

PowerFlex 700 Adjustable Frequency AC Drive – Frames 7...10

This document explains the 5 BASIC STEPS needed to install and perform a Basic Start-Up of the PowerFlex 700 AC drive. A Human Interface Module (HIM) is required to perform the Basic Start-Up routine covered in this manual.

The information provided is intended for qualified installers only.

Additional Resources

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

Resource	Description
PowerFlex 700 Standard Control User Manual, publication 20B-UM001	Provides detailed information on: <ul style="list-style-type: none"> Parameters and programming Faults, alarms, and troubleshooting
PowerFlex 700 Vector Control User Manual (v4.001 & up), publication 20B-UM002	
PowerFlex 700 AC Drive Technical Data, publication 20B-TD001	This publication provides detailed drive specifications, option specifications and input protection device ratings.
PowerFlex Comm Adapter Manuals, publication 20COMM-UM...	These publications provide information on configuring, using, and troubleshooting PowerFlex communication adapters.
PowerFlex 70 and PowerFlex 700 Reference Manual, publication PFLEX-RM001	These publications provide detailed application specific information for programming and configuring the PowerFlex 700 drive.
PowerFlex 70 Enhanced Control and PowerFlex 700 Vector Control Reference Manual, publication PFLEX-RM004	
Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-IN001	Provides basic information needed to properly wire and ground PWM AC drives.
Safety Guidelines for the Application, Installation and Maintenance of Solid State Control, publication SGI-1.1	Provides general guidelines for the application, installation, and maintenance of solid-state control.
Guarding Against Electrostatic Damage, publication 8000-4.5.2	Provides practices for guarding against Electrostatic damage (ESD)
Product Certifications website, http://ab.com	Provides declarations of conformity, certificates, and other certification details.

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

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

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	4
Step 1: Read the Precautions and General Information	5
EMC Compliance	7
Component Locations	8
Step 2: Lifting and Mounting the Drive	12
Lifting	12
Environment	14
Minimum Mounting Clearances & Heat Dissipation	14
Removing the Frame 7 Cover	14
Dimensions	15
Step 3: Wire the Drive	29
Special Considerations	29
Cable Types Acceptable for 200...600 Volt Installations	31
Single-Phase Input Power – Frame 7 Only	32
Power Terminal Blocks	33
Fan Circuit Power Supply	35
Additional Frame 10 Wiring Requirement for IP00 AC Input Drives	38
DC Link Chokes – Frames 8...10	38
Auxiliary Control Power Supply	39
General Grounding Requirements	40
Motor Overload Protection	41
Drive, Fuse & Circuit Breaker Ratings	41
Output Devices	45
Using Input/Output Contactors	45
Disconnecting MOVs	46
Step 4: I/O Wiring	49
I/O Wiring Examples	52
Hardware Enable Circuitry (Vector Control Only)	54
Encoder Interface Option	54
Reference Control	56
Step 5: Start-Up Check List	59
Prepare For Drive Start-Up	59
Supplemental Information	62
DC Input (Common Bus) and Precharge Notes	62
Human Interface Module (HIM) Overview	63
Start-Up Routines	64
Drive Status Indicators & DPI Port Locations	68
Common I/O Programming Changes	70
Troubleshooting	71
Common Symptoms and Corrective Actions	73
Manually Clearing Faults	75

Catalog Number Explanation

20B D 325 A 3 A N N N E C 0 m n

a b c d e f g h i j k l m n

<i>a</i>	
Drive	
Code	Type
20B	PowerFlex 700

<i>b</i>				
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

<i>c</i>			
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.

<i>d</i>	
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

<i>e</i>	
HIM	
Code	Operator Interface
0	Blank Cover
3	LCD Display, Full Numeric Keypad

<i>f</i>	
Documentation	
Code	Type
A	Manual
N	No Manual
Q	No Shipping Package (Internal Use Only)

<i>g</i>	
Brake	
Code	w/Brake IGBT ‡
N	No

‡ Brake IGBT is not available on Frames 7...10.

<i>h</i>	
Internal Braking Resistor	
Code	w/Resistor
N	No

* Not available on Frames 7...10.

<i>i</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.

<i>j</i>	
Comm Slot	
Code	Network Type
C	ControlNet (Coax)
D	DeviceNet
E	EtherNet/IP
N	None

<i>k</i>		
Control & I/O		
Code	Control	I/O Volts
C	Vector Δ	24V DC
D	Vector Δ	115V AC

Δ Vector Control Option utilizes DPI Only.

<i>l</i>	
Feedback	
Code	Type
0	None
1	Encoder, 12V/5V

<i>m</i>	
Future Use	

<i>n</i>	
Future Use	

Step 1: Read the Precautions and General Information

Qualified Personnel



ATTENTION: Allow only qualified personnel familiar with adjustable frequency AC drives and associated machinery to plan or implement the installation, start-up and subsequent maintenance of the system. Failure to comply can 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 following points (refer to pages [8](#) through [11](#) for locations):

- +DC and -DC terminals of the Power Terminal Block
- +DC terminal of the Power Terminal Block and the chassis
- -DC terminal of the Power Terminal Block and the chassis

The voltage must be zero for all three measurements.



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 can be required to remove the AC line to the drive. An auxiliary braking method can 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 can 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 can 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: 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 drives bus voltage is increasing toward levels that will cause a fault. However, it can also cause either of the following two conditions to occur.

- 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) occurs if the speed reaches [Maximum Speed] + [Overspeed Limit], (parameters 82 and 83). If this condition is unacceptable, action must 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).
- 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 provides 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.

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](#) on [page 40](#) 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 Pulse Width Modulated (PWM) AC Drives, publication [DRIVES-IN001](#) be referenced to assure CE EMC compliance.

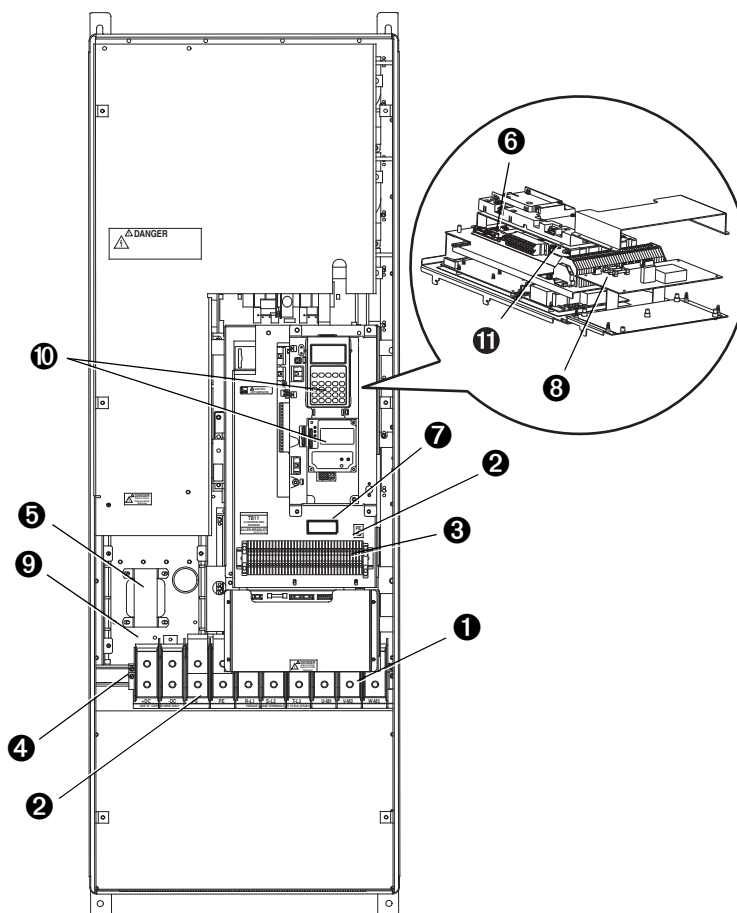
Table 1 - Recommended Filters

Base Drive Catalog No.	Power (kW)	Current A (at 50° C)	Schaffner Part No.	EN61800-3 Cat. C1, EN6100-6-3, CISPR11, Group 1, Class B (Meters)	EN61800-3 Cat. C2 EN6100-6-4, CISPR11, Group 1, Class A (Meters)
20BC292 20BD248 20BD292	160	320	FN3359-320-99	100 ⁽¹⁾	150 ⁽¹⁾
20BC325 20BC365 20BD325 20BD365	200	400	FN3359-400-99		
20BC415 20BD415	250	600	FN3359-600-99		
20BC535 20BD535	315	600	FN3359-600-99		
20BD600	355	800	FN3359-800-99		
20BD730	400	800	FN3359-800-99		
20BD875	500	1000	FN3359-1000-99		

(1) Motor cable length limit with this filter. Supplementary EMC enclosure required to provide attenuation of radiated emissions.

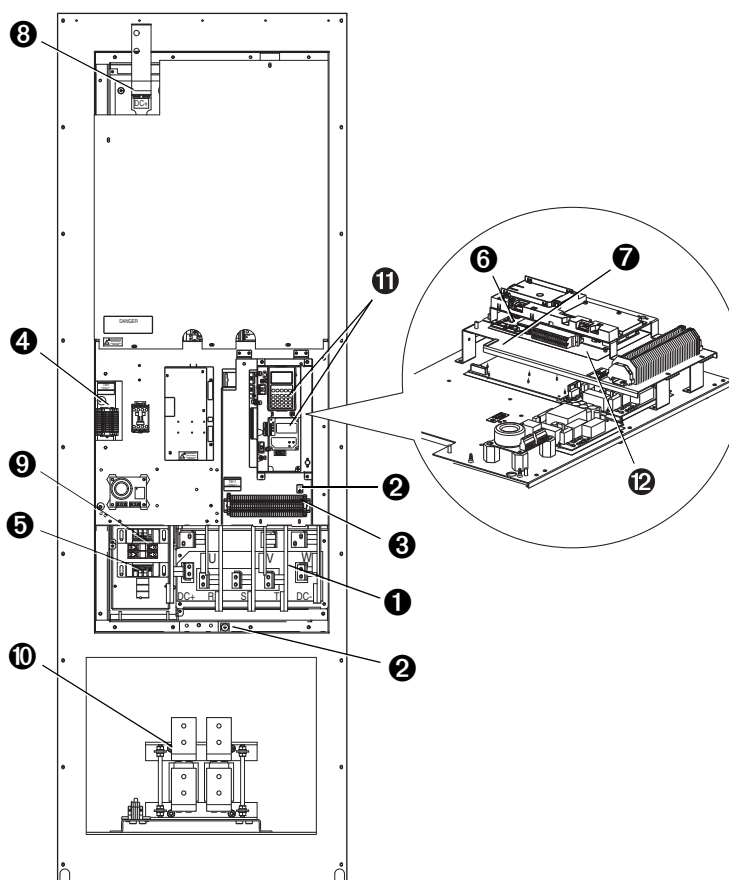
Component Locations

Frame 7



No.	Component
①	Power Terminal Block
②	PE Ground
③	I/O & Auxiliary Control Voltage - TB11
④	Fan Terminal Block (DC input only)
⑤	Fan Transformer (AC input only)
⑥	Main Control Board

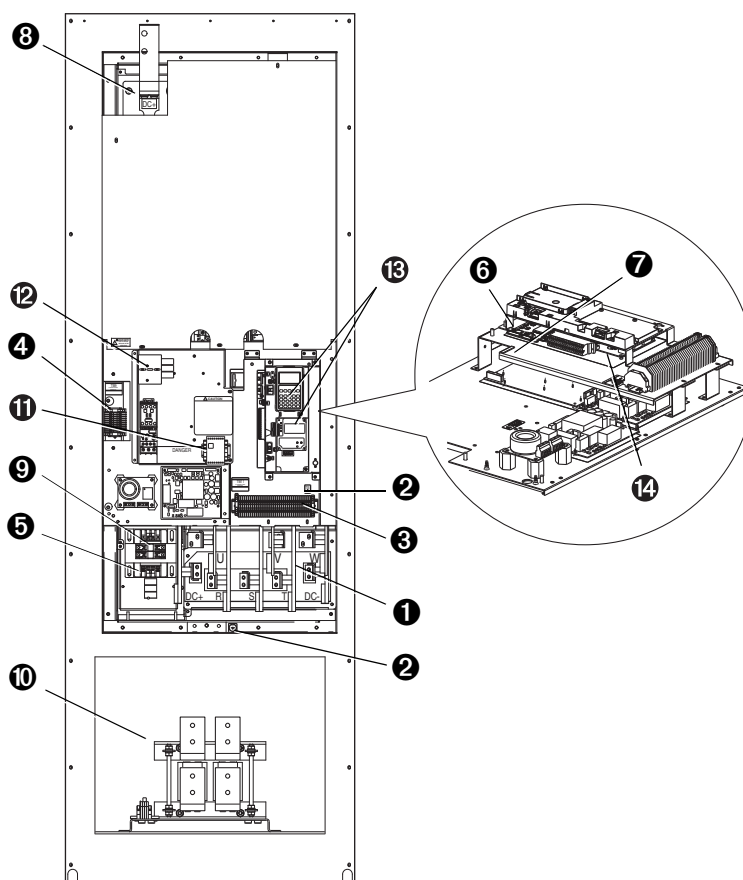
No.	Component
⑦	Nameplate
⑧	Precharge Board
⑨	MOV
⑩	HIM/Comm Module (Optional)
⑪	Encoder Feedback Board (Optional)

Frame 8

No.	Component
1	Power Terminals
2	PE Ground (and MOV wire)
3	I/O & Auxiliary Control Voltage - TB11
4	Fan Terminal Block - TB9
5	Fan Transformer (AC input only)
6	Main Control Board

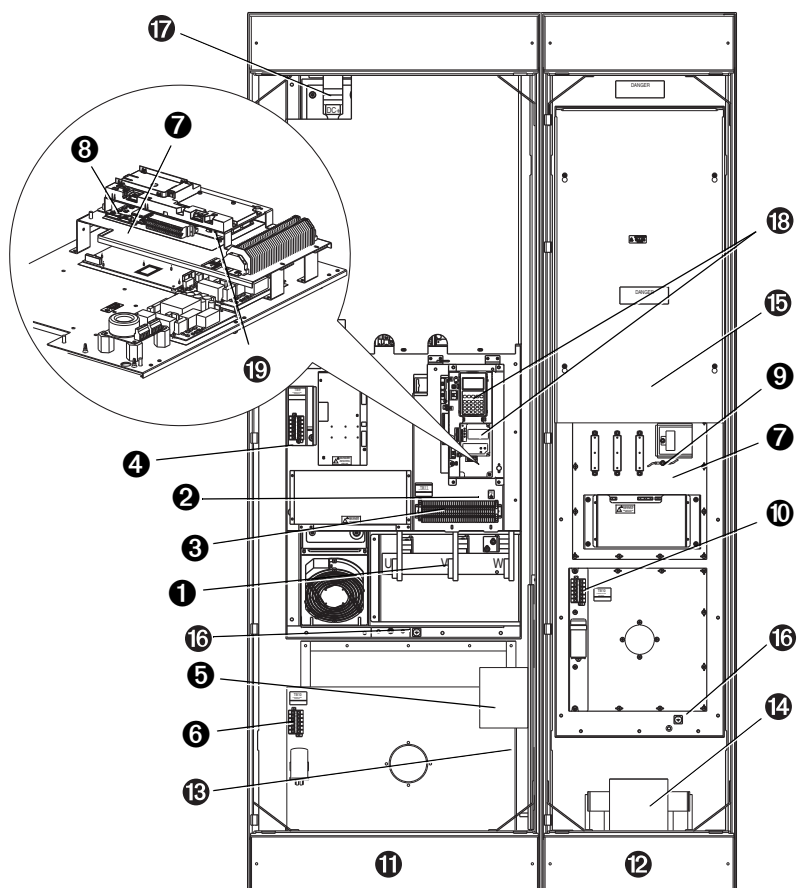
No.	Component
7	Nameplate
8	DC Bus/Brake Terminals
9	MOV (under boards)
10	DC Link Choke (AC input only)
11	HIM/Comm Module (Optional)
12	Encoder Feedback Board (Optional)

Frames 9



No.	Component
①	Power Terminals
②	PE Ground (and MOV wire)
③	I/O & Auxiliary Control Voltage - TB11
④	Fan Terminal Block (cap. fan) - TB9
⑤	Fan Transformer (cap. fan) - AC input only
⑥	Main Control Board
⑦	Nameplate

No.	Component
⑧	DC Bus/Brake Terminals
⑨	MOV (under boards)
⑩	DC Link Choke (AC input only)
⑪	Phase Monitor Relay
⑫	Blower Terminal Block (three-phase)
⑬	HIM/Comm Module (Optional)
⑭	Encoder Feedback Board (Optional)

Frame 10

AC Input drive is shown. For DC Input drives, reference the left Inverter section.

No.	Component
①	Motor Terminal Block
②	PE Ground
③	I/O & Auxiliary Control Voltage - TB11
④	Fan Terminal Block - TB9 (Capacitor Assembly Fan)
⑤	Fan Transformer (IP20 Only)
⑥	Fan Terminal Block - TB10 (Heatsink Fan)
⑦	Nameplate
⑧	Main Control Board
⑨	MOV Jumper
⑩	Fan Terminal Block - TB12 (Heatsink Fan)

No.	Component
①	Inverter Section
②	Converter Section
③	PE Bus Bar (IP20 Only)
④	DC Link Choke (AC input only, supplied loose for IP00)
⑤	AC Input Terminals (Behind Shield)
⑥	PE Connection Point (IP00)
⑦	DC Bus/Brake Terminals
⑧	HIM/Comm Module (Optional)
⑨	Encoder Feedback Board (Optional)

Step 2: Lifting and Mounting the Drive



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

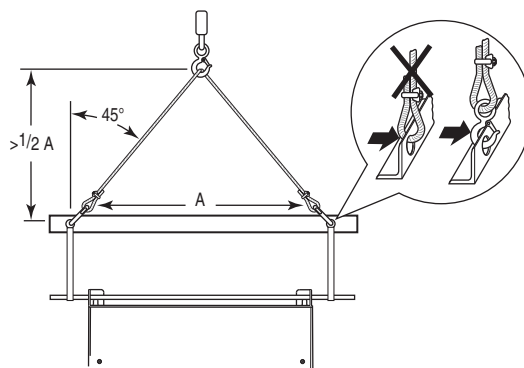
Braces attached to the front of Frame 8, 9 or 10 IP20, NEMA/UL Type 1 drives are required for structural integrity. If necessary, the braces can be removed for wiring, but must be replaced upon completion.

Lifting

Frame 7

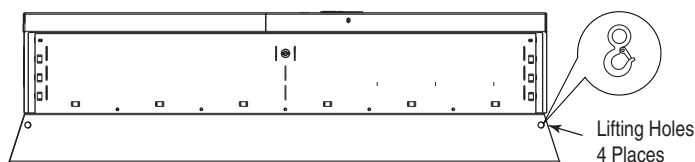
IP00, NEMA/UL Type Open

Approximate Weight	147 kg (324 lbs.) + 26 kg (58 lbs.) for shipping materials
--------------------	--



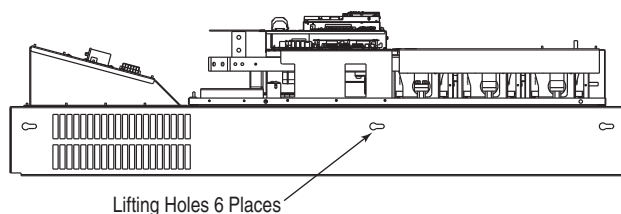
IP20, NEMA/UL Type 1

Approximate Weight	170 kg (375 lbs.) + 26 kg (58 lbs.) for shipping materials
--------------------	--

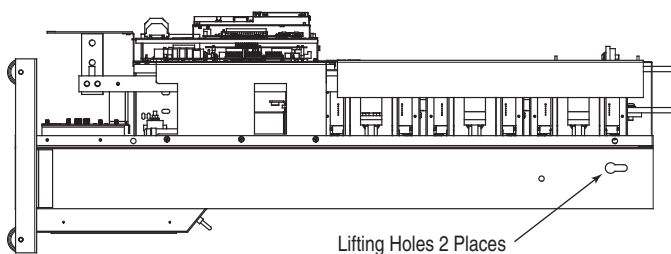


*Frames 8, 9 and 10***IP00, NEMA/UL Type Open**

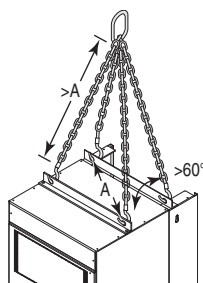
Approximate Weight	Frame 8	–	384 kg (847 lbs.) + 47 kg (103 lbs.) for shipping materials
	Frame 9	–	401 kg (884 lbs.) + 47 kg (103 lbs.) for shipping materials
	Frame 10	DC Input	305 kg (672 lbs.) + 47 kg (103 lbs.) for shipping materials
		AC input	532 kg (1172 lbs.) + 91 kg (200 lbs.) for shipping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

Environment

Operating Temperatures

PowerFlex 700 drives are designed to operate at 0...40 °C ambient. To operate the drive in installations between 41...50 °C, see [Table 2](#) and refer to pages [42](#) through [44](#) for exceptions.

Table 2 - Acceptable Surrounding Air Temperature & Required Actions

Enclosure Rating	Temperature Range	Drive
IP20, NEMA/UL Type 1	0...40 °C (0...104 °F)	Frames 7...10
IP00, NEMA/UL Type Open/Flange Mount Front: IP00, NEMA/UL Type Open Back/Heat Sink: IP54, NEMA12	0...65 °C (0...149 °F) Control Board 0...40 °C (0...104 °F) Heat Sink Entry Air	Frames 7...10
Roll In Front: IP00, NEMA/UL Type Open Back/Heat Sink: IP54, NEMA12	0...65 °C (0...149 °F) Control Board 0...40 °C (0...104 °F) Heat Sink Entry Air	Frames 8...9

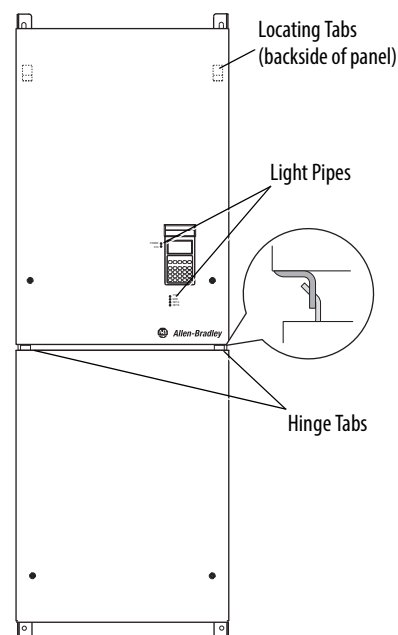
Minimum Mounting Clearances & Heat Dissipation

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	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 - Minimum of 152 mm (6.0 in.) at the back of the enclosure (flange mount surface to wall).
8...10	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. Flange Mount - Minimum of 102 mm (4.0 in.) on each side.

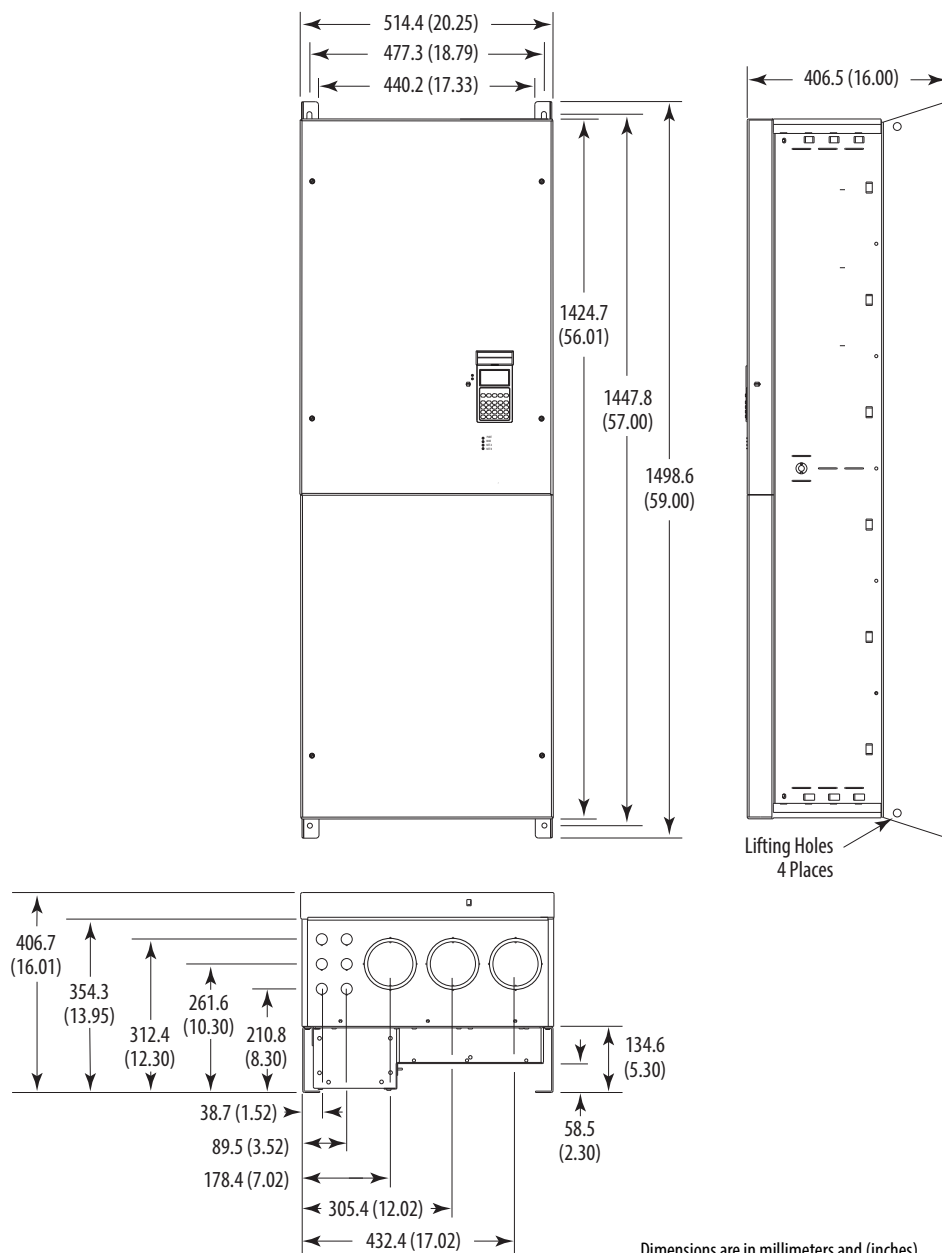
Removing the Frame 7 Cover

1. Loosen lower panel screws and pull the bottom edge out.
2. Tilt panel sufficiently to remove Hinge Tabs from the upper panel. Remove panel and set aside.
3. Loosen upper panel screws and pull bottom edge out slightly.
4. Slide panel down until Locating Tabs clear chassis. Remove panel and set aside.
5. Replace panels in reverse order. Carefully align tabs and light pipes.



Dimensions

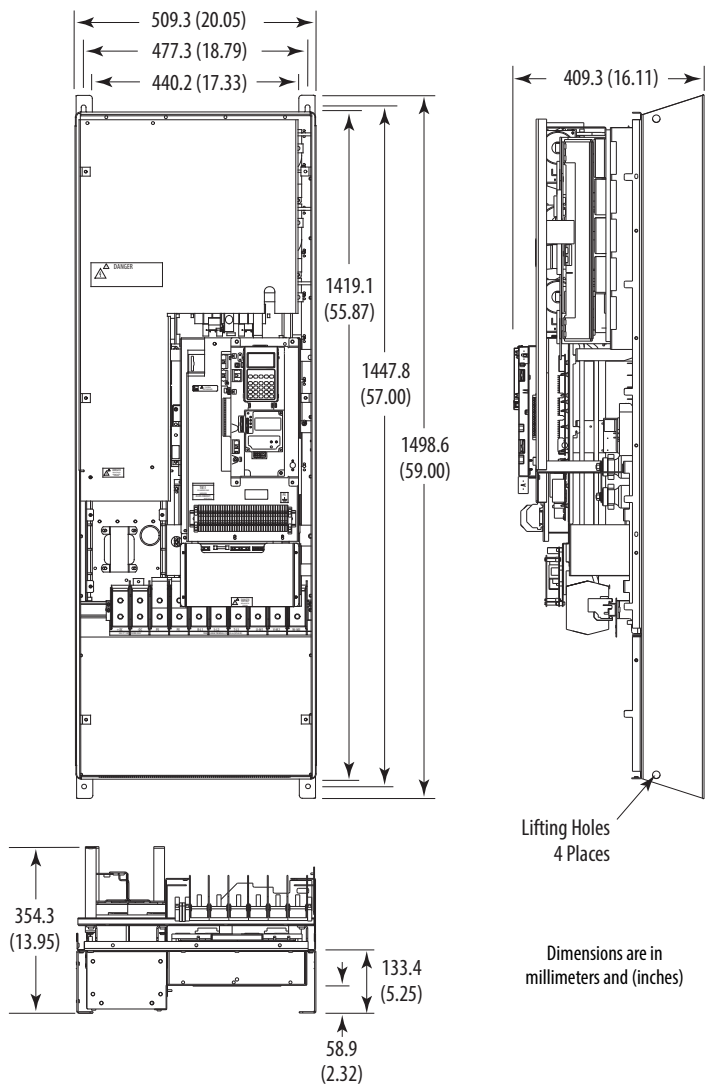
Frame 7 – IP20, NEMA/UL Type 1



Dimensions are in millimeters and (inches)

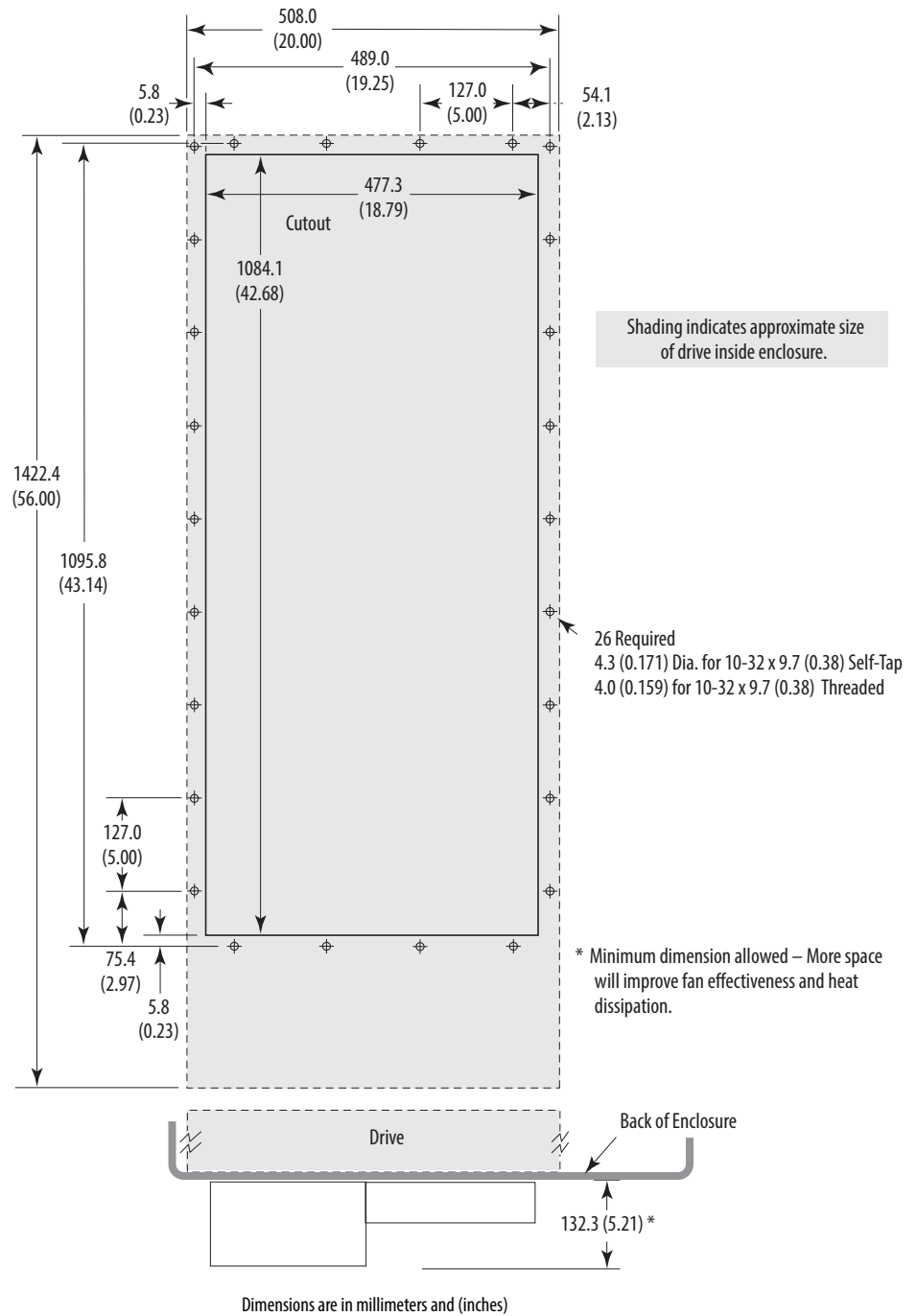
Approx. Weight kg (lbs.)	
Drive	Drive & Packaging
170 (375)	196 (433)

Frame 7 – IP00, NEMA/UL Type Open



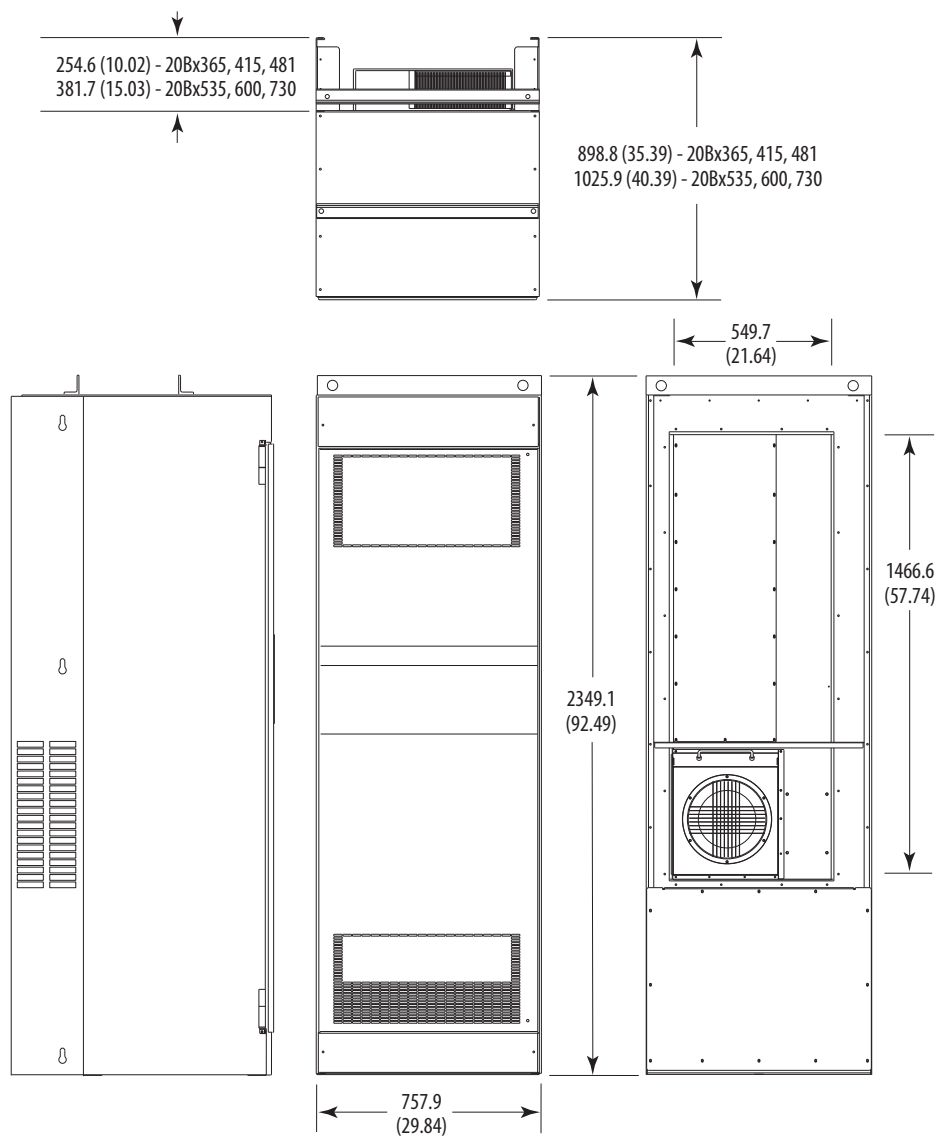
Approx. Weight kg (lbs.)	
Drive	Drive & Packaging
147 (324)	173 (382)

Frame 7 – Flange Mount Cutout



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

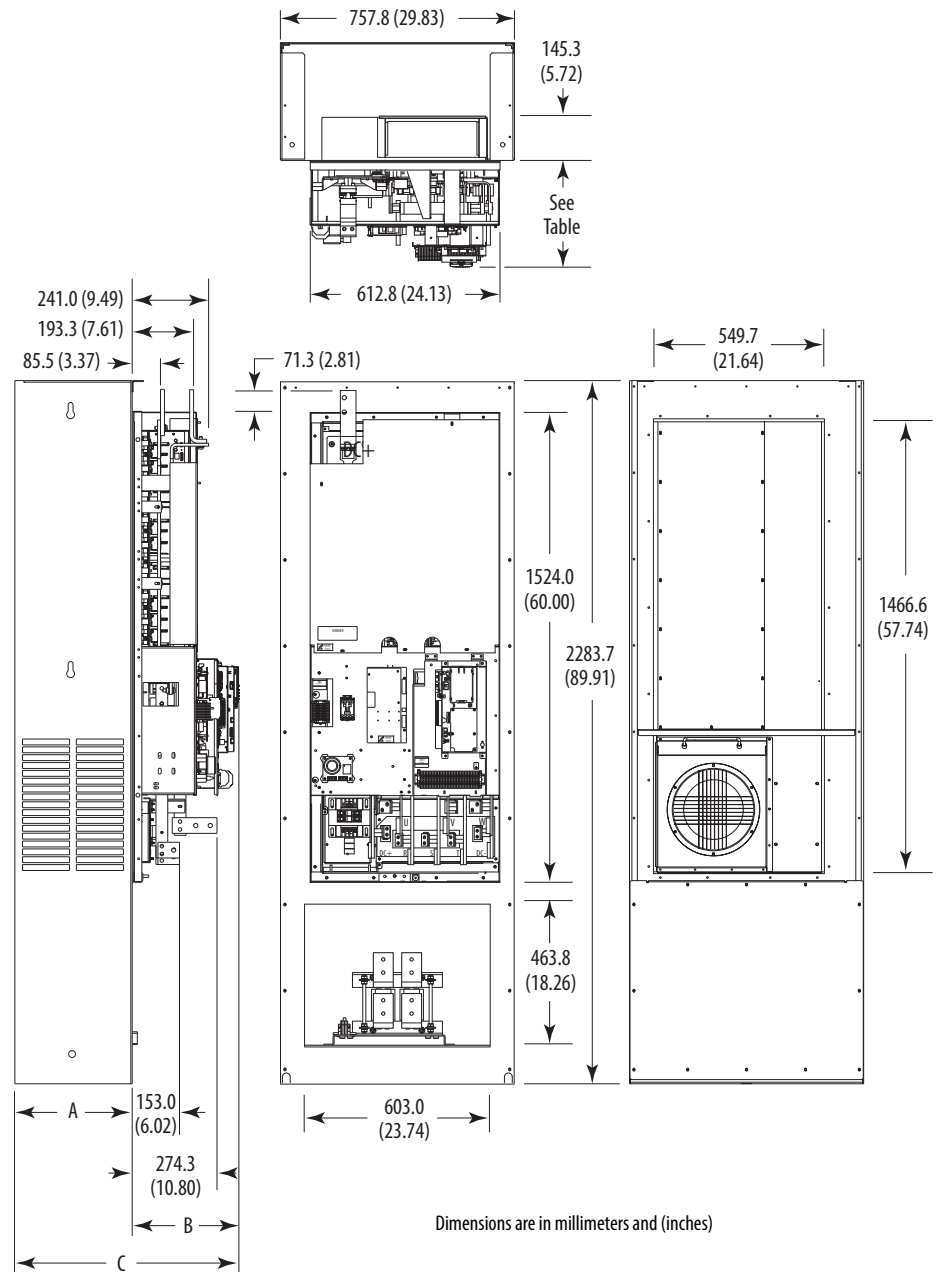
Frames 8 and 9 – IP20, NEMA/UL Type 1



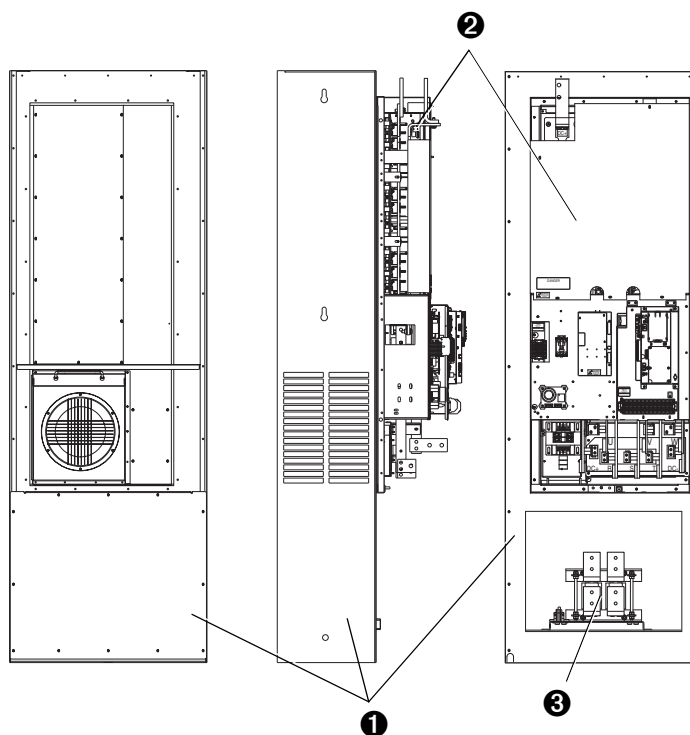
Dimensions are in millimeters and (inches)

Approx. Weight kg (lbs.)		
Frame	Drive	Drive & Packaging
8	509 (1122)	556 (1225)
9	526 (1159)	603 (1262)

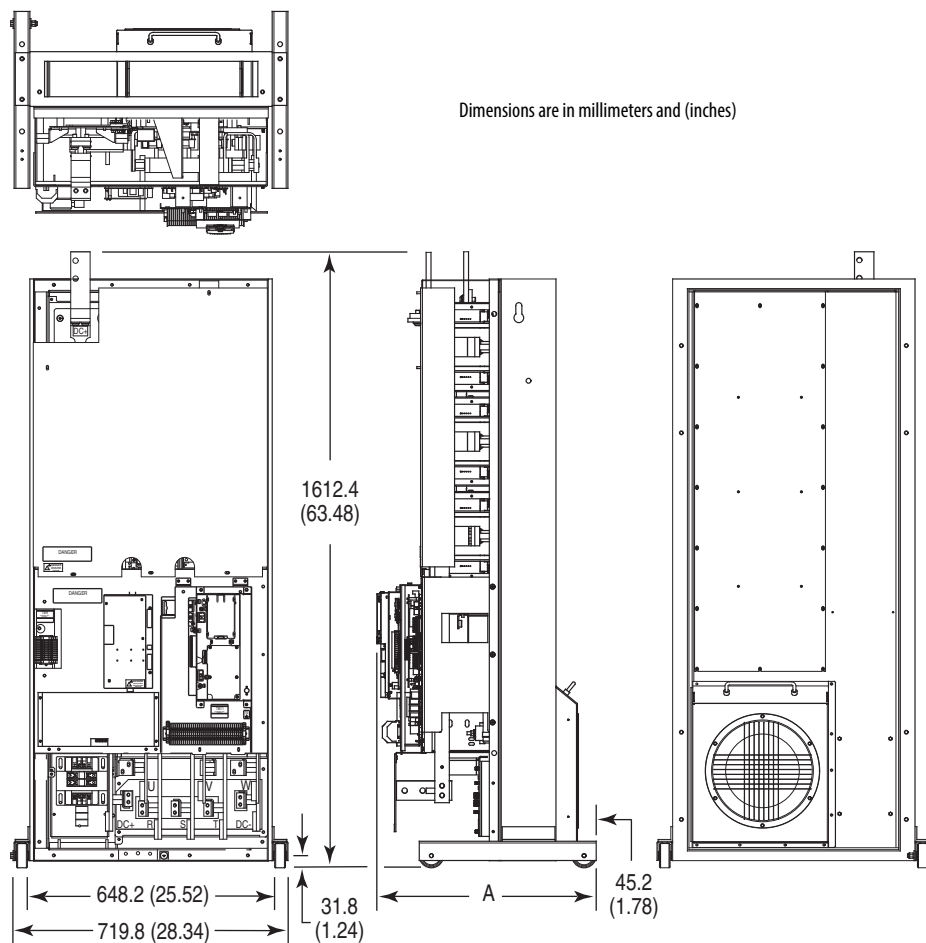
Frames 8 and 9 – IP00, NEMA/UL Type Open



Frame	Cat. No.	A	B	C	Approx. Weight kg (lbs.)	
					Drive	Drive & Packaging
8	20Bx365, 415, 481	254.6 (10.02)	345.3 (13.59)	599.4 (23.60)	384 (847)	431 (950)
	20Bx535, 600	381.7 (15.03)	345.5 (13.60)	726.6 (28.61)	384 (847)	431 (950)
9	20Bx730	381.1 (15.00)	345.3 (13.60)	771.9 (30.39)	401 (884)	448 (987)

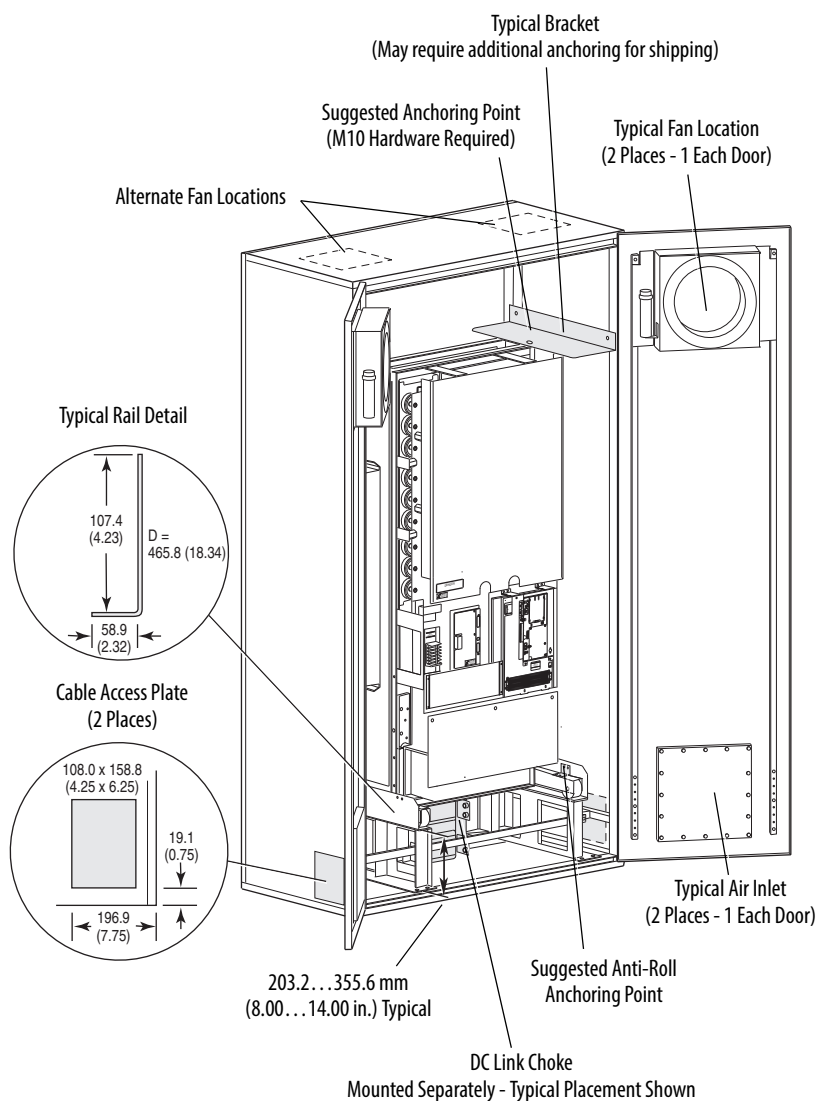
Frames 8 and 9 – Converting an IP00 Drive for Flange Mounting

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 28 for dimensions) and is wired directly to drive.

Frames 8 and 9 Roll-In – IP00, NEMA/UL Type Open

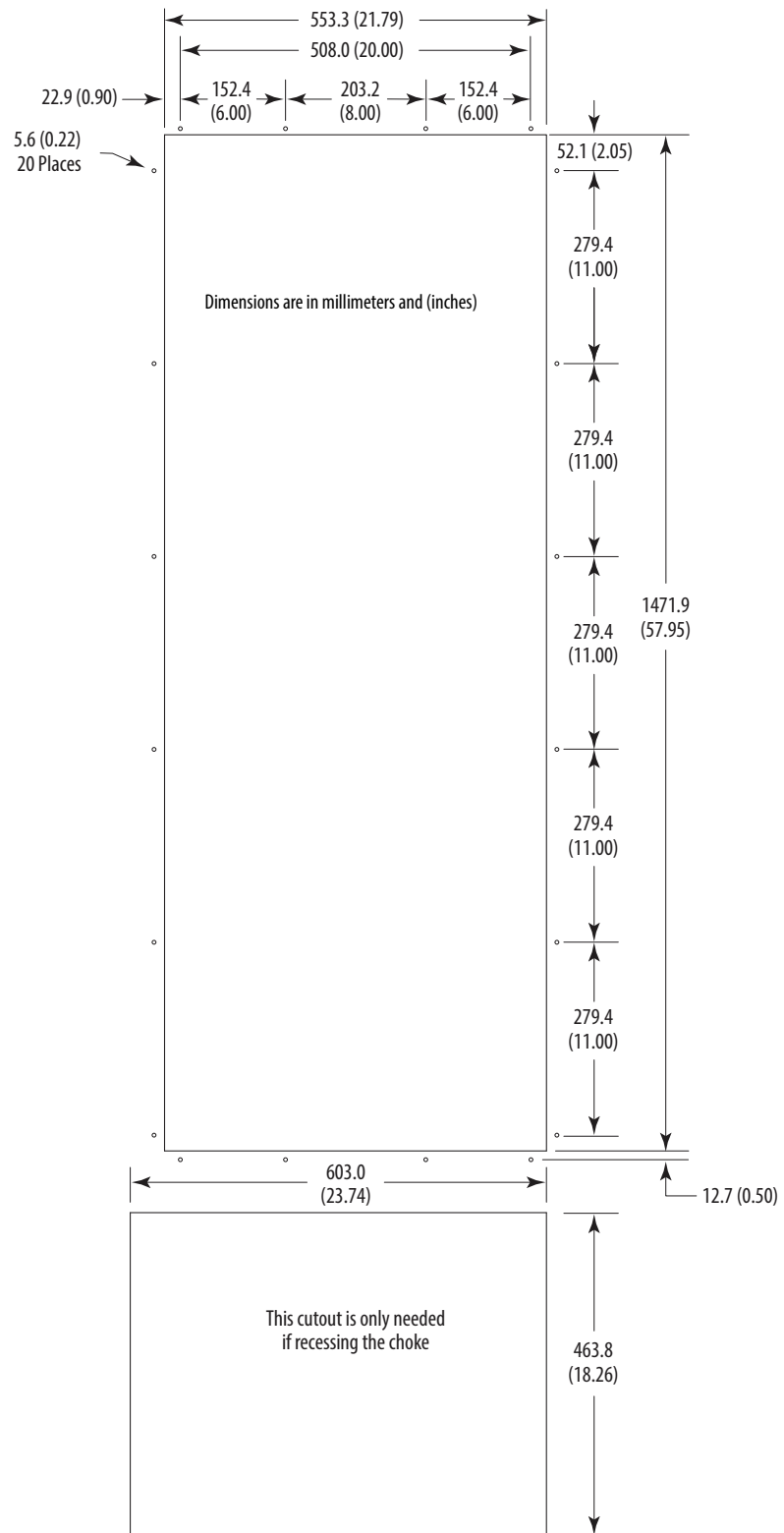
Frame	Cat. No.	A	Approx. Weight kg (lbs.)	
			Drive	Drive & Packaging
8	20Bx365, 415, 481	574.8 (22.63)	250 (552)	297 (655)
8	20Bx535, 600	574.8 (22.63)	250 (552)	297 (655)
9	20Bx730	594.3 (23.40)	267 (589)	314 (692)

Frames 8 and 9 Roll-In Mounting Considerations



IMPORTANT

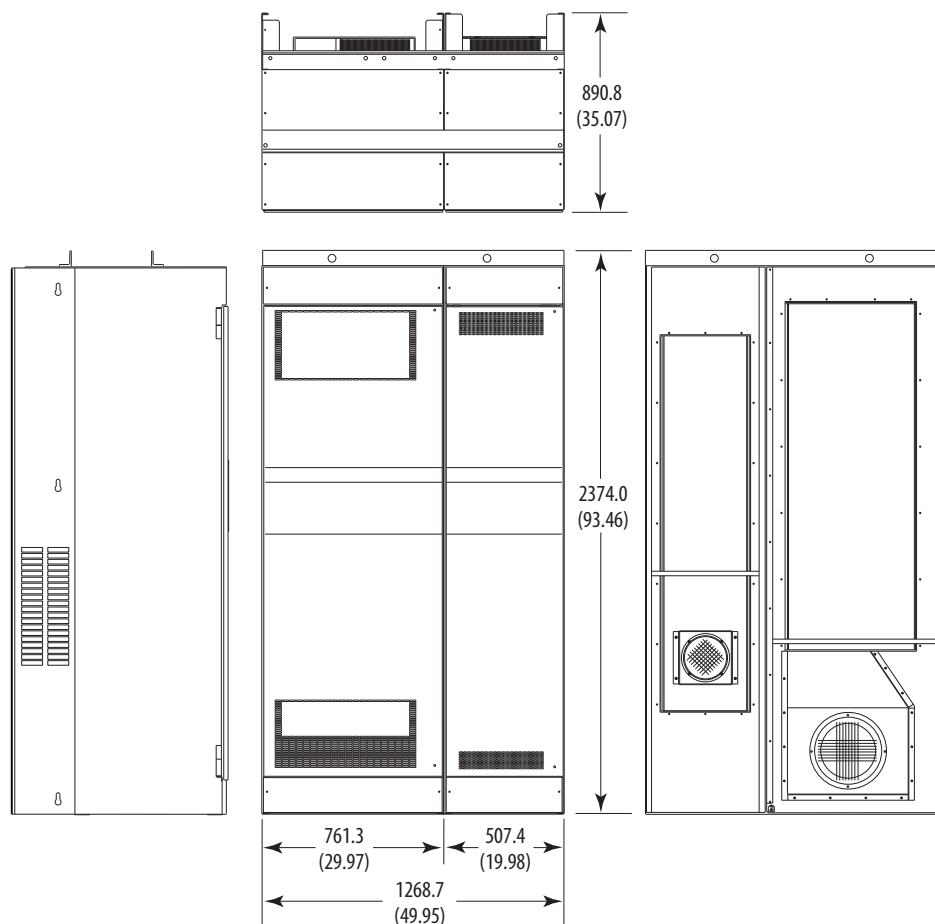
This information illustrates how an open roll-in style drive could be mounted in a user supplied enclosure. Illustrations are intended only to identify structural mounting points and hardware shapes. You must design and fabricate steel components based on the actual mounting configuration, calculated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

Frames 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 – IP20, NEMA/UL Type 1

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

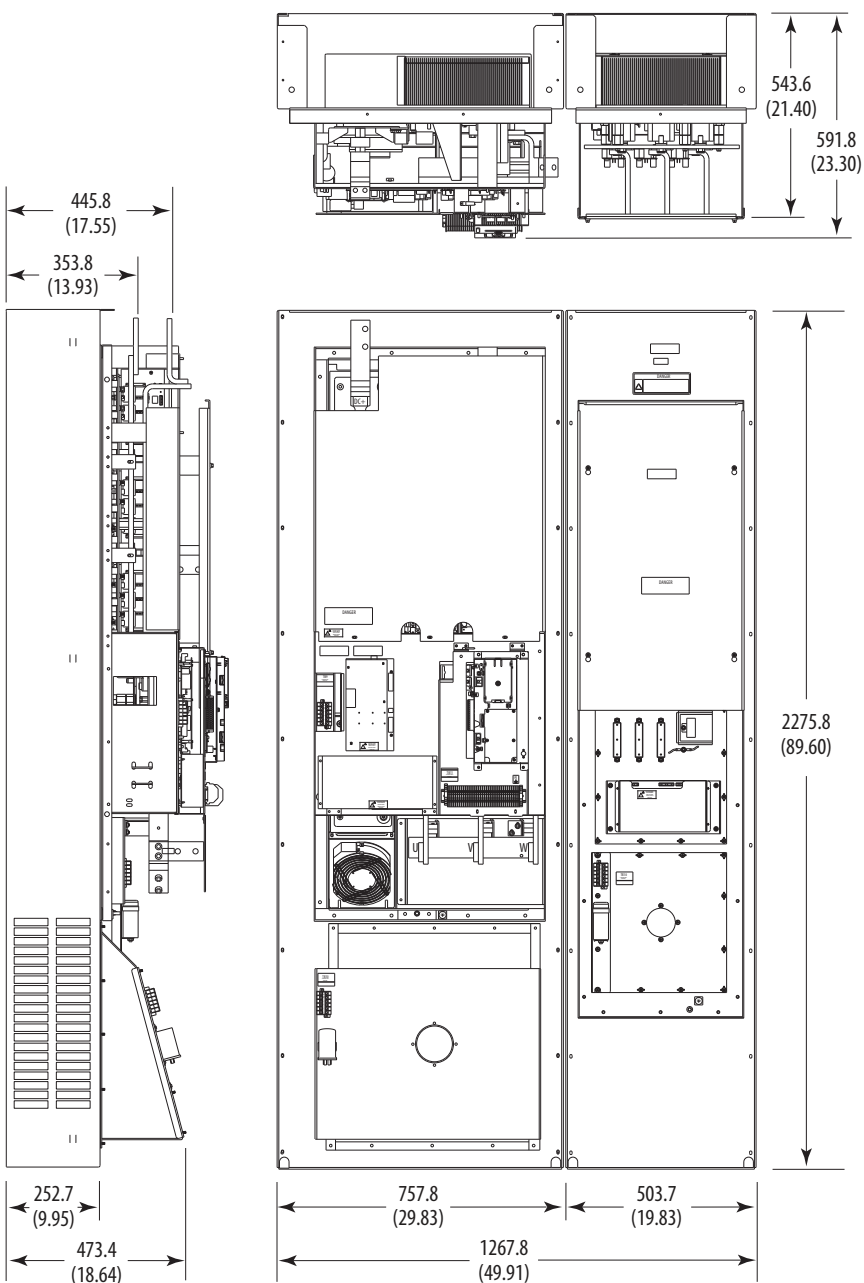


Dimensions are in millimeters and (inches)

Approx. Weight kg (lbs.)		
Type	Drive	Drive & Packaging
DC Input	468 (1032)	515 (1135)
AC Input	867 (1912)	958 (2112)

Frame 10 – IP00, NEMA/UL Type Open

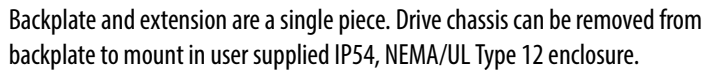
AC Input Shown, for DC Input Dimensions use the Inverter (Left) Bay

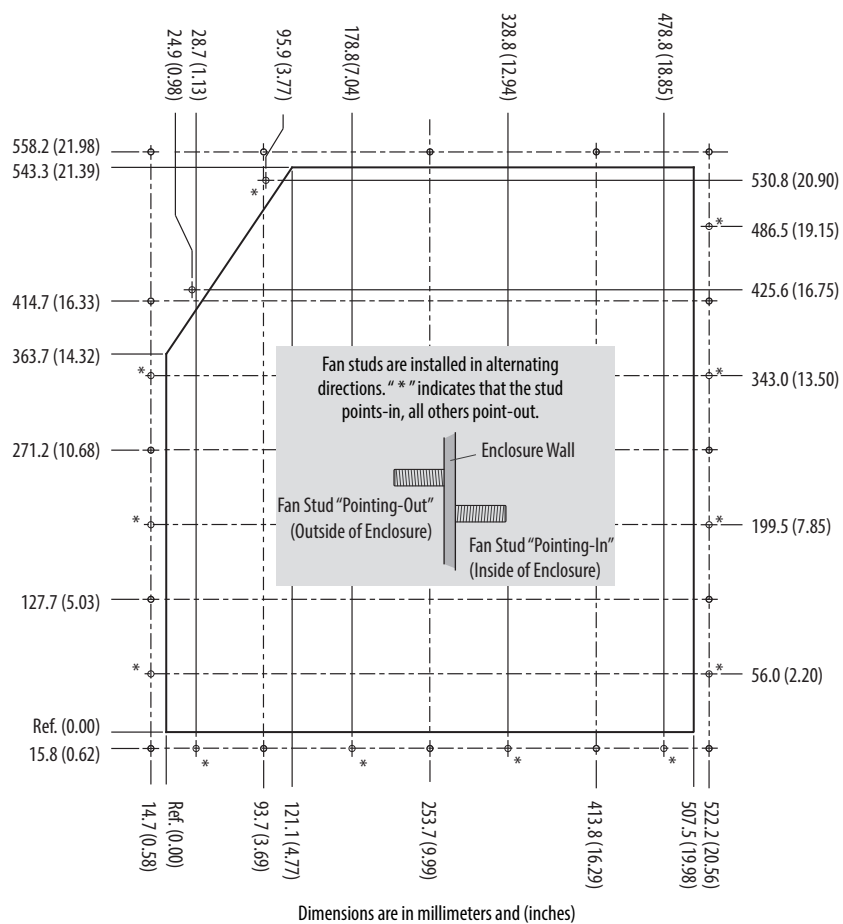


Dimensions are in millimeters and (inches)

Approx. Weight kg (lbs.)		
Type	Drive	Drive & Packaging
DC Input	305 (672)	352 (775)
AC Input	532 (1172)	623 (1372)

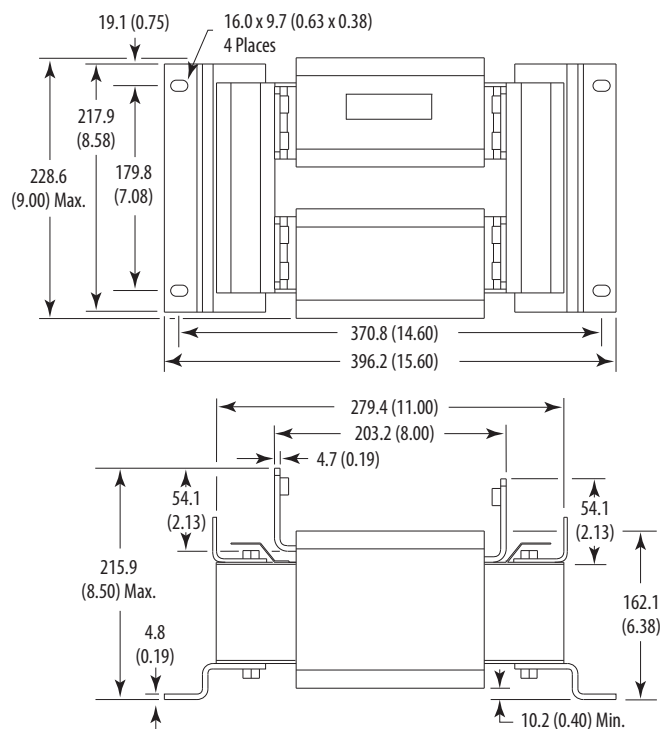
IMPORTANT



Frame 10 – Flange Mount Cutout Detail**IMPORTANT**

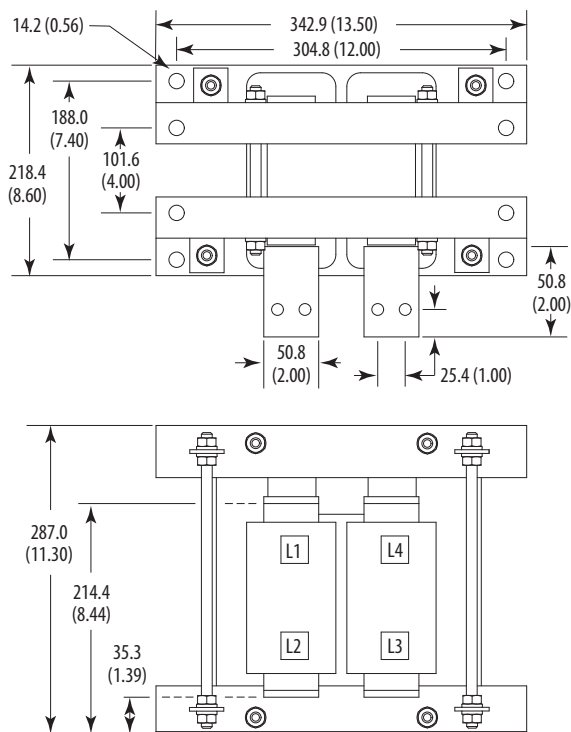
Backplate and extension are a single piece. Drive chassis can be removed from backplate to mount in user supplied IP54, NEMA/UL Type 12 enclosure.

DC Link Choke – Frame 8

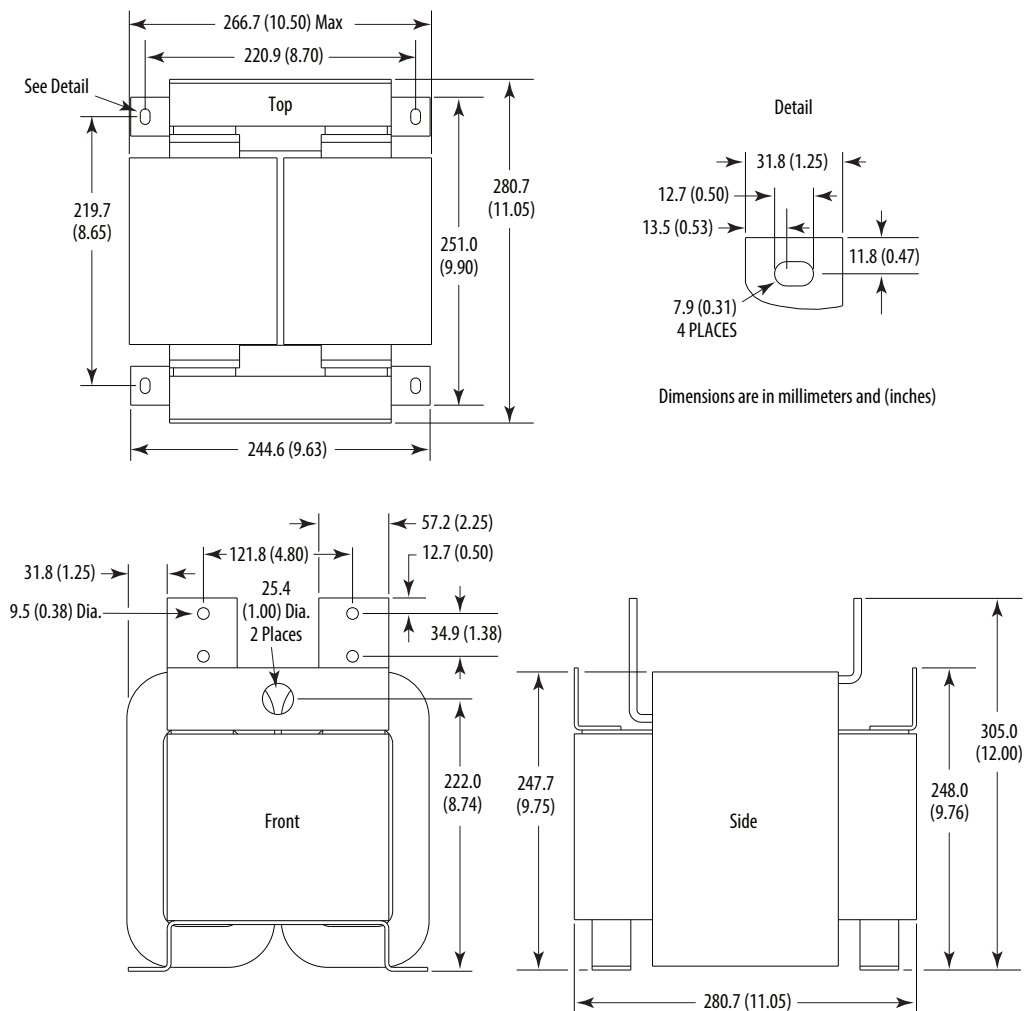


Dimensions are in millimeters and (inches)

DC Link Choke – Frame 9



Dimensions are in millimeters and (inches)

DC Link Choke – Frame 10**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 41](#).

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

Unbalanced, Ungrounded, Resistive or B Phase Grounded Distribution Systems

If phase to ground voltage exceeds 125% of normal line to line voltage or the supply system is ungrounded, refer to the Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication [DRIVES-IN001](#).



ATTENTION: To guard against drive damage, PowerFlex 700 drives contain protective MOVs and common mode capacitors that are referenced to ground. These devices must be disconnected if the drive is not installed on a solidly grounded system. See [page 46](#) for details.

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.

EMC Compliance

Frames 7...10: Drives are CE Certified for use with 400V AC and 480V AC center grounded neutral power supply systems only. Refer to [page 7](#) for details.

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 Pulse Width Modulated (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 must be disabled. This helps to 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 Pulse Width Modulated (PWM) AC Drives, publication [DRIVES-IN001](#) or the PowerFlex 700 Technical Data, publication [20B-TD001](#).

Cable Types Acceptable for 200...600 Volt Installations

A variety of cable types are acceptable for drive installations. For many installations, unshielded cable is adequate, provided it can be separated from sensitive circuits. As an approximate guide, allow a spacing of 0.3 meters (1 foot) for every 10 meters (32.8 feet) of length. In all cases, long parallel runs must be avoided. Do not use cable with an insulation thickness less than or equal to 15 mils (0.4mm/0.015 in.). Use Copper wire only. Wire gauge requirements and recommendations are based on 75 °C. Do not reduce wire gauge by using higher temperature wire.

Unshielded

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

Shielded/Armored Cable

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

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

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

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

Other types of shielded cable are available, but the selection of these types can limit the allowable cable length. Particularly, some of the newer cables bundle 4 conductors of THHN wire and wrap them tightly with a foil shield. This construction can greatly increase the cable charging current required and reduce the overall drive performance. Unless specified in the individual distance tables as tested with the drive, these cables are not recommended and their performance against the lead length limits supplied is not known. See [Table 3](#).

Table 3 - Recommended Shielded Wire

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

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% (at maximum ambient temperature of 25 °C) of the three-phase ratings. Refer to [Table 4](#) on [page 33](#).

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 on the Precharge Board (see below) allows 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 is properly powered.

Typical Location - Phase Select Jumper

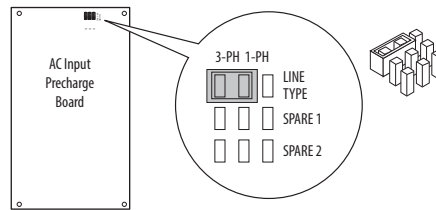


Table 4 - 380...480 Volt Single-Phase AC Input Ratings

480V Single-Phase AC Input						380...400V Single-Phase AC Input						Temp.
Drive Catalog Number	Frame	Hp Rating	Input Amps	Three-Phase Output		Drive Catalog Number	Frame	kW Rating	Input Amps	Three-Phase Output		
				V AC	Amps					V AC	Amps	
20BD292	7	125	237.4	0-460	146	20BC292	7	80	247.7	0-400	146	25
20BD325	7	125	264.3	0-460	162.5	20BC325	7	90	275.7	0-400	162.5	25

Power Terminal Blocks



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

Refer to pages [8](#) through [11](#) for typical locations.

Name	Frame	Description	Wire Size Range see Note ⁽²⁾		Torque	
			Maximum	Minimum	Maximum	Recommended
Power Terminal Block	7	Input power, DC+, DC-, PE, motor connections	150.0 mm ² (300 MCM) see Note ⁽³⁾	2.5 mm ² (14 AWG)	2.7 N•m (24 lb•in)	2.7 N•m (24 lb•in)
	8...10	Input power, DC+, DC-, PE, motor connections	300.0 mm ² (600 MCM) see Note ⁽³⁾	2.5 mm ² (14 AWG)	10.0 N•m (87 lb•in)	10.0 N•m (87 lb•in)
AUX Terminal Block ⁽¹⁾	7...10	Auxiliary Control Voltage PS+, PS- ⁽¹⁾	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)
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		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) External control power - select drives only, see [Auxiliary Control Power Supply on page 39](#) for details.

(2) **Maximum/minimum sizes that the terminal block accepts - these are not recommendations.**

(3) If can be necessary to connect multiple wires in parallel to these terminals by using multiple lugs.

Frame	Terminal Block	
	AC Input	DC Input
7		
8...9		
10		

Terminal	Description	Notes
DC+/DC- Top of drive	DC Bus (+) DC Bus (-)	DC Input/Brake Chopper Connections
DC+/DC- Power TB	DC Bus (+) DC Bus (-)	DC Link Choke - wire to: Bottom of drives (Frames 8...9) Converter section (Frame 10)
PE	PE Ground	
PS+ PS-	AUX (+) AUX (-)	Auxiliary Control Voltage (see page 39) for details.
	Motor Ground	
U V W	U (T1) V (T2) W (T3)	To Motor
R S T	R (L1) S (L2) T (L3)	AC Line Input Power Three-Phase = R, S & T Single-Phase = R & S Only

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.

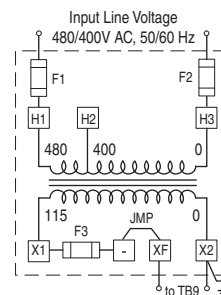
IMPORTANT Some drives utilize a fan transformer to power the internal fan(s). This transformer is sized specifically for the internal fan(s) and must not be used to power other circuitry.

Frame 7

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 34 for location.
AC Input	IP00, NEMA/UL Type Open	250 VA	1	N/A (Connected internally)
	IP20, NEMA/UL Type 1	250 VA	1	

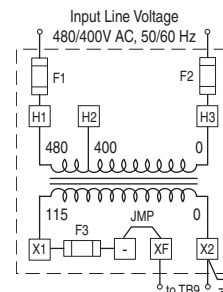
Frame 8

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 37 for terminal designations.
AC Input	IP00, NEMA/UL Type Open	500 VA	1	TB9 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, the transformer taps may require changing.
	IP20, NEMA/UL Type 1	500 VA	1	



Frame 9

Drive Type	Enclosure	Rating (120VAC)	No. of Fans	Connect at ...
DC Input	IP00, NEMA/UL Type Open	500 VA	2	TB9 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 37 for terminal designations.
	IP20, NEMA/UL Type 1	500 VA	2	
AC Input	IP00, NEMA/UL Type Open	500 VA	2	TB9 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, the transformer taps may require changing.
	IP20, NEMA/UL Type 1	500 VA	2	

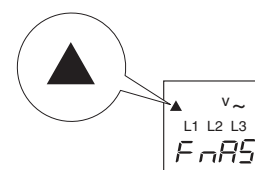


Frame 9 Blower Operation

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 relay (see page 10 for location) is used.

When wiring is complete, apply drive power and check for proper fan operation. Depending on when the drive was manufactured, one of two different phase monitor relays is used:

- Drives Manufactured Before January 20, 2011: If phasing is correct, a solid triangle is displayed on the phase monitor relay (shown at right).
- Drives Manufactured January 20, 2011 and after: If phasing is correct, the “R/T” LED on the phase monitor relay illuminates.
- If phasing is not correct, the “F1” and “F2” LEDs alternately illuminate.

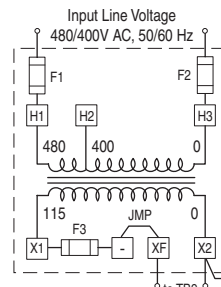


Regardless of which phase monitor relay is used in the drive, if the blower does not operate:

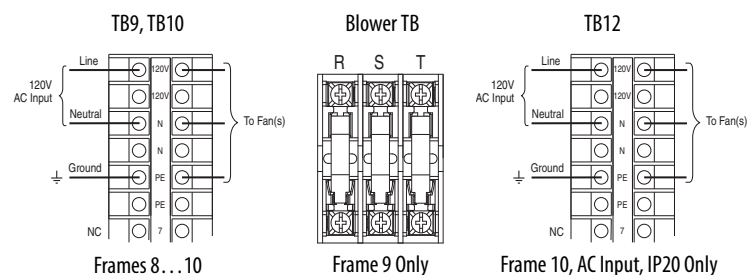
1. Remove all input power and wait 5 minutes for the DC bus to discharge. Verify that the DC bus has discharged by measuring across the + and - DC bus terminals. The reading must be less than 50 volts.
2. Verify blower fuses and replace if necessary.
3. Switch any two input power leads at the top of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

Frame 10

Drive Type	Enclosure	Rating (120VAC)	No. of Fans	Connect at ...
DC Input	IP00, NEMA/UL Type 0pen	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 37 for terminal designations.
AC Input	IP00, NEMA/UL Type 0pen	1000 VA	3	TB9, 10 & 12 Requires user supplied 120V AC. See page 11 for TB locations and page 37 for terminal designations.
	IP20, NEMA/UL Type 1	1000 VA	3	TB9, 10 & 12 A transformer (see page 11) matches the input line voltage to the internal fan voltage. If line voltage is different than the voltage class specified on the drive nameplate, the transformer taps may require changing.



Fan/Blower Terminal Blocks - Frames 8...10



Fan Transformer Specifications/Fusing

Frame	Rating	Recommended Fuses	
		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

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 are 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 is 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 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 11](#) for IP00 PE grounding locations.

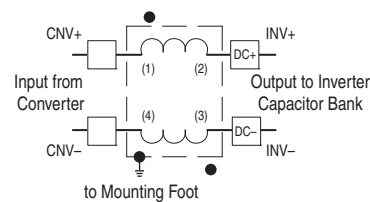
DC Link Chokes – Frames 8...10

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 34](#) for connection information. Drive rating information can be found on [pages 42...42](#).



Auxiliary Control Power Supply

If desired, an auxiliary control power supply can be used with certain drives to keep the drive control logic up when the main AC power is removed.

An auxiliary control power supply can only be used with:

- 400/480 and 600/690 Volt drives with Vector Control (15th position of the catalog number string equals “C,” or “D”).

Using an auxiliary control power supply requires the use of some type of AC line monitoring, as well as control of the Precharge Enable signal. Consult the factory for additional guidance.

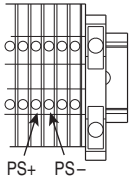


ATTENTION: An Auxiliary Control Power Supply **Must Not** be used with any PowerFlex 700 Standard Control drive or 200/240 Volt Vector Control drive. Using the power supply with these drives causes equipment/component damage.

Connection is performed at the I/O terminal block (see pages [8...11](#)).

Power supply must provide	
UL Installation	300V DC, $\pm 10\%$
Non UL Installation	270...600V DC, $\pm 10\%$

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 accepts - these are not recommendations.

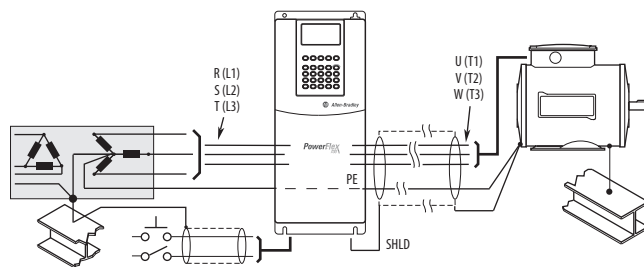
General Grounding Requirements

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 must be periodically checked.

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

IMPORTANT Do Not discard or replace grounding hardware.

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. Connect the **motor cable** shield to this terminal on the drive (drive end) and the motor frame (motor end). A shield terminating cable gland can also be used.

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

RFI Filter Grounding

Using an optional RFI filter can result in relatively high ground leakage currents. Therefore, the **filter must be used only 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 must not include any form of plug or socket that permits inadvertent disconnection. Some local codes can require redundant ground connections. Periodically check the integrity of all connections. Refer to the instructions supplied with the filter.

Motor Overload Protection

Class 10 motor overload protection according to NEC article 430 and motor over-temperature protection according to NEC article 430.126 (A)(2). UL 508C File E59272.

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 can determine additional requirements for these installations.



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 on pages [42](#) through [44](#).

The tables on the following pages provide recommended AC line input fuse and circuit breaker information. See Fusing and Circuit Breakers below for UL and IEC requirements. Sizes listed are the recommended sizes based on 40 °C (104 °F) and the U.S. NEC. Other country, state, or local codes can require different ratings. Tables with DC link fuse recommendations for DC input drives are also provided.

Fusing

The recommended fuse types are listed below. If available current ratings do not match those listed in the tables provided, choose the next higher fuse rating.

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

Circuit Breakers

The “non-fuse” listings in the following tables include inverse time circuit breakers and instantaneous trip circuit breakers (motor circuit protectors). If one of these is chosen as the desired protection method, the following requirements apply:

- IEC – Both types of circuit breakers are acceptable for IEC installations.
- UL - Only inverse time circuit breakers are acceptable for 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.

400 Volt AC Input Protection Devices ⁽⁷⁾

Drive Catalog Number ⁽⁶⁾	Frame	kW Rating		PWM Freq.	Temp. ⁽⁸⁾	Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker ⁽³⁾	Motor Circuit Protector ⁽⁴⁾
		ND	HD	kHz	°C	Amps	kVA	Cont.	1 Min.	3 Sec.	Min. ⁽¹⁾	Max. ⁽²⁾	Min. ⁽¹⁾	Max. ⁽²⁾	Max. ⁽⁵⁾	Max. ⁽⁵⁾
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

See [page 43](#) for Notes.480 Volt AC Input Protection Devices ⁽⁷⁾

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

See [page 43](#) for Notes.

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) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.
- (6) Drives have dual current ratings; one for normal duty applications, and one for heavy duty applications. The drive can be operated at either rating.
- (7) 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.
- (8) 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.

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⁾⁽⁵⁾
		ND	HD	kHz	°C	Amps	kW	Cont.	1 Min.	3 Sec.		
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⁾

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⁾⁽⁵⁾
		ND	HD	kHz	°C	Amps	kW	Cont.	1 Min.	3 Sec.		
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.

(5) See Fuse Certification and Test Data in PowerFlex AC Drives in Common Bus Configurations Application Guidelines, publication [DRIVES-AT002](#), for fuse self-certification and test data for Bussmann 170M and JKS fuses recommended for the DC bus fusing.

Output Devices

Common mode cores are internal to the drive. For information on output contactors see below. Other devices such as cable terminators and output reactors are discussed in the Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication [DRIVES-IN001](#).

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 start and stop the motor. If an input device is used, operation must not exceed one cycle per minute or drive damage occurs.



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 can be required to remove the AC line to the drive. An auxiliary braking method can 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 can 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 is removed from the respective motor, but the drive continues 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 can cause the drive to fault. If any of these conditions are determined to be undesirable or unsafe, an auxiliary contact on the output contactor must be wired to a drive digital input that is programmed as "Enable." This causes the drive to execute a coast-to-stop (cease output) whenever an output contactor is opened.

Bypass Contactor Precaution



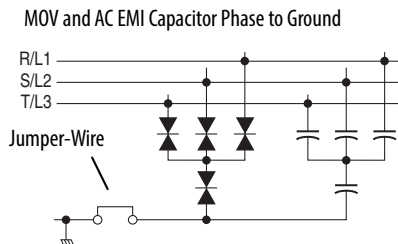
ATTENTION: An incorrectly applied or installed bypass system can result in component damage or reduction in product life. The most common causes are:

- 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 5 on page 47](#).



See Wiring and Grounding Guidelines for Pulse Width Modulated (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: Allow only qualified personnel familiar with adjustable frequency AC drives and associated machinery to perform maintenance/repair of the system. Failure to comply can 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 following points (refer to pages [8](#) through [11](#) for locations):

- +DC and -DC terminals of the Power Terminal Block
- +DC terminal of the Power Block and the chassis
- -DC terminal of the Power Terminal Block and the chassis

The voltage must be zero for all three measurements.



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 5 - Recommended Power Jumper Configurations

Power Source Type ⁽¹⁾	MOV/Input Filter Caps ⁽²⁾	Benefits of Correct Configuration on Power Source Type
Solid Ground <ul style="list-style-type: none"> AC fed, solidly grounded DC fed from passive rectifier which has an AC source and solid ground 	Connected	<ul style="list-style-type: none"> Reduced electrical noise, Most stable operation, EMC compliance, Reduced voltage stress on components and motor bearings.
Non-Solid Ground <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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.

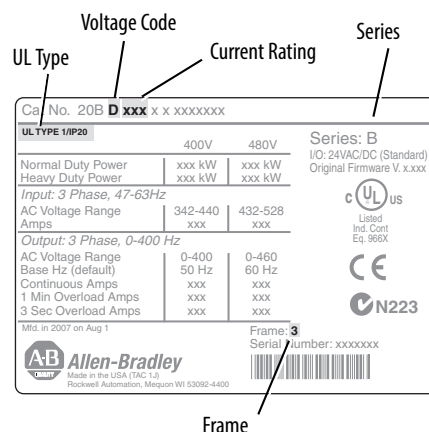
(2) When MOVs are disconnected, the power system must have its own transient protection to ensure known and controlled voltages.

To connect or disconnect these devices, refer to pages [48](#) and [49](#).

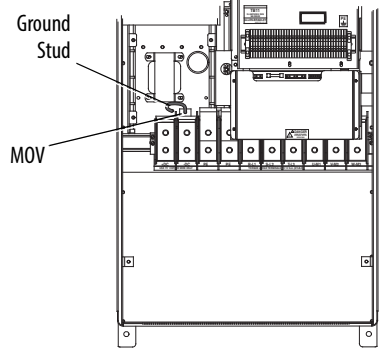
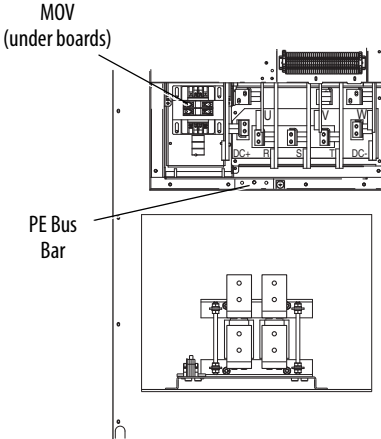
On an ungrounded distribution system where the line-to-ground voltages on any phase could exceed 125% of the nominal line-to-line voltage, install an isolation transformer. See Wiring and Grounding Guidelines for PWM AC Drives, publication DRIVES-IN001 for more information on impedance grounded and ungrounded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

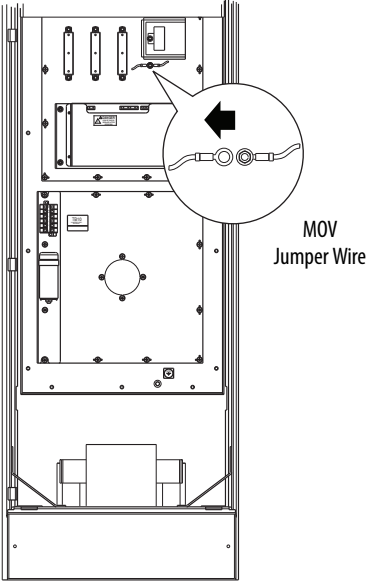
Drive Identification

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



Jumper Settings and Locations

Frame	Voltage Code	Current Rating	Factory Default Jumper Settings	Power Source Type
			MOV (1) (2)	
7	All	All	A green/yellow wire <u>connected</u> to a ground stud on the drive chassis.	<p>Solid Ground</p> <p>Connect the green/yellow MOV jumper wire to the ground stud on the drive chassis.</p>
				<p>Non-Solid Ground</p> <p>The green/yellow MOV jumper wire must be insulated from ground. If necessary, remove the wire from the stud on the drive chassis. Insulate/secure the wire to guard against unintentional contact with the chassis or components.</p>
8...9	All	All	A green/yellow wire <u>connected</u> to the PE bus bar.	<p>Solid Ground</p> <p>Connect the green/yellow MOV jumper wire to "PE."</p>
				<p>Non-Solid Ground</p> <p>Remove the green/yellow MOV jumper wire from the PE bus bar. Insulate/secure the wire to guard against unintentional contact with the chassis or components.</p>

Frame	Voltage Code	Current Rating	Factory Default Jumper Settings	Power Source Type
			MOV ⁽¹⁾⁽²⁾	
10	All	All	A green/yellow wire <u>connected</u> to chassis 	<p>Solid Ground Connect the green/yellow MOV jumper wire to the chassis.</p> <p>Non-Solid Ground Remove the green/yellow MOV jumper wire from the chassis. Insulate/secure the wire to guard against unintentional contact with the chassis or components.</p>

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

(2) Frame 7...10 drives do not have common mode capacitors.

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 by using higher temperature wire.
- Wire with an insulation rating of 600V or greater is recommended.
- Separate control and signal wires from power wires by at least 0.3 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.

Wire Recommendations

Type		Wire Type(s)	Description	Min. Insulation Rating
Signal (1)(2)(3)	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 ⁽⁴⁾	0.196 mm ² (24 AWG), individually shielded	
	Encoder/Pulse I/O 30 to 152 m (100 to 500 ft.)	Signal: Belden 9730/9728 ⁽⁴⁾	0.196 mm ² (24 AWG), individually shielded	
		Power: Belden 8790 ⁽⁵⁾	0.750 mm ² (18 AWG)	
		Combined: Belden 9892 ⁽⁶⁾	0.330 mm ² (22 AWG) or 0.500 mm ² (20 AWG)	
	Encoder/Pulse I/O 152 to 259 m (500 to 850 ft.)	Signal: Belden 9730/9728 ⁽⁴⁾	0.196 mm ² (24 AWG), individually shielded	
		Power: Belden 8790 ⁽⁵⁾	0.750 mm ² (18 AWG)	
		Combined: Belden 9773/9774 ⁽⁷⁾	0.750 mm ² (18 AWG), individually shielded	
Digital I/O (1)(2)(3)	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)
	Unshielded	Per US NEC or applicable national or local code	—	

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

(2) 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.

(3) 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.

(4) 9730 is 3 individually shielded pairs (2 channel + power). If 3 channel is required, use 9728.

(5) 8790 is 1 shielded pair.

(6) 9892 is 3 individually shielded pairs (3 channel) + 1 shielded pair for power.

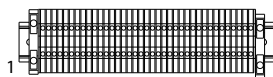
(7) 9773 is 3 individually shielded pairs (2 channel + power). If 3 channel is required, use 9774.

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 accepts - these are not recommendations.

I/O Terminal Designations



No.	Signal	Factory Default	Description	Related Param.
1	Analog In 1 (–) ⁽¹⁾	⁽³⁾	Isolated ⁽⁴⁾ , bipolar, differential, $\pm 10\text{V}/4\text{-}20\text{mA}$, 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 (–)	⁽³⁾	Bipolar (current output is not bipolar), $\pm 10\text{V}/4\text{-}20\text{mA}$, 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. ⁽²⁾	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. ⁽²⁾	NOT Fault		
14	Digital Out 2 – N.C. ⁽²⁾	NOT Run		
15	Digital Out 2/3 Com.			
16	Digital Out 3 – N.O. ⁽²⁾	Run		
17	Current In Jumper ⁽¹⁾ – Analog In 1		Placing a jumper across terminals 17 & 18 (or 19 & 20) configures 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 - Control & I/O Cat. No. option D Opto isolated Low State: less than 30V AC High State: greater than 100V AC 24V DC - Control & I/O Cat. No. option C 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. 54	Speed Sel 3		
33	Digital Out 4 – N.C.	Fault	Dedicated fault output - Not user configurable. Relay energizes (picks up) when power is applied to the drive and deenergizes (drops 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 39 .	
PS-	Aux. Control Power (–)		Refer to page 39 .	
PE	PE Ground		PE Ground	
PE	PE Ground		PE Ground	

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

(2) Contacts in unpowered state. Any relay programmed as Fault or Alarm energizes (picks up) when power is applied to the drive and deenergizes (drops out) when a fault or alarm exists. Relays selected for other functions energize only when that condition exists and deenergize when condition is removed.

(3) These inputs/outputs are dependant on a number of parameters (see "Related Parameters").

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

(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)		<ul style="list-style-type: none"> Adjust Scaling: Parameters 91/92 and 325/326 View Results: Parameter 002
Joystick Bipolar Speed Reference ⁽¹⁾ ±10V Input		<ul style="list-style-type: none"> 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		<ul style="list-style-type: none"> 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		<ul style="list-style-type: none"> 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		<ul style="list-style-type: none"> 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		<ul style="list-style-type: none"> 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		<ul style="list-style-type: none"> 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 49](#) 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 $\pm 10\text{V}$, 0-20 mA Bipolar +10V Unipolar (shown)		<ul style="list-style-type: none"> 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		<ul style="list-style-type: none"> 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)		<ul style="list-style-type: none"> Set Digital Input:#1: Parameter 361 = "8, Run Forward" Set Digital Input #2: Parameter 362 = "9, Run Reverse"
3-Wire Control Internal supply		<ul style="list-style-type: none"> No Changes Required
3-Wire Control External supply (I/O Board dependent). Requires 3-wire functions only ([Digital In1 Sel]). Using 2-wire selections causes a type 2 alarm.		<ul style="list-style-type: none"> No Changes Required
Digital Input PLC Output Card (Board dependent).		<ul style="list-style-type: none"> No Changes Required
Digital Output Relays (two at terminals 14-16) shown in powered state with drive faulted. See page 51 .		<ul style="list-style-type: none"> Select Source to Activate: Parameters 380/384
Enable Input		<ul style="list-style-type: none"> Configure with parameter 366 For dedicated hardware Enable: Remove Jumper J10 (see page 54)

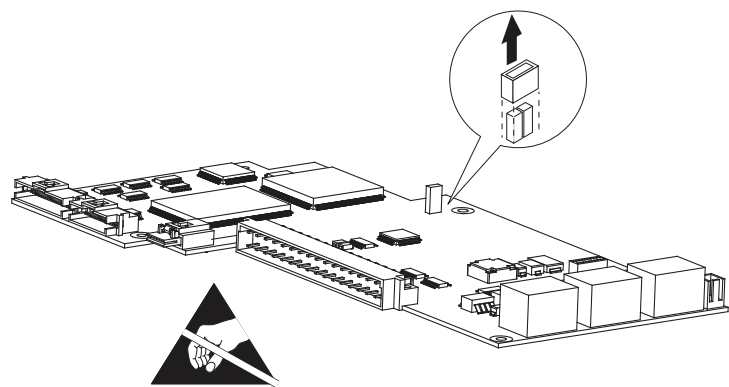
(1) **Important:** Programming inputs for 2 wire control deactivates all HIM Start buttons unless parameter 192, [Save HIM Ref], bit 1 [Manual Mode] = "1." This allows the HIM to control Start and Jog.

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.”

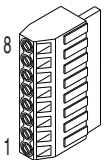
- 1. Remove HIM support plate to gain access to the Main Control Board (see pages 8 through 11).
- 2. Locate & remove Jumper J10 on the Main Control Board (see below).
- 3. Wire Enable to “Digital In 6” (see page 51).
- 4. Verify that [Digital In6 Sel], parameter 366 is set to “1, Enable.”

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	

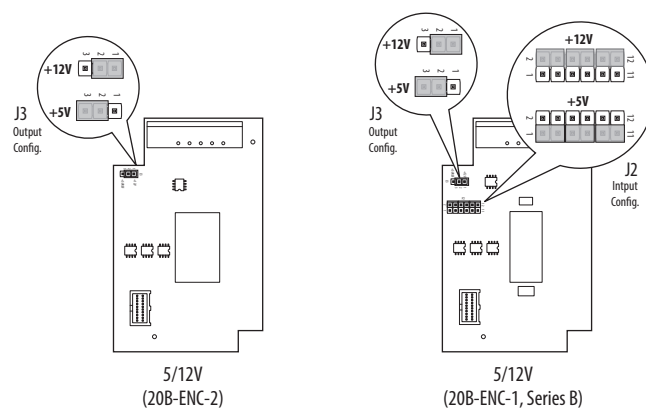
(1) Jumper selectable +5/12V is available on 20B-ENC-1 Encoder Boards.

(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 accepts 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



Sample Encoder Wiring

I/O	Connection Example	I/O	Connection Example
Encoder Power – Internal Drive Power Internal (drive) 12V DC, 250mA ⁽¹⁾		Encoder Power – External Power Source	
Encoder Signal – Single-Ended, Dual Channel⁽²⁾		Encoder Signal – Differential, Dual Channel	

(1) SHLD connection is on drive chassis.

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

Reference Control

Auto Speed Sources

The drive speed command can be obtained from a number of different sources. The source is determined by drive programming and the condition of the Speed Select digital inputs, Auto/Manual digital inputs or reference select bits of a command word.

The default source for a command reference (all speed select inputs are open—the default setting) is the selection programmed in [Speed Ref A Sel]. If any of the speed select inputs are closed, the drive uses other parameters as the speed command source.

Manual Speed Sources

The manual source for speed command to the drive can be selected several ways:

- The HIM can provide the manual source when:
 - manual control is requested from the HIM (see [ALT Functions](#) on [page 64](#)) or ...
 - the I/O terminal block requests manual control through a digital input programmed for “Auto/Manual.” [TB Man Ref Sel] is then set to one of the DPI ports with a HIM connected to it.⁽¹⁾
- The I/O terminal block analog input can provide the manual source when a digital input is programmed for “Auto/Manual” when active. [TB Man Ref Sel] is set to “Analog Input.”

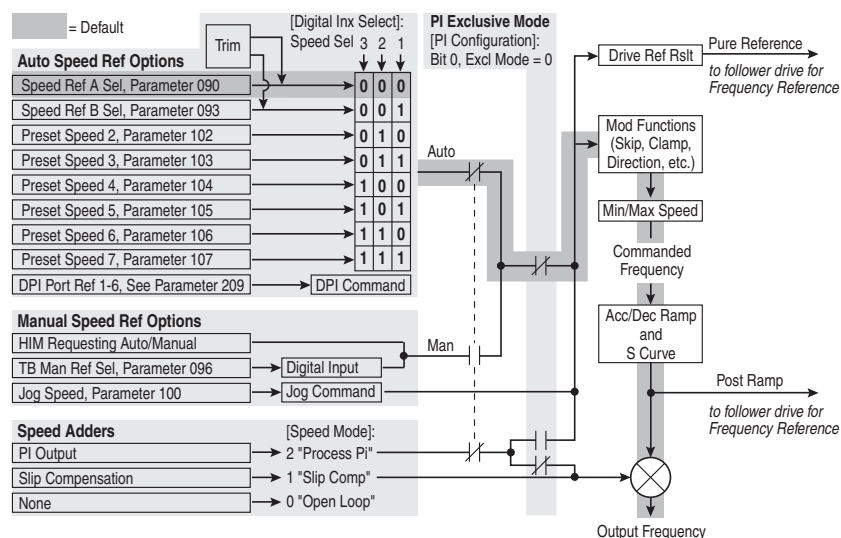
Changing Speed Sources

The selection of the active Speed Reference can be made through digital inputs, DPI command, jog button or Auto/Manual HIM operation.

Torque Reference Source

The torque reference is normally supplied by an analog input or network reference. Switching between available sources while the drive is running is not available. Digital inputs programmed as “Speed Sel 1,2,3” and the HIM Auto/Manual function (see above) do not affect the active torque reference when the drive is in Vector Control Mode.

(1) Requires drive firmware v7.001 or greater and a Series B HIM with firmware v5.004 or greater.

Speed Reference Selection Chart (1)**Auto/Manual Examples****PLC = Auto, HIM = Manual**

A process is run by a PLC when in Auto mode and requires manual control from the HIM during set-up. The Auto speed reference is issued by the PLC through a communications module installed in the drive. Because the internal communication is designated as Port 5, [Speed Ref A Sel] is set to "DPI Port 5" with the drive running from the Auto source.

- Attain Manual Control
 - Press ALT then Auto/Man on the HIM. When the HIM attains manual control, the drive speed command comes from the HIM speed control keys.
- Release to Auto Control
 - Press ALT then Auto/Man on the HIM again. When the HIM releases manual control, the drive speed command returns to the PLC.

PLC = Auto, Terminal Block = Manual

A process is run by a PLC when in Auto mode and requires manual control from an analog potentiometer wired to the drive terminal block. The auto speed reference is issued by the PLC through a communications module installed in the drive. Because the internal communication is designated as Port 5, [Speed Ref A Sel] is set to "DPI Port 5" with the drive running from the Auto source. Since the Manual speed reference is issued by an analog input ("Analog In 1 or 2"), [TB Man Ref Sel] is set to the same input. To switch between Auto and Manual, [Digital In3 Sel] is set to "Auto/Manual."

- Attain Manual Control
 - Close the digital input.
With the input closed, the speed command comes from the pot.
- Release to Auto Control
 - Open the digital input.
With the input open, the speed command returns to the PLC.

(1) To access Preset Speed 1, set parameter 090 or 093 to "Preset Speed 1."

PLC = Auto, Terminal Block = Manual, with speed reference from the HIM

IMPORTANT	Requires drive firmware v7.001 or greater and a Series B HIM with firmware v5.004 or greater.
------------------	---

A process is run by a PLC when in Auto mode and requires manual control from the terminal block with the speed reference provided by the HIM.

The auto speed reference is produced by the PLC and transmitted to the drive through a communications module installed in the drive. Because the internal communication is designated as Port 5, [Speed Ref A Sel] is set to "DPI Port 5" with the drive running from the Auto source.

When Manual mode is requested through the terminal block digital input, the drive evaluates if Manual mode can be granted.

If [TB Man Ref Sel], parameter 96 is set to a DPI Port and [Man Ref Preload], parameter 193 is enabled, the drive transfers the last value of the automatic speed reference to the HIM. The HIM is now the speed reference source. The terminal block has exclusive control based on [Save HIM Ref], parameter 192, bit 1 (Manual Mode).

If [TB Man Ref Sel] is set to a DPI Port and [Man Ref Preload] is disabled, the HIM is now the speed reference source. The terminal block has exclusive control based on [Save HIM Ref], bit 1 (Manual Mode).

If [TB Man Ref Sel] is set to one of the DPI Ports, a HIM must be connected on the DPI Port selected.

IMPORTANT	The HIM does not enter Manual mode, it is only the reference source for the terminal block.
------------------	---

- Attain Manual Control
 - Close the digital input.
With the input closed, the speed command comes from the HIM.
- Release to Auto Control
 - Open the digital input.
With the input open, the speed command returns to the PLC.

Auto/Manual Notes

1. Manual control is exclusive. If a HIM or terminal block takes manual control, no other device can take manual control until the controlling device releases manual control.
2. If a HIM has manual control and power is removed from the drive, the drive returns to Auto mode when power is reapplied.
3. Parameter 192 - [Save HIM Ref], bit 1 can enable Manual mode to allow starts and jogs from the HIM in 2-wire mode.

Step 5: Start-Up Check List

- This check list supports the Basic Start-Up menu option. See [page 64](#) 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 can 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, allow only qualified service personnel to 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, use remote devices to start up the drive.

IMPORTANT When power is first applied, the HIM can 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 [Abbreviated Fault 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 is displayed.
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 by using the Enter key which steps 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](#).

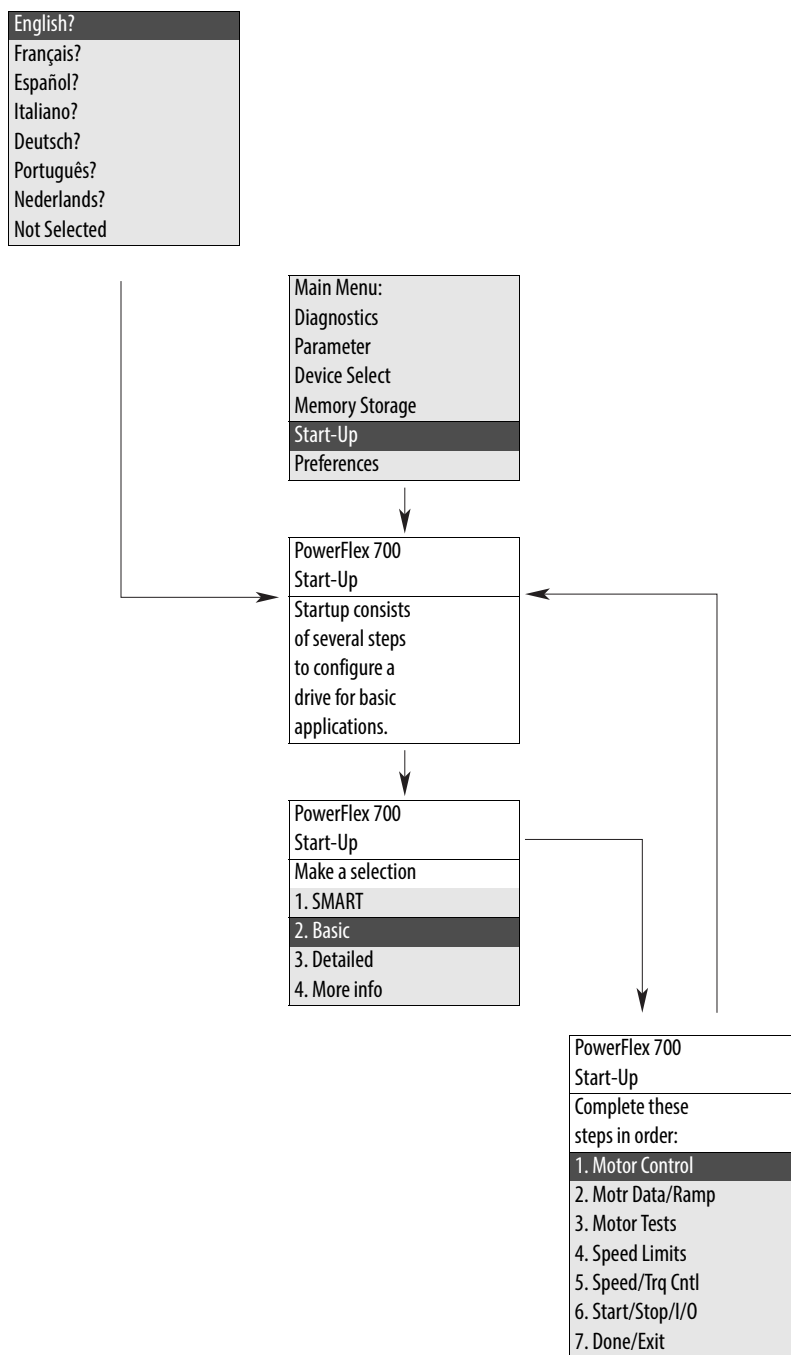
Information About Start-Up Motor Tests

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 can 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 cannot 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



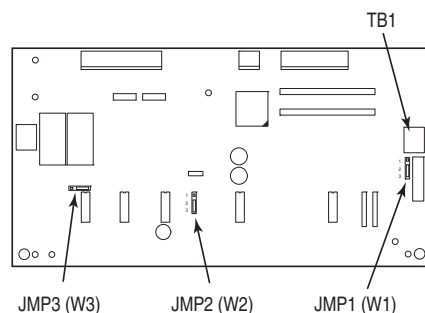
Supplemental Information DC Input (Common Bus) and Precharge Notes

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.

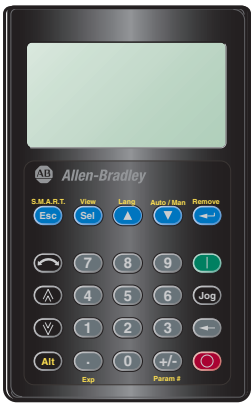
Human Interface Module (HIM) Overview

LCD Display Elements

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

Human Interface Module (HIM) Key Functions

Key	Description
	Exit a menu, cancel a change to a parameter value, or acknowledge a fault/alarm.
	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.
	Access the function associated with a programming or numeric key. Refer to the drive user manual for more information.
	Start the drive.
	Stop the drive or clear a fault.
	Jog the drive.
	Change direction.
	Increase speed.
	Decrease speed.



Human Interface Module (HIM)









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

Human Interface Module (HIM) Main Menu

Main Menu Screen	Menu Selections
F-> Power Loss Auto	Main Menu:
0.0 Hz	Diagnostics
Main Menu: Diagnostics Parameter Device Select	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
	S.M.A.R.T.	Displays the S.M.A.R.T. screen. This function allows the drive parameter values to be quickly programmed by directly accessing the most frequently used drive functions. Refer to the User Manual for more information.
	Log In/Out	Log in to change parameter settings. Log out to protect parameter settings. Change a password.
	View	Allows the selection of how parameters are viewed or detailed information about a parameter or component.
ALT 	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 66](#).

- **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)

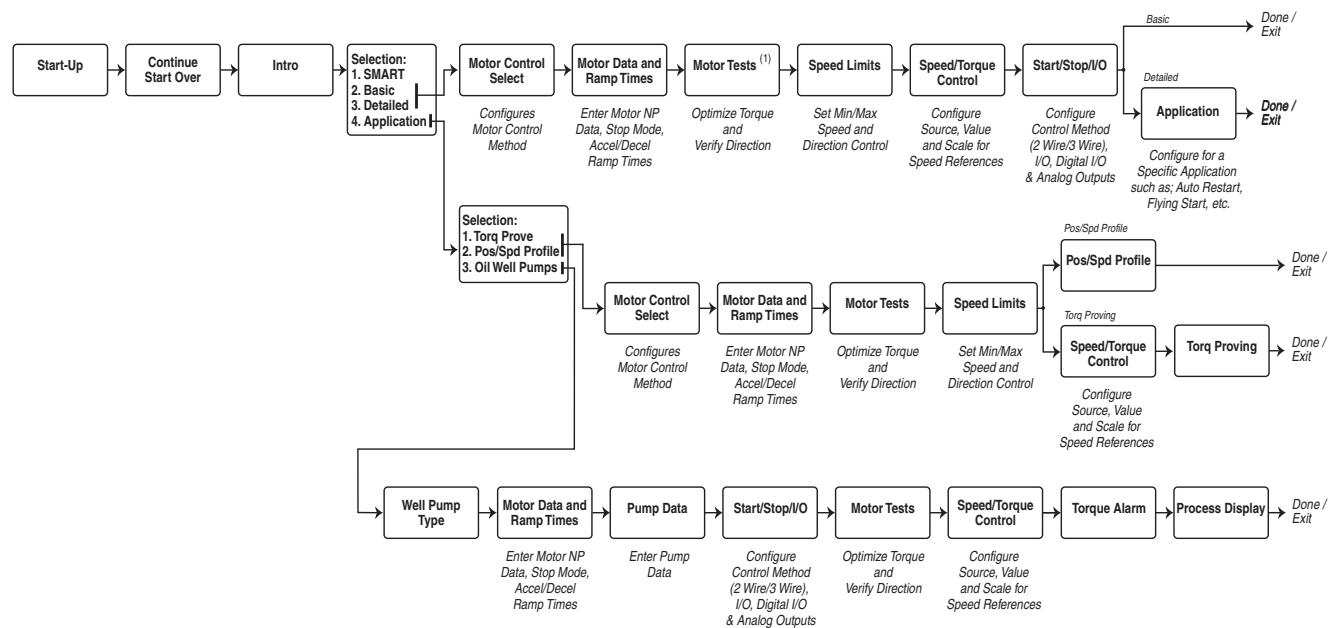
See [page 67](#) for details.

IMPORTANT

Power must be applied to the drive when viewing or changing parameters. Previous programming can 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 can 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 cannot 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.	ALT Esc	F-> Stopped Auto
2. View and change parameter values as desired. For HIM information, see Appendix B in the User Manual.		SMART List: Digital In2 Sel Stop Mode A Minimum Speed
3. Press Esc to exit the S.M.A.R.T. start.	Esc	

Running an Assisted Start Up

IMPORTANT This start-up routine requires an LCD HIM.

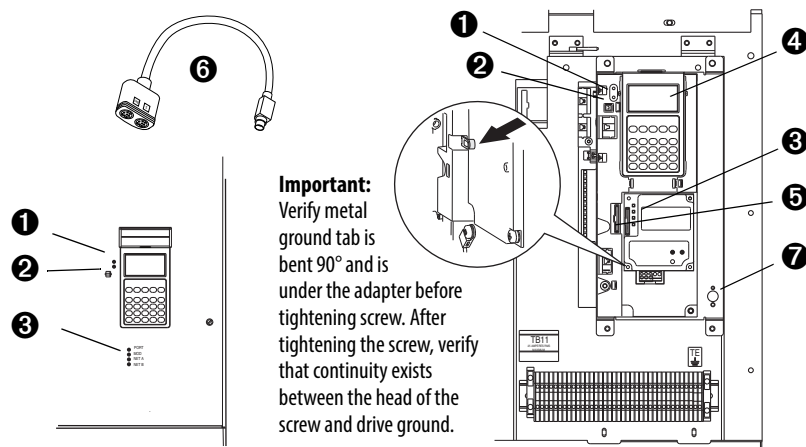
The Assisted start-up routine prompts you to input required information. Access Assisted Start Up by selecting “Start Up” from the Main Menu.

To perform an Assisted Start-Up

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

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



No.	Name	Color	State	Description
1	PWR (Power)	Green	Steady	Illuminates when power is applied to the drive.
2	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.
3	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).
4	DPI Port 1			HIM connection.
5	DPI Port 5			Cable connection for communications adapter.
6	DPI Port 3 or 2			Splitter cable connected to DPI Port 2 provides additional port.
7	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 above the “Line Type” jumper shown on [page 33](#).

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 Parameter 090 [Speed Ref A Sel] to option 1 “Analog In 1”
This sets the speed reference input to I/O terminals 1 & 2. For 4...20 mA operation, a jumper must be placed between terminals 17 & 18.
2. Set Parameter 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]
 - 179 [Sleep-Wake Ref]
3. Set Parameter 091 [Speed Ref A Hi] to the upper value of the desired speed reference range in Hz
4. Set Parameter 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 disables the Start button on the HIM.

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

See I/O Wiring Examples beginning on [page 52](#).

Restoring Factory Defaults

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

Troubleshooting

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

Table 6 - Abbreviated Fault Listing

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.	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 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 7 - Abbreviated Alarm Listing

Alarm	No.	Type ⁽¹⁾	Description																																																																																																				
Dig In ConflictA	17	②	<div>Digital input functions are in conflict. Combinations marked with a “.” will cause an alarm.</div> <table><tr><td></td><td>Acc2/Dec2</td><td>Accel 2</td><td>Decel 2</td><td>Jog 1/2</td><td>Jog Fwd</td><td>Jog Rev</td><td>Fwd/Rev</td></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>		Acc2/Dec2	Accel 2	Decel 2	Jog 1/2	Jog Fwd	Jog Rev	Fwd/Rev	Acc2/Dec2		.	.					Accel 2	.							Decel 2	.							Jog 1/2					.	.		Jog Fwd				.			.	Jog Rev				.			.	Fwd/Rev					.	.																																					
	Acc2/Dec2	Accel 2	Decel 2	Jog 1/2	Jog Fwd	Jog Rev	Fwd/Rev																																																																																																
Acc2/Dec2		.	.																																																																																																				
Accel 2	.																																																																																																						
Decel 2	.																																																																																																						
Jog 1/2					.	.																																																																																																	
Jog Fwd				.			.																																																																																																
Jog Rev				.			.																																																																																																
Fwd/Rev					.	.																																																																																																	
Dig In ConflictB	18	②	<div>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.</div> <table><tr><td></td><td>Start</td><td>Stop-CF</td><td>Run</td><td>Run Fwd</td><td>Run Rev</td><td>Jog 1/2</td><td>Jog Fwd</td><td>Jog Rev</td><td>Fwd/Rev</td></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>		Start	Stop-CF	Run	Run Fwd	Run Rev	Jog 1/2	Jog Fwd	Jog Rev	Fwd/Rev	Start				Stop-CF										Run		Run Fwd	Run Rev	Jog 1/2				.	.					Jog Fwd	.		.							Jog Rev	.		.							Fwd/Rev				.	.				
	Start	Stop-CF	Run	Run Fwd	Run Rev	Jog 1/2	Jog Fwd	Jog Rev	Fwd/Rev																																																																																														
Start																																																																																																	
Stop-CF																																																																																																							
Run																																																																																															
Run Fwd																																																																																														
Run Rev																																																																																														
Jog 1/2				.	.																																																																																																		
Jog Fwd	.		.																																																																																																				
Jog Rev	.		.																																																																																																				
Fwd/Rev				.	.																																																																																																		
Dig In ConflictC	19	②	<div>More than one physical input has been configured to the same input function. Multiple configurations are not allowed for the following input functions.</div> <div>Forward/Reverse Run Reverse Bus Regulation Mode B</div> <div>Speed Select 1 Jog Forward Acc2 / Dec2</div> <div>Speed Select 2 Jog Reverse Accel 2</div> <div>Speed Select 3 Run Decel 2</div> <div>Run Forward Stop Mode B</div>																																																																																																				
TB Man Ref Cflct	30	②	<div>Occurs when:</div> <ul style="list-style-type: none">“Auto/Manual” is selected (default) for [Digital In3 Sel], parameter 363 <i>and</i>[TB Man Ref Sel], parameter 96 has been reprogrammed. <div>No other use for the selected analog input can be programmed.</div> <div>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.</div> <div>To correct:</div> <ul style="list-style-type: none">Verify/reprogram the parameters that reference an analog input <i>or</i>Reprogram [Digital In3] to another function or “Unused.”																																																																																																				

(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	<ul style="list-style-type: none"> 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 52 . <ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> Mutually exclusive choices have been made (i.e., Jog and Jog Forward). 2 wire and 3 wire programming can be conflicting. Exclusive functions (i.e, direction control) can 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 can 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 by 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)
<ol style="list-style-type: none">1. Press Esc to acknowledge the fault. The fault information is removed so that you can use the Human Interface Module (HIM).2. Address the condition that caused the fault.3. The cause must be corrected before the fault can be cleared.4. After corrective action has been taken, clear the fault by one of these methods:<ul style="list-style-type: none">– Press Stop– Cycle drive power– Set parameter 240 [Fault Clear] to “1.”– “Clear Faults” on the Human Interface Module (HIM) Diagnostic menu.	 

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products.

At <http://www.rockwellautomation.com/support>, you can find technical manuals, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools. You can also visit our Knowledgebase at <http://www.rockwellautomation.com/knowledgebase> for FAQs, technical information, support chat and forums, software updates, and to sign up for product notification updates.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnectSM support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit <http://www.rockwellautomation.com/support/>.

Installation Assistance

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

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

New Product Satisfaction Return

Rockwell Automation tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete this form, publication [RA-DU002](#), available at <http://www.rockwellautomation.com/literature/>.

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



PN-208994

Allen-Bradley, Rockwell Software, Rockwell Automation, PowerFlex, RSLink, DriveExplorer, DriveExecutive, ControlFLASH, and TechConnect are trademarks of Rockwell Automation, Inc.
Trademarks not belonging to Rockwell Automation are property of their respective companies.

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, 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-IN014H-EN-P - June 2013
Supersedes Publication 20B-IN014G-EN-P - July 2010

PN-208994
Copyright © 2013 Rockwell Automation, Inc. All rights reserved. Printed in the U.S.A.