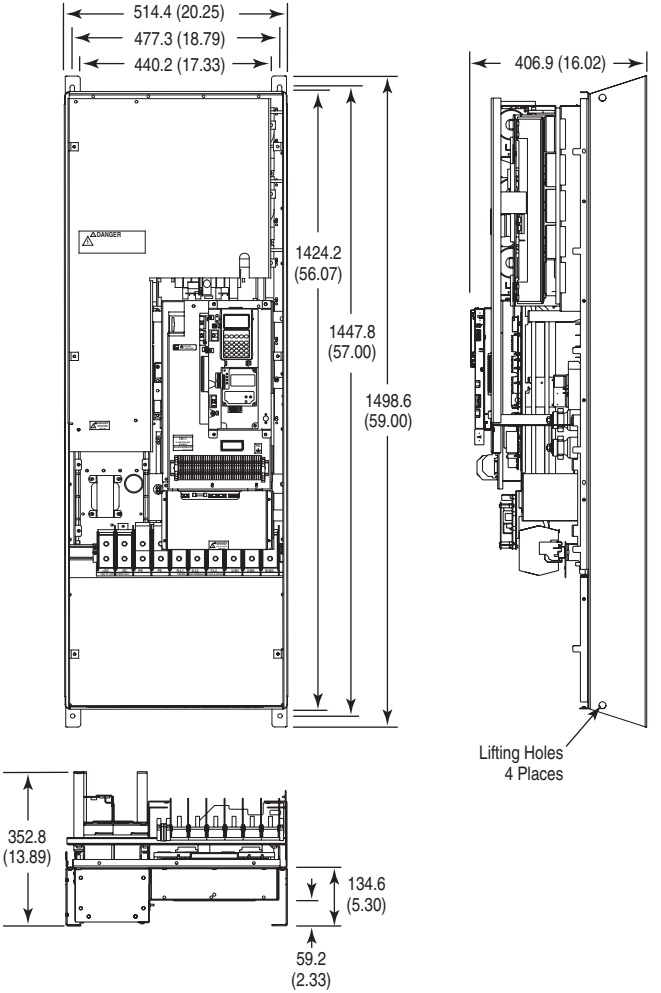
IP20, NEMA/UL Type 1 – Frame 10

AC Input Shown, for DC Input Dimensions use the Inverter (Left) Bay



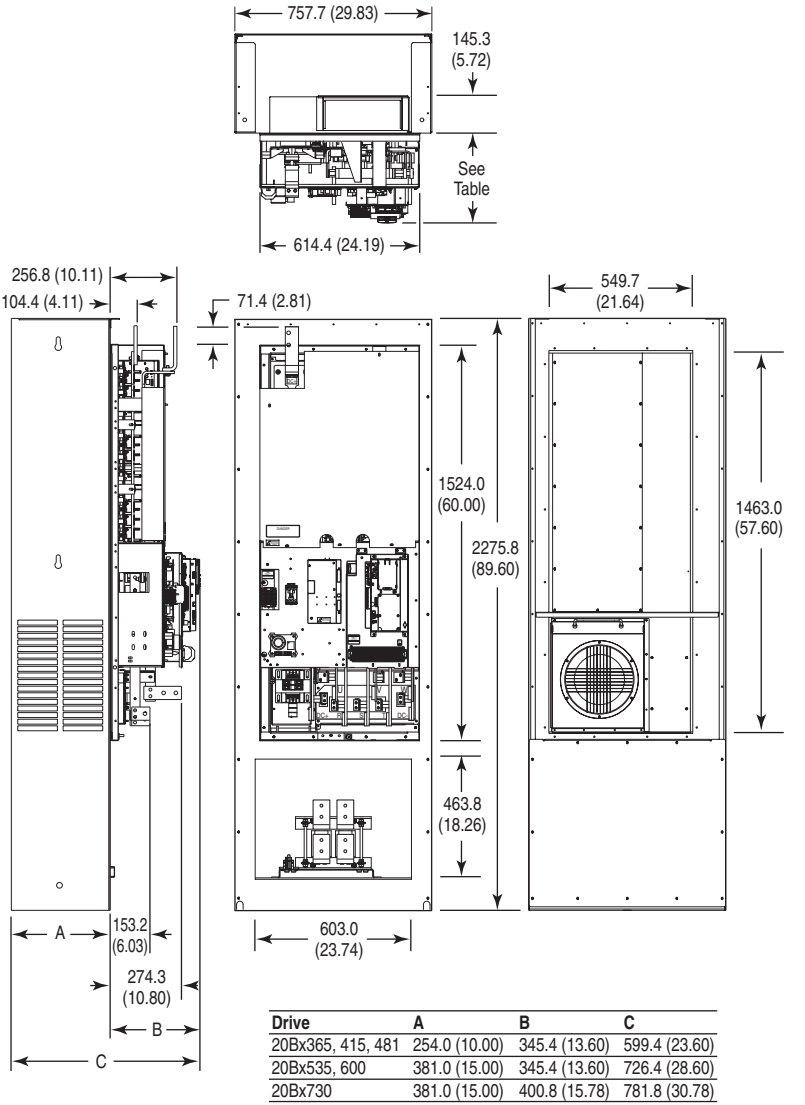
Dimensions are in millimeters and (inches) – See page 14 for weights.

IP00, NEMA/UL Type Open – Frame 7



Dimensions are in millimeters and (inches) – See page 13 for weights.

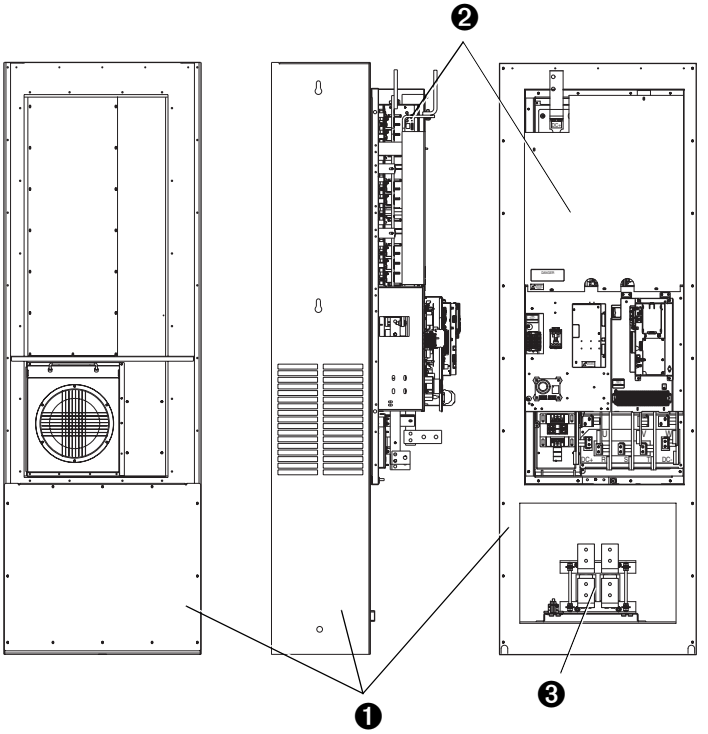
IP00, NEMA/UL Type Open – Frames 8 & 9



Drive	A	B	C
20Bx365, 415, 481	254.0 (10.00)	345.4 (13.60)	599.4 (23.60)
20Bx535, 600	381.0 (15.00)	345.4 (13.60)	726.4 (28.60)
20Bx730	381.0 (15.00)	400.8 (15.78)	781.8 (30.78)

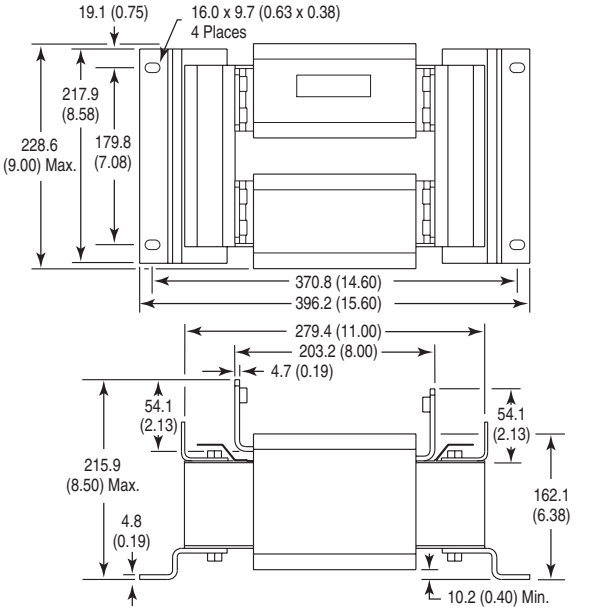
Dimensions are in millimeters and (inches) – See page 14 for weights.

Converting an IP00 Drive for Flange Mounting – Frames 8 & 9

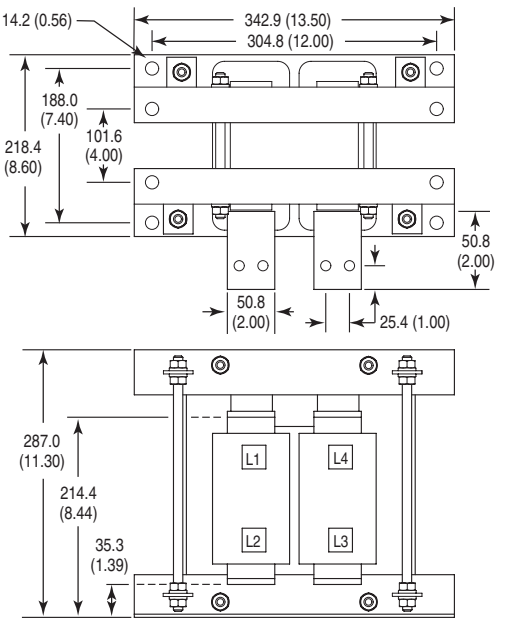


No.	Component
❶	Remove these IP00 enclosure components.
❷	Drive assembly to be flange mounted.
❸	DC link choke - mounts separately in enclosure (see page 22 for dimensions) and is wired directly to drive.

DC Link Choke – Frame 8



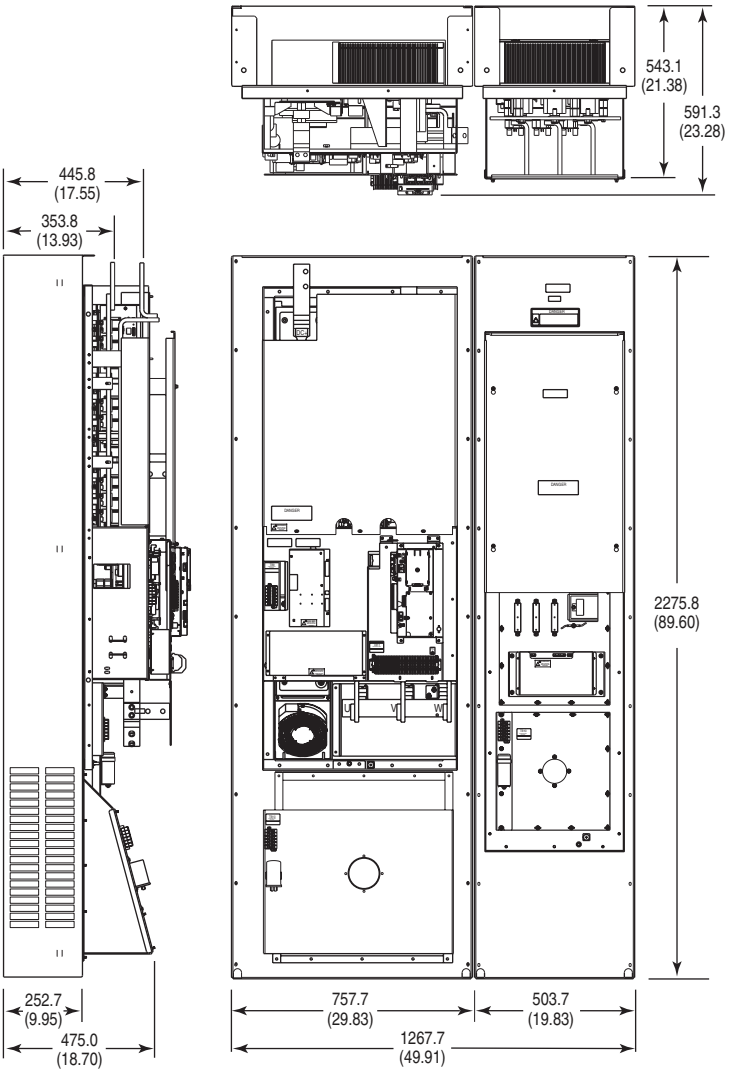
DC Link Choke – Frame 9



Dimensions are in millimeters and (inches)

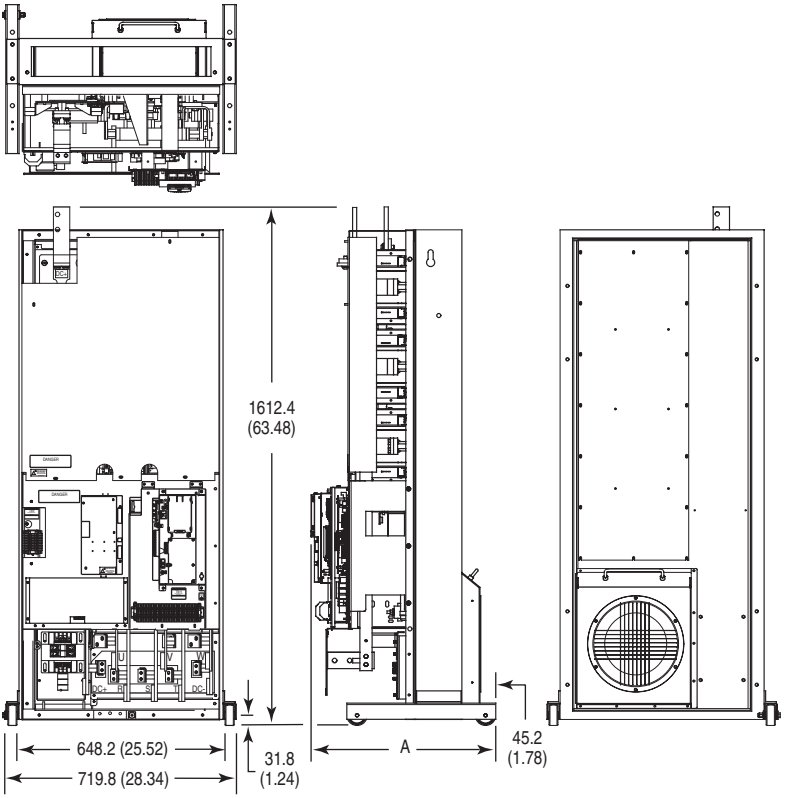
IP00, NEMA/UL Type Open – Frame 10

AC Input Shown, for DC Input Dimensions use the Inverter (Left) Bay



Dimensions are in millimeters and (inches) – See page 14 for weights.

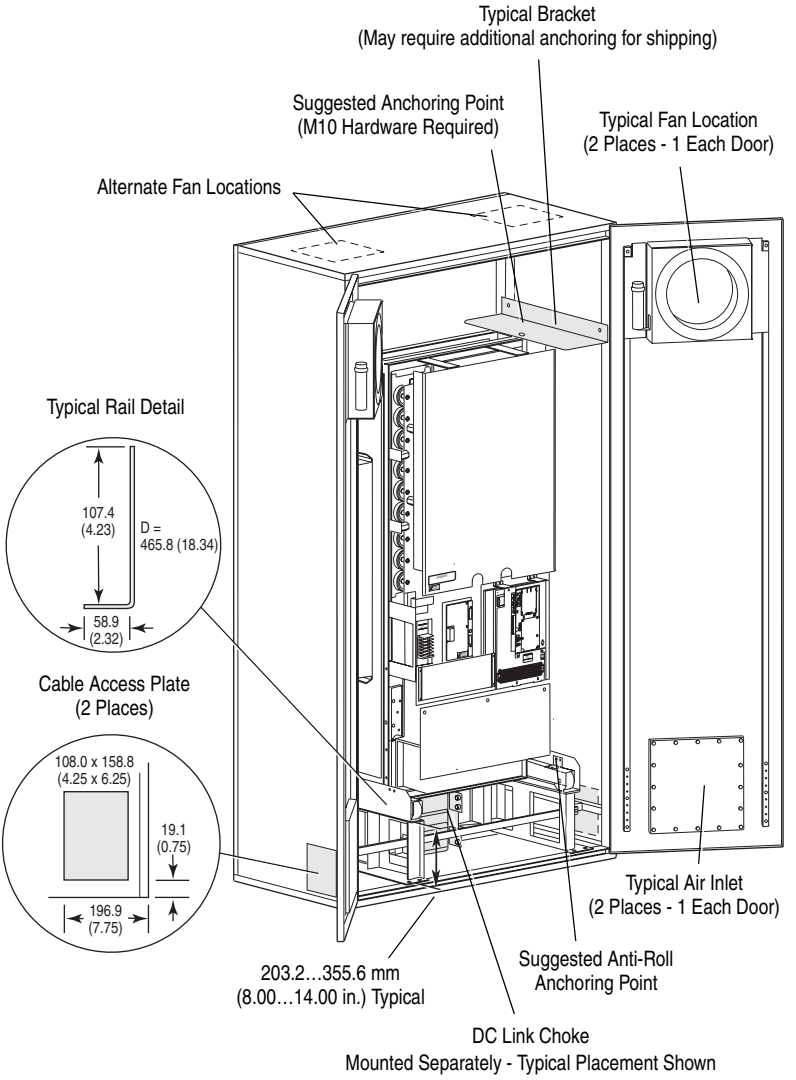
IP00, NEMA/UL Type Open – Frame 8 & 9 Roll-In



Drive	A
20Bx365, 415, 481	574.8 (22.63)
20Bx535, 600	574.8 (22.63)
20Bx730	630.2 (24.81)

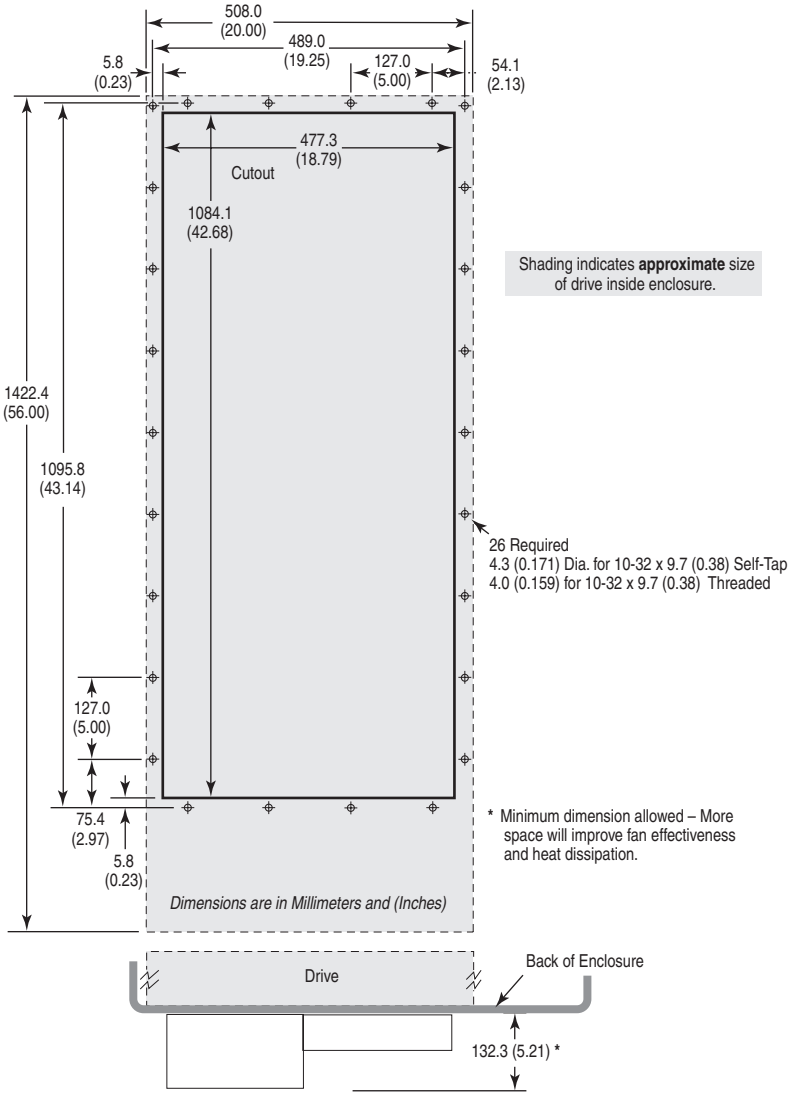
Dimensions are in millimeters and (inches) – See page 14 for weights.

Frame 8 & 9 Roll-In Mounting Considerations



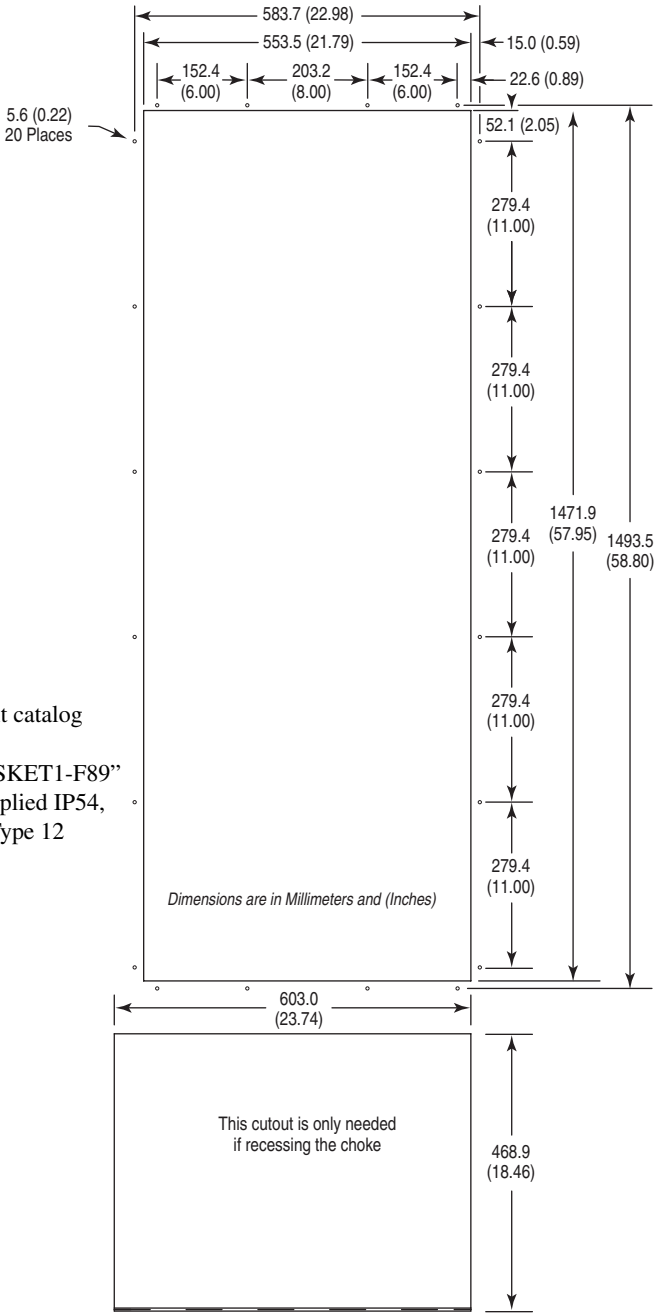
Important: This information illustrates how an open roll-in style drive could be mounted in a user supplied enclosure. Illustrations are only intended to identify structural mounting points and hardware shapes. You must design and fabricate steel components based on the actual mounting configuration, calculated loads and enclosure specifications. Minimum thickness of all parts = 4.6 mm (0.18 in.).

Frame 7 Flange Mount Cutout



Important: Use gasket kit catalog number “SK-G1-GASKET1-F7” with user supplied IP54, NEMA/UL Type 12 enclosure.

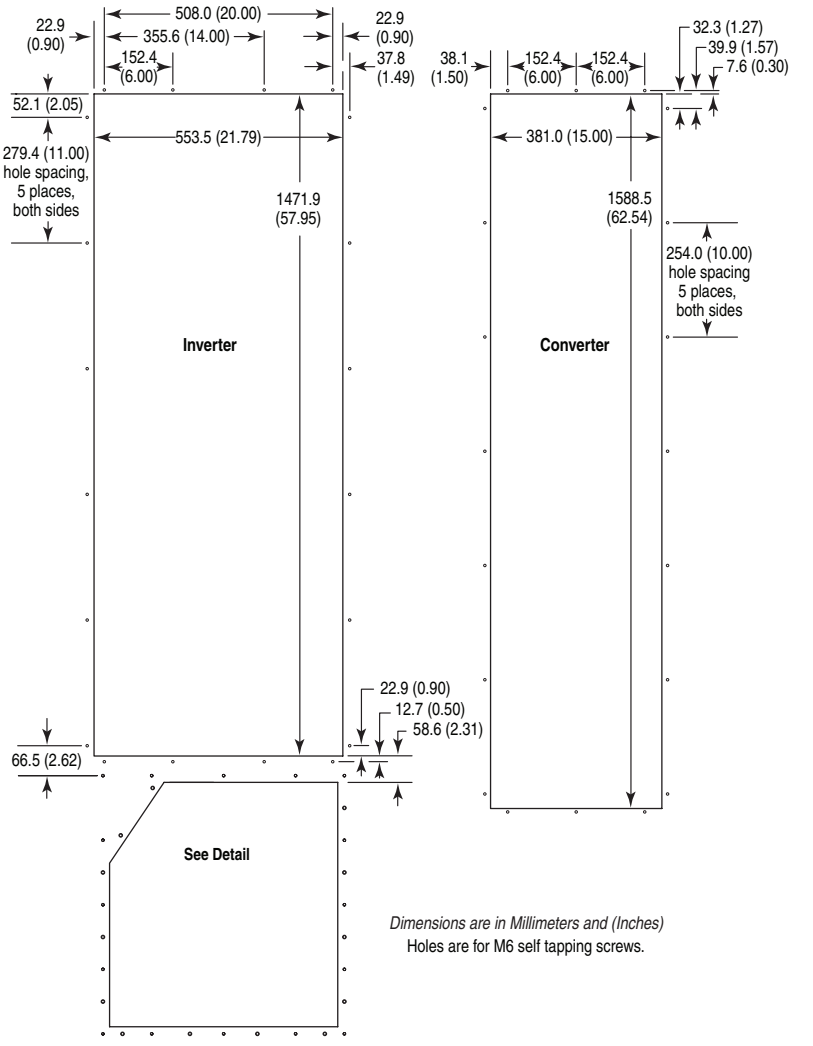
Frame 8 & 9 Flange Mount Cutout



Important:

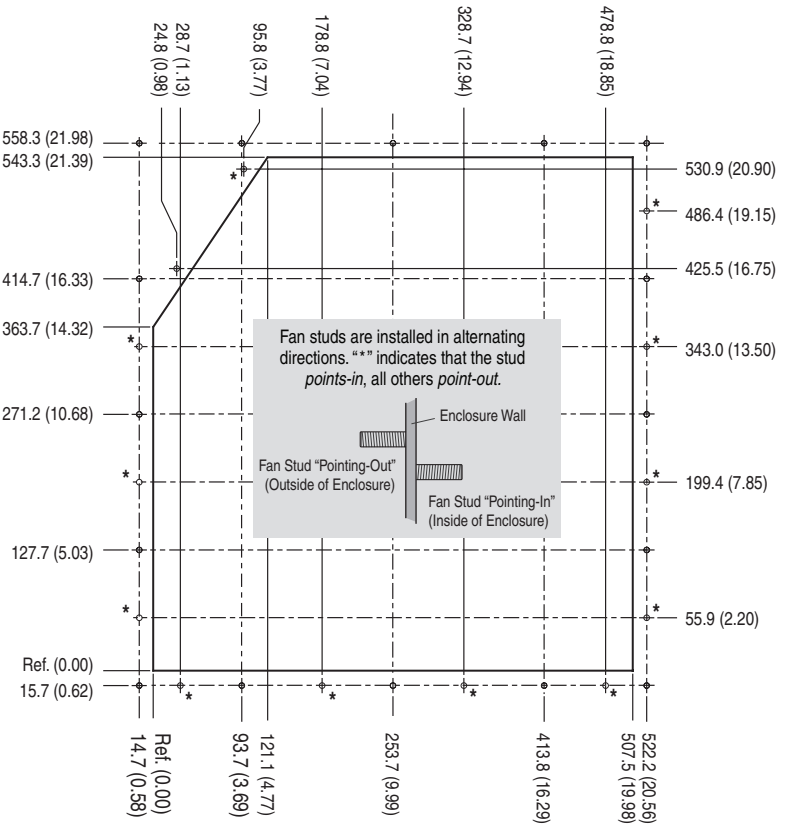
Use gasket kit catalog number "SK-G1-GASKET1-F89" with user supplied IP54, NEMA/UL Type 12 enclosure.

Frame 10 Flange Mount Cutout



Important: Backplate and extension are a single piece. Drive chassis can be removed from backplate to mount in user supplied IP54, NEMA/UL Type 12 enclosure.

Frame 10 Flange Mount Cutout Detail



Dimensions are in millimeters and (inches)

Important: Backplate and extension are a single piece. Drive chassis can be removed from backplate to mount in user supplied IP54, NEMA/UL Type 12 enclosure.

Step 3 Wire the Drive

Special Considerations

PowerFlex 700 drives are suitable for use on a circuit capable of delivering up to a maximum of 200,000 rms symmetrical amperes.

ATTENTION: To guard against personal injury and/or equipment damage caused by improper fusing or circuit breaker selection, use only the recommended line fuses/circuit breakers specified on page 42.

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

Unbalanced, Ungrounded, Resistive or B Phase Grounded Distribution Systems

If phase to ground voltage will exceed 125% of normal line to line voltage or the supply system is ungrounded, refer to the *Wiring and Grounding Guidelines for AC Drives* (publication DRIVES-IN001).

ATTENTION: PowerFlex 700 drives contain protective MOVs that are referenced to ground. These devices must be disconnected if the drive is installed on an ungrounded, resistive or B phase grounded distribution system. See page 48.

Input Power Conditioning

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

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

If any or all of these conditions exist, it is recommended that the user install a minimum amount of impedance between the drive and the source. This impedance could come from the supply transformer itself, the cable between the transformer and drive or an additional transformer or reactor.

Cable Trays and Conduit

If cable trays or large conduits are to be used, refer to the guidelines presented in the *Wiring and Grounding Guidelines for PWM AC Drives*, publication DRIVES-IN001.

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

Motor Cable Lengths

Typically, motor lead lengths less than 91 meters (300 feet) are acceptable. However, if your application dictates longer lengths, refer to the *Wiring and Grounding Guidelines for PWM AC Drives*, publication DRIVES-IN001.

Single-Phase Input Power – Frame 7 Only

The PowerFlex 700 drive is typically used with a three-phase input supply. Frame 7 drives have been listed by UL to operate on single-phase input power with the requirement that the output current is derated by 50% of the three-phase ratings identified on pages 43 through 46.

AC Input Phase Selection

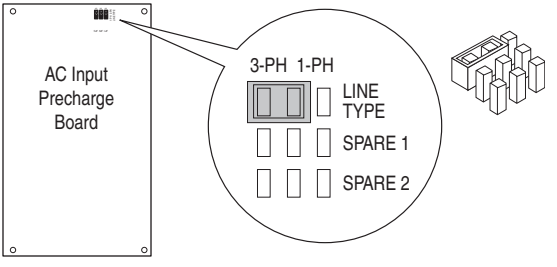
ATTENTION: To avoid a shock hazard, ensure that all power to the drive has been removed before performing the following.

Important: Frames 8…10 are not designed for single-phase operation.

Moving the "Line Type" jumper located on the Precharge Board (see below) will allow single or three-phase operation.

Important: When selecting single-phase operation, input power must be applied to the R (L1) and S (L2) terminals. This ensures that the fan will be properly powered.

Typical Location - Phase Select Jumper



Wire Recommendations

Type		Wire Type(s)	Description	Min. Insulation Rating
Power (1)(2)	Standard	600V, 90 °C (194 °F) XHHW2/RHW-2 Anixter B209500-B209507, Belden 29501-29507, or equivalent	• Four tinned copper conductors with XLPE insulation. • Copper braid/aluminum foil combination shield and tinned copper drain wire. • PVC jacket.	
Signal (1)(3)(4)	Standard Analog I/O	Belden 8760/9460 (or equivalent)	0.750 mm^2 (18 AWG), twisted pair, 100% shield with drain.	300V, 75…90 °C (167…194 °F)
		Belden 8770 (or equivalent)	0.750 mm^2 (18 AWG), 3 conductor, shielded for remote pot only.	
	Encoder/Pulse I/O <30 m (100 ft.)	Combined: Belden 9730 (5)	0.196 mm^2 (24 AWG)	
	Encoder/Pulse I/O 30 to 152 m (100 to 500 ft.)	Signal: Belden 9730/9728 (5)	0.196 mm^2 (24 AWG)	
		Power: Belden 8790 (6)	0.750 mm^2 (18 AWG)	
		Combined: Belden 9892 (7)	0.330 mm^2 (18 AWG), power is 0.500 mm^2 (20 AWG)	
	Encoder/Pulse I/O 152 to 259 m (500 to 850 ft.)	Signal: Belden 9730/9728 (5)	0.196 mm^2 (24 AWG)	
		Power: Belden 8790 (6)	0.750 mm^2 (18 AWG)	
		Combined: Belden 9773/9774 (8)	0.750 mm^2 (18 AWG)	
Digital I/O (1)(3)(4)	Shielded	Multi-conductor shielded cable such as Belden 8770 (or equivalent)	0.750 mm^2 (18 AWG), 3 conductor, shielded.	300V, 60 °C (140 °F)

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

(2) The use of shielded wire for AC input power may not be necessary but is always recommended.

(3) If the wires are short and contained within a cabinet which has no sensitive circuits, the use of shielded wire may not be necessary, but is always recommended.

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

(5) 9730 is 3 individually shielded pairs (2 channel + power). If 3 channel is required, use 9728.

(6) 8790 is 1 shielded pair.

(7) 9892 is 3 individually shielded pairs (3 channel) + 1 shielded pair for power.

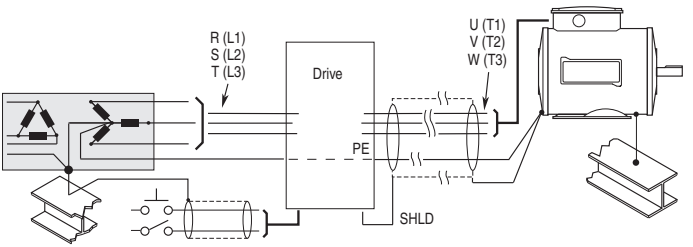
(8) 9773 is 3 individually shielded pairs (2 channel + power). If 3 channel is required, use 9774.

General Grounding Requirements

The drive Safety Ground - PE must be connected to system ground. Ground impedance must conform to the requirements of national and local industrial safety regulations and/or electrical codes. The integrity of all ground connections should be periodically checked.

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

Typical Grounding



Safety Ground - PE

This is the safety ground for the drive that is required by code. This point must be connected to adjacent building steel (girder, joist), a floor ground rod or bus bar (see above). Grounding points must comply with national and local industrial safety regulations and/or electrical codes.

Shield Termination

The Shield terminal (PE) provides a grounding point for the motor cable shield. The **motor cable** shield should be connected to this terminal on the drive (drive end) and the motor frame (motor end). A shield terminating cable gland may also be used.

When shielded cable is used for **control and signal wiring**, the shield should be grounded at the source end only, not at the drive end.

RFI Filter Grounding

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

Power Wiring

Terminal Block Specifications

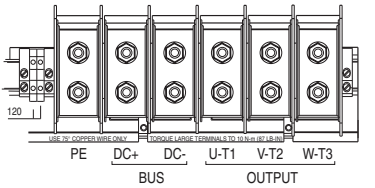
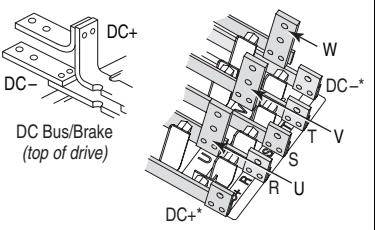
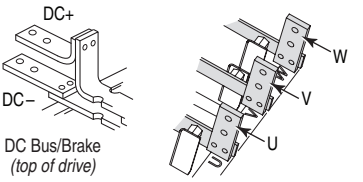
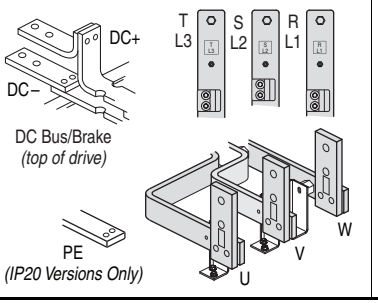
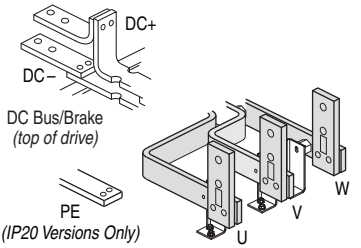
Refer to pages 8 through 12 for typical locations.

Name	Frame	Description	Wire Size Range(1)		Torque	
			Maximum	Minimum	Maximum	Recommended
Power Terminal Block	7	Input power, DC+, DC–, PE, motor connections	150.0 mm^2 (300 MCM) *see Note* (2)	2.5 mm^2 (14 AWG)	2.7 N•m (24 lb•in)	2.7 N•m (24 lb•in)
	8 & 9	Input power, DC+, DC–, PE, motor connections	300.0 mm^2 (600 MCM) *see Note* (2)	2.5 mm^2 (14 AWG)	10.0 N•m (87 lb•in)	10.0 N•m (87 lb•in)
	10	Input power, DC+, DC–, PE, motor connections	300.0 mm^2 (600 MCM) *see Note* (2)	2.5 mm^2 (14 AWG)	10.0 N•m (87 lb•in)	10.0 N•m (87 lb•in)
Fan Terminal Block	7	User Supplied Fan Voltage	4.0 mm^2 (12 AWG)	0.5 mm^2 (22 AWG)	0.9 N•m (8.0 lb•in)	0.6 N•m (5.3 lb•in)
	8…10	User Supplied Fan Voltage (TB9, TB10 & TB12)	4.0 mm^2 (12 AWG)	0.5 mm^2 (22 AWG)	0.6 N•m (5.3 lb•in)	0.6 N•m (5.3 lb•in)

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

(2) If may be necessary to connect multiple wires in parallel to these terminals using multiple lugs.

Power Terminal Blocks

Frame	Terminal Block: AC Input	Terminal Block: DC Input
7		
8, 9	 ** for DC link choke wiring*	
10		

Terminal	Description	Notes
DC +/– (Top of Drive)	DC Bus	DC Input/Brake Connections
DC +/– (Power TB)	DC Bus	DC Link Choke, wire to: Bottom of Drive - Frames 8/9 Converter Section - Frame 10
PS+, PS–	Auxiliary Control Terminal Block	see pages 8 through 12 for location
PE	PE Ground	
⏚	Motor Ground	
U	U (T1)	To Motor
V	V (T2)	
W	W (T3)	
R	R (L1)	AC Line Input Power Three-Phase = R, S & T Single-Phase = R & S Only
S	S (L2)	
T	T (L3)	

Fan Circuit Power Supply

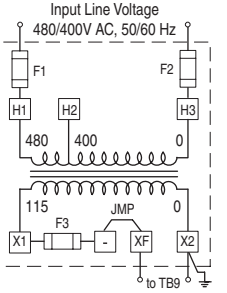
ATTENTION: To avoid a shock hazard, ensure that all power to the drive has been removed before connecting the fan supply.

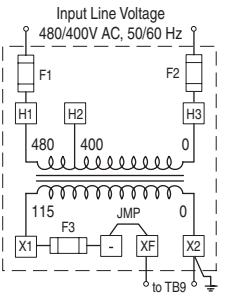
Important: Some drives utilize a fan transformer to power the internal fan(s). This transformer is sized specifically for the internal fan(s) and must not be used to power other circuitry.

Frame 7 Fan Connections

Drive Type	Enclosure	Rating *(120VAC)*	No. of Fans	Connect at …
DC Input	IP00, NEMA/UL Type Open	250 VA	1	Power Terminal Block
	IP20, NEMA/UL Type 1	250 VA	1	Requires user supplied 120V AC. See page 35 for location.
AC Input	IP00, NEMA/UL Type Open	250 VA	1	N/A (Connected internally)
	IP20, NEMA/UL Type 1	250 VA	1	

Frame 8 Fan Connections

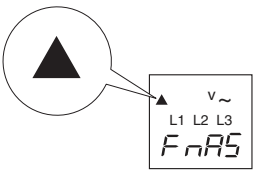
Drive Type	Enclosure	Rating *(120VAC)*	No. of Fans	Connect at …
DC Input	IP00, NEMA/UL Type Open	500 VA	1	TB9
	IP20, NEMA/UL Type 1	500 VA	1	Requires user supplied 120V AC. See page 9 for TB location and page 38 for terminal designations.
AC Input	IP00, NEMA/UL Type Open	500 VA	1	TB9
	IP20, NEMA/UL Type 1	500 VA	1	A transformer matches the input line voltage to the internal fan voltage. If line voltage is different than the voltage class specified on the drive nameplate, it may be necessary to change transformer taps (see below). 

Frame 9 Fan Connections				
Drive Type	**Enclosure**	**Rating** *(120VAC)*	**No. of Fans**	**Connect at …**
DC Input	IP00, NEMA/UL Type Open	500 VA	2	**TB9**
	IP20, NEMA/UL Type 1	500 VA	2	Requires user supplied 120V AC for cap. bank fan and phase monitor. **Blower Terminal Block** Three-phase power must be supplied to the Blower TB. See page 10 for TB locations and page 38 for terminal designations.
AC Input	IP00, NEMA/UL Type Open	500 VA	2	**TB9**
	IP20, NEMA/UL Type 1	500 VA	2	A transformer (see page 10 for location) matches the input line voltage to the internal voltage used for the capacitor fan and phase detector module. If the line voltage is different than the voltage class specified on the drive nameplate, it may be necessary to change transformer taps (as shown). 

Frame 9 Blower Operation

Frame 9 drives use a single-phase capacitor bank fan and a three-phase blower for cooling. Proper phasing must be supplied to terminals R, S, and T of the Power Terminal Block (AC drives) or the Blower Terminal Block (DC drives) to assure correct blower rotation. To verify this, a Phase Monitor (see page 10 for location) is used.

When wiring is complete, apply drive power. If phasing is correct, a solid triangle will be displayed on the Phase Monitor.

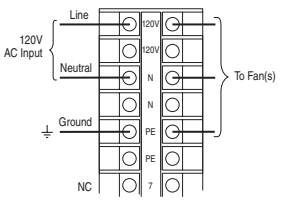


If the blower does not operate:

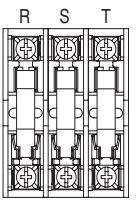
1. Remove all input power and wait 5 minutes for the DC bus to discharge. Verify that the DC bus has discharged by measuring across the + and – DC bus terminals. The reading must be less than 50 volts.
2. Verify blower fuses and replace if necessary.
3. Switch any two input power leads at the top of the blower fuse block.
4. Apply power and verify proper operation.

Fan/Blower Terminal Blocks

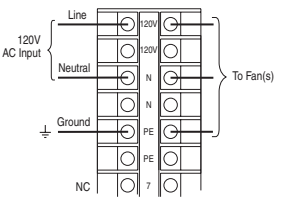
TB9 (Frames 8…10)
TB10 (Frame 10)



Blower TB
(Frame 9)



TB12
(Frame 10, AC Input, IP20 Only)

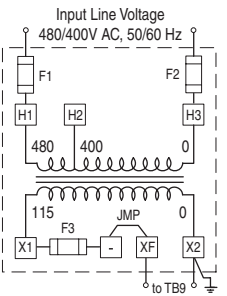


Fan Transformer Specifications/Fusing

		Recommended Fuses	
Frame	**Rating**	**Primary (Quantity 2)**	**Secondary (Quantity 1)**
8 & 9	500 VA	2.8A, 600V AC, KLDR/ATQR Type	6.25A, 250V AC, Time Delay
10	1000 VA	6A, 600V AC, KLDR/ATQR Type	9A, 250V AC, Time Delay

Three-Phase Blower Fusing

Frame	Recommended Fuses (Quantity 3)
9	5A, 600V AC, Time Delay

Frame 10 Fan Connections				
Drive Type	**Enclosure**	**Rating** *(120VAC)*	**No. of Fans**	**Connect at …**
DC Input	IP00, NEMA/UL Type Open	1000 VA	2	TB9 & 10
	IP20, NEMA/UL Type 1	1000 VA	2	Requires user supplied 120V AC. See page 11 for TB locations and page 38 for terminal designations.
AC Input	IP00, NEMA/UL Type Open	1000 VA	3	TB9, 10 & 12 Requires user supplied 120V AC. See page 12 for TB locations and page 38 for terminal designations.
	IP20, NEMA/UL Type 1	1000 VA	3	TB9, 10 & 12 A transformer (see page 12) matches the input line voltage to the internal fan voltage. If line voltage is different than the voltage class specified on the drive nameplate, it may be necessary to change transformer taps. 

Additional Frame 10 Wiring Requirement for IP00 AC Input Drives

The Inverter and Converter sections of Frame 10 AC Input IP00, NEMA/UL Type Open drives are shipped separately. Once installed, the following connections will be required.

1. DC Link Choke Wiring
   DC link chokes are supplied loose for customer mounting and wiring in IP00 drives. Refer to DC Link Chokes – Frames 8…10 below.

2. Thermistor Wiring
   Thermistor wiring will be coiled loose in the Converter section for shipping. Locate the wire (labeled "To INV") and route through the enclosure wall. Connect it to the mating connector located above the HIM cradle.

ATTENTION: To avoid possible drive damage, ensure that the thermistor wiring described above has been properly performed.

3. Ground the drive chassis
   Refer to page 12 for IP00 PE grounding locations.

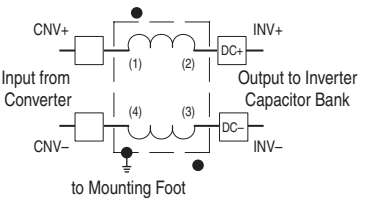
DC Link Chokes – Frames 8…10

DC Link Chokes are supplied with Frame 8…10 AC input drives.

Frame	Type	DC Link Choke is supplied …
8, 9	IP00, NEMA/UL Type Open	Mounted and wired
	IP20, NEMA/UL Type 1	Mounted and wired
	IP00, NEMA/UL Type Open Roll-In	Loose without cables (see wiring info below)
10	IP00, NEMA/UL Type Open	Loose without cables (see wiring info below)
	IP20, NEMA/UL Type 1	Mounted and wired

DC Link Choke Wiring

Refer to the diagram and page 35 for connection information. Drive rating information can be found on pages 43…44.



Auxiliary Control Power Supply

If desired, an auxiliary control power supply can be used with Frame 7…10 drives to keep the drive control logic up when the main AC power is removed. However, doing so will require the use of some type of AC line monitoring, as well as control of the Precharge Enable signal. Consult the factory for additional guidance.

ATTENTION: An Auxiliary Control Power Supply **Must Not** be used with any PowerFlex 700 Standard Control drive or 200/240 Volt Vector Control drive. Using the power supply with these drives will cause equipment/component damage. Refer to the User Manual or publication 20B-DU009 for details.

Connection is performed at the I/O terminal block (see pages 8…12).

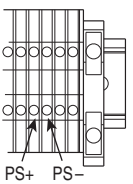
Power supply must provide	
UL Installation	300V DC, ±10%
Non UL Installation	270…600V DC, ±10%

Auxiliary Control Voltage Terminal Block Specification

Wire Size Range(1)		Torque	
Maximum	Minimum	Maximum	Recommended
4.0 mm^2 (12 AWG)	0.049 mm^2 (30 AWG)	0.6 N•m (5.3 lb•in)	0.6 N•m (5.3 lb•in)

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

Auxiliary Control Voltage Terminals



Drive, Fuse & Circuit Breaker Ratings

The PowerFlex 700 can be installed with input fuses or an input circuit breaker. National and local industrial safety regulations and/or electrical codes may determine additional requirements for these installations. Refer to tables A through D for recommended fuses/circuit breakers.

ATTENTION: The PowerFlex 700 does not provide branch short circuit protection. Specifications for the recommended fuse or circuit breaker to provide protection against short circuits are provided in tables A through D.

The tables on the following pages provide drive ratings (including continuous, 1 minute and 3 second) and recommended AC line input fuse and circuit breaker information. Both types of short circuit protection are acceptable for UL and IEC requirements. Sizes listed are the recommended sizes based on 40 degree C and the U.S. NEC. Other country, state or local codes may require different ratings.

Fusing

If fuses are chosen as the desired protection method, refer to the recommended types listed below. If available amp ratings do not match the tables provided, the closest fuse rating that exceeds the drive rating should be chosen.

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

Circuit Breakers

The “non-fuse” listings in the following tables include both circuit breakers (inverse time or instantaneous trip) and 140M Self-Protecting Motor Starters. **If one of these is chosen as the desired protection method**, the following requirements apply.

- IEC and UL – Both types of devices are acceptable for IEC and UL installations.

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

Table A 400 Volt AC Input (See page 45 for Notes)

Drive Catalog Number (9)	Frame	kW Rating		PWM Freq.	Temp. (11)	Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker (3)	Motor Circuit Protector (4)	140M Motor Protector with Adjustable Current Range (5)(6)			
		ND	*HD*	*kHz*	*°C*	*Amps*	*kVA*	*Cont.*	*1 Min.*	*3 Sec.*	*Min.* (1)	*Max.* (2)	*Min.* (1)	*Max.* (2)	*Max.* (8)	*Max.* (8)	*Available Catalog Numbers - 140...* (7)			
400 Volt AC Input																				
20BC292	7	160		4	40	293	203	292	322	438	375	650	375	850	850	400	–	–	–	–
			150	4	40	264	183	263	395	526	350	550	350	550	750	400	–	–	–	–
20BC325	7	180		4	40	326	226	325	358	488	425	700	425	950	950	600	–	–	–	–
			180	4	40	326	226	325	488	650	425	700	425	950	950	600	–	–	–	–
20BC365	8	200		2	40	366	253	365	402	548	475	800	475	1000	1000	600	–	–	–	–
			180	2	40	326	226	325	488	650	425	700	425	950	950	600	–	–	–	–
20BC415	8	240		2	40	416	288	415	457	623	525	900	525	1200	1200	600	–	–	–	–
			200	2	40	366	253	365	548	730	475	800	475	1000	1000	600	–	–	–	–
20BC481	8	280		2	40	483	334	481	530	722	600	1000	600	1400	1400	700	–	–	–	–
			240	2	40	416	288	415	623	830	525	900	525	1200	1200	600	–	–	–	–
20BC535	8	300		2	40	537	372	535	589	803	700	1200	700	1600	1600	700	–	–	–	–
			280	2	40	483	334	481	722	962	600	1000	600	1400	1400	700	–	–	–	–
20BC600	8	350		2	40	602	417	600	660	900	750	1300	750	1800	1800	800	–	–	–	–
			300	2	40	537	371	535	803	1070	700	1200	700	1600	1600	700	–	–	–	–
20BC730	9	400		2	40	702	486	730	803	1095	900	1500	900	2100	2100	900	–	–	–	–
			350	2	40	602	417	600	900	1200	750	1300	750	1800	1800	800	–	–	–	–
20BC875	10	500		2	40	877	608	875	963	1313	1100	1900	1100	2600	2600	1200	–	–	–	–
			400	2	40	877	486	700	1050	1400	900	1500	900	2100	2100	900	–	–	–	–

Table B 480 Volt AC Input (See page 45 for Notes)

Drive Catalog Number (9)	Frame	Hp Rating		PWM Freq.	Temp. (11)	Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker (3)	Motor Circuit Protector (4)	140M Motor Protector with Adjustable Current Range (5)(6)			
		ND	*HD*	*kHz*	*°C*	*Amps*	*kVA*	*Cont.*	*1 Min.*	*3 Sec.*	*Min.* (1)	*Max.* (2)	*Min.* (1)	*Max.* (2)	*Max.* (8)	*Max.* (8)	*Available Catalog Numbers - 140...* (7)			
480 Volt AC Input																				
20BD292	7	250		4	40	281	233	292	322	438	375	650	375	850	850	400	–	–	–	–
			200	4	40	253	210	263	395	526	350	550	350	550	750	400	–	–	–	–
20BD325	7	250		4	40	313	260	325	358	488	425	700	425	950	950	600	–	–	–	–
			250	4	40	313	260	325	488	650	425	700	425	950	950	600	–	–	–	–
20BD365	8	300		2	40	351	292	365	402	548	475	800	475	1000	1000	600	–	–	–	–
			250	2	40	313	260	325	488	650	425	700	425	950	950	600	–	–	–	–
20BD415	8	350		2	40	399	331	415	457	623	525	900	525	1200	1200	600	–	–	–	–
			300	2	40	351	291	365	548	730	475	800	475	1000	1000	600	–	–	–	–
20BD481	8	400		2	40	462	384	481	530	722	600	1000	600	1400	1400	700	–	–	–	–
			350	2	40	399	331	415	623	830	525	900	525	1200	1200	600	–	–	–	–
20BD535	8	450		2	40	514	427	535	589	803	700	1200	700	1600	1600	700	–	–	–	–
			400	2	40	462	384	481	722	962	600	1000	600	1400	1400	700	–	–	–	–
20BD600	8	500		2	40	577	479	600	660	900	750	1300	750	1800	1800	800	–	–	–	–
			450	2	40	514	427	535	803	1070	700	1200	700	1600	1600	700	–	–	–	–
20BD730	9	600		2	40	673	559	730	803	1095	900	1500	900	2100	2100	900	–	–	–	–
			500	2	40	577	479	600	900	1200	750	1300	750	1800	1800	800	–	–	–	–
20BD875	10	700		2	40	841	699	875	963	1313	1100	1900	1100	2600	2600	1200	–	–	–	–
			600	2	40	673	559	700	1050	1400	900	1500	900	2100	2100	900	–	–	–	–

Notes:

(1) Minimum protection device size is the lowest rated device that supplies maximum protection without nuisance tripping.

(2) Maximum protection device size is the highest rated device that supplies drive protection. For US NEC, minimum size is 125% of motor FLA. Ratings shown are maximum.

(3) Circuit Breaker - inverse time breaker. For US NEC, minimum size is 125% of motor FLA. Ratings shown are maximum.

(4) Motor Circuit Protector - instantaneous trip circuit breaker. For US NEC minimum size is 125% of motor FLA. Ratings shown are maximum.

(5) Bulletin 140M with adjustable current range should have the current trip set to the minimum range that the device will not trip.

(6) Manual Self-Protected (Type E) Combination Motor Controller, UL listed for 208 Wye or Delta, 240 Wye or Delta, 480Y/277 or 600Y/ 347. Not UL listed for use on 480V or 600V Delta/Delta systems.

(7) The AIC ratings of the Bulletin 140M Motor Protector may vary. See publication 140M-SG001B-EN-P.

(8) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.

(9) Drives have dual current ratings; one for normal duty applications, and one for heavy duty applications. The drive may be operated at either rating.

(10) Frame 7...10 drives are CE Certified for use with 400V AC and 480V AC center grounded neutral power supply systems only. It is the responsibility of the user to determine compliance to the EMC directive.

(11) Temperature rating is for IP20, NEMA/UL Type 1. For IP00, NEMA Type Open the temperature rating is 65 °C for the control board and 40 °C for the heat sink entry air.

Table C 540 Volt DC Input with Precharge

Drive Catalog Number	Frame	kW Rating		PWM Freq.	Temp.	DC Input Ratings		Output Amps			Fuse	Non-Time Delay Fuse (1)
		ND	*HD*	*kHz*	*°C*	*Amps*	*kW*	*Cont.*	*1 Min.*	*3 Sec.*		
540 Volt DC Input												
20BP292	7	160		4	40	342	185	292	322	438	500	170M6608 (4)
			150	4	40	309	166	263	395	526	630	170M6610 (4)
20BP325	7	180		4	40	381	206	325	358	488	630	170M6610 (4)
			180	4	40	381	206	325	488	650	800	170M6612 (4)
20BP365	8	200		2	40	428	231	365	402	548	630	170M6610 (4)
			180	2	40	381	206	325	488	650	800	170M6612 (4)
20BP415	8	240		2	40	487	262	415	457	623	800	170M6612 (4)
			200	2	40	428	231	365	548	730	900	170M6613 (4)
20BP481	8	280		2	40	564	304	481	530	722	900	170M6613 (4)
			240	2	40	487	262	415	623	830	1000	170M6614 (4)
20BP535	8	300		2	40	627	338	535	589	803	1000	170M6614 (4)
			280	2	40	564	304	481	722	962	1100	170M6615 (4)
20BP600	8	350		2	40	703	379	600	660	900	1100 (2)	170M6615 (4)
			300	2	40	627	338	535	803	1070	1200 (2)	170M6616 (4)
20BP730	9	400		2	40	855	461	730	803	1095	1200 (3)	170M6616 (4)
			350	2	40	703	379	600	900	1200	1400 (3)	170M6617 (4)
20BH875 No Precharge	10	500		2	40	1025	553	875	963	1313	2 x 800	170M6612 (4)
			400	2	40	820	443	700	1050	1400	2 x 800	170M6612 (4)

Table D 650 Volt DC Input with Precharge

Drive Catalog Number	Frame	Hp Rating		PWM Freq.	Temp.	DC Input Ratings		Output Amps			Fuse	Non-Time Delay Fuse (1)
		ND	*HD*	*kHz*	*°C*	*Amps*	*kW*	*Cont.*	*1 Min.*	*3 Sec.*		
650 Volt DC Input												
20BR292	7	250		4	40	328	212	292	322	438	500	170M6608 (4)
			200	4	40	296	191	263	395	526	630	170M6610 (4)
20BR325	7	250		4	40	365	236	325	358	488	550	170M6609 (3)
			250	4	40	365	236	325	488	650	800	170M6612 (4)
20BR365	8	300		2	40	410	265	365	402	548	630	170M6610 (4)
			250	2	40	365	236	325	488	650	800	170M6612 (4)
20BR415	8	350		2	40	466	302	415	457	623	700	170M6611 (4)
			300	2	40	410	265	365	548	730	800	170M6612 (4)
20BR481	8	400		2	40	540	350	481	530	722	800	170M6619 (4)
			350	2	40	466	302	415	623	830	900	170M6613 (4)
20BR535	8	450		2	40	601	389	535	589	803	900	170M6613 (4)
			400	2	40	540	350	481	722	962	1000	170M6614 (4)
20BR600	8	500		2	40	674	436	600	660	900	1000 (2)	170M6614 (4)
			450	2	40	601	389	535	803	1070	1200 (2)	170M6616 (4)
20BR730	9	600		2	40	820	533	730	803	1095	1200 (3)	170M6616 (4)
			500	2	40	674	436	600	900	1200	1400 (3)	170M6617 (4)
20BJ875 No Precharge	10	700		2	40	983	636	875	963	1313	1400	2-170M6611 (4)
			600	2	40	786	509	700	1050	1400	1600	2-170M6612 (4)

(1) The power source to common bus inverters must be derived from AC voltages 600V or less, as defined in NFPA70; Art 430-18 (NEC). Battery supplies or MG sets are not included. The following devices were validated to break current of the derived power DC Bus.
Disconnects: Allen-Bradley Bulletin 1494, 30-400A; 194, 30-400A; or ABB OESA, 600 & 800A; OESL, all sizes.
Fuses: Bussmann Type JKS, all sizes; Type 170M, Case Sizes 1, 2 and 3, or Ferraz Shawmut Type HSJ, all sizes. For any other devices, please contact the factory.

(2) Two 630A Bussmann 170M6608 can also be used.

(3) Two 700A Bussmann 170M6611 can also be used.

(4) Bussmann or equivalent.

Using Input/Output Contactors

Input Contactor Precautions

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

ATTENTION: The drive start/stop/enable control circuitry includes solid state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional hardwired stop circuit may be required to remove the AC line to the drive. An auxiliary braking method may be required.

Output Contactor Precaution

ATTENTION: To guard against drive damage when using output contactors, the following information must be read and understood. One or more output contactors may be installed between the drive and motor(s) for the purpose of disconnecting or isolating certain motors/loads. If a contactor is opened while the drive is operating, power will be removed from the respective motor, but the drive will continue to produce voltage at the output terminals. In addition, reconnecting a motor to an active drive (by closing the contactor) could produce excessive current that may cause the drive to fault. If any of these conditions are determined to be undesirable or unsafe, an auxiliary contact on the output contactor should be wired to a drive digital input that is programmed as "Enable." This will cause the drive to execute a coast-to-stop (cease output) whenever an output contactor is opened.

Bypass Contactor Precaution

ATTENTION: An incorrectly applied or installed bypass system can result in component damage or reduction in product life. The most common causes are:

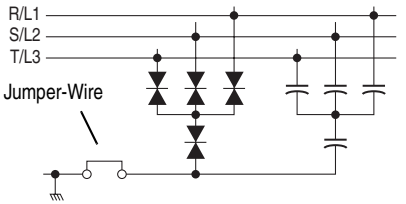
- Wiring AC line to drive output or control terminals.
- Improper bypass or output circuits not approved by Allen-Bradley.
- Output circuits which do not connect directly to the motor.

Contact Allen-Bradley for assistance with application or wiring.

Disconnecting MOVs

The PowerFlex 700 drive contains protective MOVs referenced to ground (see below). To guard against unstable operation and/or damage, the drive must be properly configured as shown in Table E on page 49.

MOV and AC EMI Capacitor Phase to Ground



See Wiring and Grounding Guidelines for PWM AC Drives, publication DRIVES-IN001 for more information on impedance grounded and ungrounded systems.

Before proceeding, ensure that all power to the drive has been removed.

ATTENTION: Only qualified personnel familiar with adjustable frequency AC drives and associated machinery should perform maintenance/repair of the system. Failure to comply may result in personal injury and/or equipment damage.

ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the +DC & –DC terminals of the Power Terminal Block (refer to the User Manual for location). The voltage must be zero.

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 drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

Table E Recommended Power Jumper Configurations

Power Source Type (1)	MOV/Input Filter Caps (2)	Benefits of Correct Configuration
Unknown	Connected	See Solid & Non-Solid Ground points below
Solid Ground • AC fed, solidly grounded • DC fed from passive rectifier which has an AC source and solid ground	Connected	• UL compliance, • Reduced electrical noise, • Most stable operation, • EMC compliance, • Reduced voltage stress on components and motor bearings
Non-Solid Ground • AC fed ungrounded • Impedance grounded • High resistive ground • B phase ground • Regenerative unit such as common DC bus supply & brake • DC fed from an active converter	Disconnected	• Helps avoid severe equipment damage when ground fault occurs

(1) It is highly recommended to accurately determine the power source type and then configure appropriately.

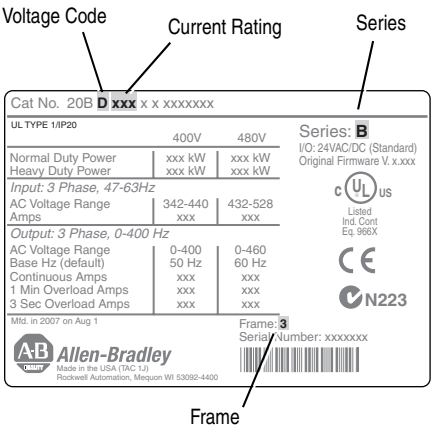
(2) When MOVs are disconnected, the power system must have its own transient protection to ensure known and controlled voltages.

To connect or disconnect these devices, refer to pages 50 and 51.

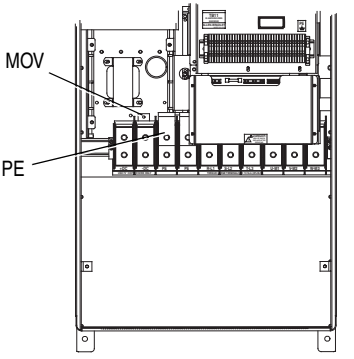
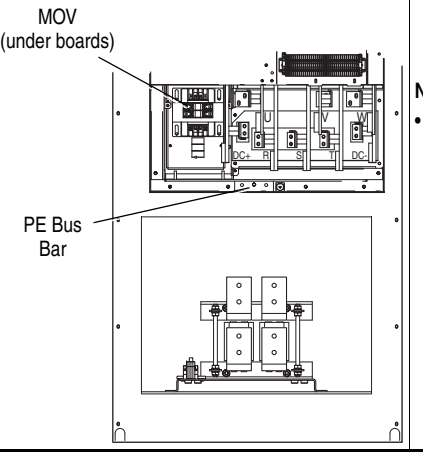
An ungrounded distribution system where the line-to-ground voltages on any phase could exceed 125% of the nominal line-to-line voltage, an isolation transformer should be installed. See Wiring and Grounding Guidelines for PWM AC Drives, publication DRIVES-IN001 for more information on impedance grounded and ungrounded systems.

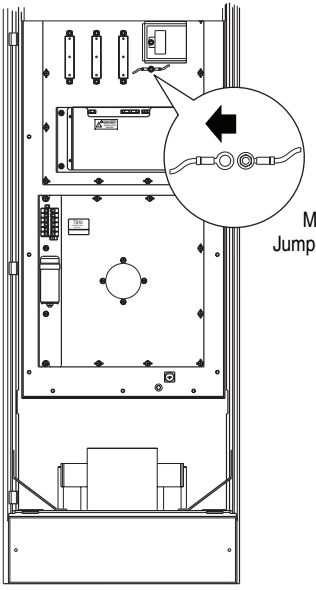
Drive Identification

Refer to the drive nameplate and locate the "Voltage Code," "Current Rating," "Frame" and "Series." Use this information to locate the proper procedure in the following tables.



Jumper Settings and Locations

Frame	Voltage Code	Current Rating	Factory Default Jumper Settings *MOV (1)*	Power Source Type
7	All	All	A green/yellow wire connected to Power Terminal Block "PE"	**Solid Ground** • The green/yellow MOV jumper wire should be connected to "PE." **Non-Solid Ground** • The green/yellow MOV jumper wire should be insulated from ground. If necessary, remove the wire from "PE" and insulate/secure it to guard against unintentional contact with chassis or components.
				
8…9	All	All	A green/yellow wire connected to the "PE" bus bar	**Solid Ground** • The green/yellow MOV jumper wire should be connected to "PE." **Non-Solid Ground** • The green/yellow MOV jumper wire should be insulated from ground. If necessary, remove the wire from the "PE" bus bar and insulate/secure it to guard against unintentional contact with chassis or components.
				

Frame	Voltage Code	Current Rating	Factory Default Jumper Settings *MOV (1)*	Power Source Type
10	All	All	A green/yellow wire connected to chassis  Converter Section	**Solid Ground** • The green/yellow MOV jumper wire should be connected to the chassis. **Non-Solid Ground** • The green/yellow MOV jumper wire should be insulated from ground. If necessary, remove the wire and insulate/secure both ends to guard against unintentional contact with chassis or components.

(1) AC input drives only. MOV's do not exist on DC input drives.

DC Input (Common Bus) and Precharge Notes

The following notes must be read and understood.

Important Application Notes

1. If drives without internal precharge are used (Frame 10 700 Hp only), then:

a) precharge capability must be provided in the system to guard against possible damage, and …

b) disconnect switches Must Not be used between the input of the drive and a common DC bus without the use of an external precharge device.

2. If drives with internal precharge (Frames 7…9) are used with a disconnect switch to the common bus, then:

a) an auxiliary contact on the disconnect must be connected to a digital input of the drive. The corresponding input (parameter 361…366) must be set to option 30, "Precharge Enable." This provides the proper precharge interlock, guarding against possible damage to the drive when connected to a common DC bus, and …

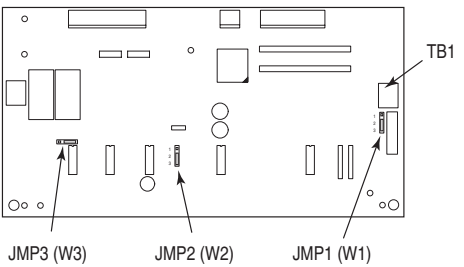
b) an auxiliary contact on the disconnect must also be connected to TB1 on the Precharge Board. Set JMP1 to the voltage being used and JMP2 to "Interlock."

3. Set jumpers on the Precharge Board as shown below:

Jumper	Setting	Description
JMP1	1-2	24V DC input
	2-3 (1)	120V AC Input
JMP2	1-2	Interlock
	2-3 (1)	Bypass
JMP3	1-2	Do Not Use
	2-3 (1)	Bypass

(1) Default setting.

Precharge Board Jumpers



Step 4 I/O Wiring

Important points to remember about I/O wiring:

- Use Copper wire only. Wire gauge requirements and recommendations are based on 75 degrees C. Do not reduce wire gauge when using higher temperature wire.
- Wire with an insulation rating of 600V or greater is recommended.
- Control and signal wires should be separated from power wires by at least 0.3 meters (1 foot).

Important: I/O terminals labeled "(–)" or "Common" are not referenced to earth ground and are designed to greatly reduce common mode interference. Grounding these terminals can cause signal noise.

ATTENTION: Configuring an analog input for 0…20 mA operation and driving it from a voltage source could cause component damage. Verify proper configuration prior to applying input signals.

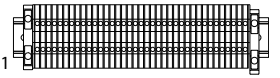
ATTENTION: Hazard of personal injury or equipment damage exists when using bipolar input sources. Noise and drift in sensitive input circuits can cause unpredictable changes in motor speed and direction. Use speed command parameters to help reduce input source sensitivity.

I/O Terminal Block Specifications

Name	Description	Wire Size Range(1)		Torque	
		Maximum	Minimum	Maximum	Recommended
I/O Terminal Block	Signal & control connections	4.0 mm^2 (12 AWG)	0.049 mm^2 (30 AWG)	0.6 N•m (5.3 lb•in)	0.6 N•m (5.3 lb•in)
Encoder Terminal Block	Encoder power & signal connections	0.75 mm^2 (18 AWG)	0.196 mm^2 (24 AWG)	0.6 N•m (5.3 lb•in)	0.6 N•m (5.3 lb•in)

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

I/O Terminal Designations



No.	Signal	Factory Default	Description	Related Param.
1	Analog In 1 (–)(1)	(2)	Isolated(3), bipolar, differential, ±10V/4-20mA, 11 bit & sign, 88k ohm input impedance. For 4-20mA, a jumper must be installed at terminals 17 & 18 (or 19 & 20).	320 - 327
2	Analog In 1 (+)(1)			
3	Analog In 2 (–)(1)			
4	Analog In 2 (+)(1)			
5	Pot Common	–	For (+) and (–) 10V pot references.	
6	Analog Out 1 (–)	(2)	Bipolar (current output is not bipolar), ±10V/ 4-20mA, 11 bit & sign, voltage mode - limit current to 5 mA. Current mode - max. load resistance is 400 ohms.	340 - 347
7	Analog Out 1 (+)			
8	Analog Out 2 (–)			
9	Analog Out 2 (+)			
10	HW PTC Input 1	–	1.8k ohm PTC, Internal 3.32k ohm pull-up resistor	238 259
11	Digital Out 1 – N.C.(4)	Fault	Max. Resistive Load: 240V AC/30V DC – 1200VA, 150W Max. Current: 5A, Min. Load: 10mA Max. Inductive Load: 240V AC/30V DC – 840VA, 105W Max. Current: 3.5A, Min. Load: 10mA	380 - 391
12	Digital Out 1 Common			
13	Digital Out 1 – N.O.(4)	NOT Fault		
14	Digital Out 2 – N.C.(4)	NOT Run		
15	Digital Out 2/3 Com.			
16	Digital Out 3 – N.O.(4)	Run		
17	Current In Jumper(1) – Analog In 1		Placing a jumper across terminals 17 & 18 (or 19 & 20) will configure that analog input for current.	
18				
19	Current In Jumper(1) – Analog In 2			
20				
21	–10V Pot Reference	–	2k ohm minimum load.	
22	+10V Pot Reference	–		
23	HW PTC Input 2	–	See above	
24	+24V DC(5)	–	Drive supplied logic input power. (5)	
25	Digital In Common	–		
26	24V Common(5)	–	Common for internal power supply.	
27	Digital In 1	Stop - CF	115V AC, 50/60 Hz - Opto isolated Low State: less than 30V AC High State: greater than 100V AC 24V DC - Opto isolated Low State: less than 5V DC High State: greater than 20V DC 11.2 mA DC	361 - 366
28	Digital In 2	Start		
29	Digital In 3	Auto/Man.		
30	Digital In 4	Speed Sel 1		
31	Digital In 5	Speed Sel 2		
32	Digital In 6/Hardware Enable, see pg. 58	Speed Sel 3		
33	Digital Out 4 – N.C.	Fault	Dedicated fault output - Not user configurable. Relay will energize (pick up) when power is applied to drive and deenergize (drop out) when a fault exists. See Terminals 11-16 for specs.	
34	Digital Out 4 Common			
35	Digital Out 4 – N.O.	NOT Fault		
PS+	Aux. Control Power (+)		Refer to page 41.	
PS-	Aux. Control Power (–)		Refer to page 41.	
PE	PE Ground		PE Ground	
PE	PE Ground		PE Ground	

See page 55 for notes.

(1) **Important:** 0…20mA operation requires a jumper at terminals 17 & 18 (or 19 & 20). Drive damage may occur if jumper is not installed.

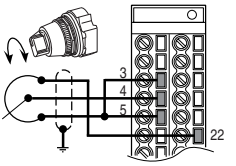
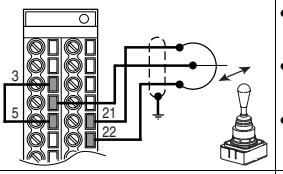
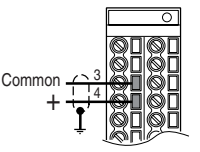
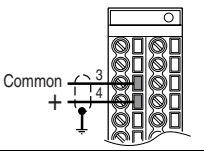
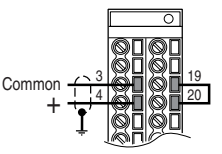
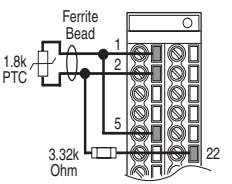
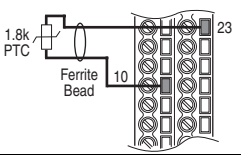
(2) These inputs/outputs are dependant on a number of parameters (see “Related Parameters”).

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

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

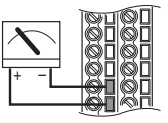
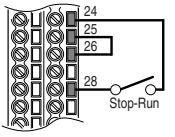
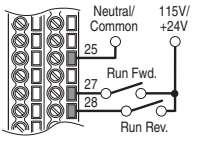
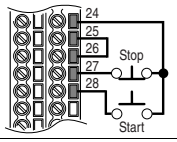
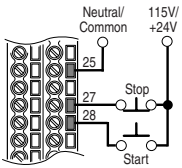
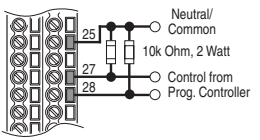
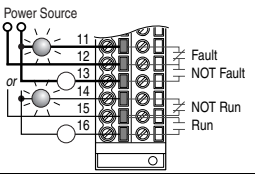
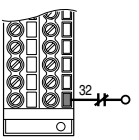
(5) 150mA maximum Load. Not present on 115V versions.

I/O Wiring Examples

Input/Output	Connection Example	Required Parameter Changes
Potentiometer Unipolar Speed Reference(1) 10k Ohm Pot. Recommended (2k Ohm Minimum)		• Adjust Scaling: Parameters 91/92 and 325/326 • View Results: Parameter 002
Joystick Bipolar Speed Reference (1) ±10V Input		• Set Direction Mode: Parameter 190 = “1, Bipolar” • Adjust Scaling: Parameters 91/92 and 325/326 • View Results: Parameter 002
Analog Input Bipolar Speed Reference ±10V Input		• Set Direction Mode: Parameter 190 = “1, Bipolar” • Adjust Scaling: Parameters 91/92 and 325/326 • View Results: Parameter 002
Analog Voltage Input Unipolar Speed Reference 0 to +10V Input		• Configure Input with parameter 320 • Adjust Scaling: Parameters 91/92 and 325/326 • View results: Parameter 002
Analog Current Input Unipolar Speed Reference 0-20 mA Input		• Configure Input for Current: Parameter 320 and add jumper at appropriate terminals • Adjust Scaling: Parameters 91/92 and 325/326 • View results: Parameter 002
Analog Input, PTC PTC OT set > 5V PTC OT cleared < 4V PTC Short < 0.2V		• Set Fault Config 1: Parameter 238, bit 7 = “Enabled” • Set Alarm Config 1: Parameter 259, bit 11 = “Enabled” • View Status Drive Alarm 1: Parameter 211, bit 11 = “True”
HW PTC Input(2) PTC OT set > 5V PTC OT cleared < 4V PTC Short < 0.2V		• Set Fault Config 1: Parameter 238, bit 13 = “Enabled” • Set Alarm Config 1: Parameter 259, bit 18 = “Enabled” • View Status: Drive Alarm 1: Parameter 211, bit 18 = “True”

(1) Refer to the Attention statement on page 53 for important bipolar wiring information.

(2) A PTC (Positive Temperature Coefficient) device (motor thermistor) embedded in the motor windings, can be monitored by the drive for motor thermal protection.

Input/Output	Connection Example	Required Parameter Changes
Analog Output ±10V, 0-20 mA Bipolar +10V Unipolar *(shown)*		• Configure with Parameter 340 • Select Source Value: Parameter 380, [Digital Out1 Sel] • Adjust Scaling: Parameters 343/344
2-Wire Control Non-Reversing(1) 24V DC internal supply		• Disable Digital Input:#1: Parameter 361 = “0, Unused” • Set Digital Input #2: Parameter 362 = “7, Run” • Set Direction Mode: Parameter 190 = “0, Unipolar”
2-Wire Control Reversing(1) External supply (I/O Board dependent)		• Set Digital Input:#1: Parameter 361 = “8, Run Forward” • Set Digital Input #2: Parameter 362 = “9, Run Reverse”
3-Wire Control Internal supply		• No Changes Required
3-Wire Control External supply (I/O Board dependent). Requires 3-wire functions only ([Digital In1 Sel]). Using 2-wire selections will cause a type 2 alarm.		• No Changes Required
Digital Input PLC Output Card (Board dependent).		• No Changes Required
Digital Output Relays (two at terminals 14-16) shown in powered state with drive faulted. See page 54.		• Select Source to Activate: Parameters 380/384
Enable Input		• Configure with parameter 366 For dedicated hardware Enable: Remove Jumper J10 (see page 58)

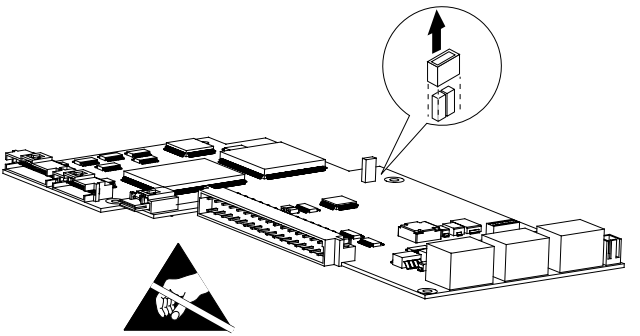
(1) **Important:** Programming inputs for 2 wire control deactivates all HIM Start buttons unless parameter 192, [Save HIM Ref], bit 1 [Manual Mode] = “1.” This will allow HIM to control Start and Jog.

Hardware Enable Circuitry (Vector Control Only)

By default, the user can program a digital input as an Enable input. The status of this input is *interpreted by drive software*. If the application requires the drive to be disabled *without* software interpretation, a "dedicated" hardware enable configuration can be utilized. This is done by removing a jumper and wiring the enable input to "Digital In 6."

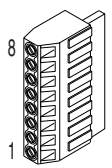
1. Remove HIM support plate to gain access to the Main Control Board (see pages 8 through 12).
2. Locate & remove Jumper J10 on the Main Control Board (see below).
3. Wire Enable to "Digital In 6" (see page 54).
4. Verify that [Digital In6 Sel], parameter 366 is set to "1, Enable."

Hardware Enable Jumper (J10) Location



Encoder Interface Option

Encoder Terminal Designations



No.	Description	
8	+12V (1) DC Power	Internal power source 250 mA.
7	+12V (1) DC Return (Common)	
6	Encoder Z (NOT)	Pulse, marker or registration input. (2)
5	Encoder Z	
4	Encoder B (NOT)	Quadrature B input.
3	Encoder B	
2	Encoder A (NOT)	Single channel or quadrature A input.
1	Encoder A	

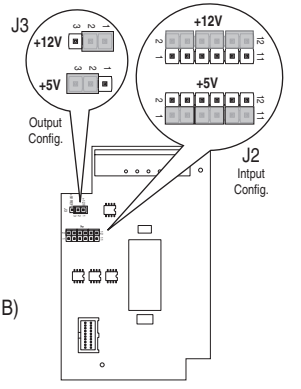
(1) Jumper selectable +5/12V is available on 20B-ENC-1 Encoder Boards.

(2) Z channel can be used as a pulse input while A & B are used for encoder.

Encoder Specifications

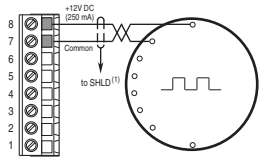
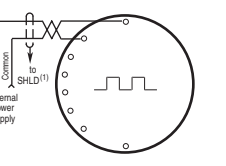
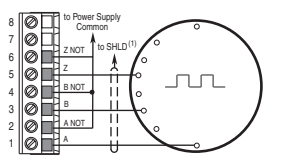
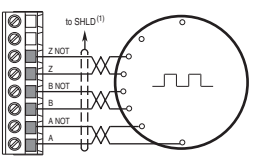
Type:	Incremental, dual channel
Supply:	12V, 250 mA. 12V, 10 mA minimum inputs isolated with differential transmitter, 250 kHz maximum.
Quadrature:	90°, ±27 degrees at 25 degrees C.
Duty Cycle:	50%, +10%
Requirements:	Encoders must be line driver type, quadrature (dual channel) or pulse (single channel), 8-15V DC output (3.5-6V DC when jumpers are in 5V position), single-ended or differential and capable of supplying a minimum of 10 mA per channel. Maximum input frequency is 250 kHz. The Encoder Interface Board accepts 12V DC square-wave with a minimum high state voltage of 7.0V DC. With the jumpers in the 5V position, the encoder will accept a 5V DC square-wave with a minimum high state voltage of 3.1V DC. In either jumper position, the maximum low state voltage is 0.4V DC.

+5/12V Encoder Jumper Location



5/12V
(20B-ENC-1, Series B)

Sample Encoder Wiring

I/O	Connection Example	I/O	Connection Example
Encoder Power – Internal Drive Power Internal (drive) 12V DC, 250mA		**Encoder Power – External Power Source**	
Encoder Signal – Single-Ended, Dual Channel (1)		**Encoder Signal – Differential, Dual Channel**	

(1) Example applies to 20B-ENC-1 only.

Step 5 Start-Up Check List

- This check list supports the Basic Start-Up menu option. See page 65 for information on other start-up routines.
- A Human Interface Module (HIM) is required to run the Basic Start-Up routine.
- The Basic Start-Up routine may modify parameter values for Analog and Digital I/O. Refer to Common I/O Programming Changes on page 70.

ATTENTION: Power must be applied to the drive to perform the following start-up procedure. Some of the voltages present are at incoming line potential. To avoid electric shock hazard or damage to equipment, only qualified service personnel should perform the following procedure. Thoroughly read and understand the procedure before beginning.

Prepare For Drive Start-Up

❑ **1.** Confirm that all inputs are connected to the correct terminals and are secure.

❑ **2.** Verify that AC line power at the disconnect device is within the rated value of the drive.

❑ **3.** Verify that control power voltage is correct.

❑ **4.** The remainder of this procedure requires that a HIM be installed. Connect a Human Interface Module (HIM) to Drive Peripheral Interface (DPI) Port 1 or 2. If an operator interface is not available, remote devices should be used to start up the drive.

Important: When power is first applied, the HIM may require approximately 5 seconds until commands are recognized (including the Stop key). An explanation of the LED indicators can be found on page 68.

❑ **5.** Apply AC power and control voltages to the drive.

If any of the six digital inputs are configured to “Stop – CF” (CF = Clear Fault) or “Enable,” verify that signals are present or reconfigure [Digital Inx Sel], parameters 361…366. If an I/O option is not installed (i.e. no I/O terminal block), verify that [Digital Inx

Sel] is not configured to “Stop – CF” or “Enable.” If this is not done, the drive will not start. Refer to Troubleshooting – Abbreviated Fault & Alarm Listing on page 71 for a list of potential digital input conflicts.

If the STS LED is not flashing green at this point, refer to Drive Status Indicators & DPI Port Locations on page 68.

❑ **6.** When prompted, select a display language. The PowerFlex 700 Start-Up Screen will then display.

❑ **7.** Press the Enter key to display the Start-Up Menu.

❑ **8.** Use the Arrow keys to highlight “2. Basic”.

❑ **9.** Press the Enter key. Follow the menu using the Enter key which will step you through the Start-Up routine.

The Basic Start-Up routine asks simple questions and prompts you to input required information. See also Common I/O Programming Changes on page 70.

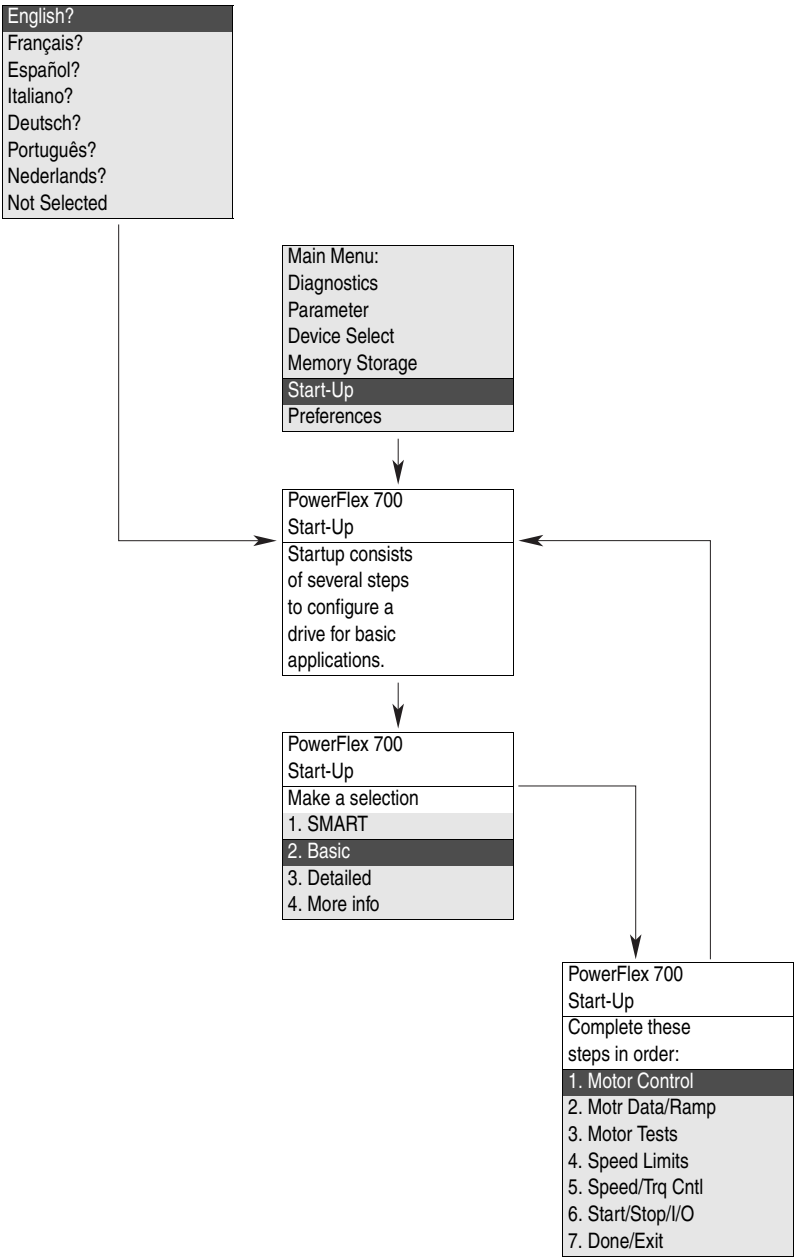
Information About Start-Up Motor Tests

Control schemes vary based on which Start/Jog Source is selected in Step 3. Motor Tests.

Start/Jog Source	Control Source Description
Digital Inputs	Digital In 1 = Stop / Digital In 2 = Start / Digital In 3 = Jog
Local Human Interface Module (HIM)–Port 1	Human Interface Module (HIM) connected to DPI Port 1 controls Stop / Start / Jog Digital In 1…6 are temporarily disabled during motor tests.
Remote HIM	Human Interface Module (HIM) connected to DPI Port 2 controls Stop / Start / Jog Digital In 1…6 are temporarily disabled during motor tests.

During motor tests and tuning procedures, the drive may modify certain parameter values for proper Start Up operation. These values are then reset to their original values when Start Up is complete. The affected parameters are: 053, 080, 276, 278 and 361…366. If power is removed from the drive during the tests without aborting the auto-tune procedure, these parameters may not reset to their original value. If this situation occurs, reset the drive to factory defaults (see page 70) and repeat the Start Up procedure.

First Powerup Menu Structure



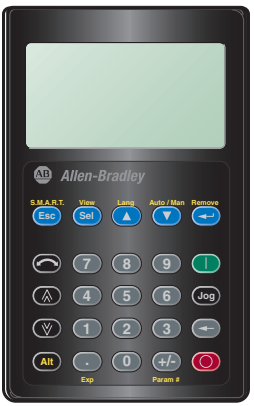
Human Interface Module (HIM) Overview

LCD Display Elements

Display	Description
F-> | Power Loss | Auto 0.0 Hz Main Menu: Diagnostics Parameter Device Select	Direction | Drive Status | Alarm | Auto/Man | Information Commanded or Output Frequency Programming / Monitoring / Troubleshooting

Human Interface Module (HIM) Key Functions

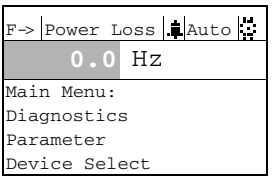
Key	Description
Esc	Exit a menu, cancel a change to a parameter value, or acknowledge a fault/alarm.
Sel	Select a digit, select a bit, or enter edit mode in a parameter screen.
▲	Scroll through options, increase a value, or toggle a bit.
▼	Scroll through options, decrease a value, or toggle a bit.
↵	Enter a menu, enter edit mode in a parameter screen, or save a change to a parameter value.
ALT	Access the function associated with a programming or numeric key. Refer to the drive user manual for more information.
I	Start the drive.
O	Stop the drive or clear a fault.
Jog	Jog the drive.



Human Interface Module (HIM)

	Change direction.	These keys are active only when the HIM is granted Manual Control or Param. 090 [Speed Ref A Sel] / 093 [Speed Ref B Sel] is set to: Option 18 “DPI Port 1” for a HIM installed in the drive cover or Option 19 “DPI Port 2” for a HIM connected by cable for handheld or remote installation option
	Increase speed.	
	Decrease speed.	

Human Interface Module (HIM) Main Menu

Main Menu Screen	Menu Selections
	Main Menu: Diagnostics Parameter Device Select Memory Storage Start-Up Preferences

ALT Functions

To use an ALT function, start at the Main Menu and press the ALT key, release it, then press the programming key associated with one of the following functions:

ALT Key then		Function	Function Description
ALT	Esc	S.M.A.R.T.	Displays the S.M.A.R.T. screen. This function allows the drive parameter values to be quickly programed by directly accessing the most frequently used drive functions. Refer to the User Manual for more information.
	Esc	Log In/Out	Log in to change parameter settings. Log out to protect parameter settings. Change a password.
	Sel	View	Allows the selection of how parameters will be viewed or detailed information about a parameter or component.
	Sel	Device	Select a connected adapter for editing.
	▲	Lang	Displays the language selection screen. The LCD Human Interface Module (HIM) on an architecture class drive allows you to change the display language any time.
	▼	Auto/Man	Switches between Auto and Manual Modes. If the Human Interface Module (HIM) requests Manual Mode, the Speed Reference source is transferred to the Human Interface Module (HIM).
	↵	Remove	Allows Human Interface Module (HIM) removal without causing a fault if the Human Interface Module (HIM) is not the last controlling device and does not have Manual control of the drive.
	+/–	Param #	Allows entry of a parameter number for viewing/editing.

Start-Up Routines

The PowerFlex 700 start up routines allow the user to commission the drive more quickly and accurately. If you have an LCD HIM, two methods are provided.

- **S.M.A.R.T. Start**
  This routine is accessible by using the "ALT" function key on the LCD HIM. This keystroke brings up a list of parameters needed to program the eight most commonly adjusted drive functions. These include Start, Stop, Minimum Speed, Maximum Speed, Acceleration Time, Deceleration Time, Reference source (speed command) and Electronic Overload setting for the motor. No knowledge of parameter organization or access is required. S.M.A.R.T. Start can commission the drive in just a few minutes. See page 67.

- **Assisted Start Up**
  Three levels of Assisted Start Up (Basic, Detailed and Application) aid the user in commissioning the drive asking simple Yes/No or "Enter Data" questions. The user is guided through the Start Up to reduce the amount of time necessary to get the drive "up and running." The following are included in startup:
  - Input Voltage Ratings
  - Motor Data
  - Motor Tests & Auto-tuning
  - Speed/Torque Control & Direction Limits
  - Speed Reference
  - Start & Stop Modes
  - Ramp Setup
  - Digital and Analog I/O
  - Application Set-up (TorqProve, Oil Well Pumps, Positioning/ Speed Profiling)

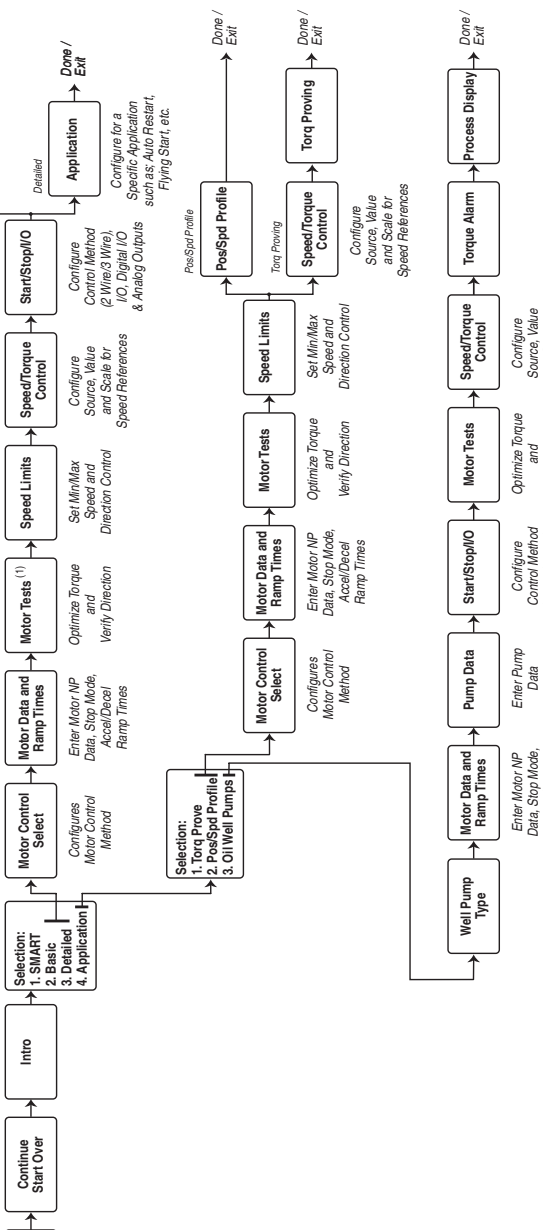
  See page 67 for details.

Important Information

Power must be applied to the drive when viewing or changing parameters. Previous programming may affect the drive status and operation when power is applied. If the I/O Cassette has been changed, a Reset Defaults operation must be performed.

Torque Proving applications can use the Assisted Start Up to tune the motor. However, it is recommended that the motor be disconnected from the hoist/crane equipment during the routine. If this is not possible, refer to the manual tuning procedure in the User Manual.

Start Up Menu



(1) During Motor Tests and tuning procedures, the drive may modify certain parameter values for proper Start Up operation. These values are then reset to their original values when Start Up is complete. The affected parameters are: 053, 080, 276, 278 and 361-366. If power is removed from the drive during the tests without aborting the auto-tune procedure, these parameters may not be reset to their original value. If this situation occurs, reset the drive to factory defaults and repeat the Start Up procedure.

Running S.M.A.R.T. Start

During a Start Up, the majority of applications require changes to only a few parameters. The LCD HIM on a PowerFlex 700 drive offers S.M.A.R.T. start, which displays the most commonly changed parameters. With these parameters, you can set the following functions:

S - Start Mode and Stop Mode
M - Minimum and Maximum Speed
A - Accel Time 1 and Decel Time 1
R - Reference Source
T - Thermal Motor Overload

To run a S.M.A.R.T. start routine:

Step	Key(s)	Example LCD Displays
1. Press ALT and then Esc (S.M.A.R.T). The S.M.A.R.T. start screen appears. 2. View and change parameter values as desired. For HIM information, see Appendix B in the User Manual. 3. Press Esc to exit the S.M.A.R.T. start.	ALT Esc Esc	F-> Stopped Auto SMART List: Digital In2 Sel Stop Mode A Minimum Speed

Running an Assisted Start Up

Important: This start-up routine requires an LCD HIM.

The Assisted start-up routine prompts you to input required information. Access Assisted Start Up by selecting “Start Up” from the Main Menu.

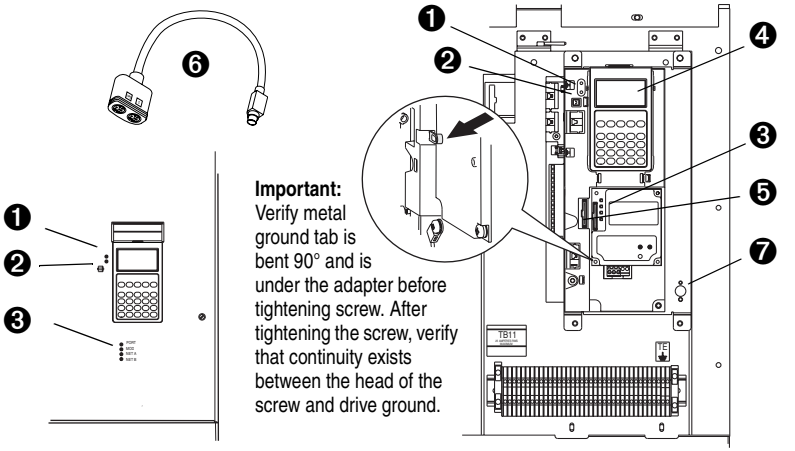
To perform an Assisted Start-Up

Step	Key(s)	Example LCD Displays
1. In the Main Menu, press the Up Arrow or Down Arrow to scroll to “Start Up”. 2. Press Enter.	▲ ▼ ↵	F-> Stopped Auto 0.0 Hz Main Menu: Memory Storage Start Up Preferences

Important: Done/Exit must be selected upon completion of the Start Up routine in order for any Start Up/Autotune data to be saved.

Drive Status Indicators & DPI Port Locations

Drive Status Indicators and Port Locations



No.	Name	Color	State	Description
❶	PWR (Power)	Green	Steady	Illuminates when power is applied to the drive.
❷	STS (Status)	Green	Flashing	Drive ready, but not running and no faults are present.
			Steady	Drive running, no faults are present.
		Yellow	Flashing, Drive Stopped	A start inhibit condition exists, the drive cannot be started. Check parameter 214 [Start Inhibits].
			Flashing, Drive Running	An intermittent type 1 alarm condition is occurring. Check parameter 211 [Drive Alarm 1].
			Steady, Drive Running	A continuous type 1 alarm condition exists. Check parameter 211 [Drive Alarm 1].
		Red	Flashing	Fault has occurred. Check [Fault x Code] or Fault Queue.
			Steady	A non-resettable fault has occurred.
❸	PORT	Refer to the Communication Adapter User Manual.		Status of DPI port internal communications (if present).
	MOD			Status of communications module (when installed).
	NET A			Status of network (if connected).
	NET B			Status of secondary network (if connected).

No.	Connector	Description
❹	DPI Port 1	HIM connection.
❺	DPI Port 5	Cable connection for communications adapter.
❻	DPI Port 3 or 2	Splitter cable connected to DPI Port 2 provides additional port.
❼	DPI Port 2	Cable connection for handheld and remote options. Located on side of chassis for Frame 7 IP20, NEMA/UL Type 1.

AC Precharge Board LED Indications

The LEDs are located above the “Line Type” jumper shown on page 31.

Name	Color	State	Description
Power	Green	Steady	Indicates when precharge board power supply is operational
Alarm	Yellow	Flashing	Number in “[ ]” indicates flashes and associated alarm(1):
		[1]	Low line voltage (<90%).
		[2]	Very low line voltage (<50%).
		[3]	Low phase (one phase <80% of line voltage).
		[4]	Frequency out of range or asymmetry (line sync failed).
		[5]	Low DC bus voltage (triggers ride-through operation).
		[6]	Input frequency momentarily out of range (40-65 Hz).
		[7]	DC bus short circuit detection active.
Fault	Red	Flashing	Number in “[ ]” indicates flashes and associated fault(2):
		[2]	DC bus short (Udc <2% after 20 ms).
		[4]	Line sync failed or low line (Uac <50% Unom).

(1) An alarm condition automatically resets when the condition no longer exists

(2) A fault indicates a malfunction that must be corrected and can only be reset after cycling power.

Common I/O Programming Changes

Your application needs may require changing parameters from their factory default settings.

Speed Reference A

Change Speed Reference A from Analog In 2 to Analog In 1 to connect an external potentiometer.

1. Set Param. 090 [Speed Ref A Sel] to option 1 “Analog In 1”
   This sets the speed reference input to I/O terminals 14 & 15 for voltage and I/O terminals 16 & 17 for current
2. Set Param. 096 [TB Man Ref Sel] to option 9 “MOP Level”
   This eliminates a potential Conflict alarm condition. Analog In 2 is not a valid Speed Reference source if selected for any of the following:
   - 117 [Trim In Select]
   - 126 [PI Reference Sel]
   - 128 [PI Feedback Sel]
   - 147 [Current Lmt Sel]
3. Set Param. 091 [Speed Ref A Hi] to the upper value of the desired speed reference range in Hz
4. Set Param. 092 [Speed Ref A Lo] to the lower value of the desired speed reference range in Hz

Control Scheme

Change from 3 Wire Start/Stop to 2 Wire Run/Not Run at Digital In 1 & Digital In 2.

Important: This will disable the Start button on the HIM.

1. Set Param. 361 [Digital In1 Sel] to option 7 “Run” or 9 “Run Reverse”
2. Set Param. 362 [Digital In2 Sel] to another option such as 8 “Run Forward” or 10 “Jog”

See I/O Wiring Examples beginning on page 56.

Restoring Factory Defaults

From the Human Interface Module (HIM) Main Menu select: Memory Storage / Reset To Defaults

Troubleshooting – Abbreviated Fault & Alarm Listing

For a complete listing of Faults and Alarms, refer to the PowerFlex 700 User Manual.

Fault	No.	Type(1)	Description	Action
Auxiliary Input	2	①	Auxiliary input interlock is open.	Check remote wiring.
Decel Inhibit	24	③	The drive is not following a commanded deceleration because it is attempting to limit bus voltage.	1. Verify input voltage is within drive specified limits. 2. Verify system ground impedance follows proper grounding techniques. 3. Disable bus regulation and/or add dynamic brake resistor and/or extend deceleration time. **Refer to page 6 for further info.** 4. Disable with parameter 238.
FluxAmpsRef Rang	78		The value for flux amps determined by the Autotune procedure exceeds the programmed [Motor NP FLA], parameter 042.	1. Reprogram [Motor NP FLA] with the correct motor nameplate value. 2. Repeat Autotune.
HW OverCurrent	12	①	The drive output current has exceeded the hardware current limit.	Check programming. Check for excess load, improper DC boost setting, DC brake volts set too high or other causes of excess current.
IR Volts Range	77		"Calculate" is the autotune default and the value determined by the autotune procedure for IR Drop Volts is not in the range of acceptable values.	Re-enter motor nameplate data.
Motor Overload	7	① ③	Internal electronic overload trip. Enable/Disable with [Fault Config 1].	An excessive motor load exists. Reduce load so drive output current does not exceed the current set by [Motor NP FLA].
OverSpeed Limit	25	①	Functions such as Slip Compensation or Bus Regulation have attempted to add an output frequency adjustment greater than that programmed in [Overspeed Limit], parameter 083.	Remove excessive load or overhauling conditions or increase [Overspeed Limit].
OverVoltage	5	①	DC bus voltage exceeded maximum value.	Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time or install dynamic brake option.
SW OverCurrent	36	①	Drive output current has exceeded the 1ms current rating. This rating is greater than the 3 second current rating and less than the hardware overcurrent fault level. It is typically 200…250% of the drive continuous rating.	Check for excess load, improper DC boost setting. DC brake volts set too high.

(1) See the User Manual for a description of fault types.

<table>
<tr><th>Alarm</th><th>No.</th><th>Type(1)</th><th>Description</th></tr>
<tr><td>Dig In ConflictA</td><td>17</td><td>②</td><td>Digital input functions are in conflict. Combinations marked with a “  ” will cause an alarm.
<table>
<tr><th></th><th>Acc2/Dec2</th><th>Accel 2</th><th>Decel 2</th><th>Jog 1/2</th><th>Jog Fwd</th><th>Jog Rev</th><th>Fwd/Rev</th></tr>
<tr><td>Acc2/Dec2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Accel 2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Decel 2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog 1/2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog Fwd</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog Rev</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Fwd/Rev</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Dig In ConflictB</td><td>18</td><td>②</td><td>A digital Start input has been configured without a Stop input or other functions are in conflict. Combinations that conflict are marked with a “” and will cause an alarm.
<table>
<tr><th></th><th>Start</th><th>Stop-CF</th><th>Run</th><th>Run Fwd</th><th>Run Rev</th><th>Jog 1/2</th><th>Jog Fwd</th><th>Jog Rev</th><th>Fwd/Rev</th></tr>
<tr><td>Start</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Stop-CF</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Run</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Run Fwd</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Run Rev</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog 1/2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog Fwd</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog Rev</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Fwd/Rev</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Dig In ConflictC</td><td>19</td><td>②</td><td>More than one physical input has been configured to the same input function. Multiple configurations are not allowed for the following input functions.
Forward/Reverse
Speed Select 1
Speed Select 2
Speed Select 3
Run Forward
Run ReverseBus Regulation Mode B
Jog ForwardAcc2 / Dec2
Jog ReverseAccel 2
RunDecel 2
Stop Mode B</td></tr>
<tr><td>TB Man Ref Cflct</td><td>30</td><td>②</td><td>Occurs when:
• “Auto/Manual” is selected (default) for [Digital In3 Sel], parameter 363 and
• [TB Man Ref Sel], parameter 96 has been reprogrammed.
No other use for the selected analog input may be programmed.
Example: If [TB Man Ref Sel] is reprogrammed to “Analog In 2,” all of the factory default uses for “Analog In 2” must be reprogrammed (such as parameters 90, 117, 128 and 179). Refer to the Auto/Manual Examples section of the PowerFlex 700 User Manual.
To correct:
• Verify/reprogram the parameters that reference an analog input or
• Reprogram [Digital In3] to another function or “Unused.”</td></tr>
</table>

(1) See the User Manual for a description of alarm types.

Common Symptoms and Corrective Actions

Drive does not Start from Start or Run Inputs wired to the terminal block.

Cause(s)	Indication	Corrective Action
Drive is Faulted	Flashing red status light	Clear fault. • Press Stop • Cycle power • Set [Fault Clear] to 1 • "Clear Faults" on the HIM Diagnostic menu.
Incorrect input wiring. Refer to the wiring examples starting on page 56. • 2 wire control requires Run, Run Forward, Run Reverse or Jog input. • 3 wire control requires Start and Stop inputs. • Jumper from terminal 25 to 26 is required.	None	Wire inputs correctly and/or install jumper.
Incorrect digital input programming. • Mutually exclusive choices have been made (i.e., Jog and Jog Forward). • 2 wire and 3 wire programming may be conflicting. • Exclusive functions (i.e, direction control) may have multiple inputs configured. • Stop is factory default and is not wired.	None	Program [Digital Inx Sel], parameters 361…366 for correct inputs. Start or Run programming may be missing.
	Flashing yellow status light and "DigIn CflctB" indication on LCD HIM. [Drive Status 2] shows type 2 alarm(s).	Program [Digital Inx Sel] to resolve conflicts. Remove multiple selections for the same function. Install stop button to apply a signal at stop terminal.

Drive does not Start from Human Interface Module (HIM).

Cause(s)	Indication	Corrective Action
Drive is programmed for 2 wire control. HIM Start button is disabled for 2 wire control unless param. 192, bit 1 = "1."	None	If 2 wire control is required, no action needed. If 3 wire control is required, program [Digital Inx Sel] for correct inputs.

Drive does not respond to changes in speed command.

Cause(s)	Indication	Corrective Action
No value is coming from the source of the command.	LCD HIM Status Line indicates "At Speed" and output is 0 Hz.	1. If the source is an analog input, check wiring and use a meter to check for presence of signal. 2. Check [Commanded Speed], parameter 002 for correct source.
Incorrect reference source has been programmed.	None	3. Check parameter 213, [Speed Ref Source] for the source of the speed reference. 4. Reprogram parameter 090, [Speed Ref A Sel] for correct source.
Incorrect Reference source is being selected via remote device or digital inputs.	None	5. Check parameter 209, [Drive Status 1], bits 12 & 13 for unexpected source selections. 6. Check parameter 216 [Dig In Status] to see if inputs are selecting an alternate source. 7. Reprogram digital inputs to correct "Speed Sel x" option.

Motor and/or drive will not accelerate to commanded speed.

Cause(s)	Indication	Corrective Action
Acceleration time is excessive.	None	Reprogram [Accel Time x].
Excess load or short acceleration times force the drive into current limit, slowing or stopping acceleration.	None	Check [Drive Status 2], bit 10 to see if the drive is in Current Limit. Remove excess load or reprogram [Accel Time x].
Speed command source or value is not as expected.	None	Check for the proper Speed Command using Steps 1 through 7 above.
Programming is preventing the drive output from exceeding limiting values.	None	Check [Maximum Speed] and [Maximum Freq] (parameters 082 and 055) to assure that speed is not limited by programming.

Motor operation is unstable.

Cause(s)	Indication	Corrective Action
Motor data was incorrectly entered or Autotune was not performed.	None	1. Correctly enter motor nameplate data. 2. Perform "Static" or "Rotate" Autotune procedure.

Drive will not reverse motor direction.

Cause(s)	Indication	Corrective Action
Digital input is not selected for reversing control.	None	Check [Digital Inx Sel]. Choose correct input and program for reversing mode.
Digital input is incorrectly wired.	None	Check input wiring.
Direction mode parameter is incorrectly programmed.	None	Reprogram [Direction Mode] for analog “Bipolar” or digital “Unipolar” control.
Motor wiring is improperly phased for reverse.	None	Switch two motor leads.
A bipolar analog speed command input is incorrectly wired or signal is absent.	None	1. Use meter to check that an analog input voltage is present. 2. Check wiring. Positive voltage commands forward direction. Negative voltage commands reverse direction.

Stopping the drive results in a Decel Inhibit fault.

Cause(s)	Indication	Corrective Action
The bus regulation feature is enabled and is halting deceleration due to excessive bus voltage. Excess bus voltage is normally due to excessive regenerated energy or unstable AC line input voltages. Internal timer has halted drive operation.	Decel Inhibit fault screen. LCD Status Line indicates “Faulted”.	1. See Attention statement on page 6. 2. Reprogram parameters 161/162 to eliminate any “Adjust Freq” selection. 3. Disable bus regulation (parameters 161 & 162) and add a dynamic brake. 4. Correct AC input line instability or add an isolation transformer. 5. Reset drive.

Manually Clearing Faults

Step	Key(s)
1. Press Esc to acknowledge the fault. The fault information will be removed so that you can use the Human Interface Module (HIM). 2. Address the condition that caused the fault. The cause must be corrected before the fault can be cleared. 3. After corrective action has been taken, clear the fault by one of these methods: • Press Stop • Cycle drive power • Set parameter 240 [Fault Clear] to “1.” • “Clear Faults” on the Human Interface Module (HIM) Diagnostic menu.	 

Parameter List – Vector Control Option (v6.xxx)

Number	Parameter Name	Group
1	Output Freq	Metering
2	Commanded Freq	Metering
3	Output Current	Metering
4	Torque Current	Metering
5	Flux Current	Metering
6	Output Voltage	Metering
7	Output Power	Metering
8	Output Powr Fctr	Metering
9	Elapsed MWh	Metering
10	Elapsed Run Time	Metering
11	MOP Reference	Metering
12	DC Bus Voltage	Metering
13	DC Bus Memory	Metering
14	Elapsed kWh	Metering
16	Analog In1 Value	Metering
17	Analog In2 Value	Metering
18	PTC HW Value	Metering
21	Spd Fdbk No Filt	Metering
22	Ramped Speed	Metering
23	Speed Reference	Metering
24	Commanded Torque**	Metering
25	Speed Feedback	Metering
26	Rated kW	Drive Data
27	Rated Volts	Drive Data
28	Rated Amps	Drive Data
29	Control SW Ver	Drive Data
40	Motor Type	Motor Data
41	Motor NP Volts	Motor Data
42	Motor NP FLA	Motor Data
43	Motor NP Hertz	Motor Data
44	Motor NP RPM	Motor Data
45	Motor NP Power	Motor Data
46	Mtr NP Pwr Units	Motor Data
47	Motor OL Hertz	Motor Data
48	Motor OL Factor	Motor Data
49	Motor Poles	Motor Data
50	Motor OL Mode[6.x]	Motor Data
53	Motor Cntl Sel	Torq Attributes
54	Maximum Voltage	Torq Attributes
55	Maximum Freq	Torq Attributes
56	Compensation	Torq Attributes
57	Flux Up Mode	Torq Attributes
58	Flux Up Time	Torq Attributes
59	SV Boost Filter	Torq Attributes
61	Autotune	Torq Attributes
62	IR Voltage Drop	Torq Attributes
63	Flux Current Ref	Torq Attributes
64	Ixo Voltage Drop	Torq Attributes
66	Autotune Torque**	Torq Attributes
67	Inertia Autotune**	Torq Attributes
69	Start/Acc Boost	Volts per Hertz
70	Run Boost*	Volts per Hertz
71	Break Voltage*	Volts per Hertz
72	Break Frequency*	Volts per Hertz
79	Speed Units	Spd Mode & Limits
80	Feedback Select	Spd Mode & Limits
81	Minimum Speed	Spd Mode & Limits
82	Maximum Speed	Spd Mode & Limits
83	Overspeed Limit	Spd Mode & Limits
84-86	Skip Frequency 1-3*	Spd Mode & Limits
87	Skip Freq Band*	Spd Mode & Limits
88	Speed/Torque Mod**	Spd Mode & Limits
90, 93	Speed Ref X Sel	Speed Reference
91, 94	Speed Ref X Hi	Speed Reference
92, 95	Speed Ref X Lo	Speed Reference
96	TB Man Ref Sel	Speed Reference
97	TB Man Ref Hi	Speed Reference
98	TB Man Ref Lo	Speed Reference
99	Pulse Input Ref	Speed Reference
100	Jog Speed 1	Discrete Speeds
101-107	Preset Speed 1-7	Discrete Speeds
108	Jog Speed 2	Discrete Speeds
116	Trim % Setpoint	Speed Trim
117	Trim In Select	Speed Trim
118	Trim Out Select	Speed Trim
119	Trim Hi	Speed Trim
120	Trim Lo	Speed Trim
121	Slip RPM @ FLA	Slip Comp
122	Slip Comp Gain*	Slip Comp
123	Slip RPM Meter	Slip Comp
124	PI Configuration	Process PI
125	PI Control	Process PI
126	PI Reference Sel	Process PI
127	PI Setpoint	Process PI
128	PI Feedback Sel	Process PI
129	PI Integral Time	Process PI
130	PI Prop Gain	Process PI
131	PI Lower Limit	Process PI
132	PI Upper Limit	Process PI
133	PI Preload	Process PI
134	PI Status	Process PI
135	PI Ref Meter	Process PI
136	PI Fdback Meter	Process PI
137	PI Error Meter	Process PI
138	PI Output Meter	Process PI
139	PI BW Filter	Process PI
140, 141	Accel Time X	Ramp Rates
142, 143	Decel Time X	Ramp Rates
145	DB While Stopped	Stop/Brake Modes
146	S Curve %	Ramp Rates
147	Current Lmt Sel	Load Limits
148	Current Lmt Val	Load Limits
149	Current Lmt Gain	Load Limits
150	Drive OL Mode	Load Limits
151	PWM Frequency	Load Limits
152	Droop RPM @ FLA	Load Limits
153	Regen Power Limit**	Load Limits
154	Current Rate Limit**	Load Limits
155, 156	Stop Mode X	Stop/Brake Modes
157	DC Brk Lvl Sel	Stop/Brake Modes
158	DC Brake Level	Stop/Brake Modes
159	DC Brake Time	Stop/Brake Modes
160	Bus Reg Ki*	Stop/Brake Modes
161, 162	Bus Reg Mode X	Stop/Brake Modes
163	DB Resistor Type	Stop/Brake Modes
164	Bus Reg Kp*	Stop/Brake Modes
165	Bus Reg Kd*	Stop/Brake Modes
166	Flux Braking	Stop/Brake Modes

Number	Parameter Name	Group
167	Powerup Delay	Restart Modes
168	Start At PowerUp	Restart Modes
169	Flying Start En	Restart Modes
170	Flying StartGain	Restart Modes
174	Auto Rstrt Tries	Restart Modes
175	Auto Rstrt Delay	Restart Modes
177	Gnd Warn Level	Power Loss
178	Sleep-Wake Mode	Restart Modes
179	Sleep-Wake Ref	Restart Modes
180	Wake Level	Restart Modes
181	Wake Time	Restart Modes
182	Sleep Level	Restart Modes
183	Sleep Time	Restart Modes
184	Power Loss Mode	Power Loss
185	Power Loss Time	Power Loss
186	Power Loss Level	Power Loss
187	Load Loss Level	Power Loss
188	Load Loss Time	Power Loss
189	Shear Pin Time	Power Loss
190	Direction Mode	Direction Config
192	Save HIM Ref	HIM Ref Config
193	Man Ref Preload	HIM Ref Config
194	Save MOP Ref	MOP Config
195	MOP Rate	MOP Config
196	Param Access Lvl	Drive Memory
197	Reset To Defalts	Drive Memory
198	Load Frm Usr Set	Drive Memory
199	Save To User Set	Drive Memory
200	Reset Meters	Drive Memory
201	Language	Drive Memory
202	Voltage Class	Drive Memory
203	Drive Checksum	Drive Memory
204	Dyn UserSet Cnfg	Drive Memory
205	Dyn UserSet Sel	Drive Memory
206	Dyn UserSet Actv	Drive Memory
209, 210	Drive Status X	Diagnostics
211, 212	Drive Alarm X	Diagnostics
213	Speed Ref Source	Diagnostics
214	Start Inhibits	Diagnostics
215	Last Stop Source	Diagnostics
216	Dig In Status	Diagnostics
217	Dig Out Status	Diagnostics
218	Drive Temp	Diagnostics
219	Drive OL Count	Diagnostics
220	Motor OL Count	Diagnostics
221	Mtr OL Trip Time	Diagnostics
222	Drive Status 3[6.x]	Diagnostics
223	Status 3 @ Fault[6.x]	Diagnostics
224	Fault Speed	Diagnostics
225	Fault Amps	Diagnostics
226	Fault Bus Volts	Diagnostics
227, 228	Status X @ Fault	Diagnostics
229, 230	Alarm X @ Fault	Diagnostics
234, 236	Testpoint X Sel	Diagnostics
235, 237	Testpoint X Data	Diagnostics
238	Fault Config 1	Faults
240	Fault Clear	Faults
241	Fault Clear Mode	Faults
242	Power Up Marker	Faults
243	Fault 1 Code	Faults
244	Fault 1 Time	Faults
245	Fault 2 Code	Faults
246	Fault 2 Time	Faults
247	Fault 3 Code	Faults
248	Fault 3 Time	Faults
249	Fault 4 Code	Faults
250	Fault 4 Time	Faults
251	Fault 5 Code	Faults
252	Fault 5 Time	Faults
253	Fault 6 Code	Faults
254	Fault 6 Time	Faults
255	Fault 7 Code	Faults
256	Fault 7 Time	Faults
257	Fault 8 Code	Faults
258	Fault 8 Time	Faults
259	Alarm Config 1	Alarms
261	Alarm Clear	Alarms
262-269	Alarm X Code	Alarms
270	DPI Baud Rate	Comm Control
271	Drive Logic Rslt	Comm Control
272	Drive Ref Rslt	Comm Control
273	Drive Ramp Rslt	Comm Control
274	DPI Port Sel	Comm Control
275	DPI Port Value	Comm Control
276	Logic Mask	Masks & Owners Security
277	Start Mask	Masks & Owners
278	Jog Mask	Masks & Owners
279	Direction Mask	Masks & Owners
280	Reference Mask	Masks & Owners
281	Accel Mask	Masks & Owners
282	Decel Mask	Masks & Owners
283	Fault Clr Mask	Masks & Owners
284	MOP Mask	Masks & Owners
285	Local Mask	Masks & Owners
288	Stop Owner	Masks & Owners
289	Start Owner	Masks & Owners
290	Jog Owner	Masks & Owners
291	Direction Owner	Masks & Owners
292	Reference Owner	Masks & Owners
293	Accel Owner	Masks & Owners
294	Decel Owner	Masks & Owners
295	Fault Clr Owner	Masks & Owners
296	MOP Owner	Masks & Owners
297	Local Owner	Masks & Owners
298	DPI Ref Select	Comm Control
299	DPI Fdbk Select	Comm Control
300-307	Data In XX	Datalinks
308	HighRes Ref[6.x]	Datalinks
310-317	Data Out XX	Datalinks
320	Anlg In Config	Analog Inputs
321	Anlg In Sqr Root	Analog Inputs
322, 325	Analog In X Hi	Analog Inputs
323, 326	Analog In X Lo	Analog Inputs
324, 327	Analog In X Loss	Analog Inputs
340	Anlg Out Config	Analog Outputs
341	Anlg Out Absolut	Analog Outputs
342, 345	Analog OutX Sel	Analog Outputs
343, 346	Analog OutX Hi	Analog Outputs
344, 347	Analog OutX Lo	Analog Outputs
354, 355	Anlg OutX Scale	Analog Outputs
361-366	Digital InX Sel	Digital Inputs
377, 378	Anlg OutX Setpt	Analog Outputs
379	Dig Out Setpt	Digital Outputs
380, 384, 388	Digital OutX Sel	Digital Outputs

Number	Parameter Name	Group
381, 385, 389	Dig OutX Level	Digital Outputs
382, 386, 390	Dig OutX OnTime	Digital Outputs
383, 387, 391	Dig OutX OffTime	Digital Outputs
392	Dig Out Invert	Digital Outputs
393	Dig Out Param	Digital Outputs
394	Dig Out Mask	Digital Outputs
411	DigIn DataLogic[6.x]	Digital Inputs
412	Motor Fdbk Type	Speed Feedback
413	Encoder PPR	Speed Feedback
414	Enc Position Fdbk	Speed Feedback
415	Encoder Speed	Speed Feedback
416	Fdbk Filter Sel	Speed Feedback
419	Notch Filter Freq**	Speed Feedback
420	Notch Filter K**	Speed Feedback
421	Marker Pulse	Speed Feedback
422	Pulse In Scale	Speed Feedback
423	Encoder Z Chan	Speed Feedback
427, 431	Torque Ref X Sel**	Torq Attributes
428, 432	Torque Ref X Hi**	Torq Attributes
429, 433	Torque Ref X Lo**	Torq Attributes
430	Torq Ref A Div**	Torq Attributes
434	Torque Ref B Mult**	Torq Attributes
435	Torque Setpoint**	Torq Attributes
436	Pos Torque Limit**	Torq Attributes
437	Neg Torque Limit**	Torq Attributes
438	Torque Setpoint2**	Torq Attributes
440	Control Status**	Torq Attributes
441	Mtr Tor Cur Ref**	Torq Attributes
445	Ki Speed Loop**	Speed Regulator
446	Kp Speed Loop**	Speed Regulator
447	Kf Speed Loop**	Speed Regulator
448	Spd Err Filt BW[6.x]	Speed Regulator
449	Speed Desired BW**	Speed Regulator
450	Total Inertia**	Speed Regulator
451	Speed Loop Meter**	Speed Regulator
454	Rev Speed Limit**	Speed Regulator
459	PI Deriv Time	Process PI
460	PI Reference Hi	Process PI
461	PI Reference Lo	Process PI
462	PI Feedback Hi	Process PI
463	PI Feedback Lo	Process PI
464	PI Output Gain	Process PI
476-494	ScaleX In Value	Scaled Blocks
477-495	ScaleX In Hi	Scaled Blocks
478-496	ScaleX In Lo	Scaled Blocks
479-497	ScaleX Out Hi	Scaled Blocks
480-498	ScaleX Out Lo	Scaled Blocks
481-499	ScaleX Out Value	Scaled Blocks
595	Port Mask Act	Security
596	Write Mask Cfg	Security
597	Write Mask Act	Security
598	Logic Mask Act	Security
600	TorqProve Cnfg	Torq Proving
601	TorqProve Setup	Torq Proving
602	Spd Dev Band	Torq Proving
603	SpdBand Integrat	Torq Proving
604	Brk Release Time	Torq Proving
605	ZeroSpdFloatTime	Torq Proving
606	Float Tolerance	Torq Proving
607	Brk Set Time	Torq Proving
608	TorqLim SlewRate	Torq Proving
609	BrkSlip Count	Torq Proving
610	Brk Alarm Travel	Torq Proving
611	MicroPos Scale%	Torq Proving
612	TorqProve Status	Torq Proving
613	Brake Test Torq[6.x]	Torq Proving
631	Rod Load Torque	Oil Well Pump
632	TorqAlarm Level	Oil Well Pump
633	TorqAlarm Action	Oil Well Pump
634	TorqAlarm Dwell	Oil Well Pump
635	TorqAlrm Timeout	Oil Well Pump
636	TorqAlrm TO Act	Oil Well Pump
637	PCP Pump Sheave	Oil Well Pump
638	Max Rod Torque	Oil Well Pump
639	Min Rod Speed	Oil Well Pump
640	Max Rod Speed	Oil Well Pump
641	OilWell Pump Sel	Oil Well Pump
642	Gearbox Rating	Oil Well Pump
643	Gearbox Sheave	Oil Well Pump
644	Gearbox Ratio	Oil Well Pump
645	Motor Sheave	Oil Well Pump
646	Total Gear Ratio	Oil Well Pump
647	DB Resistor	Oil Well Pump
648	Gearbox Limit	Oil Well Pump
650	Adj Volt Phase	Adjust Voltage
651	Adj Volt Select	Adjust Voltage
652	Adj Volt Ref Hi	Adjust Voltage
653	Adj Volt Ref Lo	Adjust Voltage
654-660	Adj Volt Preset1-7	Adjust Voltage
661	Min Adj Voltage	Adjust Voltage
662	Adj Volt Command	Adjust Voltage
663	MOP Adj VoltRate	Adjust Voltage
669	Adj Volt TrimSel	Adjust Voltage
670	Adj Volt Trim Hi	Adjust Voltage
671	Adj Volt Trim Lo	Adjust Voltage
672	Adj Volt Trim %	Adjust Voltage
675	Adj Volt AccTime	Adjust Voltage
676	Adj Volt DecTime	Adjust Voltage
677	Adj Volt S Curve	Adjust Voltage
700	Pos/Spd Prof Sts	ProfSetup/Status
701	Units Traveled	ProfSetup/Status
702	Home Position[6.x]	ProfSetup/Status
705	Pos/Spd Prof Cmd	ProfSetup/Status
707	Encoder Pos Tol	ProfSetup/Status
708	Counts Per Unit	ProfSetup/Status
711	Vel Override	ProfSetup/Status
713	Find Home Speed	ProfSetup/Status
714	Find Home Ramp	ProfSetup/Status
718	Pos Reg Filter	ProfSetup/Status
719	Pos Reg Gain	ProfSetup/Status
720…	Step x Type	Profile Setup
721…	Step x Velocity	Profile Setup
722…	Step x AccelTime	Profile Setup
723…	Step x DecelTime	Profile Setup
724…	Step x Value	Profile Setup
725…	Step x Dwell	Profile Setup
726…	Step x Batch	Profile Setup
727…	Step x Next	Profile Setup

* These parameters will only be displayed when parameter 053 [Motor Cntl Sel] is set to option "2 or 3."

** These parameters will only be displayed when parameter 053 [Motor Cntl Sel] is set to option "4."

6.x Firmware 6.002 and later.

Specifications

Category	Specification	
Agency Certification		Listed to UL508C and CAN/CSA-C2.2 No. 14-M91.
		Marked for all applicable European Directives EMC Directive (2004/108/EC) EN 61800-3 Adjustable Speed electrical power drive systems Low Voltage Directive (2006/95/EC) EN 50178 Electronic Equipment for use in Power Installations
	The drive is also designed to meet the following specifications: NFPA 70 - US National Electrical Code	

Category	Specification				
Protection	**Drive**	380/400V	480V		
	AC Input Overvoltage Trip:	570VAC	570VAC		
	AC Input Undervoltage Trip:	233VAC	280VAC		
	Bus Overvoltage Trip:	810VDC	810VDC		
	Bus Undervoltage Shutoff/ Fault:	305VDC	305VDC		
	Nominal Bus Voltage:	540VDC	648VDC		
	All Drives				
	Heat Sink Thermistor:	Monitored by microprocessor overtemp trip			
	Drive Overcurrent Trip Software Overcurrent Trip: Hardware Overcurrent Trip:	 200% of rated current (typical) 220…300% of rated current (dependent on drive rating)			
	Line transients:	up to 6000 volts peak per IEEE C62.41-1991			
	Control Logic Noise Immunity:	Showering arc transients up to 1500V peak			
	Power Ride-Thru:	15 milliseconds at full load			
	Logic Control Ride-Thru:	0.5 seconds minimum, 2 seconds typical			
	Ground Fault Trip:	Phase-to-ground on drive output			
	Short Circuit Trip:	Phase-to-phase on drive output			
Environment	Altitude:	1000 m (3300 ft) max. without derating			
	Maximum Surrounding Air Temperature w/o Derating: IP20, NEMA Type Open:	 0…40 degrees C (32…104 degrees F) for chassis (heatsink) 0…65 degrees C (32…149 degrees F) for control (front of backplane)			
	Storage Temp. (all const.):	-40…70 degrees C (-40…158 degrees F)			
	Atmosphere:	**Important:** Drive **must not** be installed in an area where the ambient atmosphere contains volatile or corrosive gas, vapors or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere.			
	Relative Humidity:	5 to 95% non-condensing			
	Shock:	15G peak for 11ms duration (±1.0 ms)			
	Vibration:	0.152 mm (0.006 in.) displacement, 1G peak			
	Sound:	Frame	Fan Speed	Sound Level	Note: Sound pressure level is measured at 2 meters.
		7	756 CFM	74 dB	
		8	1200 CFM	78 dB	
		9	2800 CFM	82 dB	
		10 Inv.	1850 CFM	78 dB	
		10 Cnv.	1200 CFM	78 dB	

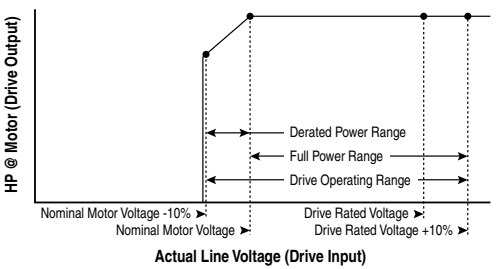
Category	Specification	
Electrical	Voltage Tolerance:	See page 81
	Input Frequency Tolerance:	47…63 Hz.
	Input Phases:	Three-phase input provides full rating for all drives. Single-phase operation (Frame 7 Only) provides 50% of rated current. The drive can be supplied as 6 pulse or 18 pulse in a configured package.
	Input Displacement Power Factor:	0.98 across entire speed range.
	Efficiency:	97.5% at rated amps, nominal line volts.
	Max. Short Circuit Rating:	200,000 Amps symmetrical.
	Actual Short Circuit Rating:	Determined by AIC rating of installed fuse/circuit breaker.
Control	Method:	Sine coded PWM with programmable carrier frequency. Ratings apply to all drives (refer to the *Derating Guidelines* in the PowerFlex Reference Manual).
	Carrier Frequency:	Refer to pages 43-46.
	Output Voltage Range:	0 to rated motor voltage
	Output Frequency Range:	0 to 420 Hz
	Frequency Accuracy Digital Input: Analog Input:	 Within ±0.01% of set output frequency. Within ±0.4% of maximum output frequency.
	Frequency Control:	Speed Regulation - w/Slip Compensation (Volts per Hertz Mode) 0.5% of base speed across 40:1 speed range 40:1 operating range 10 rad/sec bandwidth
		Speed Regulation - w/Slip Compensation (Sensorless Vector Mode) 0.5% of base speed across 80:1 speed range 80:1 operating range 20 rad/sec bandwidth
		Speed Regulation - w/Feedback (Sensorless Vector Mode) 0.1% of base speed across 80:1 speed range 80:1 operating range 20 rad/sec bandwidth
	Speed Control:	Speed Regulation - w/o Feedback (Vector Control Mode) 0.1% of base speed across 120:1 speed range 120:1 operating range 50 rad/sec bandwidth
		Speed Regulation - w/Feedback (Vector Control Mode) 0.001% of base speed across 120:1 speed range 1000:1 operating range 250 rad/sec bandwidth
	Torque Regulation:	Torque Regulation - w/o Feedback ±5%, 600 rad/sec bandwidth
		Torque Regulation - w/Feedback ±2%, 2500 rad/sec bandwidth
	Selectable Motor Control:	Sensorless Vector with full tuning. Standard V/Hz with full custom capability and Vector Control.
	Stop Modes:	Multiple programmable stop modes including - Ramp, Coast, DC-Brake, Ramp-to-Hold and S-curve.
	Accel/Decel:	Two independently programmable accel and decel times. Each time may be programmed from 0…3600 seconds in 0.1 second increments.
	Intermittent Overload:	110% Overload capability for up to 1 minute 150% Overload capability for up to 3 seconds
	Current Limit Capability:	Proactive Current Limit programmable from 20 to 160% of rated output current. Independently programmable proportional and integral gain.
	Electronic Motor Overload Protection:	Class 10 protection with speed sensitive response. Investigated by U.L. to comply with N.E.C. Article 430. U.L. File E59272, volume 12.

Category	Specification	
Encoder	Type:	Incremental, dual channel
	Supply:	12V, 250 mA. 12V, 10 mA minimum inputs isolated with differential transmitter, 250 kHz maximum.
	Quadrature:	90°, ±27 degrees at 25 degrees C.
	Duty Cycle:	50%, +10%
	Requirements:	Encoders must be line driver type, quadrature (dual channel) or pulse (single channel), 8…15V DC output (3.5…6V DC when jumpers are in 5V position), single-ended or differential and capable of supplying a minimum of 10 mA per channel. Maximum input frequency is 250 kHz. The Encoder Interface Board accepts 12V DC square-wave with a minimum high state voltage of 7.0V DC. With the jumpers in the 5V position, the encoder will accept a 5V DC square-wave with a minimum high state voltage of 3.1V DC. In either jumper position, the maximum low state voltage is 0.4V DC.

Voltage Tolerance

Drive Rating	Nominal Line Voltage	Nominal Motor Voltage	Drive Full Power Range	Drive Operating Range
380…400	380	380*	380…528	342…528
	400	400	400…528	
	480	460	460…528	

Drive Full Power Range =	Nominal Motor Voltage to Drive Rated Voltage +10%. Rated power is available across the entire Drive Full Power Range.
Drive Operating Range =	Lowest (*) Nominal Motor Voltage –10% to Drive Rated Voltage +10%. Drive Output is linearly derated when Actual Line Voltage is less than the Nominal Motor Voltage.



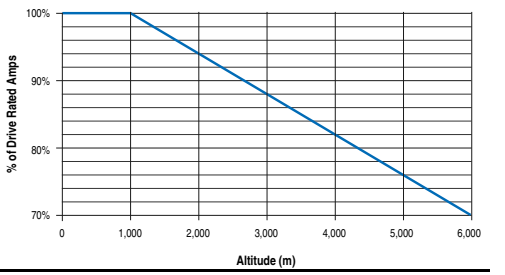
Heat Dissipation

Watts Loss (Rated Load, Speed & PWM)

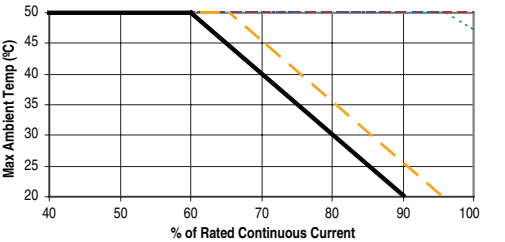
Voltage	Frame	Hp Rating		Dissipation *(Watts)*					
				AC Input			*DC Input*		
		ND	*HD*	*External*	*Internal*	*Total*	*External*	*Internal*	*Total*
400/480V AC	7	250	200	3422	514	3936	3098	497	3595
		250	250	4224	618	4842	3848	599	4447
	8	300	250	3125	569	3694	2698	547	3245
		350	300	3588	681	4269	3091	655	3746
		400	350	4284	850	5133	3692	816	4510
		450	400	4850	1000	5850	4178	965	5143
		500	450	5278	2010	7288	4506	1969	6475
	9	600	500	8740	2270	11010	7752	2218	9970
	10	700	600	8595	2339	10934	7470	2280	9750

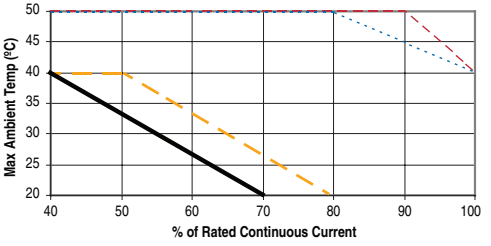
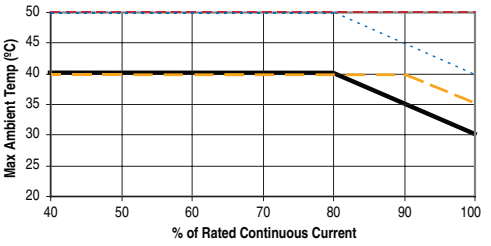
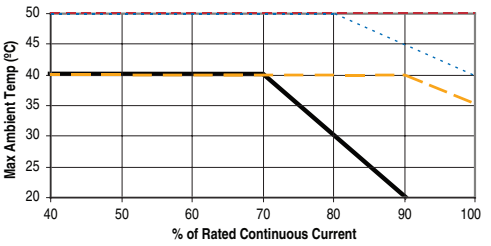
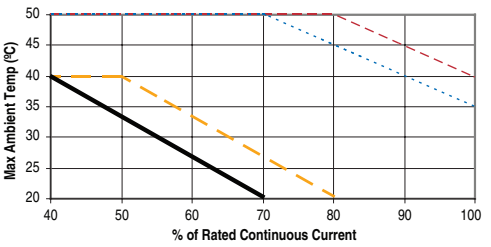
Derate Guidelines

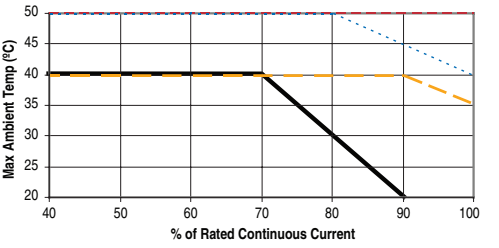
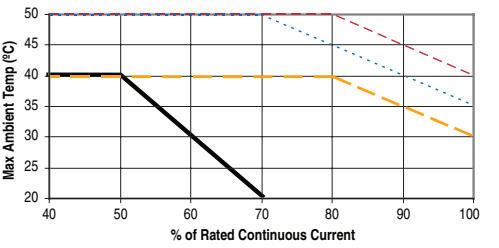
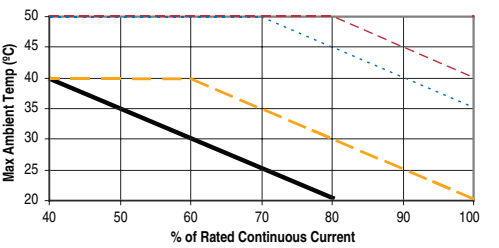
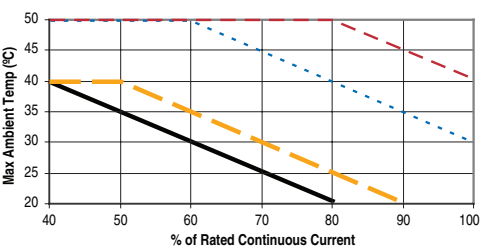
Altitude

Frame	Type	Derate
All	Altitude	

Ambient Temperature Load

Power Rating			Derating
Normal Duty	Heavy Duty	Cont. Amps	2 kHz 4 kHz 8 kHz 10 kHz
400/480 Volt			
250 HP	200 HP	292	

Power Rating			Derating
Normal Duty	**Heavy Duty**	**Cont. Amps**	2 kHz 4 kHz 8 kHz 10 kHz
250 HP	250 HP	325	
300 HP	250 HP	365	
350 HP	300 HP	415	
400 HP	350 HP	481	

Power Rating			Derating
Normal Duty	Heavy Duty	Cont. Amps	2 kHz 4 kHz 8 kHz 10 kHz
450 HP	400 HP	535	
500 HP	450 HP	600	
600 HP	500 HP	730	
700 HP	600 HP	875	

Notes:

PN-62356

U.S. Allen-Bradley Drives Technical Support
Tel: (1) 262.512.8176, Fax: (1) 262.512.2222, Email: support@drives.ra.rockwell.com, Online: www.ab.com/support/abdrives

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 20B-IN014F-EN-P – October 2009
Supersedes 20B-IN014E-EN-P – November 2008

PN-62356