

Technical Data



PowerFlex 70 Adjustable Frequency AC Drive



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LISTEN.
THINK.
SOLVE.

Additional Resources

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

| Resource | Description |
|---|---|
| PowerFlex 70 Adjustable Frequency AC Drive User Manual, publication 20A-UM001 | Provides the basic information needed to start up and troubleshoot the PowerFlex® 70 Adjustable Frequency AC Drive. |
| PowerFlex 70 and 700 Reference Manual - Volume 1, publication PFLEX-RM001 | Provides detailed information for specifications and dimensions, operation, and dynamic brake selection for the drive. |
| PowerFlex 70 Adjustable Frequency AC Drive Installation Instructions, publication 20A-IN009 | Provides the five basic steps needed to install and perform a basic startup of the PowerFlex 70 drive. |
| Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-IN001 | Provides the basic information needed to properly wire and ground Pulse Width Modulated (PWM) AC drives. |
| Industry Installation Guidelines for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-AT003 | Provides basic information for enclosure systems and environmental/location considerations (to help protect against environmental contaminants), and power and grounding considerations needed to properly install 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) |
| Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1 | Provides general guidelines for installing a Rockwell Automation industrial system. |
| Product Certifications website, http://www.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

PowerFlex 70 drives are designed to worldwide standards providing out-of-the-box performance around the globe. Available ratings include these options:

- 0.5...25 Hp output at 240V AC input
- 0.5...50 Hp output at 480V AC input
- 0.5...50 Hp output at 600V AC input

The PowerFlex 70 drive can be used with a full featured LCD human interface module (HIM) that provides multilingual text for startup, metering, programming, and troubleshooting.

The PowerFlex 70 can be programmed for either volts per hertz, sensorless vector, or vector control with FORCE™ Technology to cover a wide range of applications from fans to extruders.

Optional internal communication modules provide fast and efficient control and/or data exchange with host controllers over popular interfaces. These interfaces include: DeviceNet, EtherNet, ControlNet, remote I/O, serial communications, and other open control and communication networks. Computer tools such as DriveExplorer™ and DriveTools™ SP assist with programming, monitoring, and troubleshooting the PowerFlex 70.



Flexible Packaging and Mounting

- **IP20, NEMA / UL Type 1** – For conventional mounting inside or outside a control cabinet. Conduit plate is vertically removable for easy installation and replacement without disturbing conduit.
- **IP66, NEMA / UL Type 4X/12** (indoor use) – For mounting directly in the production environment. Listed by UL to resist dust, dirt, other contaminants, and to survive high-pressure water spray. Also certified by NSF International to assure conformity with international food equipment standards.
- **Flange Type** – For mounting heatsink through back of an enclosure, thus removing a large portion of the heat inside a cabinet. The backside is rated IP66, NEMA / UL Type 4X/12 for both indoor and outdoor use.
- **Zero-Stacking™** - Drives can be mounted directly next to one another with no reduction of ambient temperature rating (50 °C [122 °F] for IP20, NEMA / UL Type 1 and Flange Mount; 40 °C [104 °F] for IP66, NEMA / UL Type 4X/12).

Space Saving Hardware Features

- Integral electromagnetic compatibility (EMC) filtering provides a compact, all-in-one package solution for meeting EMC requirements, including CE in Europe.
- Integral dynamic brake transistor delivers a cost-effective means of switching regenerative energy without costly external chopper circuits.
- Internal dynamic brake resistor 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 computer-based configuration tools.

The LCD HIMs provide these features and functions:

- 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

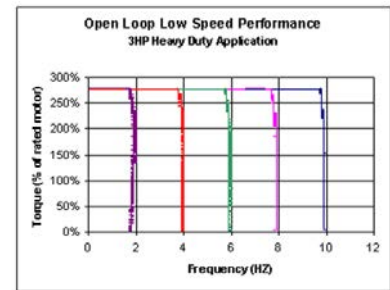
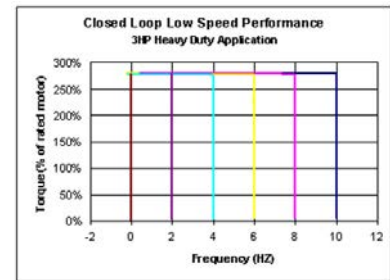
Remote versions for panel mount application

Outstanding Control and Performance

- **Vector Control with FORCE™ Technology** ⁽¹⁾ provides outstanding torque and speed regulation, with or without encoder feedback.
- **Sensorless Vector Control** develops high torque over a wide speed range, and adapts to individual motor characteristics.

Drives Features

- Fast acting **Current Limit** and **Bus Voltage Regulation** result in maximum acceleration and deceleration without tripping.
- **Flying Start** delivers smooth connection into rotating loads, regardless of commanded direction, without the need for any speed feedback device.
- **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.
- **User Sets**, allowing up to three complete sets of parameter data, can be individually loaded for different batch processes.
- **Slip compensation** delivers minimum of 0.5% open loop speed regulation across a wide speed range, eliminating the need for speed feedback devices in some applications.
- **Safe Off Option** ⁽¹⁾, the first offering available within the DriveGuard® series of safety solutions, prevents a drive from delivering rotational energy to motors by integrating a safety circuit with the drive’s power switching signals. This solution meets EN ISO 13849-1, Category 3.
- **Droop Control** ⁽¹⁾ for load sharing applications.
- **Sleep/Wake Control** ⁽¹⁾ for analog control of start and stop.



⁽¹⁾ The feature is available only for enhanced control.

Unsurpassed Capability in Network Communications

PowerFlex drives are fully compatible with the wide variety of Allen-Bradley® DPI™ (drive peripheral interface) communication adapters, offering the following benefits.

| BACnet | DeviceNet | ControlNet | EtherNet/IP | Remote I/O ⁽¹⁾ | RS-485 DF1 | Profibus DP | LonWorks | Modbus RTU | Modbus TCP | Metasys N2 | Siemens PT FLN | Description |
|--------|-----------|------------|-------------|---------------------------|------------|-------------|----------|------------|------------|------------|----------------|--|
| X | X | X | X | | | | | | | | | Unconnected Messaging permits other network devices (for example, PanelView™) to communicate directly to a drive without routing the communication through the network scanner. |
| X | X | X | X | X | | | X | | | | | Adapter Routing -- Plug PC into one drive and talk to other Allen-Bradley drives on same network, without being routed through network scanner. |
| X | X | X | X | X | X | X | X | X | X | X | X | Access to 100% of all parameters over the network. |
| X | X | | X | | X | | | | | | | AutoBaud capability makes initial connections less problematic. |
| X | | | | | | | | | | | | 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 (for example, reference must change by more than 5%). |
| X | | X | | | | | | | | | | 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), that can also significantly reduce network traffic. |
| X | | | | | | | | | | | | Automatic Device Replacement (ADR) 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. |
| X | X | X | X | X | X | X | X | X | X | X | X | Flexible Fault Configuration – Adapters can be programmed to take fault-based actions such 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) versus a network idle condition (PLC set to 'Program.') |

⁽¹⁾ The remote I/O has silver series status. For more information, refer to <http://www.ab.com/silver>.

Catalog Number Explanation

| | | | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1-3 | 4 | 5-7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 20A | B | 2P2 | A | 3 | A | Y | Y | N | N | C | 0 |
| <i>a</i> | <i>b</i> | <i>c</i> | <i>d</i> | <i>e</i> | <i>f</i> | <i>g</i> | <i>h</i> | <i>i</i> | <i>j</i> | <i>k</i> | <i>l</i> |

a

| Drive | |
|-------|--------------|
| Code | Type |
| 20A | PowerFlex 70 |

b

| Voltage Rating | | |
|----------------|---------|-----|
| Code | Voltage | Ph. |
| B | 240V AC | 3 |
| C | 400V AC | 3 |
| D | 480V AC | 3 |
| E | 600V AC | 3 |

c1

| ND Rating | | | |
|-------------------|------|------------|-------|
| 208V, 60 Hz Input | | | |
| Code | Amps | kW (Hp) | Frame |
| 2P2 | 2.5 | 0.37 (0.5) | A |
| 4P2 | 4.8 | 0.75 (1.0) | A |
| 6P8 | 7.8 | 1.5 (2.0) | B |
| 9P6 | 11 | 2.2 (3.0) | B |
| 015 | 17.5 | 4.0 (5.0) | C |
| 022 | 25.3 | 5.5 (7.5) | D |
| 028 | 32.2 | 7.5 (10) | D |
| 042 | 43 | 11 (15) | D |
| 054 | 62.1 | 15 (20) | E |
| 070 | 78.2 | 18.5 (25) | E |

c2

| ND Rating | | | |
|-------------------|------|------------|-------|
| 240V, 60 Hz Input | | | |
| Code | Amps | kW (Hp) | Frame |
| 2P2 | 2.2 | 0.37 (0.5) | A |
| 4P2 | 4.2 | 0.75 (1.0) | A |
| 6P8 | 6.8 | 1.5 (2.0) | B |
| 9P6 | 9.6 | 2.2 (3.0) | B |
| 015 | 15.3 | 4.0 (5.0) | C |
| 022 | 22 | 5.5 (7.5) | D |
| 028 | 28 | 7.5 (10) | D |
| 042 | 42 | 11 (15) | D |
| 054 | 54 | 15 (20) | E |
| 070 | 70 | 18.5 (25) | E |

c3

| ND Rating | | | |
|-------------------|------|------------|-------|
| 400V, 50 Hz Input | | | |
| Code | Amps | kW (Hp) | Frame |
| 1P3 | 1.3 | 0.37 (0.5) | A |
| 2P1 | 2.1 | 0.75 (1.0) | A |
| 3P5 | 3.5 | 1.5 (2.0) | A |
| 5P0 | 5.0 | 2.2 (3.0) | B |
| 8P7 | 8.7 | 4.0 (5.0) | B |
| 011 | 11.5 | 5.5 (7.5) | C |
| 015 | 15.4 | 7.5 (10) | C |
| 022 | 22 | 11 (15) | D |
| 030 | 30 | 15 (20) | D |
| 037 | 37 | 18.5 (25) | D |
| 043 | 43 | 22 (30) | D |
| 060 | 60 | 30 (40) | E |
| 072 | 72 | 37 (50) | E |

c4

| ND Rating | | | |
|-------------------|------|------------|-------|
| 480V, 60 Hz Input | | | |
| Code | Amps | kW (Hp) | Frame |
| 1P1 | 1.1 | 0.37 (0.5) | A |
| 2P1 | 2.1 | 0.75 (1.0) | A |
| 3P4 | 3.4 | 1.5 (2.0) | A |
| 5P0 | 5.0 | 2.2 (3.0) | B |
| 8P0 | 8.0 | 3.7 (5.0) | B |
| 011 | 11 | 5.5 (7.5) | C |
| 014 | 14 | 7.5 (10) | C |
| 022 | 22 | 11 (15) | D |
| 027 | 27 | 15 (20) | D |
| 034 | 34 | 18.5 (25) | D |
| 040 | 40 | 22 (30) | D |
| 052 | 52 | 30 (40) | E |
| 065 | 65 | 37 (50) | E |

c5

| ND Rating | | | |
|---------------------|------|------------|-------|
| 600V, 60 Hz Input * | | | |
| Code | Amps | kW (Hp) | Frame |
| 0P9 | 0.9 | 0.37 (0.5) | A |
| 1P7 | 1.7 | 0.75 (1.0) | A |
| 2P7 | 2.7 | 1.5 (2.0) | A |
| 3P9 | 3.9 | 2.2 (3.0) | B |
| 6P1 | 6.1 | 4.0 (5.0) | B |
| 9P0 | 9.0 | 5.5 (7.5) | C |
| 011 | 11 | 7.5 (10) | C |
| 017 | 17 | 11 (15) | D |
| 022 | 22 | 15 (20) | D |
| 027 | 27 | 18.5 (25) | D |
| 032 | 32 | 22 (30) | D |
| 041 | 41 | 30 (40) | E |
| 052 | 52 | 37 (50) | E |

* CE certification testing has not been performed on 600V class drives.

d

| Enclosure | |
|-----------|---|
| Code | Enclosure |
| A | Panel Mount - IP 20, NEMA/UL Type 1 |
| C | Wall/Machine Mount = IP66, NEMA/UL Type 4X/12 for indoor use only |
| F | Flange Mount - Front Chassis = IP 20, NEMA/UL Type 1; Rear Heatsink = IP66, NEMA/UL Type 4X/12 for indoor/outdoor use |
| G | Wall/Machine Mount - IP54, NEMA/UL Type 12 * |

* Only available on Frame E.

e

| HIM | |
|------|------------------|
| Code | Interface Module |
| 0 | Blank Cover |
| 3 | Full Numeric LCD |
| 5 | Prog. Only LCD * |

* Only available with NEMA 4X, option C.

See [Catalog Number Explanation \(continued\)](#) on page 6 for more drive options.

Catalog Number Explanation (continued)

| Position Number | | | | | | | | | | | |
|-----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1-3 | 4 | 5-7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 20A | B | 2P2 | A | 3 | A | Y | Y | N | N | C | 0 |
| <i>a</i> | <i>b</i> | <i>c</i> | <i>d</i> | <i>e</i> | <i>f</i> | <i>g</i> | <i>h</i> | <i>i</i> | <i>j</i> | <i>k</i> | <i>l</i> |

f

| Documentation | |
|---------------|-----------|
| Code | Type |
| A | Manual |
| N | No Manual |

g

| Brake IGBT | |
|------------|--------------|
| Code | w/Brake IGBT |
| Y | Yes |

h

| Internal Brake Resistor | |
|-------------------------|------------|
| Code | w/Resistor |
| Y | Yes |
| N | No |

i

| Emission Class | |
|----------------|--|
| Code | Rating |
| A | Filtered* A* & B Frames (Optional) C, D, & E Frames (Standard) |
| N | Not Filtered* A & B Frames (Optional) C, D, & E Frames |

* 600V Frames A through D available only without filter (Cat. Code N). 600V Frame E available only with filter (Cat. Code A).

* Increases size to Frame B.

j

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

k

| Control & I/O | | |
|---------------|----------|----------|
| Code | Control | Safe-Off |
| N* | Standard | N/A |
| C | Enhanced | No |
| G* | Enhanced | Yes |

* No longer available for sale.

* Not available as factory installed option for 600V ratings.

l

| Feedback | |
|----------|-----------------------------------|
| Code | Feedback |
| 0 | No Feedback - Enhanced Control |
| 1 | 5V/12V Encoder w/Enhanced Control |

Factory Installed Options

Human Interface and Wireless Interface Modules (Pos. e) IP20, NEMA/UL Type 1 and Flange Type Drives



Cat. Code: 0
No HIM (Blank Plate)



Cat. Code: 3
LCD Display, Full
Numeric Keypad

IP66, NEMA/UL Type 4X/12 Drives (Position e)



Cat. Code: 0
No HIM (Blank)



Cat. Code: 3
LCD Display, Full Numeric Keypad



Cat. Code: 5
LCD Display, Programmer Only

Documentation

| Description | Cat. Code (Position f) |
|---|---------------------------|
| English User Manual, Multi-Language Quick Start | A |
| No User Manual | N |

Internal Dynamic Brake Resistors

| Drive Input Voltage | Brake Resistance | Frame | Cat. Code |
|---------------------|------------------|---------------|---------------|
| | Ω | | (Position h) |
| 200...240V AC | 62 | A | Y |
| | | B | Y |
| | | C | Y |
| | 22 | D | Y |
| | | E | Not Available |
| 380...480V AC | 115 | A | Y |
| | | B | Y |
| | | C | Y |
| | 62 | D | Y |
| | | E | Not Available |
| 600V AC | 115 | A | Y |
| | | B | Y |
| | | C | Y |
| | D and E | Not Available | |

These resistors have a limited duty cycle. Refer to the PowerFlex Dynamic Braking Selection Guide to determine if an internal resistor will be sufficient. An external resistor may be required.

Internal EMC Filter

| Drive Input Voltage | CE Filter | Frame * | Cat. Code |
|---------------------|-----------|---------|--------------|
| | | | (Position i) |
| 200...240V AC | Optional | B | A |
| | Standard | C | |
| | Standard | D | |
| 380...480V AC | Optional | B | A |
| | Standard | C | |
| | Standard | D | |
| | Standard | E | |

* Internal CE filters are not available for PowerFlex 70 A Frame drives. If an A Frame rating is ordered with an internal filter option, it will be supplied in a B Frame.

Internal Communication Adapters

| Description | Cat. Code (Position j) |
|--|---------------------------|
| ControlNet™ Communication Adapter (Coax) | C |
| DeviceNet™ Communication Adapter | D |
| EtherNet/IP™ Communication Adapter | E |

Control Options

| Description | Cat. Code (Position k) |
|-------------------------------------|---------------------------|
| Enhanced Control without DriveGuard | C |
| Enhanced Control with DriveGuard | G |

Feedback Options

| Description | Cat. Code (Position l) |
|----------------|---------------------------|
| None | 0 |
| 5V/12V Encoder | 1 |

User Installed Options

Human Interface and Wireless Interface Modules



No HIM (Blank Plate)
20-HIM-A0



LCD Display, Full
Numeric Keypad
20-HIM-A3



LCD Display,
Programmer Only
20-HIM-A5



Enhanced LCD Display,
Full Numeric Keypad
20-HIM-A6



Remote (Panel Mount)
LCD Display, Full
Numeric Keypad
20-HIM-C3S



Remote (Panel Mount)
LCD Display,
Programmer Only
20-HIM-C5S



Enhanced LCD Display,
Full Numeric Keypad
20-HIM-A6S

| Description | Handheld/Local (Drive Mount) | Remote (Panel Mount) IP66, NEMA/UL Type 4x/12 * |
|---|---------------------------------|--|
| | Cat. No. | Cat. No. |
| No HIM (Blank Plate) | 20-HIM-A0 | - |
| LCD Display, Full Numeric Keypad | 20-HIM-A3 | 20-HIM-C3S ‡ |
| LCD Display, Programmer Only | 20-HIM-A5 | 20-HIM-C5S ‡ |
| Enhanced LCD Display, Full Numeric Keypad | 20-HIM-A6 | 20-HIM-A6S |

* For indoor use only.

‡ Includes a 1202-C30 interface cable, 3 m (9.8 ft), for connection to drive.

Human Interface Module Accessories

| Description | Cat. No. |
|--|-------------------|
| Bezel Kit for LCD HIMs, NEMA/UL Type 1 ‡ | 20-HIM-B1 |
| PowerFlex HIM Interface Cable, 1 m (39 in) ♣ | 20-HIM-H10 |
| Cable Kit (Male-Female) ▶ | |
| 0.33 Meters (1.1 Feet) | 1202-H03 |
| 1 Meter (3.3 Feet) | 1202-H10 |
| 3 Meter (9.8 Feet) | 1202-H30 |
| 9 Meter (29.5 Feet) | 1202-H90 |
| Comm Option Cable Kit | |
| 0.33 Meters (1.1 Feet) | 1202-C03 |
| 1 Meter (3.3 Feet) | 1202-C10 |
| 3 Meter (9.8 Feet) | 1202-C30 |
| 9 Meter (29.5 Feet) | 1202-C90 |
| DPI Cable Kit with Connectors, Tools and 100 m (328 ft.) Cable | 1202-CBL-KIT-100M |
| DPI Cable Connector Kit | 1202-TB-KIT-SET |
| DPI/SCANport™ One to Two Port Splitter Cable | 1203-S03 |

‡ Includes a 1202-C30 interface cable (3 meters) for connection to drive.

♣ Required only when HIM is used as handheld or remote.

▶ Required in addition to 20-HIM-H10 for distances up to a total maximum of 10 Meters (32.8 Feet).

Dynamic Brake Resistors

Small Duty Internal Dynamic Brake Resistors

Limited duty resistors mount directly to the back surface of the drive and require no extra panel space. Internal resistors are non-destructive and do not require a resistor overheat external safety circuit.

| PowerFlex 70 AC Drive | | | Small Duty Internal DB Resistor | | | | | | | | |
|--------------------------------|---------------------|----------------------|---------------------------------|----------------------|---------------------|---------------|----------------------------------|------------------------------|------------|------------------------------|------------|
| Normal Duty* kW (Hp) | Heavy Duty* kW (Hp) | Min DB Res Ohms ±10% | Part Number | Resistance* Ohms ±5% | Continuous Power kW | Max Energy kJ | Max Braking Torque % of ND Motor | Application Type 1 | | Application Type 2 | |
| | | | | | | | | Braking Torque % of ND Motor | Duty Cycle | Braking Torque % of ND Motor | Duty Cycle |
| 200...240 Volt AC Input Drives | | | | | | | | | | | |
| 0.37 (0.5) | 0.25 (0.33) | 33 | 20AB-DB1-A | 62 | 0.048 | 8.3 | 307% | 100% | 25.9% | 150% | 17.3% |
| 0.75 (1.0) | 0.55 (0.75) | 33 | 20AB-DB1-A | 62 | 0.048 | 7.3 | 300% | 100% | 12.8% | 150% | 8.5% |
| 1.5 (2.0) | 1.1 (1.5) | 33 | 20AB-DB1-B | 62 | 0.028 | 0.8 | 160% | 100% | 3.7% | 150% | 2.5% |
| 2.2 (3.0) | 1.5 (2.0) | 33 | 20AB-DB1-B | 62 | 0.028 | 0.8 | 109% | 100% | 2.5% | 109% | 2.3% |
| 4.0 (5.0) | 3.0 (3.0) | 30 | 20AB-DB1-C | 62 | 0.040 | 0.8 | 60% | 60% | 3.3% | N/A | N/A |
| 5.5 (7.5) | 4.0 (5.0) | 21 | 20AB-DB1-D | 22 | 0.036 | 0.9 | 117% | 100% | 1.3% | 117% | 1.1% |
| 7.5 (10) | 5.5 (7.5) | 21 | 20AB-DB1-D | 22 | 0.036 | 0.9 | 86% | 86% | 1.1% | N/A | N/A |
| 400...480 Volt AC Input Drives | | | | | | | | | | | |
| 0.37 (0.5) | 0.25 (0.33) | 68 | 20AD-DB1-A | 115 | 0.048 | 8.3 | 320% | 100% | 25.9% | 150% | 17.3% |
| 0.75 (1.0) | 0.55 (0.75) | 68 | 20AD-DB1-A | 115 | 0.048 | 9.0 | 259% | 100% | 12.8% | 150% | 8.5% |
| 1.5 (2.0) | 1.1 (1.5) | 68 | 20AD-DB1-A | 115 | 0.048 | 2.4 | 243% | 100% | 6.4% | 150% | 4.3% |
| 2.2 (3.0) | 1.5 (2.0) | 68 | 20AD-DB1-B | 115 | 0.028 | 0.9 | 206% | 100% | 2.5% | 150% | 1.7% |
| 4.0 (5.0) | 3.0 (3.0) | 68 | 20AD-DB1-B | 115 | 0.028 | 0.9 | 129% | 100% | 1.4% | 129% | 1.1% |
| 5.5 (7.5) | 4.0 (5.0) | 74 | 20AD-DB1-C | 115 | 0.04 | 0.9 | 94% | 94% | 1.5% | N/A | N/A |
| 7.5 (10) | 5.5 (7.5) | 74 | 20AD-DB1-C | 115 | 0.04 | 0.9 | 69% | 69% | 1.5% | N/A | N/A |
| 11 (15) | 7.5 (10) | 44 | 20AD-DB1-D | 62 | 0.036 | 0.8 | 87% | 87% | 0.8% | N/A | N/A |
| 15 (20) | 11 (15) | 31 | 20AD-DB1-D | 62 | 0.036 | 0.8 | 64% | 64% | 0.8% | N/A | N/A |
| 500...600 Volt AC Input Drives | | | | | | | | | | | |
| 0.37 (0.5) | 0.25 (0.33) | 117 | 20AD-DB1-A | 115 | 0.048 | 8.3 | 287% | 100% | 25.9% | 150% | 17.3% |
| 0.75 (1.0) | 0.55 (0.75) | 117 | 20AD-DB1-A | 115 | 0.048 | 9.0 | 263% | 100% | 12.8% | 150% | 8.5% |
| 1.5 (2.0) | 1.1 (1.5) | 117 | 20AD-DB1-A | 115 | 0.048 | 2.4 | 243% | 100% | 6.4% | 150% | 4.3% |
| 2.2 (3.0) | 1.5 (2.0) | 117 | 20AD-DB1-B | 115 | 0.028 | 0.9 | 202% | 100% | 2.5% | 150% | 1.7% |
| 4.0 (5.0) | 3.0 (3.0) | 80 | 20AD-DB1-B | 115 | 0.028 | 0.9 | 193% | 100% | 1.4% | 150% | 0.9% |
| 5.5 (7.5) | 4.0 (5.0) | 80 | 20AD-DB1-C | 115 | 0.04 | 0.9 | 147% | 100% | 1.5% | 147% | 1.0% |
| 7.5 (10) | 5.5 (7.5) | 80 | 20AD-DB1-C | 115 | 0.04 | 0.9 | 108% | 100% | 1.1% | 108% | 1.0% |
| 11 (15) | 7.5 (10) | 48 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 15 (20) | 11 (15) | 48 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

* Duty cycle listed is based on full speed to zero speed deceleration. For constant regen at full speed, duty cycle capability is half of what is listed. Application Type 1 represents maximum capability up to 100% braking torque where possible. Application Type 2 represents more than 100% braking torque where possible, up to a maximum of 150%.

※ Always check resistor ohms against minimum resistance for drive being used.

Internal Dynamic Brake Resistor Kits

| Drive Input Voltage | Brake Resistance | Frame | Cat. No. |
|---------------------|------------------|---------------|---------------|
| | Ω | | |
| 200...240V AC | 62 | A | 20AB-DB1-A |
| | | B | 20AB-DB1-B |
| | | C | 20AB-DB1-C |
| | | D | 20AB-DB1-D |
| | E | Not Available | |
| 380...480V AC | 115 | A | 20AD-DB1-A |
| | | B | 20AD-DB1-B |
| | | C | 20AD-DB1-C |
| | 62 | D | 20AD-DB1-D |
| | | E | Not Available |
| 600V AC | 115 | A | 20AD-DB1-A |
| | | B | 20AD-DB1-B |
| | | C | 20AD-DB1-C |
| | D and E | Not Available | |

These resistors have a limited duty cycle. Refer to the PowerFlex Dynamic Braking Resistor Calculator Application Technique, publication [PFLEX-AT001](#), to determine if an internal resistor is sufficient. An external resistor may be required.

Medium Duty External Dynamic Brake Resistors

These resistors provide a larger duty cycle capability than the internal type. Includes an internal thermal switch for use in external safety circuit.

| PowerFlex 70 AC Drive | | | Medium Duty External DB Resistor | | | | | | | | | |
|--------------------------------|------------------------|----------------------------|----------------------------------|----------------------------|------------------------|------------------|-------------------------------------|---------------------------------|------------|---------------------------------|------------|--|
| Normal Duty* kW (Hp) | Heavy Duty* kW (Hp) | Min DB Res Ohms ±10% | Part Number | Resistance* Ohms ±5% | Continuous Power kW | Max Energy kJ | Max Braking Torque % of ND Motor | Application Type 1 | | Application Type 2 | | |
| | | | | | | | | Braking Torque % of ND Motor | Duty Cycle | Braking Torque % of ND Motor | Duty Cycle | |
| 200...240 Volt ac Input Drives | | | | | | | | | | | | |
| 0.37 (0.5) | 0.25 (0.33) | 33 | AK-R2-091P500 | 91 | 0.086 | 17 | 293% | 100% | 46% | 150% | 31% | |
| 0.75 (1.0) | 0.55 (0.75) | 33 | AK-R2-091P500 | 91 | 0.086 | 17 | 218% | 100% | 23% | 150% | 15% | |
| 1.5 (2.0) | 1.1 (1.5) | 33 | AK-R2-091P500 | 91 | 0.086 | 17 | 109% | 100% | 11% | 109% | 11% | |
| 2.2 (3.0) | 1.5 (2.0) | 33 | AK-R2-047P500 | 47 | 0.166 | 33 | 144% | 100% | 15% | 144% | 11% | |
| 4.0 (5.0) | 3.0 (3.0) | 30 | AK-R2-047P500 | 47 | 0.166 | 33 | 79% | 79% | 11% | N/A | N/A | |
| 5.5 (7.5) | 4.0 (5.0) | 23 | AK-R2-030P1K2 | 30 | 0.26 | 52 | 90% | 90% | 10% | N/A | N/A | |
| 7.5 (10) | 5.5 (7.5) | 23 | AK-R2-030P1K2 | 30 | 0.26 | 52 | 66% | 66% | 10% | N/A | N/A | |
| 400...480 Volt ac Input Drives | | | | | | | | | | | | |
| 0.37 (0.5) | 0.25 (0.33) | 68 | AK-R2-360P500 | 360 | 0.086 | 17 | 305% | 100% | 47% | 150% | 31% | |
| 0.75 (1.0) | 0.55 (0.75) | 68 | AK-R2-360P500 | 360 | 0.086 | 17 | 220% | 100% | 23% | 150% | 15% | |
| 1.5 (2.0) | 1.1 (1.5) | 68 | AK-R2-360P500 | 360 | 0.086 | 17 | 110% | 100% | 12% | 110% | 11% | |
| 2.2 (3.0) | 1.5 (2.0) | 68 | AK-R2-120P1K2 | 120 | 0.26 | 52 | 197% | 100% | 24% | 150% | 16% | |
| 4.0 (5.0) | 3.0 (3.0) | 68 | AK-R2-120P1K2 | 120 | 0.26 | 52 | 124% | 100% | 13% | 124% | 10% | |
| 5.5 (7.5) | 4.0 (5.0) | 74 | AK-R2-120P1K2 | 120 | 0.26 | 52 | 90% | 90% | 10% | N/A | N/A | |
| 7.5 (10) | 5.5 (7.5) | 74 | AK-R2-120P1K2 | 120 | 0.26 | 52 | 66% | 66% | 10% | N/A | N/A | |
| 11 (15) ‡ | 7.5 (10) ‡ | 44 | ‡ | 60 | 0.52 | 104 | 90% | 90% | 10% | N/A | N/A | |
| 15 (20) ‡ | 11 (15) ‡ | 31 | ‡ | 60 | 0.52 | 104 | 66% | 66% | 10% | N/A | N/A | |
| 500...600 Volt ac Input Drives | | | | | | | | | | | | |
| 0.37 (0.5) | 0.25 (0.33) | 117 | AK-R2-360P500 | 360 | 0.086 | 17 | 274% | 100% | 46% | 150% | 31% | |
| 0.75 (1.0) | 0.55 (0.75) | 117 | AK-R2-360P500 | 360 | 0.086 | 17 | 251% | 100% | 23% | 150% | 15% | |
| 1.5 (2.0) | 1.1 (1.5) | 117 | AK-R2-360P500 | 360 | 0.086 | 17 | 172% | 100% | 11% | 150% | 8% | |
| 2.2 (3.0) | 1.5 (2.0) | 117 | AK-R2-120P1K2 | 120 | 0.26 | 52 | 193% | 100% | 24% | 150% | 16% | |
| 4.0 (5.0) | 3.0 (3.0) | 80 | AK-R2-120P1K2 | 120 | 0.26 | 52 | 185% | 100% | 13% | 150% | 9% | |
| 5.5 (7.5) | 4.0 (5.0) | 80 | AK-R2-120P1K2 | 120 | 0.26 | 52 | 141% | 100% | 9% | 141% | 7% | |
| 7.5 (10) | 5.5 (7.5) | 80 | AK-R2-120P1K2 | 120 | 0.26 | 52 | 103% | 100% | 7% | 103% | 7% | |
| 11 (15) ‡ | 7.5 (10) ‡ | 48 | ‡ | 60 | 0.52 | 104 | 141% | 100% | 9% | 141% | 7% | |
| 15 (20) ‡ | 11 (15) ‡ | 48 | ‡ | 60 | 0.52 | 104 | 103% | 100% | 7% | 103% | 7% | |

* Duty cycle listed is based on full speed to zero speed deceleration. For constant regen at full speed, duty cycle capability is half of what is listed. Application Type 1 represents maximum capability up to 100% braking torque where possible. Application Type 2 represents more than 100% braking torque where possible, up to a maximum of 150%.

‡ Always check resistor ohms against minimum resistance for drive being used.

‡ For 11 and 15 kW (15 and 20 Hp) applications, use two 7.5 kW (10 Hp) size resistors wired in parallel.

External Dynamic Brake Resistor Kits

| Drive Input Voltage | Brake Resistance | Continuous Power | Cat. No. |
|---------------------|------------------|------------------|---------------|
| | Ω | W | |
| 200...240V ac | 30 | 260 | AK-R2-030P1K2 |
| | 47 | 166 | AK-R2-047P500 |
| | 91 | 86 | AK-R2-091P500 |
| 480...600V ac | 120 | 260 | AK-R2-120P1K2 |
| | 360 | 86 | AK-R2-360P500 |

Communication Options

Communication Option Kits

| Description | Cat. No. |
|---|------------------|
| BACnet MS/TP RS485 Communication Adapter | 20-COMM-B |
| ControlNet Communication Adapter (Coax) | 20-COMM-C |
| DeviceNet Communication Adapter | 20-COMM-D |
| EtherNet/IP Communication Adapter | 20-COMM-E |
| HVAC Communication Adapter | 20-COMM-H |
| CANopen Communication Adapter | 20-COMM-K |
| LonWorks Communication Adapter | 20-COMM-L |
| Modbus/TCP Communication Adapter | 20-COMM-M |
| PROFIBUS DP Communication Adapter | 20-COMM-P |
| ControlNet Communication Adapter (Fiber) | 20-COMM-Q |
| Remote I/O Communication Adapter † 1 | 20-COMM-R |
| RS485 DF1 Communication Adapter | 20-COMM-S |
| External Communications Kit Power Supply | 20-XCOMM-AC-PS1 |
| DPI External Communications Kit | 20-XCOMM-DC-BASE |
| External DPI I/O Option Board † | 20-XCOMM-IO-OPT1 |
| Compact I/O Module (3 Channel) | 1769-SM1 |
| Serial Null Modem Adapter | 1203-SNM |
| Smart Self-powered Serial Converter (RS232) includes 1203-SFC and 1202-C10 Cables | 1203-SSS |
| Universal Serial Bus™ (USB) Converter includes 2m USB, 20-HIM-H10 & 22-HIM-H10 Cables | 1203-USB |

† For use only with DPI External Communications Kits 20-XCOMM-DC-BASE.

1 The remote I/O has silver series status. For more information, refer to <http://www.ab.com/silver>.

Other Options

| Description | Cat. No. |
|-------------------------------|------------------|
| DriveGuard † Safe-Off Board § | 20A-DG01 |
| 5V/12V Encoder § | 20A-ENC-1 |
| 115V ac Interface | AK-M9-115VAC-1 |
| Frame E Flange Gasket | AK-M9-GASKET1-E4 |
| Service Connection Board †* | SK-M9-SCB1 |

§ Works only with PowerFlex 70 Enhanced Control.

* Provides temporary DPI/HIM connection for NEMA/UL Type 1 and Flange drives with cover removed.

Terminators

| Description † | Cat. No. |
|---|-----------|
| for use with 3.7 kW (5 Hp) & below drives | 1204-TFA1 |
| for use with 1.5 kW (2 Hp) & up drives | 1204-TFB2 |

† Refer to Appendix A of publication DRIVES-IN001 for selection information.

Reflected Wave Reduction Modules

| Description † | Cat. No. |
|-------------------------------|----------------|
| 17A with Common Mode Choke | 1204-RWC-17-A |
| 9A without Choke, Book Mount | 1204-RWR2-09-B |
| 9A without Choke, Stack Mount | 1204-RWR2-09-C |

† Refer to Appendix A of publication DRIVES-IN001 for selection information.

Reflective Wave Reduction Devices

1321-RWR devices are used at the output of the drive to reduce dv/dt and motor terminal peak voltages

| 480V, 60 Hz, Three-phase | | |
|--------------------------|------------|---------------------|
| Drive Cat. No. | kW (Hp) | RWR Filter Cat. No. |
| 20AD1P1-ND | 0.37 (0.5) | – |
| 20AD2P1-ND | 0.75 (1.0) | – |
| 20AD3P4-ND | 1.5 (2.0) | – |
| 20AD5P0-ND | 2.2 (3.0) | – |
| 20AD8P0-ND | 4.0 (5.0) | 1321-RWR8-DP |
| 20AD011-ND | 5.5 (7.5) | 1321-RWR12-DP |
| 20AD014-ND | 7.5 (10) | 1321-RWR18-DP |
| 20AD022-ND | 11 (15) | 1321-RWR25-DP |
| 20AD027-ND | 15 (20) | 1321-RWR35-DP |
| 20AD034-ND | 18.5 (25) | 1321-RWR35-DP |
| 20AD040-ND | 22 (30) | 1321-RWR45-DP |
| 20AD052-ND | 30 (40) | 1321-RWR55-DP |
| 20AD065-ND | 37 (50) | 1321-RWR80-DP |

| 600V, 60 Hz, Three-phase | | |
|--------------------------|------------|---------------------|
| Drive Cat. No. | kW (Hp) | RWR Filter Cat. No. |
| 20AE0P9-ND | 0.37 (0.5) | – |
| 20AE1P7-ND | 0.75 (1.0) | – |
| 20AE2P7-ND | 1.5 (2.0) | – |
| 20AE3P9-ND | 2.2 (3.0) | – |
| 20AE6P1-ND | 4.0 (5.0) | 1321-RWR8-EP |
| 20AE9P0-ND | 5.5 (7.5) | 1321-RWR12-EP |
| 20AE011-ND | 7.5 (10) | 1321-RWR18-EP |
| 20AE017-ND | 11 (15) | 1321-RWR25-EP |
| 20AE022-ND | 15 (20) | 1321-RWR35-EP |
| 20AE027-ND | 18.5 (25) | 1321-RWR45-EP |
| 20AE032-ND | 22 (30) | 1321-RWR55-EP |
| 20AE041-ND | 30 (40) | 1321-RWR80-EP |
| 20AE052-ND | 37 (50) | 1321-RWR100-EP |

Isolation Transformers

For installations that have specific types of AC supply configurations or require drive protection due to AC line disturbances, isolation transformers are available.

| Motor Rating kW (Hp) | 240V, 60 Hz, Three-phase, 240V Primary and 240V Secondary | 460V, 60 Hz, Three-phase, 460V Primary and 460V Secondary | 575V, 60 Hz, Three-phase 575V Primary and 575V Secondary |
|-------------------------|--|--|---|
| | IP32 (NEMA / UL Type 3R) | IP32 (NEMA / UL Type 3R) | IP32 (NEMA / UL Type 3R) |
| | Cat. No. | Cat. No. | Cat. No. |
| 0.25 (0.33) | 1321-3TW005-AA | 1321-3TW005-BB | – |
| 0.37 (0.5) | 1321-3TW005-AA | 1321-3TW005-BB | – |
| 0.55 (0.75) | 1321-3TW005-AA | 1321-3TW005-BB | – |
| 0.75 (1.0) | 1321-3TW005-AA | 1321-3TW005-BB | 1321-3TW005-CC |
| 1.1 (1.5) | 1321-3TW005-AA | 1321-3TW005-BB | – |
| 1.5 (2.0) | 1321-3TW005-AA | 1321-3TW005-BB | 1321-3TW005-CC |
| 2.2 (3.0) | 1321-3TW005-AA | 1321-3TW005-BB | 1321-3TW005-CC |
| 4.0 (5.0) | 1321-3TW007-AA | 1321-3TW007-BB | 1321-3TW007-CC |
| 5.5 (7.5) | 1321-3TW011-AA | 1321-3TW011-BB | 1321-3TW011-CC |
| 7.5 (10) | 1321-3TW014-AA | 1321-3TW014-BB | 1321-3TW014-CC |
| 11 (15) | 1321-3TW020-AA | 1321-3TW020-BB | 1321-3TW020-CC |
| 15 (20) | 1321-3TW027-AA | 1321-3TW027-BB | 1321-3TW027-CC |
| 18.5 (25) | 1321-3TW034-AA | 1321-3TW034-BB | 1321-3TW034-CC |
| 22 (30) | – | 1321-3TW040-BB | 1321-3TW040-CC |
| 30 (40) | – | 1321-3TW051-BB | 1321-3TW051-CC |
| 37 (50) | – | 1321-3TH063-BB | 1321-3TH063-CC |

Input/Output Line Reactors

For impedance matching, protection from AC line disturbances or motor protection, reactors are available for both the input and output sides of the drive.

Table 1 - 240V, 60 Hz, Three-phase, 3% Impedance

| Drive Cat. No. | Duty | Hp | Input Line Reactor ⁽¹⁾ | | Output Line Reactor ⁽¹⁾ | |
|----------------|-------------|------|-----------------------------------|-------------------------|------------------------------------|-------------------------|
| | | | IP00 (NEMA / UL Type Open) | IP11 (NEMA / UL Type 1) | IP00 (NEMA / UL Type Open) | IP11 (NEMA / UL Type 1) |
| | | | Cat. No. | Cat. No. | Cat. No. | Cat. No. |
| 20AB2P2 | Heavy Duty | 0.33 | 1321-3R2-D | 1321-3RA2-D | 1321-3R2-D | 1321-3RA2-D |
| 20AB2P2 | Normal Duty | 0.5 | 1321-3R2-D | 1321-3RA2-D | 1321-3R2-D | 1321-3RA2-D |
| 20AB4P2 | Heavy Duty | 0.75 | 1321-3R4-A | 1321-3RA4-A | 1321-3R4-A | 1321-3RA4-A |
| 20AB4P2 | Normal Duty | 1 | 1321-3R4-A | 1321-3RA4-A | 1321-3R4-A | 1321-3RA4-A |
| 20AB6P8 | Heavy Duty | 1.5 | 1321-3R8-B | 1321-3RA8-B | 1321-3R8-A | 1321-3RA8-A |
| 20AB6P8 | Normal Duty | 2 | 1321-3R8-A | 1321-3RA8-A | 1321-3R8-A | 1321-3RA8-A |
| 20AB9P6 | Heavy Duty | 2 | 1321-3R8-A | 1321-3RA8-A | 1321-3R12-A | 1321-3RA12-A |
| 20AB9P6 | Normal Duty | 3 | 1321-3R12-A | 1321-3RA12-A | 1321-3R12-A | 1321-3RA12-A |
| 20AB015 | Heavy Duty | 3 | 1321-3R12-A | 1321-3RA12-A | 1321-3R18-A | 1321-3RA18-A |
| 20AB015 | Normal Duty | 5 | 1321-3R18-A | 1321-3RA18-A | 1321-3R18-A | 1321-3RA18-A |
| 20AB022 | Heavy Duty | 5 | 1321-3R18-A | 1321-3RA18-A | 1321-3R25-A | 1321-3RA25-A |
| 20AB022 | Normal Duty | 7.5 | 1321-3R25-A | 1321-3RA25-A | 1321-3R25-A | 1321-3RA25-A |
| 20AB028 | Heavy Duty | 7.5 | 1321-3R25-A | 1321-3RA25-A | 1321-3R35-A | 1321-3RA35-A |
| 20AB028 | Normal Duty | 10 | 1321-3R35-A | 1321-3RA35-A | 1321-3R35-A | 1321-3RA35-A |
| 20AB042 | Heavy Duty | 10 | 1321-3R35-A | 1321-3RA35-A | 1321-3R45-A | 1321-3RA45-A |
| 20AB042 | Normal Duty | 15 | 1321-3R45-A | 1321-3RA45-A | 1321-3R45-A | 1321-3RA45-A |
| 20AB054 | Heavy Duty | 15 | 1321-3R45-A | 1321-3RA45-A | 1321-3R55-A | 1321-3RA55-A |
| 20AB054 | Normal Duty | 20 | 1321-3R55-A | 1321-3RA55-A | 1321-3R55-A | 1321-3RA55-A |
| 20AB070 | Heavy Duty | 20 | 1321-3R55-A | 1321-3RA55-A | 1321-3R80-A | 1321-3RA80-A |
| 20AB070 | Normal Duty | 25 | 1321-3R80-A | 1321-3RA80-A | 1321-3R80-A | 1321-3RA80-A |

(1) Input line reactors were sized based on the NEC fundamental motor amps. Output line reactors were sized based on the VFD rated output currents.

Table 2 - 240V, 60 Hz, Three-phase, 5% Impedance

| Drive Cat. No. | Duty | Hp | Input Line Reactor ⁽¹⁾ | | Output Line Reactor ⁽¹⁾ | |
|----------------|-------------|------|-----------------------------------|-------------------------|------------------------------------|-------------------------|
| | | | IP00 (NEMA / UL Type Open) | IP11 (NEMA / UL Type 1) | IP00 (NEMA / UL Type Open) | IP11 (NEMA / UL Type 1) |
| | | | Cat. No. | Cat. No. | Cat. No. | Cat. No. |
| 20AB2P2 | Heavy Duty | 0.33 | 1321-3R2-A | 1321-3RA2-A | 1321-3R2-A | 1321-3RA2-A |
| 20AB2P2 | Normal Duty | 0.5 | 1321-3R2-A | 1321-3RA2-A | 1321-3R2-A | 1321-3RA2-A |
| 20AB4P2 | Heavy Duty | 0.75 | 1321-3R4-B | 1321-3RA4-B | 1321-3R4-B | 1321-3RA4-B |
| 20AB4P2 | Normal Duty | 1 | 1321-3R4-B | 1321-3RA4-B | 1321-3R4-B | 1321-3RA4-B |
| 20AB6P8 | Heavy Duty | 1.5 | 1321-3R8-B | 1321-3RA8-B | 1321-3R8-B | 1321-3RA8-B |
| 20AB6P8 | Normal Duty | 2 | 1321-3R8-B | 1321-3RA8-B | 1321-3R8-B | 1321-3RA8-B |
| 20AB9P6 | Heavy Duty | 2 | 1321-3R8-B | 1321-3RA8-B | 1321-3R12-B | 1321-3RA12-B |
| 20AB9P6 | Normal Duty | 3 | 1321-3R12-B | 1321-3RA12-B | 1321-3R12-B | 1321-3RA12-B |
| 20AB015 | Heavy Duty | 3 | 1321-3R12-B | 1321-3RA12-B | 1321-3R18-B | 1321-3RA18-B |
| 20AB015 | Normal Duty | 5 | 1321-3R18-B | 1321-3RA18-B | 1321-3R18-B | 1321-3RA18-B |
| 20AB022 | Heavy Duty | 5 | 1321-3R18-B | 1321-3RA18-B | 1321-3R25-B | 1321-3RA25-B |
| 20AB022 | Normal Duty | 7.5 | 1321-3R25-B | 1321-3RA25-B | 1321-3R25-B | 1321-3RA25-B |
| 20AB028 | Heavy Duty | 7.5 | 1321-3R25-B | 1321-3RA25-B | 1321-3R35-B | 1321-3RA35-B |
| 20AB028 | Normal Duty | 10 | 1321-3R35-B | 1321-3RA35-B | 1321-3R35-B | 1321-3RA35-B |
| 20AB042 | Heavy Duty | 10 | 1321-3R35-B | 1321-3RA35-B | 1321-3R45-B | 1321-3RA45-B |
| 20AB042 | Normal Duty | 15 | 1321-3R45-B | 1321-3RA45-B | 1321-3R45-B | 1321-3RA45-B |
| 20AB054 | Heavy Duty | 15 | 1321-3R45-B | 1321-3RA45-B | 1321-3R55-B | 1321-3RA55-B |
| 20AB054 | Normal Duty | 20 | 1321-3R55-B | 1321-3RA55-B | 1321-3R55-B | 1321-3RA55-B |
| 20AB070 | Heavy Duty | 20 | 1321-3R55-B | 1321-3RA55-B | 1321-3R80-B | 1321-3RA80-B |
| 20AB070 | Normal Duty | 25 | 1321-3R80-B | 1321-3RA80-B | 1321-3R80-B | 1321-3RA80-B |

(1) Input line reactors were sized based on the NEC fundamental motor amps. Output line reactors were sized based on the VFD rated output currents.

PowerFlex 70 Adjustable Frequency AC Drive

Table 3 - 480V, 60 Hz, Three-phase, 3% Impedance

| Drive Cat. No. | Duty | Hp | Input Line Reactor ⁽¹⁾ | | Output Line Reactor ⁽¹⁾ | |
|----------------|-------------|------|-----------------------------------|-------------------------|------------------------------------|-------------------------|
| | | | IP00 (NEMA / UL Type Open) | IP11 (NEMA / UL Type 1) | IP00 (NEMA / UL Type Open) | IP11 (NEMA / UL Type 1) |
| | | | Cat. No. | Cat. No. | Cat. No. | Cat. No. |
| 20AD1P1 | Heavy Duty | 0.33 | 1321-3R1-C | 1321-3RA1-C | 1321-3R2-B | 1321-3RA2-B |
| 20AD1P1 | Normal Duty | 0.5 | 1321-3R1-C | 1321-3RA1-C | 1321-3R2-B | 1321-3RA2-B |
| 20AD2P1 | Heavy Duty | 0.75 | 1321-3R2-A | 1321-3RA2-A | 1321-3R2-A | 1321-3RA2-A |
| 20AD2P1 | Normal Duty | 1 | 1321-3R2-A | 1321-3RA2-A | 1321-3R2-A | 1321-3RA2-A |
| 20AD3P4 | Heavy Duty | 1.5 | 1321-3R4-C | 1321-3RA4-C | 1321-3R4-B | 1321-3RA4-B |
| 20AD3P4 | Normal Duty | 2 | 1321-3R4-B | 1321-3RA4-B | 1321-3R4-B | 1321-3RA4-B |
| 20AD5P0 | Heavy Duty | 2 | 1321-3R4-B | 1321-3RA4-B | 1321-3R8-C | 1321-3RA8-C |
| 20AD5P0 | Normal Duty | 3 | 1321-3R8-C | 1321-3RA8-C | 1321-3R8-C | 1321-3RA8-C |
| 20AD8P0 | Heavy Duty | 3 | 1321-3R8-C | 1321-3RA8-C | 1321-3R8-B | 1321-3RA8-B |
| 20AD8P0 | Normal Duty | 5 | 1321-3R8-B | 1321-3RA8-B | 1321-3R8-B | 1321-3RA8-B |
| 20AD011 | Heavy Duty | 5 | 1321-3R8-B | 1321-3RA8-B | 1321-3R12-B | 1321-3RA12-B |
| 20AD011 | Normal Duty | 7.5 | 1321-3R12-B | 1321-3RA12-B | 1321-3R12-B | 1321-3RA12-B |
| 20AD014 | Heavy Duty | 7.5 | 1321-3R12-B | 1321-3RA12-B | 1321-3R18-B | 1321-3RA18-B |
| 20AD014 | Normal Duty | 10 | 1321-3R18-B | 1321-3RA18-B | 1321-3R18-B | 1321-3RA18-B |
| 20AD022 | Heavy Duty | 10 | 1321-3R18-B | 1321-3RA18-B | 1321-3R25-B | 1321-3RA25-B |
| 20AD022 | Normal Duty | 15 | 1321-3R25-B | 1321-3RA25-B | 1321-3R25-B | 1321-3RA25-B |
| 20AD027 | Heavy Duty | 15 | 1321-3R25-B | 1321-3RA25-B | 1321-3R25-B | 1321-3RA25-B |
| 20AD027 | Normal Duty | 20 | 1321-3R35-B | 1321-3RA35-B | 1321-3R25-B | 1321-3RA25-B |
| 20AD034 | Heavy Duty | 20 | 1321-3R35-B | 1321-3RA35-B | 1321-3R35-B | 1321-3RA35-B |
| 20AD034 | Normal Duty | 25 | 1321-3R35-B | 1321-3RA35-B | 1321-3R35-B | 1321-3RA35-B |
| 20AD040 | Heavy Duty | 25 | 1321-3R35-B | 1321-3RA35-B | 1321-3R45-B | 1321-3RA45-B |
| 20AD040 | Normal Duty | 30 | 1321-3R45-B | 1321-3RA45-B | 1321-3R45-B | 1321-3RA45-B |
| 20AD052 | Heavy Duty | 30 | 1321-3R45-B | 1321-3RA45-B | 1321-3R55-B | 1321-3RA55-B |
| 20AD052 | Normal Duty | 40 | 1321-3R55-B | 1321-3RA55-B | 1321-3R55-B | 1321-3RA55-B |
| 20AD065 | Heavy Duty | 40 | 1321-3R55-B | 1321-3RA55-B | 1321-3R80-B | 1321-3RA80-B |
| 20AD065 | Normal Duty | 50 | 1321-3R80-B | 1321-3RA80-B | 1321-3R80-B | 1321-3RA80-B |

(1) Input line reactors were sized based on the NEC fundamental motor amps. Output line reactors were sized based on the VFD rated output currents.

Table 4 - 480V, 60 Hz, Three-phase, 5% Impedance

| Drive Cat. No. | Duty | Hp | Input Line Reactor ⁽¹⁾ | | Output Line Reactor ⁽¹⁾ | |
|----------------|-------------|------|-----------------------------------|-----------------------------|------------------------------------|-------------------------|
| | | | IP00 (NEMA / UL Type Open) | IP11 (NEMA / UL Type 1) | IP00 (NEMA / UL Type Open) | IP11 (NEMA / UL Type 1) |
| | | | Cat. No. | Cat. No. | Cat. No. | Cat. No. |
| 20AD1P1 | Heavy Duty | 0.33 | 1321-3R1-B | 1321-3RA1-B | 1321-3R2-C | 1321-3RA2-C |
| 20AD1P1 | Normal Duty | 0.5 | 1321-3R1-B | 1321-3RA1-B | 1321-3R2-C | 1321-3RA2-C |
| 20AD2P1 | Heavy Duty | 0.75 | 1321-3R2-C | 1321-3RA2-C | 1321-3R2-B | 1321-3RA2-B |
| 20AD2P1 | Normal Duty | 1 | 1321-3R2-B | 1321-3RA2-B | 1321-3R2-B | 1321-3RA2-B |
| 20AD3P4 | Heavy Duty | 1.5 | 1321-3R4-D | 1321-3RA4-D | 1321-3R4-D | 1321-3RA4-D |
| 20AD3P4 | Normal Duty | 2 | 1321-3R4-D | 1321-3RA4-D | 1321-3R4-D | 1321-3RA4-D |
| 20AD5P0 | Heavy Duty | 2 | 1321-3R4-D | 1321-3RA4-D | 1321-3R8-D | 1321-3RA8-D |
| 20AD5P0 | Normal Duty | 3 | 1321-3R8-D | 1321-3RA8-D | 1321-3R8-D | 1321-3RA8-D |
| 20AD8P0 | Heavy Duty | 3 | 1321-3R8-D | 1321-3RA8-D | 1321-3R8-C | 1321-3RA8-C |
| 20AD8P0 | Normal Duty | 5 | 1321-3R8-C | 1321-3RA8-C | 1321-3R8-C | 1321-3RA8-C |
| 20AD011 | Heavy Duty | 5 | 1321-3R8-C | 1321-3RA8-C | 1321-3R12-C | 1321-3RA12-C |
| 20AD011 | Normal Duty | 7.5 | 1321-3R12-C | 1321-3RA12-C | 1321-3R12-C | 1321-3RA12-C |
| 20AD014 | Heavy Duty | 7.5 | 1321-3R12-C | 1321-3RA12-C | 1321-3R18-C | 1321-3RA18-C |
| 20AD014 | Normal Duty | 10 | 1321-3R18-C | 1321-3RA18-C | 1321-3R18-C | 1321-3RA18-C |
| 20AD022 | Heavy Duty | 10 | 1321-3R18-C | 1321-3RA18-C | 1321-3R25-C | 1321-3RA25-C |
| 20AD022 | Normal Duty | 15 | 1321-3R25-C | 1321-3RA25-C | 1321-3R25-C | 1321-3RA25-C |
| 20AD027 | Heavy Duty | 15 | 1321-3R25-C | 1321-3RA25-C | 1321-3R25-C | 1321-3RA25-C |
| 20AD027 | Normal Duty | 20 | 1321-3R35-C ⁽²⁾ | 1321-3RA35-C ⁽²⁾ | 1321-3R25-C | 1321-3RA25-C |
| 20AD034 | Heavy Duty | 20 | 1321-3R35-C ⁽²⁾ | 1321-3RA35-C ⁽²⁾ | 1321-3R35-C | 1321-3RA35-C |
| 20AD034 | Normal Duty | 25 | 1321-3R35-C | 1321-3RA35-C | 1321-3R35-C | 1321-3RA35-C |
| 20AD040 | Heavy Duty | 25 | 1321-3R35-C | 1321-3RA35-C | 1321-3R45-C | 1321-3RA45-C |
| 20AD040 | Normal Duty | 30 | 1321-3R45-C | 1321-3RA45-C | 1321-3R45-C | 1321-3RA45-C |
| 20AD052 | Heavy Duty | 30 | 1321-3R45-C | 1321-3RA45-C | 1321-3R55-C | 1321-3RA55-C |
| 20AD052 | Normal Duty | 40 | 1321-3R55-C | 1321-3RA55-C | 1321-3R55-C | 1321-3RA55-C |
| 20AD065 | Heavy Duty | 40 | 1321-3R55-C | 1321-3RA55-C | 1321-3R80-C | 1321-3RA80-C |
| 20AD065 | Normal Duty | 50 | 1321-3R80-C | 1321-3RA80-C | 1321-3R80-C | 1321-3RA80-C |

(1) Input line reactors were sized based on the NEC fundamental motor amps. Output line reactors were sized based on the VFD rated output currents.

(2) 4% impedance.

Table 5 - 600V, 60 Hz, Three-phase, 3% Impedance

| Drive Cat. No. | Duty | Hp | Input Line Reactor ⁽¹⁾ | | Output Line Reactor ⁽¹⁾ | |
|----------------|-------------|------|-----------------------------------|-------------------------|------------------------------------|-------------------------|
| | | | IP00 (NEMA / UL Type Open) | IP11 (NEMA / UL Type 1) | IP00 (NEMA / UL Type Open) | IP11 (NEMA / UL Type 1) |
| | | | Cat. No. | Cat. No. | Cat. No. | Cat. No. |
| 20AE0P9 | Heavy Duty | 0.33 | 1321-3R1-C | 1321-3RA1-C | 1321-3R1-B | 1321-3RA1-B |
| 20AE0P9 | Normal Duty | 0.5 | 1321-3R1-C | 1321-3RA1-C | 1321-3R1-B | 1321-3RA1-B |
| 20AE1P7 | Heavy Duty | 0.75 | 1321-3R2-B | 1321-3RA2-B | 1321-3R2-B | 1321-3RA2-B |
| 20AE1P7 | Normal Duty | 1 | 1321-3R2-B | 1321-3RA2-B | 1321-3R2-B | 1321-3RA2-B |
| 20AE2P7 | Heavy Duty | 1.5 | 1321-3R2-A | 1321-3RA2-A | 1321-3R4-D | 1321-3RA4-D |
| 20AE2P7 | Normal Duty | 2 | 1321-3R4-C | 1321-3RA4-C | 1321-3R4-D | 1321-3RA4-D |
| 20AE3P9 | Heavy Duty | 2 | 1321-3R4-C | 1321-3RA4-C | 1321-3R4-C | 1321-3RA4-C |
| 20AE3P9 | Normal Duty | 3 | 1321-3R4-C | 1321-3RA4-C | 1321-3R4-C | 1321-3RA4-C |
| 20AE6P1 | Heavy Duty | 3 | 1321-3R4-C | 1321-3RA4-C | 1321-3R8-C | 1321-3RA8-C |
| 20AE6P1 | Normal Duty | 5 | 1321-3R8-C | 1321-3RA8-C | 1321-3R8-C | 1321-3RA8-C |
| 20AE9P0 | Heavy Duty | 5 | 1321-3R8-C | 1321-3RA8-C | 1321-3R12-C | 1321-3RA12-C |
| 20AE9P0 | Normal Duty | 7.5 | 1321-3R12-C | 1321-3RA12-C | 1321-3R12-C | 1321-3RA12-C |
| 20AE011 | Heavy Duty | 7.5 | 1321-3R12-C | 1321-3RA12-C | 1321-3R12-B | 1321-3RA12-B |
| 20AE011 | Normal Duty | 10 | 1321-3R12-B | 1321-3RA12-B | 1321-3R12-B | 1321-3RA12-B |
| 20AE017 | Heavy Duty | 10 | 1321-3R12-B | 1321-3RA12-B | 1321-3R18-B | 1321-3RA18-B |
| 20AE017 | Normal Duty | 15 | 1321-3R18-B | 1321-3RA18-B | 1321-3R18-B | 1321-3RA18-B |
| 20AE022 | Heavy Duty | 15 | 1321-3R18-B | 1321-3RA18-B | 1321-3R25-B | 1321-3RA25-B |
| 20AE022 | Normal Duty | 20 | 1321-3R25-B | 1321-3RA25-B | 1321-3R25-B | 1321-3RA25-B |
| 20AE027 | Heavy Duty | 20 | 1321-3R25-B | 1321-3RA25-B | 1321-3R35-C | 1321-3RA35-C |
| 20AE027 | Normal Duty | 25 | 1321-3R35-C | 1321-3RA35-C | 1321-3R35-C | 1321-3RA35-C |
| 20AE032 | Heavy Duty | 25 | 1321-3R35-C | 1321-3RA35-C | 1321-3R35-B | 1321-3RA35-B |
| 20AE032 | Normal Duty | 30 | 1321-3R35-B | 1321-3RA35-B | 1321-3R35-B | 1321-3RA35-B |
| 20AE041 | Heavy Duty | 30 | 1321-3R35-B | 1321-3RA35-B | 1321-3R45-B | 1321-3RA45-B |
| 20AE041 | Normal Duty | 40 | 1321-3R45-B | 1321-3RA45-B | 1321-3R45-B | 1321-3RA45-B |
| 20AE052 | Heavy Duty | 40 | 1321-3R45-B | 1321-3RA45-B | 1321-3R55-B | 1321-3RA55-B |
| 20AE052 | Normal Duty | 50 | 1321-3R55-B | 1321-3RA55-B | 1321-3R55-B | 1321-3RA55-B |

(1) Input line reactors were sized based on the NEC fundamental motor amps. Output line reactors were sized based on the VFD rated output currents.

Table 6 - 600V, 60 Hz, Three-phase, 5% Impedance

| Drive Cat. No. | Duty | Hp | Input Line Reactor ⁽¹⁾ | | Output Line Reactor ⁽¹⁾ | |
|----------------|-------------|------|-----------------------------------|-----------------------------|------------------------------------|-----------------------------|
| | | | IP00 (NEMA / UL Type Open) | IP11 (NEMA / UL Type 1) | IP00 (NEMA / UL Type Open) | IP11 (NEMA / UL Type 1) |
| | | | Cat. No. | Cat. No. | Cat. No. | Cat. No. |
| 20AE0P9 | Heavy Duty | 0.33 | 1321-3R1-A | 1321-3RA1-A | 1321-3R1-B | 1321-3RA1-B |
| 20AE0P9 | Normal Duty | 0.5 | 1321-3R1-B | 1321-3RA1-B | 1321-3R1-B | 1321-3RA1-B |
| 20AE1P7 | Heavy Duty | 0.5 | 1321-3R1-B | 1321-3RA1-B | 1321-3R2-C | 1321-3RA2-C |
| 20AE1P7 | Normal Duty | 1 | 1321-3R2-C | 1321-3RA2-C | 1321-3R2-C | 1321-3RA2-C |
| 20AE2P7 | Heavy Duty | 1 | 1321-3R2-C | 1321-3RA2-C | 1321-3R4-D ⁽²⁾ | 1321-3RA4-D ⁽²⁾ |
| 20AE2P7 | Normal Duty | 2 | 1321-3R4-D ⁽²⁾ | 1321-3RA4-D ⁽²⁾ | 1321-3R4-D ⁽²⁾ | 1321-3RA4-D ⁽²⁾ |
| 20AE3P9 | Heavy Duty | 2 | 1321-3R4-D ⁽²⁾ | 1321-3RA4-D ⁽²⁾ | 1321-3R4-D | 1321-3RA4-D |
| 20AE3P9 | Normal Duty | 3 | 1321-3R4-D | 1321-3RA4-D | 1321-3R4-D | 1321-3RA4-D |
| 20AE6P1 | Heavy Duty | 3 | 1321-3R4-D | 1321-3RA4-D | 1321-3R8-D | 1321-3RA8-D |
| 20AE6P1 | Normal Duty | 5 | 1321-3R8-D | 1321-3RA8-D | 1321-3R8-D | 1321-3RA8-D |
| 20AE9P0 | Heavy Duty | 5 | 1321-3R8-D | 1321-3RA8-D | 1321-3R12-C ⁽²⁾ | 1321-3RA12-C ⁽²⁾ |
| 20AE9P0 | Normal Duty | 7.5 | 1321-3R12-C ⁽²⁾ | 1321-3RA12-C ⁽²⁾ | 1321-3R12-C ⁽²⁾ | 1321-3RA12-C ⁽²⁾ |
| 20AE011 | Heavy Duty | 7.5 | 1321-3R12-C ⁽²⁾ | 1321-3RA12-C ⁽²⁾ | 1321-3R12-C | 1321-3RA12-C |
| 20AE011 | Normal Duty | 10 | 1321-3R12-C | 1321-3RA12-C | 1321-3R12-C | 1321-3RA12-C |
| 20AE017 | Heavy Duty | 10 | 1321-3R12-C | 1321-3RA12-C | 1321-3R18-C | 1321-3RA18-C |
| 20AE017 | Normal Duty | 15 | 1321-3R18-C | 1321-3RA18-C | 1321-3R18-C | 1321-3RA18-C |
| 20AE022 | Heavy Duty | 15 | 1321-3R18-C | 1321-3RA18-C | 1321-3R25-C ⁽²⁾ | 1321-3RA25-C ⁽²⁾ |
| 20AE022 | Normal Duty | 20 | 1321-3R25-C ⁽²⁾ | 1321-3RA25-C ⁽²⁾ | 1321-3R25-C ⁽²⁾ | 1321-3RA25-C ⁽²⁾ |
| 20AE027 | Heavy Duty | 20 | 1321-3R25-C ⁽²⁾ | 1321-3RA25-C ⁽²⁾ | 1321-3R35-C ⁽²⁾ | 1321-3RA35-C ⁽²⁾ |
| 20AE027 | Normal Duty | 25 | 1321-3R35-C ⁽²⁾ | 1321-3RA35-C ⁽²⁾ | 1321-3R35-C ⁽²⁾ | 1321-3RA35-C ⁽²⁾ |
| 20AE032 | Heavy Duty | 25 | 1321-3R35-C ⁽²⁾ | 1321-3RA35-C ⁽²⁾ | 1321-3R35-C ⁽²⁾ | 1321-3RA35-C ⁽²⁾ |
| 20AE032 | Normal Duty | 30 | 1321-3R35-C ⁽²⁾ | 1321-3RA35-C ⁽²⁾ | 1321-3R35-C ⁽²⁾ | 1321-3RA35-C ⁽²⁾ |
| 20AE041 | Heavy Duty | 30 | 1321-3R35-C ⁽²⁾ | 1321-3RA35-C ⁽²⁾ | 1321-3R45-C | 1321-3RA45-C |
| 20AE041 | Normal Duty | 40 | 1321-3R45-C | 1321-3RA45-C | 1321-3R45-C | 1321-3RA45-C |
| 20AE052 | Heavy Duty | 40 | 1321-3R45-C | 1321-3RA45-C | 1321-3R55-C | 1321-3RA55-C |
| 20AE052 | Normal Duty | 50 | 1321-3R55-C | 1321-3RA55-C | 1321-3R55-C | 1321-3RA55-C |

(1) Input line reactors were sized based on the NEC fundamental motor amps. Output line reactors were sized based on the VFD rated output currents.

(2) 4% impedance.

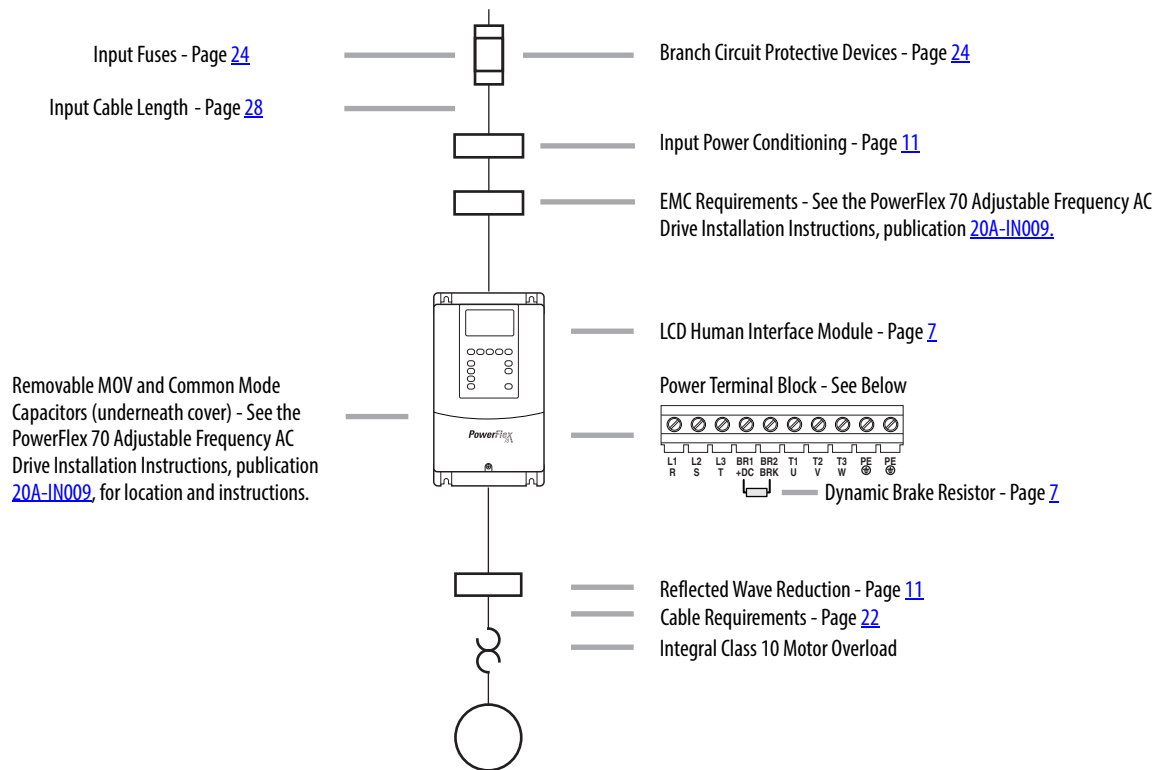
Installation Considerations

Power Wiring

The PowerFlex 70 has the following built in protective features to help simplify installation:

- Ground fault protection during start-up and running helps ensure reliability
- 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 an ungrounded, high-resistance or B phase grounded distribution system. These devices must also be disconnected if a regenerative unit is used as a bus supply or brake.
- 6kV transient protection 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 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 cables types.



Terminal Blocks

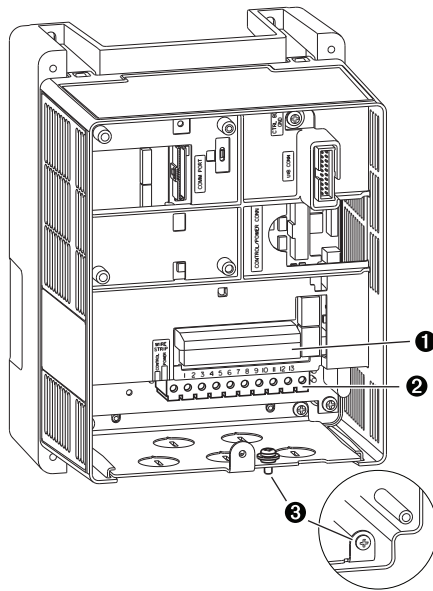
Terminal Block Specifications

| No. | Name | Description | Frame | Wire Size Range ⁽¹⁾ | | Torque | |
|-----|----------------------|--------------------------------------|-------------|--------------------------------|----------------------------|------------------|--------------------------|
| | | | | Max, mm ² (AWG) | Min, mm ² (AWG) | Max, N•m (lb•in) | Recommended, N•m (lb•in) |
| ❶ | I/O terminal block | Signal and control connections | All | 1.5 (16) | 0.05 (30) | 0.55 (4.9) | 0.5 (4.4) |
| ❷ | Power terminal block | Input power and motor connections | A, B, and C | 3.5 (12) | 0.3 (22) | 0.66 (5.5) | 0.6 (5) |
| | | | D | 8.4 (8) | 0.8 (18) | 1.7 (15) | 1.4 (12) |
| | | | E | 25.0 (3) | 2.5 (14) | 2.71 (24) | 2.71 (24) |
| ❸ | SHLD terminal | Terminating point for wiring shields | All | — | — | 1.6 (14) | 1.6 (14) |

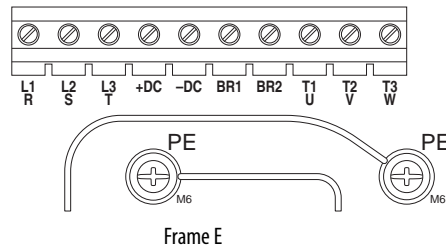
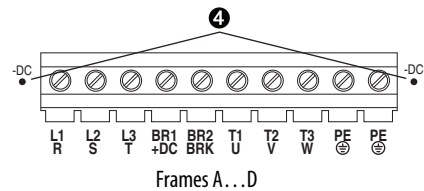
(1) Maximum/minimum sizes that the terminal block accepts - these are not recommendations.

| Terminal | Description | Notes |
|----------|------------------------|--|
| BR1 | DC brake (+) | DB resistor connection - Important: Do not connect both an internal and external DB resistor at the same time. This can violate the minimum allowed DB resistance and cause drive damage. |
| BR2 | DC brake (-) | |
| +DC | DC bus (+) | ❹ Test point on Frames A...D on the left or right of the power terminal block. Frame E has a dedicated terminal. |
| -DC | DC bus (-) | |
| PE | PE ground | |
| U, V, W | U (T1), V (T2), W (T3) | To the motor |
| R, S, T | R (L1), S (L2), T (L3) | AC line input power |

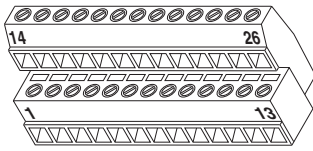
Typical Terminal Block Location



Power Terminals



Control Terminals



| No. | Signal | Factory Default | Description | Related Param. |
|-----|-------------------------------------|--|---|----------------|
| 1 | Digital In 1 | Stop – CF (CF = clear fault) | 11.2 mA at 24V DC | 361...366 |
| 2 | Digital In 2 | Start | 19.2V minimum on state | |
| 3 | Digital In 3 | Auto/Man | 3.2V maximum off state | |
| 4 | Digital In 4 | Speed Sel 1 | Important: Use only 24V DC, not suitable for 115V AC circuitry. ⁽³⁾ | |
| 5 | Digital In 5 | Speed Sel 2 | Inputs can be wired as sink or source. | |
| 6 | Digital In 6 | Speed Sel 3 | | |
| 7 | 24V Common | – | Drive supplied power for digital In1...6 inputs only. | |
| 8 | Digital In Common | – | Not intended for use on circuits outside of the drive. | |
| 9 | +24V DC | – | See examples beginning on page 21 . 150 mA maximum load. | |
| 10 | +10V Pot Reference | – | 2 k Ω minimum load. | |
| 11 | Digital Out 1 – N.O. ⁽¹⁾ | NOT Fault | <u>Max Resistive Load</u> 250V AC / 30V DC 50 VA / 60 Watts | 380...387 |
| 12 | Digital Out 1 Common | | <u>Max Inductive Load</u> 250V AC / 30V DC 25 VA / 30 Watts | |
| 13 | Digital Out 1 – N.C. ⁽¹⁾ | Fault | <u>Minimum DC Load</u> 10 μ A, 10 mV DC | |
| 14 | Analog In 1 (– Volts) | ⁽²⁾ Voltage – Reads value at 14 & 15 | Non-isolated, 0...10V, 10 bit, 100 k Ω input impedance. ⁽⁴⁾ | 320...327 |
| 15 | Analog In 1 (+ Volts) | | Non-isolated, 4...20 mA, 10 bit, 100 Ω input impedance. ⁽⁴⁾ | |
| 16 | Analog In 1 (– Current) | ⁽²⁾ Voltage – Reads value at 18 & 19 | Isolated, bipolar, differential, 0...10V unipolar (10 bit) or \pm 10V bipolar (10 bit and sign), 100 k Ω input impedance. ⁽⁵⁾ | |
| 17 | Analog In 1 (+ Current) | | Isolated, 4...20mA, 10 bit and sign, 100 Ω input impedance. ⁽⁵⁾ | |
| 18 | Analog In 2 (– Volts) | | | |
| 19 | Analog In 2 (+ Volts) | | | |
| 20 | Analog In 2 (– Current) | | | |
| 21 | Analog In 2 (+ Current) | | | |
| 22 | 10V Pot Common | ⁽²⁾ Output Freq | 0...10V, 10 bit, 10 k Ω (2 k Ω minimum) load. | 340...344 |
| | Analog Out (– Volts) | | 0...20 mA, 10 bit, 400 Ω maximum load. ⁽⁶⁾ | |
| | Analog Out (– Current) | | Referenced to chassis ground. | |
| 23 | Analog Out (+ Volts) | | Common if internal 10V supply (terminal 10) is used. | |
| | Analog Out (+ Current) | | | |
| 24 | Digital Out 2 – N.O. ⁽¹⁾ | Run | See description at No.s 11-13. | 380...387 |
| 25 | Digital Out 2 Common | | | |
| 26 | Digital Out 2 – N.C. ⁽¹⁾ | NOT Run | | |

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

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

(3) For use with 115V AC circuitry. A 115V AC interface option (AK-M9-115VAC-1) must be used

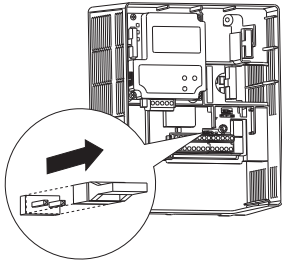
(4) Differential isolation - external source must be less than 10V with respect to PE.

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

(6) Analog output current is only available with enhanced control drives.

Hardware Enable Circuitry (enhanced control only)

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



1. Remove drive cover.
2. Locate and remove the enable jumper on the main control board.
3. Wire the enable input to Digital In 6.
4. Verify that 366 [Digital In6 Sel] is set to option 1 Enable.

Safe Off Board Terminal Block (enhanced control only)

| No. | Signal | Description |
|-----|----------------|--|
| 1 | Monitor - N.C. | Normally closed contacts for monitoring relay status. |
| 2 | Common - N.C. | Maximum resistive load: 250V ac / 30V dc / 50 VA / 60 Watts Maximum inductive load: 250V ac / 30V dc / 25 VA / 30 Watts |
| 3 | +24V DC | Connections for user supplied power to energize coil. |
| 4 | 24V common | |

Connection Examples

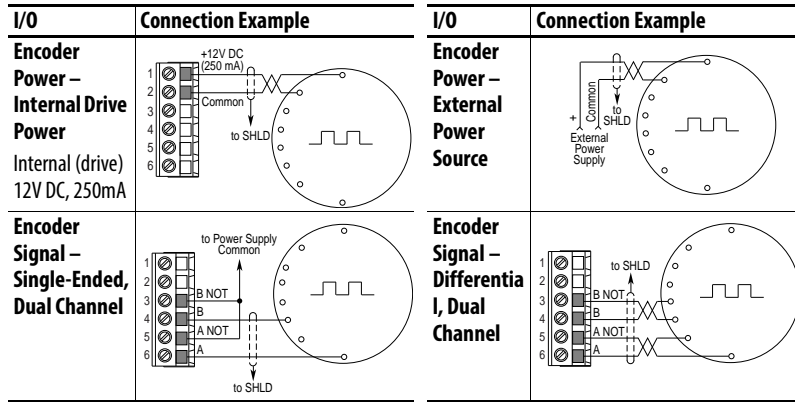
For detailed connection examples refer to the DriveGuard Safe Torque Off Option (Series B) for PowerFlex 40P and PowerFlex 70 Enhanced Control AC Drives User Manual, publication [PFLEX-UM003](#).

Encoder Interface Terminal Block (enhanced control only)

| No. | Signal | Description | Jumper Settings |
|-----|------------------------------|---|-----------------|
| 1 | 5...12V power ⁽¹⁾ | Internal power source 250 mA (isolated) | |
| 2 | Power return | | |
| 3 | Encoder B (NOT) | Single channel or quadrature B input. | |
| 4 | Encoder B | | |
| 5 | Encoder A (NOT) | Single channel or quadrature A input. | |
| 6 | Encoder A | | |

(1) Jumper selectable +5...12V is available on 20A-ENC-1 encoder boards.

Sample Encoder Wiring



EMC Filters

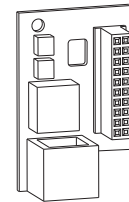
| Description | Frame | Factory Installed (Position 13) |
|-------------------------------------|---------|---------------------------------|
| Internal 3-phase 200...480 filter ❶ | B, C, D | A |

❶ Standard on Frames C and D. Optional on Frame B (Frame A ratings increase to Frame B).

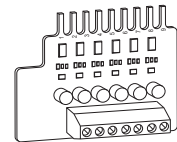
Other Options

| Description | Catalog No. | Factory Installed | |
|----------------------------|------------------|-------------------|-----------------------------|
| | | User Installed | (Position 15) (Position 16) |
| Service connection board ❷ | SK-M9-SCB1 | N/A | N/A |
| 115 V AC interface card | AK-M9-115VAC-1 | N/A | N/A |
| Frame E flange gasket | AK-M9-GASKET1-E4 | N/A | N/A |

❷ Provides temporary DPI/HIM connection for NEMA 1 and flange drives with cover removed.

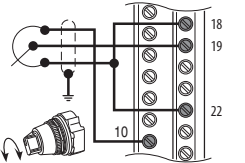
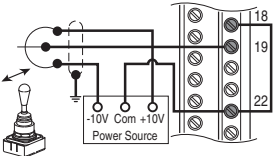
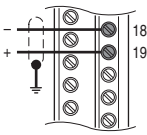
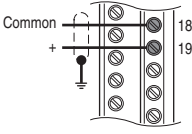
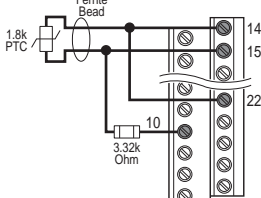
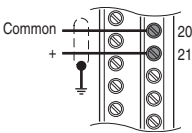
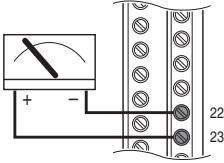
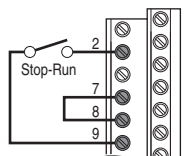


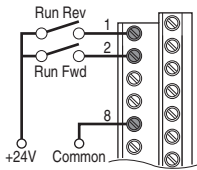
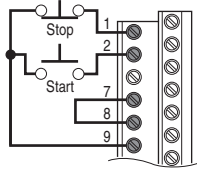
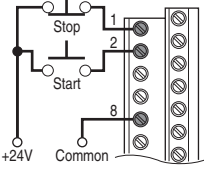
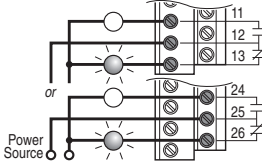
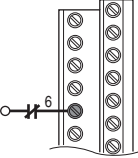
Service Connection Board SK-M9-SCB1



115V Interface Card AK-M9-115VAC-1

I/O Wiring Examples

| Input/Output | Connection Example | Required Parameter Settings |
|---|--|--|
| Potentiometer Unipolar Speed Reference 10 kΩ Pot. Recommended (2 kΩ minimum) |  | Select Speed Reference source: Param. 090 = 1 "Analog In 2" Adjust Scaling: Param. 091, 092, 322, 323 Check Results: Param. 016 |
| Joystick Bipolar Speed Reference ±10V Input |  | Set Direction Mode: Param. 190 = 1 "Bipolar" Adjust Scaling: Param. 091, 092, 325, 326 Check Results: Param. 017 |
| Analog Input Bipolar Speed Reference ±10V Input |  | Adjust Scaling: Param. 091, 092, 325, 326 Check Results: Param. 017 |
| Analog Input Unipolar Speed Reference 0 to +10V Input |  | Adjust Scaling: Param. 091, 092, 325, 326 Check Results: Param. 017 |
| Analog Input, PTC PTC OT set > 5V PTC OT cleared < 4V PTC Short < 0.2V |  | Set Fault Config 1: Param. 238, Bit #7 = 1 "Enabled" Set Alarm Config 1: Param. 259, Bit #11 = 1 "Enabled" |
| Analog Input Unipolar Speed Reference 4-20 mA Input |  | Configure Input for Current: Param. 320, Bit #1 = 1 "Current" Adjust Scaling: Param. 091, 092, 325, 326 Check Results: Param. 017 |
| Analog Output Unipolar 0 to +10V Output. Can Drive a 2 kΩ load (25 mA short circuit limit) |  | Select Source Value: Param. 342 Adjust Scaling: Param. 343, 344 |
| 2 Wire Control Non-Reversing | Internal Supply  | Disable Digital Input 1: Param. 361 = 0 "Not Used" Set Digital Input 2: Param. 362 = 7 "Run" |

| Input/Output | Connection Example | Required Parameter Settings |
|--|--|---|
| 2 Wire Control Reversing | External Supply  | Set Digital Input 1: Param. 361 = 8 "Run Forward" Set Digital Input 2: Param. 362 = 9 "Run Reverse" |
| 3 Wire Control | Internal Supply  | Use factory default parameter settings. |
| 3 Wire Control | External Supply  | Use factory default parameter settings. |
| Digital Output Form C Relays Energized in Normal State. |  | Select Source: Param. 380, 384 |
| Enable Input Shown in enabled state. |  | Standard Control Configure with parameter 366 Enhanced Control Configure with parameter 366 For dedicated hardware Enable: Remove Enable Jumper (ENBL JMP) on the Main Control Board. |

Cable Recommendations

Cable Types Acceptable for 200...600V Installations

A variety of cable types are acceptable for drive installations. For many installations, unshielded cable is adequate, provided it can be separated from sensitive circuits. As an approximate guide, allow a spacing of 0.3 m (1 ft) for every 10 m (32.8 ft) of length. In all cases, long parallel runs must be avoided. Do not use cable with an insulation thickness less than or equal to 15 mils (0.4mm/0.015 in.). Use copper wire only. Wire gauge requirements and recommendations are based on 75 °C (167 °F). Do not reduce wire gauge when using higher temperature wire. See [Table 7 on page 23](#).

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 cannot 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. Use shielded cable in installations with sensitive equipment such as weigh scales, capacitive proximity switches and other devices that can be affected by electrical noise in the distribution system. Applications with large numbers of drives in a similar location, imposed EMC regulations or a high degree of communications/ networking are also good candidates for shielded cable.

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

Follow all best practices required for the installation environment, including temperature, flexibility, moisture characteristics, and chemical resistance. In addition, use a braided shield that is 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 XLPE insulated conductors with a 100% coverage foil and an 85% coverage copper braided shield (with drain wire) surrounded by a PVC jacket.

Other types of shielded cable are available, but the selection of these types can limit the allowable cable length. Particularly, some of the newer cables bundle four 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.

Table 7 - Cable Type Recommendations

| Location | Rating/Type | Description |
|----------------------------------|---|---|
| Standard (Option 1) | 600V, 90°C (194°F) XHHW2/RHW-2 Anixter B209500-B209507, Belden 29501-29507, or equivalent | <ul style="list-style-type: none"> Four tinned copper conductors with 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 0LF-7xxxx or equivalent | <ul style="list-style-type: none"> Three tinned copper conductors with XLPE insulation. 5 mil single helical copper tape (25% overlap min.) with three bare copper grounds in contact with shield. PVC jacket. |
| Class I & II; Division I & II | Tray rated 600V, 90°C (194°F) RHH/RHW-2 Anixter 7V-7xxxx-3G or equivalent | <ul style="list-style-type: none"> Three bare copper conductors with XLPE insulation and impervious corrugated continuously welded aluminum armor. Black sunlight resistant PVC jacket overall. Three copper grounds on #10 AWG and smaller. |

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 Ratings and Branch Circuit Protection

See [Table 8](#) through [Table 13](#) for power ratings and branch circuit protection information.

Single-phase Input Power

The PowerFlex 70 drive is typically used with a three-phase input supply. Single-phase operation of the drive is not currently rated under the UL 508C listing. Rockwell Automation has verified that single-phase operation with output current derated by 50% of the three-phase ratings identified in [Table 11](#) through [Table 13](#).

Table 8 - 208/240 Volt AC Three-phase Input Drive Ratings and Input Protection Devices

| Cat.No. | Frame ⁽¹⁾ | Hp Rating | | Input Ratings | | Output Amps | | | Dual Element Time Delay Fuse | | Non-time Delay Fuse | | Circuit Breaker ⁽⁴⁾ | Motor Circuit Protector ⁽⁶⁾ | 140M Motor Protector with Adjustable Current Range ^{(7) (8)} | | | |
|--------------------------|----------------------|-----------|------|---------------|------|-------------|--------|--------|------------------------------|--------------------|---------------------|--------------------|--------------------------------|--|---|--------------|--|------|
| | | ND | HD | Amps | kVA | Cont. | 1 Min. | 3 Sec. | Min ⁽²⁾ | Max ⁽³⁾ | Min ⁽²⁾ | Max ⁽³⁾ | Max ⁽⁵⁾ | Max ⁽⁵⁾ | Available Catalog Numbers ⁽⁹⁾ | | Minimum Enclosure Volume (in. ³) ⁽¹⁰⁾ | |
| 208 Volt AC Input | | | | | | | | | | | | | | | | | | |
| 20AB2P2 | A | 0.5 | 0.33 | 2.9 | 1.1 | 2.5 | 2.7 | 3.7 | 6 | 6 | 6 | 10 | 15 | 7 | 140M-C2E-B40 | 140M-D8E-B40 | – | 3441 |
| 20AB4P2 | A | 1 | 0.75 | 5.6 | 2 | 4.8 | 5.5 | 7.4 | 10 | 10 | 10 | 17.5 | 15 | 7 | 140M-C2E-B63 | 140M-D8E-B63 | – | 3441 |
| 20AB6P8 | B | 2 | 1.5 | 10 | 3.6 | 7.8 | 10.3 | 13.8 | 15 | 15 | 15 | 30 | 30 | 15 | 140M-C2E-C10 | 140M-D8E-C10 | 140M-F8E-C10 | 3441 |
| 20AB9P6 | B | 3 | 2 | 14 | 5.1 | 11 | 12.1 | 16.5 | 20 | 25 | 20 | 40 | 40 | 30 | 140M-C2E-C16 | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AB015 | C | 5 | 3 | 16 | 5.8 | 17.5 | 19.2 | 26.6 | 20 | 35 | 20 | 70 | 70 | 30 | 140M-C2E-C20 | 140M-D8E-C20 | 140M-F8E-C20 | 3441 |
| 20AB022 | D | 7.5 | 5 | 23.3 | 8.3 | 25.3 | 27.8 | 37.9 | 30 | 50 | 30 | 100 | 100 | 30 | – | 140M-D8E-C25 | 140M-F8E-C25 | 5098 |
| 20AB028 | D | 10 | 7.5 | 29.8 | 10.7 | 32.2 | 37.9 | 50.6 | 40 | 70 | 40 | 125 | 125 | 50 | – | – | 140M-F8E-C32 | 5098 |
| 20AB042 | D | 15 | 10 | 39.8 | 14.3 | 43 | 55.5 | 74 | 60 | 100 | 60 | 175 | 175 | 70 | – | – | 140M-F8E-C45 | 5098 |
| 20AB054 | E | 20 | 15 | 57.5 | 20.7 | 62.1 | 72.4 | 96.6 | 80 | 125 | 80 | 200 | 200 | 100 | – | – | – | – |
| 20AB070 | E | 25 | 20 | 72.3 | 26.0 | 78.2 | 93.1 | 124 | 90 | 175 | 90 | 300 | 300 | 100 | – | – | – | – |
| 240 Volt AC Input | | | | | | | | | | | | | | | | | | |
| 20AB2P2 | A | 0.5 | 0.33 | 2.5 | 1.1 | 2.2 | 2.4 | 3.3 | 3 | 4.5 | 3 | 8 | 15 | 3 | 140M-C2E-B25 | 140M-D8E-B25 | – | 3441 |
| 20AB4P2 | A | 1 | 0.75 | 4.8 | 2 | 4.2 | 4.8 | 6.4 | 6 | 9 | 6 | 15 | 15 | 7 | 140M-C2E-B63 | 140M-D8E-B63 | – | 3441 |
| 20AB6P8 | B | 2 | 1.5 | 8.7 | 3.6 | 6.8 | 9 | 12 | 15 | 15 | 15 | 25 | 25 | 15 | 140M-C2E-C10 | 140M-D8E-C10 | 140M-F8E-C10 | 3441 |
| 20AB9P6 | B | 3 | 2 | 12.2 | 5.1 | 9.6 | 10.6 | 14.4 | 20 | 20 | 20 | 35 | 35 | 15 | 140M-C2E-C16 | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AB015 | C | 5 | 3 | 13.9 | 5.8 | 15.3 | 17.4 | 23.2 | 20 | 30 | 20 | 60 | 60 | 30 | 140M-C2E-C16 | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AB022 | D | 7.5 | 5 | 19.9 | 8.3 | 22 | 24.4 | 33 | 25 | 45 | 25 | 80 | 80 | 30 | – | 140M-D8E-C25 | 140M-F8E-C25 | 5098 |
| 20AB028 | D | 10 | 7.5 | 25.7 | 10.7 | 28 | 33 | 44 | 35 | 60 | 35 | 110 | 110 | 50 | – | – | 140M-F8E-C32 | 5098 |
| 20AB042 | D | 15 | 10 | 38.7 | 16.1 | 42 | 46.2 | 63 | 50 | 90 | 50 | 150 | 150 | 50 | – | – | 140M-F8E-C45 | 5098 |
| 20AB054 | E | 20 | 15 | 49.8 | 20.7 | 54 | 63 | 84 | 60 | 100 | 60 | 200 | 200 | 100 | – | – | – | – |
| 20AB070 | E | 25 | 20 | 64.5 | 26.8 | 70 | 81 | 108 | 90 | 150 | 90 | 275 | 275 | 100 | – | – | – | – |

See [page 27](#) for notes.

Table 9 - 400/480 Volt AC Three-phase Input Drive Ratings and Input Protection Devices

| Cat.No. | Frame (1) | Hp Rating | | Input Ratings | | Output Amps | | | Dual Element Time Delay Fuse | | Non-time Delay Fuse | | Circuit Breaker (4) | Motor Circuit Protector (6) | 140M Motor Protector with Adjustable Current Range (7) (8) | | | |
|--------------------------|-----------|-----------|------|---------------|------|-------------|--------|--------|------------------------------|---------|---------------------|---------|---------------------|-----------------------------|--|--------------|--------------------------------------|------|
| | | ND | HD | Amps | kVA | Cont. | 1 Min. | 3 Sec. | Min (2) | Max (3) | Min (2) | Max (3) | Max (5) | Max (5) | Available Catalog Numbers (9) | | Minimum Enclosure Volume (in.³) (10) | |
| 400 Volt AC Input | | | | | | | | | | | | | | | | | | |
| 20AC1P3 | A | 0.37 | 0.25 | 1.6 | 1.1 | 1.3 | 1.4 | 1.9 | 3 | 3 | 3 | 5 | 15 | 3 | 140M-C2E-B16 | – | – | 3441 |
| 20AC2P1 | A | 0.75 | 0.55 | 2.5 | 1.8 | 2.1 | 2.4 | 3.2 | 4 | 6 | 4 | 8 | 15 | 7 | 140M-C2E-B25 | 140M-D8E-B25 | – | 3441 |
| 20AC3P5 | A | 1.5 | 1.1 | 4.3 | 3 | 3.5 | 4.5 | 6 | 6 | 6 | 6 | 12 | 15 | 7 | 140M-C2E-B63 | 140M-D8E-B63 | – | 3441 |
| 20AC5P0 | B | 2.2 | 1.5 | 6.5 | 4.5 | 5 | 5.5 | 7.5 | 10 | 10 | 10 | 20 | 20 | 15 | 140M-C2E-C10 | 140M-D8E-C10 | 140M-F8E-C10 | 3441 |
| 20AC8P7 | B | 4 | 3 | 11.3 | 7.8 | 8.7 | 9.9 | 13.2 | 15 | 17.5 | 15 | 30 | 30 | 15 | 140M-C2E-C16 | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AC011 | C | 5.5 | 4 | 10.5 | 7.6 | 11.5 | 13 | 17.4 | 15 | 25 | 15 | 45 | 40 | 15 | 140M-C2E-C16 | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AC015 | C | 7.5 | 5.5 | 15.1 | 10.4 | 15.4 | 17.2 | 23.1 | 20 | 30 | 20 | 60 | 60 | 20 | 140M-C2E-C16 | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AC022 | D | 11 | 7.5 | 21.9 | 15.2 | 22 | 24.2 | 33 | 30 | 45 | 30 | 80 | 80 | 30 | – | 140M-D8E-C25 | 140M-F8E-C25 | 5098 |
| 20AC030 | D | 15 | 11 | 30.3 | 21 | 30 | 33 | 45 | 40 | 60 | 40 | 120 | 120 | 50 | – | – | 140M-F8E-C32 | 5098 |
| 20AC037 | D | 18.5 | 15 | 35 | 24.3 | 37 | 45 | 60 | 50 | 80 | 50 | 125 | 140 | 50 | – | – | 140M-F8E-C45 | 5098 |
| 20AC043 | D | 22 | 18.5 | 40.7 | 28.2 | 43 | 56 | 74 | 60 | 90 | 60 | 150 | 160 | 70 | – | – | – | – |
| 20AC060 | E | 30 | 22 | 56.8 | 39.3 | 60 | 66 | 90 | 80 | 125 | 80 | 225 | 240 | 80 | – | – | – | – |
| 20AC072 | E | 37 | 30 | 68.9 | 47.8 | 72 | 90 | 120 | 90 | 150 | 90 | 250 | 280 | 100 | – | – | – | – |
| 480 Volt AC Input | | | | | | | | | | | | | | | | | | |
| 20AD1P1 | A | 0.5 | 0.33 | 1.3 | 1.1 | 1.2 | 1.6 | 3 | 3 | 3 | 4 | 15 | 3 | 3 | 140M-C2E-B16 | – | – | 3441 |
| 20AD2P1 | A | 1 | 0.75 | 2.4 | 2 | 2.1 | 2.4 | 3.2 | 3 | 6 | 3 | 8 | 15 | 3 | 140M-C2E-B25 | 140M-D8E-B25 | – | 3441 |
| 20AD3P4 | A | 2 | 1.5 | 3.8 | 3.2 | 3.4 | 4.5 | 6 | 6 | 6 | 12 | 15 | 7 | 7 | 140M-C2E-B40 | 140M-D8E-B40 | – | 3441 |
| 20AD5P0 | B | 3 | 2 | 5.6 | 4.7 | 5 | 5.5 | 7.5 | 10 | 10 | 10 | 20 | 20 | 15 | 140M-C2E-B63 | 140M-D8E-B63 | – | 3441 |
| 20AD8P0 | B | 5 | 3 | 9.8 | 8.4 | 8 | 8.8 | 12 | 15 | 15 | 30 | 30 | 15 | 15 | 140M-C2E-C10 | 140M-D8E-C10 | 140M-F8E-C10 | 3441 |
| 20AD011 | C | 7.5 | 5 | 9.4 | 7.9 | 11 | 12.1 | 16.5 | 15 | 20 | 15 | 40 | 40 | 15 | 140M-C2E-C16 | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AD014 | C | 10 | 7.5 | 12.4 | 10.4 | 14 | 16.5 | 22 | 20 | 30 | 20 | 50 | 50 | 20 | 140M-C2E-C16 | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AD022 | D | 15 | 10 | 19.9 | 16.6 | 22 | 24.2 | 33 | 25 | 45 | 25 | 80 | 80 | 30 | – | 140M-D8E-C25 | 140M-F8E-C25 | 5098 |
| 20AD027 | D | 20 | 15 | 24.8 | 20.6 | 27 | 33 | 44 | 35 | 60 | 35 | 100 | 100 | 50 | – | – | 140M-F8E-C32 | 5098 |
| 20AD034 | D | 25 | 20 | 31.2 | 25.9 | 34 | 40.5 | 54 | 40 | 70 | 40 | 125 | 125 | 50 | – | – | 140M-F8E-C45 | 5098 |
| 20AD040 | D | 30 | 25 | 36.7 | 30.5 | 40 | 51 | 68 | 50 | 90 | 50 | 150 | 150 | 50 | – | – | 140M-F8E-C45 | 5098 |
| 20AD052 | E | 40 | 30 | 47.7 | 39.7 | 52 | 60 | 80 | 60 | 110 | 60 | 200 | 200 | 70 | – | – | – | – |
| 20AD065 | E | 50 | 40 | 59.6 | 49.6 | 65 | 78 | 104 | 80 | 125 | 80 | 250 | 250 | 100 | – | – | – | – |

See page 27 for notes.

Table 10 - 600 Volt AC Three-phase Input Drive Ratings and Input Protection Devices

| Cat.No. | Frame (1) | Hp Rating | | Input Ratings | | Output Amps | | | Dual Element Time Delay Fuse | | Non-time Delay Fuse | | Circuit Breaker (4) | Motor Circuit Protector (6) | 140M Motor Protector with Adjustable Current Range (7) (8) | | | |
|--------------------------|-----------|-----------|------|---------------|------|-------------|--------|--------|------------------------------|---------|---------------------|---------|---------------------|-----------------------------|--|--------------|--------------------------------------|------|
| | | ND | HD | Amps | kVA | Cont. | 1 Min. | 3 Sec. | Min (2) | Max (3) | Min (2) | Max (3) | Max (5) | Max (5) | Available Catalog Numbers (9) | | Minimum Enclosure Volume (in.³) (10) | |
| 600 Volt AC Input | | | | | | | | | | | | | | | | | | |
| 20AE0P9 | A | 0.5 | 0.33 | 1.3 | 1.3 | 0.9 | 1.1 | 1.4 | 3 | 3 | 3 | 3.5 | 15 | 3 | 140M-C2E-B16 | – | – | 3441 |
| 20AE1P7 | A | 1 | 0.75 | 1.9 | 2 | 1.7 | 2 | 2.6 | 3 | 6 | 3 | 6 | 15 | 3 | 140M-C2E-B25 | 140M-D8E-B25 | – | 3441 |
| 20AE2P7 | A | 2 | 1.5 | 3 | 3.1 | 2.7 | 3.6 | 4.8 | 4 | 6 | 4 | 10 | 15 | 7 | 140M-C2E-B40 | 140M-D8E-B40 | – | 3441 |
| 20AE3P9 | B | 3 | 2 | 4.4 | 4.5 | 3.9 | 4.3 | 5.9 | 6 | 8 | 6 | 15 | 15 | 7 | – | 140M-D8E-B63 | – | 3441 |
| 20AE6P1 | B | 5 | 3 | 7.5 | 7.8 | 6.1 | 6.7 | 9.2 | 10 | 12 | 10 | 20 | 20 | 15 | – | 140M-D8E-C10 | 140M-F8E-C10 | 3441 |
| 20AE9P0 | C | 7.5 | 5 | 7.7 | 8 | 9 | 9.9 | 13.5 | 10 | 20 | 10 | 35 | 35 | 15 | – | 140M-D8E-C10 | 140M-F8E-C10 | 3441 |
| 20AE011 | C | 10 | 7.5 | 9.8 | 10.1 | 11 | 13.5 | 18 | 15 | 20 | 15 | 40 | 40 | 15 | – | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AE017 | D | 15 | 10 | 15.3 | 15.9 | 17 | 18.7 | 25.5 | 20 | 35 | 20 | 60 | 60 | 30 | – | – | 140M-F8E-C20 | 5098 |
| 20AE022 | D | 20 | 15 | 20 | 20.8 | 22 | 25.5 | 34 | 25 | 45 | 25 | 80 | 80 | 30 | – | – | 140M-F8E-C25 | 5098 |
| 20AE027 | D | 25 | 20 | 24.8 | 25.7 | 27 | 33 | 44 | 35 | 60 | 35 | 100 | 100 | 50 | – | – | 140M-F8E-C25 | 5098 |
| 20AE032 | D | 30 | 25 | 29.4 | 30.5 | 32 | 40.5 | 54 | 40 | 70 | 40 | 125 | 125 | 50 | – | – | 140M-F8E-C32 | 5098 |
| 20AE041 | E | 40 | 30 | 37.6 | 39.1 | 41 | 48 | 64 | 50 | 90 | 50 | 150 | 150 | 100 | – | – | – | – |
| 20AE052 | E | 50 | 40 | 47.7 | 49.6 | 52 | 61.5 | 82 | 60 | 110 | 60 | 200 | 200 | 100 | – | – | – | – |

See page 27 for notes.

Table 11 - 208/240 Volt AC Single-phase Input Drive Ratings and Input Protection Devices

| Cat.No. | Frame (1) | Hp Rating | | Input Ratings | | Output Amps | | | Dual Element Time Delay Fuse | | Non-time Delay Fuse | | Circuit Breaker (4) | Motor Circuit Protector (6) | 140M Motor Protector with Adjustable Current Range (7) (8) | | | |
|--------------------------|-----------|-----------|------|---------------|------|-------------|--------|--------|------------------------------|---------|---------------------|---------|---------------------|-----------------------------|--|--------------|---------------------------------------|------|
| | | ND | HD | Amps | kVA | Cont. | 1 Min. | 3 Sec. | Min (2) | Max (3) | Min (2) | Max (3) | Max (5) | Max (5) | Available Catalog Numbers (9) | | Minimum Enclosure Volume (in. 3) (10) | |
| 208 Volt AC Input | | | | | | | | | | | | | | | | | | |
| 20AB2P2 | A | 0.5 | 0.33 | 2.9 | 0.6 | 1.3 | 1.6 | 1.9 | 6 | 6 | 6 | 10 | 15 | 7 | 140M-C2E-B40 | 140M-D8E-B40 | - | 3441 |
| 20AB4P2 | A | 1 | 0.75 | 5.6 | 1 | 2.4 | 2.8 | 3.7 | 10 | 10 | 10 | 17.5 | 15 | 7 | 140M-C2E-B63 | 140M-D8E-B63 | - | 3441 |
| 20AB6P8 | B | 2 | 1.5 | 10 | 1.8 | 3.9 | 5.2 | 6.9 | 15 | 15 | 15 | 30 | 30 | 15 | 140M-C2E-C10 | 140M-D8E-C10 | 140M-F8E-C10 | 3441 |
| 20AB9P6 | B | 3 | 2 | 14 | 2.6 | 5.5 | 6.1 | 8.3 | 20 | 25 | 20 | 40 | 40 | 30 | 140M-C2E-C16 | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AB015 | C | 5 | 3 | 16 | 2.9 | 8.6 | 9.6 | 13.3 | 20 | 35 | 20 | 70 | 70 | 30 | 140M-C2E-C20 | 140M-D8E-C20 | 140M-F8E-C20 | 3441 |
| 20AB022 | D | 7.5 | 5 | 23.3 | 4.2 | 12.7 | 13.9 | 19.0 | 30 | 50 | 30 | 100 | 100 | 30 | - | 140M-D8E-C25 | 140M-F8E-C25 | 5098 |
| 20AB028 | D | 10 | 7.5 | 29.8 | 5.4 | 16.1 | 19 | 25.3 | 40 | 70 | 40 | 125 | 125 | 50 | - | - | 140M-F8E-C32 | 5098 |
| 20AB042 | D | 15 | 10 | 39.8 | 7.2 | 21.5 | 27.8 | 37 | 60 | 100 | 60 | 175 | 175 | 70 | - | - | 140M-F8E-C45 | 5098 |
| 20AB054 | E | 20 | 15 | 57.5 | 10.4 | 31.1 | 36.2 | 48.3 | 80 | 125 | 80 | 200 | 200 | 100 | - | - | - | - |
| 20AB070 | E | 25 | 20 | 72.3 | 13.0 | 39.1 | 46.6 | 62 | 90 | 175 | 90 | 300 | 300 | 100 | - | - | - | - |
| 240 Volt AC Input | | | | | | | | | | | | | | | | | | |
| 20AB2P2 | A | 0.5 | 0.33 | 2.5 | 0.6 | 1.1 | 1.2 | 1.7 | 3 | 4.5 | 3 | 8 | 15 | 3 | 140M-C2E-B25 | 140M-D8E-B25 | - | 3441 |
| 20AB4P2 | A | 1 | 0.75 | 4.8 | 1 | 2.1 | 2.4 | 3.2 | 6 | 9 | 6 | 15 | 15 | 7 | 140M-C2E-B63 | 140M-D8E-B63 | - | 3441 |
| 20AB6P8 | B | 2 | 1.5 | 8.7 | 1.8 | 3.4 | 4.5 | 6 | 15 | 15 | 15 | 25 | 25 | 15 | 140M-C2E-C10 | 140M-D8E-C10 | 140M-F8E-C10 | 3441 |
| 20AB9P6 | B | 3 | 2 | 12.2 | 2.6 | 4.8 | 5.3 | 7.2 | 20 | 20 | 20 | 35 | 35 | 15 | 140M-C2E-C16 | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AB015 | C | 5 | 3 | 13.9 | 2.9 | 7.7 | 8.7 | 11.6 | 20 | 30 | 20 | 60 | 60 | 30 | 140M-C2E-C16 | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AB022 | D | 7.5 | 5 | 19.9 | 4.2 | 11 | 12.2 | 16.5 | 25 | 45 | 25 | 80 | 80 | 30 | - | 140M-D8E-C25 | 140M-F8E-C25 | 5098 |
| 20AB028 | D | 10 | 7.5 | 25.7 | 5.4 | 14 | 16.5 | 22 | 35 | 60 | 35 | 110 | 110 | 50 | - | - | 140M-F8E-C32 | 5098 |
| 20AB042 | D | 15 | 10 | 38.7 | 8.1 | 21 | 23.1 | 31.5 | 50 | 90 | 50 | 150 | 150 | 50 | - | - | 140M-F8E-C45 | 5098 |
| 20AB054 | E | 20 | 15 | 49.8 | 10.4 | 27 | 31.5 | 42 | 60 | 100 | 60 | 200 | 200 | 100 | - | - | - | - |
| 20AB070 | E | 25 | 20 | 64.5 | 13.4 | 35 | 40.5 | 54 | 90 | 150 | 90 | 275 | 275 | 100 | - | - | - | - |

See page 27 for notes.

Table 12 - 400/480 Volt AC Single-phase Input Drive Ratings and Input Protection Devices

| Cat.No. | Frame (1) | Hp Rating | | Input Ratings | | Output Amps | | | Dual Element Time Delay Fuse | | Non-time Delay Fuse | | Circuit Breaker (4) | Motor Circuit Protector (6) | 140M Motor Protector with Adjustable Current Range (7) (8) | | | |
|--------------------------|-----------|-----------|------|---------------|------|-------------|--------|--------|------------------------------|---------|---------------------|---------|---------------------|-----------------------------|--|--------------|---------------------------------------|------|
| | | ND | HD | Amps | kVA | Cont. | 1 Min. | 3 Sec. | Min (2) | Max (3) | Min (2) | Max (3) | Max (5) | Max (5) | Available Catalog Numbers (9) | | Minimum Enclosure Volume (in. 3) (10) | |
| 400 Volt AC Input | | | | | | | | | | | | | | | | | | |
| 20AC1P3 | A | 0.37 | 0.25 | 1.6 | 0.6 | 0.7 | 0.7 | 1.0 | 3 | 3 | 3 | 5 | 15 | 3 | 140M-C2E-B16 | - | - | 3441 |
| 20AC2P1 | A | 0.75 | 0.55 | 2.5 | 0.9 | 1.1 | 1.2 | 1.6 | 4 | 6 | 4 | 8 | 15 | 7 | 140M-C2E-B25 | 140M-D8E-B25 | - | 3441 |
| 20AC3P5 | A | 1.5 | 1.1 | 4.3 | 1.5 | 1.8 | 2.3 | 3 | 6 | 6 | 6 | 12 | 15 | 7 | 140M-C2E-B63 | 140M-D8E-B63 | - | 3441 |
| 20AC5P0 | B | 2.2 | 1.5 | 6.5 | 2.3 | 2.5 | 2.8 | 3.8 | 10 | 10 | 10 | 20 | 20 | 15 | 140M-C2E-C10 | 140M-D8E-C10 | 140M-F8E-C10 | 3441 |
| 20AC8P7 | B | 4 | 3 | 11.3 | 3.9 | 4.4 | 5.0 | 6.6 | 15 | 17.5 | 15 | 30 | 30 | 15 | 140M-C2E-C16 | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AC011 | C | 5.5 | 4 | 11 | 3.8 | 5.8 | 6.5 | 8.7 | 15 | 25 | 15 | 45 | 40 | 15 | 140M-C2E-C16 | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AC015 | C | 7.5 | 5.5 | 15.1 | 5.2 | 7.7 | 8.6 | 11.6 | 20 | 30 | 20 | 60 | 60 | 20 | 140M-C2E-C16 | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AC022 | D | 11 | 7.5 | 21.9 | 7.6 | 11 | 12.1 | 16.5 | 30 | 45 | 30 | 80 | 80 | 30 | - | 140M-D8E-C25 | 140M-F8E-C25 | 5098 |
| 20AC030 | D | 15 | 11 | 30.3 | 10.5 | 15 | 16.5 | 22.5 | 40 | 60 | 40 | 120 | 120 | 50 | - | - | 140M-F8E-C32 | 5098 |
| 20AC037 | D | 18.5 | 15 | 35 | 12.2 | 18.5 | 22.5 | 30 | 50 | 80 | 50 | 125 | 140 | 50 | - | - | 140M-F8E-C45 | 5098 |
| 20AC043 | D | 22 | 18.5 | 40.7 | 14.1 | 21.5 | 28 | 37 | 60 | 90 | 60 | 150 | 160 | 70 | - | - | - | - |
| 20AC060 | E | 30 | 22 | 56.8 | 19.7 | 30 | 33 | 45 | 80 | 125 | 80 | 225 | 240 | 80 | - | - | - | - |
| 20AC072 | E | 37 | 30 | 68.9 | 23.9 | 36 | 45 | 60 | 90 | 150 | 90 | 250 | 280 | 100 | - | - | - | - |
| 480 Volt AC Input | | | | | | | | | | | | | | | | | | |
| 20AD1P1 | A | 0.5 | 0.33 | 1.3 | 0.6 | 0.6 | 0.6 | 0.8 | 3 | 3 | 3 | 4 | 15 | 3 | 140M-C2E-B16 | - | - | 3441 |
| 20AD2P1 | A | 1 | 0.75 | 2.4 | 1 | 1.1 | 1.2 | 1.6 | 3 | 6 | 3 | 8 | 15 | 3 | 140M-C2E-B25 | 140M-D8E-B25 | - | 3441 |
| 20AD3P4 | A | 2 | 1.5 | 3.8 | 1.6 | 1.7 | 2.3 | 3 | 6 | 6 | 6 | 12 | 15 | 7 | 140M-C2E-B40 | 140M-D8E-B40 | - | 3441 |
| 20AD5P0 | B | 3 | 2 | 5.6 | 2.4 | 2.5 | 2.6 | 3.8 | 10 | 10 | 10 | 20 | 20 | 15 | 140M-C2E-B63 | 140M-D8E-B63 | - | 3441 |
| 20AD8P0 | B | 5 | 3 | 9.8 | 4.2 | 4 | 4.4 | 6 | 15 | 15 | 15 | 30 | 30 | 15 | 140M-C2E-C10 | 140M-D8E-C10 | 140M-F8E-C10 | 3441 |

Table 12 - 400/480 Volt AC Single-phase Input Drive Ratings and Input Protection Devices (continued)

| Cat. No. | Frame (1) | Hp Rating | | Input Ratings | | Output Amps | | | Dual Element Time Delay Fuse | | Non-time Delay Fuse | | Circuit Breaker (4) | Motor Circuit Protector (6) | 140M Motor Protector with Adjustable Current Range (7) (8) | | | |
|----------|-----------|-----------|-----|---------------|------|-------------|--------|--------|------------------------------|---------|---------------------|---------|---------------------|-----------------------------|--|--------------|---------------------------------------|------|
| | | ND | HD | Amps | kVA | Cont. | 1 Min. | 3 Sec. | Min (2) | Max (3) | Min (2) | Max (3) | Max (5) | Max (5) | Available Catalog Numbers (9) | | Minimum Enclosure Volume (in. 3) (10) | |
| 20AD011 | C | 7.5 | 5 | 9.5 | 4 | 5.5 | 6.1 | 8.3 | 15 | 20 | 15 | 40 | 40 | 15 | 140M-C2E-C16 | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AD014 | C | 10 | 7.5 | 12.5 | 5.2 | 7 | 8.3 | 11 | 20 | 30 | 20 | 50 | 50 | 20 | 140M-C2E-C16 | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AD022 | D | 15 | 10 | 19.9 | 8.3 | 11 | 12.1 | 16.5 | 25 | 45 | 25 | 80 | 80 | 30 | – | 140M-D8E-C25 | 140M-F8E-C25 | 5098 |
| 20AD027 | D | 20 | 15 | 24.8 | 10.3 | 13.5 | 16.5 | 22 | 35 | 60 | 35 | 100 | 100 | 50 | – | – | 140M-F8E-C32 | 5098 |
| 20AD034 | D | 25 | 20 | 31.2 | 13 | 17 | 20.3 | 27 | 40 | 70 | 40 | 125 | 125 | 50 | – | – | 140M-F8E-C45 | 5098 |
| 20AD040 | D | 30 | 25 | 36.7 | 19.9 | 20 | 25.5 | 34 | 50 | 90 | 50 | 150 | 150 | 50 | – | – | 140M-F8E-C45 | 5098 |
| 20AD052 | E | 40 | 30 | 47.7 | 12.8 | 26 | 30 | 40 | 60 | 110 | 60 | 200 | 200 | 70 | – | – | – | – |
| 20AD065 | E | 50 | 40 | 59.6 | 24.8 | 32.5 | 39 | 52 | 80 | 125 | 80 | 250 | 250 | 100 | – | – | – | – |

See page 27 for notes.

Table 13 - 600 Volt AC Single-phase Input Drive Ratings and Input Protection Devices

| Cat. No. | Frame (1) | Hp Rating | | Input Ratings | | Output Amps | | | Dual Element Time Delay Fuse | | Non-time Delay Fuse | | Circuit Breaker (4) | Motor Circuit Protector (6) | 140M Motor Protector with Adjustable Current Range (7) (8) | | | |
|--------------------------|-----------|-----------|------|---------------|------|-------------|--------|--------|------------------------------|---------|---------------------|---------|---------------------|-----------------------------|--|--------------|---------------------------------------|------|
| | | ND | HD | Amps | kVA | Cont. | 1 Min. | 3 Sec. | Min (2) | Max (3) | Min (2) | Max (3) | Max (5) | Max (5) | Available Catalog Numbers (9) | | Minimum Enclosure Volume (in. 3) (10) | |
| 600 Volt AC Input | | | | | | | | | | | | | | | | | | |
| 20AE0P9 | A | 0.5 | 0.33 | 1.3 | 0.7 | 0.5 | 0.6 | 0.7 | 3 | 3 | 3 | 3.5 | 15 | 3 | 140M-C2E-B16 | – | – | 3441 |
| 20AE1P7 | A | 1 | 0.75 | 1.9 | 1 | 0.9 | 1 | 1.3 | 3 | 6 | 3 | 6 | 15 | 3 | 140M-C2E-B25 | 140M-D8E-B25 | – | 3441 |
| 20AE2P7 | A | 2 | 1.5 | 3 | 1.6 | 1.4 | 1.8 | 2.4 | 4 | 6 | 4 | 10 | 15 | 7 | 140M-C2E-B40 | 140M-D8E-B40 | – | 3441 |
| 20AE3P9 | B | 3 | 2 | 4.4 | 2.3 | 2 | 2.2 | 3 | 6 | 8 | 6 | 15 | 15 | 7 | – | 140M-D8E-B63 | – | 3441 |
| 20AE6P1 | B | 5 | 3 | 7.5 | 3.9 | 3.1 | 3.4 | 4.6 | 10 | 12 | 10 | 20 | 20 | 15 | – | 140M-D8E-C10 | 140M-F8E-C10 | 3441 |
| 20AE9P0 | C | 7.5 | 5 | 7.7 | 4 | 4.5 | 5 | 6.8 | 10 | 20 | 10 | 35 | 35 | 15 | – | 140M-D8E-C10 | 140M-F8E-C10 | 3441 |
| 20AE011 | C | 10 | 7.5 | 9.8 | 5.1 | 5.5 | 6.8 | 9 | 15 | 20 | 15 | 40 | 40 | 15 | – | 140M-D8E-C16 | 140M-F8E-C16 | 3441 |
| 20AE017 | D | 15 | 10 | 15.3 | 8 | 8.5 | 9.4 | 12.8 | 20 | 35 | 20 | 60 | 60 | 30 | – | – | 140M-F8E-C20 | 5098 |
| 20AE022 | D | 20 | 15 | 20 | 10.4 | 11 | 12.8 | 17 | 25 | 45 | 25 | 80 | 80 | 30 | – | – | 140M-F8E-C25 | 5098 |
| 20AE027 | D | 25 | 20 | 24.8 | 12.9 | 13.5 | 16.5 | 22 | 35 | 60 | 35 | 100 | 100 | 50 | – | – | 140M-F8E-C25 | 5098 |
| 20AE032 | D | 30 | 25 | 29.4 | 15.3 | 16 | 20.3 | 27 | 40 | 70 | 40 | 125 | 125 | 50 | – | – | 140M-F8E-C32 | 5098 |
| 20AE041 | E | 40 | 30 | 37.6 | 19.6 | 20.5 | 24 | 32 | 50 | 90 | 50 | 150 | 150 | 100 | – | – | – | – |
| 20AE052 | E | 50 | 40 | 47.7 | 24.8 | 26 | 30.8 | 41 | 60 | 110 | 60 | 200 | 200 | 100 | – | – | – | – |

- (1) For IP 66 (NEMA / UL Type 4X/12) enclosures, drives listed as Frame A increase to Frame B and drives listed as Frame C increase to Frame D.
- (2) Minimum protection device size is the lowest rated device that supplies maximum protection without nuisance tripping.
- (3) 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.
- (4) Circuit Breaker - inverse time breaker. For US NEC, minimum size is 125% of motor FLA. Ratings shown are maximum.
- (5) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.
- (6) Motor Circuit Protector - instantaneous trip circuit breaker. For US NEC, minimum size is 125% of motor FLA. Ratings shown are maximum.
- (7) Bulletin 140M with adjustable current range must have the current trip set to the minimum range that the device does not trip.
- (8) 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.
- (9) The AIC ratings of the Bulletin 140M Motor Protector Circuit Breakers can vary. See [Bulletin 140M Motor Protection Circuit Breakers Application Ratings](#).
- (10) 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.

Mounting

This section includes information for mounting the drives.

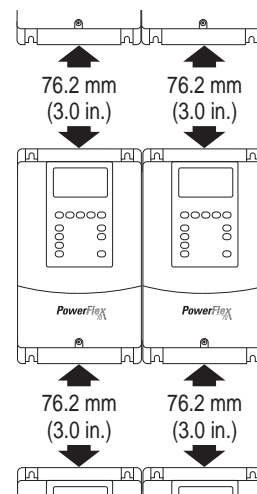
Maximum Surrounding Air Temperature

| Enclosure Rating | Temperature Range |
|---|-------------------------|
| Open Type, IP 20, NEMA / UL Type 1 and flange mount | 0...50 °C (32...122 °F) |
| IP 66, NEMA / UL Type 4X/12 | 0...40 °C (32...104 °F) |
| IP 54, NEMA / UL Type 12 | 0...40 °C (32...104 °F) |

IMPORTANT Some drives are equipped with an adhesive label on the top of the chassis. Removing the adhesive label from the drive changes the enclosure rating from NEMA / UL Type 1 Enclosed to Type Open.

Minimum Mounting Clearances

Specified vertical clearance requirements are intended to be from the drive to the closest object that can restrict airflow through the drive heat sink and chassis. The drive must be mounted in a vertical orientation as shown, and must make full contact with the mounting surface. Do not use standoffs or spacers. In addition, inlet air temperature must not exceed the product specification.



Clearances apply to all PowerFlex 70 Drives:
 • Panel Mount
 • Flange Mount
 • NEMA Type 4X/12

PowerFlex 70 Frames Output Power

| Output Power | | Frame Size | | | | | | | |
|---------------|---------------|---------------------|----------|--------------|---------------------|----------|--------------|---------------|----------|
| kW ND (HD) | Hp ND (HD) | 208...240V AC Input | | | 400...480V AC Input | | | 600V AC Input | |
| | | Not Filtered | Filtered | IP66 (4X/12) | Not Filtered | Filtered | IP66 (4X/12) | Not Filtered | Filtered |
| 0.37 (0.25) | 0.5 (0.33) | A | B | B | A | B | B | A | — |
| 0.75 (0.55) | 1 (0.75) | A | B | B | A | B | B | A | — |
| 1.5 (1.1) | 2 (1.5) | B | B | B | A | B | B | A | — |
| 2.2 (1.5) | 3 (2) | B | B | B | B | B | B | B | — |
| 4 (3) | 5 (3) | — | C | D | B | B | B | B | — |
| 5.5 (4) | 7.5 (5) | — | D | D | — | C | D | C | — |
| 7.5 (5.5) | 10 (7.5) | — | D | D | — | C | D | C | — |
| 11 (7.5) | 15 (10) | — | D | D | — | D | D | D | — |
| 15 (11) | 20 (15) | — | E | E | — | D | D | D | — |
| 18.5 (15) | 25 (20) | — | E | E | — | D | D | — | — |
| 22 (18.5) | 30 (25) | — | — | — | — | D | D | — | — |
| 30 (22) | 40 (30) | — | — | — | — | E | E | — | — |
| 37 (30) | 50 (40) | — | — | — | — | E | E | — | — |

Approximate Dimensions and Weights

This section provides the approximate dimensions for the drives.

Figure 1 - Frames A...E

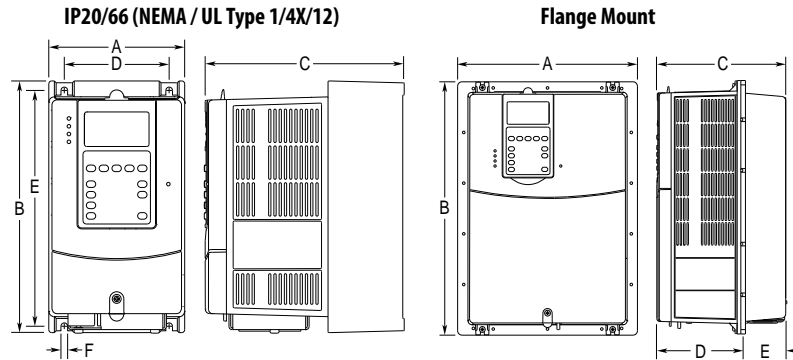
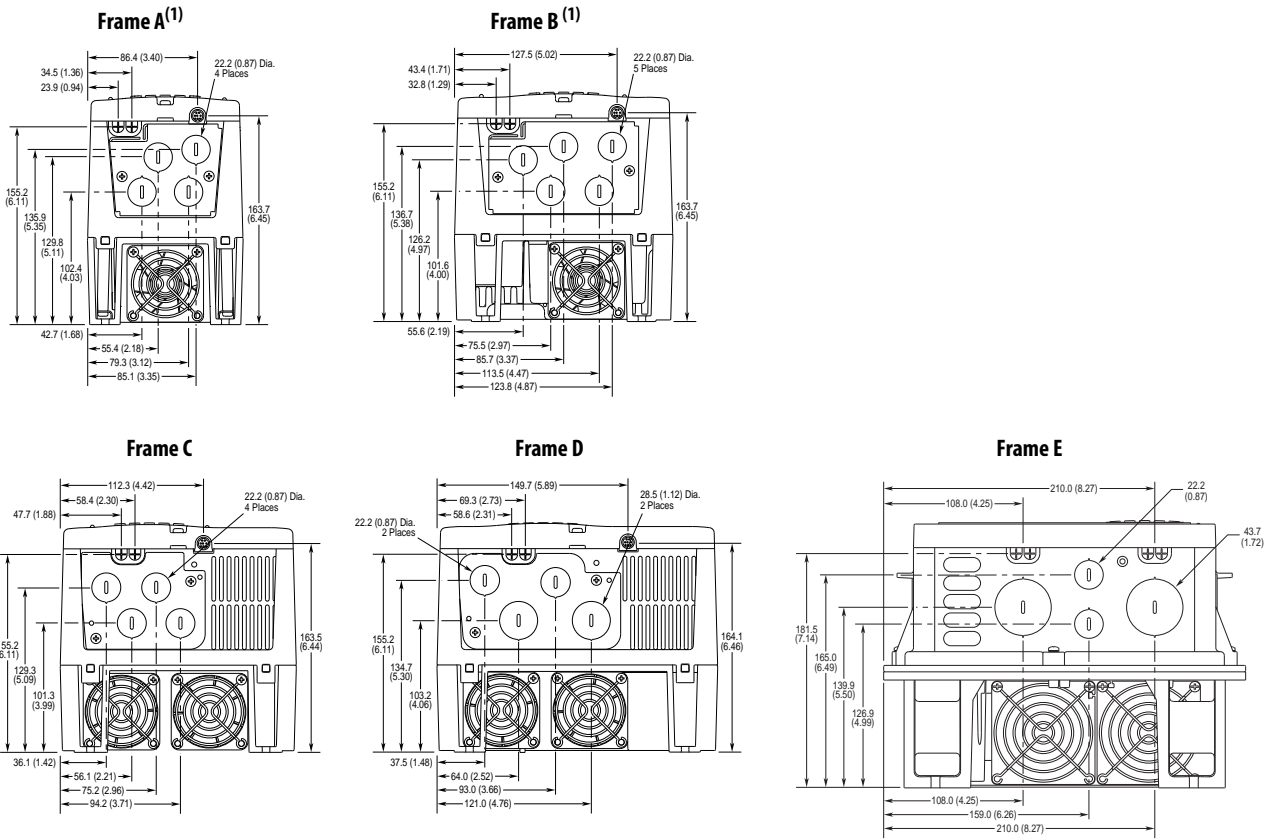


Table 14 - Frame Dimensions, mm (in.)

| Frame Size | Dimension | | | | | | Weight ⁽¹⁾ kg (lb) |
|-----------------------------------|---------------|---------------|--------------|--------------|---------------|------------|----------------------------------|
| | A | B | C | D | E | F | |
| IP20, NEMA / UL Type 1 | | | | | | | |
| A | 122.4 (4.82) | 225.7 (8.89) | 179.8 (7.08) | 94.2 (3.71) | 211.6 (8.33) | 5.8 (0.23) | 2.71 (6.0) |
| B | 171.7 (6.76) | 234.6 (9.24) | 179.8 (7.08) | 122.7 (4.83) | 220.2 (8.67) | 5.8 (0.23) | 3.60 (7.9) |
| C | 185.0 (7.28) | 300.0 (11.81) | 179.8 (7.08) | 137.6 (5.42) | 285.6 (11.25) | 5.8 (0.23) | 6.89 (15.2) |
| D | 219.9 (8.66) | 350.0 (13.78) | 179.8 (7.08) | 169.0 (6.65) | 335.6 (13.21) | 5.8 (0.23) | 9.25 (20.4) |
| E | 280.3 (11.04) | 555.8 (21.88) | 207.1 (8.15) | 200.0 (7.87) | 491.0 (19.33) | 6.9 (0.27) | 18.60 (41.0) |
| IP66, NEMA / UL Type 4X/12 | | | | | | | |
| B | 171.7 (6.76) | 239.8 (9.44) | 203.3 (8.00) | 122.7 (4.83) | 220.2 (8.67) | 5.8 (0.23) | 3.61 (8.0) |
| D | 219.9 (8.66) | 350.0 (13.78) | 210.7 (8.29) | 169.0 (6.65) | 335.6 (13.21) | 5.8 (0.23) | 9.13 (20.1) |
| E | 280.3 (11.04) | 555.8 (21.88) | 219.8 (8.65) | 200.0 (7.87) | 491.0 (19.33) | 6.9 (0.27) | 18.60 (41.0) |
| Flange Mount | | | | | | | |
| A | 156.0 (6.14) | 225.8 (8.89) | 178.6 (7.03) | 123.0 (4.84) | 55.6 (2.19) | — | 2.71 (6.0) |
| B | 205.2 (8.08) | 234.6 (9.24) | 178.6 (7.03) | 123.0 (4.84) | 55.6 (2.19) | — | 3.60 (7.9) |
| C | 219.0 (8.62) | 300.0 (11.81) | 178.6 (7.03) | 123.0 (4.84) | 55.6 (2.19) | — | 6.89 (15.2) |
| D | 248.4 (9.78) | 350.0 (13.78) | 178.6 (7.03) | 123.0 (4.84) | 55.6 (2.19) | — | 9.25 (20.4) |
| E | 280.3 (11.04) | 555.8 (21.88) | 207.1 (8.15) | 117.2 (4.61) | 89.9 (3.54) | — | 18.60 (41.0) |

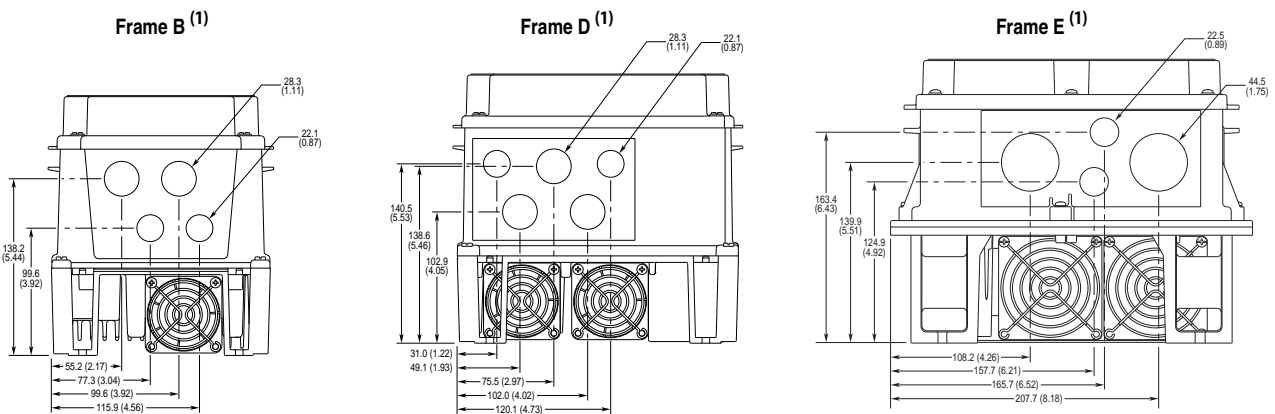
(1) Weights include HIM and standard I/O.

Figure 2 - IP20, NEMA / UL Type 1 Bottom View Dimensions, mm (in.)



(1) Fan existence is dependent on drive rating and package style.

Figure 3 - IP 66 (NEMA / UL Type 4X/12) Bottom View Dimensions, mm (in.)



(1) DPI Port 2 is not accessible from outside of the drive standard. A service connection board (catalog number SK-M9-SCB1) is required.

Figure 4 - Flange Mount Bottom View Dimensions, mm (in.)

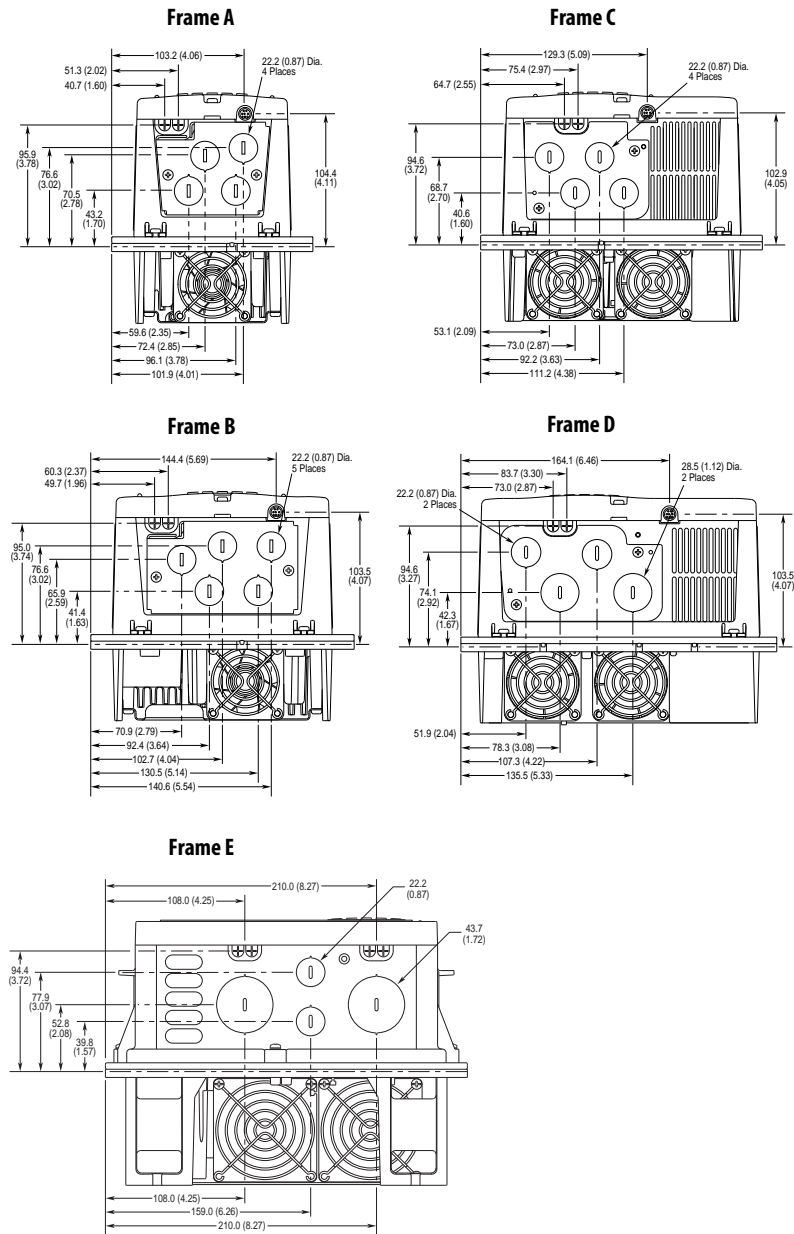


Figure 5 - Cutout Dimensions, mm (in.)

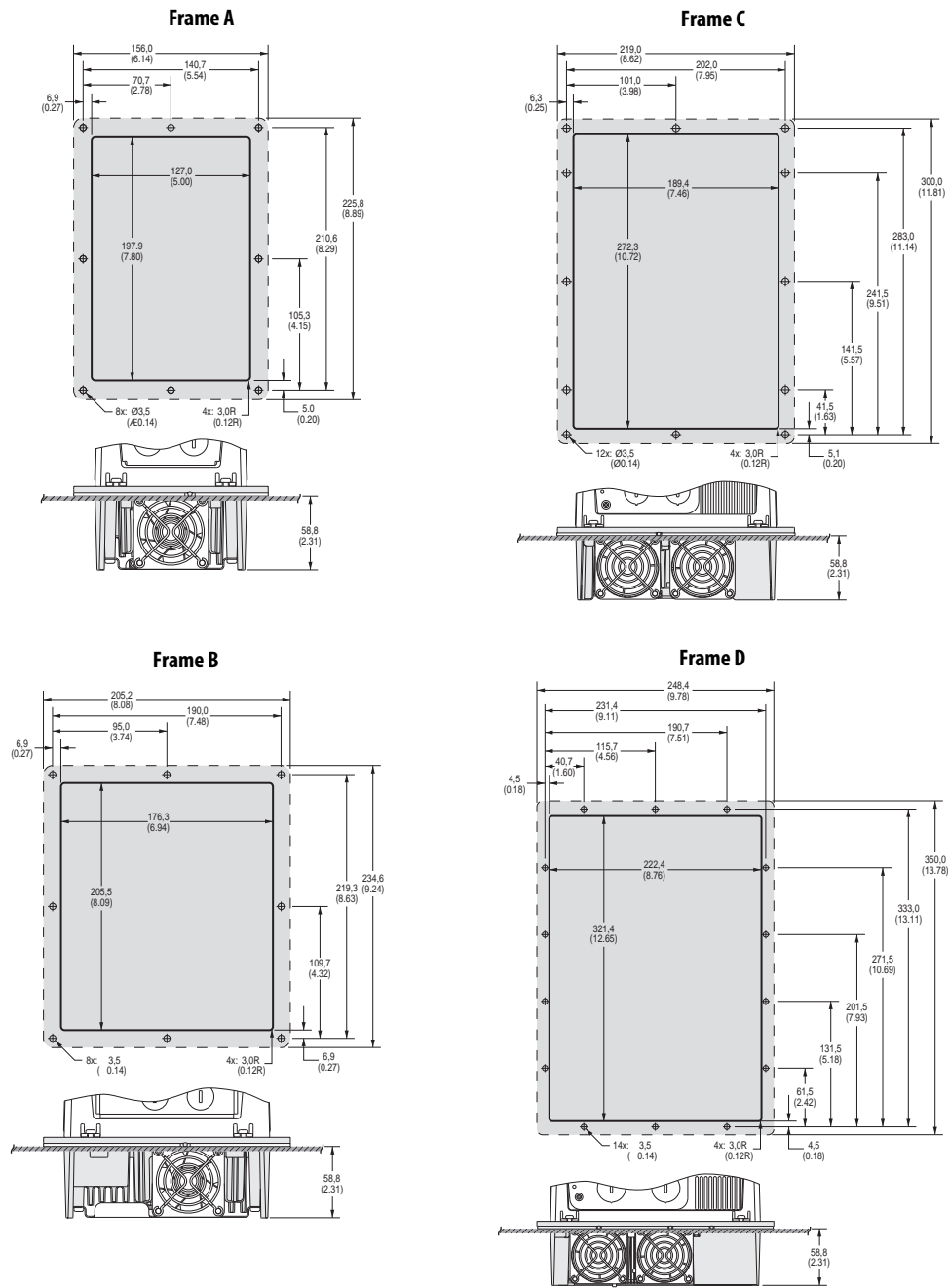
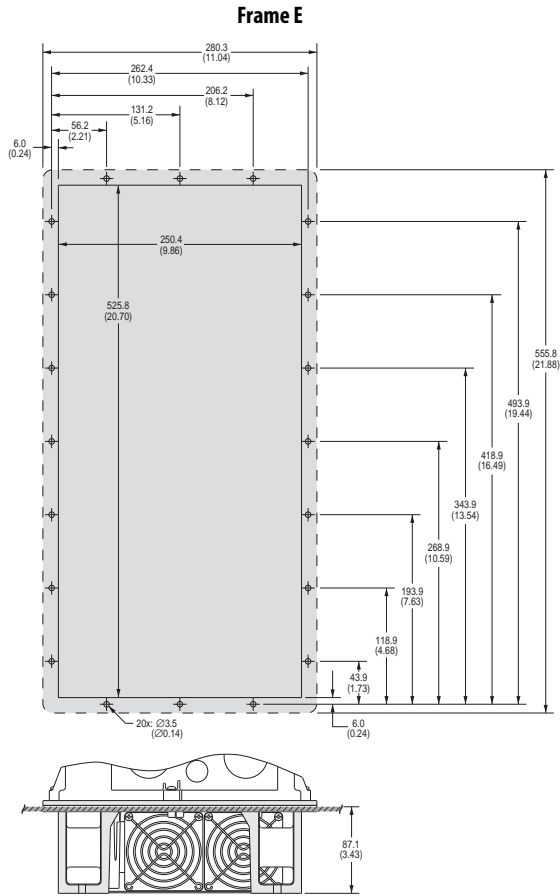


Figure 6 - Cutout Dimensions, mm (in.) (continued)



PowerFlex 70 Configured Drives

The PowerFlex 70 packaged drives program lets you create drive packages based on your specific needs. This program enhances stand-alone drive functionality through additional control, power, and packaging options that are ideal for original equipment manufacturers (OEM) and customers with special installation needs.

Catalog-configured Drives Program

The catalog configured drives program lets you create drive packages based on your specific needs. A complete drive package can be specified by assembling a single catalog number string that includes a base drive and all required options. Packaging is available for 480V requirements in NEMA Type 1 (IP20), NEMA 4/12 (IP65) indoor, and NEMA 3/4 (IP65) outdoor ratings. Focused on higher volume, repeat business, the standard designs provide consistent manufacturing and minimizes customer resources by reducing engineering, manufacturing, and installation time.

TIP This program supports the enhanced control version of the PowerFlex 70 drive.

NEMA Type 1

NEMA Type 4/12 Indoor

NEMA Type 3/4 Outdoor

- Enhanced control
- Flange mount drive
- Welded construction
- 480V rating

All Enclosure Types

- Drive input protection options
- Input/Output contactors
- Bypass options
- Input/Output line reactor options
- 115V control power options
- Control interface and feedback options
- Human interface modules
- Motor interface options
- Operator devices
- Drawing and test options



Figure 7 - Approximate Dimensions

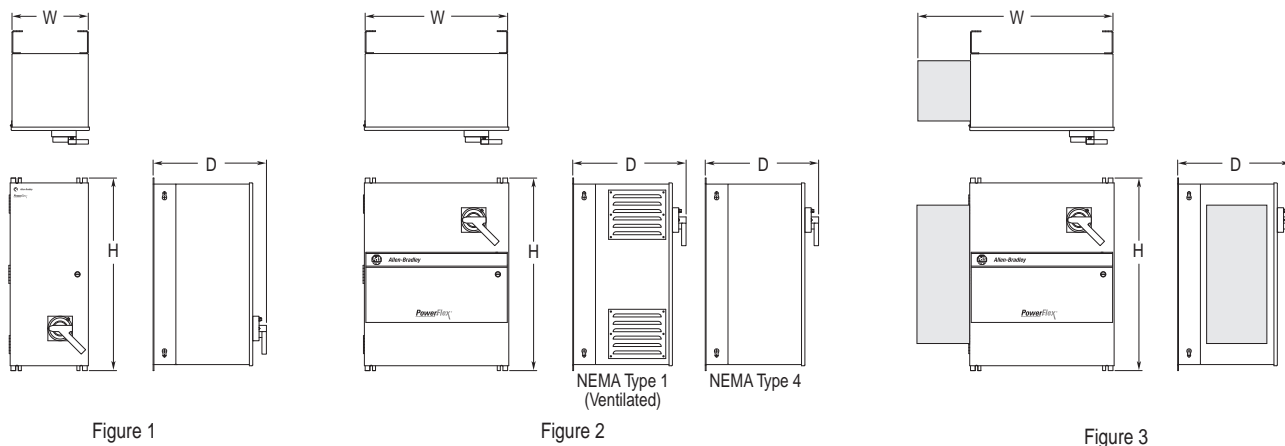


Table 15 - Maximum Enclosure Dimensions

| Ratings ND Hp | HD Hp | Drive Frame Size | Power Flex 70 Flange Drive Cat. No. | Enclosure Style for Flange Mounted Drives | | | | | | | | | | | | | |
|------------------------------------|-------|------------------------|---|--|-------|-------------|-------|--|-------|----------------------------------|-------|------------------------------|-------|---|-------|----------------------------------|---|
| | | | | NEMA Type 1, Option Code A | | | | NEMA Type 4 Indoor, Option Code D NEMA Type 12 Indoor, Option Code G | | | | NEMA Type 3/4, Option Code E | | | | | |
| | | | | B0, C1, C5, S1, S9...S13, S16, P1...P3 or P6, Drive Mounted Options & All HIMs | | All Options | | B0, C1, C5, S1, S9...S13, S16, P1...P3 or P6, Drive Mounted Options & All NEMA 4 HIMs | | All Options Less Line Reactor | | All Options | | B0, C1, C5, S1, S9...S13, S16, P1...P3 or P6, Drive Mounted Options | | All Options Less Line Reactor | |
| Figure | Style | Figure | Style | Figure | Style | Figure | Style | Figure | Style | Figure | Style | Figure | Style | Figure | Style | | |
| 480V AC, Three-phase Drives | | | | | | | | | | | | | | | | | |
| 0.5 | 0.33 | A | D1P1 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 3 | 2 | 3 | 1 | 1 | 2 | 3 |
| 1.0 | 0.75 | A | D2P1 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 3 | 2 | 3 | 1 | 1 | 2 | 3 |
| 2.0 | 1.5 | A | D3P4 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 3 | 2 | 3 | 1 | 1 | 2 | 3 |
| 3.0 | 2.0 | B | D5P0 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 3 | 2 | 4 | 1 | 1 | 2 | 3 |
| 5.0 | 3.0 | B | D8P0 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 3 | 2 | 4 | 1 | 1 | 2 | 3 |
| 7.5 | 5.0 | C | D011 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 3 | 2 | 4 | 1 | 1 | 2 | 3 |
| 10 | 7.5 | C | D014 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 3 | 2 | 4 | 1 | 1 | 2 | 3 |
| 15 | 10 | D | D022 | 1 | 1 | 2 | 4 | 1 | 1 | 2 | 4 | 2 | 5 | 16 | 1 | 2 | 4 |
| 20 | 15 | D | D027 | 1 | 1 | 2 | 4 | 1 | 1 | 2 | 4 | 2 | 5 | 1 | 1 | 2 | 4 |
| 25 | 20 | D | D034 | 1 | 1 | 2 | 4 | 1 | 1 | 2 | 4 | 2 | 5 | 1 | 1 | 2 | 5 |
| 30 | 25 | D | D040 | 1 | 1 | 2 | 4 | 1 | 1 | 2 | 4 | 2 | 5 | 1 | 1 | 2 | 5 |
| 40 | 30 | E | D052 | 1 | 2 | 2 | 6 | 1 | 2 | 2 | 6 | 2 | 7 | 1 | 2 | 2 | 6 |
| 50 | 40 | E | D065 | 1 | 2 | 2 | 6 | 1 | 2 | 2 | 6 | 2 | 7 | 1 | 2 | 2 | 6 |

● Figure 2, Style 5, when one line reactor is selected. Figure 3, Style 8, when two line reactors are selected.

Table 16 - Enclosure Dimensions

| Figure | Style | Enclosure Rating | Option Code (Position d) | Dimensions | |
|--------|-------|----------------------------------|-----------------------------|-------------------------|--------------------|
| | | | | H x W x D (mm) | H x W x D (in.) |
| 1 | 1 | NEMA 1 | A | 812.8 x 330.2 x 484.1 | 32 x 13 x 19.06 |
| 1 | 2 | NEMA 1 | A | 1,270.0 x 406.4 x 484.1 | 50 x 16 x 19.06 |
| 2 | 3 | NEMA 1 | A | 812.8 x 609.6 x 484.1 | 32 x 24 x 19.06 |
| 2 | 4 | NEMA 1 | A | 965.2 x 609.6 x 484.1 | 38 x 24 x 19.06 |
| 2 | 6 | NEMA 1 | A | 1,270.0 x 762.0 x 484.1 | 50 x 30 x 19.06 |
| 1 | 1 | NEMA 4/12 Indoor, NEMA 4 Outdoor | D, G, E | 812.8 x 330.2 x 484.1 | 32 x 13 x 19.06 |
| 1 | 2 | NEMA 4/12 Indoor, NEMA 4 Outdoor | D, G, E | 1,270.0 x 406.4 x 484.1 | 50 x 16 x 19.06 |
| 2 | 3 | NEMA 4/12 Indoor, NEMA 4 Outdoor | D, G, E | 812.8 x 609.6 x 484.1 | 32 x 24 x 19.06 |
| 2 | 4 | NEMA 4/12 Indoor, NEMA 4 Outdoor | D, G, E | 965.2 x 609.6 x 484.1 | 38 x 24 x 19.06 |
| 2 | 5 | NEMA 4/12 Indoor, NEMA 4 Outdoor | D, G, E | 1,270.0 x 609.6 x 484.1 | 50 x 24 x 19.06 |
| 2 | 6 | NEMA 4/12 Indoor, NEMA 4 Outdoor | D, G, E | 1,270.0 x 762.0 x 484.1 | 50 x 30 x 19.06 |
| 2 | 7 | NEMA 4/12 Indoor, NEMA 4 Outdoor | D, G, E | 1,270.0 x 914.4 x 484.1 | 50 x 36 x 19.06 |
| 3 | 8 | NEMA 4/12 Indoor, NEMA 4 Outdoor | D, G, E | 812.8 x 831.9 x 484.1 | 50 x 32.75 x 19.06 |
| 3 | 9 | NEMA 4/12 Indoor, NEMA 4 Outdoor | D, G, E | 1,270.0 x 984.3 x 484.1 | 50 x 38.75 x 19.06 |

● Depth includes 6.35 mm (2.5 in) for operator handle, if ordered.

Standard Drive Certifications and Specifications

Table 17 through Table 20 provide certification information and technical specifications.

Table 17 - Certifications

| Certifications ⁽¹⁾ | Description | Frames | |
|---|---|---------------------|---------------|
| | | A...E 240...480V | A...E 600V |
| ABS | American Bureau of Shipping MA Certificate 08-HS303172A-3-PDA for auxiliary services on AB Classed vessels and offshore platforms | X | X |
| RCM | Certified by Rockwell Automation to be in conformity with the requirements of the applicable Australian legislation and standards referenced below: IEC 61800-3 | X | |
| c-UL-us | Listed to UL508C and CAN/CSA C22.2 No. 14-05 Configured drives can be listed to UL508A | X | X |
| 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 | X | X |
| | 2004/108/EC (EMC Directive) EN 61800-3 Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods | X | |
| EAC | Low Voltage TR CU 004/2011 EMC TR CU 020/2011 | X | X |
| EPRI/SEMIF 47 | EPRI Quality Star Certificates SEMIF47.116 for SEMI F47 compliance, only 480V units tested | X | |
| Functional Safety | TÜV Rheinland Certificate 01/205/0665/09 Safe Off Option satisfies requirements for Category 3 safety function according to EN ISO 13849-1 | X | |
| Korean KC Registration | KCC-REM-RAA-20A Refer to the certificate of registration for specific drive catalog numbers that have this certification. ⁽¹⁾ | X | X |
| Lloyd's Register | Lloyd's Register Type Approval Certificate 08/60014 (E1) (marine certification) | X | |
| Plenum Rating | Listed to UL508C Suitable for installation in a compartment handling conditioned air. ⁽²⁾ | | |
| 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 | X | X |
| Designed to Meet Applicable Requirements | IEC 61800-2 – Adjustable speed electrical power drive systems - Part 2: General requirements - Rating specifications for low voltage adjustable frequency AC power drive systems | X | X |
| | NEMA ICS 7.1 – Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems | X | X |
| | NFPA 70 – US National Electric Code | X | X |
| | NSF – Type 4X enclosure NSF Listed to meet Criteria C2 for splash and non-food zones | X | X |

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

(2) Flange mount enclosure, Frames A...D only.

Table 18 - Specifications

| Category | Specification | | | | | | |
|--|---|--|---------|---------|---------|----------|------|
| Protection | Drive | 200... 208V | 240V | 380/400 | 480V | 600V | 690V |
| | AC input overvoltage trip | 247V AC | 285V AC | 475V AC | 570V AC | 690V AC | |
| | AC input undervoltage trip | 120V AC | 138V AC | 233V AC | 280V AC | 345V AC | |
| | Bus overvoltage trip | 405V DC | 405V DC | 810V DC | 810V DC | 1013V DC | |
| | Bus undervoltage output shutoff | 153V DC | 153V DC | 305V DC | 437V DC | 437V DC | |
| | Bus undervoltage fault level | 160V DC | 160V DC | 300V DC | 300V DC | 375V DC | |
| | Nominal bus voltage | 281V DC | 324V DC | 540V DC | 648V DC | 810V DC | |
| | All Drives | | | | | | |
| | Heat sink thermistor | Monitored by microprocessor overtemp trip | | | | | |
| | Drive overcurrent trip | | | | | | |
| | Software current limit | 20...160% of rated current | | | | | |
| | Hardware current limit | 200% of rated current (typical) | | | | | |
| | Instantaneous current limit | 220...300% of rated current (dependent on drive rating) | | | | | |
| | Line transients | Up to 6000 volts peak per IEEE C62.41-1991 | | | | | |
| Control logic noise immunity | Showering arc transients up to 1500V peak | | | | | | |
| Power ride-thru | 15 milliseconds at full load | | | | | | |
| Logic control ride-thru | 0.5 seconds minimum, 2 seconds typical | | | | | | |
| Ground fault trip | Phase-to-ground on drive output | | | | | | |
| Short circuit trip | Phase-to-phase on drive output | | | | | | |
| Environment | Altitude | 1000 m (3300 ft) max without derating | | | | | |
| | Maximum surrounding air temperature without derating | | | | | | |
| | IP20, NEMA / UL Type 1 flange mount | 0...50 °C (32...122 °F) 0...50 °C (32...122 °F) | | | | | |
| | IP66, NEMA / UL Type 4X/12 (indoor) | 0...40 °C (32...104 °F) | | | | | |
| | Cooling fan operation | | | | | | |
| | Frames A and C | Fan operates when power is applied. | | | | | |
| | Frames B, D, and E | Fan operates when power is applied and in Run condition. | | | | | |
| | 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, store the drive where it is not exposed to a corrosive atmosphere. | | | | | |
| | Relative humidity | 5...95% non-condensing | | | | | |
| | Shock | 15 g peak for 11 ms duration (±1.0 ms) | | | | | |
| | Vibration | 0.152 mm (0.006 in.) displacement, 1 g peak | | | | | |
| | Surrounding environment | | | | | | |
| Pollution degree: | | | | | | | |
| Pollution degree 1 and 2 | All enclosures are acceptable for pollution degree 1 and 2. | | | | | | |
| Pollution degree 3 and 4 | An enclosure that meets or exceeds IP54, NEMA / UL Type 12, is required for pollution degree 3 and 4. | | | | | | |
| See Table 19 on page 37 for descriptions of pollution degree rating. | | | | | | | |

Table 19 - 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 a temporary conductivity, caused by condensation, is expected when the drive is out of operation. |
| 3 | Conductive pollution or dry non-conductive pollution occurs, that becomes conductive due to condensation, and is expected. |
| 4 | The pollution generates persistent conductivity caused, for example, by conductive dust, rain, or snow. |

Table 20 - Specifications (continued)

| Category | Specification | |
|---------------------------|---|--|
| Electrical | Voltage tolerance | -10% of minimum, +10% of maximum. See page 115 in the PowerFlex 70 Adjustable Frequency AC Drives User Manual, publication 20A-UM001, 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 provides 50% of rated current. |
| | Displacement power factor (all drives) | 0.98 across speed range. |
| | Efficiency | 97.5% at rated amps, nominal line volts. |
| | Maximum short circuit rating | 200,000 amps symmetrical. |
| | Max short circuit current rating (by using the recommended fuse or circuit breaker type) | Maximum short circuit current rating to match specified fuse/circuit breaker capability. |
| | Drive to motor power ratio | |
| Minimum | Recommended not less than 1:2 ratio | |
| Maximum | Recommended not greater than 2:1 ratio | |
| Control | Method | Sine coded PWM with programmable carrier frequency. Ratings apply to all drives. |
| | Carrier frequency | 2, 3, 4, 5, 6, 7, 8, 9, and 10 kHz Standard . 2, 4, 8, and 12 kHz EC . Drive rating based on 4 kHz. |
| | Output voltage range | 0 to rated motor voltage |
| | Output frequency range | 0...400 Hz Standard . 0...500 Hz EC . |
| | Frequency accuracy | |
| | Digital input | Within $\pm 0.01\%$ of set output frequency. |
| | Analog input | Within $\pm 0.4\%$ of maximum output frequency. |
| | Frequency control - speed regulation | with slip compensation (V/Hz mode) 0.5% of base speed across 40:1 speed range 40:1 operating range 10 rad/sec bandwidth |
| | | with slip compensation (Sensorless Vector mode) 0.5% of base speed across 80:1 speed range 80:1 operating range 20 rad/sec bandwidth |
| | | with feedback (Sensorless Vector mode) EC 0.001% of base speed across 40:1 speed range 0.1% of base speed across 80:1 speed range 80:1 operating range 20 rad/sec bandwidth |
| | Speed control - speed regulation | without feedback (Vector Control mode) EC 0.1% of base speed across 120:1 speed range 120:1 operating range 30 rad/sec bandwidth |
| | | with feedback (Vector Control mode) EC 0.001% of base speed across 120:1 speed range 1000:1 operating range 125 rad/sec bandwidth |
| | Torque regulation | without feedback +/-10% EC with feedback +/-5% EC |
| | Selectable motor control | Sensorless Vector with full tuning. Standard V/Hz with full custom capability and vector control. |
| | Stop modes | Multiple programmable stop modes including - Ramp, Coast, DC-Brake, Fast Brake, Ramp-to-Hold and S-curve. |
| | Accel/Decel | Two independently programmable accel and decel times. Each time can 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 and integral gain. | |
| Motor overload protection | Class 10 motor overload protection according to NEC article 430 and motor over-temperature protection according to NEC article 430.126 (A)(2). UL 508C File E59272. | |

Table 20 - Specifications (continued)

| Category | Specification | |
|----------|---------------|--|
| Encoder | Type | Incremental, dual channel |
| | Supply | 5V/12V Configurable $\pm 5\%$ |
| | Quadrature | $90^\circ \pm 27^\circ$ |
| | Duty cycle | 50% +10% |
| | Requirements | Encoders must be line driver type, quadrature (dual-channel) or pulse (single-channel), single-ended or differential and capable of supplying a minimum of 10 mA per channel. The encoder interface board accepts 5V or 12V DC square-wave with a minimum high state voltage of 3.5V DC (5V mode) and 7.0V DC (12V mode). Maximum low state voltage is 1V DC (for both 5V and 12V modes). Maximum input frequency is 250 kHz. |

Table 21 - Watts Loss (rated load, speed, and PWM)⁽¹⁾

| Voltage | ND Hp | External Watts | Internal Watts | Total Watts Loss |
|-------------|-------|----------------|----------------|------------------|
| 208V | 0.5 | 12.2 | 19.2 | 31.4 |
| | 1.0 | 30.7 | 20.5 | 51.2 |
| | 2.0 | 44.6 | 22.6 | 67.2 |
| | 3.0 | 67.3 | 25.4 | 92.7 |
| | 5.0 | 141.3 | 33.2 | 174.5 |
| | 7.5 | 205.7 | 34.2 | 239.9 |
| | 10 | 270.4 | 48.1 | 318.5 |
| | 15 | 385.6 | 40.3 | 425.9 |
| | 20 | 494.6 | 44.9 | 539.5 |
| | 25 | 650.7 | 51.6 | 702.3 |
| 240V | 0.5 | 12.2 | 19.2 | 31.4 |
| | 1.0 | 30.7 | 20.5 | 51.2 |
| | 2.0 | 44.6 | 22.6 | 67.2 |
| | 3.0 | 67.3 | 25.4 | 92.7 |
| | 5.0 | 141.3 | 33.2 | 174.5 |
| | 7.5 | 205.7 | 34.2 | 239.9 |
| | 10 | 270.4 | 48.1 | 318.5 |
| | 15 | 385.6 | 40.3 | 425.9 |
| | 20 | 494.6 | 44.9 | 539.5 |
| | 25 | 650.7 | 51.6 | 702.3 |
| 400V | 0.37 | 11.5 | 17.9 | 29.4 |
| | 0.75 | 27.8 | 19.5 | 47.3 |
| | 1.5 | 43.6 | 21.6 | 65.2 |
| | 2.2 | 64.6 | 24.0 | 88.6 |
| | 4.0 | 99.5 | 28.2 | 127.7 |
| | 5.5 | 140.0 | 27.8 | 167.8 |
| | 7.5 | 193.3 | 32.0 | 225.3 |
| | 11 | 305.4 | 34.2 | 339.6 |
| | 15 | 432.9 | 42.9 | 475.8 |
| | 18.5 | 363.8 | 40.5 | 404.3 |
| | 22 | 396.8 | 41.5 | 438.3 |
| | 30 | 500.8 | 50.0 | 550.8 |
| | 37 | 632.0 | 57.7 | 689.7 |
| 480V | 0.5 | 11.5 | 17.9 | 29.4 |
| | 1.0 | 27.8 | 19.5 | 47.3 |
| | 2.0 | 43.6 | 21.6 | 65.2 |
| | 3.0 | 64.6 | 24.0 | 88.6 |
| | 5.0 | 99.5 | 28.2 | 127.7 |
| | 7.5 | 140.0 | 27.8 | 167.8 |
| | 10 | 193.3 | 32.0 | 225.3 |
| | 15 | 305.4 | 34.2 | 339.6 |
| | 20 | 432.9 | 42.9 | 475.8 |
| | 25 | 363.8 | 40.5 | 404.3 |
| | 30 | 396.8 | 41.5 | 438.3 |
| | 40 | 500.8 | 50.0 | 550.8 |
| | 50 | 632.0 | 57.7 | 689.7 |
| 600V | 0.5 | 11.5 | 17.9 | 29.4 |
| | 1.0 | 27.8 | 19.5 | 47.3 |
| | 2.0 | 43.6 | 21.6 | 65.2 |
| | 3.0 | 64.6 | 24.0 | 88.6 |
| | 5.0 | 99.5 | 28.2 | 127.7 |
| | 7.5 | 140.0 | 27.8 | 167.8 |
| | 10 | 193.3 | 32.0 | 225.3 |
| | 15 | 305.4 | 34.2 | 339.6 |
| | 20 | 432.9 | 42.9 | 475.8 |
| | 25 | 281.4 | 42.4 | 323.8 |
| | 30 | 311.9 | 43.4 | 355.3 |
| | 40 | 389.9 | 51.8 | 441.7 |
| | 50 | 501.4 | 59.9 | 561.3 |

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

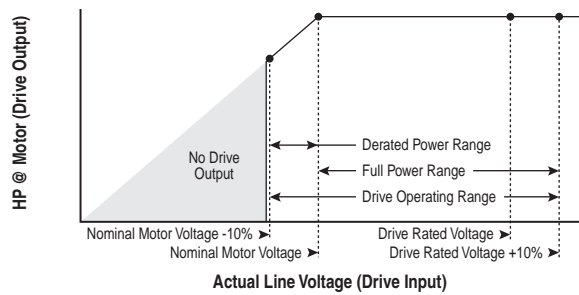
Voltage Tolerance

This section provides information to help you determine the voltage tolerance for your drive installation.

| 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...400 | 380 | 380 † | 380...528 | 342...528 |
| | 400 | 400 | 400...528 | |
| | 480 | 460 | 460...528 | |
| 500...600 | 600 | 575 † | 575...660 | 432...660 |

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.

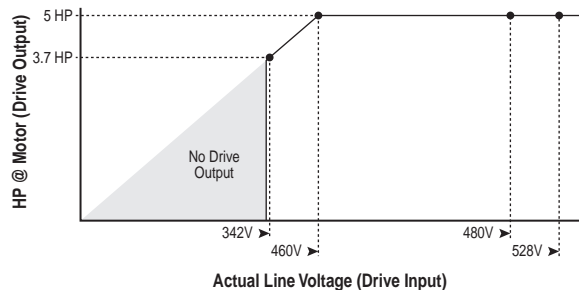


Example:

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.



Derating Guidelines

Follow these guidelines for derating your drive installation.

Altitude and Efficiency

| Frame | Type | Derate |
|-------|----------------------|--------|
| All | Altitude | |
| | Efficiency (typical) | |

Ambient Temperature/Load

Table 22 - 240V AC

| PowerFlex 70 Power Rating | | Derating |
|---------------------------|------------|----------|
| ND Hp | HD Hp | |
| 240 Volt | | |
| 0.5...3.0 | 0.33...2.0 | None |
| 5.0 | 3.0 | |
| 7.5 | 5.0 | |
| 10 | 7.5 | |
| 15 | 10 | |
| 20 | 15 | |
| 25 | 20 | |

Table 23 - 400V AC

| PowerFlex 70 Power Rating | | Derating |
|---------------------------|------------|----------|
| ND kW | HD kW | |
| 400 Volt | | |
| 0.37...5.5 | 0.25...4.0 | None |
| 7.5 | 5.5 | |
| 11 | 7.5 | |
| 15 | 11 | |
| 18.5 | 15 | |
| 22 | 18.5 | |
| 30 | 22 | |

Table 23 - 400V AC (continued)

| PowerFlex 70 Power Rating | | Derating |
|---------------------------|-------|----------|
| ND kW | HD kW | |
| 400 Volt | | |
| 37 | 30 | |

Table 24 - 480V AC

| PowerFlex 70 Power Rating | | Derating |
|---------------------------|------------|----------|
| ND Hp | HD Hp | |
| 480 Volt | | |
| 0.5...7.5 | 0.33...5.0 | None |
| 10 | 7.5 | |
| 15 | 10 | |
| 20 | 15 | |
| 25 | 20 | |
| 30 | 25 | |

Table 24 - 480V AC (continued)

| PowerFlex 70 Power Rating | | Derating |
|--|-------|----------|
| ND Hp | HD Hp | |
| --- 2 kHz -.-.- 4 kHz — 6 kHz - - - 8 kHz — 10 kHz | | |
| 480 Volt | | |
| 40 | 30 | |
| 50 | 40 | |

Table 25 - 600V AC

| PowerFlex 70 Power Rating | | Derating |
|--|------------|----------|
| ND Hp | HD Hp | |
| --- 2 kHz -.-.- 4 kHz — 6 kHz - - - 8 kHz — 10 kHz | | |
| 600 Volt | | |
| 0.5...5.0 | 0.33...3.0 | None |
| 7.5 | 5.0 | |
| 10 | 7.5 | |
| 15 | 10 | |
| 20 | 15 | |

Table 25 - 600V AC (continued)

| PowerFlex 70 Power Rating | | Derating |
|---------------------------|-------|----------|
| ND Hp | HD Hp | |
| 600 Volt | | |
| 25 | 20 | |
| 30 | 25 | |
| 40 | 30 | |
| 50 | 40 | |

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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