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Allen-Bradley

PowerFlex 700 Adjustable Frequency AC Drive



Topic	Page
Product Overview	2
Certifications and Specifications	7
Design Considerations	12
Drive, Fuse and Circuit Breaker Ratings	24
Cable Recommendations	33
Power Wiring	34
I/O Wiring	44
Mounting	49
Dimensions and Weights	53
PowerFlex 700 Packaged Drives	77
Drive Options	78

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Additional Resources

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

Resource	Description
PowerFlex 700 Adjustable Frequency AC Drive Installation Instructions – Frames 0…6, publication 20B-IN0019	Provides detailed information about installation and start-up.
PowerFlex 700 Adjustable Frequency AC Drive Installation Instructions – Frames 7…10, publication 20B-IN0014	
PowerFlex 700 Standard Control User Manual, publication 20B-UM001	Provides detailed information on: • Parameters and programming • Faults, alarms, and troubleshooting
PowerFlex 700 Vector Control User Manual (v4.001 & up), publication 20B-UM002	
PowerFlex 70 and PowerFlex 700 Reference Manual, publication PFLEX-RM001	Provides 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.
Preventive Maintenance of Industrial Control and Drive System Equipment, publication DRIVES-TD001	Provides a guide to performing preventive maintenance.
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.

Product Overview

The PowerFlex 700 AC drive offers outstanding performance in an easy-to-use drive that you have come to expect from Rockwell Automation. This world-class performance comes in a small and competitively priced package. The PowerFlex 700 AC drive is designed to control three-phase induction motors in applications with requirements ranging from the simplest speed control to the most demanding torque control. The drive has volts per hertz, sensorless vector and vector control. Vector control includes Allen-Bradley's patented Force™ Technology which provides world class motor control.



Flexible Packaging and Mounting

- **IP20, NEMA / UL Type 1** – For conventional mounting inside or outside a control cabinet. Conduit plate is removable for easy installation and replacement without disturbing conduit.
- **IP54, NEMA / UL Type 12** – Stand-alone, wall mount drives are available for dust tight applications with power ratings from 75 to 200 Hp (Frames 5 & 6).
- **IP54, NEMA / UL Type 12** – Flange mount drives with an IP00, NEMA / UL Type Open front. These can be installed in a user supplied cabinet to meet IP54, NEMA / UL Type 12. This allows the majority of heat to be exhausted out the back of the cabinet while keeping the cabinet protected. Power ratings range from 75 to 700 Hp (Frames 5...10).
- **Zero Stacking**™ – Frame 0...6 drives can be mounted next to each other with no reduction of surrounding air temperature rating (50°C). This unique bookshelf design also allows access to one drive without disturbing another.

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Space Saving Hardware Features

- **Integral EMC Filtering** plus built-in DC bus choke common mode cores and common mode capacitors provides a compact, all-in-one package solution for meeting EMC requirements, including CE in Europe. Frames 0...6 only (Frames 7...10 meet CE when installed per recommendations).
- **Internal Communications** allow the user to integrate the drive into the manufacturing process. Status indicators for all internal communication options are visible on the cover for easy setup and monitoring of drive communications. Users can easily manage information from shop floor to top floor and seamlessly integrate their complete system as they control, configure and collect data.
- **Integral Dynamic Brake Transistor** delivers a cost effective means of switching regenerative energy without costly external chopper circuits. These internal transistors are available in power ratings from 0.5 to 200 Hp.
- **Internal Dynamic Brake Resistor** (up to 25 Hp) requires no extra panel space, and supplies a large amount of braking torque for short periods.

Easy to Use Human Interface Tools

The PowerFlex 7-Class AC drives provide common Human Interface tools that are familiar and easy to use. These include the LCD Human Interface modules and PC-based configuration tools.

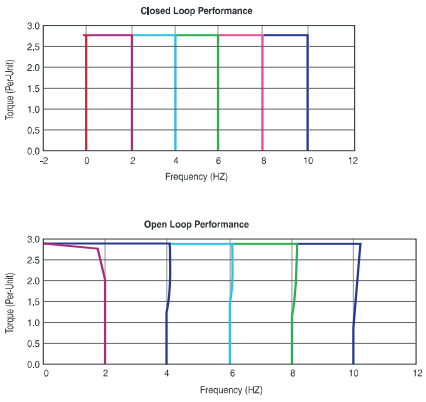
- LCD Human Interface modules provide:
  - Large and easy to read 7 line x 21 character backlit display
  - Variety of languages (English, French, German, Italian, Spanish, Portuguese, Dutch)
  - Alternate function keys for shortcuts to common tasks
  - “Calculator-like” number pad for fast and easy data entry (Full Numeric version only)
  - Control keys for local start, stop, speed, and direction
  - Remote versions for panel mount application

Outstanding Control and Performance

Multiple motor control algorithms allow performance matched to the application need:

- **Volts/Hertz** for simple Fan and Pump applications.
- **Sensorless Vector** for high torque production over a wide speed range.
- **Vector** for outstanding torque regulation and excellent low speed/zero speed performance (w/Vector Control cassette).

The PowerFlex 700 drive's Vector Control uses Allen-Bradley's patented Force™ Technology which provides excellent low-speed performance - whether it is operated with or without feedback. While this industry-leading control provides the highest level of drive performance, it is as easy to use as any general purpose drive available.



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Drives Features

- Fast-acting **Current Limit** and **Bus Voltage Regulation** result in maximum accel/decel without tripping.
- **High speed analog inputs** improve drive response to torque or speed commands.
- **Programming flexibility** allows parameters to be linked within the drive.
- **Flying Start** delivers smooth and instantaneous connection into rotating loads, regardless of commanded direction, without the need for any speed feedback.
- **Integral Process PI Control** can eliminate the need for a separate process loop controller.
- **Inertia Ride-Through** offers tripless operation during a prolonged power outage by using the rotating energy stored in high inertia, low-friction loads.
- **Position Indexer/Speed Profiler** uses a 16 step indexer to provide point-to-point positioning or velocity profiling based on encoder counts, digital inputs, parameter levels or time.
- **TorqProve**™ assures control of the load when transferring control between the drive and a mechanical brake.
- **Speed Regulation** - Open Loop or Closed Loop
  - **Slip Compensation** delivers a minimum 0.5% speed regulation without feedback hardware.
  - **Droop** allows drives to load share without fighting each other.
  - **Encoder Feedback** provides up to 0.001% speed regulation for the tightest application requirements.
- **Torque Regulation** - Open Loop or Closed Loop
  - **Open Loop** torque regulation provides ±5% regulation.
  - **Encoder Feedback** provides ±2% regulation and the ability to hold full load at zero speed.

Unsurpassed Capability in Network Communications

PowerFlex drives are fully compatible with the wide variety of Allen-Bradley DPI™ communication adapters, offering the following benefits:

BACnet®	ControlNet™	DeviceNet™	EtherNet/IP™	LonWorks™	Modbus RTU	PROFIBUS™	Remote I/O(1)	RS485 DF1	USB	Description
	✔	✔	✔							**(Unconnected Messaging)** permits other network devices (e.g. PanelView™) to communicate directly to a drive without routing the communication through the network scanner.
✔	✔	✔	✔					✔	✔	**Adapter Routing** - Plug PC into one drive and talk to all other Allen-Bradley drives on same network, without being routed through network scanner.
✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	Access to 100% of all parameters over the network.
✔		✔	✔			✔				**AutoBaud** capability makes initial connections less problematic.
		✔								**Change of State** significantly reduces network traffic by configuring control messages to be sent only upon customer defined states. Very flexible configuration for each node (Example: "reference must change by more than 5%").
		✔	✔							**Peer Control** provides master-slave type control between drives, where one or more slave drives (consumers) can run based on the status of a master drive (producer), which can also significantly reduce network traffic.
		✔								**ADR (Automatic Device Replacement)** saves significant time and effort when replacing a drive, by allowing the scanner to be configured to automatically detect a new drive and download the required parameter settings.
✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	**Flexible Fault Configuration** - Adapters can be programmed to take fault based actions as ramp to stop, coast-to-stop and hold last state, as well as send user configurable logic control and speed reference values. In addition, different actions can be taken based on whether the network experienced a serious problem (broken cable etc.) versus network idle condition (PLC set to "Program").

(1) This item has Silver Series status. For information, refer to http://www.ab.com/silver.

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Catalog Number Explanation

20B	D	2P1	A	3	A	Y	N	A	E	C	0	NN	AD
a	*b*	*c1…c5*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*

a

Drive	
Code	Type
20B	PowerFlex 700

b

Voltage Rating				
Code	Voltage	Ph.	Prechg.	Frames
B	240V AC	3	-	0…6
C	400V AC	3	-	0…10
D	480V AC	3	-	0…10
E	600V AC	3	-	0…6
F	690V AC	3	-	5…6
H	540V DC	-	N	5…6, 10
J	650V DC	-	N	5…6, 10
N	325V DC	-	Y	5…6
P	540V DC	-	Y	5…9
R	650V DC	-	Y	5…9
T	810V DC	-	Y	5…6
W	932V DC	-	Y	5…6

c1

ND Rating				
208/240V, 60 Hz Input				
Code	208V Amps	240V Amps	Hp	Frame
2P2	2.5	2.2	0.5	0
4P2	4.8	4.2	1.0	0
6P8	7.8	6.8	2.0	1
9P6	11	9.6	3.0	1
015	17.5	15.3	5.0	1
022	25.3	22	7.5	1
028	32.2	28	10	2
042	48.3	42	15	3
052	56	52	20	3
070	78.2	70	25	4
080	92	80	30	4
104	120	104	40	5
130	130	130	50	5
154	177	154	60	6
192	221	192	75	6
260	260	260	100	6

c2

ND Rating			
400V, 50 Hz Input			
Code	Amps	kW	Frame
1P3	1.3	0.37	0
2P1	2.1	0.75	0
3P5	3.5	1.5	0
5P0	5.0	2.2	0
8P7	8.7	4.0	0
011	11.5	5.5	0
015	15.4	7.5	1
022	22	11	1
030	30	15	2
037	37	18.5	2
043	43	22	3
056	56	30	3
072	72	37	3
085	85	45	4
105	105	55	5
125	125	55	5
140	140	75	5
170	170	90	6
205	205	110	6
260	260	132	6
292	292	160	7
325	325	180	7
365	365	200	8
415	415	240	8
481	481	280	8
535	535	300	8
600	600	350	8
730	730	400	9
875	875	500	10

c3

ND Rating			
480V, 60 Hz Input			
Code	Amps	Hp	Frame
1P1	1.1	0.5	0
2P1	2.1	1.0	0
3P4	3.4	2.0	0
5P0	5.0	3.0	0
8P0	8.0	5.0	0
011	11	7.5	0
014	14	10	1
022	22	15	1
027	27	20	2
034	34	25	2
040	40	30	3
052	52	40	3
065	65	50	3
077	77	60	4
096	96	75	5
125	125	100	5
156	156	125	6
180	180	150	6
248	248	200	6
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

c4

ND Rating			
600V, 60 Hz Input			
Code	Amps	Hp	Frame
1P7	1.7	1.0	0
2P7	2.7	2.0	0
3P9	3.9	3.0	0
6P1	6.1	5.0	0
9P0	9.0	7.5	0
011	11	10	1
017	17	15	1
022	22	20	2
027	27	25	2
032	32	30	3
041	41	40	3
052	52	50	3
062	62	60	4
077	77	75	5
099	99	100	5
125	125	125	6
144	144	150	6

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20B	D	2P1	A	3	A	Y	N	A	E	C	0	NN	AD
a	*b*	*c1…c5*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*

c5

ND Rating

690V, 50 Hz Input

Code	Amps	kW	Frame
052	52	45	5
060	60	55	5
082	82	75	5
098	98	90	6
119	119	110	6
142	142	132	6

d

Enclosure

Code	Enclosure
A	IP20, NEMA/UL Type 1
F ♠	Open/Flange Mount Front: IP00, NEMA/UL Type Open Back/Heatsink: IP54, NEMA Type 12
N ♣	Open/Flange Mount Front: IP00, NEMA/UL Type Open Back/Heatsink: IP54, NEMA 12
G ♠	Stand-Alone/Wall Mount IP54, NEMA/UL Type 12
U	Roll-In Front: IP00, NEMA/UL Type Open Back/Heatsink: IP54, NEMA 12 Frames 8 & 9 Only

♠ Only available for Frame 5 & Frame 6 drives, 400…690V.

♣ Only available for Frames 7…10.

e

HIM

Code	Operator Interface
0	Blank Cover
3	LCD Display, Full Numeric Keypad
J ♦	Remote (Panel Mount), IP66, NEMA/UL Type 12 Full Numeric LCD HIM
K ♦	Remote (Panel Mount), IP66, NEMA/UL Type 12 Prog. Only LCD HIM

♦ Available with Frames 5…6 Stand-Alone IP54 drives (Enclosure Code "G").

f

Documentation

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

g

Brake

Code	w/Brake IGBT ‡
Y	Yes
N	No

‡ Brake IGBT is standard on Frames 0-3, optional on Frames 4-6 and not available on Frames 7…10.

h

Internal Braking Resistor

Code	w/Resistor
Y	Yes ★
N	No

★ Not available for Frame 3 drives or larger.

i

Emission

Code	CE Filter §	CM Choke
A	Yes	Yes
B #	Yes	No
N	No	No

§ Note: 600V class drives below 77 Amps (Frames 0-4) are declared to meet the Low Voltage Directive. It is the responsibility of the user to determine compliance to the EMC directive. Frames 7…10, 400/480V AC drives (Voltage Rating codes "C" and "D") meet CE certification requirements when installed per recommendations.

Only available for 208…240V Frame 0-3 drives.

j

Comm Slot

Code	Network Type
C	ControlNet (Coax)
D	DeviceNet
E	EtherNet/IP
N	None

k

Control & I/O

Code	Control	I/O Volts
A	Standard ♦	24V DC/AC
B	Standard ♦	115V AC
C	Vector △	24V DC
D	Vector △	115V AC
N	Standard	None

△ Vector Control Option utilizes DPI Only.

♦ Frame 0…6 drives only.

l

Feedback

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

m

Future Use

n

Special Firmware (Frames 0…6 Only)

Code	Type
AD ♦	60 Hz Maximum
AE ♦	Cascading Fan/Pump Control
AX ♦	82 Hz Maximum
BA ♦	Pump Off (for pump jack)

♦ Must be used with Vector Control option C or D (Position k). Positions m-n are only required when custom firmware is supplied.

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Certifications and Specifications

Certifications

Certification [1]	Description	Frames			
		0…4			
		230…480V	600V	5…6	7…10
ABS	American Bureau of Shipping MA Certificate 08-HS303172B-3-PDA for auxiliary services on AB Classed vessels and offshore platforms	✔		✔	
CE	Certified by Rockwell Automation to be in conformity with the essential requirements of the applicable European Directives and the standards referenced below have been applied:				
	2006/95/EC (Low Voltage Directive) EN 50178 Electronic Equipment for use in Power Installations	✔	✔	✔	✔
	2004/108/EC (EMC Directive) EN 61800-3 Adjustable Speed electrical power drive systems - Part 3: EMC requirements and specific test methods.	✔		✔	✔ [2]
RCM	Certified by Rockwell Automation to be in conformity with the requirements of the applicable Australian legislation and the standards referenced: IEC 61800-3.	✔		✔	✔
c-UL-us	Listed to UL508C and C22.2 No. 14. Packaged drives may be listed to UL508A.	✔	✔	✔	✔
EAC	Low Voltage TR CU 004/2011 EMC TR CU 020/2011	✔	✔	✔	✔
EPRI /SEMIF47	EPRI Quality Star Certificates SEMIF47.115 and SEMIF47.127 for SEMI F47 compliance, only 480V units tested	✔		✔	
Functional Safety	EC-Type-Examination Certificate TUV 05 ATEX 7153 for directive 94/9/EC: Safe turn off of certified ATEX motors used in Group II Category (2) GD potentially explosive atmospheres.	✔	✔	✔	✔
Korean KC Registration	KCC-REM-RAA-20B Refer to the certificate of registration for specific drive catalog numbers that have this certification.	✔	✔	✔	✔
Lloyd's Register	Lloyd's Register Type Approval Certificate 08-HS303172B-3-PDA (marine certification)	✔		✔	
Trentec	Tested by Trentec to be compliant with AC156 Acceptance Criteria for Seismic Qualification Testing of Nonstructural Components and 2003 International Building Code for worst-case seismic level for USA excluding site class F	✔	✔	✔	
Designed to Meet Applicable Requirements	CMAA Specification #70 (Crane Manufacturers of America Assoc.)	✔	✔	✔	✔
	NFPA 70 – US National Electrical Code	✔	✔	✔	✔
	NEMA ICS 7.1 – Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems	✔	✔	✔	✔
	IEC 61800-2 – Adjustable Speed Electrical Power Drive Systems - Part 2: General Requirements - Rating specifications for low voltage adjustable frequency AC power drive systems.	✔	✔	✔	✔

(1) See the product certifications website, http://www.rockwellautomation.com/products/certification for declarations of conformity, certificates, and other certification details.

(2) Frames 7…10 provided as IP00 or NEMA / UL Open style must be installed in a supplementary enclosure which provides adequate attenuation of radiated emissions in order to be compliant with EN 61800-3.

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Environmental

Category	Specification				
Environment	Altitude:	1000 m (3300 ft) max. without derating			
	Maximum Surrounding Air Temperature without Derating - IP20, NEMA / UL Type Open: Frames 0…6 Frames 7…10	 0…50 °C (32…122 °F), typical. See Installation Instructions for details. 0…40 °C (32…104 °F) for chassis (heatsink) 0…65 °C (32…149 °F) for control (front of backplane)			
	Storage Temperature (all const.):	-40…70 °C (-40…158 °F)			
	Atmosphere:	**Important:** Drive **must not** be installed in an area where the ambient atmosphere contains volatile or corrosive gas, vapors or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere.			
	Relative Humidity:	5 to 95% non-condensing			
	Shock:	15G peak for 11ms duration (±1.0 ms)			
	Vibration:	0.152 mm (0.006 in.) displacement, 1G peak			
	Surrounding Environment Pollution Degree Pollution Degree 1 & 2: Pollution Degree 3 & 4: (See page 11 for descriptions of each pollution degree rating.)	 All enclosures acceptable. Enclosure that meets or exceeds IP54, NEMA / UL Type 12 required.			
	Sound:	Frame	Fan Velocity	Sound Level	Note: Sound pressure level is measured at 2 meters.
		0	30 CFM	58 dB	
		1	30 CFM	59 dB	
		2	50 CFM	57 dB	
		3	120 CFM	61 dB	
		4	190 CFM	59 dB	
		5	200 CFM	71 dB	
		6	300 CFM	72 dB	
		7	756 CFM	74 dB	
		8	1200 CFM	78 dB	
		9	2800 CFM	82 dB	
		10 Inv.	1850 CFM	78 dB	
		10 Cnv.	1200 CFM	78 dB	

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Technical Specifications

Category	Specification						
Protection	**Drive**	200…208V	240V	380/400V	480V	600V Frames 0…4	600/690V Frames 5…6
	AC Input Overvoltage Trip:	285V AC	285V AC	570V AC	570V AC	716V AC	818V AC
	AC Input Undervoltage Trip:	120V AC	138V AC	233V AC	280V AC	345V AC	345V AC
	Bus Overvoltage Trip:	405V DC	405V DC	810V DC	810V DC	1013V DC	1162V DC
	Bus Undervoltage Shutoff/Fault:	153V DC	153V DC	305V DC	305V DC	381V DC	437V DC
	Nominal Bus Voltage:	281V DC	324V DC	540V DC	648V DC	810V DC	932V DC
	All Drives						
	Heat Sink Thermistor:	Monitored by microprocessor overtemp trip					
	Drive Overcurrent Trip Software Overcurrent Trip: Hardware Overcurrent Trip:	 200% of rated current (typical) 220…300% of rated current (dependent on drive rating)					
	Line transients:	up to 6000 volts peak per IEEE C62.41-1991					
	Control Logic Noise Immunity:	Showering arc transients up to 1500V peak					
	Power Ride-Thru:	15 milliseconds at full load					
	Logic Control Ride-Thru:	0.5 seconds minimum, 2 seconds typical					
	Ground Fault Trip:	Phase-to-ground on drive output					
	Short Circuit Trip:	Phase-to-phase on drive output					
Electrical	Voltage Tolerance:	See page 12 for full power and operating range					
	Input Frequency Tolerance:	47…63 Hz					
	Input Phases:	Three-phase input provides full rating for all drives. Single-phase operation possible on certain drives and provides 50% of rated current (see Installation Instructions for details). Frames 0…7: Drive can be supplied as 6 pulse or 18 pulse in an engineered package.					
	Displacement Power Factor:	0.98 across entire speed range					
	Efficiency:	97.5% at rated amps, nominal line volts					
	Maximum Short Circuit Rating:	200,000 Amps symmetrical					
	Actual Short Circuit Rating:	Determined by AIC rating of installed fuse/circuit breaker					
	Drive to Motor Power Ratio Minimum Maximum	 Recommended not less than 1:2 ratio Recommended not greater than 2:1 ratio					

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Category	Specification	
Control	Method:	Sine coded PWM with programmable carrier frequency. Ratings apply to all drives (refer to the *Derating Guidelines* in the PowerFlex Reference Manual). The drive can be supplied as 6 pulse or 18 pulse in a configured package.
	Carrier Frequency:	2, 4, 8, and 10 kHz. Drive rating based on 4 kHz. See the Input Protection Device tables in the Installation Instructions for exceptions.
	Output Voltage Range:	0 to rated motor voltage
	Output Frequency Range:	Standard Control – 0 to 400 Hz., Vector Control – 0 to 420 Hz
	Frequency Accuracy Digital Input: Analog Input:	 Within ±0.01% of set output frequency Within ±0.4% of maximum output frequency
	Frequency Control:	Speed Regulation - w/Slip Compensation (Volts per Hertz Mode) 0.5% of base speed across 40:1 speed range, 40:1 operating range 10 rad/sec bandwidth
		Speed Regulation - w/Slip Compensation (Sensorless Vector Mode) 0.5% of base speed across 80:1 speed range, 80:1 operating range 20 rad/sec bandwidth
		Speed Regulation - w/Feedback (Sensorless Vector Mode) 0.1% of base speed across 80:1 speed range, 80:1 operating range 20 rad/sec bandwidth
	Speed Control:	Speed Regulation - w/o Feedback (Vector Control Mode) 0.1% of base speed across 120:1 speed range, 120:1 operating range 50 rad/sec bandwidth
		Speed Regulation - w/Feedback (Vector Control Mode) 0.001% of base speed across 120:1 speed range, 1000:1 operating range, 250 rad/sec bandwidth
	Torque Regulation:	Torque Regulation - w/o Feedback ±5%, 600 rad/sec bandwidth
		Torque Regulation - w/Feedback ±2%, 2500 rad/sec bandwidth
	Selectable Motor Control:	Sensorless Vector with full tuning. Standard V/Hz with full custom capability. PF700 adds Vector Control.
	Stop Modes:	Multiple programmable stop modes including - Ramp, Coast, DC-Brake, Ramp-to-Hold and S-curve.
	Accel/Decel:	Two independently programmable accel and decel times. Each time may be programmed from 0…3600 seconds in 0.1 second increments.
	Intermittent Overload:	110% Overload capability for up to 1 minute, 150% Overload capability for up to 3 seconds.
	Current Limit Capability:	Proactive Current Limit programmable from 20…160% of rated output current. Independently programmable proportional & integral gain.
	Motor Overload Protection Frames 0…6 Standard Control:	 PowerFlex 700 drives with standard control, identified by an N, A, or B in position 15 of the catalog number, only provide Class 10 motor overload protection according to NEC article 430. They do not provide speed sensitive overload protection, thermal memory retention and motor over-temperature sensing according to NEC article 430.126 (A) (2). If such protection is needed in the end-use product, it must be provided by additional means.
	Frames 0…6 Vector Control:	PowerFlex 700 drives with vector control, identified by a C or D in position 15 of the catalog number, provide 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.
	Frames 7…10 Vector Control:	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.

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Category	Specification						
Control (continued)	Digital/Analog Input Latency	Signal		Motor Control	Latency		
					Min.	Max	Typical
		Digital Input	Start	FVC	8.4 ms	10.4 ms	8.4 ms
				SVC	9.2 ms	16.0 ms	9.2 ms
			Stop	FVC	10.0 ms	12.4 ms	10.4 ms
				SVC	10.0 ms	12.0 ms	10.4 ms
		Analog Input	Torque 4 kHz PWM	FVC	772 µs	1.06 ms	840 µs
			Torque 2 kHz PWM	FVC	1.008 ms	1.46 ms	1.256 ms
			Speed	FVC	4.6 ms	8.6 ms	4.8 ms
			Speed	SVC	4.8 ms	12.4 ms	6.4 ms
Encoder	Type:	Incremental, dual channel					
	Supply:	12V, 250 mA. 12V, 10 mA minimum inputs isolated with differential transmitter, 250 kHz maximum.					
	Quadrature:	90°, ±27 degrees at 25 degrees C.					
	Duty Cycle:	50%, +10%					
	Requirements:	Encoders must be line driver type, quadrature (dual channel) or pulse (single channel), 8…15V DC output (4…6V DC when jumpers are in 5V position), single-ended or differential and capable of supplying a minimum of 10 mA per channel. Maximum input frequency is 250 kHz. The Encoder Interface Board accepts 12V DC square-wave with a minimum high state voltage of 7.0V DC. With the jumpers in the 5V position, the encoder will accept a 5V DC square-wave with a minimum high state voltage of 3.0V DC. In either jumper position, the maximum low state voltage is 0.4V DC.					

Pollution Degree Ratings According to EN 61800-5-1

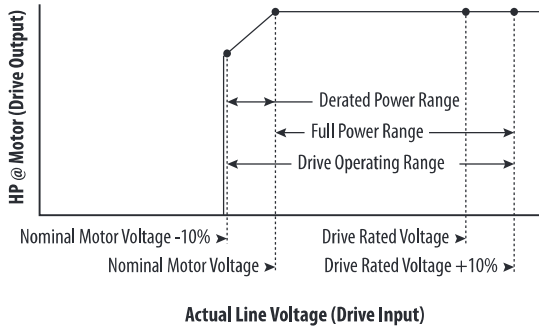
Pollution Degree	Description
1	No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.
2	Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation is to be expected, when the drive is out of operation.
3	Conductive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

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Design Considerations

Input Voltage Tolerance

Drive Rating	Nominal Line Voltage	Nominal Motor Voltage	Drive Full Power Range	Drive Operating Range
200…240	200	200*	200…264	180…264
	208	208	208…264	
	240	230	230…264	
380…480	380	380*	380…528	342…528
	400	400	400…528	
	480	460	460…528	
500…600 (Frames 0…4 Only)	600	575*	575…660	432…660
500…690 (Frames 5 & 6 Only)	600	575*	575…660	475…759
	690	690	690…759	475…759



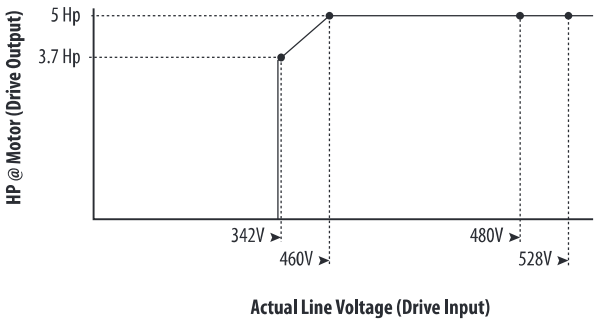
Drive Full Power Range = Nominal Motor Voltage to Drive Rated Voltage +10%.
Rated current is available across the entire Drive Full Power Range

Drive Operating Range = Lowest* Nominal Motor Voltage –10% to Drive Rated Voltage +10%.
Drive Output is linearly derated when Actual Line Voltage is less than the Nominal Motor Voltage

EXAMPLE Calculate the maximum power of a 5 Hp, 460V motor connected to a 480V rated drive supplied with 342V Actual Line Voltage input.

- Actual Line Voltage / Nominal Motor Voltage = 74.3%
- 74.3% × 5 Hp = 3.7 Hp
- 74.3% × 60 Hz = 44.6 Hz

At 342V Actual Line Voltage, the maximum power the 5 Hp, 460V motor can produce is 3.7 Hp at 44.6 Hz.



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Approximate Watts Loss

The following tables list the watts loss data for drives running at full load, full speed and default carrier frequency.

Internal watts are those dissipated by the control structure of the drive and will be dissipated into the cabinet regardless of mounting style. External watts are those dissipated directly through the heatsink and will be outside the cabinet for flange mount and inside the cabinet for other mounting types.

Watts Loss – Frames 0...6

Voltage	ND Hp/kW	External Watts	Internal Watts	Total Watts Loss[1]
IP20, NEMA / UL Type 1				
240V	0.5	9	37	46
	1	22	39	61
	2	38	39	77
	3	57	41	98
	5	97	82	179
	7.5	134	74	208
	10	192	77	269
	15	276	92	368
	20	354	82	436
	25	602	96	698
	30	780	96	876
	40	860	107	967
	50	1132	138	1270
	60	1296	200	1496
	75	1716	277	1993
	100	1837	418	2255
400V	0.37	11	42	53
	0.75	19	44	63
	1.5	31	45	76
	2.2	46	46	93
	4	78	87	164
	5.5	115	79	194
	7.5	134	84	218
	11	226	99	326
	15	303	91	394
	18.5	339	102	441
	22	357	103	459
	30	492	117	610
	37	568	148	717
	45	722	207	930
	55	821	286	1107
	55	1130	397	1527
	90	1402	443	1845
	110	1711	493	2204
	132	1930	583	2513

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Voltage	ND Hp/kW	External Watts	Internal Watts	Total Watts Loss[1]
480V	0.5	11	42	53
	1	19	44	63
	2	31	45	76
	3	46	46	93
	5	78	87	164
	7.5	115	79	194
	10	134	84	218
	15	226	99	326
	20	303	91	394
	25	339	102	441
	30	357	103	459
	40	492	117	610
	50	568	148	717
	60	722	207	930
	75	821	286	1107
	100	1130	397	1527
	125	1402	443	1845
	150	1711	493	2204
	200	1930	583	2513
600V	0.5	9	37	46
	1	14	40	54
	2	25	40	65
	3	41	42	83
	5	59	83	142
	7.5	83	75	157
	10	109	77	186
	15	177	93	270
	20	260	83	343
	25	291	95	385
	30	324	95	419
	40	459	109	569
	50	569	141	710
	60	630	195	825
	75	1053	308	1361
	100	1467	407	1874
	125	1400	500	1900
	150	1668	612	2280
690V	45	894	141	1034
	55	1056	195	1251
	75	1105	308	1412
	90	1389	407	1796
	110	1283	500	1783
	132	1592	612	2204

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Voltage	ND Hp/kW	External Watts	Internal Watts	Total Watts Loss(1)
IP54, NEMA / UL Type 12				
480V	75	873	234	1107
	100	1237	290	1527
	125	1563	282	1845
	150	1874	330	2204
	200	2100	413	2513
600V	75	1091	270	1361
	100	1537	337	1874
	125	1584	316	1900
	150	1895	385	2280

(1) Worst case condition including Vector Control board, HIM, and Communication Module.

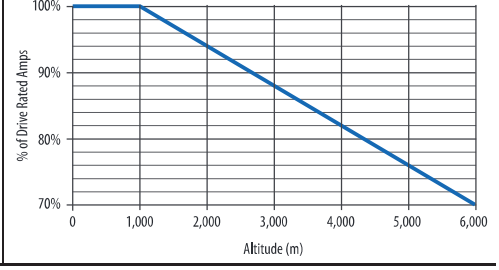
Watts Loss – Frames 7...10

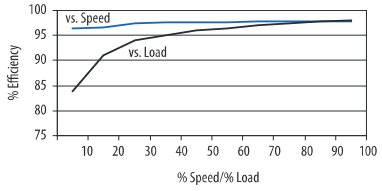
Voltage	Frame	Hp Rating		Dissipation (Watts)(1)					
				AC Input			DC Input		
		ND	HD	External	Internal	Total	External	Internal	Total
IP20, NEMA / UL Type 1									
400/480V	7	250	200	3422	514	3936	3098	497	3595
		250	250	4224	618	4842	3848	599	4447
	8	300	250	3125	569	3694	2698	547	3245
		350	300	3588	681	4269	3091	655	3746
		400	350	4284	850	5133	3692	816	4510
		450	400	4850	1000	5850	4178	965	5143
		500	450	5278	2010	7288	4506	1969	6475
	9	600	500	8740	2270	11010	7752	2218	9970
	10	700	600	8595	2339	10934	7470	2280	9750

(1) Worst case condition including Vector Control board, HIM, and Communication Module.

Derating Guidelines

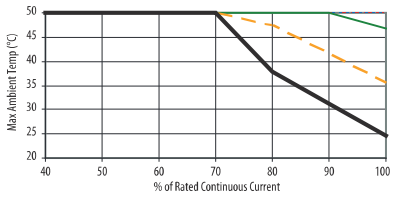
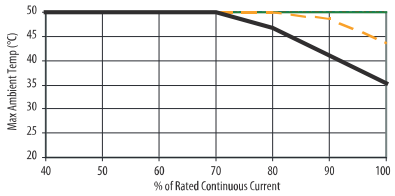
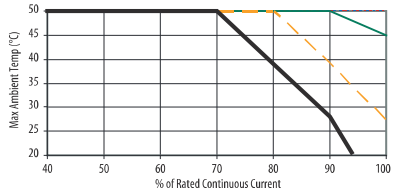
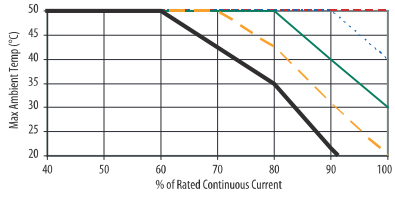
Altitude and Efficiency

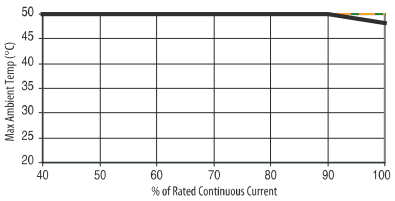
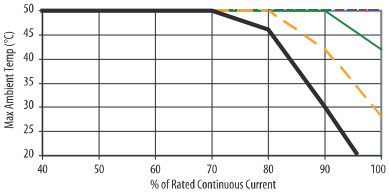
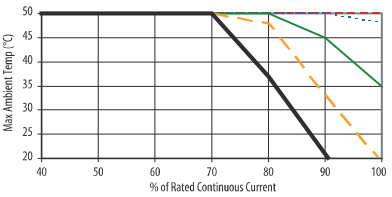
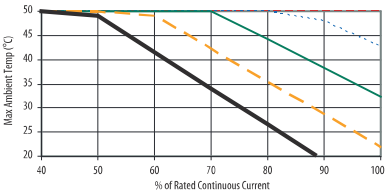
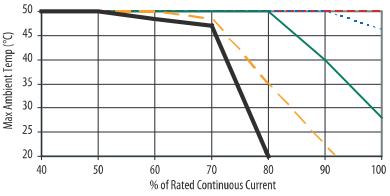
Frame	Type	Derate
All	Altitude	

Frame	Type	Derate
All	Efficiency (typical)	

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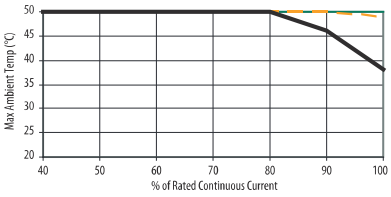
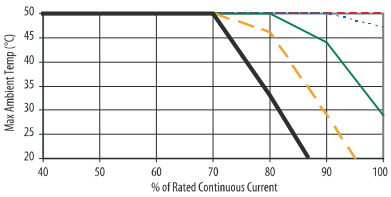
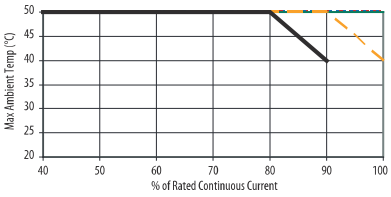
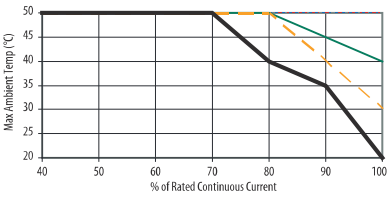
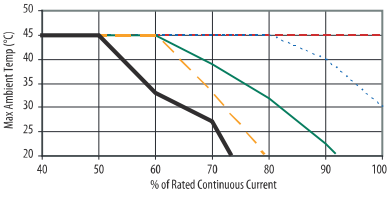
Ambient Temperature/Load – 240V AC

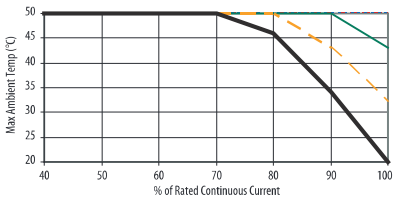
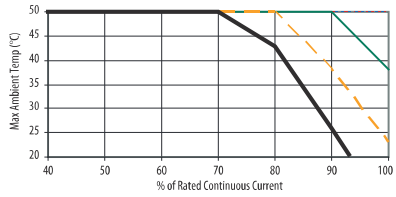
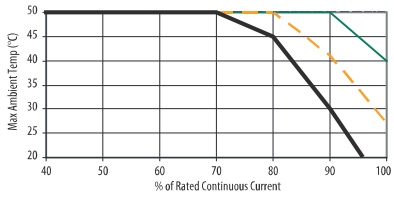
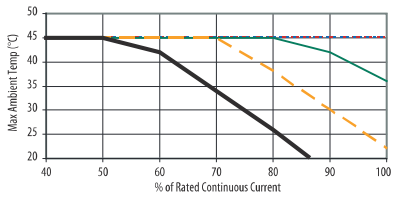
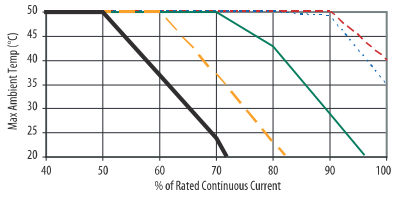
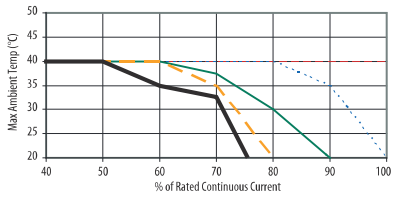
240 Volt Power Rating			Derating — — — 2 kHz ····· 4 kHz ———
ND Hp	**HD Hp**	**Cont. Amps**	
0.5…5.0	0.33…3.0	2.2…15.3	None
10…15	7.5…10	28…42	None
25	20	70	
40	30	104 (80)	
60	50	154 (130)	
100	75	260 (205)	

240 Volt Power Rating			Derating — — — 2 kHz ····· 4 kHz ———
ND Hp	**HD Hp**	**Cont. Amps**	
7.5	5.0	22	
20	15	52	
30	25	80	
50	40	130 (104)	
75	60	192 (154)	

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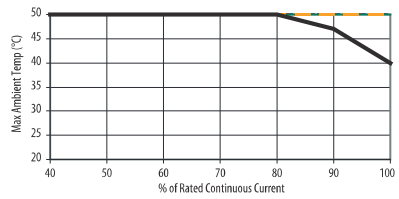
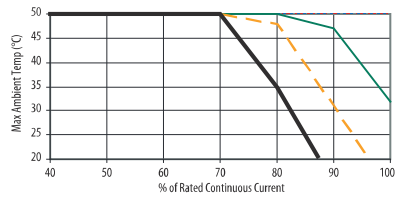
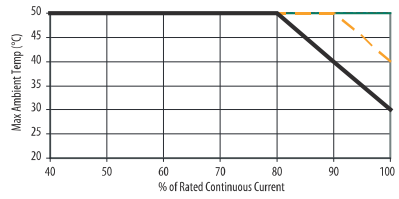
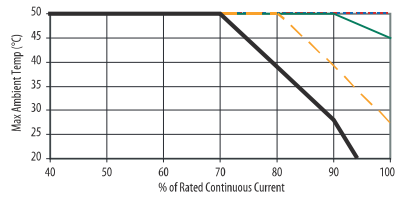
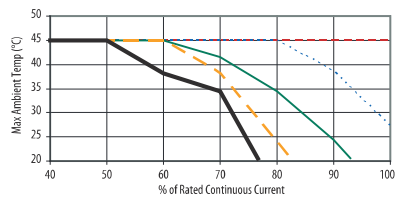
Ambient Temperature/Load – 400V AC

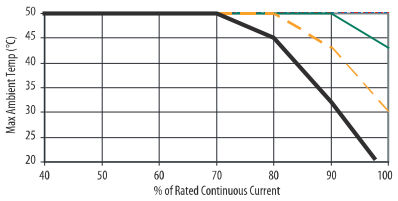
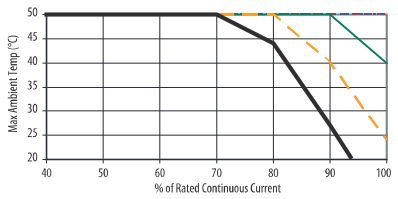
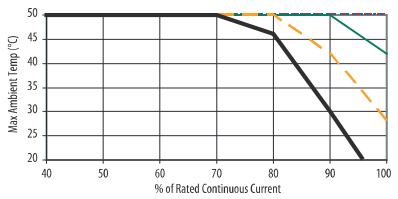
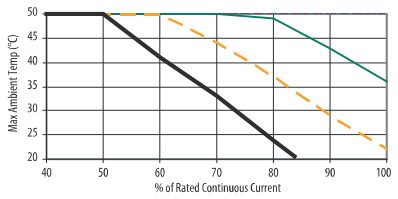
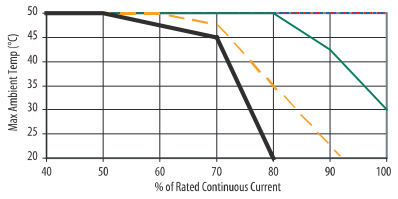
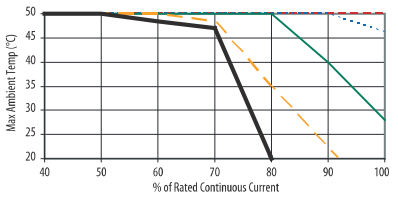
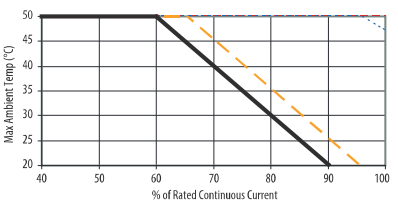
400 Volt Power Rating			Derating
ND kW	HD kW	Cont. Amps	2 kHz 4 kHz 6 kHz 8 kHz 10 kHz
0.37…7.5	0.25…5.5	1.3…15.4	None
15	11	30	
22	18.5	43	None
37	30	72	
55	45	105 (85)	
90	75	170 (140)	
132	110	260 (205)	

400 Volt Power Rating			Derating
ND kW	HD kW	Cont. Amps	2 kHz 4 kHz 6 kHz 8 kHz 10 kHz
11	7.5	22	
18.5	15	37	
30	22	56	
45	37	85 (72)	
75	55	140 (105)	
110	90	205 (170)	
160	150	292 (263)	see 480 Volt, 292 (263) Amp on page 18
180	180	325 (325)	see 480 Volt, 325 (325) Amp on page 19
200	180	365 (325)	see 480 Volt, 365 (325) Amp on page 19
240	200	415 (365)	see 480 Volt, 415 (365) Amp on page 19
280	240	481 (415)	see 480 Volt, 481 (415) Amp on page 19
300	280	535 (481)	see 480 Volt, 535 (481) Amp on page 19
350	300	600 (535)	see 480 Volt, 600 (535) Amp on page 19
400	350	730 (600)	see 480 Volt, 730 (600) Amp on page 19
500	400	875 (700)	see 480 Volt, 875 (700) Amp on page 19

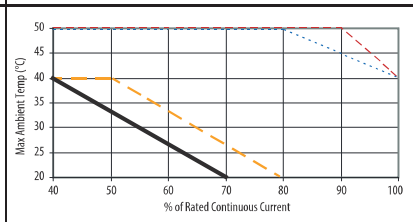
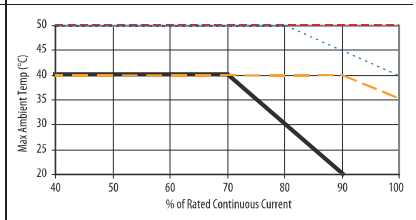
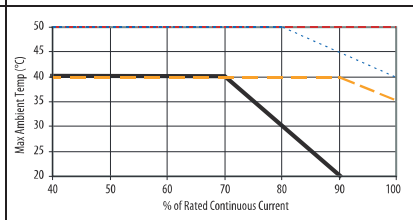
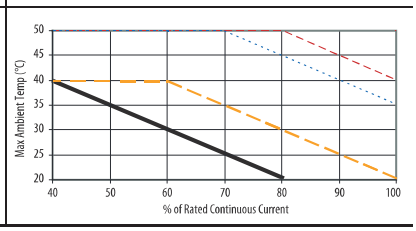
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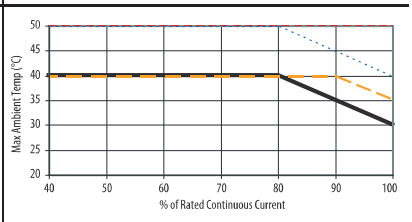
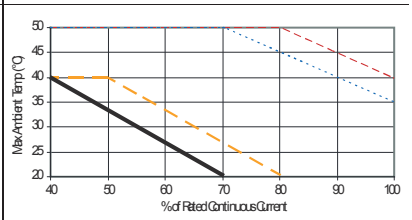
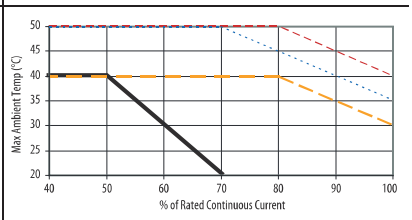
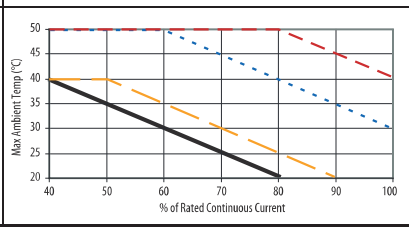
Ambient Temperature/Load – 480V AC

480 Volt Power Rating			Derating
ND Hp	HD Hp	Cont. Amps	2 kHz 4 kHz 6 kHz 8 kHz 10 kHz
0.5…10	0.33…7.5	1.1…14	None
20	15	27	
30	25	40	None
50	40	65	
75	60	96 (77)	
125	100	156 (125)	
200	150	248 (180)	

480 Volt Power Rating			Derating
ND Hp	HD Hp	Cont. Amps	2 kHz 4 kHz 6 kHz 8 kHz 10 kHz
15	10	22	
25	20	34	
40	30	52	
60	50	77 (65)	
100	75	125 (96)	
150	125	180 (156)	
250	200	292 (263)	

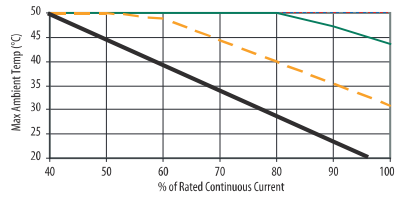
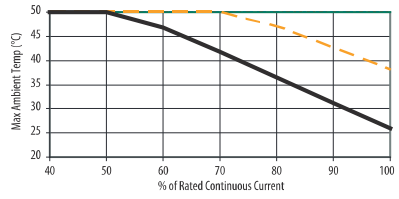
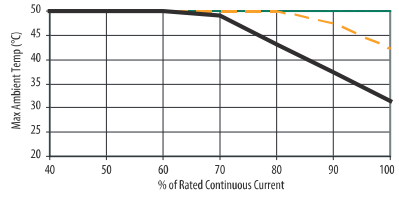
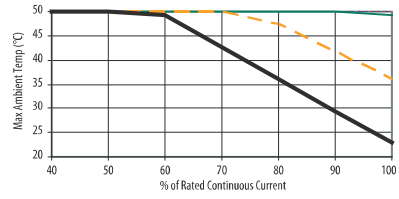
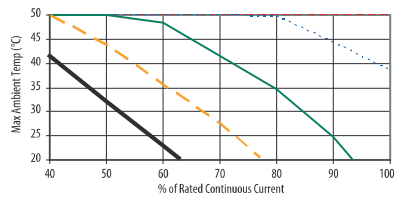
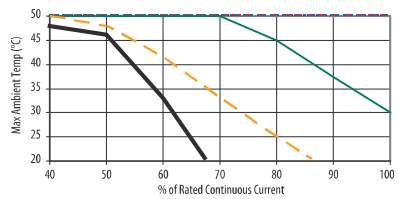
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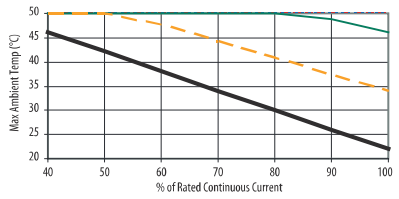
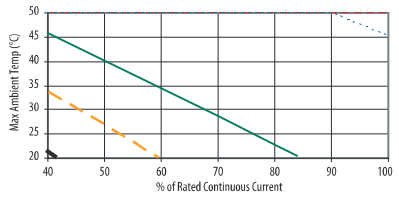
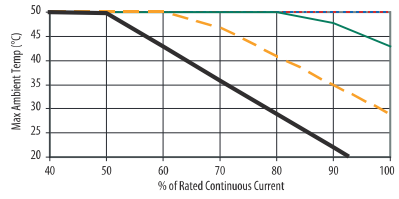
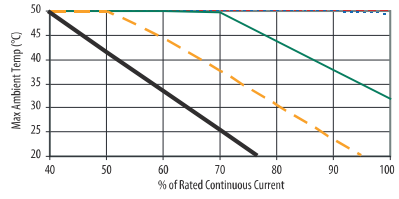
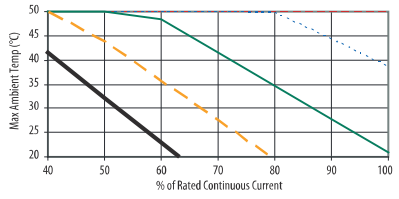
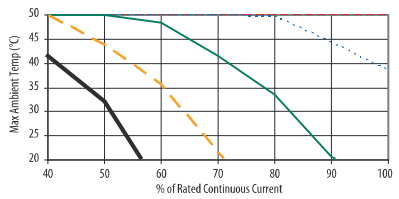
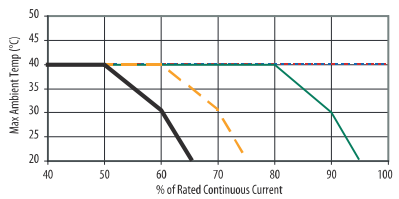
480 Volt Power Rating			Derating
ND Hp	HD Hp	Cont. Amps	2 kHz, 4 kHz, 6 kHz, 8 kHz, 10 kHz
250	250	325 (325)	
350	300	415 (365)	
450	400	535 (481)	
600	500	730 (600)	

480 Volt Power Rating			Derating
ND Hp	HD Hp	Cont. Amps	2 kHz, 4 kHz, 6 kHz, 8 kHz, 10 kHz
300	250	365 (325)	
400	350	481 (415)	
500	450	600 (535)	
700	600	875 (700)	

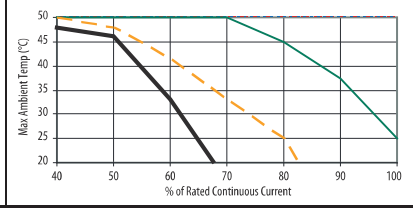
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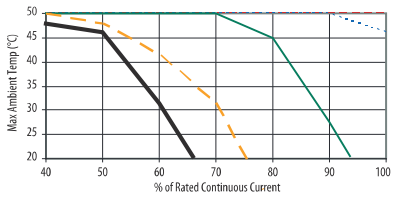
Ambient Temperature/Load – 600V AC

600 Volt Power Rating			Derating — — — 2 kHz ····· 4 kHz ———
ND Hp	HD Hp	Cont. Amps	
1.0…2.0	0.5…1.0	1.7…2.7	None
5.0	3.0	6.1	
10	7.5	11	
20	15	22	
30	25	32	
50	40	52	
75	60	77 (63)	

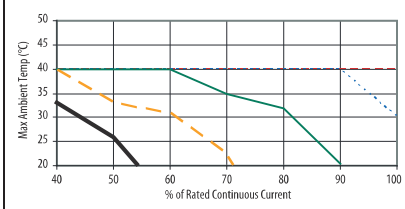
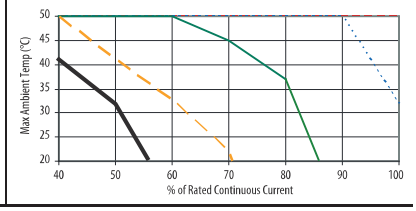
600 Volt Power Rating			Derating — — — 2 kHz ····· 4 kHz ———
ND Hp	HD Hp	Cont. Amps	
3.0	2.0	3.9	
7.5	5.0	9	
15	10	17	
25	20	27	
40	30	41	
60	50	62	
100	75	99 (77)	

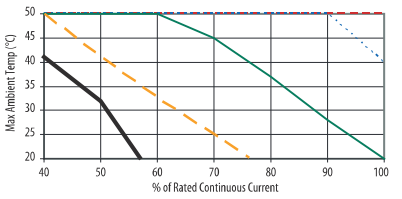
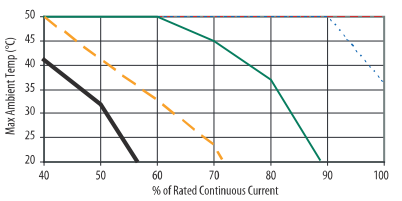
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600 Volt Power Rating			Derating
ND Hp	HD Hp	Cont. Amps	2 kHz, 4 kHz
125	100	125 (99)	

600 Volt Power Rating			Derating
ND Hp	HD Hp	Cont. Amps	2 kHz, 4 kHz
150	125	144 (125)	

Ambient Temperature/Load – 690V AC

690 Volt Power Rating			Derating
ND kW	HD kW	Cont. Amps	2 kHz, 4 kHz, 6 kHz, 8 kHz, 10 kHz
45…55	37.5…45	52…60 (46…52)	None
90	75	98 (82)	
132	110	142 (119)	

690 Volt Power Rating			Derating
ND kW	HD kW	Cont. Amps	2 kHz, 4 kHz, 6 kHz, 8 kHz, 10 kHz
75	55	82 (60)	
110	90	119 (98)	

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Single-Phase Input Power

The PowerFlex 700 drive is typically used with a three-phase input supply. Single-phase operation is possible with output current derated by 50% (at maximum ambient temperature of 25 °C) of the three-phase ratings.

208/240 Volt Single-Phase AC Input Ratings

240V Single-Phase AC Input						208V Single-Phase AC Input						Temp.
Drive Catalog Number	Frame	Hp Rating	Input Amps	Three-Phase Output		Drive Catalog Number	Frame	Hp Rating	Input Amps	Three-Phase Output		
				V AC	Amps					V AC	Amps	°C
20BB2P2	0	0.25	1.5	0-230	1.1	20BB2P2	0	0.25	1.7	0-200	1.3	25
20BB4P2	0	0.5	2.8	0-230	2.1	20BB4P2	0	0.5	3.2	0-200	2.4	25
20BB6P8	1	1	5.1	0-230	3.4	20BB6P8	1	1	5.9	0-200	3.9	25
20BB9P6	1	1.5	7.2	0-230	4.8	20BB9P6	1	1.5	8.3	0-200	5.5	25
20BB015	1	2.5	11.9	0-230	7.7	20BB015	1	2.5	13.6	0-200	8.8	25
20BB022	1	3.75	17.3	0-230	11	20BB022	1	3.75	19.9	0-200	12.7	25
20BB028	2	5	22.2	0-230	14	20BB028	2	5	25.7	0-200	16.1	25
20BB042	3	7.5	33.4	0-230	21	20BB042	3	7.5	38.5	0-200	24.2	25
20BB052	3	10	41.3	0-230	26	20BB052	3	10	44.6	0-200	28	25
20BB070	4	12.5	55.6	0-230	35	20BB070	4	12.5	62.3	0-200	39.1	25
20BB080	4	15	63.6	0-230	40	20BB080	4	15	73.3	0-200	46	25
20BB104	5	20	84.6	0-230	52	20BB104	5	20	97.9	0-200	60	25
20BB130	5	25	105.7	0-230	65	20BB130	5	25	106.1	0-200	65	25
20BB154	6	30	125.2	0-230	77	20BB154	6	30	144.4	0-200	88.5	25
20BB192	6	37.5	156.1	0-230	96	20BB192	6	37.5	180.3	0-200	110.5	25
20BB260	6	50	211.4	0-230	130	20BB260	6	50	212.1	0-200	130	25

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	°C
20BD1P1	0	0.25	0.7	0-460	0.6	20BC1P3	0	0.2	1	0-400	0.7	25
20BD2P1	0	0.5	1.4	0-460	1.1	20BC2P1	0	0.4	1.6	0-400	1.1	25
20BD3P4	0	1	2.3	0-460	1.7	20BC3P5	0	0.75	2.7	0-400	1.8	25
20BD5P0	0	1.5	3.4	0-460	2.5	20BC5P0	0	1.1	3.9	0-400	2.5	25
20BD8P0	0	2.5	6	0-460	4	20BC8P7	0	2	6.9	0-400	4.4	25
20BD011	0	3.75	8.2	0-460	5.5	20BC011	0	2.75	9.3	0-400	5.8	25
20BD014	1	5	10.9	0-460	7	20BC015	1	3.75	12.5	0-400	7.7	25
20BD022	1	7.5	17.3	0-460	11	20BC022	1	5.5	17.8	0-400	11	25
20BD027	2	10	21.4	0-460	13.5	20BC030	2	7.5	24.6	0-400	15	25
20BD034	2	12.5	27	0-460	17	20BC037	2	9.25	30.3	0-400	18.5	25
20BD040	3	15	31.8	0-460	20	20BC043	3	11	35.2	0-400	21.5	25
20BD052	3	20	41.3	0-460	26	20BC056	3	15	45.9	0-400	28	25
20BD065	3	25	51.6	0-460	32.5	20BC072	3	18.5	59.7	0-400	36	25
20BD077	4	30	62.6	0-460	38.5	20BC085	4	22.5	70.5	0-400	42.5	25
20BD096	5	37.5	78.1	0-460	48	20BC105	5	27.5	87	0-400	52.5	25
20BD125	5	50	101.6	0-460	62.5	20BC125	5	27.5	103.6	0-400	62.5	25
–	–	–	–	–	–	20BC140	5	37.5	117.4	0-400	70	25
20BD156	6	62.5	126.8	0-460	78	20BC170	6	45	142.6	0-400	85	25
20BD180	6	75	146.4	0-460	90	20BC205	6	55	171.9	0-400	102.5	25
20BD248	6	100	201.6	0-460	124	20BC260	6	66	220.6	0-400	130	25

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600…690 Volt Single-Phase AC Input Rating

600V Single-Phase AC Input						690V 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	°C
20BE1P7	0	0.5	1.1	0-575	0.9	–	–	–	–	–	–	25
20BE2P7	0	1	1.8	0-575	1.4	–	–	–	–	–	–	25
20BE3P9	0	1.5	2.6	0-575	2	–	–	–	–	–	–	25
20BE6P1	0	2.5	4.6	0-575	3.1	–	–	–	–	–	–	25
20BE9P0	0	3.75	6.7	0-575	4.5	–	–	–	–	–	–	25
20BE011	1	5	8.5	0-575	5.5	–	–	–	–	–	–	25
20BE017	1	7.5	13.3	0-575	8.5	–	–	–	–	–	–	25
20BE022	2	10	17.5	0-575	11	–	–	–	–	–	–	25
20BE027	2	12.5	21.4	0-575	13.5	–	–	–	–	–	–	25
20BE032	3	15	25.4	0-575	16	–	–	–	–	–	–	25
20BE041	3	20	32.6	0-575	20.5	–	–	–	–	–	–	25
20BE052	3	25	41.3	0-575	26	20BF052	5	22.5	43.1	0-690	26	25
20BE062	4	30	50.4	0-575	31	20BF060	5	27.5	49.9	0-690	30	25
20BE077	5	37.5	62.6	0-575	38.5	20BF082	5	37.5	68.4	0-690	41	25
20BE099	5	50	80.5	0-575	49.5	20BF098	5	45	82	0-690	49	25
20BE125	6	62.5	101.6	0-575	62.5	20BF119	6	55	100	0-690	59.5	25
20BE144	6	75	117.1	0-575	72	20BF142	6	66	120.2	0-690	71	25

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Drive, Fuse and 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.

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 – UL Class CC, T, RK1 or J must be used for Frames 0...6.
  UL Class T, RK1, J, or L must be used for Frames 7...10.

Circuit Breakers

The “non-fuse” listings in the following tables include inverse time circuit breakers, instantaneous trip circuit breakers (motor circuit protectors) and 140M self-protected combination motor controllers (Frames 0...6 only). If one of these is chosen as the desired protection method, the following requirements apply:

- IEC – Both types of circuit breakers and 140M self-protected combination motor controllers (Frames 0...6 only) are acceptable for IEC installations.
- UL – Only inverse time circuit breakers and the specified 140M self-protected combination motor controllers (Frames 0...6 only) 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.

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208 Volt AC Input Protection Devices – Frames 0…6

Drive Catalog Number	Frame	Hp Rating		PWM Freq.	Temp. (11)	Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker (3)	Motor Circuit Protector (4)	140M Motor Protector with Adjustable Current Range (5)(6)			
		ND	HD	kHz	°C	Amps	kVA	Cont.	1 Min.	3 Sec.	Min. (1)	Max. (2)	Min. (1)	Max. (2)	Max. (8)	Max. (8)	Available Catalog Numbers - 140… (7)			Min. Enclosure Vol. (in.³) (14)
20BB2P2	0	0.5	0.33	4	50	1.9	0.7	2.5	2.8	3.8	3	6	3	10	15	3	M-C2E-B25	M-D8E-B25	–	7269
20BB4P2	0	1	0.75	4	50	3.7	1.3	4.8	5.6	7	6	10	6	17.5	15	7	M-C2E-B63	M-D8E-B63	–	7269
20BB6P8	1	2	1.5	4	50	6.8	2.4	7.8	10.4	13.8	10	15	10	30	30	15	M-C2E-C10	M-D8E-C10	M-F8E-C10	7269
20BB9P6	1	3	2	4	50	9.5	3.4	11	12.1	17	12	20	12	40	40	15	M-C2E-C16	M-D8E-C16	M-F8E-C16	7269
20BB015	1	5	3	4	50	15.7	5.7	17.5	19.3	26.3	20	35	20	70	70	30	M-C2E-C20	M-D8E-C20	M-F8E-C20	7269
20BB022	1	7.5	5	4	50	23	8.3	25.3	27.8	38	30	50	30	100	100	30	–	M-D8E-C25	M-F8E-C25	7269
20BB028	2	10	7.5	4	50	29.6	10.7	32.2	38	50.6	40	70	40	125	125	50	–	–	M-F8E-C32	7269
20BB042	3	15	10	4	50	44.5	16	48.3	53.1	72.5	60	100	60	175	175	70	–	–	M-F8E-C45	13630
20BB052	3	20	15	4	50	51.5	17.1	56	64	86	80	125	80	200	200	100	–	–	–	–
20BB070	4	25	20	4	50	72	25.9	78.2	93	124	90	175	90	300	300	100	–	–	–	–
20BB080	4	30	25	4	50	84.7	30.5	92	117	156	110	200	110	350	350	150	–	–	–	–
20BB104 (12)	5	40	–	4	50	113	40.7	120	132	175	150	250	150	475	350	150	–	–	–	–
		–	30	4	50	84.7	30.5	92	138	175	125	200	125	350	300	150	–	–	–	–
20BB130 (12)	5	50	–	4	50	141	44.1	130	143	175	175	275	175	500	375	250	–	–	–	–
		–	40	4	50	113	35.3	104	156	175	125	225	125	400	300	150	–	–	–	–
20BB154 (12)	6	60	–	4	50	167	60.1	177	195	266	225	350	225	500	500	250	–	–	–	–
		–	50	4	50	141	50.9	150	225	300	200	300	200	500	450	250	–	–	–	–
20BB192 (12)	6	75	–	4	50	208	75	221	243	308	300	450	300	600	600	400	–	–	–	–
		–	60	4	50	167	60.1	177	266	308	225	350	225	500	500	250	–	–	–	–
20BB260 (12)	6	100	–	2	45	255	91.9	260	286	390	300	575	300	750	750	400	–	–	–	–
		–	75	2	50	199	71.7	205	305	410	225	450	225	600	600	400	–	–	–	–

See page 29 for notes.

240 Volt AC Input Protection Devices – Frames 0…6

Drive Catalog Number	Frame	Hp Rating		PWM Freq.	Temp. (11)	Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker (3)	Motor Circuit Protector (4)	140M Motor Protector with Adjustable Current Range (5)(6)			
		ND	HD	kHz	°C	Amps	kVA	Cont.	1 Min.	3 Sec.	Min. (1)	Max. (2)	Min. (1)	Max. (2)	Max. (8)	Max. (8)	Available Catalog Numbers - 140… (7)			Min. Enclosure Vol. (in.³) (14)
20BB2P2	0	0.5	0.33	4	50	1.7	0.7	2.2	2.4	3.3	3	6	3	10	15	3	M-C2E-B25	M-D8E-B25	–	7269
20BB4P2	0	1	0.75	4	50	3.3	1.4	4.2	4.8	6.4	5	8	5	15	15	7	M-C2E-B63	M-D8E-B63	–	7269
20BB6P8	1	2	1.5	4	50	5.9	2.4	6.8	9	12	10	15	10	25	25	15	M-C2E-C10	M-D8E-C10	M-F8E-C10	7269
20BB9P6	1	3	2	4	50	8.3	3.4	9.6	10.6	14.4	12	20	12	35	35	15	M-C2E-C10	M-D8E-C10	M-F8E-C10	7269
20BB015	1	5	3	4	50	13.7	5.7	15.3	16.8	23	20	30	20	60	60	30	M-C2E-C16	M-D8E-C16	M-F8E-C16	7269
20BB022	1	7.5	5	4	50	19.9	8.3	22	24.2	33	25	50	25	80	80	30	–	M-D8E-C25	M-F8E-C25	7269
20BB028	2	10	7.5	4	50	25.7	10.7	28	33	44	35	60	35	100	100	50	–	–	M-F8E-C32	7269
20BB042	3	15	10	4	50	38.5	16	42	46.2	63	50	90	50	150	150	50	–	–	M-F8E-C45	13630
20BB052	3	20	15	4	50	47.7	19.8	52	63	80	60	100	60	200	200	100	–	–	–	–
20BB070	4	25	20	4	50	64.2	26.7	70	78	105	90	150	90	275	275	100	–	–	–	–
20BB080	4	30	25	4	50	73.2	30.5	80	105	140	100	180	100	300	300	100	–	–	–	–
20BB104 (12)	5	40	–	4	50	98	40.6	104	115	175	125	225	125	400	300	150	–	–	–	–
		–	30	4	50	73	30.5	80	120	160	100	175	100	300	300	100	–	–	–	–
20BB130 (12)	5	50	–	4	50	122	50.7	130	143	175	175	275	175	500	375	250	–	–	–	–
		–	40	4	50	98	40.6	104	156	175	125	225	125	400	300	150	–	–	–	–
20BB154 (12)	6	60	–	4	50	145	60.1	154	169	231	200	300	200	600	450	250	–	–	–	–
		–	50	4	50	122	50.7	130	195	260	175	275	175	500	375	250	–	–	–	–
20BB192 (12)	6	75	–	4	50	180	74.9	192	211	288	225	400	225	600	575	250	–	–	–	–
		–	60	4	50	145	60.1	154	231	308	200	300	200	600	450	250	–	–	–	–
20BB260 (12)	6	100	–	2	45	233	96.7	260	286	390	300	575	300	750	750	300	–	–	–	–
		–	75	2	50	169	70.1	205	305	410	225	450	225	600	600	250	–	–	–	–

See page 29 for notes.

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400 Volt AC Input Protection Devices – Frames 0…6

Drive Catalog Number	Frame	kW Rating		PWM Freq.	Temp.	Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker (3)	Motor Circuit Protector (4)	140M Motor Protector with Adjustable Current Range(5)(6)			
		ND	HD	kHz	°C	Amps	kVA	Cont.	1 Min.	3 Sec.	Min. (1)	Max. (2)	Min. (1)	Max. (2)	Max. (8)	Max. (8)	Available Catalog Numbers - 140… (7)			Min. Enclosure Vol. (in.3) (14)
20BC1P3	0	0.37	0.25	4	50 (11)	1.1	0.77	1.3	1.4	1.9	3	3	3	6	15	3	M-C2E-B16	–	–	7269
20BC2P1	0	0.75	0.55	4	50 (11)	1.8	1.3	2.1	2.4	3.2	3	6	3	8	15	3	M-C2E-B25	M-D8E-B25	–	7269
20BC3P5	0	1.5	0.75	4	50 (11)	3.2	2.2	3.5	4.5	6	6	7	6	12	15	7	M-C2E-B40	M-D8E-B40	–	7269
20BC5P0	0	2.2	1.5	4	50 (11)	4.6	3.2	5	5.5	7.5	6	10	6	20	20	7	M-C2E-B63	M-D8E-B63	–	7269
20BC8P7	0	4	2.2	4	50 (11)	7.9	5.5	8.7	9.9	13.2	15	17.5	15	30	30	15	M-C2E-C10	M-D8E-C10	M-F8E-C10	7269
20BC011	0	5.5	4	4	50 (11)	10.8	7.5	11.5	13	17.4	15	25	15	45	45	15	M-C2E-C16	M-D8E-C16	M-F8E-C16	7269
20BC015	1	7.5	5.5	4	50 (11)	14.4	10	15.4	17.2	23.1	20	30	20	60	60	20	M-C2E-C20	M-D8E-C20	M-F8E-C20	7269
20BC022	1	11	7.5	4	50 (11)	20.6	14.3	22	24.2	33	30	45	30	80	80	30	–	M-D8E-C25	M-F8E-C25	7269
20BC030	2	15	11	4	50 (11)	28.4	19.7	30	33	45	35	60	35	120	120	50	–	–	M-F8E-C32	7269
20BC037	2	18.5	15	4	50 (11)	35	24.3	37	45	60	45	80	45	125	125	50	–	–	M-F8E-C45	7269
20BC043	3	22	18.5	4	50 (11)	40.7	28.2	43	56	74	60	90	60	150	150	60	–	–	–	–
20BC056	3	30	22	4	50 (11)	53	36.7	56	64	86	70	125	70	200	200	100	–	–	–	–
20BC072	3	37	30	4	50 (10)(11)	68.9	47.8	72	84	112	90	150	90	250	250	100	–	–	–	–
20BC085 (12)	4	45	–	4	45 (11)	81.4	56.4	85	94	128	110	200	110	300	300	150	–	–	–	–
		–	37	4	45 (11)	68.9	47.8	72	108	144	90	175	90	275	300	100	–	–	–	–
20BC105 (12)	5	55	–	4	50 (9)	100.5	69.6	105	116	158	125	225	125	400	300	150	–	–	–	–
		–	45	4	50 (9)	81.4	56.4	85	128	170	110	175	110	300	300	150	–	–	–	–
20BC125 (12)	5	55	–	4	50 (9)	121.1	83.9	125	138	163	150	275	150	500	375	250	–	–	–	–
		–	45	4	50 (9)	91.9	63.7	96	144	168	125	200	125	375	375	150	–	–	–	–
20BC140 (12)	5	75	–	4	40 (9)	136	93.9	140	154	190	200	300	200	400	400	250	–	–	–	–
		–	55	4	40 (9)	101	69.6	105	157	190	150	225	150	300	300	150	–	–	–	–
20BC170 (12)	6	90	–	4	50 (9)	164	126	170	187	255	250	375	250	600	500	250	–	–	–	–
		–	75	4	50 (9)	136	103	140	210	280	200	300	200	550	400	250	–	–	–	–
20BC205 (12)	6	110	–	4	40 (9)	199	148	205	220	289	250	450	250	600	600	400	–	–	–	–
		–	90	4	40 (9)	164	126	170	255	313	250	375	250	600	500	250	–	–	–	–
20BC260 (12)	6	132	–	2	45 (9)	255	177	260	286	390	350	550	350	750	750	400	–	–	–	–
		–	110	2	50 (9)	199	138	205	308	410	250	450	250	600	600	400	–	–	–	–

See page 29 for notes.

400 Volt AC Input Protection Devices – Frames 7…10

Drive Catalog Number (12)	Frame	kW Rating		PWM Freq.	Temp. (16)	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. (8)	Max. (8)
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 29 for notes.

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480 Volt AC Input Protection Devices – Frames 0…6

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)	140M Motor Protector with Adjustable Current Range (5)(6)			
		ND	HD	kHz	°C	Amps	kVA	Cont.	1 Min.	3 Sec.	Min. (1)	Max. (2)	Min. (1)	Max. (2)	Max. (8)	Max. (8)	Available Catalog Numbers - 140… (7)			Min. Enclosure Vol. (in.^{3}) (14)
20BD1P1	0	0.5	0.33	4	50 (11)	0.9	0.7	1.1	1.2	1.6	3	3	3	6	15	3	M-C2E-B16	–	–	7269
20BD2P1	0	1	0.75	4	50 (11)	1.6	1.4	2.1	2.4	3.2	3	6	3	8	15	3	M-C2E-B25	–	–	7269
20BD3P4	0	2	1.5	4	50 (11)	2.6	2.2	3.4	4.5	6	4	8	4	12	15	7	M-C2E-B40	M-D8E-B40	–	7269
20BD5P0	0	3	2	4	50 (11)	3.9	3.2	5	5.5	7.5	6	10	6	20	20	7	M-C2E-B63	M-D8E-B63	–	7269
20BD8P0	0	5	3	4	50 (11)	6.9	5.7	8	8.8	12	10	15	10	30	30	15	M-C2E-C10	M-D8E-C10	M-F8E-C10	7269
20BD011	0	7.5	5	4	50 (11)	9.5	7.9	11	12.1	16.5	15	20	15	40	40	15	M-C2E-C16	M-D8E-C16	M-F8E-C16	7269
20BD014	1	10	7.5	4	50 (11)	12.5	10.4	14	16.5	22	17.5	30	17.5	50	50	20	M-C2E-C16	M-D8E-C16	M-F8E-C16	7269
20BD022	1	15	10	4	50 (11)	19.9	16.6	22	24.2	33	25	50	25	80	80	30	–	M-D8E-C25	M-F8E-C25	7269
20BD027	2	20	15	4	50 (11)	24.8	20.6	27	33	44	35	60	35	100	100	50	–	–	M-F8E-C32	7269
20BD034	2	25	20	4	50 (11)	31.2	25.9	34	40.5	54	40	70	40	125	125	50	–	–	M-F8E-C45	7269
20BD040	3	30	25	4	50 (11)	36.7	30.5	40	51	68	50	90	50	150	150	50	–	–	M-F8E-C45	13630
20BD052	3	40	30	4	50 (11)	47.7	39.7	52	60	80	60	110	60	200	200	70	–	–	–	–
20BD065	3	50	40	4	50 (11)	59.6	49.6	65	78	104	80	125	80	250	250	100	–	–	–	–
20BD077 (12)	4	60	–	4	50 (11)	72.3	60.1	77	85	116	100	170	100	300	300	100	–	–	–	–
		–	50	4	50 (11)	59.6	49.6	65	98	130	80	125	80	250	250	100	–	–	–	–
20BD096 (12)	5	75	–	4	50 (9)	90.1	74.9	96	106	144	125	200	125	350	350	125	–	–	–	–
		–	60	4	50 (9)	72.3	60.1	77	116	154	100	170	100	300	300	100	–	–	–	–
20BD125 (12)	5	100	–	4	50 (9)	117	97.6	125	138	163	150	250	150	500	375	150	–	–	–	–
		–	75	4	50 (9)	90.1	74.9	96	144	168	125	200	125	350	350	125	–	–	–	–
20BD156 (12)	6	125	–	4	50 (9)	147	122	156	172	234	200	350	200	600	450	250	–	–	–	–
		–	100	4	50 (9)	131	109	125	188	250	175	250	175	500	375	250	–	–	–	–
20BD180 (12)	6	150	–	4	50 (9)	169	141	180	198	270	225	400	225	600	500	250	–	–	–	–
		–	125	4	50 (9)	147	122	156	234	312	200	350	200	600	450	250	–	–	–	–
20BD248 (12)	6	200	–	2	45 (9)	233	194	248	273	372	300	550	300	700	700	400	–	–	–	–
		–	150	2	50 (9)	169 (17)	141	180	270	360	225	400	225	600	500	250	–	–	–	–

See page 29 for notes.

480 Volt AC Input Protection Devices – Frames 7…10

Drive Catalog Number (12)	Frame	Hp Rating		PWM Freq.	Temp. (16)	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. (8)	Max. (8)
20BD292	7	250		4	40	281	233	292	322	438	375	650	375	850	850	400
			200	4	40	253	210	263	395	526	350	550	350	550	750	400
20BD325	7	250		4	40	313	260	325	358	488	425	700	425	950	950	600
			250	4	40	313	260	325	488	650	425	700	425	950	950	600
20BD365	8	300		2	40	351	292	365	402	548	475	800	475	1000	1000	600
			250	2	40	313	260	325	488	650	425	700	425	950	950	600
20BD415	8	350		2	40	399	331	415	457	623	525	900	525	1200	1200	600
			300	2	40	351	291	365	548	730	475	800	475	1000	1000	600
20BD481	8	400		2	40	462	384	481	530	722	600	1000	600	1400	1400	700
			350	2	40	399	331	415	623	830	525	900	525	1200	1200	600
20BD535	8	450		2	40	514	427	535	589	803	700	1200	700	1600	1600	700
			400	2	40	462	384	481	722	962	600	1000	600	1400	1400	700
20BD600	8	500		2	40	577	479	600	660	900	750	1300	750	1800	1800	800
			450	2	40	514	427	535	803	1070	700	1200	700	1600	1600	700
20BD730	9	600		2	40	673	559	730	803	1095	900	1500	900	2100	2100	900
			500	2	40	577	479	600	900	1200	750	1300	750	1800	1800	800
20BD875	10	700		2	40	841	699	875	963	1313	1100	1900	1100	2600	2600	1200
			600	2	40	673	559	700	1050	1400	900	1500	900	2100	2100	900

See page 29 for notes.

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600 Volt AC Input Protection Devices – Frames 0…6 (13)

Drive Catalog Number	Frame	Hp Rating		PWM Freq.	Temp. (11)	Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker (3)	Motor Circuit Protector (4)	140M Motor Protector with Adjustable Current Range (5)(6)			
		ND	HD	kHz	°C	Amps	kVA	Cont.	1 Min.	3 Sec.	Min. (1)	Max. (2)	Min. (1)	Max. (2)	Max. (8)	Max. (8)	Available Catalog Numbers - 140… (7)			Min. Enclosure Vol. (in.³) (14)
20BE1P7	0	1	0.5	4	50	1.3	1.4	1.7	2	2.6	2	4	2	6	15	3	M-C2E-B16	–	–	7269
20BE2P7	0	2	1	4	50	2.1	2.1	2.7	3.6	4.8	3	6	3	10	15	3	M-C2E-B25	–	–	7269
20BE3P9	0	3	2	4	50	3	3.1	3.9	4.3	5.9	6	9	6	15	15	7	M-C2E-B40	M-D8E-B40	–	7269
20BE6P1	0	5	3	4	50	5.3	5.5	6.1	6.7	9.2	9	12	9	20	20	15	–	M-D8E-B63	–	7269
20BE9P0	0	7.5	5	4	50	7.8	8.1	9	9.9	13.5	10	20	10	35	30	15	–	M-D8E-C10	M-F8E-C10	7269
20BE011	1	10	7.5	4	50	9.9	10.2	11	13.5	18	15	25	15	40	40	15	–	M-D8E-C10	M-F8E-C10	7269
20BE017	1	15	10	4	50	15.4	16	17	18.7	25.5	20	40	20	60	50	20	–	M-D8E-C16	M-F8E-C16	7269
20BE022	2	20	15	4	50	20.2	21	22	25.5	34	30	50	30	80	80	30	–	–	M-F8E-C25	7269
20BE027	2	25	20	4	50	24.8	25.7	27	33	44	35	60	35	100	100	50	–	–	M-F8E-C25	7269
20BE032	3	30	25	4	50	29.4	30.5	32	40.5	54	40	70	40	125	125	50	–	–	M-F8E-C32	13630
20BE041	3	40	30	4	50	37.6	39.1	41	48	64	50	90	50	150	150	100	–	–	–	–
20BE052	3	50	40	4	50	47.7	49.6	52	61.5	82	60	110	60	200	200	100	–	–	–	–
20BE062	4	60	50	2	50	58.2	60.5	62	78	104	80	125	80	225	225	100	–	–	–	–
20BE077 (12)	5	75	–	2	50 (9)	72.3	75.1	77	85	116	90	150	90	300	300	100	–	–	–	–
		–	60	2	50 (9)	58.2	60.5	63	94	126	90	125	90	250	250	100	–	–	–	–
20BE099 (12)	5	100	–	2	40 (9)	92.9	96.6	99	109	126	125	200	125	375	375	150	–	–	–	–
		–	75	2	40 (9)	72.3	75.1	77	116	138	100	175	100	300	300	100	–	–	–	–
20BE125 (12)	6	125	–	2	50 (9)	117	122	125	138	188	150	250	150	375	375	250	–	–	–	–
		–	100	2	50 (9)	93	96.6	99	149	198	125	200	125	375	375	150	–	–	–	–
20BE144 (12)	6	150	–	2	50 (9)	135	141	144	158	216	175	300	175	400	400	250	–	–	–	–
		–	125	2	50 (9)	117	122	125	188	250	150	275	150	375	375	250	–	–	–	–

See page 29 for notes.

690 Volt AC Input Protection Devices – Frames 0…6 (13)

Drive Catalog Number (12)	Frame	kW Rating		PWM Freq.	Temp. (11)	Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker (3)	Motor Circuit Protector (4)
		ND	HD	kHz	°C	Amps	kVA	Cont.	1 Min.	3 Sec.	Min. (1)	Max. (2)	Min. (1)	Max. (2)	Max. (8)	Max. (8)
20BF052	5	45	–	4	50 (9)	46.9	56.1	52	57	78	60	110	60	175	175	–
		–	37.5	4	50 (9)	40.1	48	46	69	92	50	90	50	150	150	–
20BF060	5	55	–	4	50 (9)	57.7	68.9	60	66	90	80	125	80	225	225	–
		–	45	4	50 (9)	46.9	56.1	52	78	104	60	110	60	175	175	–
20BF082	5	75	–	2	50 (9)	79	94.4	82	90	123	100	200	100	375	375	–
		–	55	2	50 (9)	57.7	68.9	60	90	120	80	125	80	225	225	–
20BF098	5	90	–	2	40 (9)	94.7	113	98	108	127	125	200	125	375	375	–
		–	75	2	40 (9)	79	94.4	82	123	140	100	200	100	375	375	–
20BF119	6	110	–	2	50 (9)	115	137	119	131	179	150	250	150	400	–	–
		–	90	2	50 (9)	94.7	113	98	147	196	125	200	125	375	–	–
20BF142	6	132	–	2	50 (9)	138	165	142	156	213	175	300	175	450	–	–
		–	110	2	50 (9)	115	137	119	179	238	150	250	150	400	–	–

See page 29 for notes.

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Notes

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

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

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

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

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

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

(7) The AIC ratings of the Bulletin 140M Motor Protector Circuit Breakers can vary. See Bulletin 140M Motor Protection Circuit Breakers Application Ratings.

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

(9) UL Type 12/IP54 (flange mount) heat sink ambient temperature rating is 40° C/ambient of unprotected drive portion (inside enclosure) is 55° C. The ambient temperature for the UL Type 12/IP54 stand-alone drives is 40° C.

(10) Must remove top label and vent plate, drive enclosure rating is IP00, NEMA / UL Type Open.

(11) Frames 0...4 temperature rating is for NEMA / UL Type Open. The adhesive top label must be removed to operate drive at this temperature. Frames 5 & 6 do not have a top label.

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

(13) Note: 600V class drives below 77 Amps (Frames 0...4) are declared to meet the Low Voltage Directive. It is the responsibility of the user to determine compliance to the EMC directive.

(14) When using a Manual Self-Protected (Type E) Combination Motor Controller, the drive must be installed in a ventilated or non-ventilated enclosure with the minimum volume specified in this column. Application specific thermal considerations can require a larger enclosure.

(15) 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.

(16) 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.

(17) Input current on the drive can be lower than the output current due to the power factor correction in the drive.

325 Volt DC Input Protection Devices – Frames 0...6

Drive Catalog Number	Frame	Hp Rating		PWM Freq.	Temp. (1)	DC Input Ratings	Output Amps			Fuse	Non-Time Delay Fuse (2)(11)
		ND	HD	kHz	°C	Amps	Cont.	1 Min.	3 Sec.		
20BB2P2	0	0.5	0.33	4	50	2	2.2	2.4	3.3	5	JKS-5
20BB4P2	0	1	0.75	4	50	3.8	4.2	4.8	6.4	10	JKS-10
20BB6P8	1	2	1.5	4	50	6.9	6.8	9	12	15	HSJ15
20BB9P6	1	3	2	4	50	9.7	9.6	10.6	14.4	20	HSJ20
20BB015	1	5	3	4	50	16	15.3	16.8	23	30	HSJ30
20BB022	1	7.5	5	4	50	23.3	22	24.2	33	45	HSJ45
20BB028	2	10	7.5	4	50	30	28	33	44	60	HSJ60
20BB042	3	15	10	4	50	45	42	46.2	63	90	HSJ90
20BB052	3	20	15	4	50	55	52	63	80	100	HSJ100
20BB070	4	25	20	4	50	75.3	70	78	105	150	HSJ150
20BB080	4	30	25	4	50	86.8	80	105	140	175	HSJ175
20BN104 (3)	5	40	–	4	50	114.1	104	115	175	200	HSJ200
		–	30	4	50	85.8	80	120	160	200	HSJ200
20BN130 (3)	5	50	–	4	50	142.6	130	143	175	200	HSJ200
		–	40	4	50	114.1	104	156	175	200	HSJ200
20BN154 (3)	6	60	–	4	50	169	154	169	231	300	HSJ300
		–	50	4	50	142.6	130	195	260	300	HSJ300
20BN192 (3)	6	75	–	4	50	210.6	192	211	288	350	HSJ350
		–	60	4	50	169	154	231	308	350	HSJ350
20BN260 (3)	6	100	–	2	45	285.3	260	286	390	400	HSJ400
		–	75	2	50	210.6	205	305	410	400	HSJ400

See page 32 for notes.

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540 Volt DC Input Protection Devices – Frames 0…6

Drive Catalog Number	Frame	kW Rating		PWM Freq.	Temp. [1]	DC Input Ratings	Output Amps			Fuse	Non-Time Delay Fuse [2][11]
		ND	HD	kHz	°C	Amps	Cont.	1 Min.	3 Sec.		
20BC1P3	0	0.37	0.25	4	50	1.3	1.3	1.4	1.9	3	JKS-3
20BC2P1	0	0.75	0.55	4	50	2.1	2.1	2.4	3.2	6	JKS-6
20BC3P5	0	1.5	0.75	4	50	3.7	3.5	4.5	6	8	JKS-8
20BC5P0	0	2.2	1.5	4	50	5.3	5	5.5	7.5	10	JKS-10
20BC8P7	0	4	3	4	50	9.3	8.7	9.9	13.2	15	HSJ15
20BC011	0	5.5	4	4	50	12.6	11.5	13	17.4	20	HSJ20
20BC015	1	7.5	5.5	4	50	16.8	15.4	17.2	23.1	25	HSJ25
20BC022	1	11	7.5	4	50	24	22	24.2	33	40	HSJ40
20BC030	2	15	11	4	50	33.2	30	33	45	50	HSJ50
20BC037	2	18.5	15	4	50	40.9	37	45	60	70	HSJ70
20BC043	3	22	18.5	4	50	47.5	43	56	74	90	HSJ90
20BC056	3	30	22	4	50	61.9	56	64	86	100	HSJ100
20BC072	3	37	30	4	50 [7]	80.5	72	84	112	125	HSJ125
20BC085 [3][5]	4	45	–	4	45	95.1	85	94	128	150	HSJ150
		–	37	4	45	80.5	72	108	144	175	HSJ175
20BH105 [3][5]	5	55	–	4	50 [4]	120.2	105	116	158	175	HSJ175
		–	45	4	50 [4]	95.1	85	128	170	200	HSJ200
20BH140 [3][5]	5	75	–	4	40 [4]	159	140	154	190	225	HSJ225
		–	55	4	40 [4]	120.2	105	158	190	225	HSJ225
20BH170 [3][5]	6	90	–	4	50 [4]	192.3	170	187	255	300	HSJ300
		–	75	4	50 [4]	159	140	210	280	300	HSJ300
20BH205 [3][5]	6	110	–	4	40 [4]	226	205	220	289	350	HSJ350
		–	90	4	40 [4]	192.3	170	255	313	350	HSJ350
20BH260 [3][5]	6	132	–	2	45 [4]	298	260	286	390	500	HSJ500
		–	110	2	50 [4]	226	205	305	410	500	HSJ500

See page 32 for notes.

540 Volt DC Input with Precharge – Frames 7…10

Drive Catalog Number	Frame	kW Rating		PWM Freq.	Temp.	DC Input Ratings		Output Amps			Fuse	Non-Time Delay Fuse [2][11]
		ND	HD	kHz	°C	Amps	kW	Cont.	1 Min.	3 Sec.		
20BP292	7	160		4	40	342	185	292	322	438	500	170M6608 [10]
			150	4	40	309	166	263	395	526	630	170M6610 [10]
20BP325	7	180		4	40	381	206	325	358	488	630	170M6610 [10]
			180	4	40	381	206	325	488	650	800	170M6612 [10]
20BP365	8	200		2	40	428	231	365	402	548	630	170M6610 [10]
			180	2	40	381	206	325	488	650	800	170M6612 [10]
20BP415	8	240		2	40	487	262	415	457	623	800	170M6612 [10]
			200	2	40	428	231	365	548	730	900	170M6613 [10]
20BP481	8	280		2	40	564	304	481	530	722	900	170M6613 [10]
			240	2	40	487	262	415	623	830	1000	170M6614 [10]
20BP535	8	300		2	40	627	338	535	589	803	1000	170M6614 [10]
			280	2	40	564	304	481	722	962	1100	170M6615 [10]
20BP600	8	350		2	40	703	379	600	660	900	1100 [8]	170M6615 [10]
			300	2	40	627	338	535	803	1070	1200 [8]	170M6616 [10]
20BP730	9	400		2	40	855	461	730	803	1095	1200 [9]	170M6616 [10]
			350	2	40	703	379	600	900	1200	1400 [9]	170M6617 [10]
20BH875 No Precharge	10	500		2	40	1025	553	875	963	1313	2 x 800	170M6612 [10]
			400	2	40	820	443	700	1050	1400	2 x 800	170M6612 [10]

See page 32 for notes.

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650 Volt DC Input Protection Devices – Frames 0…6

Drive Catalog Number	Frame	Hp Rating		PWM Freq.	Temp.[1]	DC Input Ratings	Output Amps			Fuse	Non-Time Delay Fuse[2][11]
		ND	HD	kHz	°C	Amps	Cont.	1 Min.	3 Sec.		
20BD1P1	0	0.5	0.33	4	50	1.0	1.1	1.2	1.6	3	JKS-3
20BD2P1	0	1	0.75	4	50	1.9	2.1	2.4	3.2	6	JKS-6
20BD3P4	0	2	1.5	4	50	3.0	3.4	4.5	6.0	6	JKS-6
20BD5P0	0	3	2	4	50	4.5	5.0	5.5	7.5	10	JKS-10
20BD8P0	0	5	3	4	50	8.1	8.0	8.8	12	15	HSJ15
20BD011	0	7.5	5	4	50	11.1	11	12.1	16.5	20	HSJ20
20BD014	1	10	7.5	4	50	14.7	14	16.5	22	30	HSJ30
20BD022	1	15	10	4	50	23.3	22	24.2	33	40	HSJ40
20BD027	2	20	15	4	50	28.9	27	33	44	50	HSJ50
20BD034	2	25	20	4	50	36.4	34	40.5	54	60	HSJ60
20BD040	3	30	25	4	50	42.9	40	51	68	80	HSJ80
20BD052	3	40	30	4	50	55.7	52	60	80	90	HSJ90
20BD065	3	50	40	4	50	69.7	65	78	104	100	HSJ100
20BD077[3]	4	60	–	4	50	84.5	77	85	116	150	HSJ150
		–	50	4	50	69.7	65	98	130	150	HSJ150
20BR096[3][6]	5	75	–	4	50[4]	105.3	96	106	144	175	HSJ175
		–	60	4	50[4]	84.5	77	116	154	175	HSJ175
20BR125[3][6]	5	100	–	4	50[4]	137.1	125	138	163	200	HSJ200
		–	75	4	50[4]	105.3	96	144	168	200	HSJ200
20BR156[3][6]	6	125	–	4	50[4]	171.2	156	172	234	300	HSJ300
		–	100	4	50[4]	137.1	125	188	250	300	HSJ300
20BR180[3][6]	6	150	–	4	50[4]	204	180	198	270	400	HSJ400
		–	125	4	50[4]	171.2	156	234	312	400	HSJ400
20BR248[3][6]	6	200	–	2	45[4]	272	248	273	372	400	HSJ400
		–	150	2	50[4]	204	180	270	360	400	HSJ400

See page 32 for notes.

650 Volt DC Input with Precharge – Frames 7…10

Drive Catalog Number	Frame	Hp Rating		PWM Freq.	Temp.	DC Input Ratings		Output Amps			Fuse	Non-Time Delay Fuse[2][11]
		ND	HD	kHz	°C	Amps	kW	Cont.	1 Min.	3 Sec.		
20BR292	7	250		4	40	328	212	292	322	438	500	170M6608[10]
			200	4	40	296	191	263	395	526	630	170M6610[10]
20BR325	7	250		4	40	365	236	325	358	488	550	170M6609[10]
			250	4	40	365	236	325	488	650	800	170M6612[10]
20BR365	8	300		2	40	410	265	365	402	548	630	170M6610[10]
			250	2	40	365	236	325	488	650	800	170M6612[10]
20BR415	8	350		2	40	466	302	415	457	623	700	170M6611[10]
			300	2	40	410	265	365	548	730	800	170M6612[10]
20BR481	8	400		2	40	540	350	481	530	722	800	170M6619[10]
			350	2	40	466	302	415	623	830	900	170M6613[10]
20BR535	8	450		2	40	601	389	535	589	803	900	170M6613[10]
			400	2	40	540	350	481	722	962	1000	170M6614[10]
20BR600	8	500		2	40	674	436	600	660	900	1000[8]	170M6614[10]
			450	2	40	601	389	535	803	1070	1200[8]	170M6616[10]
20BR730	9	600		2	40	820	533	730	803	1095	1200[9]	170M6616[10]
			500	2	40	674	436	600	900	1200	1400[9]	170M6617[10]
20BJ875 No Precharge	10	700		2	40	983	636	875	963	1313	1400	2 x 170M6611[10]
			600	2	40	786	509	700	1050	1400	1600	2 x 170M6612[10]

See page 32 for notes.

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810 Volt DC Input Protection Devices – Frames 0…6

Drive Catalog Number	Frame	Hp Rating		PWM Freq.	Temp.(1)	DC Input Ratings	Output Amps			Fuse	Non-Time Delay Fuse (2)(11)
		ND	HD	kHz	°C	Amps	Cont.	1 Min.	3 Sec.		
20BE1P7	0	1	0.75	4	50	1.5	1.7	2	2.6	3	JKS-3
20BE2P7	0	2	1.5	4	50	2.4	2.7	3.6	4.8	6	JKS-6
20BE3P9	0	3	2	4	50	3.5	3.9	4.3	5.9	6	JKS-6
20BE6P1	0	5	3	4	50	6.2	6.1	6.7	9.2	10	JKS-10
20BE9P0	0	7.5	5	4	50	9.1	9	9.9	13.5	15	HSJ15
20BE011	0	10	7.5	4	50	11.5	11	13.5	18	20	HSJ20
20BE017	1	15	10	4	50	18	17	18.7	25.5	30	HSJ30
20BE022	2	20	15	4	50	23.6	22	25.5	34	40	HSJ40
20BE027	2	25	20	4	50	29	27	33	44	50	HSJ50
20BE032	3	30	25	4	50	34.3	32	40.5	54	60	HSJ60
20BE041	3	40	30	4	50	43.9	41	48	64	70	HSJ70
20BE052	3	50	40	4	50	55.7	52	61.5	82	90	HSJ90
20BE062	4	60	50	2	50	68	62	78	104	125	HSJ125
20BT099(3)	5	100	–	2	40	108.6	99	109	126	150	HSJ150
		–	75	2	40	84.5	77	116	138	150	HSJ150
20BT144(3)	6	150	–	2	50	158	144	158	216	250	HSJ250
		–	125	2	50	137.1	125	188	250	250	HSJ250

932 Volt DC Input Protection Devices – Frames 0…6

Drive Catalog Number	Frame	kW Rating		PWM Freq.	Temp.(1)	DC Input Ratings	Output Amps			Fuse	Non-Time Delay Fuse (2)(11)
		ND	HD	kHz	°C	Amps	Cont.	1 Min.	3 Sec.		
20BW052(3)	5	45	–	2	50(4)	58.2	52	57	78	100	170M3691
		–	37.5	2	50(4)	46.9	46	69	92	100	170M3691
20BW098(3)	5	90	–	2	50(4)	110.7	98	108	127	160	170M3693
		–	75	2	50(4)	92.3	82	123	140	160	170M3693
20BW142(3)	6	132	–	2	50(4)	162.2	142	156	213	250	170M3695
		–	110	2	40(4)	134.9	119	179	238	315	170M3696

Notes

(1) Frames 0…4 temperature rating is for NEMA / UL Type Open. The adhesive top label must be removed to operate drive at this temperature. Frames 5 & 6 do not have a top label.

(2) 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.

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

(4) UL Type 12/IP54 (flange mount) heatsink ambient temperature rating is 40 °C/ambient of unprotected drive portion (inside enclosure) is 55 °C. The ambient temperature for the UL Type 12/IP54 stand-alone drives is 40 °C.

(5) Also applies to "P" voltage class.

(6) Also applies to "J" voltage class.

(7) Must remove top label and vent plate, drive enclosure rating is IP00, NEMA / UL Type Open.

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

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

(10) Bussmann or equivalent.

(11) 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.

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Cable Recommendations

Power 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 when using higher temperature wire. See table below.

Location	Rating/Type	Description
Standard (Option 1)	600V, 90° C (194° F) XHHW2/RHW-2 Anixter B209500-B209507, Belden 29501-29507, or equivalent	• Four tinned copper conductors with XLP 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	• 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	• 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.

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 should 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 should be given in installations with sensitive equipment such as weigh scales, capacitive proximity switches and other devices that may 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 may also help reduce shaft voltage and induced bearing currents for some applications. In addition, the increased impedance of shielded cable may help extend the distance that the motor can be located from the drive without the addition of motor protective devices such as terminator networks.

Consideration should 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 should be included and be specified by the cable manufacturer as having coverage of at least 75%. An additional foil shield can greatly improve noise containment.

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

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

Maximum Motor Cable Lengths

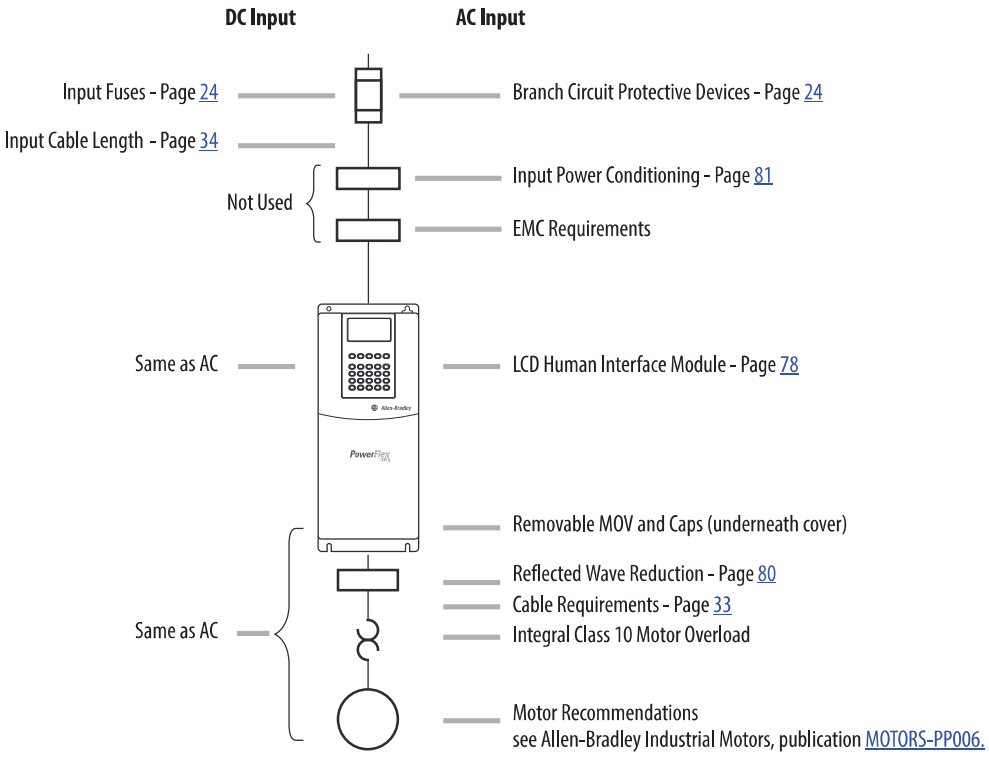
For information on maximum motor cable lengths, refer to the Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-IN001.

Power Wiring

The PowerFlex 700 has the following built in protective features to help simplify installation:

- Ground fault protection during start up and running ensures reliable operation
- Electronic motor overload protection increases motor life
- Removable MOV to ground and common mode capacitors to ground ensure compatibility with ungrounded systems. These devices must be disconnected if the drive is installed on a resistive grounded distribution system, an ungrounded distribution system, a B phase grounded distribution system or impedance grounded system. These devices must also be disconnected if the drive power source is a regenerative unit (such as a bus supply and brake) or is DC fed from an active converter.
- 6 kV transient protection provides increased robustness for 380...480V system voltages

There are many other factors that must be considered for optimal performance in any given application. The block diagram below highlights the primary installation considerations. Consult the Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-IN001 for detailed recommendations on input power conditioning, dynamic braking, reflected wave protection and motor cable types.



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Terminal Blocks

Terminal Block Specifications

Refer to pages 36...38 for typical locations.

No.	Name	Frame	Description	Wire Size Range - See Note (3)		Torque	
				Maximum	Minimum	Maximum	Recommended
❶	Power Terminal Block	0 & 1	Input power and motor connections	4.0 mm^2 (12 AWG)	0.5 mm^2 (22 AWG)	1.7 N•m (15 lb.•in.)	0.8 N•m (7 lb.•in.)
		2	Input power and motor connections	10.0 mm^2 (8 AWG)	0.8 mm^2 (18 AWG)	1.7 N•m (15 lb.•in.)	1.4 N•m (12 lb.•in.)
		3	Input power and motor connections	25.0 mm^2 (3 AWG)	2.5 mm^2 (14 AWG)	3.6 N•m (32 lb.•in.)	1.8 N•m (16 lb.•in.)
			BR1, 2 terminals	10.0 mm^2 (8 AWG)	0.8 mm^2 (18 AWG)	1.7 N•m (15 lb.•in.)	1.4 N•m (12 lb.•in.)
		4	Input power and motor connections	35.0 mm^2 (3 AWG)	10.0 mm^2 (14 AWG)	4.0 N•m (35 lb.•in.)	4.0 N•m (35 lb.•in.)
		5 75 Hp, 480V 100 Hp, 600V	Input power, DC+, DC–, BR1, 2, PE, motor connections	50.0 mm^2 (1 AWG)	4.0 mm^2 (8 AWG)	See Note (5)	
		5 100 Hp	Input power, DC+, DC– and motor	70.0 mm^2 (2/0 AWG)	10.0 mm^2 (8 AWG)		
			BR1, 2, PE terminals	50.0 mm^2 (1/0 AWG)	4.0 mm^2 (12 AWG)		
		6	Input power, DC+, DC–, BR1, 2, PE, motor connections	150.0 mm^2 (300 MCM) *see Note (4)*	2.5 mm^2 (14 AWG)	6.0 N•m (52 lb.•in.)	6.0 N•m (52 lb.•in.)
		7	Input power, DC+, DC–, PE, motor connections	150.0 mm^2 (300 MCM) *see Note (4)*	2.5 mm^2 (14 AWG)	2.7 N•m (24 lb.•in.)	2.7 N•m (24 lb.•in.)
		8 & 9	Input power, DC+, DC–, PE, motor connections	300.0 mm^2 (600 MCM) *see Note (4)*	2.5 mm^2 (14 AWG)	10.0 N•m (87 lb.•in.)	10.0 N•m (87 lb.•in.)
		10	Input power, DC+, DC–, PE, motor connections	300.0 mm^2 (600 MCM) *see Note (4)*	2.5 mm^2 (14 AWG)	10.0 N•m (87 lb.•in.)	10.0 N•m (87 lb.•in.)
❷	SHLD Terminal	0...6	Terminating point for wiring shields	—	—	1.6 N•m (14 lb.•in.)	1.6 N•m (14 lb.•in.)
❸	AUX Terminal Block	0...4	Auxiliary control voltage PS+, PS– (1)(2)	1.5 mm^2 (16 AWG)	0.2 mm^2 (24 AWG)	—	—
		5...6		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.)
		7...10		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.)
❹	I/O Terminal Block	0...6	Signal & control connections	2.5 mm^2 (14 AWG)	0.30 mm^2 (22 AWG)	0.6 N•m (5.3 lb.•in.)	0.6 N•m (5.3 lb.•in.)
		7...10		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.)
❺	Encoder Terminal Block	0...10	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.)
❻	Fan Terminal Block	5...6	User supplied fan voltage	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.)
		7		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: UL Installation-300V DC, ±10%, Non UL Installation-270...600V DC, ±10% (0...3 Frame-40W, 165 mA, 5 Frame-80W, 90 mA).

(2) An Auxiliary Control Power Supply such as the 20-24V-AUX can be used with 400/480 and 600/690 Volt drives with Vector Control. However, consult the factory before using an auxiliary power supply in these instances. **Important:** The Auxiliary Control Power Supply Must Not be used with any Standard Control drive or any 200/240V PowerFlex 700 drive, Standard or Vector Control.

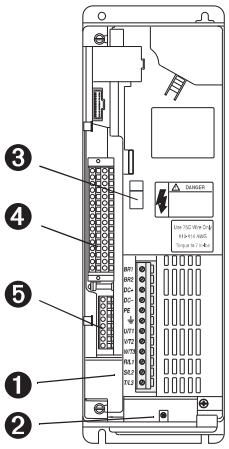
(3) **Maximum/minimum sizes that the terminal block will accept -** these are not recommendations**.**

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

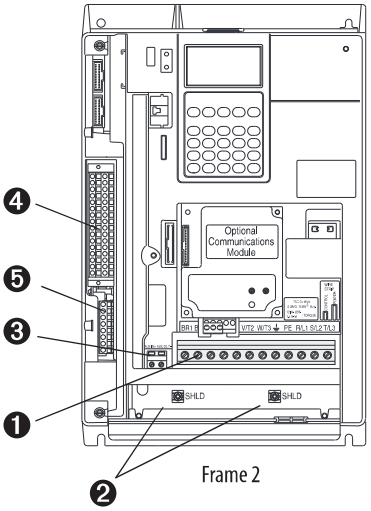
(5) Refer to the terminal block label inside the drive.

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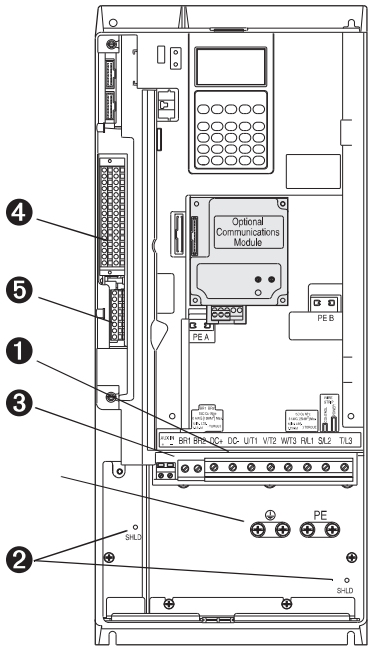
Typical Terminal Block Location



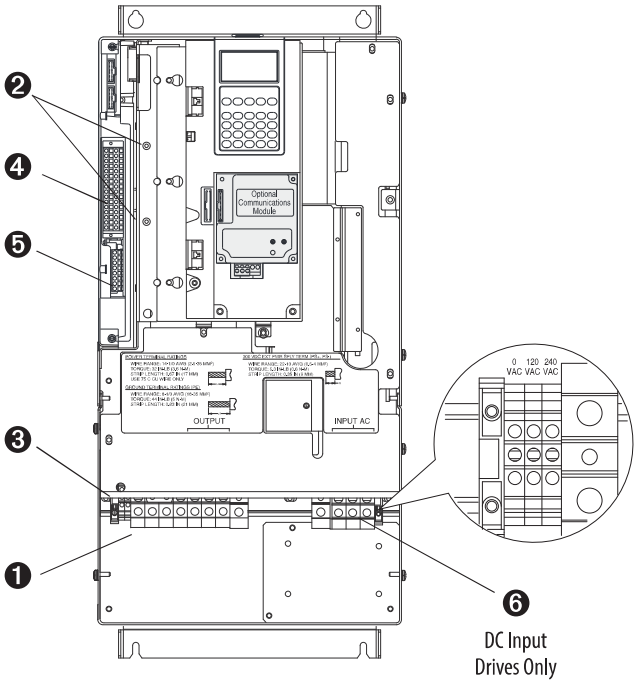
Frames 0...1



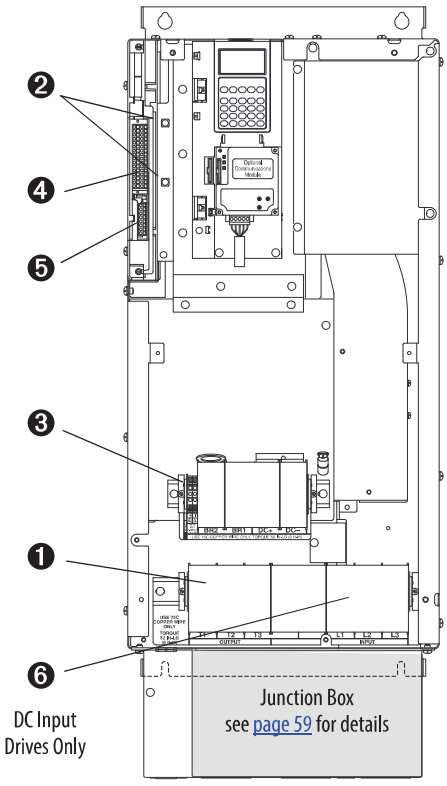
Frame 2



Frames 3...4



Frame 5

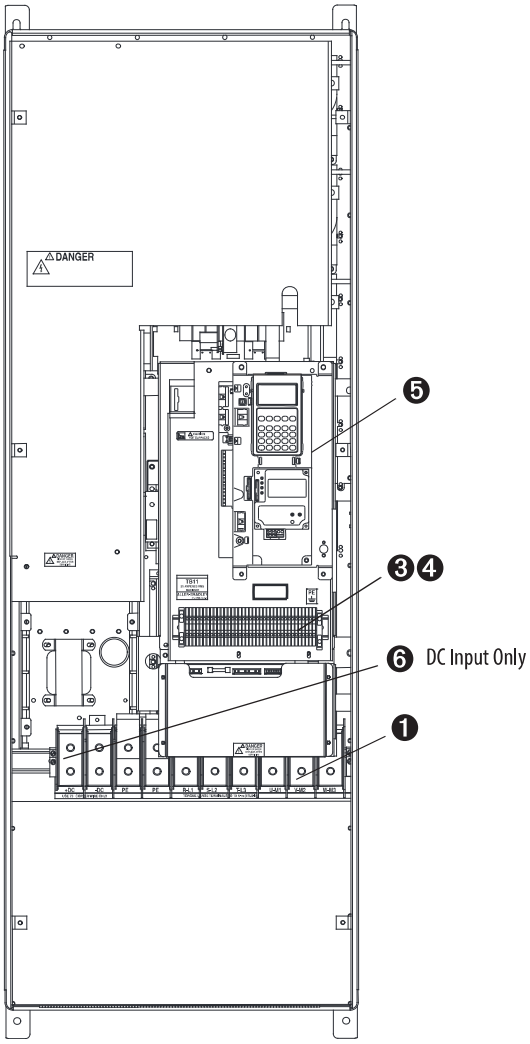


Frame 6

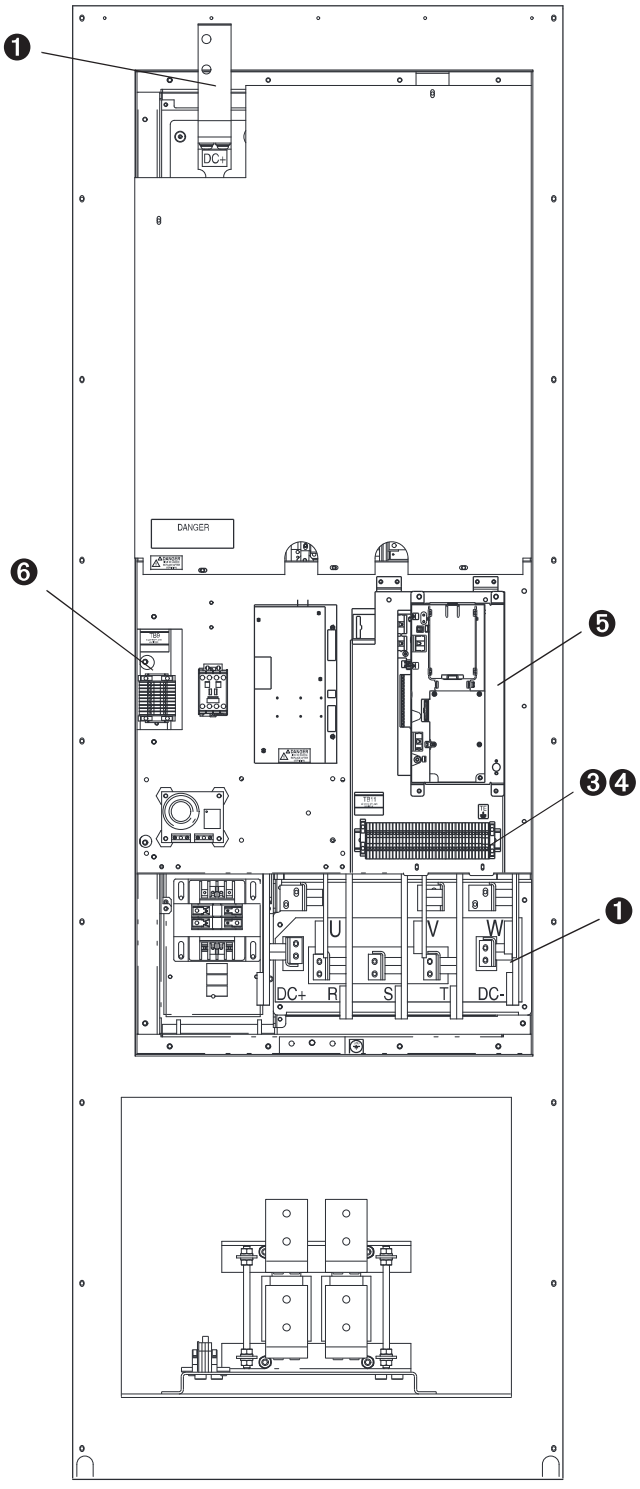
⏚ / PE

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Typical Terminal Block Locations (continued)



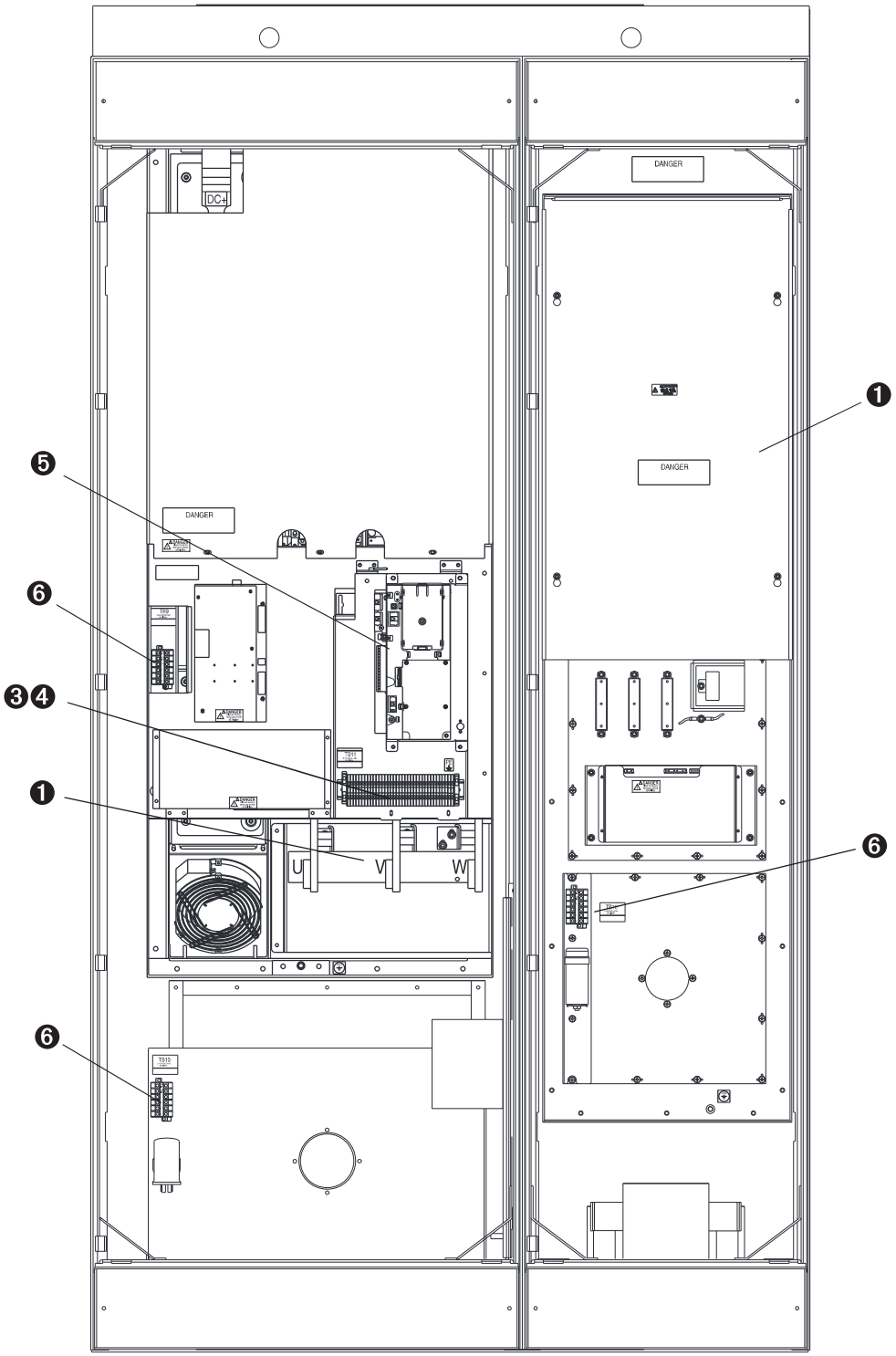
Frame 7



Frames 8…9

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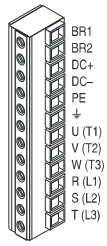
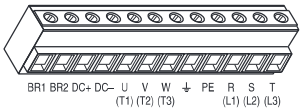
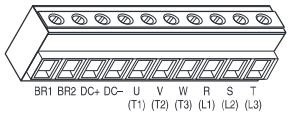
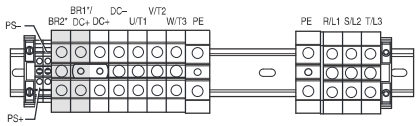
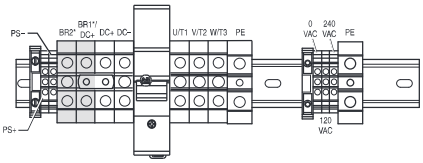
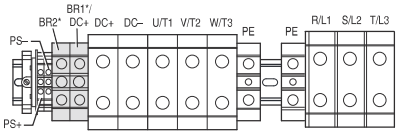
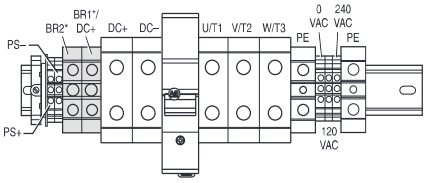
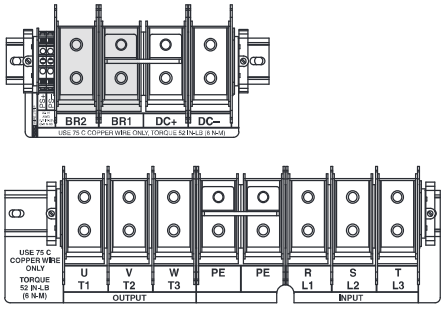
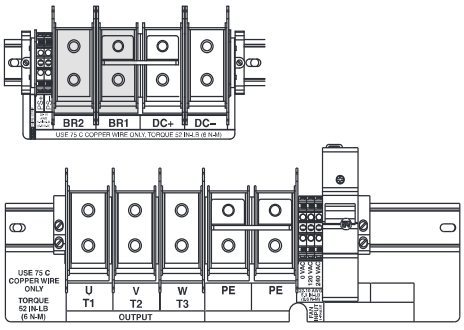
Typical Terminal Block Locations (continued)



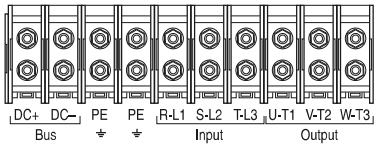
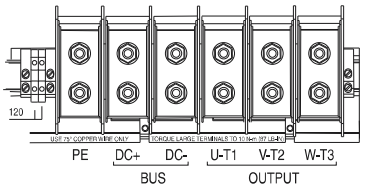
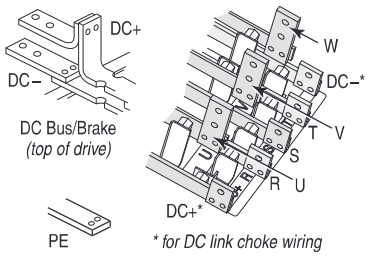
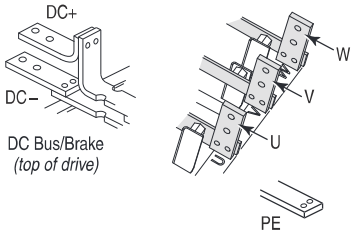
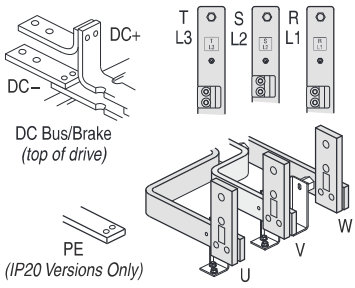
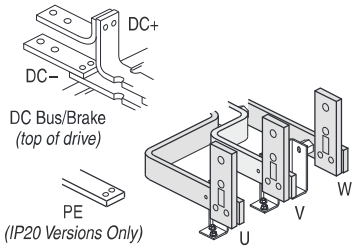
Frame 10
AC Input shown, DC Input Drives utilize the Inverter (Left) Bay only

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Power Terminals

<table>
<tr><th>Frame</th><th>Terminal Block</th><th></th></tr>
<tr><td>0…1</td><td>
</td><td rowspan="3">* Note:
Shaded BR1 & BR2 Terminals will only be present on drives ordered with the Brake Option.</td></tr>
<tr><td>2</td><td>
</td></tr>
<tr><td>3…4</td><td>
</td></tr>
<tr><td></td><td>AC Input</td><td>DC Input</td></tr>
<tr><td>5</td><td>75 Hp, Normal Duty

</td><td>75 Hp, Normal Duty

</td></tr>
<tr><td></td><td>100 Hp, Normal Duty

</td><td>100 Hp, Normal Duty

</td></tr>
<tr><td>6</td><td>125…200 Hp, Normal Duty

</td><td>125…200 Hp, Normal Duty

</td></tr>
</table>

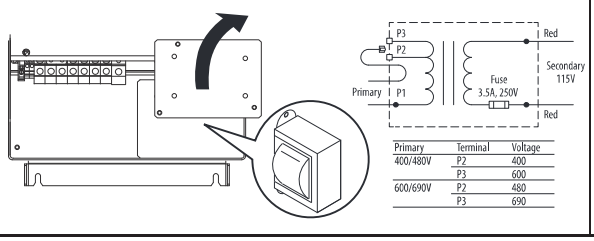
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Frame	Terminal Block	
	AC Input	**DC Input**
7		
8…9		
10		

Fan Circuit Power Supply

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. If your line voltage is different than the voltage class specified on the drive nameplate, changing the transformer taps will be required.

Frames 5…6 Fan Connections

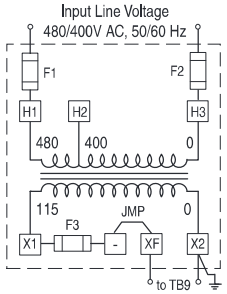
Drive Type	Enclosure	Rating (120V AC)	No. of Fans	Connect at …
DC Input	IP00, NEMA / UL Type Open	100 VA (Frame 5) 138 VA (Frame 6)	1	Power Terminal Block Requires user supplied 120 or 240V AC. See page 36 for TB locations and terminal designations.
	IP20, NEMA / UL Type 1 IP54, NEMA / UL Type 12	100 VA (Frame 5) 138 VA (Frame 6)	1	
AC Input	IP00, NEMA / UL Type Open	100 VA (Frame 5) 138 VA (Frame 6)	1	N/A (Connected internally) 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. The transformer is behind the Power Terminal Block. Access is gained by releasing the terminal block from the rail and removing the transformer cover plate. 1. Locate the small metal tab at the bottom of the end terminal block. 2. Press the tab-in and pull the top of the block out. Repeat for the next block if desired. 3. Remove the transformer cover plate. 4. Select the appropriate transformer tap. 5. Replace cover and terminal block.
	IP20, NEMA / UL Type 1 IP54, NEMA / UL Type 12	100 VA (Frame 5) 138 VA (Frame 6)	1	
				

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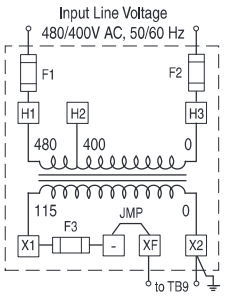
Frame 7

Drive Type	Enclosure	Rating *(120VAC)*	No. of Fans	Connect at . . .
DC Input	IP00, NEMA / UL Type Open	250 VA	1	Power Terminal Block Requires user supplied 120V AC. See page 40 for location.
	IP20, NEMA / UL Type 1	250 VA	1	
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 Requires user supplied 120V AC. See page 37 for TB location and page 42 for terminal designations.
	IP20, NEMA / UL Type 1	500 VA	1	
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

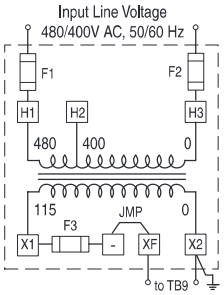
Drive Type	Enclosure	Rating (120VAC)	No. of Fans	Connect at . . .
DC Input	IP00, NEMA / UL Type Open	500 VA	2	**TB9** Requires user supplied 120V AC for cap. bank fan and phase monitor. **Blower Terminal Block** Three-phase power must be supplied to the Blower TB. See page 37 for TB locations and page 42 for terminal designations.
	IP20, NEMA / UL Type 1	500 VA	2	
AC Input	IP00, NEMA / UL Type Open	500 VA	2	**TB9** A transformer 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 is used.

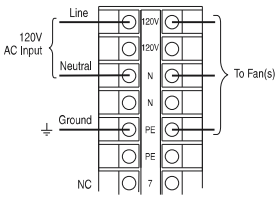
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Frame 10

Drive Type	Enclosure	Rating *(120VAC)*	No. of Fans	Connect at . . .
DC Input	IP00, NEMA / UL Type Open	1000 VA	2	TB9 & 10 Requires user supplied 120V AC. See page 38 for TB locations and page 42 for terminal designations.
	IP20, NEMA / UL Type 1	1000 VA	2	
AC Input	IP00, NEMA / UL Type Open	1000 VA	3	TB9, 10 & 12 Requires user supplied 120V AC. See page 38 for TB locations and page 42 for terminal designations.
	IP20, NEMA / UL Type 1	1000 VA	3	TB9, 10 & 12 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. 

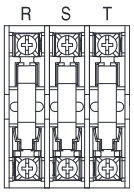
Fan/Blower Terminal Blocks - Frames 8...10

TB9, TB10



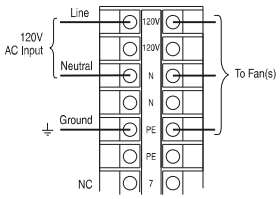
Frames 8...10

Blower TB



Frame 9 Only

TB12



Frame 10, AC Input, IP20 Only

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

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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.
3. Ground the drive chassis.

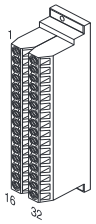
DC Link Chokes – Frames 8…10

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
10	IP00, NEMA / UL Type Open	Loose without cables
	IP20, NEMA / UL Type 1	Mounted and wired

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I/O Wiring



Standard Control Option – Frames 0…6 (1)

No.	Signal	Factory Default	Description
1	Anlg Volts In 1 (–)	(3)	Isolated (4), bipolar, differential, ±10V, 11 bit & sign, 88k ohm input impedance.
2	Anlg Volts In 1 (+)		
3	Anlg Volts In 2 (–)	(3)	Isolated (5), bipolar, differential, ±10V, 11 bit & sign, 88k ohm input impedance.
4	Anlg Volts In 2 (+)		
5	Pot Common	–	For (+) and (–) 10V pot references.
6	Anlg Volts Out 1 (–)	(3)	Bipolar, ±10V, 11 bit & sign, 2k ohm minimum load.
7	Anlg Volts Out 1 (+)		
8	Anlg Current Out 1 (–)	(3)	4-20mA, 11 bit & sign, 400 ohm maximum load.
9	Anlg Current Out 1 (+)		
10	Reserved for Future Use		
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
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 Common		
16	Digital Out 2 – N.O. (2)	Run	
17	Anlg Current In 1 (–)	(3)	Isolated (4), 4-20 mA, 11 bit & sign, 124 ohm input impedance.
18	Anlg Current In 1 (+)		
19	Anlg Current In 2 (–)	(3)	Isolated (5), 4-20 mA, 11 bit & sign, 124 ohm input impedance.
20	Anlg Current In 2 (+)		
21	–10V DC Pot Ref.	–	2k ohm minimum.
22	+10V DC Pot Ref.	–	
23	Reserved for Future Use		
24	+24V DC (6)	–	Drive supplied logic input power. (6)
25	Digital In Common	–	
26	24V Common (6)	–	Common for internal power supply.
27	Digital In 1	Stop - CF	115V AC, 50/60 Hz - Control & I/O Cat. No. option B Opto isolated Low State: less than 30V AC High State: greater than 100V AC, 5.0 mA 24V AC/DC, 50/60 Hz - Control & I/O Cat. No. option A Opto isolated Low State: less than 5V AC/DC High State: greater than 20V AC/DC, 11.2 mA DC Digital Input Impedance: 35k ohm
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	Speed Sel 3	

Vector Control Option – Frames 0…6 (1)

Signal	Factory Default	Description
Analog In 1 (–) (7)	(3)	Isolated (9), bipolar, differential, ±10V/0-20 mA, 11 bit & sign. For 0-20 mA, a jumper must be installed at terminals 17 & 18 (or 19 & 20). 88k ohm input impedance when configured for volt. & 95.3 ohm for current
Analog In 1 (+) (7)		
Analog In 2 (–) (7)		
Analog In 2 (+) (7)		
Pot Common	–	For (+) and (–) 10V pot references.
Analog Out 1 (–)	(3)	Single-ended bipolar (current output is not bipolar), ±10V/0-20 mA, 11 bit & sign, Voltage mode - limit current to 5 mA. Current mode - max. load is 400 ohms.
Analog Out 1 (+)		
Analog Out 2 (–)		
Analog Out 2 (+)		
HW PTC Input 1	–	1.8k ohm PTC, Internal 3.32k ohm pull-up resistor
Digital Out 1 – N.C. (2)	Fault	Max. Resistive Load: 240V AC/30V DC – 1200VA, 150W Max. Current: 5A, Min. Load: 10 mA Max. Inductive Load: 240V AC/30V DC – 840VA, 105W Max. Current: 3.5A, Min. Load: 10 mA
Digital Out 1 Common		
Digital Out 1 – N.O. (2)	NOT Fault	
Digital Out 2 – N.C. (2)	NOT Run	
Digital Out 2/3 Com.		
Digital Out 3 – N.O. (2)	Run	
Current In Jumper (7) – Analog In 1		Placing a jumper across terminals 17 & 18 (or 19 & 20) configures that analog input for current.
Current In Jumper (7) – Analog In 2		
–10V DC Pot Ref.	–	2k ohm minimum load.
+10V DC Pot Ref.	–	
HW PTC Input 2	–	See above
+24V DC (6)	–	Drive supplied logic input power. (6)
Digital In Common	–	
24V Common (6)	–	Common for internal power supply.
Digital In 1 (8)	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, 5.7 mA 24V DC - Control & I/O Cat. No. option C Opto isolated Low State: less than 5V DC High State: greater than 20V DC, 10 mA DC Digital Input Impedance: 21k ohm
Digital In 2 (8)	Start	
Digital In 3 (8)	Auto/Man.	
Digital In 4 (8)	Speed Sel 1	
Digital In 5 (8)	Speed Sel 2	
Digital In 6/Hardware Enable (8), see pg. 46	Speed Sel 3	

(1) Refer to the catalog number position "k" to determine your control option (A or B = standard control option, C or D = vector control option).

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

(3) These inputs/outputs are dependant on a number of parameters.

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

(5) Differential Isolation - External source must be less than 10V with respect to PE.

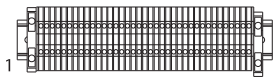
(6) 150 mA maximum load designed to power digital inputs only. Not present on 115V versions.

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

(8) A 10k ohm, 2 watt burden resistor must be installed on each digital input when using a triac type device. The resistor is installed between each digital input and neutral /common.

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

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Vector Control Option – Frames 7…10

No.	Signal	Factory Default	Description
1	Analog In 1 (–) (1)	(3)	Isolated (4), bipolar, differential, ±10V/4-20mA, 11 bit & sign, 88k ohm input impedance. For 4-20mA, a jumper must be installed at terminals 17 & 18 (or 19 & 20).
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), ±10V/4-20mA, 11 bit & sign, voltage mode - limit current to 5 mA. Current mode - max. load resistance is 400 ohms.
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
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
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
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. 46	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 (+)		
PS-	Aux. Control Power (–)		
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.

(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.

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